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FOREFRONT

Computer Systems Group
21st Century Computing Today
Q4 FY93

Alpha AXP in Japan

64ビット Alpha AXP システム、誕生

Peter Conklin

"Alpha is the most talked-about system architecture in Japan today," says Peter Conklin following his recent trip to Japan.

World's Fastest Workstations: Page 7

ALPHA AXP SYSTEM PERFORMS WORLD'S FASTEST SORT: RUNS INDUSTRY-STANDARD, ONE-MILLION RECORD SORT BENCHMARK IN UNDER 10 SECONDS

Digital announced the world's fastest sort performance running the industry-standard sort benchmark—one million 100-byte records in 9.11 seconds. This is 640% faster than the fastest reported sort time of 58.3 seconds and 285% faster than the fastest unpublished time of 26 seconds. The benchmark was performed using a DEC 10000 model 610 OpenVMS AXP system.

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Bill Demmer announces new management changes
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FOREFRONT

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FOREFRONT strives to support a forum for the entire CSG WW community to share information, directions, and key accomplishments in all its functional dimensions, that is, customers, markets, engineering, and manufacturing. Its goal is to highlight technical efforts and successes that lead to new products and markets for Digital.

This is your information forum. Your participation is vital to its continuation and success. You are encouraged to contribute articles that are of interest to the CSG community. The deadline for submitting articles for the next edition is July 15.

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Peter Conklin Visits Japan

by Dick Willett

During a recent trip to Japan, Peter Conklin, Technical Director of Operating Systems, presented Alpha AXP to the Information Processing Society of Japan (IPS-J) and helped Kubota Computer introduce Alpha AXP to its customers. He also met with systems architects from Mitsubishi to discuss the future of computing.

Presentation of Alpha at IPS-J Seminar

The IPS-J is the senior computer technical society of Japan and has active participation by all industry and user leaders. For the past year, the society has conducted a seminar series called "Technologies That Will Survive the Century." Although other vendors participated, Digital was the only company to provide a presentation by a U.S. technology leader.

The IPS-J provided full simultaneous translation so that Peter was able to participate fully in the proceedings. His talk and slide presentation described Alpha AXP as the basis for 21st Century Computing. "Based on the reactions of the audience," Peter said, "Alpha appears to be the most talked-about system architecture in Japan today. It has already established a reputation for being the most exciting computer architecture in the industry."

The session, which had more than 150 participants, ended with a panel of leaders in the Japanese computer industry. More than half of the panelists already have Alpha systems installed, including workstations at the University of Tokyo and NTT.

Kazuhiko Nishi and Masayoshi Son, the presidents of two of Japan's leading personal computing software companies (ASCII and SoftBank), expressed excitement about Alpha's potential for personal computing. So far, office workers in Japan have made relatively little use of computers or even typewriters because of the complex Japanese writing system, Kanji, which has more than 30,000 characters in common use.

In June, Digital will beginning shipping Windows with Kanji support. Combined with Kanji fonts and the underlying power of Alpha AXP running NT Windows, this will make Digital the first vendor to meet the need for personal computing in Kanji.

Peter commented, "Alpha was very well received and provides Digital with an excellent opportunity to build strong relationships with leaders of the Japanese computer industry."

Other topics at the IPS-J seminar emphasized the importance of extensive parallelism in future computing. The Japanese fifth generation computing project, ICOT, is now focused on parallelism. ICOT, which installed an Alpha AXP 7000 system the week of the seminar, started with a hardware focus but quickly evolved to studies of parallelism in applications. Peter noted that ICOT's "applications experience combined with Digital's experience in both SMP and cluster parallel computing opens a tremendous opportunity for industry leadership."

Announcement to Kubota Computer Customers

The following week, Peter was a featured speaker at Kubota Computer's announcement of Alpha workstations with their new Denali high performance graphics subsystem. This was a joint Kubota and Digital end user show, a first for Digital Japan. In addition to Peter, it featured Gordon Bell and drew more than 400 attendees.

Gordon was a cofounder of the Ardent computing systems that evolved into today's Kubota Pacific workstations. He described the history of high performance graphics workstations and mini-super computer systems, then described the technology trends for computing through this decade.

Peter explained how the Alpha vision addresses these trends and that Digital is delivering the initial systems today. He described the new Alpha AXP 3000/500X ("Hot Pink") workstations with Kubota's Denali graphics as "the fastest graphics stations in the industry

in.both computational and graphics performance." Local speakers detailed the specifics of the new workstations.

The following day, Gordon and Peter attended a meeting with systems architects at Mitsubishi's Computer Development Laboratories. These systems architects have participated in at least five parallelism projects as part of the fifth generation computing project and have also built many of Mitsubishi's minicomputer and mainframe systems. This meeting allowed the architects to review the results of their research projects and to discuss the future of computing structures.

Like other researchers in Japan, Mitsubishi built research hardware to explore parallelism, but then used it to explore new applications software algorithms for parallel computing. This research included visualization and character recognition systems and artificial intelligence applications. During the review, the participants explored what the technology trends imply about future computer structures. They determined that by the end of the decade we will see SMP on a chip, memory system interconnects that dominate performance, and the challenge of deploying applications to take advantage of the inherent parallelism of the hardware. Peter observed that "Digital is well positioned to lead in the design of these system structures with our experience and leadership in clustering systems."

Peter's final comment is that "participation in these discussions with leaders in the industry and with our partners is an excellent way to explore the future of computing. Getting out and learning what others are thinking is the only way to ensure that we continue to lead the industry in meeting customers' needs."

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64ビット Alpha AXP システム、誕生

"64 Bit Alpha AXP System is Born"

Digital Unveils Three New Alpha Workstations

by Glen Zimmerman and
Dave Bouffard

On April 20th, Digital Equipment Corporation unveiled its second wave of Alpha AXP workstations, three new workstations that fill out its five-member family of Alpha AXP workstations. All three of the 64-bit workstations—the high-end Model 500X, the volume platform Model 300, and the entry-level Model 300L—are binary-compatible with all previously announced Alpha AXP systems.

At the same time, Digital announced R4000 daughter-card upgrades for its existing DECstation and DECsystem family of workstations and servers.

DEC 3000 Model 500X AXP Workstation

DEC 3000 Model 500X AXP Workstation

Code named "Hot Pink Flamingo," this 200-MHz pedestal system offers customers the fastest uniprocessor in the industry. Its benchmark profile includes a SPEC89 of 160.8, SPECint92 of 109.7, and a SPECfp92 of 163.4—thus offering more raw performance than either HP or IBM's highest performing models, the HP 9000/755 or IBM 6000/580 workstations.

The new system offers a maximum internal memory of 1 Gbyte with five TURBOchannel I/O expansion slots, each able to support 100-Mbyte throughput. The TURBO channel interconnect allows system configuration with high-speed FDDI controllers, third-party IPI disk controllers, or additional SCSI adapters for high performance I/O. The workstation can also support up to four internal 3.5-inch disk drives.

The Model 500X, available today with the DEC OSF/1 operating system and later this summer with the OpenVMS environment, is particularly suited for demanding technical and compute-intensive applications such as financial modeling, structural analysis, and electrical simulation.

DEC 3000 Model 300 AXP Workstation

As a step up from the entry-level Alpha workstation, the Model 300 was designed for customers who require high-performance 2D, minimal 3D, and serious expandability —at an affordable price. This price/performance leader offers benchmark numbers of 77+ for SPECfp, and 67+ for SPECint. It features two TURBOchannel I/O interconnect slots, each supporting 100 MByte throughput.

The Model 300 configuration that includes 32 Mbyte memory, 426 Mbyte disk, and 16-inch color monitor may be the most cost-effective workstation in the industry.

The DEC 3000 Model 300 AXP workstation is the volume platform for Digital's OEMs, VARs, and resellers, offering growth in networking, storage, and graphics as application demands increase. For Digital's installed base customers, the Alpha-ready program announced in November has now been expanded to include upgrade paths from the Personal DECstation and VAXstation VLC workstations to the Model 300. The Model 300 is available as of May for both DEC OSF/1 and OpenVMS operating systems.

DEC 3000 Model 300 AXP Workstation

DEC 3000 Model 300L AXP Workstation

This entry-level, desktop Alpha workstation offers twice the performance of the Sun SPARCstation 10/LX at 21 percent less cost. It is the highest performing workstation under $5K in the industry. The low-profile Model 300L is targeted at 2D applications, such as electronic publishing and computer-aided software engineering (CASE).

The DEC 3000 Model 300L is a cost-effective entry into the high-performance environment of Alpha systems. It is available with both the DEC OSF/1 and OpenVMS operating systems as of May.

DEC 3000 Model 300L AXP Workstation

R4000 Daughter-card Upgrades for the DECstation and DECsystem Family

Two high-performance CPU daughter boards are now available for existing DECstation and DECsystem users. The upgrades, more than doubling previous performance, come in two cards: a 50-Mhz, R4000-based board, and a larger 66-Mhz, R4400-based board. The smaller upgrade offers SPECfp 45.9 and SPECint 46.7 performance; the larger upgrade board provides SPECfp 55.5 and SPECint 55.0 performance. The daughter cards will be available in July.

"We are very proud of these new additions to both the Alpha AXP and DECstation families," said David Laurello, Alpha Personal Systems, Engineering Manager. "In one fell swoop, we've given our current customers new platforms to embrace and new customers reasons to migrate—to the most powerful price/performance workstations in the industry."

Alpha AXP System Performs World's Fastest Sort

An Alpha AXP system running the OpenVMS operating system has shattered a record by performing an industry-standard sort benchmark in 9.11 seconds—more than six times faster than the supercomputer that set the record last year.

The sort benchmark, first proposed by a group of 25 database experts in a 1985 DATAMATION magazine, is a standard test of batch and utility performance in the database community. Through a disk-to-disk sort of one million 100-byte records, the sort benchmark involves many parts of the computer system, including processor, I/O subsystem, file system, and operating system.

The sort performance metric is the elapsed time of the following seven steps: (1) launch the sort program, (2) open the input file and create the output file, (3) read the input file, (4) sort the file, (5) write the output file, (6) close the files, and (7) terminate the program.

The previously documented record for the sort benchmark was 58.3 seconds on a 30-CPU, 30-disk, Intel IPSC/2 Hypercube in 1992. A Cray-MP supercomputer set an unpublished 26.0-second record.

The record-breaking sort benchmark was performed by a Digital 10000 AXP system with a single 200-MHz microprocessor and 16 RZ74 SCSI disks. To set this record, the OpenVMS AXP operating system processed 17 input and 17 output files, read and wrote 100 million bytes of data, and performed 25 million in-memory compares, all in under 10 seconds.

An innovative algorithm called AlphaSort (patent pending) was written to exploit the Alpha AXP microprocessor's cache and I/O architecture. Using an array of industry-standard SCSI disks, the Alpha AXP system can read and write date at supercomputer speeds. The AlphaSort algorithm implements a simple file striping scheme to assist in balancing Alpha AXP system performance.

"Anyone considering downsizing should look at this benchmark, which clearly demonstrates that Alpha AXP systems can exceed commercial mainframe performance for a fraction of the cost of a mainframe," said Bill Demmer, vice president, Computer Systems Group. "This benchmark also demonstrates the leadership commercial functionality of our OpenVMS AXP operating system."

Alpha AXP Milestones- 2/92 to 5/93

by Al McGuire

February 25, 1992: Digital introduces the Alpha AXP 64-bit RISC architecture and 150-MHz DECchip 21064 microprocessor. Cray and Kubota announce they will license Alpha AXP technology.

April 1992: Digital unveils software rollout for DEC OSF/1 for AXP and OpenVMS AXP operating systems.

April 1992: Digital and Microsoft announce the Microsoft Windows NT operating system will be available on Alpha AXP-based computer systems.

April-May 1992: Digital displays working third-party applications on early production Alpha AXP systems to more than 30,000 people during DECWORLD '92. The "Wall of Fame" lists 700 companies pledging to port 1200 applications to the Alpha AXP architecture.

June 1992: Digital announces plans for a $425-million semiconductor manufacturing facility in Hudson, Mass., to produce Alpha AXP microprocessors.

June 1992: Digital and UNIX System Laboratories jointly announce plans to ensure that UNIX System V Release 4.2 will be made available to run on Alpha AXP-based computer systems.

June 1992: Ing. C. Olivetti & Co. licenses Alpha AXP technology.

July 1992: Digital officially renames the VMS operating system to "OpenVMS" and introduces 13 Alpha-ready OpenVMS VAX systems and servers.

July 1992: Raytheon Company licenses the Alpha AXP architecture for military computer systems.

September 1992: Digital completes opening of 34 application migration centers worldwide and shipping of more than 1000 AXP systems to software developers.

November 1992: Digital formally introduces Alpha AXP computing, including computer systems ranging from workstations to mainframes, the OpenVMS AXP operating system and layered software products, and a DEC OSF/1 for AXP software development environment. Encore Computer Corporation announces it will license Alpha AXP technology.

November 1992: Four hundred software development partners worldwide announce availability dates for nearly 900 Alpha AXP applications; more than 400 of these applications are scheduled to be available by March 1993.

January 1993: The "Wall of Fame" listing now includes 1084 companies and more than 2000 applications.

February 1993: Digital and Europe's Advanced Computer Research Institute (ACRI) jointly announce that the Alpha AXP architecture will be incorporated into the ACRI high performance computing architecture. Digital and ACRI will cooperate to optimize DEC OSF/1 for AXP operating system for parallel multiprocessor systems.

February 1993: Digital targets OEMs with cost-optimized Alpha AXP. More than 35 OEMs now design Alpha AXP technology into their products.

February 1993: Digital ships 26 OpenVMS AXP layered software products ahead of schedule. Digital now provides a complete software suite to Alpha AXP developers, systems integrators, and end users.

February 25, 1993: Digital announces its 200-MHz DECchip 21064 microprocessor, price reductions for its 150-MHz DECchip 21064 microprocessor, and expansion of the DECchip Alpha AXP microprocessor family into the desktop and embedded markets.

March 17, 1993: Digital ships OSF/1 AXP, the first 64-bit Unified UNIX operating system on schedule. Major database vendors commit to port their products to AXP.

March 1993: Digital announces availability of VMSclusters and SMP for OpenVMS AXP one year ahead of schedule. Digital announces Novell will port its Software Environment to Alpha AXP.

April 1993: Alpha AXP performs the world's fastest sort, and the world's fastest transaction processing at over 258 TPC-A. Digital announces the highest performance workstation under $5000; under $10,000; under $15,000; and at any price (the 200MHz Alpha)

May 1993: Digital announces the world's fastest PC running Microsoft's brand new Windows NT operating system. Digital announces availability of over 2000 applications for Alpha AXP OpenVMS and OSF/1 systems and over 10,000 applications that run Alpha AXP Windows NT systems.

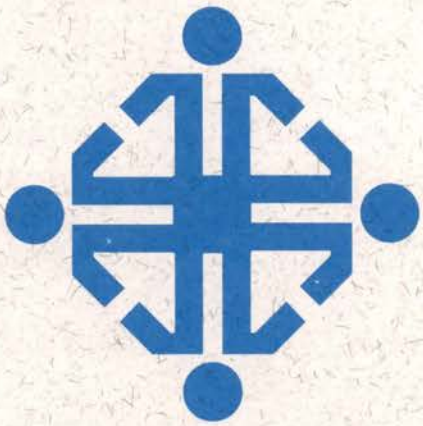
Top Partner Program Enhances Revenue and Visibility

by Chris Gannon

The Importance of Partnership

Digital has always recognized the importance of forming close working relationships with other players in the computer industry. The Digital TOP PARTNER Program not only enhances this recognition, but it also provides the necessary next step for Digital to significantly increase its revenue and visibility. Today, 90 percent of Digital indirect business is sold with or through fewer than 10 percent of our existing business partners, and our top 25 revenue partners drive over 85 percent of the product revenue. As Digital continues to add value with operating systems, utilities, tools, and other middleware, we become increasingly dependent on our partners to provide top-quality applications for customers. It is, therefore, in Digital's best interest to tighten its already close-knit partner relationships.

Program Goal



The TOP PARTNER Program, jointly developed by Alpha Personal Systems and the Computer Systems Group, is designed to increase Digital's return on investment and visibility by focusing on and selectively investing in those partners who consistently sell their software solution products with or through Digital. The partners will be selected, and the success of the program will be measured by the following process created by Tom Donahue, TOP PARTNER Program Manager for the Computer Systems Group's Channels server products:

- Identifying the Top 50 Partners that will drive the most revenue in FY93
- Investing people, money, and time in the TOP PARTNER relationships to boost Digital's visibility and increase market share
- Measuring, over time, the return on investment for Digital
- Reinvesting or disinvesting in TOP PARTNERS based on the return of investment and, in some cases, allowing the focus to move to future growth partners who have the potential to drive revenue for several years

"The TOP PARTNER Program is similar to investing in a mutual fund," according to Tom Donahue. "We clearly cannot invest in every software company and expect a strong return on investment. By identifying a manageable number of strong software products, we can better manage our investments, readily measure and improve our return, and reward those software partners who bring the revenue 'back' to Digital." Jan Colombi, Channels Manager for Alpha Personal Systems, believes the TOP PARTNER Program pulls together and promotes what Digital has to offer our partners, thus leveraging more business for both. "Digital has been working closely with partners in the RISC/UNIX area for over two years to build relationships that translate into revenue for Digital. The TOP PARTNER Program formalizes these efforts and makes it easier for the partners to do business with us."

How the Program Works

In conjunction with the CBU relationship and corporate account managers, Tom Donahue and Sally Fritzinger (Alpha Personal Systems Marketing) provide the partners with a team of sales and marketing consultants to ensure that program feedback is done within a tightly monitored loop. Working with individual partners to create a joint plan also ensures attainment of the original program goal—to increase Digital's return on investment and visibility.

Each plan emphasizes the following key elements:

- Co-sponsoring and co-funding common programs, such as customer events, seminars, and marketing programs
- Combining resources to boost visibility through joint international marketing and engineering support
- Creating advertising messages and success stories that emphasize "one look"
- Increasing revenue by promoting the unique strengths of Digital and the partner

Benefits

Through the TOP PARTNER program, Digital is investing in its future. We are enlisting a proven "off payroll" sales force to market and sell Digital products that lead to increased license share for partners and improved system sales. These high-visibility partners and applications address key Digital markets and improve the return on investments. Partner accountability and easier management of the program reinforce the focus of the program.

Digital is already seeing the benefits of partnership through its relationship with Oracle. Since its inception, Digital's relationship with Oracle has resulted a significant increase in revenue and visibility. Digital has actively participated in Oracle's worldwide user conferences. Oracle, in turn, actively participated in Digital's Alpha AXP announcement. Currently, Digital is working with Oracle and its VARs to ensure the success of Digital's Alpha AXP architecture and the Oracle 7 product. Digital has also increased its visibility through its investment in joint advertising campaigns with our top partners. One example is a recent joint effort that promoted Digital's Alpha AXP architecture and Cognos's PowerHouse product. There have been similar advertising campaigns with Sybase and Oracle.

In addition to more tailored programs developed with each of the top vendors, Digital also encourages key partners to take advantage of existing successful Digital programs where they can demonstrate their solutions to customers. Over the last two years, the majority of our top partners have actively participated in the Open Systems Open House (OSOH) program run by Alpha Personal Systems marketing. OSOH has resulted in several thousand leads for Digital systems running third-party software.

According to Duncan Anderson, Partner Manager for CSG, "In looking at our top 50 CSO partners, it's important to understand that those developers leverage over $3 billion in Digital product sales yearly! Our aim with the TOP PARTNER program is to not replace any good work currently going on with our partners, but to augment those sales relationships with the very best support that Digital engineering can offer."

The TOP PARTNER program is worldwide. In Europe, the TOP PARTNER program has successfully implemented campaigns under the European Applications Program as well as under the ALPHA-Trak campaign. The TOP PARTNER Program enables Digital to tighten its current partner relationships, increase its revenue, and enhance its visibility through investments that are manageable and measurable. It is through programs such as TOP PARTNER that Digital can ensure its success and remain the "open" computer vendor of the industry.

For more information about the TOP PARTNER Program, contact Tom Donahue (Computer Systems Group) at DTN 293-5307 or Sally Fritzinger (Alpha Personal Systems) at DTN 223-6544.

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ALPHA-Trak Campaign Spurs Revenue

by Lynn Berman and Joan Ross

ALPHA-Trak, a joint direct marketing campaign between Digital and selected software business partners, was launched worldwide in January and March.

The ALPHA-Trak campaign focuses on our software business partners' vertical solutions—server or timeshare—for:

- Alpha-ready VAX systems or DECsystems
- Alpha AXP Systems (OpenVMS and OSF/1)

In an effort to open up new markets for Alpha AXP systems, the campaign primarily targets new, non-Digital customers, with secondary emphasis on upgrading the business partner's installed Digital base.

With the commitment of more than 50 leading solution providers and their sales forces, ALPHA-Trak has the makings of a world-class campaign. By the end of Q3, there will be a mailing of 400,000 in the United States and Canada, 15,000 in Europe, and 10,000 in GIA.

The Best Solution

The campaign combines the efforts of Jeannie Hogan, representing the Independent Software Vendor Group (ISVG) and Joan Ross, representing the Computer Systems Group (CSG). Jay Reeg (CSG) is the European program driver and Bill Kelly (CSG) is the GIA driver. Supporting teams from ISVG, CSG, U.S. Marketing, and the IBUs have created a comprehensive campaign that focuses each software business partner on Digital business for 90 to 120 days. The messages are simple. Besides promoting Alpha AXP's technological advantages, ALPHA-Trak is a solutions-focused campaign. The software business partner provides the best customer solution; the software business partner and Digital, as a team, provide the best solution in the targeted industry.

No Loose Ends

Valuable sales leads are recorded, tracked, and given to the right person(s) for follow through. Each IBU nominates the software business partners considered leading solution providers within their markets. Those participating in ALPHA-Trak have their Vice Presidents of Sales and Marketing directing their company's efforts, including sales training, lead distribution, lead tracking, and reporting.

Within U.S. Marketing, Business Development Managers in the field will accept the leads and act as contact points for the software business partners. Some leads are hotter than others. Each software business partner and program driver will identify the top 25 leads and track them throughout the entire cycle. When appropriate, Digital and the software business partner will structure joint sales calls to close business.

Participating Software

Business Partners Software business partners participating in the North American ALPHA-Trak campaign are ASA, Biles, BBN, Cincom, Cognos, DAI, Datatel, Dynix, EA Systems, EDS/GDS, GE Fanuc, GSI/Transcom, HBO, IDI, IDX, NPRI Promis, Oracle, Ross, Smartstar, Software AG, and Xerox.

European ALPHA-Trak rollout, which began in January, includes the following participants: Andersen Consulting, GSI/Transcom, CEGID, Witron, Program Standard, PSI, CIE, Uniface, Cognos, Sybase, Oracle, Ingres, Informix, AT&T Istel, Fraser Williams, and Calidus.

GIA ALPHA-Trak participants include Arc/Cadcentre, Ask Ingress, Berger, CADIX, CAPA GRAPHICS, Computer Associates, Computer Management Centre, Cybernet Systems, Eden Technology, Emphasys, Marubeni-Hytech, MKC, Nihon-Sougou Laboratories, OMRON Software, ORACLE Japan, QAD Inc., Ross Systems, Ryutia Corporation, SAP, SAS Japan, SEIKO Instruments, Wilsons, and ZENRIN.

Rollout began in March. For more information on ALPHA-Trak, contact Joan Ross at DTN 293-5283 (MSBCS::ROSS) or Jeannie Hogan at DTN 297-4664 (MR4DEC::JHOGAN).

Product Phase-down Contributes to Controlling the Bottom Line

by Ann Hablanian

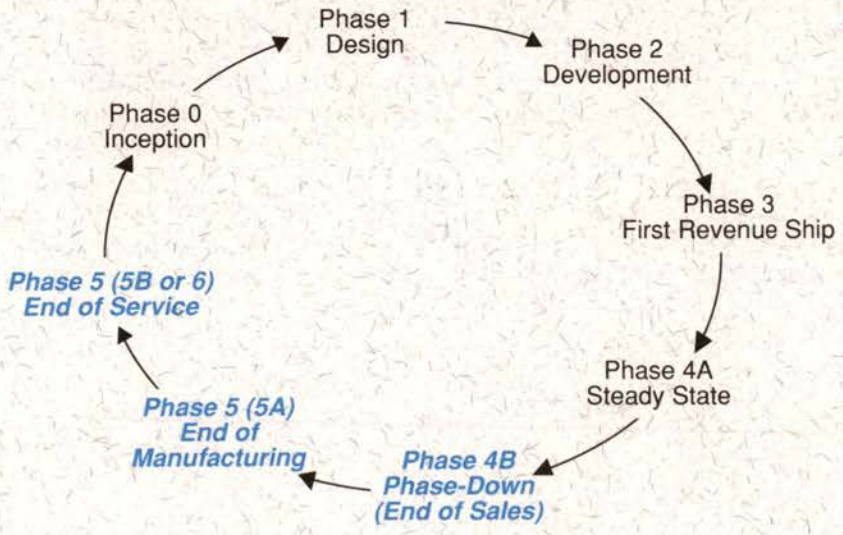
Six quarters after announcement, Product X had shipped only a fraction of its initial forecast and Digital was left with substantial leftover inventory.

This situation and similar scenarios forced Digital to pay closer attention to the material exposure part of investments and to follow specific corporate guidelines for the phase review process, including product phase-down.

During an audit by Coopers and Lybrand in 1985, auditors identified management process problems throughout the corporation and stated, specifically, that an excessively large percentage of inventory was being maintained in the non-active category. Reserve dollars posted against this inventory exposed the Corporation to short-term profit losses.

The Corporation's Board of Directors' Budget Committee immediately set up controls and reviewed the situation. The Budget Committee's findings concluded that the major contributor to short-term profit losses was lack of focus on life cycle management. Increasing competition and decreased product life cycles mandated a new approach to life cycle management. Ed Goucher, who helped write the guidelines, explained that the result was to delegate management responsibility to each PCU.

In 1989, the low-end MicroVAX product management group, led by Lou Philippon, addressed this issue. The highly successful MicroVAX II product, launched in 1985, was approaching phase-down and engineering teams were centered on new product development and a flurry of product announcements. Maintaining emphasis on cost control and profitability required that a team be assigned with the special task of monitoring product activity from Phase 4B through the end of the product's life cycle. The result was the creation of the Product Phase-Down (PPD) Team.



Careful product phase-down is critical to controlling the bottom line and to maintaining customer satisfaction.

The Product Phase-Down Team

The current 4000 Systems and Servers Business (4SSB) PPD team includes one product manager dedicated to driving the process by serving as the focal point for prod-

ucts approaching and undergoing phase-down. Other key members of the team include the worldwide manufacturing program manager, who coordinates numerous plant activities from chip manufacture to final assembly; a materials manager, who deals with manufacturing class part numbers and specific aging inventory analysis; and the business group's financial analyst. Current team members are respectively Ann Hablanian, Allan King, Deb Blumer, and Jim Cuzner.

Extended team members include, the Digital Services Logistics representative, the geography Area Operations staff, Systems and Support Engineering (SASE) personnel, and the plant manufacturing and supply/demand personnel. Worldwide marketing groups, as well as Corporate Contributions and the Legal departments, are involved as required, as are all system peripheral and add-on option groups, the custom build groups, and remarketing groups.

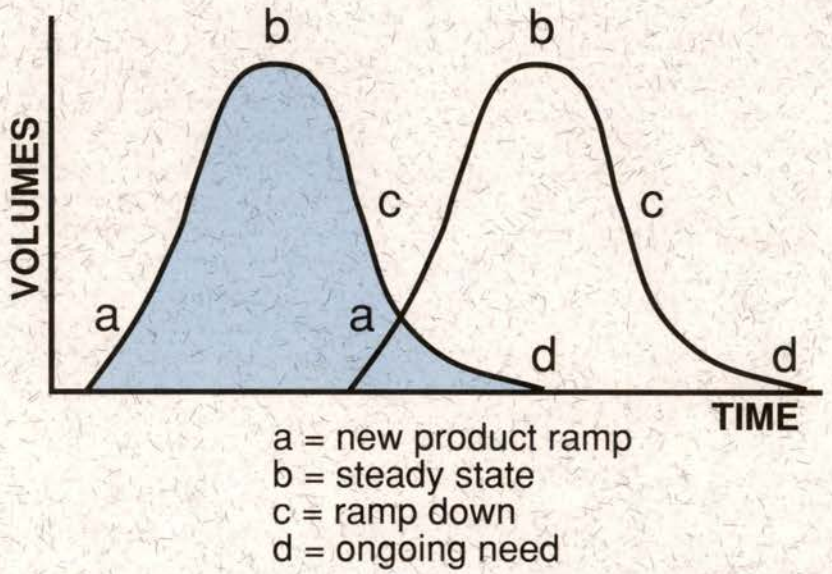
Timing - When to Phase Down

Ideal assumptions drive the PPD planning process. Six to nine months before a replacement product is introduced, material analysis for the older product starts and migration strategies are identified. Discussion with the geographies begin to evaluate the potential of repricing models and consider other methods of enhancing revenue for the older product.

Ideally, the new hardware system offers customers a distinct advantage over the older model. Based on the competitive demand, the new system is positioned and priced as a replacement and offers performance and/or other enhancements. The new product is introduced precisely when planned, the initial competitive conditions remain intact, and manufacturing ramps up as forecast.

In reality, unexpected factors such as chip yields may suddenly diminish and drive the entire process.

An ideal situation yields a perfect bell curve. In real situations, there is always ongoing lag to meet special customer needs. The government, for example, may prolong a changeover based on stringent procurement processes and regulations.



Phase-down announcements trigger temporary increased activity as accounts with special migration needs for a specific hardware footprint or software compliance rush to place their orders.

Customer satisfaction is a key and ongoing goal in the phase-down process. The balancing act is in simultaneously considering shutting down of older lines and business while maintaining customer satisfaction.

Inherent in phase-down is a smooth transition from manufacturing to service, since service support can continue for many years after manufacturing production stops.

Closing the loop between the final phases of the aging product to the beginning of the new one necessitates dialogue between engineering and groups, such as the waste management group.

The cost to dispose of hazardous waste is a prime example. With increased awareness of environmental issues, Germany, for example, and Europe, in general, are becoming more stringent in their hazardous waste disposal requirements and place legal responsibility on the producer. If engineering material design and procurement groups fail to consider the consequences of product disposal, the company's existence may be in jeopardy.

For Digital, this translates to communication and the institution of strict but flexible controls at every level.

Phase-Down Guidelines

Reinforced by messages from the field, the PPD experience has yielded the following guidelines:

- Limit new product offerings.
- Price new products appropriately to make migration happen smoothly and quickly.
- Communicate to major accounts and the sales force with clear and simple messages.
- Streamline the transition process rather than extensively manipulating prices and making enhancements to existing products.

Recycle, Don't Scrap

While the most expedient alternative may be to scrap old equipment, more creative alternatives exist. When 75 MicroVAX II systems were unexpectedly returned by distributors, for example, they were shipped to Digital collaborative engineering Centers in Europe and to train students from the eastern European countries.

To equip a standard CAD classroom within a university or library in an eastern European county or a former USSR republic, Bob Jenefsky, the business development manager for education and science in Central and Eastern Europe, and Robert Boers of European Engineering bundled a base VAX system with load and print devices, a PC, and PC integration capability.

European Corporate Contributions has approved 10 of these packages for universities in Russia and Ukraine, including Moscow Aviation Institute, the State Technical University of St. Petersburg, and the Kiev Polytechnical Institute. The leveraging of future sales and reciprocal contractual activities have already begun.

Measuring Success

Success, to a great extent, is based on Phase 4B assessment of future sales versus excess inventory and inventory write-off exposure. It is not solely a matter of praising ourselves for meeting our own forecasts, but for having executed the plans we put in place to control both the expected and unexpected inventory exposure that surfaces in the interval of nine months or more between the Phase 4B and Phase 5 exits.

One method of measuring success is to determine the percent of material exposure to operating profit. Our current rate is less than one percent. Measured against corporate guidelines for the maintenance of 85 percent of hardware inventory in the Active category (up to three months supply), we are on target at 85 percent for Q1 and Q2 FY93. In the other significant categories of Surplus and Obsolete, at two percent obsolete and six percent surplus, we readily beat the average derived with related system groups.

Focus on the Bottom Line

The phase-down activity success is based on controlling the bottom line, yet it is easy to lose focus when the spotlight is on new product introductions.

Saving $20K blocks is a noteworthy PPD activity. And saving $250K from the scrap heap is a major accomplishment, since it translates to a direct contribution to Digital's gross profits. By helping new subsidiaries and emerging marketplaces establish themselves, the yield in future market share and profit for the Corporation is inestimable.

CSG Adds Engineering Design Services

by Vic Penney and Dick Willett

One of the newer members of the Computer Systems Group is the Engineering Design Services (EDS) organization managed by Bill Picott.

Bill's group is responsible for delivering best-in-class engineering design services and technology to the Digital hardware design community through one integrated organization that includes:

- Diagnostic Services & Firmware Engineering (Jeff Katzif)
- Electrical CAE/CAD (Jim King)
- European Engineering Design Services (Sam McGuinness)
- Finance & Administration (Bob Claise)
- Human Resources (Mary Ann Joyce)
- Planning & Operations (Vic Penney)
- Regulatory Engineering & Standards Domains (Dick Belanger)
- Systems Technical Operations (STO) - SHR (Ed Lee)

The services provided by EDS include Component Engineering (STO), Diagnostics and Firmware Engineering, ECAx, Electrical CAD Libraries, Electrical CAD Tools, EMC Engineering, Engineering Technical Training, MCAx (NaC, STO), Model Shop (STO), Telecom Engineering, PWB Layout Design, Regulatory Engineering Technical Standards Domains, Safety Engineering, and Simulation Models.

The EDS business is primarily self-liquidating. Approximately 92 percent of the work is charged out to design engineering projects, five percent is direct E98 funding to support the Technical Regulatory Standards work, and three percent represents funding provided by Sales and Marketing for services delivered to Digital Customers.

The internal customers for the services provided by Bill's group include most major engineering organizations within Digital. Currently, CSG represents 38 percent of contracts, Networks Engineering 22 percent, Storage Engineering 18 percent, VIPS/CE five percent, Manufacturing six percent, and a combination of Software Engineering/Field/Marketing/Sales the remaining 11 percent.

In addition to delivering high-quality services to Engineering, EDS has initiated a number of major programs during FY93 aimed at setting strategic direction and achieving excellence in engineering services. At the forefront of this activity is a set of objectives and guiding principles that form the backbone of EDS operations. These objectives include consolidation of service groups for one-stop shopping; adoption of common processes, standards and tools; and the initiation of strategy efforts.

Consolidation of Service Groups

During FY93, EDS has consolidated satellite engineering service groups that provide similar services. Reporting relationships are a combination of solid line and dotted line. Included in the consolidation are the Systems Technical Operations group supporting the SHR area; the

Bill Picott's Staff: Front Row, L to R: Jim King, Dick Belanger, Olga Everett, and John Walsh. Back Row, L to R: Vic Penney, Bob Claise, Mary Ann Joyce, Ed Lee, and Bill Picott

Networks Engineering Services group in Littleton; the European Engineering Services activity supporting Ayr, Galway, and Reading; and EMC resources from both Manufacturing and CSG. The benefit of consolidating is that all groups, as members of the Virtual Central, have access to the resources and expertise of the entire organization to help meet the needs of their engineering customers.

Adoption of Common Tools

The Virtual Central EDS requires common processes, standards, and tools to ensure consistent service delivery to each engineering customer regardless of which service group does the work. The first step towards creating a common process was a business workflow process redesign effort initiated during Q2 FY93. Each function formed a worldwide team to discuss and agree upon an "ideal" business workflow process. The results of that work are now being implemented.

Initiation of Strategy Efforts

EDS has initiated three strategy efforts for the Corporation: CAD Strategy, Regulatory Strategy, and Common Console Strategy. A strategy committee in each area, comprised of experts and engineering representatives, sets strategy for common tools, common processes, improved time to market, and improved cost and quality. Further, each strategy committee is working with Bob Supnik, Engineering Technical Director, to lead strategy reviews and gain approvals. Dileep Bhandarkar, CSG Hardware Technical Director, is coordinating review and approval of the CAD Strategy. Peter Conklin, Operating Systems Technical Director and Alpha AXP Systems Technical Office Manager, is helping to coordinate review and approval of the Common Console Strategy. When the reviews, currently under way, are complete, Engineering and EDS will work together to implement the strategies.

EDS's primary objective is to provide best-in-class performance in each function. EDS has completed a cost- and time-focused benchmark for PWB Layout Design, EMC, and Safety using the services of an external consultant. Current activity includes benchmarking work focused on CAD, Regulatory, and Diagnostics/Firmware. Benchmarking teams are now determining scope, critical success factors, and objectives for the work. Plans include field work, results assessment, and followup actions and implementation by the end of Q4 FY93.

Perhaps the most significant challenge for EDS is the implementation of major programs. Progress is being made in all areas; however, successful implementation of these programs requires that EDS continue developing strong and supportive partnerships with its engineering customers. The next significant challenge for EDS is to develop a plan for implementing its strategies, and setting the expectations that EDS has just begun the journey toward achieving best-in-class service delivery performance for its engineering customers.

Benchmarking Leads to Best-in-class Performance

by Hank Moran

Benchmarking is a management tool chosen by Engineering Design Services (EDS) to ensure that EDS groups perform at best-in-class levels, as measured by benchmarking results as well as customer satisfaction. EDS recognizes that carefully selected and highly focused benchmarking activity can lead to significant operational improvements, can validate the effectiveness of EDS practices, and can expedite achievement of the highest level of excellence in all areas of EDS responsibility.

EDS initiated several benchmarking projects during FY93. The first three EDS benchmarking projects, which were undertaken by Jim King and members of his staff, concentrated on Electromagnetic Compatibility (EMC), Safety, and Printed Wire Board (PWB) Layout. The projects spawned three studies, which focused on delivery processes, with cost and time selected as critical success factors. They compared the performance of Digital internal service groups with that of several external providers of the same services, based on a set of prescribed configurations. A key objective was to identify providers whose performance was found to be best in class, then to determine the "best practices" that contribute to their success, and to finally incorporate the practices into EDS operations.

To ensure objectivity and to assist in selecting appropriate external providers, Jim contracted the services of Arthur D. Little, a prominent benchmarking firm.

The original teams consisted of Jim, the manager of each area (Stew Jackson for Safety, John Grose for EMC, Bob Murphy for PWB Layout), and content experts from their groups. These teams worked closely with the consultants throughout the studies.

The teams were eventually expanded to include new members focused on the selected areas.This allowed broader participation in the analysis of the findings from the studies.

To complete the work, small Digital teams will make site visits to companies identified as high performers to determine how these companies achieve success and to use the understanding to improve our internal practices.

Performance Comparisons

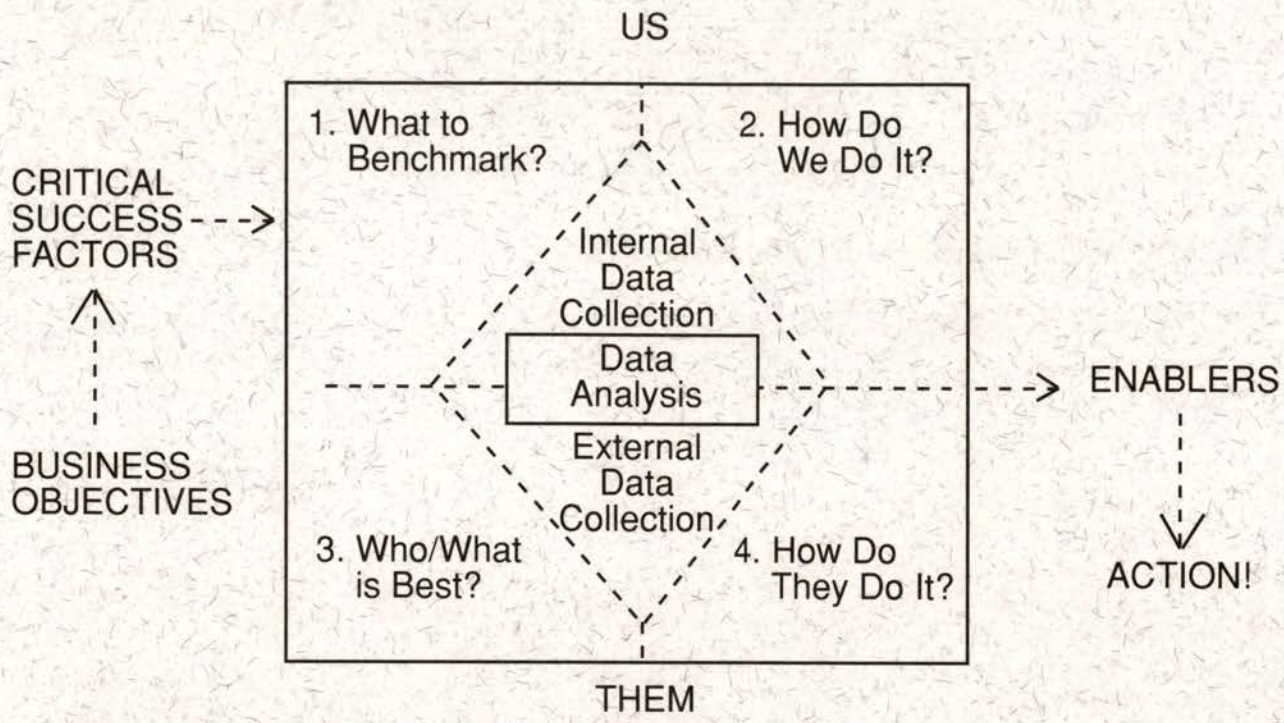
The following is a summary of the results of each study, including planned followup actions:

SAFETY

- Findings
  - We are cost-competitive in comparison with selected providers.
  - Most internal groups are faster than outside services.
  - Our quick access to agencies and recognition by agencies of our effective internal processes provide a decided edge.
  - Better tools and methods are needed to improve cost and time estimates.
  - There are many variations of internal Digital processes to qualify products.
- Actions
  - Generate improved cost-estimating and time-estimating tools and practices.
  - Find out why there is so much variability and correct it.
  - Understand Service Provider A's process for a good example of low-cost process.

EMC

- Findings
  - We are cost-competitive in comparison with selected providers.
  - We are somewhat higher in time (~5%).
  - Service Provider B is lower in both cost and time.
  - Service Provider C is lower in cost but has questionable quality.
  - There is little variation in internal Digital group estimates.
- Actions
  - Understand Service Provider B's process as lowest cost/time practice.
  - Continue using Activity-Based Costing (ABC) for better cost models.



Much has already been learned about the benchmarking process and how well EDS performs in comparison with external providers.

PWB

- Findings
  - Internal PWB layout costs are higher; PWB FAB costs are competitive.
  - Internal service has best-in-class time.
  - Evaluate the need for the documentation package.
  - Service Provider D's PC-based process has the lowest cost.
  - We need to lower our costs.
- Actions
  - Evaluate Service Provider D's PC-based process.
  - Understand how we can maintain best-in-class time and achieve lowest costs simultaneously.
  - Look at the practices of Service Providers D, E, F, and G.

Key Learnings

One key learning about of the benchmarking process is the importance of clearly defining the objectives of the benchmarking activity. Be sure to ask the right questions up front. To give direction and purpose to the study, teams must articulate clearly what information they need.

When using a consultant, it is vital to ensure that the consultant understands the technical area being studied. Our initial results were uneven across the three studies, in part because of the varied technical experience of the consultants.

It is essential to baseline internal operations effectively as a primary step in the process (for example, gathering accurate cost data using methodologies, such as Activity-Based Costing, and time data from precisely bounded process maps). Without such precision, it is difficult to conduct meaningful comparisons with the operations of other firms. We could not use the initial study conclusions because we failed to provide the best data, and we had to resubmit better data for more conclusive results. This lesson alone has resulted in improved data collection methods.

The benchmarking process does not end with the competitive analysis, which is but a step on the way to understanding best practices employed by best-performing companies. The aim is not just to be competitive, but to become the recognized best.

This learning points to the most important ingredient for successful

benchmarking—having the right team of people involved actively from the start and the right leadership. Teams must have leaders who are experts in the areas being studied, and who are responsible and accountable for seeing that the project is successfully completed. The leader must have the authority to make changes in processes, products, and services based on the benchmarking information. Without such leadership, the benchmarking activity can be a waste of time and money. In the EDS studies, EDS staff and expert players have been involved throughout the process. This participation has been a major factor contributing to the relevance, value, implementation, speed, and impact of this activity.

Other EDS Benchmarking Projects

As these studies evolved, Bill Picott, the Manager of EDS recognized the value of having all groups in EDS engage in benchmarking their areas of responsibility. He requested that a benchmarking plan be developed for all EDS and appointed Hank Moran, as Program Manager, to drive this overall plan.

Current EDS benchmarking work focuses on the following three areas:

- Regulatory Services
  - EMC Test/Approval Process
  - Safety Test/Approval Process
  - Telecommunications Test/ Approval Process
- Computer-Aided Services (CAx)
  - PWB Layout Process
  - EDA Services
  - MCAD Services
- Diagnostic Systems and Firmware
  - DSFE Test Products

Teams, which have been established in each area, have the following responsibilities:

- Define the scope and topic for the benchmarking work in its area.
- Relate benchmarking work to EDS strategies.
- Define objectives, critical success factors, metrics, priorities, questions to probe, and a schedule for the benchmark ing work.
- Conduct internal data collection ("baselining") relative to the topics to be benchmarked.
- Decide whether and how best to engage external consultants in the benchmarking work, particularly for external data collection.
- Analyze findings and propose changes based on the learning.
- Engage in team work through out the benchmarking process.

For more information on EDS benchmarking, contact Hank Moran at LEDDEV::MORAN or DTN 223-3708.

EMI Modeling Can Shorten Design Process

by Bruce Archambeault

More and more engineers and managers are becoming interested in EMI modeling. To dispel the confusion about EMI modeling, this article will address why EMI modeling is important, who should consider EMI modeling, what should be modeled, when is modeling is appropriate, and how to perform this modeling.

Why Model?

The principal reason to do EMI modeling is to reduce a product's development cost and to reduce the time to market. Modeling can allow engineers to consider the effect of various options without the need to "build it and try it." EMI modeling allows engineers to evaluate design options, as well as the effect of normal design tolerances upon the EMI performance of the equipment being designed.

Fully benefiting from EMI modeling requires a basic change in product design philosophy. In the cost-conscious atmosphere of the 90s, engineers no longer have the luxury to consider only the functional design and ignore the EMI performance until prototypes fail. The effect of choosing a particular design direction upon the EMI performance can be determined through EMI modeling well before the prototypes are built and tested, therefore increasing the likelihood that the product will pass.

Who Should Model?

EMI modeling can be done by anyone involved in a product's development, including product design engineers and EMI support engineers. The best approach is usually for a team of the design and EMI engineers to work together to perform the modeling. Today's EMI modeling tools are easy to use and provide results that are easy to understand.

What Should be Modeled?

No EMI modeling tool will model the entire system and provide an overall result. However, the EMI modeling problem can be broken into smaller problems and those individual problems can be modeled. The EMI engineer and the design engineer need to work together to determine which are the areas of greatest risk in a particular design or design approach, and then model those specific areas of risk to determine the best final approach to be implemented in the overall system. Examples of areas that could pose the greatest risk include:

- Radiation through air vents
- Radiation through slots or other openings in the shield
- Radiation from the cables in the system under test (SUT)
- Radiation through the cable shields
- Coupling from a source on the PC board to a connector, allowing a exit path for the radiation

When a designer must decide between two or more options, EMI modeling can provide an estimate of the relative difference between the implementation of the different options. If nearly no difference would result, then either could be chosen. However, if a large difference would potentially cause the SUT to fail EMI/FCC testing, then the more conservative design alternative should be chosen.

When Should Modeling be Used?

EMI modeling can be used at many different phases of the product development.

- Pre-Phase 0 and Phase 0

  Many design questions can be answered during Phase 0 to help speed the full design process during the design phase.

- Design Phase

  The design phase is the time to evaluate the specific design options to determine the best option for the particular design. A tolerance analysis of the effect of parameter variation (such as slot length) on the overall EMI design can also be performed during this phase.

- Redesign Phase

  Although this phase is not defined in the formal phase review process, some products fail EMI testing and require modifications. Using EMI modeling, alternative design options can be evaluated without the need for a back-and-forth iteration between test labs and design labs.

- ECO Phase

  Once the product design is complete, modifications are sometimes made to enhance the functionality or reduce the cost of

the product. EMI modeling provides the opportunity to evalu ate potential changes without the need to "build it and try it."

How is EMI Modeling Done?

The goal of EMI modeling is to identify potential sources and leakage channels of EMI radiation. Sources may include a RF voltage on a chip heatsink, microstrip lines, connectors, cables, or any fast risetime current path (including the reference current return [ground] path). (In general, the risetime of the signal on a particular conductor is more important than the data rate.) EMI leakage channels may include slots and air vents in a shield, connectors and cables, or coupling within the shielded box.

Numerous internal Digital software tools comprise the EMI Toolbox (EMIT). The choice of tool depends upon the particular application. Currently, tools are available to find the inductance of metal structures, the capacitance between metal structures, the radiation from an shielded SUT with cables, and radiation through air vents and slots. Often the user must use more than one tool to find the final EMI radiation.

Numerical Modeling Techniques

Different modeling tools use different numerical techniques, each with its own unique advantages, disadvantages, and limitations.

- Method of Moments

  The Method of Moments (MoM) requires the structure being modeled to be broken into relatively small wire segments and surface patches. MoM creates a system of linear equations to determine the RF currents on the segments and patches. The radiated electric and/or magnetic fields at the antenna receive location can be calculated by summing the contributions from the current on each segment and patch. A large matrix (often on the order of thousands by thousands) must be inverted. MoM determines the currents and the fields for one frequency at a time, so if multiple frequencies (or a range of frequencies) are desired, the model must be repeated a number of times.

- Finite Difference Time Domain (FDTD)

  FDTD requires the area or volume to be modeled to be broken into a grid (with the sides of the grid small compared to the shortest wavelength of interest). The electric and magnetic fields are determined throughout the grid structure through an iterative time stepping process where the fields are determined, time-advanced one step, and determined again until the fields have stabilized. Since the FDTD method is a time domain technique, a wide range of frequencies may be evaluated during one model run. FDTD requires a large working memory since the number of grid segments for real-life problems often become quite large. Depending on the model configuration, the model must continue for many time steps to allow the electric and magnetic fields to stabilize.

- Finite Element Method (FEM)

  The Finite Element Method requires that the volume under consideration be broken into volume elements (with sides small relative to the wavelength). Using the MoM technique, the RF currents are found within each volume element, allowing the electric and magnetic fields to be determined at the receive antenna location. Like the MoM technique, FEM operates on a single frequency at a time. Currently, none of the EMIT tools use the FEM technique.

There are a number of other numerical modeling techniques that will not be described here. These techniques are mostly used for far-field applications such as radar and broadcast radio. Since EMI modeling requires techniques operating in the near field, these other techniques are of little applicability here.

Summary

EMI modeling minimizes iterative trial-and-error and redesign, ensuring the fastest possible passage through EMI testing. The result is reduced product development cost and time to market.

EMI modeling is best accomplished by a team of design and EMI engineers but either engineer can perform the modeling alone. EMI modeling can be accomplished at many different phases of the product design phase, but is recommended during the early design phases (e.g., Phase 0). A number of different EMI modeling tools exist to predict the performance of individual portions of the system.

EMSCAN EMI Spatial Probe Helps Engineers

by Bruce Archambeault

Logic analyzers and oscilloscopes help engineers look at intentional signals on a printed circuit board, but an EMI engineer often needs to identify very low amplitude *unintentional* signals. These unintentional signals usually originate from the fast rise-times of intentional signals on chips and flow across a circuit board. The EMSCAN EMI spatial probe allows engineers to analyze circuit boards and determine where signals are traveling.

EMSCAN is a set of magnetic field probes arranged across a grid measuring 9.5" x 12." A PC is used to control which probe is active at any one time, and a spectrum analyzer is used to determine the field strength, i.e., the RF current directly above the active probe. The PC measures all the various probes, in turn, and then paints a display indicating the high and low RF current areas on the circuit board for the frequency of interest. EMSCAN can also be used to search the entire circuit board for the highest spectral frequencies, helping to narrow the search during spatial testing.

When Should EMSCAN be Used?

EMSCAN can be used effectively during the prototype phase of product development and during the "fix-it" phase if necessary.

During the prototype phase, circuit boards are often built before the complete system is ready for testing in the EMI lab. The circuit board can be tested on the EMSCAN to ensure that all RF currents flow to intended areas only.

During the fix-it phase, EMSCAN can help quickly identify the source of the offending emission. As changes are made to the circuit board, EMSCAN will identify if the latest change has affected the RF currents on the board. Since no change to the RF currents on the board implies no change to the overall product's emission profile, valuable time can be saved by eliminating wasteful iterations between the design engineering lab and the EMI test laboratory. Therefore, a number of changes can be evaluated without leaving the engineering laboratory.

Sample Use of EMSCAN

An example is given here of the use of the EMSCAN tool. A circuit board, chosen from a Digital product, contained a number for different frequencies. The EMSCAN was first used to find the spectral emissions from across the entire board (maximum from the entire board at each frequency). Figure 1 shows this spectral response. Note there are a number of frequencies with high-level signals.

In this example, the frequencies of 251 MHz and 321 MHz were problems in the EMI test facility. So those frequencies were the main focus of this effort. The spatial pattern for this board for those frequencies was taken and is displayed in Figures 2A and 3A. Note the high areas of RF currents spread over a large portion of the circuit board and spread well beyond the ICs needing those signals. The source of those RF currents was determined to need additional decoupling capacitors. After installation, the EMSCAN was again used to determine the RF currents at these frequencies. These results are shown in Figures 2B and 3B. Note the much smaller area for the RF currents. The product was able to pass the FCC/EMC requirements with the new configuration.

EMSCAN Availability

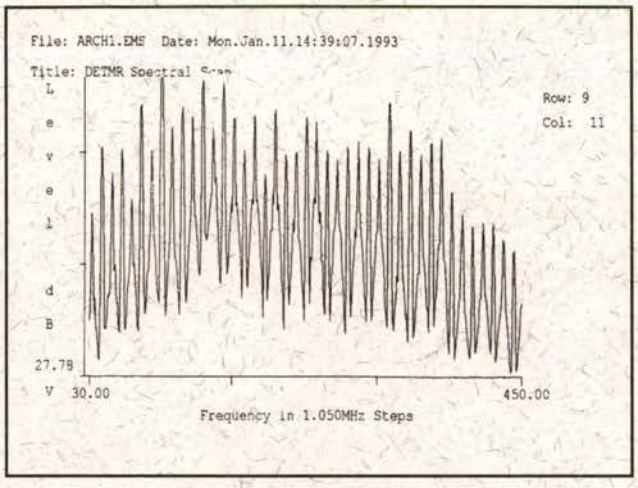
EMSCAN is available for general use by all Digital EMI and design engineers. It is currently located at the EPT/STT laboratory (located on MLO1-1). Training for individuals to use the EMSCAN themselves is available, and STT technicians are available to perform the testing as well. This testing is quick and easy, and can be done in any engineering lab. Any product that can have its operating circuit board placed on the EMSCAN panel can use EMSCAN. If a circuit board is too large, then portions of the board can be evaluated in turn.

Summary

EMSCAN is a valuable engineering tool to help analyze the location of RF currents on a circuit board. Engineers can quickly determine the usefulness of changes to circuit boards without the need for back-and-forth trips between the engineering lab and the EMI test lab.

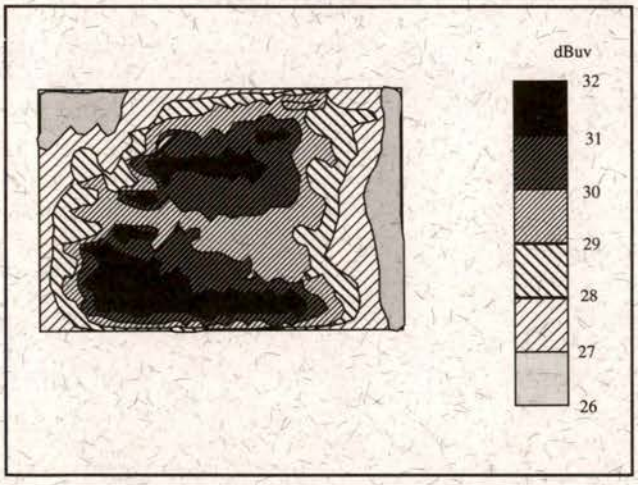
F

Figure 1



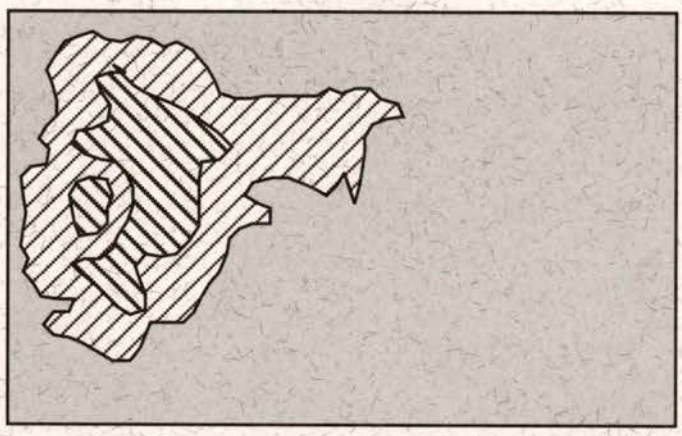
Example Spectral Response

Figure 2A



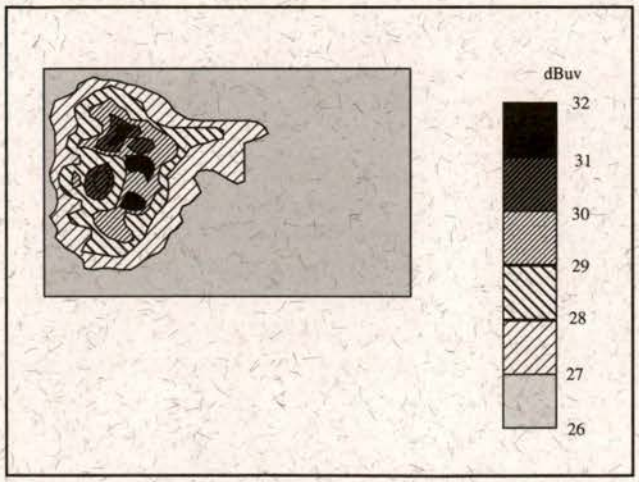
Original Spatial RF Currents @ 143 MHz

Figure 2B



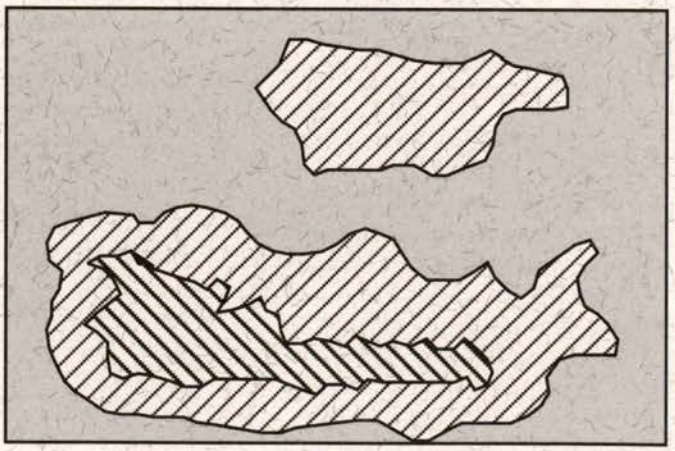
Final Spatial RF Currents @ 143 Mhz

Figure 3A



Original Spatial RF Currents @ 321 MHz

Figure 3B



Final Spatial RF Currents @ 321 MHz

High Performance Computing Presents Comeback Opportunity

by Julie Skalinski

Digital has renewed its focus on high performance computing and the opportunities it represents. High performance computing is the use of computer modeling and simulation to solve business and scientific problems. It can be found in almost every industry and is used for almost every operation from financial modeling and finite element analysis, to seismic processing and reservoir simulation.

A variety of hardware platforms are used in high performance computing, from high performance mainframes and supercomputers, to parallel processors, workstations, and workstation farms (A workstation farm is a collection of systems in a local area network interconnected via a high performance network, which functions as a distributed batch server for compute-intensive programs.) However, the trend is for customers to downsize from large systems to smaller, more cost-effective computers.

Currently, this market has estimated revenues of $10.2 billion. According to IDC, the market will grow to $25 billion by 1996. This growth is largely attributed to workstations and workstation farms.

Digital Opportunity

Digital currently has about 10 percent market share, but in the mid-1980s, Digital was recognized as a leader. We now have the opportunity to regain that leadership with a set of products designed to meet the needs of this marketplace.

Digital's fundamental product and service elements offer the performance of the 64-bit super scalar Alpha AXP systems, complemented by very competitive storage systems and interconnects, universal UNIX and OpenVMS operating systems, and commitments from leading third-party vendors.

Our workstation farms effort is quickly moving forward in a two-phased approach. In April, during Phase 1, a suite of third-party products, which enable standard AXP products to function as a farm, were announced. Phase 2, planned for the end of the calendar year, represents Digital's true added value and uniqueness. Digital has taken a leadership position in the development of the High Performance Fortran (HPF) standard for parallel systems. This will be announced along with tools for developing and tuning farm applications, and farm systems management software. A high performance computing expertise center to support ISVs and customers developing high performance computing applications, including farms, is planned for FY94.

Digital can utilize current Alpha AXP products, as well as workstation farms, for success now. At least half of recent Alpha wins have been in the high performance market, among such prestigious customers as Carnegie-Mellon University, Pitney Bowes, Hoechst Celanese, and Tampere University of Technology

Digital High Performance Computing Group

High Performance Computing has been identified as one of the three key environments on which to focus Digital engineering resources, and has obtained high levels of corporate commitment. Bob Palmer states, "Alpha AXP has given us a real opportunity to regain the lead in the scientific and technical market that was once the very foundation of our success."

Analysts agree. Aberdeen Group says that "Digital has a once-in-10-year opportunity to recapture the hearts and minds of the technical and educational markets" and that "competitive forces are collectively weak while Digital is at the beginning of a powerful new product cycle."

To capitalize on this opportunity, the High Performance Computing (HPC) Group was formed under the leadership of Paul Curtin. High Performance Computing is part of the Computer Systems Group and brings together a number of programs, including the Massively Parallel Systems Group, High Performance Computing Marketing,

the Cray relationship, the Workstations Farms effort, and the Supercomputing Center.

The High Performance Computing Group is also involved in managing the relationships with Alpha "technology partners," including Cray Research and Kubota Pacific Computer. As announced on March 30th, Kubota Pacific Computer is integrating Alpha AXP workstations with its own new, high-end graphics system. The combination of Alpha AXP and Kubota graphics delivers to customers the industry's most advanced 3D graphics and imaging solutions.

What's Happening Now?

A High Performance Steering Committee has been formed with representatives from the territories, systems and services groups, and industries that represent the most immediate opportunities for success with Alpha AXP. This committee will work to ensure that engineering delivers products that meet customer requirements. The HPC Group will work with the CBUs, the field, and other engineering organizations to develop and execute a corporate high performance computing strategy and business plan that delivers a competitive advantage to our customers and sustains Digital's unique added value.

Digital's opportunity is now! The High Performance Computing market is growing at an anticipated 15 percent CAGR through 1996. Today, Digital is equipped with the most powerful and most complete solutions to recapture this market and is committed to regaining its market leadership.

Digital Introduces OpenVMS VAX Version 6.0

by Tim Ellison and Joe Bates

As a part of Digital's strong commitment to open software standards, OpenVMS VAX Version 6.0, a major functional version will be released in June 1993. OpenVMS VAX, the new name for the operating system software that runs on Digital's VAX processors, was introduced with OpenVMS VAX Version 5.5.

This article describes the major features of Version 6.0, including new measures that minimize the impact of a new functional release. OpenVMS customers, users, software developers, and business partners will find this release much easier to install or upgrade than previous major releases.

OpenVMS VAX Version 6.0 capabilities are a direct result of requests from customers. Digital is strongly committed to OpenVMS and will continue to provide releases that will fulfill the needs of OpenVMS customers well into the future.

C2 Security

Many government and defense contract customers require operating systems to meet the Department of Defense (DoD) Trusted Computer System Evaluation Criteria *Orange Book* C2 ranking. This ranking is measured by the National Computer Security Center (NCSC) evaluation process, which evaluates the features and assurances of the operating system. While the Orange Book is a U.S. Government specification, it describes security capabilities, such as auditing, authentication, and access controls, which are also required by many commercial customers. Operating systems that obtain a C2 ranking are capable of enforcing finely grained discretionary access control and making users individually accountable for their actions through logging procedures, auditing of security-related events, and resource isolation.

Extended Physical Addressing (XPA)

Certain applications and workloads work best when they have access to vast amounts of physical memory. Before Version 6.0, physical memory was limited to 512 MB of memory (30 bit addresses). OpenVMS VAX Version 6.0 extends the address space from 30 to 32 bits. The OpenVMS VAX operating system can provide 3.5 GB of physical memory and .5 GB of I/O and adapter space. This capability enables large applications and workloads to access the huge amounts of physical memory that they require. The VAX 6000-600, VAX 7000 series, and VAX 10000 series systems will be the initial VAX family members to support extended physical addressing. Older VAX family members will continue to support a 30-bit physical address space and will not be impacted by these changes. It is expected that future members of the VAX family will also support the 32-bit physical address space.

Extended Virtual Addressing (XVA)

OpenVMS VAX Version 6.0 also allows large applications access up to two Gbytes of system virtual address space. This feature supports a recently introduced change to the VAX architecture and will be supported on the VAX 6000-600 system, the VAX 7000 series, and the VAX 10,000 series as well as the future VAX family CPUs.

Virtual Balance Slots (VBS)

Before OpenVMS VAX Version 6.0, the number of memory-resident processes in one VAX CPU was limited by the size of the system virtual address space and the way the space was allocated. When this limit was exceeded, processes would be swapped out. Excessive swapping negatively affects the overall performance of a system. VBS gives the appearance of a virtually unlimited quantity of balance slots by timesharing the set of memory-resident processes through the limited set of real balance slots. This new feature will particularly benefit systems that have a large number of processes resident in memory, either because of a large number of users (for example, ALL-IN-1) or because of a large number of processes per user (for example, Xterminals running DECwindows Motif).

Adaptive Pool Management

OpenVMS VAX Version 6.0 provides a new autotuning algorithm that reduces the probability of system outages due to exhaustion of memory allocated for system data structures (pool) and that virtually eliminates the need for customers to actively manage their allocation of pool resources. Under the new structure, the nonpaged pool area and lookaside lists are combined into one region, allowing memory packets to migrate from lookaside lists to general pool and back again based on demand. As a result, the system is capable of tuning itself according to the current demand for pool, optimizing its use of these resources, and reducing the risk of running out of these resources.

Virtual I/O Cache

Users of OpenVMS VAX Version 6.0 can expect performance improvements due to the implementation of a new standalone or clusterwide, file-oriented disk cache. Applications automatically benefit from the advantages of the Virtual I/O Cache (VIOC) without any special coding. The VIOC file-caching algorithm is dynamically chosen based on the type of clusterwide access currently in progress. VIOC minimizes bottlenecks within OpenVMS systems because it reduces the number of I/Os to the disk subsystem and the user-perceived average disk I/O latency.

MSCP Dynamic Load Balancing

The new Dynamic Load Balancing feature enhances the ability of VAXclusters to efficiently balance served disk I/O among systems within a cluster. As a result, satellite systems can dynamically load balance disk I/O across multiple MSCP servers. Dynamic load balancing allows workloads to shift to another path or system in a VAXcluster if the current serving cluster member's I/O becomes excessive. Server activity is checked every five seconds. If a server finds its activity is excessive, it uses the dynamic load balancing algorithm to offload a portion of its work to a server node in the cluster with less MSCP activity.

ISO 9660

OpenVMS support for Open Standards is enhanced with the support for the ISO 9660 standard in Version 6.0. Using this new capability, OpenVMS users and application programs can mount, dismount, and read information from ISO 9660 formatted compact disks in exactly the same ways as traditional OpenVMS Files-11 volumes.

OpenVMS System Snapshot

Over the years, Digital has received numerous requests from OpenVMS customers to reduce the time required to boot a VMS system at startup. The OpenVMS System Snapshot facility allows a system manager to significantly decrease the time required to boot OpenVMS by booting the system from a saved system image disk file. The system manager can execute procedures to create a system image disk file specific to the OpenVMS system, including the state of VAX physical memory, the page and swap files, the SYSGEN parameters, logical names, device configuration, and key OpenVMS processes.

The Snapshot facility will initially be available for VAX workstations that are booting in a standalone environment.

DECwindows Support

DECwindows Motif for OpenVMS is now available exclusively as a separate layered product and will no longer be tied to the OpenVMS operating system. Decoupling DECwindows Motif from OpenVMS releases enables us to provide updated standards, such as OSF/Motif and the MIT X Window System display server and new features for DECwindows more frequently. Digital believes that customers should pay only for the features they need. Separate packaging lets customers purchase DECwindows software only if needed.

DECwindows Motif for OpenVMS supports both the Motif and X User Interface (XUI) environments. Users can run their applications and programmers can develop applications using either the OSF/Motif or XUI window managers and toolkits. Existing DECwindows XUI applications run without changes under the DECwindows Motif for OpenVMS layered product.

Volume Shadowing

The new release of Volume Shadowing runs on OpenVMS Version 6.0 and expands the supported number of shadow sets. With this new version, customers can create up to 130 Phase II shadow sets, each comprised of one to three disks, on a standalone or VAXcluster system. Increased data availability plus the performance assists introduced in OpenVMS VAX Version 5.5-2 make volume shadowing a key asset for production system customers with large disks of critical data. Version 6.0 also contains a number of quality enhancements, a revised manual, and a binary kit. To run the software, your customer needs only to purchase a license and the documentation.

RMS Journaling

The binary kit for RMS Journaling ships with the OpenVMS VAX kit. To run the software, your customer needs only to purchase a license and documentation.

Modular Executive

Under the OpenVMS operating system, applications and programs generally fall into two distinct categories: user-mode programs with no dependencies on the internals of the OpenVMS operating system and privileged programs with at least one dependency on the OpenVMS executive internals.

User-mode programs, which make up the vast majority of programs available and running on the OpenVMS operating system, always continue to work without any modifications in new OpenVMS releases.

The OpenVMS operating system contains a version checking system that ensures that privileged programs only run against those versions of the operating system internals for which they were designed. When a new OpenVMS release delivers significant changes to the internal operating system interfaces, it increments the version numbers on these interfaces and ensures that old privileged software does not run against fundamentally changed internal interfaces. This mechanism allows end users, system managers, and corporate organizations to be sure that the integrity of their data, applications, and systems is not compromised by privileged software that does not interact correctly with the new release.

Before VMS Version 5.0, this version checking system treated all the VMS internals monolithically. If a significant change was made to any VMS internal interface, no privileged program would run until it was checked and rebuilt against the new release. While this process guaranteed the system's integrity, it made major VMS upgrades time- and labor-intensive.

To minimize the impact, VMS Version 5.0 introduced a VMS executive that was modularized into a set of 18 different images, each containing its own individual version number. This decomposition made it possible for subsequent VMS releases to change a portion of the executive and to impact only those privileged programs that used internal interfaces defined by that part of the executive. Other privileged programs were unaffected.

OpenVMS VAX Version 6.0 minimizes the impact that internal changes to OpenVMS memory management, security, and the file system will have on privileged programs because only three out of 18 components of the OpenVMS executive are being changed. The majority of privileged programs are unaffected. Only those programs that interact with the internals of these three components of the OpenVMS executive need to be checked and possibly rebuilt before executing on Version 6.0.

In addition to taking advantage of the modularization of the OpenVMS executive, Version 6.0 introduces an Image Registry that recognizes programs that can be safely run without modification.

Digital conducted a study of several hundred OpenVMS layered products that showed that fewer than 10 percent of the layered products will have to be modified to support Version 6.0. Previous major releases of have impacted up to two-thirds of those products.

As a result of these efforts, the upcoming release of OpenVMS VAX Version 6.0 will be the easiest upgrade of a major release since the original release of VMS in 1977.

Bill Demmer Speaks With CSG Employees

by Maritzie Rudden

Bill Demmer

On May 10th, Bill Demmer spent the morning at PKO2 speaking with approximately 600 employees of the Computer Systems Group about the company, Alpha, and CSG. Bill discussed the company's dual strategy, its novel structure, and the new centralized engineering function. He also addressed Digital's competitive position, the challenges to selling Alpha, and the numerous opportunities available for success and growth. Early feedback indicates that the employees present thought the time was well spent and would like to participate in similar meetings on a regular basis.

This was just one of a series of meetings Bill is having with various CSG groups, which demonstrates his commitment to involving more employees in achieving the organization's goals. Sharing information about CSG's goals is the first step in harnessing the potential of each employee.

These meetings also demonstrate an important organizational analogue: we communicate with our customers because of what they provide us in revenue and future viability. We can also engage employees in a similar transaction. If we treat them as we treat customers, we can expect their loyalty and participation in our growth. Communication is key in our efforts with both customer and employee.

More than 600 CSG employees attended Bill's presentation.

Maritzie Rudden, CSG Personnel Manager, welcomes CSG employees and introduces Bill Demmer.

In these uncertain times, these meetings are an effective way to surface positive ideas, demonstrate how employee contributions are valued, and outline upcoming plans. These meetings also allow Bill to learn firsthand about the issues most important to CSG's employees.

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OpenVMS Documentation Wins Regional STC Awards

by Margie Sherlock

Once again, the OpenVMS documentation group won high honors in the Society for Technical Communications (STC) Publications Competition. Sponsored by the Boston and Northern New England chapters of the STC, the annual competition honors writers, editors, and artists for outstanding work in their fields. Judges from the technical communication industry and academia evaluate hundreds of documents and select winners based on how well each entry communicates technical information.

The 1992/1993 OpenVMS winning books and contributors are as follows:

- Award of Excellence: *Building Dependable Systems: The VMS Approach*

  Viv Schupmann, John Smart, Ken Henderson – writers; Dolores Charpentier – editor; Natalie Pitula – artist

- Award of Merit: *Guide to Using VMS POSIX*

  Don Topaz, Mason Gilliam, Tracy Dean – writers; Mary McAleese – editor

This year's winning books provided out of the ordinary challenges for the writing teams, including extensively researching customer needs, documenting multiplatform products, and coordinating long distance with engineering, writing, and production groups.

Building Dependable Systems: The VMS Approach addresses the data centers of many businesses who support mission-critical computer applications that must run 24 hours a day, 365 days a year. Some computer vendors offer a range of hardware, software, and service products to support these 24x365 requirements.

Data center personnel face the challenge of developing a methodology for providing 24x365 computing services and learning about available products that support this rigorous style of computing.

The Dependability handbook successfully provides this information to Digital's customers. Ken Henderson, formerly of OpenVMS Engineering, envisioned and developed the idea for the Dependability handbook. He lobbied for documentation resources and teamed up with OpenVMS writers Viv Schupmann and John Smart. Together, they researched and wrote the handbook over a nine-month period. As part of their research, the authors met with data center personnel at businesses having 24x365 computing needs, consulted with the OpenVMS Partners (sales support consultants) for "war stories" about customers with 24x365 requirements, wrote a DECUS survey about fault-tolerant computing, interviewed a member of the team that developed a 24x365 Lights Out Data Center at the Digital Customer Support Center in Colorado Springs, and met with engineers, writers, and support personnel from many Digital projects.

The *Guide to Using VMS POSIX* required some innovative approaches because it describes the use of POSIX, an open systems software interface on the proprietary OpenVMS operating system. By using only the POSIX interface, programmers can develop applica-

Pictured are Front Row, L to R: Natalie Pitula and Dolores Charpentier. Back Row, L to R: Don Topaz, Viv Schupmann and John Smart. Not pictured: Mason Gilliam, Tracy Dean and Mary McAleese.

tions that can be compiled without modification to the source code and then run both on OpenVMS systems and on any other platforms that conform to the same POSIX standards.

A unique aspect in writing the manual was the distributed nature of the engineering, documentation, and product management groups. Most of the engineering work was done in Varese (Italy), with a smaller portion being done in Marlboro. The product manager was located in Nashua, NH, and the writers were located in Nashua and in Varese. Coordinating meetings, ensuring timely delivery of documentation drafts, and learning how to work closely with people who are physically remote were all a challenge for both the writers and the editor.

The Production and Design Group located at ZKO provided production support for both winning books. Becky Bouchard was the production specialist for *Building Dependable Systems: The VMS Approach*. Brenda Rogers was the production specialist for *Guide to Using VMS POSIX*.

The OpenVMS Documentation group has a firmly established tradition of winning STC awards and has won many regional and international awards in previous competitions. Winners in the top three categories (Distinguished, Excellence, Merit) of the regional competition are eligible for the STC International Technical Publications competition. Both OpenVMS books have been submitted to the 1993 International competition. The Society of Technical Communication is a nonprofit, international organization for professional communicators and technical communication educators, researchers, managers, and students.

Lea Walton Earns Recognition Award for DEMFA Cost Reduction

by Dick Willett

In 1992, DEMFA designer Lea Walton earned a Recognition Award for her cost reduction of the DEC FDDI Controller 400 (DEMFA). Lea was the senior project engineer for the DEMFA Value Engineering (DEMFA_VE) project, which involved upfront signal integrity analysis and simulation, relayout of the DEMFA, and extensive signal and system testing, all of which passed on the first powerup of DEMFA_VE.

Lea Walton

Patent Award

The DEMFA_VE project resulted in savings of $200k in the development budget, a benefit-to-cost ratio of 34.4 to 1, and cost reduction by $456.37 for each DEMFA_VE unit. In short, it will save more than one million dollars over the next five years.

Lea's previous achievements at Digital include:

- Receiving a patent for a workstation graphics chip
- Designing, specifying, and implementing logic for a video timing and control chip, used in VAX-based workstations
- Redesigning the DECserver 700 terminal server

Lea Walton holds a Bachelor's degree in Electrical Engineering from the University of Illinois at Urbana-Champaign.

UNIXWORLD Names DEC 3000 AXP 'Product of the Year'

by Dave Bouffard

Featuring a DEC 3000 Model 400 AXP system on its cover, the January issue of UNIX-WORLD magazine named the AXP workstation one of its 10 "Products of the Year."

The feature article praises the DEC 3000 system: "Credit for the most important product announcement of 1992 has to go to Digital Equipment Corporation. Its lightning speed Alpha systems—clocked at 118 SPECmarks at publication time—vaulted the world's number-two computer company into the performance lead in the UNIX workstation market."

Vice President Bill Demmer recently accepted the award for Digital at a breakfast hosted by UNIX-WORLD in San Francisco during the UNIFORUM tradeshow in March.

UNIXWORLD, the largest UNIX-based publication in the circulation, reaches 350,000 readers in 33 countries each month. It is the leading monthly magazine for manufacturers, sellers, and corporate users of UNIX and related open systems products.

On behalf of the Alpha Personal Systems Group, Dave Laurello, Group Engineering Manager, accepts the UNIFORM Product of the Year award from Vice-President Bill Demmer

Awards

by Bev Shultz

Vince Orgovon Promoted to Senior Consultant Engineer

Vince Orgovon, Project Manager for EPSILON (Version 2.0 of OpenVMS AXP), was recently promoted to Senior Consultant Engineer for his outstanding contribution to the successful delivery of Version 1.0 of the OpenVMS AXP operating system.

Vince successfully drove the OpenVMS AXP Version 1.0 effort and brought the product to market as scheduled and according to technical plan. Throughout the project, Vince could be counted on to do whatever it took to deliver the product, including working with the engineers, recognizing and articulating complex integration issues early in the process, and resolving those issues.

OpenVMS AXP Version 1.0 is expected to bring $82M in MLP in FY93 alone. Through Vince's outstanding efforts, Digital has a timely product with the quality that is critical to our success in the market.

Vince Orgovan

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by Dick Willett

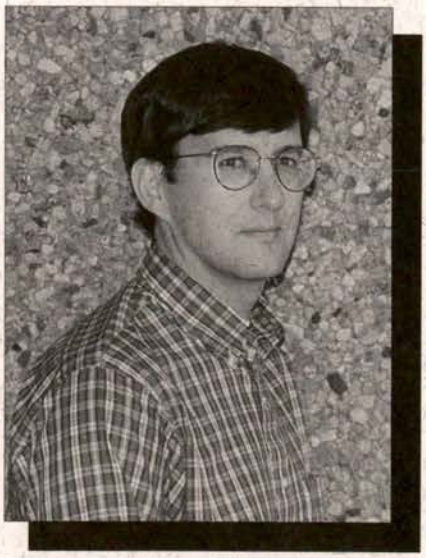
Steve Lindquist Promoted to Hardware Consultant Engineer

Steve Lindquist, an expert in the science of heat transfer and fluid flow, was recently promoted to Hardware Consultant Engineer for his contributions to the design and analysis of cooling systems for Digital hardware.

Steve, who has been at Digital for nine years and is currently a member of the DCSS engineering group, was responsible for the thermal management of the DEC 7000 system. Prior to that, he worked on a number of deskside systems, most notably the VAX 3500 system.

Before joining Digital, Steve worked at Riley and Westinghouse where he designed furnaces and cooling nuclear reactor cores.

Steve has a Bachelor's Degree from Cornell and a Master's Degree from Worcester Polytechnic Institute, both in mechanical engineering. He currently has one patent application for an enhanced heat transfer device.



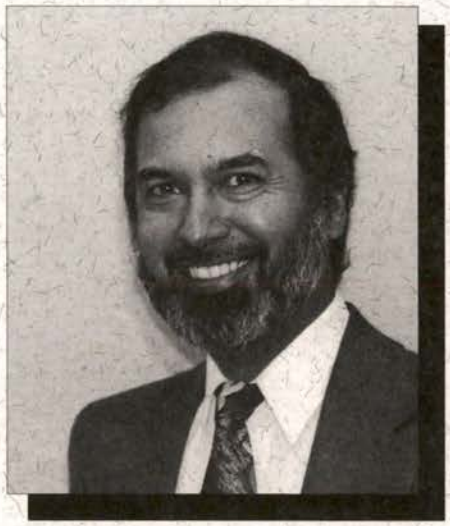
Steve Lindquist

Promotions and New Management Changes

by Bill Demmer

Dileep Bhandarkar Is Technical Director for Base Systems

Dileep Bhandarkar has joined Bill Strecker's staff as Technical Director for Base Platforms. Dileep will work with the managers of the Alpha Personal Systems, VAX and Alpha Servers, and High Performance Technical Computing groups to establish a product strategy and technical direction that is consistent with corporate direction. Dileep came to Digital in 1978 to manage the evolution of the VAX architecture. He was the chief architect for VAX vector processing, and co-architect of the PRISM RISC architecture on which the Alpha is based. Dileep established the system performance analysis group in Midrange Systems, and was one of the driving forces in the development of the first release of SPEC benchmarks. Dileep was Technical Director for MIPS-based systems and one of the principal architects of the ACE initiative. He managed the Digital-Microsoft relationship in the early stages of the first port of Windows NT to a RISC architecture.



Dileep Bhandarkar

Prior to working at Digital, Dileep was a member of the technical staff at the Central Research Laboratory and Corporate Development Center of Texas Instruments, where he worked on memory technology and computer architecture.

Dileep has a Bachelor's of Technology degree in Electrical Engineering from the Indian Institute of Technology, Bombay, as well as an MS and a PhD in Electrical Engineering from Carnegie-Mellon University. He also has taken several graduate courses in Business Administration at the University of Dallas.

Dileep holds 10 U.S. patents. He is a senior member of IEEE and the author of more than 30 technical publications on computer architecture, semiconductor technology, and performance analysis.

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by Bill Demmer

Ken Swanton Will Lead Growth of OpenVMS Business

Ken Swanton has agreed to return to the OpenVMS marketing effort to lead the campaign to increase business significantly. The OpenVMS systems environment is a $10B business, one of the largest customer bases in the industry.

During the past six months, Ken led the successful introduction of the Alpha Systems family. During the past two years, Ken managed a worldwide OpenVMS Campaign, including the Champions, Pricing, Performance, and Partners programs. This campaign, along with new Open Standards and MicroVAX performance, have stabilized this core business. Now Alpha technology and the trend toward downsizing provide an excellent growth opportunity which demands the skill and experience of Ken Swanton.

Ken Swanton

by Dick Willett

Peter Conklin Promoted to Director, Engineering Processes and Systems Group

Peter Conklin

Peter Conklin has been promoted to Director of the Engineering Processes and Systems Group, reporting to Bill Strecker. In this position, Peter will drive the efforts to improve all aspects of our engineering practice including group planning with the business units; project planning and review; system design, implementation and qualification. He will establish a program team and program office, details of which will be announced shortly.

Peter Conklin has a record of achievement in Digital for more than 20 years, from terminals to mainframes, from architecture to implementation. As Program Manager for the Alpha AXP products, he orchestrated the most complex development program in Digital's history from planning to fruition. His contributions to the VAX architecture, the DECsystem-10 family, small systems, and terminals have left a lasting mark on Digital's products and capabilities, and on the industry as a whole.

Peter joined Digital in 1969, starting in the DECsystem-10 software group. In 1975, he became one of the first members of the VAX project, where he played a crucial role in the development of the hardware and software architecture. Subsequently, he worked as a group manager in the Micro Systems Group and Technical Director of the Video, Image, and Printers Group. In 1990, he became Program Manager for Alpha AXP product development, and in November 1992 was appointed Technical Director for Operating Systems. In January, he was promoted to corporate consulting engineer. This promotion recognizes Peter's outstanding technical and managerial contributions to Digital throughout his career.

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by Bill Demmer

John O'Keefe Named Vice President of UNIX Systems Marketing for CSG

John O'Keefe

In an effort to bring about a consistency across CSG by driving all our major marketing programs from the Operating Systems dimension, Bill Demmer recently announced the appointment of John O'Keefe as Vice President of UNIX Systems Marketing for the Computer Systems Group (CSG). Bill noted, "We are approaching a major milestone in the history of Digital's UNIX endeavors with the shipment of DEC OSF/1, our new Alpha-based Unified UNIX System. In order to capitalize on this throughout the company and in the external world, we are consolidating the UNIX Operating Systems Marketing groups and those marketing functions supporting UNIX-based platforms into one, unified, UNIX Systems Marketing group."

John joined Digital 13 years ago as Manager of Product Managers for the 16-bit and 32-bit product lines. Shortly thereafter, he assumed responsibility for the 32-bit Program Office. For the past seven years, he has been part of the U.S. Channels Organization. In his new position, John will be responsible for developing UNIX Marketing Strategy, managing UNIX-based partnership relationships, implementing UNIX Marketing Programs, and providing the focus needed to establish Digital as a market leader in Open Systems. His first task will be to bring together the CSG resources in support of the March and April UNIX System announcements.

John will begin the transition to his new assignment immediately from his current role as Vice President of the Complementary Systems organization in the U.S. Sales function.

by Bill Demmer

Maritzie Rudden Becomes Group Personnel Manager and HR Business Partner

Maritzie Rudden has accepted the position of Group Personnel Manager and Human Resources (HR) Business Partner for Alpha VAX Systems, reporting to Ralph Christensen and Bill Demmer. In this leadership capacity, she will be responsible for the development and implementation of HR strategies and programs for the worldwide Hardware Engineering Group. She will participate in setting strategic direction for the group and ensure that major HR activities, particularly organizational design, organizational learning, and transformation, accomplish business goals. She will also directly manage the HR Business Partners who support the Alpha VAX Systems Group.

Maritzie's professional experiences span 25 years in academia and the public and the private sectors, both in the U.S. and abroad. She joined Digital in 1987 as the Human Resource Development Manager for Manufacturing. Currently, she is the Personnel Manager for the Mass Storage Heads Business in Shrewsbury. She holds a BA from Maryknoll College, an MA from the University of Florida, and a PhD from Pennsylvania State University.

Maritzie Rudden

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by Bill Demmer

Rick Frazier Is Promoted to Group Marketing Manager for CSG

In February, Rick Frazier was promoted to Group Marketing Manager for the Computer Systems Group (CSG) reporting to Bill Demmer. The Computer Systems Group (CSG) includes Engineering functions, Base Product Marketing for OSF, Windows NT, OpenVMS, SCO UNIX, Server Platforms, Personal Systems Platforms, and Program Offices for Alpha AXP and High Performance Technical Computing. Key priorities for CSG include:

1) Customer focus

2) Customer business unit focus

3) Territory support

4) Alpha AXP as a solution enabler

5) Integrated CSG product messages

6) Competitive focus

Rick Frazier

Consistent with these priorities, Rick will directly manage:

- Alpha AXP Marketing for CSG
- CSG marketing functions common to the diverse CSG product set
- The process to assure integrated CSG product marketing for Customers, CBUs, and Territories

Rick brings considerable experience to this assignment from his 18 years with Digital.

Most recently, Rick has been U.S. VAX Marketing Manager and U.S. Alpha AXP Marketing Manager reporting to Steve Thomas in U.S. Marketing. Rick has also held several field positions ranging from Sales Representative to District Sales Manager.

Alpha AXP One-Year Anniversary

by Dick Willett

On February 25, 1993, the Computer Systems Group celebrated the first anniversary of Alpha AXP. Participants in the successful development and introduction of Alpha products were invited to come to the Boxboro facility's cafeteria, where a large cake bearing the Alpha logo was served. Bill Demmer and Peter Graham graciously cut a slice for each attendee.

Peter Graham and Sue Hunt help Bill Demmer cut the cake.

The Alpha architecture, introduced on February 25, 1992, defines computing for the 21st Century. The architecture:

- Is designed from the outset to be "Open"
- Features a full 64 bits on a chip
- Ranges from a single processor to massively parallel systems

The initial Alpha AXP products are the first of a family of products.

VAX 7000 Takes a Licking and Keeps on Ticking

by Andrea Harris

Computer systems aren't designed to work after they fall off trucks, but at least one VAX 7000 system survived a four-foot fall and went on to perform flawlessly at a one-week symposium.

The system, owned by Elayne Hatch of CSG Event Services, was on loan to Shawn McDonald of the Database Engineering group for the January 1993 Digital Database Symposium in Nashua, NH.

The fall occurred when the system, packed in a custom shipping crate, was being moved from the truck into the hotel where the symposium was taking place. As the truck's power lift gate was being lowered, the crate slipped and fell four feet to the pavement. The shipping company blamed the accident on snowy weather.

Familiar with all aspects of shipping systems to events, Elayne Hatch asked the shipping contractor if the truck's power lift gate was equipped with a freight retainer. The shipping contractor claimed the system was strapped but the strap let go. Elayne remarked, "I have no idea how they could have strapped the system if they didn't have a freight retainer. Together, the system and crate weigh 1500 pounds and are on wheels, so securing the crate before placing it on a movable platform is critical.

Elayne Hatch places a Band-Aid on the VAX 7000 system.

They're lucky no one got hurt."

Shawn McDonald was present when the system was rolled out of the packing crate. The trucking company hadn't notified him of the mishap, but the damage was apparent. The TF85 tape drive was bent, as were one side panel and the frame of the VAX 7000 system.

"We panicked when we saw the system," remembers Shawn. "Since it was the server for all of our client systems, the VAX 7000 system was the heart and soul of the symposium. We expected the worst when we plugged in the system and were amazed and relieved when it worked... The VAX 7000 system operated for the entire week-long symposium without problems."

After the show, Randy Roy, Systems Integration Technician, performed diagnostic tests to determine the actual extent of the internal damage. Although the tape drive was beyond repair, the disks and memory boards were intact. To the surprise of those in the testing lab, the system passed all the diagnostic tests.

Although this VAX 7000 system will be retired from the rigorous trade show circuit, it will find a new home in a local data center. But first, it has to survive one last truck ride...

VAX Systems Help Save Money in Oklahoma

With the help of Digital MicroVAX 3100 and VAX 4500 systems, the State of Oklahoma is reducing cost and waiting time for highway travelers, and saving money at the same time.

Across the state, the cashless PIKEPASS system speeds motorists on their way, cuts accidents at toll plazas, reduces pollution, and allows a reduction in toll charges. Along with these benefits to motorists, it offers a king-sized benefit to the state—a savings of $160,000 in operating costs per year for each automated tollbooth. The system, from Dallas-based Amtech Corporation, uses a VAX 4500 system as a host and a MicroVAX 3100 system to run the reader.

The combination of convenience and lower tolls has benefited more than 100,000 Oklahoma motorists since the installation of the PIKEPASS system in January 1991.

Partners Advisory Group Meets with Bill Demmer

by Dick Willett

On February 24-25, 1993, the UNIX Partners Advisory Group met with Bill Demmer and Digital senior management. It was the first time Bill attended an Advisory Group meeting since taking over responsibility for the operating system.

Bill presented Digital's strategic directions, outlined the new Company structure, and reviewed his own Computer Systems Group organization. He predicted that UNIX would see the most growth for the Company over the next year, but that the VMS operating system would provide the most revenue. Rick Frazier and John O'Keefe, the new UNIX Marketing Vice President, joined Bill to meet with the Advisory Group and to hear their customer concerns.

Bill suggested that the Advisory Group narrow its issues to five and submit them to him with recommendations and/or solutions. He, in turn, would attach a cover letter and send them to the senior leadership team for review. Bill committed to returning in three months to communicate progress/status.

Bill Demmer addresses advisory group.

Anker Berg-Sonne, CBU Technical Director for Healthcare Industries, presented the Company's direction for new engineering/CBU business partnerships. The contact for the Partners Program and the customer business units will be with each CBU's technical director.

The Advisory Group also met with Jesse Lipcon and other managers from cross-functional organizations to discuss ongoing concerns with customers.

The UNIX Partners Advisory Group meets holds two local and two worldwide, face-to-face meetings per year with senior management and engineering/product management/marketing. The Advisory Group, a subset of our Partners Program, is represented by technical, business, and a wide spectrum of industry market experts.

Dianna Ellis, UNIX Partners Program Manager, is responsible for coordinating the communication link between the field and our engineering and marketing organizations so that Digital is aware of and working towards the needs of our UNIX/Open System Customers. Dianna is located at ZKO, DTN 381-6050 or dianna@unix.dec.com

UNIX Partners Advisory Group

Digital Celebrates a Decade of UNIX Computing

by Jo-Anne Falco and Jon Hall

An Early Start in UNIX

Even prior to 1983, Digital was involved in UNIX computing in a supporting role, by lending hardware and software expertise to assist AT&T and the University of California at Berkeley in porting their UNIX operating systems to PDP-11 and VAX machines. But in January of 1983, Digital decided to develop and market UNIX from the University of California at Berkeley. A January 25, 1983, program announcement described our intention to "productize and support the best available native UNIX for VAX, Berkeley UNIX V4.1."

That spring, an organization was chartered to carry out this effort. A small group of engineers, product managers and marketing people in Merrimack, New Hampshire were given the charter of creating binary distributions of UNIX for the PDP-11 and VAX systems. The binary distributions would make the UNIX system more affordable and easier to install over a wider range of equipment than the current distributions would allow. Within one year this small but growing group of people had released a binary release of UNIX for both the PDP-11 system (V7M11, later to be known as ULTRIX-11) and the VAX system (ULTRIX-32).

A Decade of Achievement

Today, the UNIX organization at Digital is known as the UNIX Software Group (USG) and is located in two sites, ZKO in Nashua, NH, and UNX in Manalapan, NJ, and is part of the Computer Systems Group (CSG). Its members total approximately 400 people.

Bill Demmer, Digital CSG Vice President, was the keynote speaker at the USG Group Meeting held last month in ZKO where he spoke before a group of approximately 150 attendees. Bill's presentation was "The New Digital" which outlined organizational changes within the Corporation and Engineering and discussed recent Alpha technical achievements. Both the presentation and its following Q&A session were videotaped for ta follow-on UNX USG Group Meeting held in Manalapan.

At the same USG Group Meeting, Bill presented the UNIX Software Group with a plaque that commemorates the 10-year anniversary of the founding of the UNIX organization at Digital and of its charter to deliver quality products on the UNIX platform. The award was presented to 19 10-year veterans of the original UNIX group:

Ten-Year Veterans pictured L to R: Bill Demmer, Tom Tresvik, Steve Reilly, Jon Hall, Larry Cohen, Al Delorey, Al Mento, Ray Lanza, Fred Canter, Jim McGinness, Bill Burns, and Steve Jenkins. Not pictured: Cindy Mazza, Sharon MacDonald, Dave Cardos, John Dustin, Chris Beute, Bill Leoffler, Adrienne Snyder, Karen Paszamant, and Dave Leonard.

Chris Beute, Bill Burns, Fred Canter, Dave Cardos, Larry Cohen, Al Delorey, John Dustin, Jon Hall, Ray Lanza, Dave Leonard, Bill Loeffler, Sharon MacDonald, Cindy Mazza, Jim McGinness, Al Mento, Karen Paszamant, Steve Reilly, Adrienne Snyder, and Tom Tresvik.

The plaque presented at this meeting is now housed in the trophy case in the ZKO cafeteria. An identical plaque will be hung in the UNX USG office.

A DECADE OF ACHIEVEMENT

To commemorate the founding of Digital's UNIX organization and its charter to deliver quality products based on the UNIX architecture.

Ten Year Anniversary
DIGITAL UNIX GROUP
1983 - 1993

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USL, Inc.

Presented by Bill Demmer to the UNIX Software Group on April 7, 1993

Bill Demmer, CSG Vice President, and Steve Jenkins, USG Group Manager, speak at the USG group meeting.

Jeff Meyer, USG Release Manager, asks Bill a question during a spirited Question and Answer session.

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FOREFRONT

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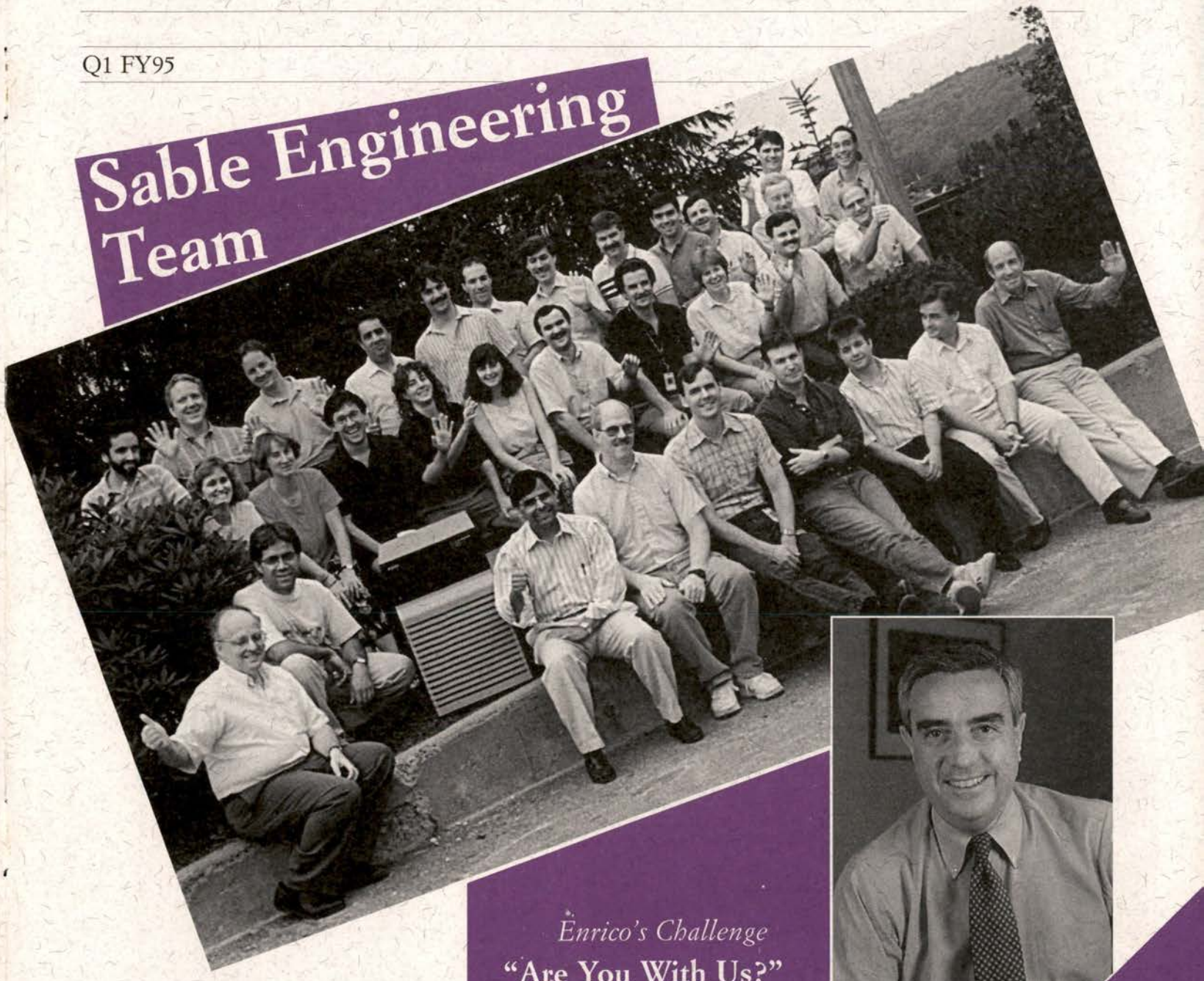
Sable Engineering Team



Enrico's Challenge
"Are You With Us?"

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***FOREFRONT** strives to support a forum for the entire LSG WW community to share information, directions, and key accomplishments in all its functional dimensions, that is, customers, markets, engineering, and manufacturing. Its goal is to highlight technical efforts and successes that lead to new products and markets for Digital.*

This is your information forum. Your participation is vital to its continuation and success. You are encouraged to contribute articles that are of interest to the LSG community. The deadline for submitting articles for the next edition is September 16, 1994.

If you wish to receive additional copies of FOREFRONT or know of someone who wants to be added to the mailing list, please send the name, location, badge number, and number of copies to MSBCS::WILLETT.

COVER PHOTO - SYSTEMS HARDWARE GROUP

FRONT ROW (left to right): Mike Chautin, Frank Touserkani, Shrey Shah, Dave Carlson, Stephen Shirron, Andy Russo, Jeff Kerrigan, Andrei Shishov, Stew Beckley

MIDDLE ROW: Pam O'Brien, Fidelma Hayes, Vince Asbridge, Rachael Berman, Vicky Triolo, Jose Flores, Kevin Peterson, Judy Gold, Carl Furbeck, Bryan Locke

BACK ROW: John Chaves, Paul Goodwin, John Bridge, John Borg, Joe Jasniewski, Joe Zagarella, Kurt Thaller, Harold Buckingham, Marco Ciaffi, Bill McCarthy, George Harris, Walt Nemes, Rich Trubey

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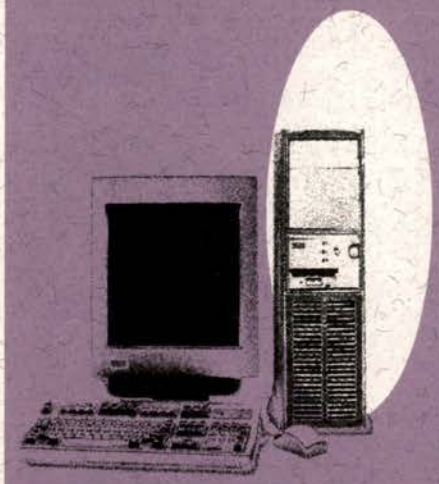


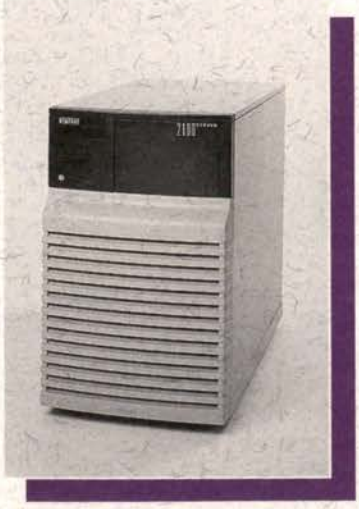
"Sable" Is Digital's Newest Powerhouse

Digital recently announced the Digital 2100 Server A500MP system, known as "Sable." Sable is being hailed as the industry's first RISC-based server integrating high-performance scalable SMP with the technology of PCI and EISA industry-standard I/O buses at an aggressive price and truly revolutionizing the economics of computing!

The Development of Sable

Many of the innovative ideas for Sable came from an Advanced Development effort established to explore the use of Alpha in low-cost servers. Credit for creating the Sable concept goes to Fidelma Hayes — at the time a member of the Advanced Development Group. The Sable team was formed, pooling its talents and sharing its commitment to developing a low-cost system without sacrificing quality, under Fidelma's leadership. Many team members made significant contributions:

Digital 2100 Server



- At the heart of the system is the Custom I/O Gate Array, which connects the system bus to PCI. The team led by Andrew Russo completed this very complex 60K gates design in record time, while following the evolution of the emerging industry standard. The result is the first multiprocessor system implementing PCI.
- Originally, Sable was planned as a dual-CPU system. Responding to competitive pressure, the small CPU team led by Kurt Thaller developed dual- and quad-CPU versions in parallel, which allowed Sable to be shipped as a four-way system on the original dual-CPU schedule.
- In an effort unique in Digital and perhaps in the entire industry, a system was delivered with the ability to support three operating systems. The firmware group led by Kevin Peterson and Stephen Shirron was critical to meeting this goal. The system integration and qualification effort was valiant with Vince Asbridge, Rich Freiss, John Nerl, Mike Chautin, and many others bringing it all together.
- The design of the Sable enclosure took an innovative approach under the direction of Alex Morton and Bryan Porter. IEI, of Oregon, was contracted as the mechanical design house for the project. The combined efforts of IEI and the Sable team created and delivered the Sable "look" in record time.
- The product management team of Stew Beckley and Pam O'Brien developed Sable's ordering system. Stew pulled together the "nuts and bolts" (part numbers, etc.) to ensure easier ordering and availability. Pam was instrumental in developing Sable's Early Ship Program, which allowed customers to benefit from Sable systems sooner than normal.

Strategies for Success

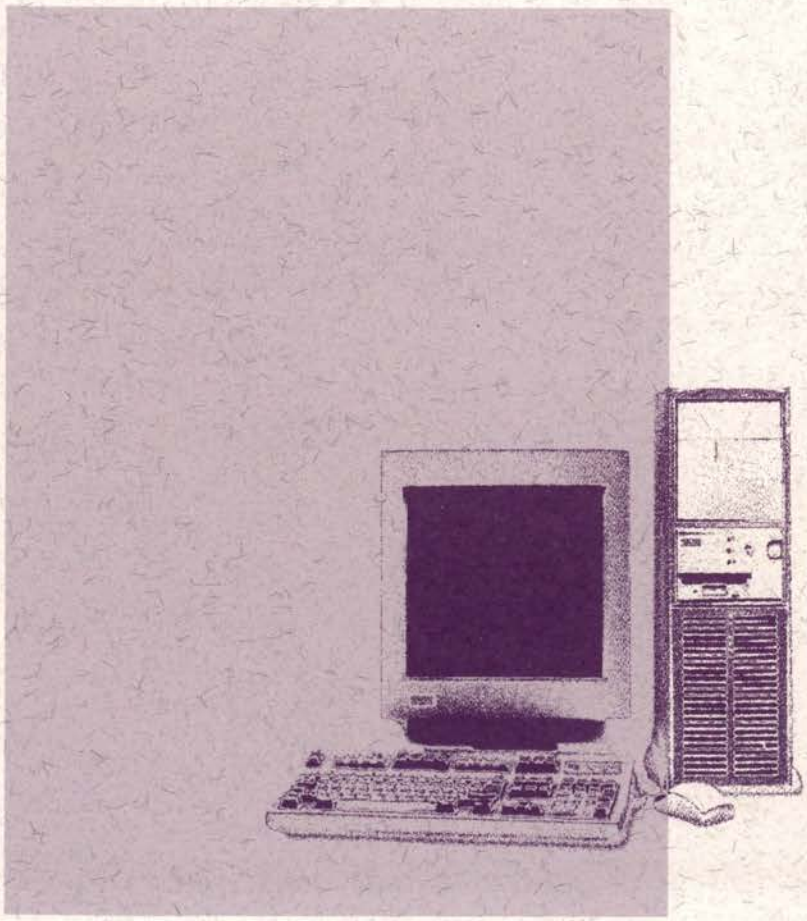
One strategic approach in Sable's development was the successful implementation of price-driven costing. Andrei Shishov was responsible for incorporating a price structure built from what the market could afford, not what the market could bear. The server was designed according to that determined price goal instead of being priced on the product costs — "price-driven costing instead of cost-driven pricing." This approach was key in keeping the cost of the system within an affordable and competitive price range.

Another successful strategy in Sable's development was the strong focus on market requirements. Product requirements were developed and agreed on by all team members before starting the product design, making the system respond to the real needs of real

customers and eliminating the need for costly and time-consuming redesigns.

Customer documentation on the Sable product created grassroots support for the system. Developed early in the product cycle under the leadership of Kathe Rhoades, the *Sable System Overview* provided detailed product information for sales reps and customers prior to the product launch. The Sable team credits early access to this useful information vehicle with preparing the field for selling this powerhouse server around the world. Hats off to the program team, which includes Andrei Shishov (Program Manager), Fidelma Hayes (Engineering Manager), Jeff Kerrigan (Operations Manager), Walter Nemes (Manufacturing), Stew Beckley and Pam O'Brien (Product Management), and to the extended Sable team for helping to make the Sable what it is today.

And the great work continues as design is under way for more Digital 2100 server family members. Currently the Demi-Sable product and the Sable with EV45 and EV5 chips are in development. And there's more to come... F



Sable Digital 2100 Server

Enrico Outlines Key Challenges to Senior Engineering Managers

"We're with you!" Was the resounding cry, followed by applause, after Enrico Pesatori met with the senior engineering managers and their direct reports in the General Doriot on July 18th.

This meeting was a part of the communication strategy that is ongoing within Digital to inform, energize, and re-engage employees in order for us to remain competitive and to return to profitability.

Enrico outlined our key challenges as boosting revenue, improving key processes, reducing SG&A costs, and increasing the volume on our current products and to meet market needs.

We need to understand the business model of a key undertaking prior to proceeding. We must have a vertically integrated organization to succeed and to respond to the need of the marketplace. These vertically integrated organizations will be held accountable for their own P&L and will be inclusive of engineering, manufacturing, marketing, and sales.

Enrico says the good news is we know how to fix the problems – redesign not reorganize:

- Manage through accountability
- Succeed through partners
- Link engineering excellence with the reality of the marketplace
- Live by market rules everywhere

We need to attract external talent to complement our internal talent and deliver products the market wants and sell products the way the market wants to buy them. We need to move from a high percentage of direct sales and broaden our market presence with a more competitive distribution strategy. The development of strong partnerships will enable us to achieve growth through indirect channels. We will continue with the downsizing but we will do it quickly.

Employees will be able to look to the future with improved morale and a solid direction. We have to change the way we design products. We must design quality products that generate high volume sales and meet the market's desires.

Details of our new direction will continue to be communicated as decisions are made. We need to work together as a team with our colleagues, our partners, and our customers.

F

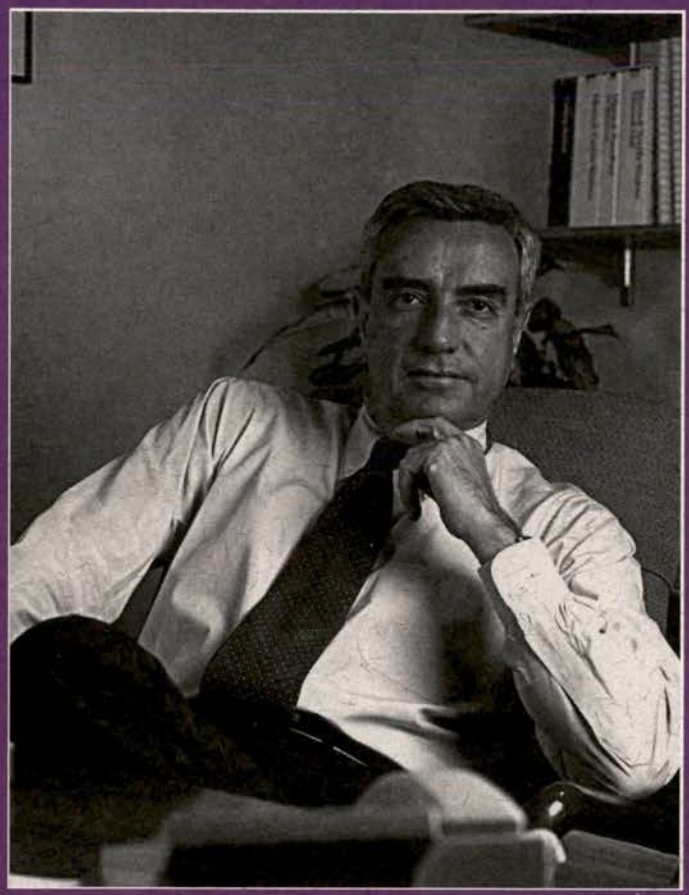
ENRICO PESATORI

Vice President & General Manager
Computer Systems Division

ENRICO PESATORI is Vice President and General Manager of Digital Equipment Corporation's Computer Systems Division. The Computer Systems Division includes three worldwide business units, each with control over the business functions critical to their success, including engineering and product development, manufacturing and logistics, marketing and communications, business information systems, channel recruitment and support, and sales. The business units are:

- ***Personal Computer Business Unit (PCBU)***
- ***Systems Business Unit (SBU)***
- ***Accounts Business Unit (ABU)***

Pesatori has been responsible for Digital's PCBU, SBU, and worldwide sales and marketing operations since April, 1994. In



early 1993, he joined Digital as Vice President and General Manager of the Personal Computer Business Unit.

During his tenure, Digital doubled its PC revenues and has become one of the fastest growing PC companies in the world. Pesatori reports directly to Digital President and CEO, Robert B. Palmer.

Pesatori served for the previous two years as President and CEO of Zenith Data Systems (ZDS), a leading worldwide supplier of notebook and desktop personal computers, owned by Groupe Bull of France.

Previously, Pesatori served 21 years with Ing. C. Olivetti & C., S.p.A. During his executive tenure at the Italian computer and electronics firm, his positions included President and CEO of Olivetti North America; President and CEO of Docutel-Olivetti, where he was responsible for restructuring the Dallas-based company; Vice President of Corporate Product Strategy; and head of the Olivetti Systems Group, where he was responsible for marketing, manufacturing, and research and development of all data-processing and microcomputer products.

He also served as President of Olivetti's first business unit, Electronic Calculators; the Electronic Typewriters business unit was then added to his responsibilities. Prior to that, he was Vice President of Manufacturing for Olivetti's operations in the U.S. and Manufacturing Manager of Olivetti's factory in Ivrea, Italy. Pesatori joined Olivetti as a Product Manager in 1969 after four years at General Electric in the United States and Italy.

Pesatori was awarded a master's degree in electronics engineering in 1965 from Polytechnic University in Turin, Italy. F

Customers Winning with Alpha AXP

Rolfe & Nolan Computer Services Uses Digital's Fault-Tolerant Technology to Make Traders Competitive

Rolfe & Nolan Computer Services PLC of London provides applications that increase the productivity of capital markets operations for financial institutions in 15 countries. Now, Rolfe & Nolan is introducing Lighthouse, a UNIX application that uses Digital's fault-tolerant client/server technologies to increase traders'competitiveness by dramatically reducing the risk, time, and cost of deals.

Using Alpha AXP servers, the DEC OSF/1 operating system, and Reliable Transaction Router software, Lighthouse integrates risk management with efficient, paperless administration of off-balance sheet products such as options, swaps, and other derivatives. As traders execute deals, the system immediately validates transactions and updates current positions. The system enables traders to monitor exposure with real-time information.

"Digital's platform suits trading operations," says Mr. Rapkin. "Working together, Rolfe & Nolan and Digital bring financial institutions a depth of expertise in providing solutions responsive to the dynamic business challenges of the worldwide capital markets industry."

Northeast Parallel Architectures Center Conducts Key Research with Alpha AXP Farm

The Northeast Parallel Architectures Center (NPAC) at Syracuse University is a center of expertise in high-performance computing and communications technology. NPAC conducts research that transforms emerging applications such as video-on-demand, three-dimensional animation, and multimedia into client/server solutions for industry. The center achieves the promise of commercial high-performance computing with an Alpha AXP AdvantageCluster solution from Digital.

NPAC Associate Director Mark Podgorny cites diverse business solutions that NPAC and its clients create with flexible, high-performance Alpha AXP farm computing. SRC (Syracuse Research Corporation) is working with NPAC on a project that will advance online design and testing of aircraft that elude radar detection.

SRC subcontracted with NPAC to parallelize the code that calculates the "signature" of an aircraft — the plane cross-section that is visible to radar. A high-performance version of the code will enable designers to achieve prototypes on line that minimize signatures and maintain aerodynamic efficiency.

High-performance computing offers the potential to turn data into insights by illustrating complex processes, such as the flow of air on a plane wing, the molecular structure of a new wonder drug, or the rise and fall of stock prices.

NPAC and Digital are collaborating with Syracuse University's Maxwell School of Citizenship and Public Affairs to develop the computing foundation of the school's new International Exploratorium, a global learning center and library. The nucleus of this interactive technology showcase will be a multimedia database on an Alpha AXP farm server.

NPAC is planning research with a large telephone company and cable television provider to pioneer innovative video-on-demand applications that exploit the power of Alpha AXP Farms. "Digital excels at high-performance solutions that are easy to manage and customize because they consist of standard, off-the-shelf products," says Mr. Podgorny. "Digital puts it together, offering products with top price/performance that can perform the most challenging processing today and into the twenty-first century."

Chipcom Builds Global Service Delivery Network Using Alpha AXP Servers

Chipcom Corporation is a fast-growing market leader in the highly competitive intelligent switching hubs segment of the networking market. Expanding at a 70 percent compound annual growth rate, Chipcom, which posted record sales of $150 million in 1993, intends to sustain its leadership by combining the superior price/performance of its products with unparalleled customer service. Chipcom is working with Digital to build an enterprise-wide, Alpha AXP client/server infrastructure as a vehicle for global service delivery.

Chipcom plans to reach its customer service goals with a solution that provides staff and customers with 24-hour, worldwide access to information seven days a week, enabling Chipcom to provide better, faster, lower-cost service. The solution comprises the scalable, standards-compliant Digital platform; the SAP R/3 suite of integrated enterprise-wide applications; and Chipcom's own networking products.

Chipcom finds Digital a valued partner in developing this dynamic global infrastructure. "Chipcom's future depends on the strength of its relationships," says Mr. Pope. "Digital shows great commitment to our success. Digital's expertise and technology help us to build a state-of-the-art platform that will provide superior service to our customers worldwide."

Siemens Integra Is On the Right Track with Linkworks

The Swiss are known for their precision. From clocks to candies, the products emanating from Switzerland bear the stamp of meticulous craftsmanship.

Siemens Integra Verkehrstechnik AG carries on this tradition. For its products — railroad signaling and security systems — precision isn't simply a feature but an absolute necessity. The lives and livelihood of millions of people rely on it.

Switzerland's leading supplier of railroad switching technology, Siemens Integra was looking for a way to bring the administration of its business up to the standards of quality and efficiency embodied in its products.

The company found the answer in Digital's LinkWorks integration software. With the LinkWorks solution, managers, administrators, and secretaries at six sites can share information and work cooperatively as never before with their existing PCs and application software, now networked with a UNIX server.

According to Markus Elsener, the Information Systems Director for Siemens Integra, user satisfaction is the true measure of how successful the LinkWorks solution is. "I think this is very important, because they have to use it. It is good because they say it is good," says Elsener.

The reason their users like LinkWorks so much was that it not only makes them more productive as a team, it makes the computer-based environment itself friendlier. For Elsener and Siemens Integra, LinkWorks has turned out to be more than a quick solution to a pressing problem. It has spurred thoughts about fresh ways to approach their business processes, for the simple reason that LinkWorks opens the door to new possibilities.

As Elsener says, "If you were to take LinkWorks out of our department, we could not imagine how to work." And that says it all.

VanCity Wins Competitive Coup with Digital's Technology

Richard Wafer thinks long-range. He likes to set goals for his organization — not easy-to-meet goals, but very challenging goals. "That way we have something to strive towards, to push ourselves a little harder," said Wafer, Vice President for Information Systems for Vancouver City Savings Credit Union, better known as VanCity, in Vancouver, Canada. VanCity is the largest credit union in Canada.

Banking is a highly competitive industry, and service is a key differentiating factor. One of Wafer's first orders of business when he was hired at VanCity was to develop a five-year strategic plan that would aggressively enhance and build VanCity's service capabilities.

The Digital solution VanCity chose for branch automation was DECbank Financial Business System (FBS). An open client/server system based on industry standards, DECbank FBS provides a total solution for production, deployment, and delivery of retail financial services.

At the VanCity branch office, tellers and management draw information from the FBS system and enter transactions through a Microsoft Windows interface on a PC client. A PC server running SCO UNIX delivers information and processes transactions. The server also passes transaction data to the GEAC 9000 mainframe at the home office.

The success of the new system has caused Wafer to change his plans. "We didn't expect to install Digital's solution in the other branches for a while. Our plan was just to put it in new branches as they opened. But the FBS implementation has been so successful, our other branches are clamoring to have the new system."

By August of 1994, VanCity expects to have all 28 of its branches converted. That's well ahead of Richard Wafer's original goal — which is no easy task.

Lectron Products Advances Auto Components with Alpha AXP Client/Server Solution through Digital

Lectron Products, Inc., provides state-of-the-art components and systems to the automobile industry worldwide. Lectron Products has nearly doubled staff productivity, increased new-product introductions five-fold, and trimmed product cycles by more than 30 percent, thanks to a paperless design and development solution from Digital.

Anticipating customers' requirements, Lectron Products is shrinking cycle times while developing a larger and more complex set of products. Lectron's 1994 products comprise an average of 2,100 feature parts, a hundred-fold gain in just two years. Developing a client/server solution that grows with Lectron's requirements, Digital provides both the systems and expertise to help Lectron Products achieve ever-higher quality and productivity benchmarks.

Lectron's showcase Product Development Center in Rochester Hills, Michigan, functions as an extended development arm of Lectron customers, which include the "big three" United

States auto makers. Lectron's interdisciplinary teams cut the time and cost of innovation by paperless interaction with suppliers and customers. The DEC OSF/1, 64-bit Alpha AXP environment enables Lectron to deploy and integrate the latest CAD/CAE tools and transfer designs across customers' diverse media and platforms.

"We go from concept to model in three weeks," says Randy Bowman, supervisor of engineering services. "As a result, we are increasing staff productivity by 40 percent, and producing 28 new products in 1994." Until 1994, the 20-year-old company averaged four new products a year. Targeting 12-month new product cycles in 1994, Lectron Products has already trimmed cycle times by 30 percent. "Digital enables us to achieve our goals by helping us to build a paperless process that extends to our suppliers and customers, regardless of their platforms."

The scalable Digital architecture provides a cost-effective, smooth growth path that expands with the staff's capacity to exploit it.

"Our Alpha systems increase our speed by 400 percent," says Mr. Bowman. "When we require more power, we can simply add processors, without relearning or rewriting software. Digital offers the best total solution."

CAE Electronics Sees Fast Revenue Growth for Products Built on DEC OSF/1

In 1991, CAE Electronics, Ltd., a subsidiary of CAE, Inc., started developing a standards-based, mission-critical client/server architecture for the utilities industry. The Montreal-based firm was already a world leader in building advanced control systems for utilities, as well as for air traffic and marine control. However, CAE saw a fast-growing market for open, distributed control systems using low-cost RISC workstations.

CAE set out to chose an operating system with which it could grow for a long period of time, without wrenching changes. After considering IBM's AIX and HP's UX operating systems, the team chose the DEC OSF/1 operating system.

The CAE team began its development effort with one of the earliest copies of DEC OSF/1. DEC OSF/1's recent origin is an advantage, believes Amodeo Clara, manager of energy control proposals. "The trend you'll see is that the earlier a vendor developed its UNIX product, the less standards-compliant its UNIX version will be. It's the opposite with the more recently developed versions of UNIX because UNIX standards have converged in the last few years." Given the scale of CAE's software development investment, the company had to have a modern, standards-based operating system.

Today, CAE Electronics sells utilities complete turnkey systems built around as many as 150 AXP workstations connected by a LAN to a realtime database. The DEC OSF/1-based systems automate management of power distribution in utilities' control rooms. Other DEC OSF/1-based applications act as energy management systems for power generation and transmission, or help to control hydroelectric dams. Customers include Boston Edison and utilities in Venezuela, Canada, and China.

CAE Electronics products built on the DEC OSF/1 operating system represent the fastest revenue growth in CAE, Inc.'s $1 billion (Canadian) annual sales, Clara says. "We're very pleased with [the] DEC OSF/1 [operating system]."

Corning Finds DEC OSF/1 Easy to Use, Improving Speed and Quality of Research

The DEC OSF/1 operating system "is a very congenial place to do software development. It's a nice, stable, robust implementation of the UNIX environment in my experience," says Les Button, research scientist specializing in optical fibers and components at Corning Inc.

Button needed "a very easy-to-use software development environment that had all the pieces that make development easier" and "a computational engine at the same time." His group considered workstations from HP, IBM, and Silicon Graphics, but chose the DEC OSF/1 systems in part because of ease of use. Button says his year-old workstation "is the only computer that I've ever seen that is almost as easy to set up as an Apple Macintosh."

The group uses a DEC 3000 Model 400 and a Model 500. Both are software development platforms that also do some production work. Button uses the Model 400 to develop FORTRAN simulations of optical fiber technology that will be used in the telecommunications industry. Fiber amplifier simulations, which are Button's specialty, take a lot of computational power. His Alpha AXP workstation "has helped me generate answers in a very timely manner."

Button notices that in developing the next generation of fiber optics technology, the distinctions between research, development, and manufacturing seem to be shrinking. His Alpha AXP workstation appears to support the trend. "This level of power makes it possible for us to turn around answers faster, and for us all to ask and to answer more detailed questions," he says.

York University Meets the Growing Demands of Academic Community with Digital Solution

In 1991, York University in Toronto, Canada's third-largest university with more than 50,000 students, trucked its mainframe off campus. That "burn-the-bridges" step led York to build a leading open client/server administrative system with Digital as a key vendor.

York's experience shows that "true client/server and open systems technology are realizable today. We're benefiting from it with the help of Digital's products," says Allan Cobb. He directs the

design and development of the university's new Student Information System (SIS), the first phase of which went into production on October 12th.

The University built the SIS as an object-oriented, distributed client/server application, based on the Open Software Foundation's Distributed Computing Environment (DCE). The student records application area is the most mission-critical administrative computing area for any university.

The Alpha AXP servers run the DEC OSF/1 operating system, but an OpenVMS AXP server runs the Oracle database and a SUN server brings some NEXT workstations into the DCE-based environment. More than 500 Digital PCs act as clients.

York put the OpenVMS AXP version of DCE right into production even though it was field-test software. "It was remarkable that it worked so well." Cobb doesn't minimize the challenge of building a pioneering DCE application. Yet the work is paying off. The university has achieved its goals. "It's easy to put a Window's working environment on a user's desk," Cobb says. What the combination of a client/server and a windowing environment has allowed us to do is to bring applications together. Cut and paste between them becomes available. When Windows gives our users this kind of access to student data that's relevant to their job, it's of great impact."

"The big benefit is that we can now provide the increased computing technology demanded by students and faculty," adds Sheldon Levy, vice president of institutional affairs. In addition to meeting the needs of the academic community, this new technology allows York to become more administratively efficient and effective at a reduced cost.

Shaw Communications Manages Explosive Growth with Digital Network

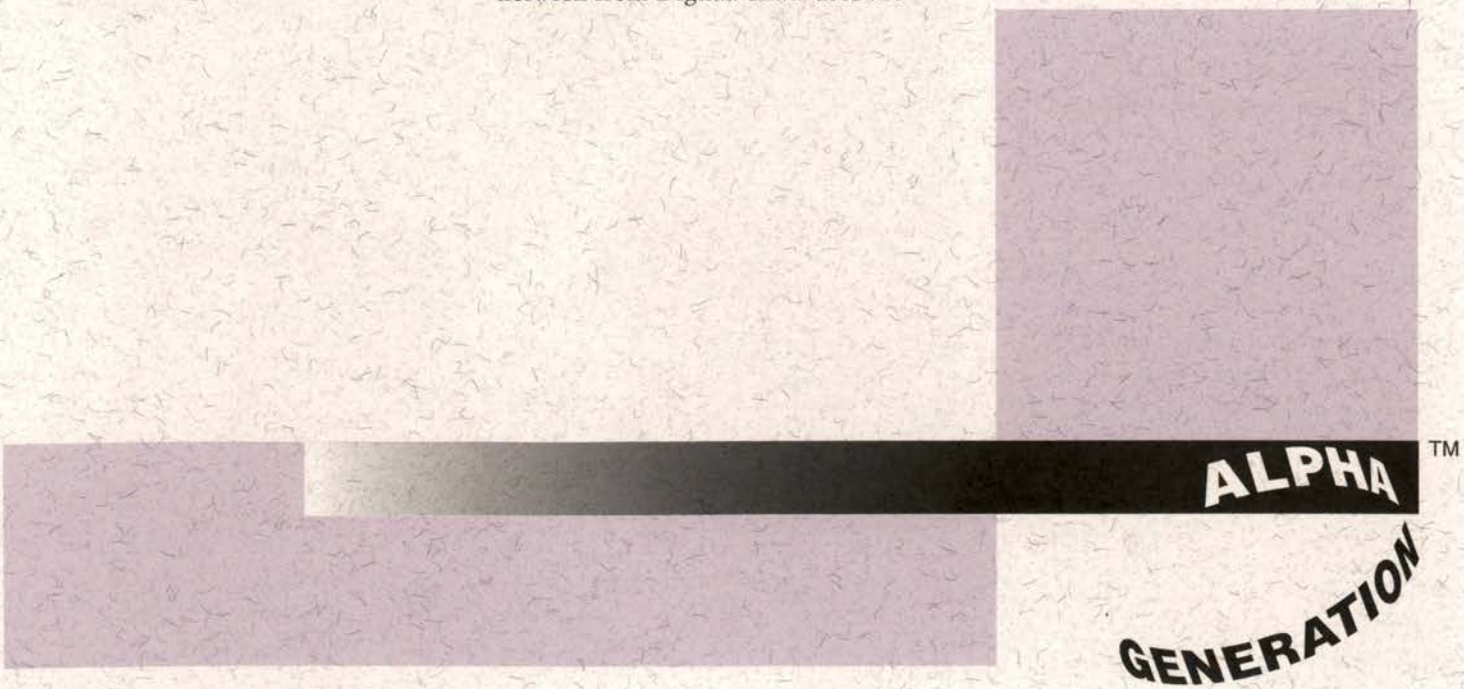
Shaw Communications, Inc., operates the third-largest cable company in Canada and serves more than 900,000 subscribers. Shaw Communications is building its leadership by enhancing services while controlling costs with a continent-wide network from Digital.

Shaw's subscriber base has tripled, and the growing customer population demands an ever-expanding spectrum of services. Shaw manages this growth using Alpha-ready VAX 7000 computers with the OpenVMS operating system as hubs of a coast-to-coast, high-speed Ethernet network from Digital. Shaw uses the Digital network to deliver advanced services, manage explosive growth, and pursue an aggressive acquisitions strategy to increase revenue.

The network provides cost-effective, efficient, centralized operation and administration of Shaw's nationwide operations. Shaw relies on this transaction processing environment to run its inhouse-developed subscriber management and billing systems and pay-per-view application as well as the Renaissance CS Financial Series from Ross Systems, Inc.

Bill Sorensen, vice president of information services, and his 12-member Information Services team efficiently manage a network that spans four time zones. As Shaw Cablevision becomes an around-the-clock operation, they plan to use Digital's POLYCENTER "lights out" network management solution to expand service without adding staff.

"Digital and Shaw complement one another's expertise," says Mr. Sorensen. "We work together well to move Shaw Communications ahead with timely and cost-effective information solutions."



Win Hindle Retires From Digital

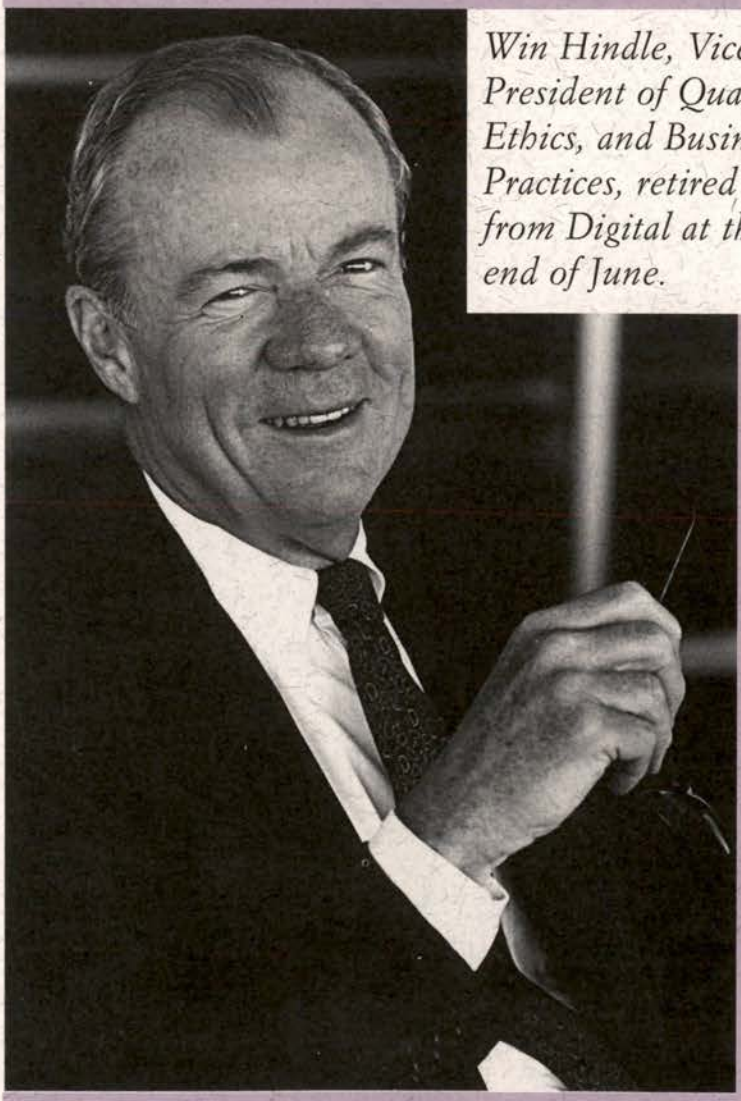
At the end of June, the Digital community said good-bye to Vice President Win Hindle, who retired after thirty-two years of dedicated service.

Win joined Digital in 1962 as assistant to company founder Ken Olsen. During his years with Digital, Hindle held management positions with responsibility for marketing, information systems, planning, business units, communications, security, and — most recently — quality, ethics, and business practices. He was named Vice President of Corporate Operations in 1978 and Senior Vice President in 1986.

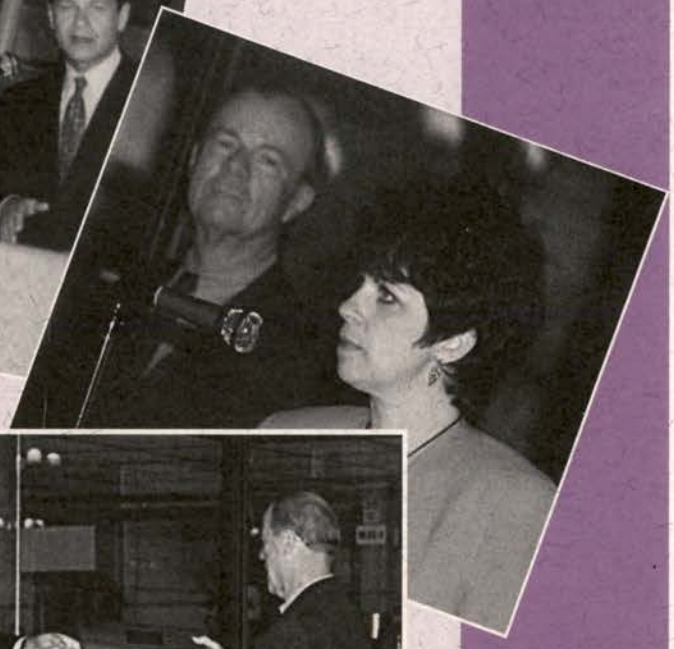
Win also chairs several internal boards, including the Investment Committee and the Canadian Board of Directors.

"It's very difficult to leave Digital after all these years," Hindle said. "The company has made solid progress along its road back to profitability. I leave with the knowledge that Bob Palmer and his management team are providing the leadership needed for Digital to succeed. I feel very fortunate to have had the opportunity of being part of this exciting venture."

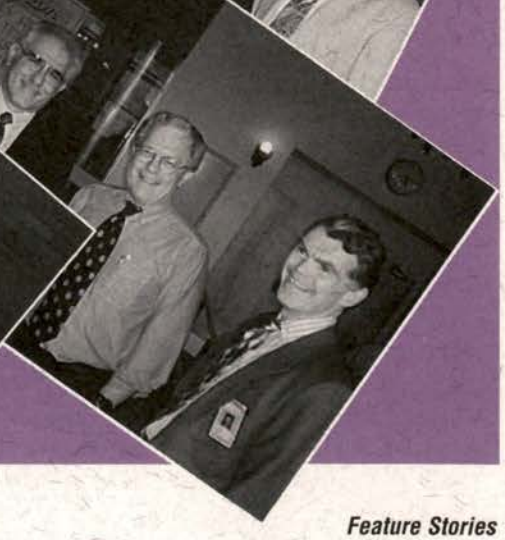
Bob Palmer, Digital's President and Chief Executive Officer, commented, "In his latest assignment, Win has worked in an area of great importance to me and has championed Digital's dedication to the highest level of values and ethical standards. His commitment to customer satisfaction and employee involvement will stand as a lasting contribution to Digital. We're grateful for Win's accomplishments on behalf of the corporation, and we wish him well in his retirement."



Win Hindle, Vice President of Quality, Ethics, and Business Practices, retired from Digital at the end of June.



A reception was held on Thursday, June 30, from 4:00-6:00 p.m. in the Mill cafeteria in honor of Win's 32 years of service. Many Digital employees, retirees, family, and friends were there to wish him well.



Digital Emphasizes Commitment to Technical Computing

by Diane Ferriter

A key component of Digital's April announcement, the third in a series of client/server announcements, emphasizes the corporation's commitment to the Technical Computing market. CSG's High Performance Computing Group led this effort by announcing a suite of innovative hardware and software products targeted at the technical market. These products and support services include:

- Technical Developers System (TDS), based on a dual processor, symmetric multiprocessing, and a 2100 A500 MP system including TechAdvantage
- TechAdvantage, a complete suite of technical development software tools for parallel and serial application development
- AdvantageCluster compute servers and AdvantageCluster file servers
- Expanded network of HPC Expertise Centers

Quest for Ideal Technical Computing Environment

These products all represent innovative packaging for Digital and demonstrate the corporation's quest to offer the most innovative and productive environment for the technical computing user.

The TDS system takes the guesswork out of ordering a technical software development system. It is a complete, powerful development package that is easy for customers to order with software and hardware at a single price. The package includes a dual processor SMP 2100 A500 MP system with factory-installed DEC OSF/1 operating system, as well as factory-installed TechAdvantage software. TechAdvantage, an integrated software package, provides all the tools necessary for software development on a single C++, and Digital's package includes a choice of compiler, Fortran 77, C, C++ and Digital's revolutionary new Fortran 90 parallel compiler. Other software components include the Digital Extended Math Library, the KAP preprocessor optimization tool, and DEC FUSE, an OSF/Motif user interface that makes extensive use of dynamic, graphical capabilities. This package is attractively priced at below the sum of the parts.

Two new AdvantageCluster systems were also announced: the AdvantageCluster File Server (ACFS) and AdvantageCluster Compute Server (ACCS). The AdvantageCluster File Server provides customers with a completely scalable solution to increase the throughput and FS requests. It's a third faster than a SUN cluster for half the price! The AdvantageCluster Compute Servers, also known as Alpha AXP farms, are a family of packaged hardware and software products providing high performance aimed to tackle compute-intensive applications. As William D. Strecker, vice president of Engineering, stated at the announcement, "Our new AdvantageCluster Compute Servers offer the power of a multimillion-dollar supercomputer for approximately $200,000."

HPC Expertise Center at Parker Street

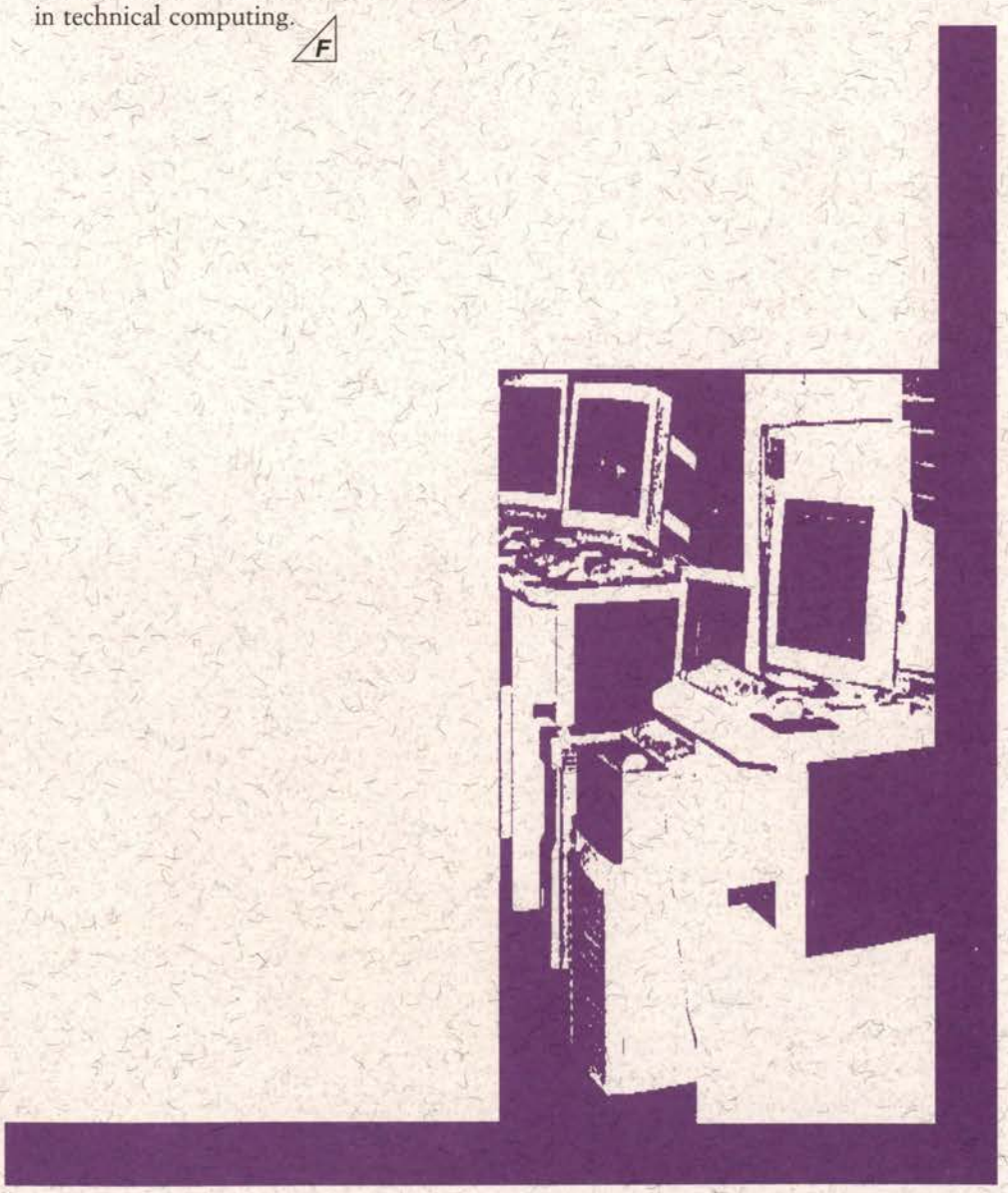
Worldwide Network of Consulting Centers

The HPC Expertise Center, located in Maynard, has become a valuable resource to maximize customers' success with Alpha AXP solutions. The center was so successful that plans are under way to expand its capabilities to several major cities here and abroad. Centers in Europe, APA, and two additional U.S. sites were announced on April 12th.

The centers will be designed to assist customers and business partners in their application development and optimization efforts for all of Digital's high-performance computing products. Specifically, these centers will provide customer consulting on utilizing the 64-bit capabilities of Alpha AXP, training, application optimization, and development assistance.

In a wide variety of industries and application areas, from computational fluid dynamics, molecular modeling, and mechanical/electrical design, to biotechnology, simulation, and financial modeling, Alpha AXP provides supercomputing performance at a low price. Inexpensive, powerful, dedicated compute resources give tremendous creative freedom for compute-intensive work. Jack Dongarra from the University of Tennessee and Oak Ridge National Laboratory claims, "Alpha AXP with [the] OSF/1 [operating system] provides one of the best UNIX development environments." Parallel code development is being done on the Alpha AXP because of the machine's high-speed processing capabilities and superior operating system.

With these products and services, Digital is demonstrating its position as a leader in technical computing.



Galway Expertise Center Delights Customers

by Pat Costello
Principal Technical Writer

The Galway Expertise Center is helping to boost worldwide sales of Alpha AXP systems by producing performance optimization results and benchmarking scores for Digital systems that delight customers. As well as improving the performance of customer applications, the Galway team is providing comparative benchmarking scores for Digital and competitor systems that put the competition in the shade.

Part of the Technical Computing group, the Galway Expertise Center played a strong supporting role in shaping customer perception to achieve recent sales orders from the Irish local government authorities, the Argonne National Laboratory, and the Louis Pasteur University in Strasbourg. Some of the team's recent benchmarking work also helped to close several major Alpha AXP sales to technical computing customers in India.

Delighted Customers Buy from Digital

"The contribution to the successful sales bid to the Irish local government authorities is particularly pleasing for us," says Carol Young, Principal Software Engineer, who heads up the performance optimization activity in Galway. Digital won this business against stiff competition from IBM and Hewlett-Packard. In placing the order with Digital, the customer specifically cited both the optimization performance results provided by the Galway team plus Digital's people and support as the deciding factors. This sales order makes Digital the largest UNIX supplier in Ireland. "We are proud to support the sales effort in a practical manner, with such positive results for the company," affirms Carol.

More sales successes resulted from the group's work with the Argonne National Laboratory in the US. In this instance, Digital outran IBM in a hotly contested race. The Argonne National Laboratory is buying twelve DEC 3000 Model 700 AXP systems and a GIGAswitch. Working together with the High Performance Computing group in Parker Street, the Galway team did a considerable amount of benchmarking and optimization of the Argonne National Laboratory's codes that helped set the stage for this success.

In another recent sales win from the Louis Pasteur University of Strasbourg, the Galway Expertise Center was instrumental in providing benchmarking results that proved beyond a shadow of a doubt that Digital's price versus performance rating is the best on the market. Even though the Louis Pasteur University had already virtually decided to buy from Hewlett-Packard, and had even located a Hewlett-Packard engineer on site to migrate applications from the existing IBM mainframe, the Galway team produced such convincing benchmarking results that the University decided to buy an Alpha AXP workstation farm.

Responding to existing market conditions, the group is currently concentrating on optimizing performance of customer applications written in FORTRAN. Many large organizations have years of development invested in their FORTRAN applications. Customers in the scientific and technical computing community are looking for ways to boost the efficiency of their existing code without having to go to costly code conversion or complete replacement of their applications. The Galway group is answering this market-driven demand and languages show a significant performance improvement on Alpha AXP systems compared to other vendors' systems.

The team follows a three-step strategy in its approach to optimizing the performance of customer applications. The first step is to evaluate the efficiency of the customer code. The team analyzes the code using standard profiling tools such as UPROFILE and ATOM. Once the team has identified inefficient sections of the code, they may replace these sections with purpose-crafted code such as DXML (Digital eXtended Math Library) routines. Additional performance improvements can sometimes be gained by using the KAP preprocessor to restructure and streamline the code. An example of this approach was the work the team carried out for the Argonne National Laboratory computational chemistry code. In this case, the team replaced existing vector library routines that were optimized for Hewlett-Packard systems with DXML routines optimized for Alpha OSF/1 systems.

The second step in optimizing the performance of customer applications is to improve the efficiency of specific algorithms. The team's in-depth expertise in numerical methods, message-passing, and parallelization techniques provides insight into the codes used to construct the algorithms in the customer applications. Using the latest tools and techniques, the team is often able to improve

on the basic building blocks of the customer code.

The third part of the Galway Expertise Center strategy is to go beyond single node application performance, and examine optimization on parallel nodes and workstation farms. To support its work, the team has set up a workstation farm consisting of a DEC 7000 system and a number of DEC 3000 Model 800 AXP workstations connected via a GIGAswitch. The team plans to grow the farm over time to include DEC 2100 multiprocessor systems and ATM interconnects. The Galway group also shares resources with other expertise centers as needed.

Areas of Expertise

Targeting the scientific and technical sectors, the Galway Expertise Center has built up industry experience in the specific areas of applied mathematics, computational chemistry, computational fluid dynamics, and finance. Applications in these areas lend themselves well to parallelization, in many cases demonstrating spectacular performance improvements when ported to workstation farms.

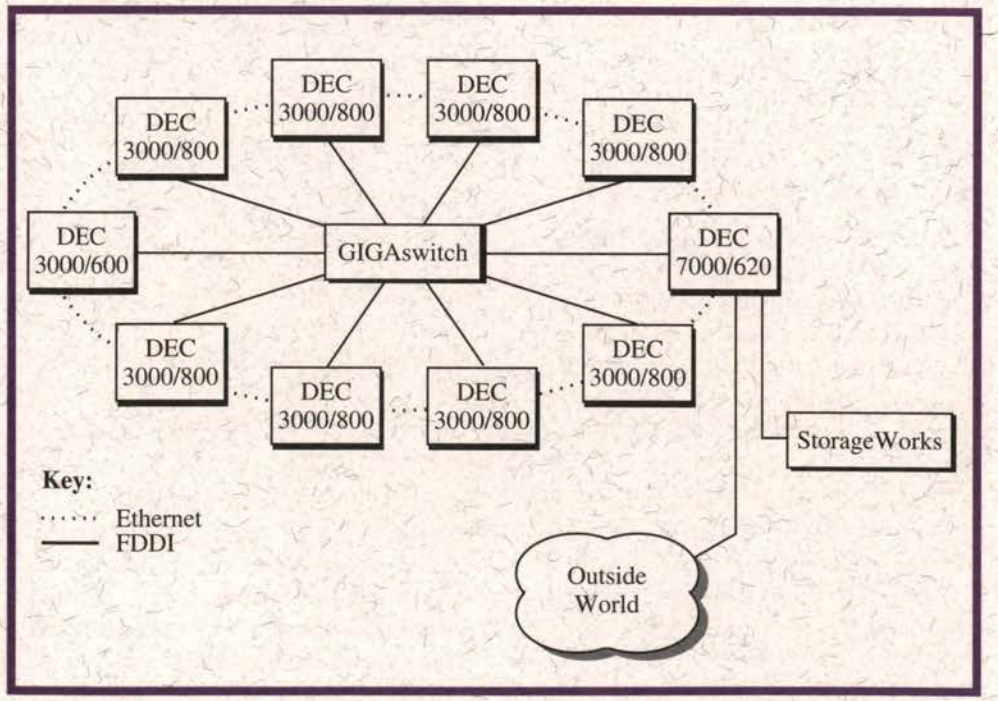
The team recently carried out an optimization project using the GAMESS computational chemistry software that compared IBM RS6000/350 and DEC 3000 Model 800 AXP machines. In a straight single-node contest the IBM machine ran the application in 10 hours and 11 minutes. The DEC 3000 Model 800 AXP machine ran the same application in just under four hours. In a four-node configuration, the DEC 3000 Model 800 AXP machines ran the application in an impressive one hour and two minutes.

"Although our business area is very complex, the secret of our success is quite simple," states Carol Young, "We are totally dedicated to providing optimum customer solutions, and we offer multidisciplinary teams, made up of multidisciplinary people, that can understand the most complex customer problem."

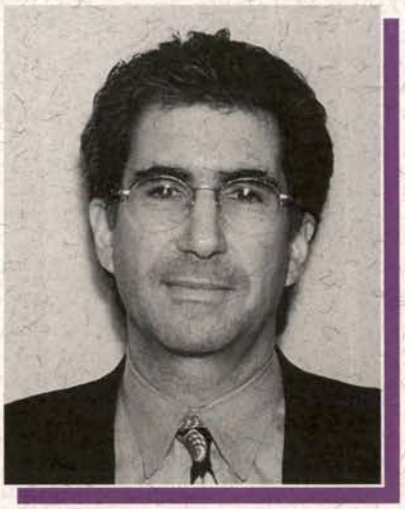
The Galway Expertise Center contributes to the support and training programs provided by the Technical Computing Group for Digital customers and field personnel in the area of scientific and technical computing. The Technical Computing group offers High Performance Computing workshops in Galway. Attendees at these workshops receive technical and sales support training to help them increase sales of Alpha AXP workstations and workstation farms. The training covers hardware and software products as well as giving attendees the opportunity to gain hands-on performance tuning experience.

Carol Young: "We are proud to contribute in a practical manner to the success of Digital's Alpha AXP sales effort."

Configuration of the workstation farm that the Galway Expertise Center is setting up to research performance optimization.



Promotions

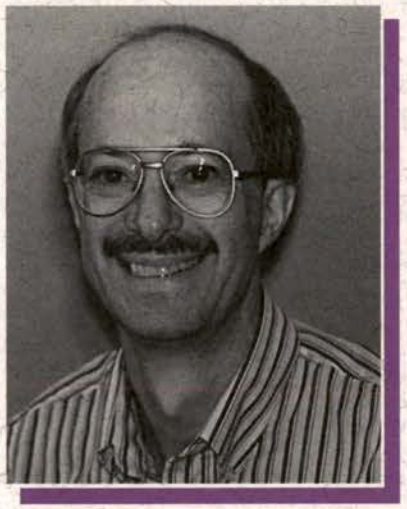


Jeff Schriesheim Promoted to Corporate Consulting Engineer

Jeff Schriesheim has been promoted to Corporate Consulting Engineer. During his 18-year tenure at Digital, Jeff has made several major technical and strategic/business contributions to Digital.

In his current role as Manager for the Windows NT/Netware Engineering and Product Management organizations, Jeff has demonstrated leadership in shaping technology that will have a significant impact on Digital and the industry in general. Jeff was also one of the early architects and key contributors to Digital's PC integration strategy and to PATHWORKS. As a key advisor to software groups wishing to transition their products to integrate with the PC software market, Jeff has better aligned Digital with our customers' "PC-centric" view of computing and with a "PC LAN-centric" view of networking.

His experience will serve Jeff well as he joins the highest ranks of technical and business contributors at Digital.



Mark Davis Promoted to Senior Consulting Engineer

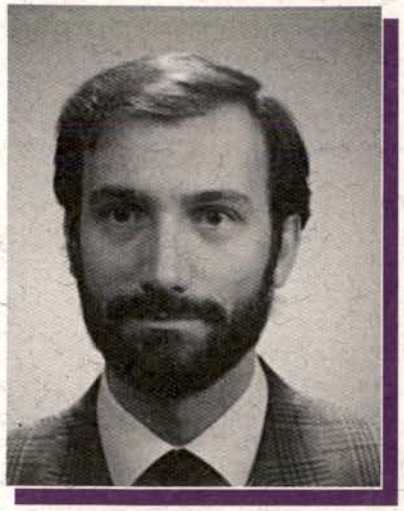
In recognition of his industry leadership in optimizing compilers, language definition, and software engineering, Mark Davis has been promoted to Software Engineering Senior Consultant in The Languages Group.

Mark is a recognized expert in the Ada language. He was a member of Intermetrics' design team during the Ada competition process and became an Ada Distinguished Reviewer for the final language definition. The Reference Manual acknowledges that he "made major contributions" to Ada 83.

Since joining The Languages Group, Mark contributed to the design and optimization of the DEC Ada compilers for AXP systems. As technical lead on the DEC OSF/1 Ada product, he developed strategies for implementing 64-bit integers and for providing precise exception handling. He chairs the DEC OSF/1 Calling Standard Committee, and the Alpha-L(anguages) Group which resolves issues common to compiler implementations on the various Alpha platforms.

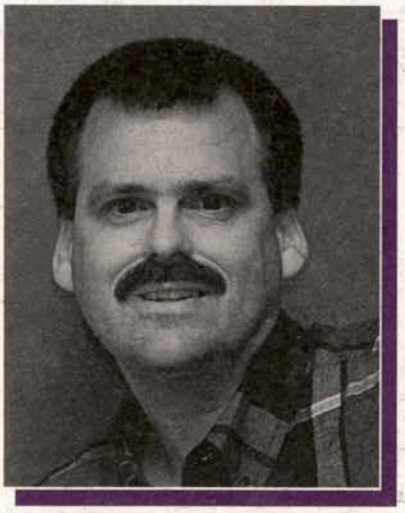
He held senior technical leadership roles in language definition and compiler development at Intermetrics for nine years, and was Technical Director and Manager of Languages at Stardent Computer, where he developed vectorizing parallelizing compilers, for six years before joining Digital in 1991.

Mark graduated Phi Beta Kapa in Mathematics from Amherst College and earned MS and PhD degrees in Computer Science from Harvard University.



Fabio V. Bagatin Promoted to Consulting Engineer

A consulting engineer in the Computer Systems Group in Italy, Fabio is a recognized expert in object-oriented methodologies and in tool integration. With more than 16 years' experience developing compilers, operating systems, distributed systems, tools, and applications, Fabio has a solid understanding of information technology and its potential capability to provide innovative solutions to complex problems. Fabio joined Digital in 1988 to work as project leader of PACE (PCTE/ATIS Common Environment) and Digital's representative in one of ECMA's (European Computer Manufacturing Association) technical group. In 1990, Fabio was appointed SDT Italy Technical Director. In 1991, he received an Excellence Award for his proposal on Client/Server case tools. In 1992, Fabio demonstrated how to add multicasting capabilities to CORBA, and in 1993, became one of the Technical Leaders of FUSE. In 1994, he was one of the main contributors to the CohesionWorX/FUSE messaging architecture. Currently, Fabio is leading the technical work that will allow porting of NeXT's Portable Distributed Objects and OpenStep to the Alpha OSF/1 platform. Prior to joining Digital, Fabio was the Unisys representative to the X/Open PC Interconnect Working Group. He holds a degree in Science and four bachelor degrees in Composition, Orchestra Conducting, Choir Conducting, and Piano.

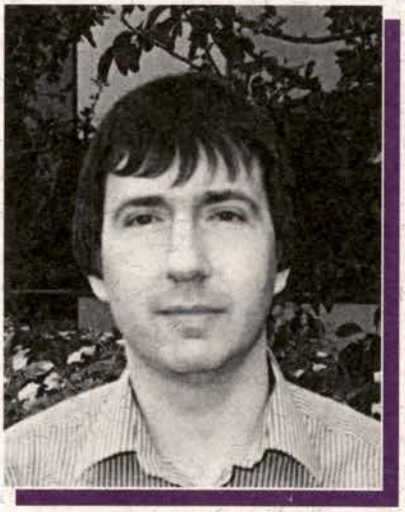


Bill Drury Promoted to Consultant Engineer

In recognition of his outstanding contributions to Digital's Transaction Processing Engineering Group, the Consultant Engineer Promotion Board has promoted Bill Drury to Consulting Engineer. Bill's achievements as Technical Leader of ACMSxp (aka Portable Transaction Processing Monitor) and expertise in complex client/server computing environments have been cited as critical to Digital's success.

Bill has worked for five years in the Transaction Processing Engineering group. For the past two and a half years Bill has led the design, development, and on-time deliveries of ACMSxp. ACMSxp provides a leadership implementation of STDL, a Multi-Vendor Integation Architecture standard. Bill has established himself as a recognized expert in the company on the use of DCE in complex environments and made significant contributions to the performance of DCE, a key underlying technology.

Bill has worked for Digital since 1989 and holds MSEE and BSEE degrees from Ohio University. Prior to joining Digital Bill worked for Datachecker Systems, Inc., and Interlan Corporation. Bill is a co-inventor for a pending patent on client/server computing and also made significant contributions to the X/Open TxRPC protocol specification.

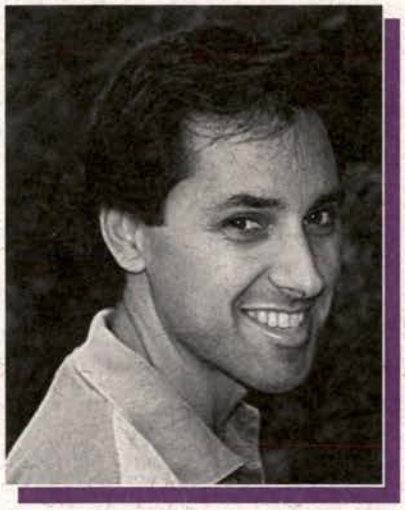


Nick Emery Promoted to Consulting Engineer

Nick Emery has made an outstanding contribution to Digital since joining 16 years ago. In particular his recent achievements have been on the X.500 Directory Services Project. Nick was a major contributor to the CCITT/ISO X.500 1993 Standard and was responsible for the advanced development project that later became the basis of Digital's X.500 product. He has since acted as the primary technical contribu-

tor to the product development and has demonstrated skills in software design and architecture as well as the ability to participate across Digital in every aspect of successful product development.

Nick graduated with a BS (Hons) in Computers and Cybernetics at the University of Kent at Canterbury, UK. Since joining Digital, Nick has worked in a number of product areas including both networking software and office applications. Nick has made a significant contribution to most of the upper layers of the OSI network model.



Mike Gagnon Promoted to Consulting Engineer

In recognition of his outstanding contributions to Database Systems and to the Transaction Processing Group, Mike Gagnon has been promoted to Consulting Engineer.

Mike joined Digital in 1981 as a key member of the Transaction Processing Group. He has always excelled in the areas of product design, technical leadership, implementation, and performance analysis.

Among the premier positions Mike has held in this organization have been project leader and senior technical contributor for multiple versions of ACMS. In these roles, Mike was responsible for delivering a high-quality, technically complex product, on schedule.

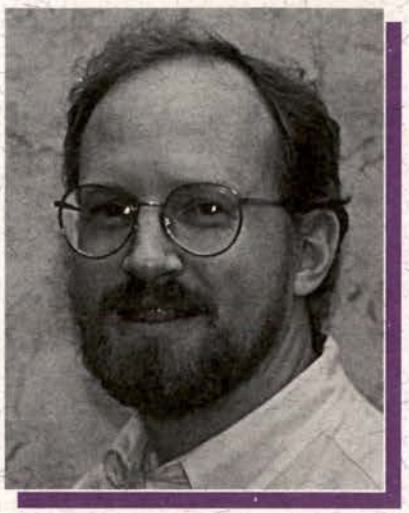
Mike has always played an important role in the area of performance analysis and implementation and has been a member of the DEC TPC Internal Audit Team since 1988.

As Project Leader for DEC DB Integrator, Mike will no doubt continue to set the standard for outstanding project and technical leadership for an ever-emerging product.

Terry Grieb Promoted to Software Consulting Engineer

Terry Grieb was recently promoted to Software Consulting Engineer in the Languages Group.

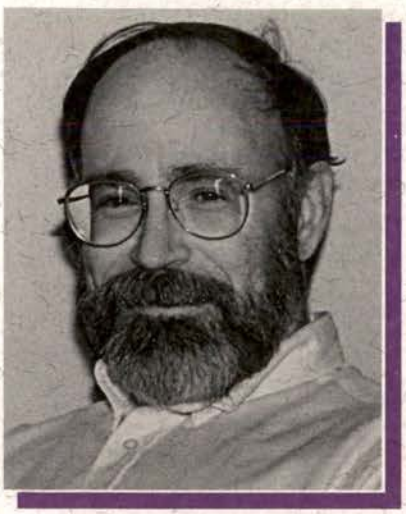
Terry joined Digital in 1974 as a Software Specialist supporting RSX-11D. A key contributor for the Alpha compiler work, Terry has been instrumental in the design of key technical architectures, in managing the overall project schedule, and in leading the integration of the layered products for the first of our quarterly CD-ROMs. Also, at the start of the Alpha Calling Standard for OpenVMS AXP and DEC OSF/1 AXP, Terry led both efforts for the Software Development Technologies group. Most recently, Terry has been a key contributor providing consulting and technical assistance as compilers and related tools move to Windows NT AXP.



Peter Hayden Promoted to Consulting Engineer

Peter Hayden is an engineer in the Windows NT Systems Group in Littleton, MA. He joined Digital in 1986 as a member of the FDDI team and led several efforts contributing to the development of the FDDI technology and product set. He then led the Personal Computer Systems Group's multimedia projects before joining the Windows NT Systems Group in 1992 where he began development of Intel emulation software to run the BIOS code on PC option cards in Alpha AXP systems. This software is now included in all of Digital's new AXP systems and was the basis for his promotion to Consulting Engineer.

Before coming to Digital, Peter worked on PBX development at AT&T Bell Laboratories. He holds a BS in electrical engineering and an MS in computer science from Union College in Schenectady, NY, and has several patent applications pending.



Dwight Manley Promoted to Consultant Engineer

Dwight Manley has been promoted to Consultant Engineer in the Applied Computational Math Group.

Dwight first joined Digital in 1979. For the past several years, he has been one of the key contributors to DXML (Digital Extended Math Library). He has also optimized for Alpha AXP a number of technical/scientific third-party codes and customer benchmarks with sometimes stunning results. Before that he worked in the VAX9000 development teams and contributed to the system design, performance modeling, vector processor architecture, and vector emulation software. Dwight has published one paper and holds ten patents.

Dwight has a BS in Mathematics from University of Massachusetts and an MS in Operations Research from Northeastern University.

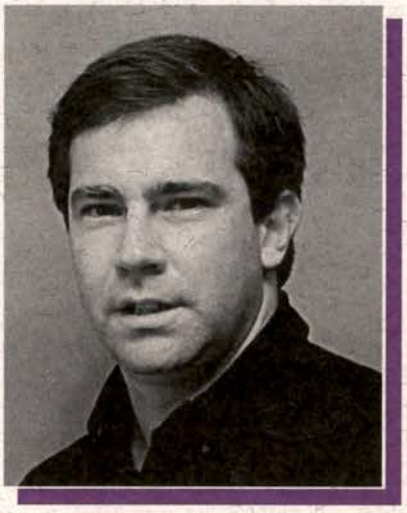
Susan Schultz Promoted to Consultant Technical Editor

Susan I. Schultz has been promoted to Consultant Technical Editor for her many contributions to Digital.

Sue joined Digital in September 1979 as a software technical editor in the VIA group, contributing to many key database, transaction-processing, and business application information sets and strategic technical programs over the next several years. Sue also served as an editing supervisor in the VIA group and as editing manager in the Corporate User Information Products group (which became IDC).

Sue's major achievements include designing and developing The Digital Style Guide and Digital Technical Documentation Handbook (both available through Butterworth-Heinemann/ Digital Press), actively participating in the development of several Digital standards, and helping to develop the Customer Contact Quick Reference Guide. She designed the curriculum for and team-taught the Professional Editing course in the Rivier College Technical Writing Program. She also helped develop the Digital-sponsored Tennessee State University program that helped train minority students in technical areas.

She has a BA in English from Bethany College and an MA in Linguistics from Ohio University. In addition, Sue completed the coursework for a PhD in English Language from Ohio University.



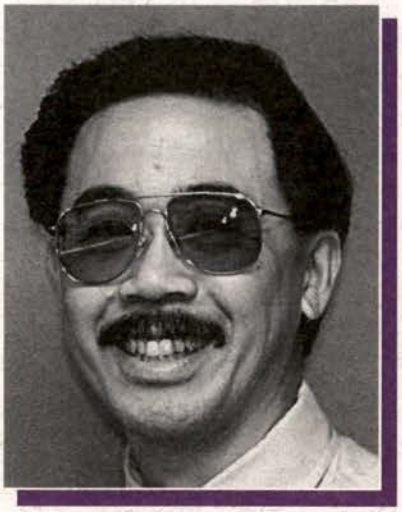
John Shakshober Promoted to Consultant Engineer

John Shakshober, Technical Director of AVS/SSG System Performance Engineering Group, was recently promoted to Consultant Engineer for his outstanding contribution to the Alpha performance enhancement projects.

John Shakshober's major contributions have been in the area of performance optimization. As Digital introduced Alpha for each of its operating systems, John was the key player in driving and influencing various groups to achieve the target performance for Alpha. John modeled, measured, and analyzed products based on the EV4 chip and more recently the EV45 chip. John was the lead engineer for the KAP optimizations. He worked at KUCK Associates to ensure that the software development would be completed within the Alpha announcement target time. He was also the leader in implementing KAP optimizations. He

led the technical performance team in measuring and optimizing the Alpha performance for announcement. He was responsible for getting the performance community to use Alpha performance tools effectively in the initial stages to achieve the performance targets. He worked effectively with OS, GEM, Compiler, RTL, and KAP teams to optimize Alpha performance. John has been involved with numerous critical customer benchmark issues and has worked hard to turn situations around for the account team. John has also been extremely successful in working with magazine benchmarks. Through John's tireless efforts and his tenacity to get the last SPECmark in, Digital continues to see Alpha performance leadership under various industry standard benchmarks.

John has a BS cum laude in Computer Engineering and an MS with honors in Electrical Engineering from Cornell University.



Steve Wong Promoted to Consulting Engineer

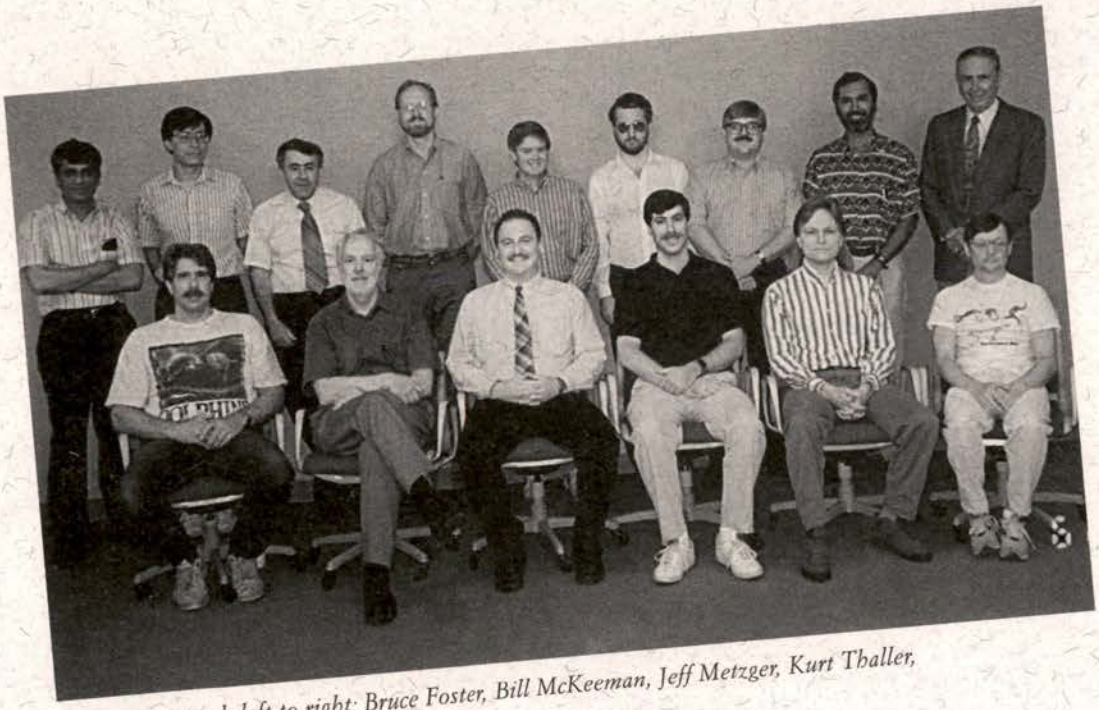
In recognition of his outstanding contributions to Digital's network management offerings, the Consultant Engineer Promotion Board has promoted Steve Wong to Consulting Engineer. In particular, Steve's contributions to the unique features of MCC, his leadership at the Desktop Management Task Force (DMTF) industry consortium, and his deep knowledge of frameworks and network management technologies have been cited as critical to Digital's success.

For the past year, Steve has been instrumental as the Open Network Management Technical Director, positioning Digital for success in the 1990s. Previously, Steve was the driving force behind numerous projects that defined the state of the art for distributed systems and network management, such as the Common Agent, the Management Events and Notifications Distributed Services (MENDS), SNMP Manager/Agent for PCs, and MCC. Earlier contributions include development of CSMA/CD and Token Bus servers, as well as Network Control Centers.

Steve holds an MS degree in Computers and Software Engineering from the Rensselaer Polytechnic Institute and a BSEE degree from the Polytechnic Institute of Brooklyn. He is a co-inventor on six pending patents in the area of network management technology.

Patent Awards

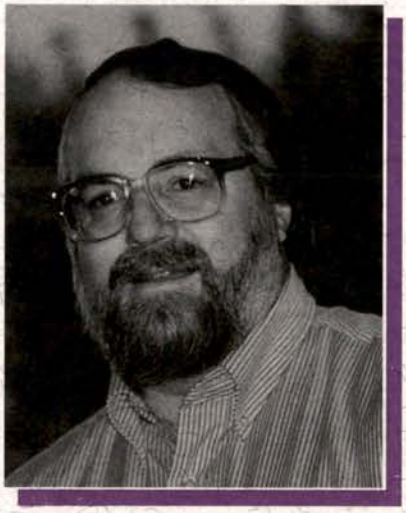
Patent Award Recipients



Front row seated, left to right: Bruce Foster, Bill McKeeman, Jeff Metzger, Kurt Thaller, Tom Benson, Jim Roth
Back row standing, left to right: Raoji Patel, Walter VanRoggen, Russ Iknaian, Peter Hayden, Dave Gagne, Doug Williams, Vice President Bill Demmer
Missing from photo: Barry Maskas, Dave Hartwell

DECwest Patent Award Recipients

Left to right: Bruce Butts, Dave Orbits, Benn Schreiber, Steve Jenness, Ken Abramson



Orbits Honored for Tenth Patent with Digital

David Orbits has received his tenth patent with Digital. Since joining Digital in 1980, Dave has worked on the design of high-performance CPUs, on multiprocessor systems, and on software for distributed shared memory MP systems. In 1985, he was a co-architect for a corporate RISC architecture called PRISM, the forerunner of the Alpha/AXP system.

Dave currently has 11 patents. His first patent, granted in 1990, was related to the Alpha/AXP architecture. He was co-inventor on five Alpha-related patents covering PAL mode, memory access control, asynchronous software interrupts, and interlocked operations. His other patents include two for vector processing, two for multiprocessor cache coherency protocols, and twofor software management of distributed shared memory. Currently he is working on a product implementing distributed shared memory support for low-cost, high-performance multiprocessor systems.

Digital's Software Patents Span

by Greg Aharonian
Internet Patent News Service

Software engineers at Digital have been awarded more than 5800 patents from 1971 to 1994. The demographic data of patents by application area shows that the development of new technology spans many disciplines.

724	Image processing	108	Multiprocessing
560	Operating systems	106	Speech recognition/synthesis
494	Process/numerical control	105	Office automation
489	Networks/communications	99	Natural language analysis
375	Graphics	96	Character recognition
354	Graphical user interface	94	Distributed processing
301	Database	93	Pattern recognition
267	Engineering	66	Biology
234	Artificial intelligence	63	Algorithms
242	Word processing	59	Simulation
229	Financial/management	59	Robotics
201	Computer-aided software engineering	56	Fuzzy logic
		52	Object-oriented programming
189	Medical	45	Physics
178	CAE/circuit design	42	Vision
172	CAD/computer-aided design	42	Parallel programming
171	Security	39	Music
153	Signal processing	35	Chemistry
144	Neural networks	31	Education
126	Compression	25	Games
118	Automobiles	11	Spreadsheets
108	Geophysical	5	Virtual reality
108	Numerical analysis		

Bill Demmer, Vice President, congratulates Dave

Many Areas

Of 4875 software patents awarded from 1991 to 1994, Digital earned 144. Following are patent counts by company (minimum of eight needed to be listed):

520	IBM	30	Intel	13	Microsoft
250	Hitachi	28	Bell Communications Research	13	NASA
144	Digital Equipment Corporation	28	Fuji Xerox	13	NCR
123	ATT Bell Laboratories	25	Honeywell	13	Tektronix
123	Kabushiki Kaisha Toshiba	25	Honda Giken Kyogo Kabushiki	12	Atlantic Richfield
104	Xerox		Kaisha	12	Boeing
73	Mitsubishi Denki Kabushiki Kaisha	23	Schlumberger Technology	12	Conoco
72	Fanuc	23	Sony	12	Northern Telecom
71	Sharp Kabushiki Kaisha	23	U.S. Philips	12	U.S. Air Force
67	Hewlett-Packard	22	E. I. Du Pont de Nemours	12	Ezel
65	Canon Kabushiki Kaisha	22	U.S. Navy	11	Harris
63	Eastman Kodak	21	Dainippon Screen Manufacturing	11	United Technologies
62	Ricoh	20	Wang Laboratories	11	Minolta Camera
60	General Electric	20	Alcatel	11	Olympus Optical
57	Fujitsu	20	Nissan Motor	10	Crosfield Electronics
56	Motorola	19	Apple Computer	9	Amoco
55	Matsushita Electric Industrial	19	Siemens Aktiengesellschaft	9	Compaq Computer
46	NEC	18	Unisys	9	General Motors
41	Sun Microsystems	16	Pitney Bowes	8	Grumman Aerospace
41	Texas Instruments	14	M.I.T.	8	Casio Computer
37	Fuji Photo Film	14	VLSI Technology		
35	Brother Kyogo Kabushiki Kaisha	14	Yamaha		
32	Hughes Aircraft	13	Allen-Bradley		
31	Westinghouse Electric	13	Bull HN Information Systems		

Software Now Links Unigraphics and VLS

by Jeff Lewis

Front, left to right: Manisha Kher, Hook Wong, Vernon Soubble
Back, left to right: Eric Tatara, Jeff Lewis, Bob Seuss

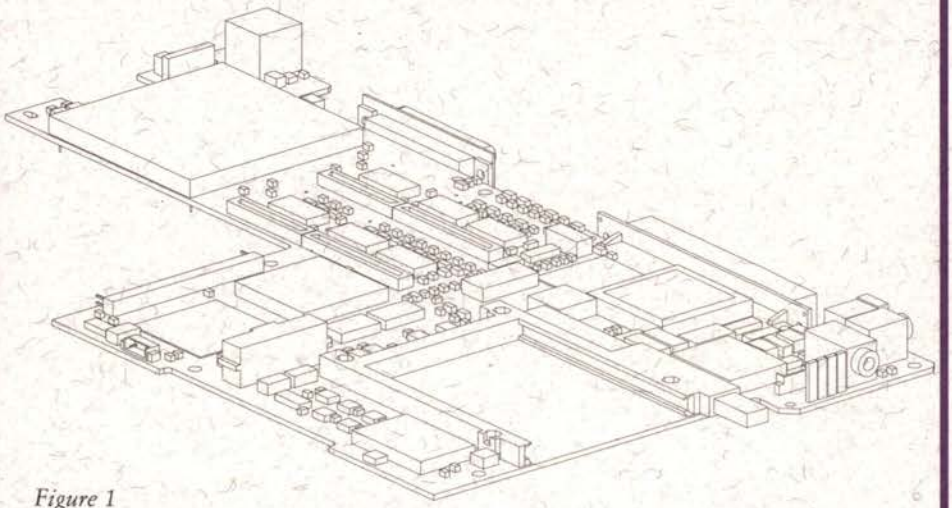


Figure 1

As the packaging of electrical and electromechanical components within a computer enclosure becomes more dense, allocating that space well becomes more critical.

Populated circuit modules in a computer or peripheral can take up a high percentage of the product's volume, yet the space these modules occupy has traditionally been one of the most difficult design parameters to control. To design an enclosure, a mechanical engineer (ME) must completely understand the volume of space surrounding all modules. MEs typically specify only certain aspects of a module design (e.g., board outline, mounting holes, connector locations, component restrictions), yet there may be hundreds (even thousands) of ICs, resistors, capacitors, etc., that are virtually impossible to control. Even the items that are defined are communicated to the module layout person through dimensioned hardcopy control drawings; the layout person must enter the data into his or her system. This is a redundant step and creates opportunities for mistakes. Then, once the module layout is complete, compliance with mechanical constraints is performed visually or by crude measurement checks against 1:1 scale plots of the completed module. Unfortunately, in this manner, most problems are detected only after the module has been fabricated and assembled in a prototype enclosure.

However, that is all about to change. Software now exists that will pass all pertinent mechanical CAD information (in Unigraphics) to the layout person's database (in VLS) and read all of this information in automatically. Then, once

the layout is complete, the three-dimensional geometry of the module and all of its components can be passed back to the ME for confirmation against the design layout and interference checking within the product design. Since a 100 percent, exact three-dimensional representation of a complete module may be checked and verified prior to that module being fabricated, costly and time-consuming re-layouts can be eliminated.

The TCS (Technical Consulting Services) group has developed a program to take a Unigraphics database of a module (such as a solid model or wireframe; see Figure 1), "squash" it into two-dimensional geometry, and allow the ME to assign the following attributes to the geometry:

- Board outline
- Board cutouts
- Board mounting holes
- Etch restrictions
- Component restrictions
- Component height restrictions
- Preplaced components

See Figures 2 and 3.

An IGES file with these labeled entities is then created and mailed to the layout person. Software developed by the TDA/EDT (Electronics Design Technology) group automatically reads the above information into a VLS database and constrains the module layout to conform to these mechanical attributes. The board outline, cutouts, mounting holes, and preplaced components are generated automatically while the etch, component, and component height restrictions define warning zones. If these zones are violated during the module layout, VLS will flag the layout person that a problem exists.

Once the module layout is complete, an IGES file containing the size and height information for all components is created and mailed to the ME. Another software program, also developed by TCS, "stretches" the

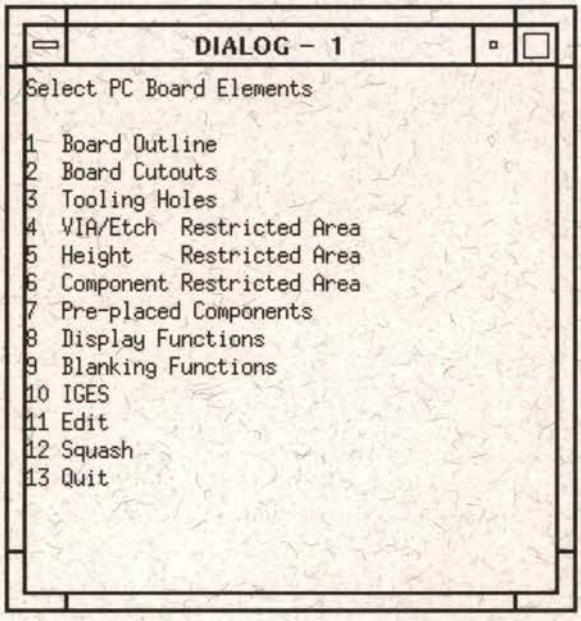
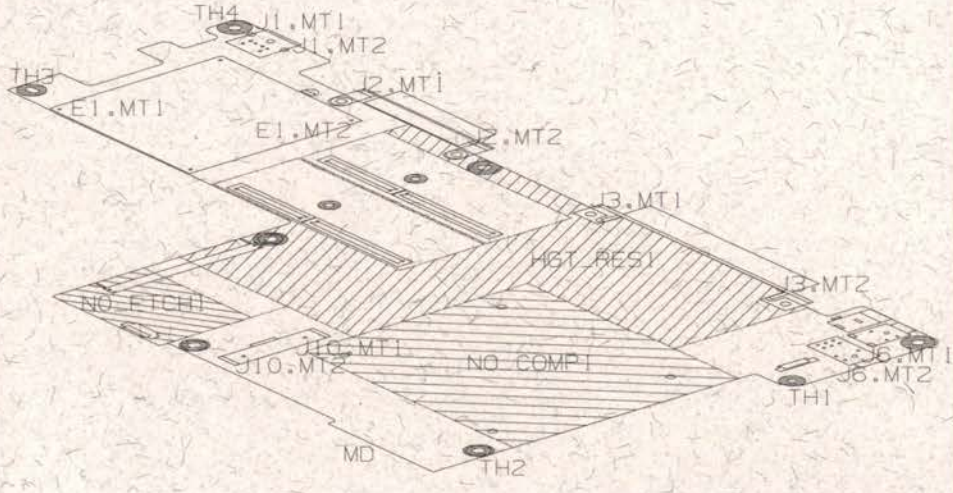


Figure 2

Figure 3



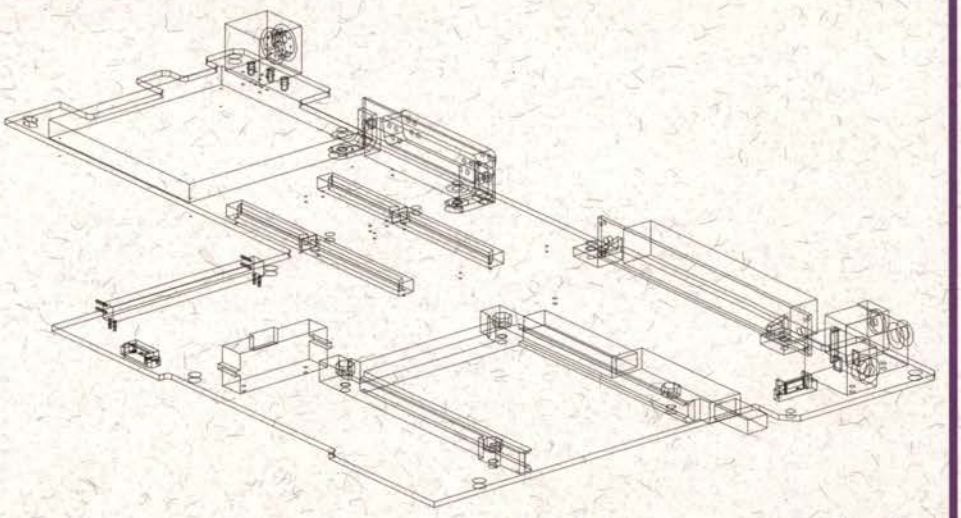


Figure 4

module and all of its components into a complete solid model (see Figure 4). With a solid model, the ME may then let the CAD system perform final interference checks of the module against all the surrounding enclosure parts. If problems are discovered, an iterative process is used between the ME and layout person until the module completely checks out.

This process has allowed us to link the mechanical and electrical worlds as never before, resulting in faster completion of quality product designs.

For more information, contact any of the following developers:

Contributor	Organization	Role	Information
Manisha Kher	*EDT*	*Electrical CAD tools implementor*	*DTN 223-1472 CADSE::KHER*
Jeff Lewis	*TCS*	*Mechanical engineer*	*DTN 223-7648 CONSLT::LEWIS*
Bob Seuss	*EDT*	*Electrical (PWB layout) designer*	*DTN 223-1426 DPEI::SEUSS*
Vern Soubble	*TCS*	*Mechanical CAD tools implementor*	*DTN 223-2982 EMDS::SOUBBLE*
Eric Tatara	*EDT*	*DLC MCAD-ECAD process & data exchange project leader*	*DTN 223-1439 CADVAX::TATARA*
Hook Wong	*EDT*	*DLC design & test project manager*	*DTN 223-1448 DPEI::WONG*

World Record TPC-A Result

by David Walrath, Gigi Lirot, Rabah Mediouni, Ranga Rengarajan

In the summer of 1993, Rdb Engineering approached the Computer Systems Group to conduct a large cluster benchmark test of at least 3,000 TPC-A TPS (transactions per second) for a late fall or early winter announcement. CSG upper management agreed, and Bhagyam Moses, the Manager of the CSG Performance Group, was assigned to organize the benchmark process. Bhagyam assigned Chris Janson, Manager of the CSGPG Commercial Performance Group, the duty of project manager, and David Walrath, formerly of the clusters and high availability organization, project leader. Another member of the final team, Rabah Mediouni from Rdb Engineering, was also drafted to be part of the benchmark effort early in the process, adding his extensive experience in database performance testing. Gigi Lirot of the CSG Performance Group was added early in 1994 to help with configuring and managing the 92 test systems eventually included in the benchmark. When the actual testing began, Ranga Rengarajan of Rdb Engineering also joined in to help due to his knowledge of the new Rdb features being used and his experience with a previous large Rdb TPC-A benchmark. The four test engineers, along with Chris Janson and Joe McFadden, a consulting technician with the CSGPC, formed the day-to-day team that produced the benchmark.

Selecting Rdb

Rdb was chosen for this large test for several reasons:

- First, Rdb appeared to have a performance edge over third-party databases on the OpenVMS AXP operating system on the TPC-A benchmark, due to the dramatic performance improvements in Rdb over the last several versions.
- Second, Rdb was in the process of implementing a new feature called Partitioned Lock Trees (PLT). Normally, a single database in a cluster will have one lock tree to control the resources in a database; this lock tree is owned by one node in the cluster, with the other cluster nodes requesting resources from this "lock master node" when they need to access the database. PLT is a new cluster performance feature in VMS and Rdb that allows Rdb to have multiple lock trees in one database, which in turn allows each cluster node to master the locks on the parts of the database it uses most often, giving potentially dramatic cluster performance improvements.
- Finally, Rdb Engineering had done significant work on fast loading of databases, and it was felt that while on other databases (as well as older versions of Rdb) it might take as long as a week to build a full 3,000 TPS database, with the newest version of Rdb a build could be done overnight. In fact, the final database was a 3,696 TPS database, more than 20 percent larger than originally planned, and took only about six and a half hours to create and load this database of over 60 gigabytes.

The first hurdle to doing a TPC benchmark is to generate an estimated performance number and determine the amount of equipment needed. 3,200 TPS was agreed on as a design goal, and it was decided that four DEC AXP 7000-660 OpenVMS systems with 200 MHz Alpha CPUs would be sufficient. The I/O configuration became a major problem, though, with the question of how many disks, HSCs or HSJs, and CI interconnects would be needed. After much discussion, Dave and Rabah felt that two CIs with 22 HSJs and 200 SCSI disks would be sufficient for 3,200 TPS. An additional 40 MicroVAX 3100-90 front-end systems (FEPs) were ordered, and 40 VAXstation 4000-90 RTE (Remote Terminal Emulator) systems were also ordered to emulate the 32,000 users needed to produce 3,200 TPS. The equipment was ordered over several weeks in September, 1993; although originally a very aggressive schedule had been proposed, most of the equipment did not arrive in BXB1 where the testing was to happen until December, and the 200 MHz CPU boards needed to even begin full-scale testing were not ready to use until late in January. The new goal became the large April 12th announcement.

Numerous Obstacles

While waiting for equipment, a surprising development occurred: IBM announced a large TPC-A result of 3,505 TPS on an IBM mainframe in December. The test was done with TPS, a very highly optimized transaction processing software package which does not include a relational database, and was therefore not completely comparable to Rdb. Since the current plan was to achieve over 3,000 TPS, it was decided that a new goal of exceeding IBM's results was desirable. While in retrospect it was easier to pass 3,000 TPS than was anticipated, at the time no one was sure that even 3,000 TPS would be broken, and there were almost as many jokes as serious discussions of beating IBM in January.

Work began to increase in January to get ready for the testing as Dave, Gigi, and Joe, with other engineers in BXB, working on setting up the systems, software, and network. Meanwhile Rabah and Ranga worked with Rdb engineering to have Rdb Version 6.1 with its new features available when the test systems were finally ready. By the middle of February, the systems were ready, and testing had begun. Almost immediately, even with only one DEC 7000 being used, a very serious and disturbing performance problem arose; Rdb seemed to lose as much as 20 percent in performance as large numbers of database areas (database files) were added to the test database. Luckily, Rdb on both the Alpha VMS and VAX VMS operating systems used the same code, so the problem could be investigated on a VAX 6000 system already in the lab running VAX PCA. A problem was eventually found and fixed within Rdb — which should help all customers with a large number of database areas — but this was the first of a series of performance problems that chewed up the time to the April 12 goal.

The next series of performance problems came from the I/O. The HSJ disk controllers had shipped with an older version of software, was slower than expected. After many attempts to work around the problem, Richie Lary and Dave Clark in CXO were persuaded to send HSJ Version 1.4 software, which was still in field test at that time. The performance increase was significant, especially with the AIJ (After Image Journal) drive, an eight-disk HSJ stripe set doing large I/O transfers. In the meantime, to help reach 3,600+ TPS, more than 60 additional disks were borrowed from other CSGPG projects and from the AVS performance group in BXB2, bringing the total number of disks in the test configuration to over 260. At the same time another serious problem developed. ACE is an innovative feature in Rdb that caches the most recent database log record onto a small, fast disk, usually a solid-state disk, so the database users won't have to wait for the larger, slower magnetic AIJ disk. First one, then another, then five EZ51 SCSI solid-state disks in a RAID-0 stripe set were used for an Rdb ACE disk, but no amount of tuning seemed able to bring the ACE disk's response time under the five milliseconds desired to reduce the journal write time. An HSC95 was even borrowed from the Rdb group and attached to the cluster with two ESE20 drives to make sure it wasn't a SCSI limitation. Three or more days were spent trying to get VMS host-based striping to work properly with small four to six block stripe-set chunk sizes; there seemed to be a bug in the driver, but an eventual solution was found in increasing the sysgen parameter KSTACKPAGES (the number of pages for process kernel stacks). In the end, this didn't give the needed performance; even modifying Rdb to make better use of the multiple EZ51s didn't seem to help significantly. Finally, however desirable, it was decided not to use the ACE disk feature. Nearly two weeks had been spent trying to make ACE work, and less than three weeks were left before April 12th. One reason the ACE feature is useful in TPC-A with Rdb is that it allows each back-end Rdb server process to do more work. Fewer servers reduce the memory needed, and since each server directs most of its I/O work to one database file on one disk, it also reduces the number of disks needed for the test system. It was felt that the disks being used now in the test — RZ26Ls, RZ28s, and RZ74s — could handle one server's worth of work, but not quite two; if the database servers could not do enough work per server, even the large number of spindles already configured wouldn't be enough. Of the 260+ disks, many were needed for journaling and other requirements; only about 240 disks were available for the actual database files. If 3,600 TPS was to be achieved with one server per disk, 15+ TPS per server would be needed. With the decision to drop ACE, each server would only be able to do 12 to 14 TPS worth of work. After a long afternoon and evening of reconfiguring the disks, striping turned out to be the best solution. Using the HSJ40's RAID-0 software, 240 disks were combined into 80 three-disk HSJ stripe sets, with three or four of the I/O intensive database areas on each stripe disk, giving the needed performance.

The Home Stretch

By this time, there were only about two weeks left, with as much as one week needed to audit the test with an external auditor, as required by the TPC rules. Additional time would be needed to produce the report also required by TPC rules. Only minimal work had been done using the entire cluster, and not one full TPC-A test with the thousands of emulated users needed for the audited test had been performed; only database tuning tests using the similar but much simpler TP-1 benchmark had been run. Dave Walrath began hinting to his management that the April 12th announcement might be impossible, but after a lively discussion the test engineers and Chris Janson decided to do whatever was necessary to make the announcement date. Work days, already 10 to 14 hours for several weeks, jumped to 16 hours as work was done to tune the network and configure the front-end MicroVAX 3100-90 systems and RTEs needed for the full TPC-A test. Ruth Morgenstein from CSGPG and Yongmin Chen from Software's Performance Expertise Center had been doing other TPC-A tests for the announcement with some of the FEPs

and RTEs from the 3,000 TPS testbed, and when they finished they provided these valuably preconfigured FEPs and RTEs to the larger test. Because the DEC 2100 test itself was running over its schedule and was still using several of these systems, the entire test configuration was not available until just a week before what was seen as the last possible day to begin the external audit and still meet the April announcement. Once the full TPC-A testing began, three problems quickly surfaced. One software problem causing the RTE program to crash took a very late night to fix, and another problem with the front-end software was not understood and fixed until the night before the auditors were to arrive. But an even more serious problem arose: to break 3,600 TPS, at least 43 front-end systems (44 to spread the users evenly to each of the four back ends) would be needed, and only 40 were in configuration. From prototype systems on back shelves and systems used for other TPC tests, four more MicroVAX 3100-90 front-end processors and four VAXstation 4000-90 RTEs to drive the front ends were scrounged almost at the last minute. On the day before the audit, the test bed was suddenly, almost magically stable, and the testers made a surprise last-minute decision that only five CPUs on each DEC 7000 system would actually be needed to achieve 3,600+ TPS. At 77 Rdb servers per back-end system and 12 TPS per server, the peak performance would be about 3,696 TPS, and a final database was built to these specifications. Had there been two or three more days to tune, 4,000 TPS might have been possible. Finally, the testers were ready for the audit on Tuesday, April 5th, and auditors from KPMG Peat Marwick arrived. TPC-A audits require several runs at the peak performance, a battery of reliability and other database tests collectively called the ACID tests (Atomicity, Consistency, Isolation, and Durability), and several other lesser tests. When on Thursday night, a corrupt database page required rebuilding a small database and rerunning a particularly long test, the testers decided that to finish on time, they would stay and work through the night; this led to a now-infamous 36-hour work day, ending with an internal review Friday afternoon of the results.

At this point, the auditors, Rabah, Ranga, and Gigi were all able to go home, and Dave Walrath spent a second night at work to complete some additional TPC testing required, to collect some additional data and documentation required by the auditors and the TPC, and to deliver the results to the principal auditor's home. The auditor needed the results on Saturday, so he could draft a memo certifying that Digital had successfully completed the audit and ship it by overnight courier on Monday to reach TPC by the Tuesday announcement.

Even then, the final piece, the Full Disclosure Report required by the TPC was not entirely completed, and only with a final rush by Dave Walrath, Gigi Lirot, Ruth Morgenstein, and Walt Kohler and Hwan Shen from the Performance Expertise Center was the report ready to ship to the TPC by Monday afternoon so it would be at the TPC administrator before the announcement on Tuesday, April 12th. On April 12th, 1994, Digital formally submitted a result of 3,692.02 TPC-A TPS to the TPC, the highest result to date of any vendor on any database.

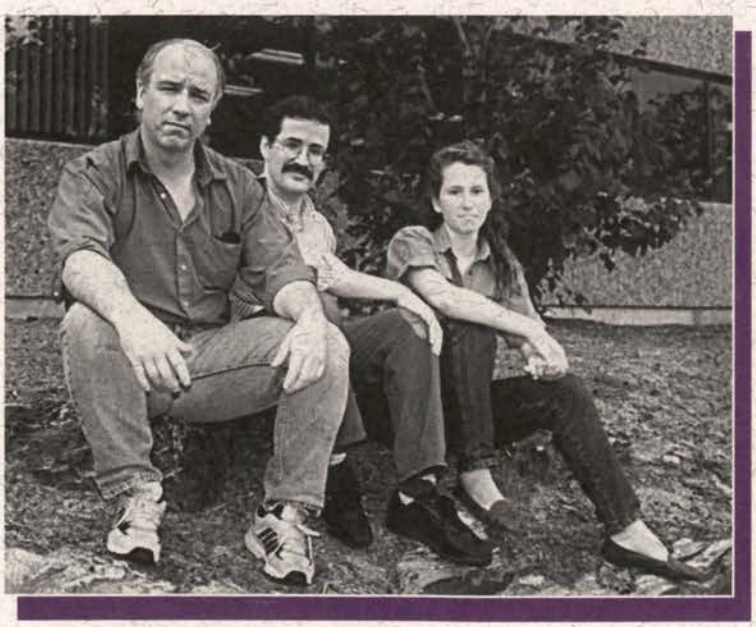
Quotes:

Ranga: "I enjoyed the focus of the benchmark. It was always clear what we wanted to do; that's good."

Rabah: "Overall I think it was a great experience! However, it did have its stressful moments."

Gigi: "It was a terrific learning experience for me to be part of such a large project."

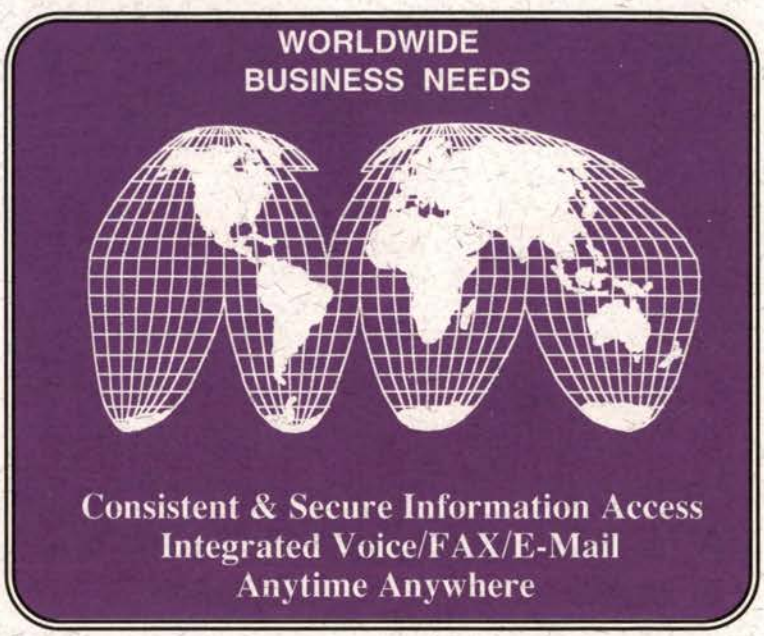
David: "It's both funny and frustrating how many people who have never done a TPC audit think these commercial benchmarks are just installing some software and turning a crank. Any of us would probably have gone crazy with this one if the others weren't there to help."



Systems Software Group — World Record TPC
Joe McFadden, Dave Walrath, and Gigi Lirot;
Missing: Rabeh Mediouni, Ranga Rengavatan

Client/Server Telecomputing on Alpha AXP — The Future Just Arrived!

by Ashu Bhatnagar
LSG Product Management Manager



Convergence of state-of-the-art technologies — high-performance, low-cost Alpha AXP systems, client/server computing, interactive multimedia, worldwide telephony, electronic mail (e-mail), voice mail, facsimile (fax), computerized text-to-speech conversion in multiple natural languages, voice recognition — has caused a revolution in the making, known as telecomputing.

Integrating a high-performance computer with a standard telephone network or a Private Branch Exchange (PBX) offers the potential of consistent and secure information access "anytime, anywhere" to all knowledge workers — a fast-growing community representing the majority of tomorrow's workforce (See Figure 1).

However, at most business enterprises today, telephony information processing is generally a closed, monolithic service that operates in isolation from generally open computerized information processing.

Digital has worked with industry-leading partners such as Microsoft, Dialogic, and third-party software vendors, distributors, and Value Added Resellers (VARs) to offer an indirect channel-ready integrated packaged solution. PC Message Server delivers on the promise of telecomputing today (See Figure 3)!

The PC Message Server solution on Alpha AXP platform is jointly sponsored by Willy Shih and Don Harbert. It has been favorably received by customers at the WindowsWorld '94 program announcement and by the ComputerWorld trade press at the Comdex '94 preview.

Even as the pieces of this complex integration puzzle are developing, major industry vendors anticipate a tremendous

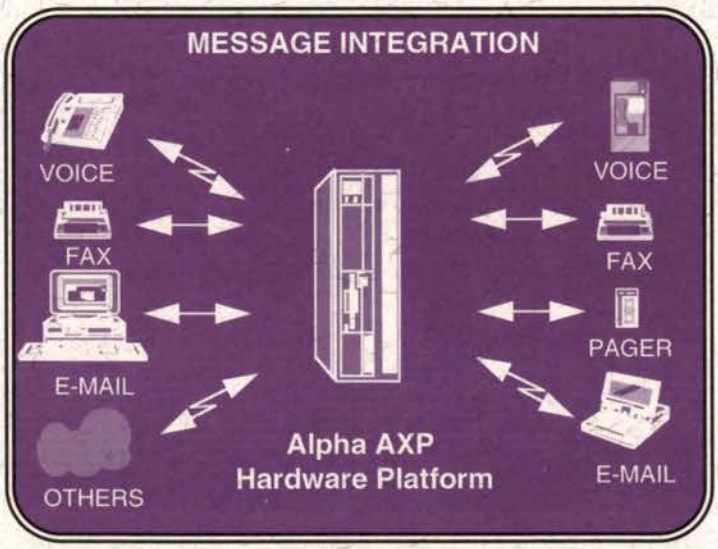


Figure 1: Technology Convergence

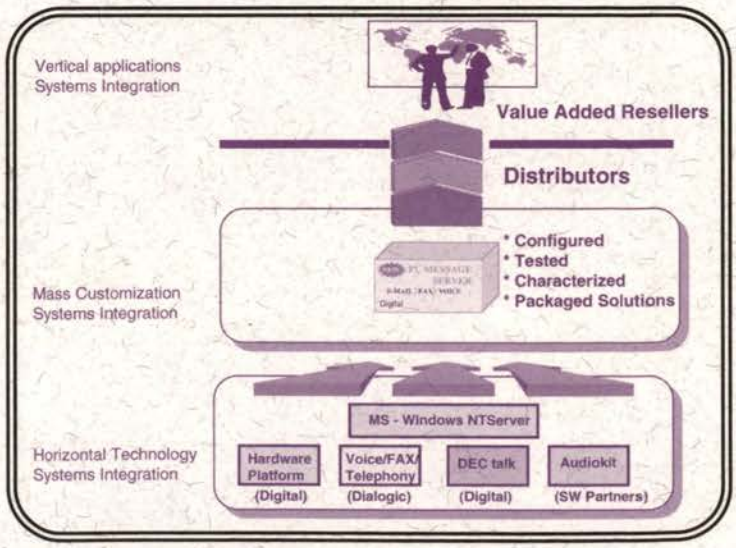


Figure 3: Partnership Based Integration Business Model

near-term worldwide market opportunity exceeding a billion-dollars in 1994. They are working aggressively at defining and implementing standard interfaces and APIs such as Microsoft's Telephony API (TAPI), Novell's Telephony Services API (TSAPI), and Apple's Macintosh Telephone Manager.

Intel is designing an interface that will more efficiently link PCs to telephones. This plug-and-play interface, scheduled for demonstration at the November Comdex show in Las Vegas, will transfer data at up to 8 megabits per second. Overcoming the limitations of the current RJ-11 phone jack, it will handle upcoming TAPI-enabled applications, built-in telephony capabilities in the next version of Microsoft Windows, and other new connection services such as ISDN, proprietary PBXes, and ATMs.

PC Message Server represents Digital's partnership-based integration business model suited for the indirect channel, as well as its partnership-based software integration strategy for the open client/server telecomputing environment.

PC Message Server, due to ship later this calendar year, is a fully configured, easy-to-use hardware/software package that includes an Alpha AXP 2100 with Windows NT server with support for Microsoft Mail API-enabled Windows applications. The server software includes a runtime engine and requires no additional client licenses. System development toolkits will be made available separately for building vertical applications (See Figure 4).

The application areas where telecomputing will be successful are many, and include:

- Individual User Application Services, such as telephony and audio multimedia for desktop users without special hardware/software such as sound card, speaker, and microphone. The server can integrate call screening, fax management, voice annotation, speech recognition, and call processing, with existing desktop PCs and phone. The cost savings will pay for the solution.

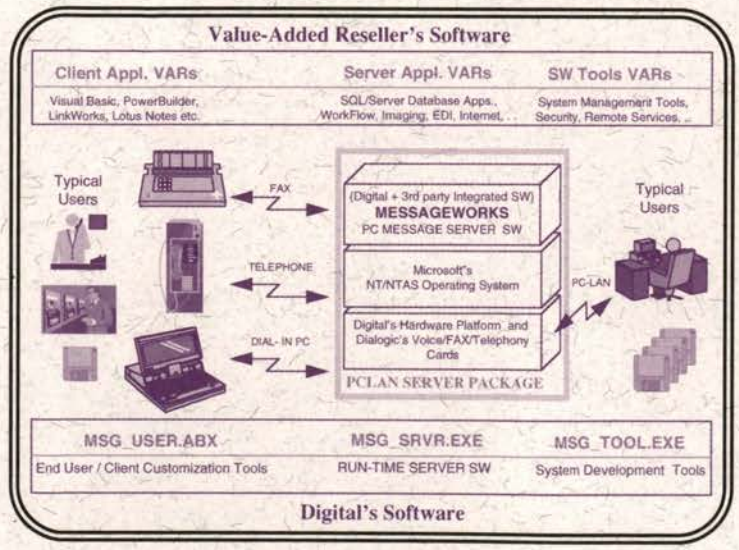


Figure 4: PC Message Server Software Integration Strategy

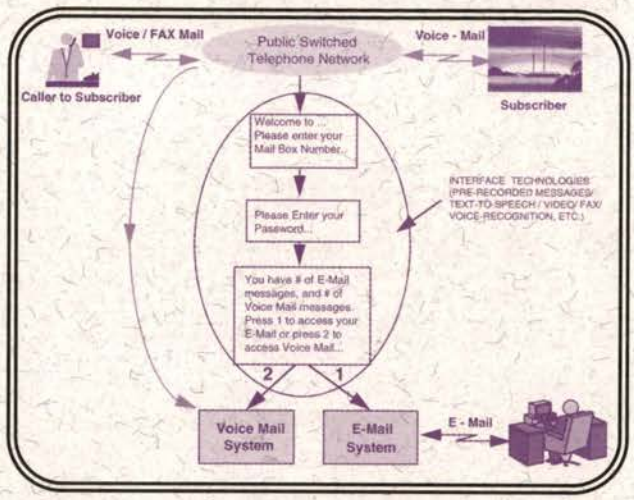


Figure 5: PC Message Server — Typical User Interface

- Unified Messaging, when applications provide an integrated messaging interface for e-mail, fax, and voice messages. A caller can remotely access only voicemail with TouchTone or speech recognition, as today; in the same way, he or she can hear or send out e-mail, or send faxes (See Figure 5).
- Third-party products can enable desktop users to manage multimedia messages from a single graphical user interface and to access voice randomly by point-and-click (versus serially, as is typical today).
- Telephony Database Transactions, such as bank-at-home, ticket purchases, reservations, catalog services, and many others.

In 1993, the worldwide call processing market was $825 million and it is poised for rapid growth around the world. By bringing the best technologies and business partners together to form PC Message Server, Digital has opened up a host of new market opportunities for our customers as well as business partners. The worldwide call processing market is poised for rapid growth and in 1993 was $825 million, with Asia/Pacific taking a 40 percent share, followed by Europe at 31 percent (See Figure 6).

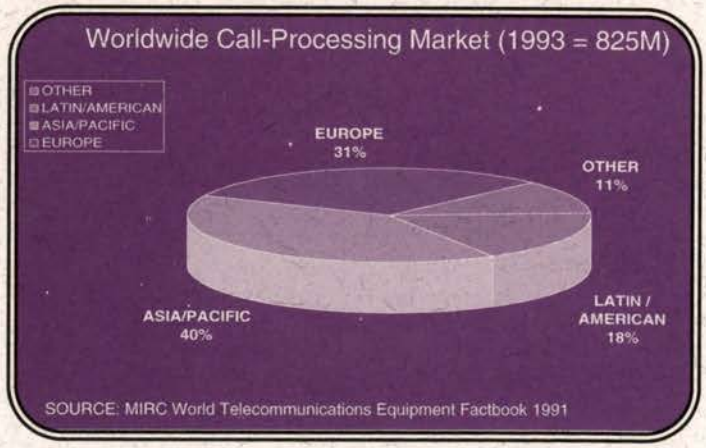


Figure 6: Worldwide Market Opportunity

UNIX Specialists Meet in New Hampshire

by Dianna Ellis
UNIX Base Product Marketing

This spring, 200 UNIX field sales support people and workstation sales specialists attended the five-day UNIX/RISC Symposium training in Nashua, New Hampshire. This training is part of a twice-a-year program made possible by John O'Keefe, Vice President of UNIX Systems Marketing, in order to make important UNIX technical training accessible worldwide.

Highlights of the week included talks by Willy Shih, Don Harbert, Kent Ferson, Dave Leonard, Bill Horzempa, Scott Reoth, Fritz Aumann, John Travalini, Tim Yeaton, and John O'Keefe.

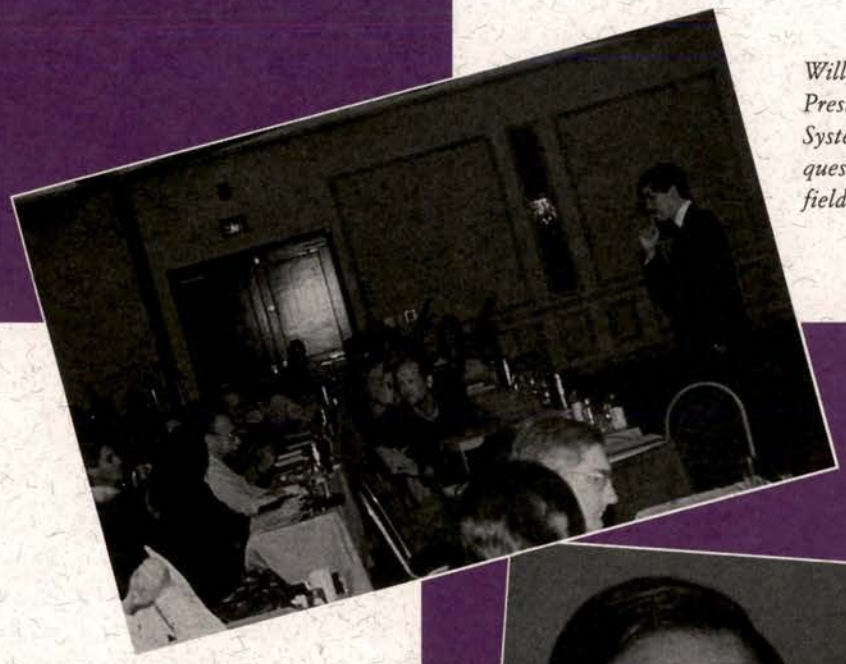
It was a full week of sessions with various engineering, product management, and marketing organizations for UNIX development across the Company. Additionally, about 23 of the field's top ISVs were present to discuss their products and answer questions from the field. There was an excellent "open house" hosted by John Ellenberger and Connie Sartinti of SDT along with engineers, managers, and project leaders demonstrating and talking about their advanced development work. Demos included a new graphical beginning-to-end user interface called "First Impressions" demonstrated by Paul Henderson from UNIX engineering.

Since the UNIX partners were not scheduled to have a spring worldwide meeting, they used the symposium forum to announce and present their UNIX Partners Program Appreciation Award to the engineering and product management teams at DECwest for their extraordinary effort in product excellence and UNIX sales support. The presentation was made by Sara de los Reyes, UNIX Partner from New York. Mark Silverberg accepted on behalf of DECwest. The plaque is displayed in the lobby at the DECwest facility.

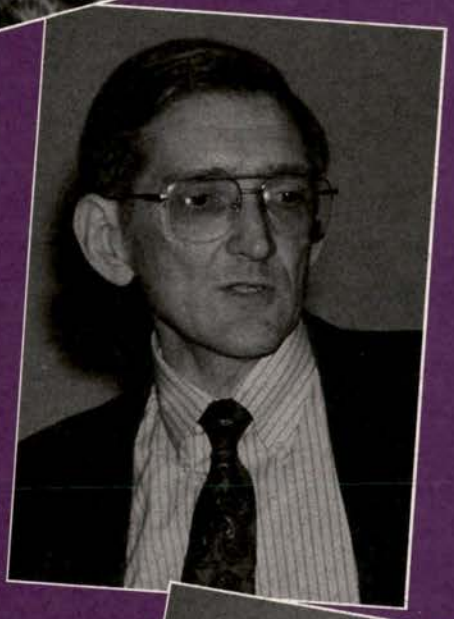
Momentum in the field is very upbeat! Since the symposium, which followed the incredible success at UNIFORUM, everyone has been on a roll. For many in UNIX sales support, this was the first opportunity to meet and speak with Willy Shih and Don Harbert. Excellent discussions with senior field managers Scott Roeth and Bill Horzempa continued well into the evening.

The diligently prepared presentations and presence of executives were greatly appreciated by the UNIX field consultants.

Sara de los Reyes, UNIX Partner from New York, presents the Partners Program Appreciation Award to DECwest Engineering & Product Management. Accepting the award is Mark Silverberg.



Willy Shih, Vice President, UNIX/NT Systems, answering questions from the field



Don Harbert, Vice President, Operating Systems Group, presents engineering strategy for UNIX, Windows NT, and OpenVMS

Willie Shih speaks to UNIX Field Consultants

Using Ferrite Beads on Typical Printed Circuit Boards

by Bruce Archambeault, Rich Mellit, Ravindra Kolte

Ferrite beads are very often part of the final design to help meet various regulatory agency EMI requirements. Ferrite beads come in a variety of configurations for mounting on Printed Wiring Boards (PWBs) and may be either surface-mounted or through-hole leaded. Unfortunately, the amount of information concerning the impedance of the ferrite bead available to designers has been limited, often requiring a hit-or-miss design approach.

Ferrite bead vendor information is of notoriously limited value because vendor test fixtures often limit the useful test frequency range, and vendors may specify the ferrite's impedance without including the effect of the PWB inductance and capacitance. With the common use of high-frequency clocks with fast rise times on many current designs, high-frequency characteristics are more important than ever. It is important that the designer understand the true impedance of the ferrite bead as it is installed on the PWB.

Under way is an effort at Digital to allow the complex impedance of these ferrite beads to be modeled as an equivalent RLC circuit, thus allowing accurate SPICE modeling during the design phase of the PWB. Since vendor impedance information has been severely limited, a series of carefully controlled measurements were made to determine accurately the complex impedance of a variety of ferrite beads currently in use in Digital up to 3 GHz. The results from this series of measurements is now available to Digital engineers.

Impedance Linearity

Ferrite beads are used for a variety of PWB traces. They can be used on power supply lines or signal lines. Due to saturation of the ferrite material, the impedance will change as the current through it increases. This can have a significant effect on the effectiveness of the ferrite in certain applications.

As Figure 1 shows, the impedance of the sample ferrite bead did not change significantly when the DC bias current was lower than 20 milliamps. However, as the current was increased to 600 milliamps, the impedance decreased by about 25 percent. This change in the impedance could be significant and allow more EMI noise to escape the equipment than allowable. Figure 2 shows the effect of the signal size upon the impedance. As can be seen, the impedance did not change as the signal level was varied from -27 dBm to +13 dBm.

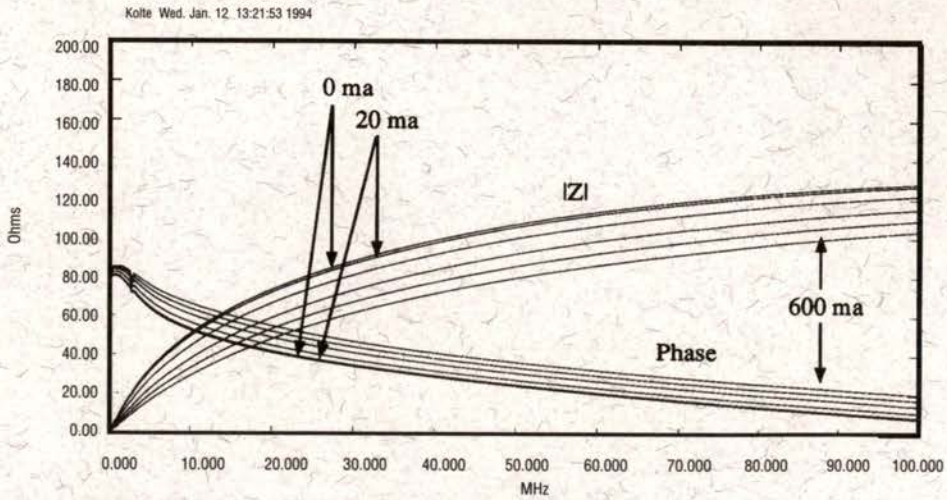


Figure 1. Ferrite Impedance with DC Current Bias

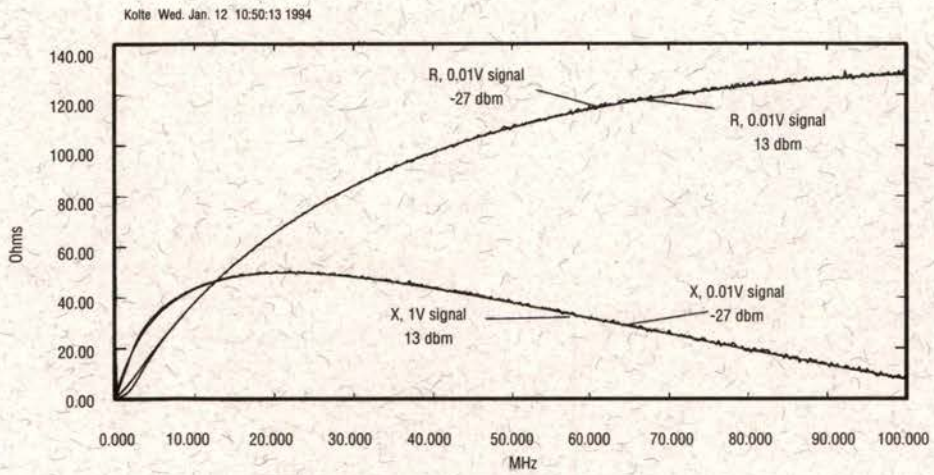


Figure 2. Ferrite Impedance for Different Signal Strengths

Effect of PWB Mounting on Impedance

At low frequencies (below about 100 MHz), the effect of the PWB mounting had very little effect on the effective ferrite impedance. However, at higher frequencies, the effect of the PWB mounting had a significant effect on the impedance. This is illustrated in Figures 3A and 3B, showing the impedance for a sample part for the mounted and the unmounted case, respectively. The impedance supplied by vendors is for the unmounted case. Since ferrite beads are often used to suppress the high-frequency harmonics present on a PWB, care should be taken when designing with them to use the correct impedance at the frequencies of interest. It was observed that this effect was most severe for ferrite parts that were physically small.

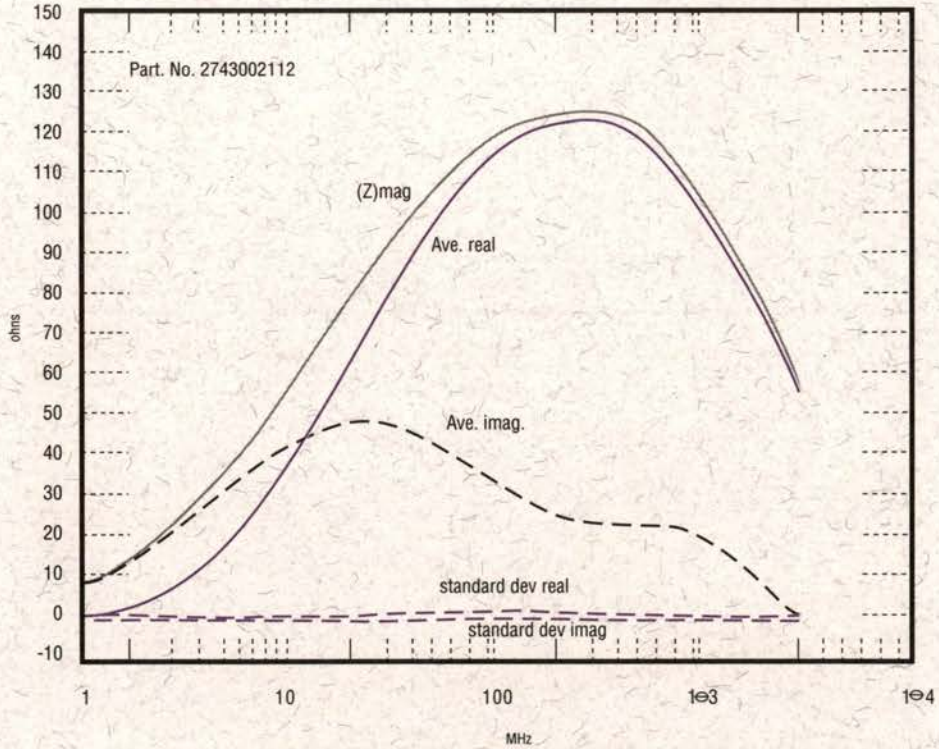


Figure 3a. Impedance for Mounted Sample Part

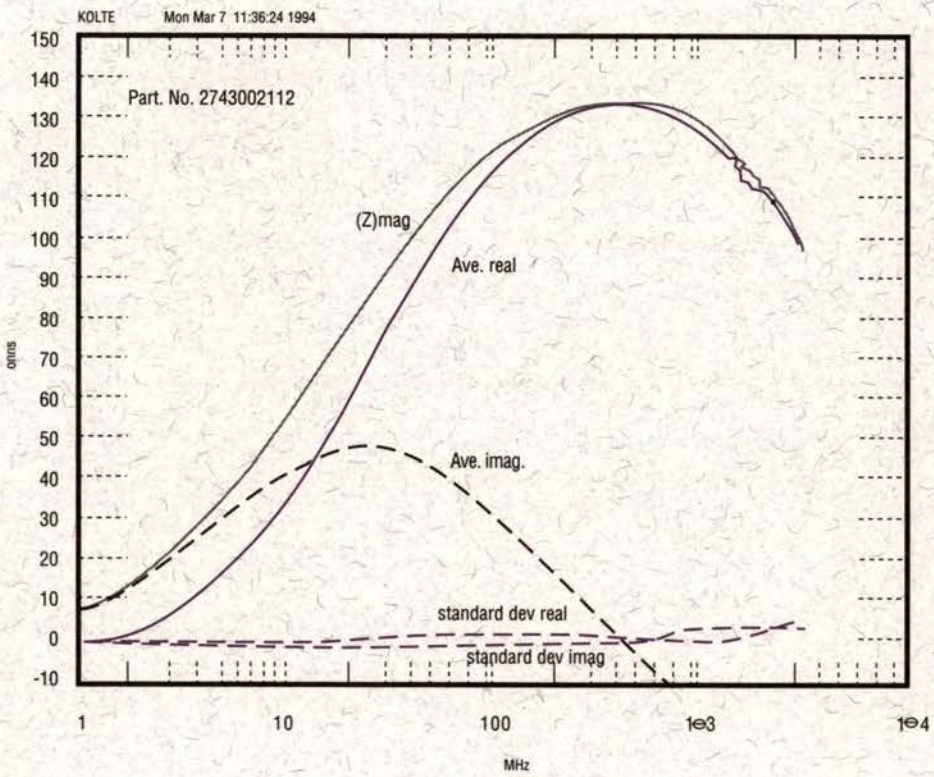


Figure 3b. Impedance for Unmounted Sample Part

Manufacturing Tolerance

A number of identical parts were tested during this process to allow some determination about the manufacturing tolerance of the impedance of the ferrite beads. Most parts had a very small standard deviation, allowing a "generic" impedance curve to identify all parts. However, some parts had a significant standard deviation, showing a variation of as much as 20 percent. Again, the parts with this effect tended to be the physically small parts. Figures 4a and 4b show examples of parts with a small standard deviation and a large standard deviation.

Summary

Now available to Digital engineers is a report that documents the true impedance from a variety of ferrite beads while installed on a PWB over a frequency range from 1 MHz to 3 GHz. Thus the effect of the PWB capacitance and inductance is included in the measurement, and the design engineer can predict the ferrite bead's true performance, and choose the appropriate part. A total of 45 different and commonly used ferrite beads have been measured using a carefully controlled and specially designed test fixture PWB. A number of identical parts were measured to show the tolerance, and the standard deviation is given so the design engineer can understand the possible variation between identical parts.

This information provides the design engineer with accurate impedance data to allow the engineer to predict the performance of the ferrite bead without the need for try-it-and-see approaches that were required in the past due to incomplete and/or incorrect vendor data.

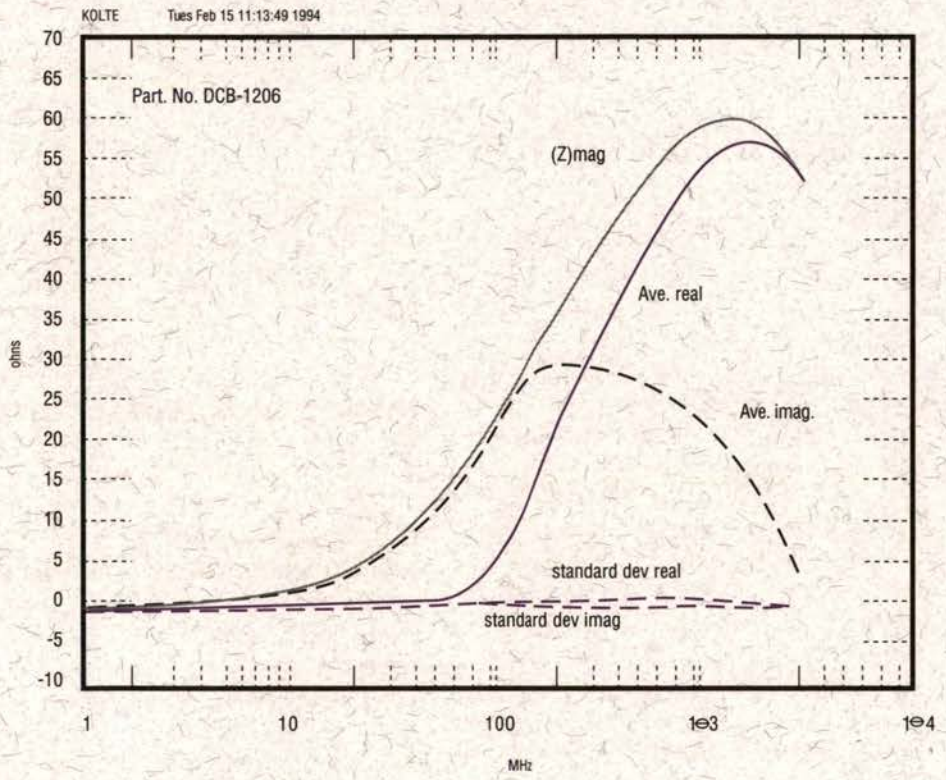


Figure 4a: Part with Small Standard Deviation.

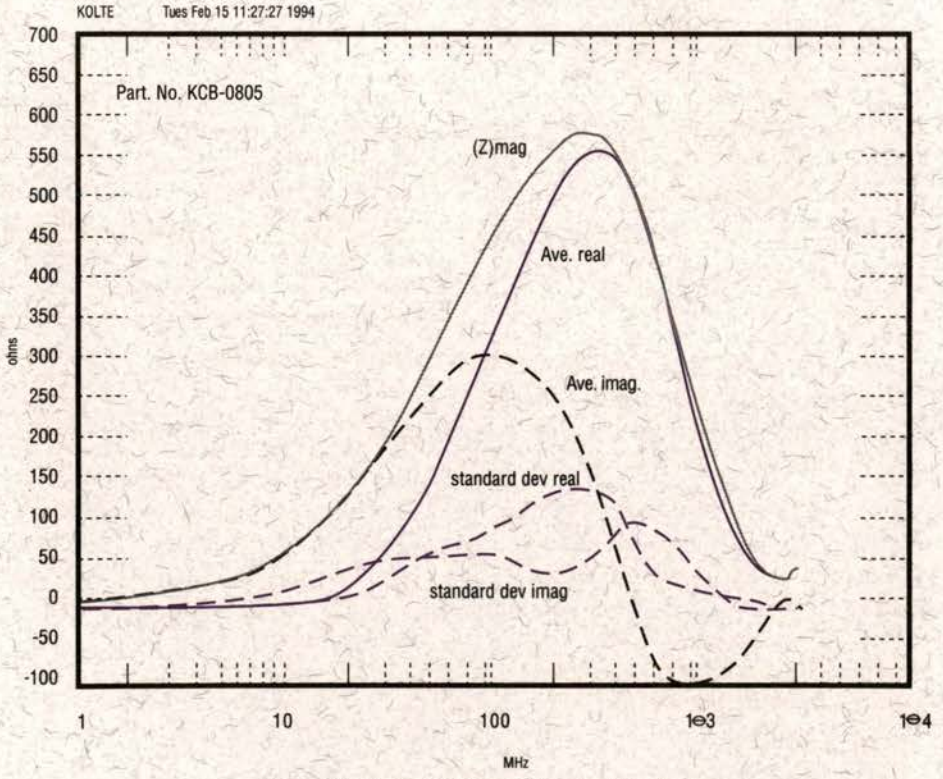


Figure 4b: Part with Large Standard Deviation.

Digital's Technical Communicators Shine at Competition

by Ellen Lehrer

Every September, technical communicators and educators from all over New England scurry to submit their entries to the annual Publications, Art, and Electronic Documentation Competition sponsored by the Boston and Northern New England Chapters of the Society for Technical Communication which is an international group of technical communicators and educators with a membership of 15,000 and over 100 chapters worldwide.

In this year's competition, companies submitted 326 entries in the publications competition, 46 in the art competition, and 40 in the electronic documentation competition. Volunteer judges, all technical communicators or educators, evaluated the entries on effectiveness and appropriateness and on the writing, editing, and graphics. The entries were also evaluated on overall appeal, interest, and usefulness to the intended reader.

Publication entries are divided into 25 categories (for example, reference and user manuals, quick reference manuals, brochures, scholarly or professional articles). Art entries are divided into eight categories, and electronic documentation entries are divided into seven categories.

The four classes of awards are distinction, excellence, merit, and accomplishment. Those entries that win distinction and excellence awards are entered into the STC International Competition. Entries from the Boston and Northern New England chapters, including Digital entries, traditionally do very well on the international level.

Digital's IDC documentation professionals competed with entries from other companies such as NEC, Progress Software, Lotus, PictureTel, and Millipore. Digital has done well in past competitions, and continued its winning ways this year. Of the 116 awards won in the publications competition, Digital won 23 awards, or 19 percent of the total. In the electronic documentation competition, Digital won five of the 22 awards, and one award in the art competition.

Team Effort Pays Off

Writing good, usable documentation often takes a large team of writers, editors, graphic artists, and production specialists. Carolyn Crowell, one of the writers of the *OpenVMS System Manager's Manual: Essentials,* which won an Award of Achievement, was one of a team of 11 contributors. Writing this book took a tremendous coordination effort as many of the contributors are from other countries, never mind from other facilities. To ensure consistency of style, terminology, and format of the book, it was necessary to develop a template of the task-oriented chapters. Carolyn and Elizabeth Adams also coordinate the submission and review dates, the Master Index entries, and the submission dates of the book for production.

Bring the Documentation Team in Early

The most successful documentation is written when the writing team is brought in before the product is designed. Such was the case for the *DEC 3000 Model 500/500S AXP Owner's Guide* which won the highest award, an Award of Distinction, in the publications competition. Keith Carter, the documentation project leader, worked with the product's design team from the very beginning. Two years before the book was completed, he took part in a four-day design review combined with a Six Sigma quality course. "Documentation concerns and input were included in the product's design, said Keith," and I was able to learn about the design from a manufacturing and engineering point of view."

The innovation that really caught the judges' attention, though, was the "ease-of-use" task icons. These icons were modeled on the symbols used at ski areas — circle, square, triangle — to symbolize beginner, intermediate, and advanced tasks. They allow users to choose the tasks they want to perform based on their knowledge and definitions of the tasks. Human factors testing performed in the early stages of documentation development convinced the documentation team that the icons worked very well.

Managing Context-Sensitive Help

An Award of Merit went to the HUBwatch documentation team, producers of *HUBwatch 2.0.* The HUBwatch product is one of the first GUI-based network management applications. As such, the user information needs to include a large amount of context-sensitive help. Managing a large amount of online information was new to both the writing and engineering teams, so the writing team created processes for version control, testing, and QAR resolution. In subsequent releases, this versatile team even took over the responsibility of incorporating the help calls into the user interface code.

Meeting Customers' Requests

The VAXELN Guide to Writing Device Drivers won an Award of Excellence in the publications competition. Donna Stolberg, lead writer on this project explains, "This document was produced in response to customer requests. In an effort to ensure that the document would meet customer expectations, we conducted an informal usability test once we had a complete draft." The usability test uncovered some omissions and shortcomings, most of which the documentation team was able to correct for the production version. The result was a task-oriented guide which walks programmers through the entire process of developing VAXELN device drivers and includes 66 annotated programming examples. Sue Gault, the Group Manager of IDC, said, "I am very proud of the IDC members who submitted entries to this prestigious competition. The entries are representative of the fine work of all IDC members. Considering the competition and the number of awards won, all Digital employees should be proud of their coworkers in IDC. Congratulations to all!"

The following is a list of the Digital IDC members who won awards in the 1993-1994 NNE-Boston Publications, Art, and Electronic Documentation competition:

Award	Entry Title	Entrant's Name
ELECTRONIC DOCUMENTATION		
Distinction	*Networks from Digital*	"The Electric Company"
Merit	*HUBwatch 2.0*	Lee Butler, Donna Micozzi
Achievement	*DECNIS Problem Solving Guide*	Celia Marsh, Heather Waters
Achievement	*Components & Peripherals Sales Information Kit*	"The Electric Company"
Achievement	*DEC 4000 AXP System Installation and Troubleshooting*	Ernie Hohengasser, *Writer* Rich Trubey, *Writer*
PUBLICATIONS		
Distinguished	*DEC 3000 Model 500/500S AXP Owner's Guide*	Keith Carter, *Writer* Jackie Unch, *Editor* Andrea Thurber, *Illustrator*
Excellent	*HSZ10-AA Controller Site Preparation Guide*	Carolyn Reynolds
Excellent	*ALPHA AXP Systems Handbook*	Charles Greenman, *Writer* Kathe Rhoades, *Editor* Lynne Kenison, *Illustrator*
Excellent	*VAXELN Guide to Writing Device Drivers*	Donna Stolberg, *Writer* Bill Joyner, *Writer* Carmen Wheatcroft, *Editor*
Merit	*DECnet/OSI Problem Solving*	Joan Goldstein, *Writer*

Award	Entry Title	Entrant's Name
Merit	*StorageWorks RAID Array 110 Subsystem Service Guide*	Carolyn Reynolds, *Writer*
Merit	*DEC 4000 AXP Model 600 Option's Guide*	Robert Young, *Writer* Gerri Ledoux, *Illustrator* Kathe Rhoades, *Editor*
Achievement	*DECnet/OSI Intro, Planning, & Glossary*	Judi Grossman, Janet Gubbay
Achievement	*DEC RAID Subsystem User's Guide*	Carolyn Reynolds
Achievement	*StorageWorks RAID Array 110 Subsystem Pocket Service Guide*	Carolyn Reynolds
Achievement	*DEC 4000 AXP Model 600 Owner's Guide*	Susan Marsh, *Writer* Kathe Rhoades, *Editor* Diana Ledoux, *Illustrator*
Achievement	*OpenVMS System Manager's Manual: Essentials*	Carolyn Crowell Elizabeth Adams
ART		
Merit	*The Knowledge Advantage* *Trademarks: Information Mapping* *Six Sigma* *OpenVMS*	Phil Dussault

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21st Century Computing Today
Q2-Q3 FY95

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DEC 7000 Model 700 Team

DEC 3000 Workstations Team

Feature Articles:

Metrication at Digital

FOREFRONT
Winner of the 1995
Society for Technical
Publications Award

A Product Management and Development Quarterly Publication

FOREFRONT strives to support a forum for the entire Product Management and Development WW community to share information, directions, and key accomplishments in all its functional dimensions, that is, customers, markets, engineering, and manufacturing. Its goal is to highlight technical efforts and successes that lead to new products and markets for Digital.

This is your information forum. Your participation is vital to its continuation and success. You are encouraged to contribute articles that are of interest to the PM&D community. The deadline for submitting articles for the next edition is February 17, 1995.

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We are pleased to announce that FOREFRONT recently received an award from the Society for Technical Communication for outstanding achievement. Each year the STC sponsors a publication competition, which honors writers, editors, and artists for outstanding work in their fields. In this year's competition, FOREFRONT competed with 270 entries from other computer companies including Sun, and HP, as well as other industries.

I want to thank all of you who have supported FOREFRONT. Your participation has been vital to its continuation and success. You certainly share in this honor. It's been my pleasure to report the accomplishments and successes of the engineering community. The award will be presented to Digital at the Society for Technical Communication awards banquet in March.

Dick Willett
Editor

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Metrication in Digital

By Eric Williams, Manager, Digital Standards, Michael Neuffer, Manager, Corporate Product Safety, and Eric Falkof, Digital Standards Technical Specialist

History Of The Metric Movement

The metric movement began with the French Revolution in 1789, which provided the opportunity to pursue the then frequently discussed concept of replacing the many confusing, traditional measurement systems. The idea most often discussed was to use a system that was based on multiples of ten. In 1791, the French National Assembly directed the French Academy of Sciences to address this situation. It took six years to determine the standard: 1/10,000,000 of a quadrant of a great circle of the Earth. The value was known as a meter, from the Greek word for measure. In the United States today, we know this as 39.37008 inches.

The Treaty of the Meter, Paris, 1875, established an International Bureau of Weights and Measures and created a permanent laboratory where international standards are kept, copies inspected, and research in metrology conducted. The General Conference of Weights and Measures, composed of representatives from more than 40 countries, meets every six years to review findings and to consider developments and changes in usage and technology.

Sputnik alerted the world that there was a new demand for accuracy in measurements. The International System (SI) evolved to address Twentieth Century technology. In the Eleventh General Conference of Weights and Measures, 1960, the International System of Units approved the use of meters, kilograms and seconds, as fundamental units for length, mass and time. The United States became interested in adopting the measurement system used in most of the rest of the world, so in 1968, the U.S. Congress passed Public Law 90-472 that authorized an intensive study of the adoption of the metric system. The study showed the United States was already metric in some ways (Do you use 1.38 inch film in your camera?), and that the nation would eventually join the rest of the world. Congress passed legislation that provided for the voluntary transition in all sectors of the economy. The Metric Conversion Act, Public Law 94-168, 1975, contained no mandatory requirements, and declared the policy of coordinating the voluntary transition to the metric system.

The value was known as a meter, from the Greek word for measure.

Although the use of customary units of measure continues to this day, the International System of Units is established and growing in different sectors of the U.S. economy. Multinational businesses such as farm machinery and automobiles have had to adapt to market demands in other countries. Remember how we used to say the world would never get Detroit to *give an inch*, that its market muscle was too strong? Supply sources have demanded change on the receivers, and we are now among the receivers.

By 1980, none of the 50 states had enacted legislation requiring the mandatory use of the International Units. However, economic factors and forces will determine when – not whether – these changes will occur. The Omnibus Trade and Competitiveness Act of 1988, Public Law 100-418, requires that the Federal government purchase metric products, or if not metric, that the supplier have a plan in place for conversion to metric dimensions by 1999.

Today, the United States is the only industrialized nation in the world using measurement standards that are based on the old English system. We join Burma and Brunei as the only countries using this antiquated system that will soon be obsolete. By the way, did you know the British converted to the metric system for its trade and commerce in 1965 to join the European Common Market? So, we should not call inches, miles, pounds, and gallons the English or British system any more.

Digital's Metric Program

Digital has had a Metrication Program since 1991 that is working toward conversion to the metric system.

The reason for Digital's metric policy is simple: it makes sense. From a technical standpoint, we join all disciplines in a single, standard measurement system. We do not have to perform mental gymnastics to convert *their* units to *our* units, nor do we have to make mental images of *their* sizes to *our* sizes. Worldwide, we visualize things the same. We do not face the prospect of specifying something on one set of units only to be told that there is no exact conversion, so, therefore, are we willing to adjust our tolerances or specifications?

This extends further to manufacturing when we request a bid for a product. If we are adamant about the measurements or tolerances, we may actually be asking for a special order to accommodate our requirements. Special orders are upsetting and do cost more. This makes our processes cost more and our products cost more.

As explained earlier, the government of the United States does not require companies from which it buys products to use the SI system now, but it is clear that the SI system is the preferred system, and that it will be required in the future. It makes good business sense that if we want to sell to the U.S. government – not to mention the worldwide marketplace – that we use the SI system.

What do we have to do? We must use new approaches for hardware design, manufacturing, documentation, marketing, and other sectors of the company. We must develop a central focus on design activity, and as a result, increase worldwide sales. It is not cost effective to convert projects in midstream, but new projects should be begun with the SI system in mind.

Who else has made the change? Our competitors and other major players in their respective industries: IBM Corporation, the whole auto industry, John Deere, Otis Elevator, Xerox, Caterpillar, and more.

Digital's Metric Activity

Digital supports the U.S. Federal initiative that is defined in Public Law 94-168, the Metric Conversion Act. Indeed, to sell to the Federal government, products must be in metric units, and if not, the supplying and manufacturing company must have a policy that defines its program to convert to SI units by 1999. Digital tracks international trends relating to SI metric standards by its participation in the Computer and Business Electronics Manufacturers' Association (CBEMA).

The Metric Conversion Act is similar to the Sword of Damocles. It is hanging over our heads, held aloft by only a thin thread, and it is waiting for the right moment to fall. The Metric Conversion Act's implementation date is that moment. We must begin now to implement the provisions of the Act or we could lose business.

Digital Standard 015-0 Abbreviations and Units of Measurement describes the use of SI (metric) units of measurement and unit symbols by all Digital personnel who produce or procure documentation, including drawings, manuals, and advertising. It also includes rules for usage and conversion factors for U.S. customary units.

What Are These Units, Anyway?

Do you remember changing miles (5280 feet) to yards (1760) by dividing by three? And maybe measuring the number of square yards of carpet you needed for your living room by dividing the number of square feet by nine? And what about converting the number of inches into feet by dividing by twelve? And what happens to all the decimal points on your calculator if the division has a remainder? Are those fractions of a yard, foot, or inch?

SI units, or units defined by Le Système International des Unités (the International System of Units), are frequently referred to as the metric system. Although the names sound medical or high-tech, like centimeter, kilogram, and liter, almost all units are simple to compare to the ones we are familiar with, and can be readily compared to common objects that we use daily. For example, the centimeter is about the width of a little fingernail. A meter is a little more than a yard. If you look at a box of cereal or pasta on a market shelf, you see the weight in SI units (453 grams is one pound). A bottle of soda is available in one or two-liter sizes. The speedometer on your car has a scale for kilometers per hour. SI units are coming closer daily. The first metric football game has already been played, back in 1977, between Carleton and St. Olaf Colleges in Minnesota.

All SI units are based on multiples of the number ten. To measure distance, a meter is divided into decimeters (one tenth of a meter), centimeters (one hundredth of a meter), and millimeters (one thousandth of a meter). On a larger scale, we jump from a meter to a kilometer (a thousand meters). With weights,

we use the kilogram (one thousand grams) as the standard, and we then use mere grams as the smaller unit. With liquids, we use the liter and thousandths of a liter, the milliliter.

The conversion from U.S. customary to SI is just a matter of acclimation. Of course, we can use mathematic conversions, but it is simpler to move directly to the new units and conform to the system used in almost every other country on the planet.

Why Change?

This is a good question. Aside from conforming to the norm, it makes sense from a personal perspective. Our whole number system is based on the number ten, so it is easy to multiply or divide by tens. Similarly, it is easy to add or subtract tens, too. Remember the example of changing feet to inches by multiplying by twelve? In SI units, we change meters to centimeters by multiplying by a hundred – just move a decimal point. Also, think how much more time will be freed in elementary schools when teachers only have to teach about multiplying and dividing by ten, and they will not have to teach the several different conversion schemes for changing miles to feet to inches. Truthfully, some kids never get it, and these kids become adults who resist changing to a simpler scheme. Since elementary schools are part of the foundation of our future, it is in our best interests to use a simple system, one that is used throughout the world. Children are our future business and government leaders in the worldwide economy, and if the SI metric system is used virtually everywhere else, it is our obligation to equip our children with the appropriate tools to fit in as well as compete.

The Road To Conversion

In the U.S., our daily lives are already moving toward the use of the SI metric system. The speedometers in our cars have metric scales that show our speed in kilometers per hour, our soda comes in liter bottles, and our cereal and pasta come in boxes of 453 grams. At Digital, we have begun using the term U.S. Customary Units to refer to the old measuring system. We cannot refer to inches, ounces, and pounds as English units, because the English went metric in 1965 to join the European Common Market. Today, if Digital wants to sell into the European Community, we must be prepared to join them in "measuring up" to the same terms.

There are places where we will continue using the U.S. Customary Units for a period of time, but even these places will change. Typically, our manufacturing businesses will continue to use the U.S. customary units, simply because of the massive investment already made in tooling and equipment. But if the U.S. auto industry could make the switch, Digital can also.

The following is a transitional step that does not dictate what will be done and when, but it demonstrates that the conversion is not as traumatic as we might think.

Exact Mathematical Conversion, Adaptive Conversion, Or Size Substitution

Is a two-by-four piece of lumber really two inches by four inches? Not really. It is 1⅝ by 3½ inches (after milling). Should we say the board is 5 by 10 centimeters, or be more precise with 4.13 by 8.9 centimeters? In either case, we must recognize that absolute precision is sometimes not desirable. We know that some measurements are just as meaningful when used in the general, descriptive way instead of the precise units.

In manufacturing and engineering technology, this may also be true as we move from the American system to SI. For example, we may use ⅜-inch holes, but there may be no absolute comparable SI standard industry practice equivalent tool. What we know and use for ⅜-inch may be 15.8 millimeters with a tolerance of +0.2/-0.3 millimeters. For some dimensions, the conversion may be simple, direct, and comparable. For others, the American unit may be the square peg for the round holes of the world's manufacturing systems.

The U.S. is the only industrialized nation in the world using measurement standards based on the old English system.

So we are faced with the concept of exact mathematical conversion or convenient adaptive conversion. At Digital, we have to be sensitive to where the measurement applies. For example, in a general specification such as for table height, the American 30 inches can be considered as 76.2 centimeters or 75 centimeters. What is the difference? Remember your high school math and physics classes, when you discussed significant digits and precision measurements? Here it is again. The exact mathematic measurement is reproducible to a high degree of precision. Or, a rounded measurement may be acceptable where mixed measurement systems are in use, such as the U.S. Here, 75 centimeters is the same number rounded to the nearest 5 centimeters. Close enough for government work, you might say. It is reasonably equivalent. But when government work is specified, 76, 76.2, or even 76.20 centimeters might be required.

At Digital, we should be aware of the use of hard metrics when we begin a new design. This requires initial specifications in SI units and full conformity to these standards. We should use size substitution of accepted metric standard sizes for the particular purpose whenever possible. However, some of our products have already begun their development or production.

In these cases, soft metrics would require converting measurements to their metric equivalents through exact mathematical conversion. Hard and soft metrics represent a transitional step toward full compliance with the SI standards.

Depending on the application, the industry, and the stage of development for a product, we may use the appropriate approach for the situation: exact mathematical, adaptive conversion, or size substitution.

Digital's Metric Policy

Digital actively supports a planned transition to the SI (metric) system in the design, manufacture, and support of its products.

Digital will:

- Think, design, manufacture, sell, and service products using the SI (metric) system of measurement.
- Work within international industry norms.

We will use the measurement system that is driven by the international marketplace, whether it is U.S. customary or metric. Failure to do this will put us in a non-competitive position.

- Manage the cost impact.

Component availability and cost-competitive pricing is essential to Digital's business. We will encourage our supply base to provide products that meet the requirements of the metric system. We will promote hard metrics, but will use soft conversion (designing in the U.S. customary system and converting to the metric system) where economically practical.

- Work with government agencies, as well as industry policy and standards groups, with regard to metric usage.

We will work closely with these groups to understand measurement requirements from a user's perspective.

- Use a process that evolves into the metric system.

New designs will be metric wherever possible (some soft conversion may be required when the availability of parts is a problem). Existing products and tooling will go through their end-of-life without change. Training, internal documentation and standards, design and manufacturing tools, and our support structure will be based on the metric system.

- Continue to use nonmetric components where there are no cost-effective metric equivalents available and where required for compatibility with existing industry standards.

SI METRIC UNITS (quoted from Digital Standard 015-0)

SI Base Units

Quantity	Unit Name	Unit Symbol
Length	metre or meter	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd

U.S. CUSTOMARY UNITS OF MEASUREMENT (from Digital Standard 015-0)

Quantity	Name of Unit	Symbol	Approximate Value
Length	inch	in	1 in = 25.4 mm
	foot	ft	1 ft = 0.3048 m
	mile	mi	1 mi = 1609.344 m
Area	circular mil	cmil	1 cmil = 5.0671×10^{-4} mm^2 (square millimeters)
Volume	fluid ounce (U.S.)	fl oz	1 fl oz = 29.57×10^{-6} m^3 (cubic meters)
	pint (U.S. liquid)	pt	1 pt = 0.4732×10^{-3} m^3 (cubic meters)
	quart (U.S. liquid)	qt	1 qt = 0.9464×10^{-3} m^3 (cubic meters)
	gallon (U.S. liquid)	gal	1 gal = 3.785×10^{-3} m^3 (cubic meters)
Mass	ounce (avoirdupois)	oz	1 oz = 28.35×10^{-3} kg
	pound	lb	1 lb = 0.4536 kg
Energy	therm	therm	1 therm = 105.5×10^6 J
Temperature	degree Fahrenheit	°F	t°F = (1.8 x t°C) + 32 (Refer to Note 1)
X-Radiation Exposure	roentgen	R	1 R = 2.58×10^{-4} C/kg

Note 1
t°F = temperature in degrees Fahrenheit
t°C = temperature in degrees Celsius

Metrics Usage In Component Engineering

By George Katronge, Senior Engineering Manager, and Russ Raby, Component Engineer

Metrication in the world of Component Engineering hasn't meant a major change in our approach to work, but has meant a new way of thinking, documentation and hardware design. Going to metric isn't something we could just "go and do." People, commodities, and the rest of the company have been making changes, in their own way, at their own pace since Digital instituted its Metrication Program back in 1993. Some of the databases we use such as CIMS, fasteners and hardware selection systems have been set up to use "worldwide" standards.

The strategy has always been to "phase-in" the metric system and "phase out" the English system. We're working in a dual system currently with both "hard" and "soft" metric. The amount of metrication must always be consistent with component availability of our customer base and on industry status.

No production machinery needed to be scrapped. Most equipment could readily be adapted to produce product with metric parts. Part accuracy and quality are more a function of the tools and people than the measuring system used. There were some problems and things we needed to address; some we are still seeing. Here are some examples of the typical problems we have seen in Component Engineering.

When part dimension tolerances are converted to metric from English or vice versa, the rounding process changes the value of the nominal base dimension. Many Standards and component Purchase Specifications are affected by this soft metric conversion and must be addressed as they arise.

For the most part, very few suppliers design parts in metric exclusively. There are exceptions in Japan and Europe; the U.S. suppliers are a mixture of both measuring systems. Part choice is normally based on the function the part performs, cost and then the space the part would consume on a board, or in an enclosure.

Most suppliers' catalogues show their tables and other part measurements in both metric and English, and put one or the other in brackets on the same page or part drawing. When this is not the case it's hard for some of us to "think" in metric. The toughest thing is the tolerances and whether or not they look reasonable. Many engineers have most of their experience in English units here in the U.S. and have a natural tendency to think in inches and pounds. For example, how long might it take for a person to lose .45 kilograms of weight, or walk 10,000 meters?

There may be differences in pad pitch between say a 0.5 mm metric pitch footprint and a 0.0197 inch pitch footprint, its English equivalent. This isn't an issue with rounding and conversion, but a problem placing pads on grid in the design tool to the closest thousandth of an inch. Surface mount pads of 12 mils were alternated with spaces of 7 and 8 mils to soften the affect of the pitch mismatch on the footprint.

Drill sizes in metric and English are generally "close enough" to convert from one to the other without much consequence. Whenever the hole dimensions are critical, and tighter accuracy is required, the suppliers of these commodities (often printed wiring boards), buy the English or metric drill sizes needed. They can then do the job and provide the correct hole size and tolerance in this way.

In the world of fasteners, when parts are joined with a nut and a bolt, a metric equivalent can always be found. There is no need to change the hole size, or plan differently based on the measuring system, or worry about substitutions. This may not be the case for screws that "self" tap. If the threads are molded, or pretapped, you probably have a problem changing to metric parts.

Many of the external problems of metric conversion within the components' space have been taken care of by joint efforts with outside companies and trade associations. The internal problems are normally communication issues, or just temporary confusion. In actuality the total problems appear to be quite minimal.

Metrics Usage In The ECAD World

By Bob Puzzo, Support Manager

The predominant printed circuit design systems currently in use within the company, namely VLS and Allegro, have the capability of performing in either metric or imperial measure. A printed circuit layout designer must select one unit of measure, be it metric or imperial measure, and use that one unit of measure for the entire design, i.e., the entire design must be in one, and only one, unit of measure. Parts used in the design that are not of that unit of measure will be automatically converted to the selected design unit of measure for use on that particular design. Output data, data which is used by subsequent organizations, is output in the same measurement units as was used to design the module. A module design can be brought from one unit of measure to another, but each iteration will cause a loss of precision as the units do not translate exactly from one to the other. This can be a problem if not watched carefully. Dual dimensioning of technical drawings can be done with minimal human intervention, and with some design systems it can be done automatically. Design data such as printed circuit hole sizes with their attendant finished hole size tolerances must be carefully monitored. These hole sizes and tolerances are not linear translations, but rather are a translation of the range of the diameter and the tolerance.

One area of concern has to be the physical definition of a part or component to be used in a design, as mentioned above. Care must be taken to define the component in the same unit of measure that the supplier used to define the part, i.e., a metric connector must be defined in metric terms, an imperial measure connector must be defined in imperial terms, else there is an immediate translation from one unit to another. A true "metric" design will not be done until all components used in the design are available as metric parts. Today, the only possibility of a true metric design might be a backplane using metric connectors and metric mechanical dimensions. Currently, the bulk of components used on most designs are defined as imperial measure devices. Component location dimensions, module mechanical outline dimensions and the like are often supplied in metric form. This combination of imperial measure components and metric mechanical definitions make for a hybrid module at the very outset of design. If the design were to be brought from one unit to another it would be yet another conversion with its associated loss of precision. Multiple translations could lead to an unacceptable level of loss of precision.

Some users of data derived from a design, i.e., board shop vendors, module assembly houses, etc., may convert design data to a neutral measurement unit, that of their selected process equipment. This additional data iteration makes it important that we carefully monitor the handling of design data and its translation from one unit of measure to another to ensure no unnecessary loss of precision in the design.

Bottom line is that physical design can be accomplished in either the metric or imperial measurement discipline, but care and thoughtful consideration of how the data is handled will play a major role in the successful completion of the design effort.

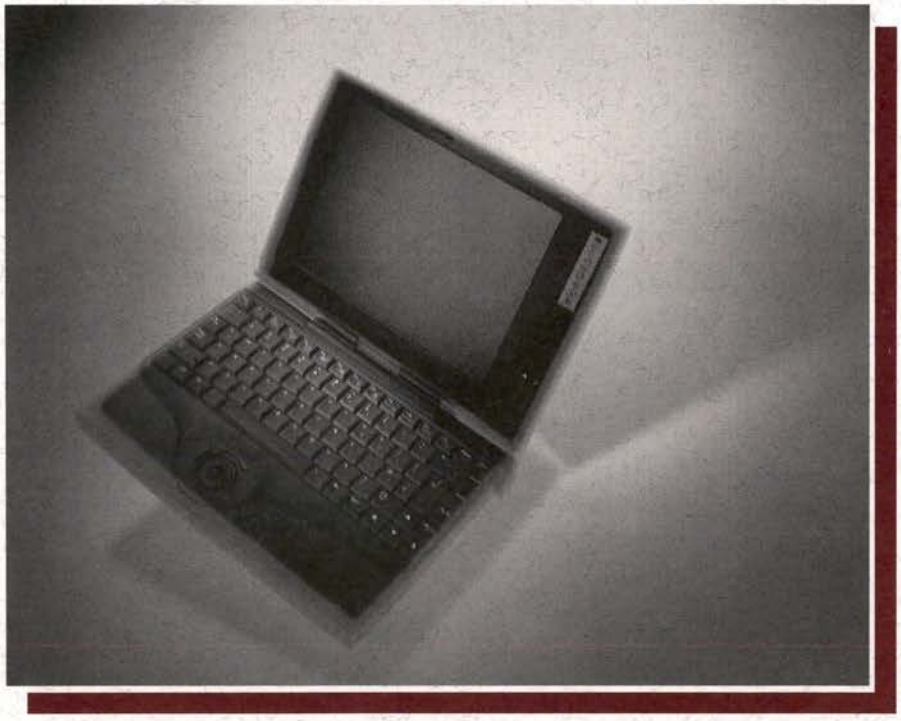
Design Group's Role In Digital's Conversion To Metrics

By Rich Johnson, Design Group Manager

The Design Group is Digital's organization responsible for the appearance of product enclosures and packaging. The Design Group has been involved in metrification for several years. The Design Group uses metrics to facilitate designing and developing products with Digital's Global Partners. Initially, drawings were dimensioned in inches (the English System) as well as metrics. Today, all drawings are dimensioned in metrics to facilitate design for manufacturing goals, unless dimensions in inches are requested. The enclosure, which includes product markings and regulatory labeling, will be produced overseas as well as in the United States. The Design Group also utilizes suppliers which are capable of working in metrics to support this practice.

An example of the use of metrics for a specific purpose by the Design Group has been on the HiNote family of portable personal computer products. The specific use of metrics in this particular case was because of the tight tolerances required in microengineering which can best be achieved in metrics.

In addition to product enclosures, product packaging is dimensioned in metrics and inches and is produced overseas as well as in the United States.



Digital's HiNote Ultra Portable.

Metrics Usage In Mechanical Engineering

By George Hitz, Engineering Manager

Metric requirements in engineering and metric capabilities in the engineering disciplines of the Technical Consulting Services (TCS) organization.

Mechanical Engineering

- Requirements

The requirement for metric (SI) dimensioning comes in the design of racks and subracks – a subrack being the enclosure that mounts within the rack itself. There are a series of international standards covering these applications:

Racks:
EIA 310C (US "RETMA" metric standard)
EIA 310D (US hard metric standard)
IEC 297 (European "RETMA" standard)
IEC 917-2 (European metric standard)

Subracks:
IEC 297 (European "RETMA" standard)
IEC 917-2 (European 25 mm metric standard)

For pedestals, desktop and mobile enclosures, and components used therein, the only "requirement" is to "think and use metric."

ALL designs should be dimensioned metrically, and use and specify metric materials, hardware and components UNLESS these are not cost effective compared to their English equivalent or where metric components are not readily available.

If some subassembly of the pedestal, desktop, or mobile enclosure is to be rack mounted, then the rack metric standards apply and should be considered during design.

- MCAD Capability in TCS

The MCAD programs in use at Digital, namely UniGraphics II, Euclid, Pro/Engineer and AutoCAD all are capable of designing and dimensioning in either metric (SI) or English units. These CAD packages are capable of mixed measurement system entry as well and will convert from one measurement system to another by a single keystroke.

Acoustic Engineering

- Requirements

International Acoustic Standards are all written with metric (SI) units of measurement. This includes items such as sound pressure (in microPascals), product dimensioning and distance to microphones.

- Capability in TCS

The acoustics engineers, the acoustic laboratory and the laboratory equipment are all using the metric (SI) system of measurements to comply with the Standards against which our products are measured. (There are exceptions where the industry has not moved away from English units of measurement such as in the area of air movers which still use cfm and inches of water.)

Thermal Engineering

- Requirements

Thermal Engineering is an adjunct to the development process of a product and as such has no specific standards to adhere to other than Digital internal requirements.

- Capability

The thermal engineers and laboratory equipment are capable of dealing in English or metric (SI) units of measurement to match the client's need.

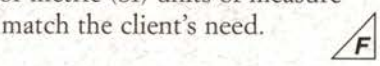
Dynamics (Shock & Vibration) Engineering

- Requirements

As with Thermal Engineering, Dynamics is an adjunct to the development process of a product and has no specific standards to adhere to other than Digital internal requirements.

- Capability

The dynamics engineer and laboratory equipment are capable of dealing with English or metric (SI) units of measurement to match the client's need.



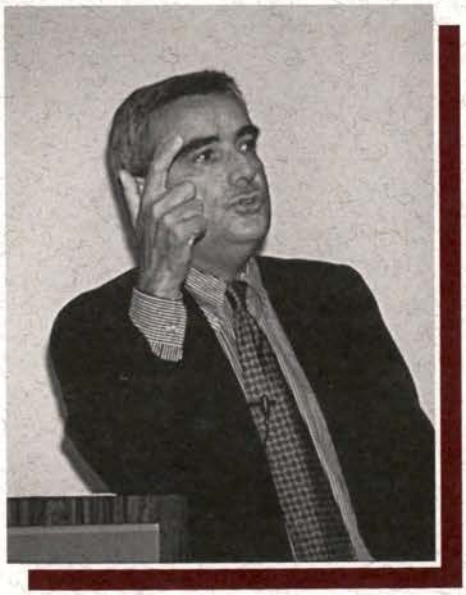
Communications Meeting

By Trish Gagnon

In November, Enrico Pesatori, Vice President and General Manager of the Computer Systems Division; Bill Demmer, Vice President of the Software Business Group; and Don Harbert, Vice President of the UNIX Business Segment and Windows NT Business Segment, met with the ZKO members of their organizations at the Sheraton Tara in Nashua. The purpose of this meeting was to provide a summary of the changes since the beginning of the fiscal year and to highlight what we can expect in the near future. Each Vice President outlined their organization, its mission and what their specific goals are.

Enrico Pesatori's presentation included the following topics:

- Digital's Q1 FY95 Results
- Computer Systems Division Overview
- Systems Business Implementation
- Product Management & Development (PM&D) Organization



Enrico Pesatori

Enrico summarized the Q1 FY95 revenue growth over Q1 FY94. He highlighted the fact that our total operating revenues were up 4%, our product revenues were up 6%, service revenues were up 1% and the PC business was up by 93%. Indirect channels were responsible for 57% of our product revenue – up 16 points from a year ago. We need indirect channels and we must design our products to be channel-ready. We need to change the way we sell to our customers.

Enrico noted the following key points with regard to the Systems Business Unit: Our gross margin increased by 5 points over Q4 FY94; our server volume is up 13%; Sable volume is up 105% and the AXP low-end servers are out of the starting blocks. The Alpha momentum continues to build. Alpha systems revenue grew 138% over last year and provided 19% of Digital's product revenue. He also told the audience that new customers were responsible for 40% of our 2100 server sales. Servers will carry the burden of turning Digital around. More than $1.3 billion in Alpha systems shipped and 6400 applications are shipping now.

There are 5 major divisions that comprise Digital's new structure:

- Advanced Technology Group
- Digital Semiconductor
- Components Division
- Computer Systems Division
- Multivendor Customer Service

There are three business units within the Computer Systems Division:

- Personal Computer Business Unit
- Systems Business Unit
- Accounts Business Unit

The Product Management and Development (PM&D) organization was discussed by each of the Vice Presidents. PM&D is a shift from a functionally driven to a product line driven organization. This model will unify four key functions:

- Product Management
- Product Planning
- Product Development
- Product Marketing

There are five principles in the new PM&D model:

- To foster innovation
- To appoint managers accountable over the product lifecycle
- To provide business managers the resources they need to be successful
- To take the lead role in achieving total P&L commitments
- To return to profitability

It will provide the business managers with the control of the critical resources and the authority to make key decisions. PM&D is a segmented business structure that aligns with how the market buys and will provide an accountability system that measures the success of delivery business results.

Within PM&D, we have established three customer/market facing groups executed against three fundamentally different business missions:

- Alpha Systems Business Group, with a focused pursuit of the platform business, managed by Dick Fishburn (acting).
  - Workstations
  - Servers
  - Low-End Servers
  - UNIX
  - NT
- Software Business Group, with a pursuit of on & off-based software revenues, managed by Bill Demmer.
  - Network O/S

  - Workgroup Software
  - Enterprise Computing
  - Object-oriented Software
- OpenVMS Systems Business Group, which will achieve OpenVMS revenue and profit goals, managed by Jesse Lipcon.
  - Systems Software
  - Layered Software
  - Alpha Channel
  - VAX Hardware

Bill Demmer said that PM&D managers will have authority over:

- Product Positioning
- PM&D Resource Deployment
- Product Requirements
- Marketing Program Content
- Initial Pricing & Pricing Adjustments
- Initial Forecast
- Third-Party Requirements
- Warranty Period

Don Harbert summarized the key challenges that currently exist in the Systems Business Unit. They include: lack of focus, poor linkage to market requirements, key processes are absent or broken, high volumes have not been realized, and accountability and responsibility are disconnected from our resources. How will we act on these challenges? Don said we will totally redesign the SBU's core capabilities and processes. This will not be "just another reorganization." It will be a fundamental change that will unleash the talents residing within our engineering and marketing community.

The purpose of the UNIX Business segment is to:

- Develop and implement UNIX product strategy for Alpha systems
- Drive all Alpha UNIX system volume and market share, and support achievement of overall Alpha business group profitability
- Drive toward sustainable, long-term UNIX business
- Support other divisions and OEM needs for Alpha UNIX technology on a business basis

Our mission is to establish Digital as a leader in the UNIX marketplace by leveraging Alpha technology and leadership UNIX system software to deliver the world's most scaleable, highest performance and available distributed computing systems for both commercial and technical computing.

Bill Demmer said that Digital's software business will differentiate itself by providing world-class networked software which enhances the productivity of users within multivendor heterogeneous environments. Bill added that Digital's Software Vision is to empower our customers to be more productive by providing access to information and the tools with which to utilize that information.

- What You Need
- When You Need It
- Where You Want It
- Easily and Transparently

Our software strategy focus will significantly increase software partnering and alliances for technology, development, applications and distribution. It will provide simplified business practices to support the way customers and software partners want to do business. Bill added that it will dramatically increase market visibility through advertising and communications worldwide. Bill stressed the fact that customers buy solutions – not just software. He also said that we need to rely more on our partners. In the past, we have been unable to work early with our software partners so we can reach the marketplace early with successful products.

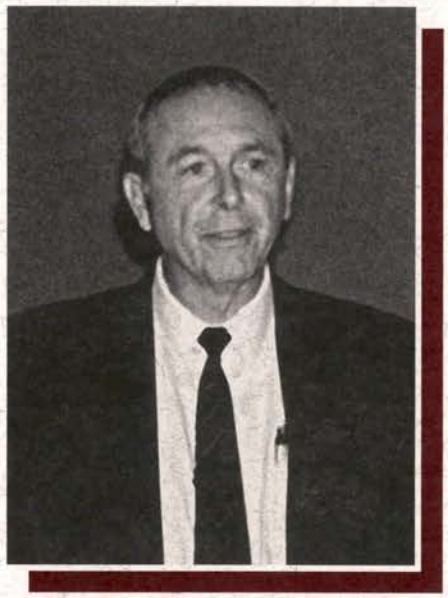
Bill summarized our software product focus for FY95:

- Client/Server networked software providing multivendor heterogeneous solutions through exploitation of Digital's core competencies in distributed computing and integration software
- Commitment to Digital's core products which includes the completed move to Alpha of all core products this fiscal year

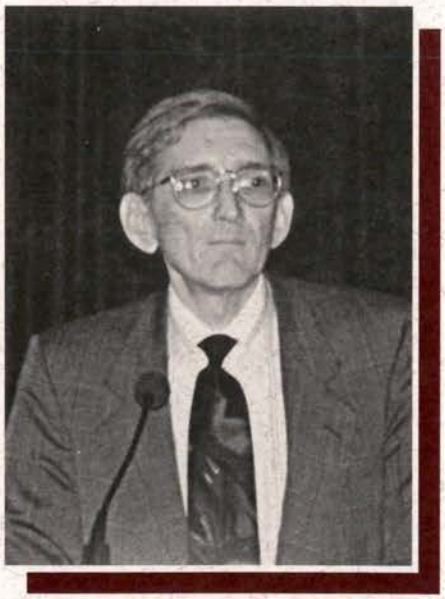
What is expected of us as Digital employees?

- Deliver against current commitments
- Internalize the PM&D principles
- Communicate the message
- Help to make it work!

Each Vice President provided the audience with the opportunity to ask questions at the end of their presentation.



Bill Demmer



Don Harbert

Product Directions Forum

By Diane Pillari

The Computer Systems Division (CSD) conducted a three-day Product Directions Forum at the end of October. Sixty-five customers and partners from Europe, Asia Pacific and the U.S. were engaged in an in-depth discussion on Digital's future products and strategies.

This three-day program was sponsored by Bill Demmer, Vice President Software Business Group; Don Harbert, Vice President Systems Software; and Pauline Nist, Vice President Systems Hardware. Don Harbert was the CSD product development executive host for this program.

The objectives of this forum are to:

Provide customers with an opportunity to understand and influence Digital's future product directions.

Provide Digital Product Managers with a forum for listening to customer needs and product requirements.

Provide a forum for peer group interaction and learning.

Integrate customer feedback into the CSD Product Planning Process.

The customers participated based on their interest in understanding and influencing Digital's product strategies and directions in one of the three technology tracks that were offered: Systems Platforms, Systems Software or Layered Software.

CSD Management presented product plans and strategies in the following areas:

Customers present recommendations to Digital executives during VP Listening Panel.

CSD Product Strategy Overview – Don Harbert

Workstation Product Family at the End of 1995 – Linda Mentzer

OpenVMS Low-End Clusters as PC Servers – Allan Belancik

Software Strategy – Mike Looney

Server Product Family at the End of 1995 – Daryl Long

Digital NT Value-Added Strategy – David Flawn

Client/Server Integration Software – Vijay Thakur

Product Evolution – Susan Blount

UNIX Strategy for Low-to-Mid-range Scalability – John Carpenter

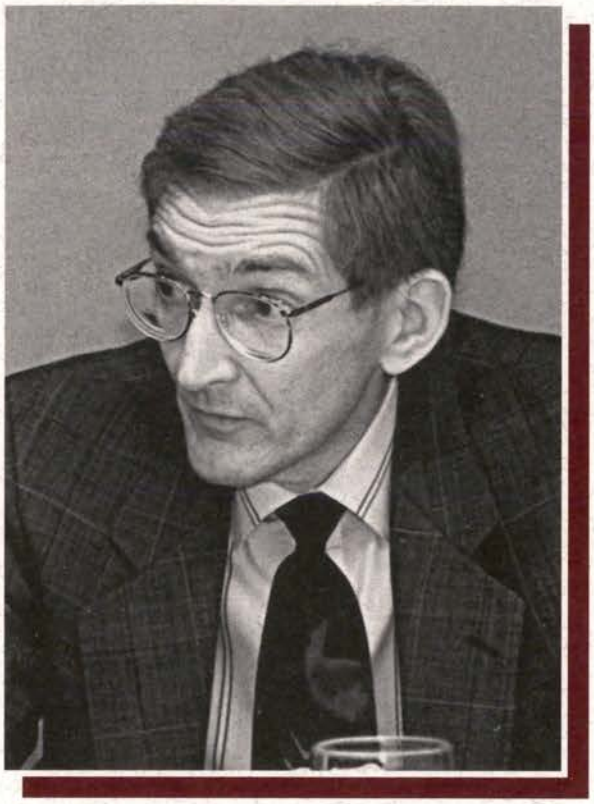
LinkWorks – Dilip Phadke

The feedback from the customer evaluations of the program indicates that customers valued the opportunity to work with Digital through this type of forum.

"I'm really frankly astonished that I was able to participate in this process. I think it's a wonderful thing. I'm very excited about being able to input on the products, and I think that our kinds of partnerships, which are going to make our company successful, really grow from these kinds of relationships. For me to hear what some of your best customers' expectations, successes, frustrations are... brings the relationship to a new level." – A customer quote from the Systems Platforms Track

Jim Friel, Manager CSD Customer Advisory Programs, says "Digital is truly blessed to have such wonderful customers and partners who are willing to invest their time and energy in helping us develop successful products for the future."

The CSD Product Directions Forums are sponsored by the CSD Product Management and Development Vice Presidents and managed by the CSD Customer Programs group. For more information on future PDFs, contact Ron Hoffman @MLO DTN 223-1606.



VP Don Harbert clarifies Product Strategies during PDF discussions.

Jim Friel, Customer Programs Manager, welcomes customers to the Product Direction Forum.

OpenVMS Partners Worldwide Fall '94 Meeting

By Georjean Staehelin, OpenVMS Product Management and Warren Sander, OpenVMS Partners Program Manager

The Fall 1994 Worldwide OpenVMS partners' meeting attracted more than 70 members of the OpenVMS Partners program to the Clarion Hotel in Nashua, New Hampshire. The OpenVMS Partners are a worldwide network of support technologists who devote a considerable amount of their time supporting Digital's OpenVMS customers.

The full-week meeting revolved around sessions dealing with technical and business issues relating to supporting OpenVMS. Sessions were presented by Digital executives, engineering groups, product management, and marketing organizations throughout the company.

Highlights of the week included talks by Enrico Pesatori, Jesse Lipcon, Bob Supnik, Pauline Nist, Nancy Strecker, Don Harbert, Ken Swanton, Kathy Hornbach and Richie Lary.

The Keynote Address delivered by Jesse Lipcon, Vice President of OpenVMS Systems, focused on the renewed emphasis the company is placing on OpenVMS and how that focus will affect the OpenVMS partners.

Enrico Pesatori received a standing ovation from the Partners for his upbeat "Digital Update" session.

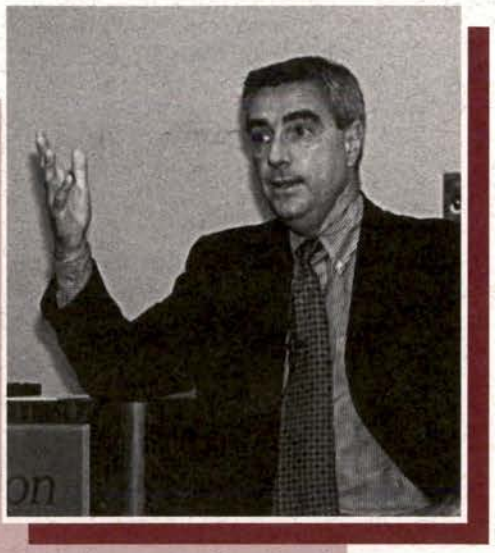
Other sessions included a very informative session by Bob Supnik on the future technologies for Alpha chips and Alpha systems. And a storage day highlighted by Richie Lary's informative talk on the Storage at Digital.

It was a very successful and productive week! The presence and participation of all the groups were greatly appreciated by the OpenVMS Partners. Everyone in the program is looking forward to the next worldwide meeting scheduled for sometime in the late spring.

For more information about the OpenVMS Partners' meeting, or for information about membership in the OpenVMS Partners Program, please send mail to VMSMKT::VMS_PARTNER.

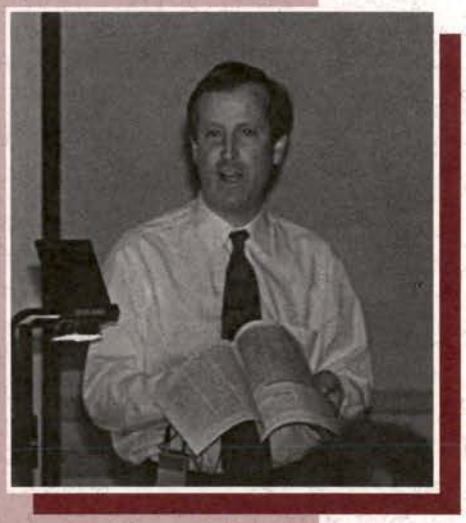
OpenVMS Partners.

Enrico Pesatori, VP and GM of Computer Systems Division, addresses the OpenVMS Partners.

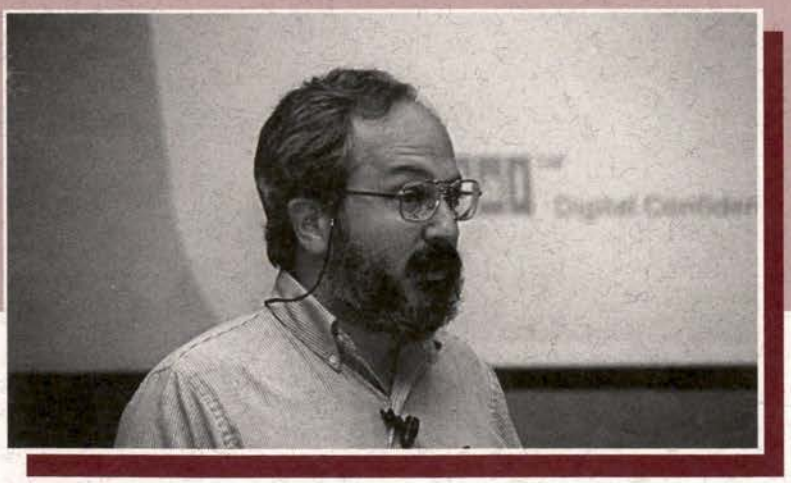


Enrico takes questions from the audience.

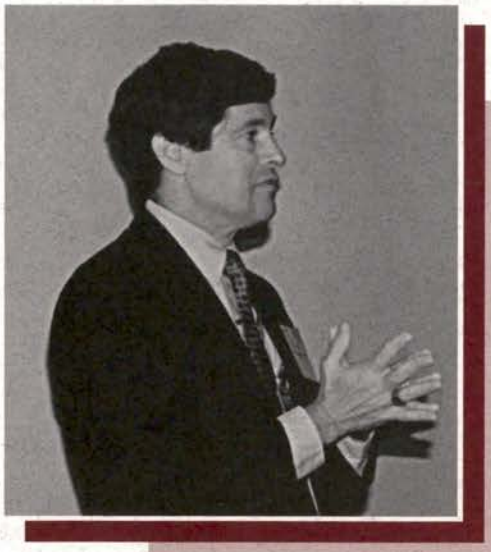
Vice President Pauline Nist presents a Systems Hardware update to the Partners.



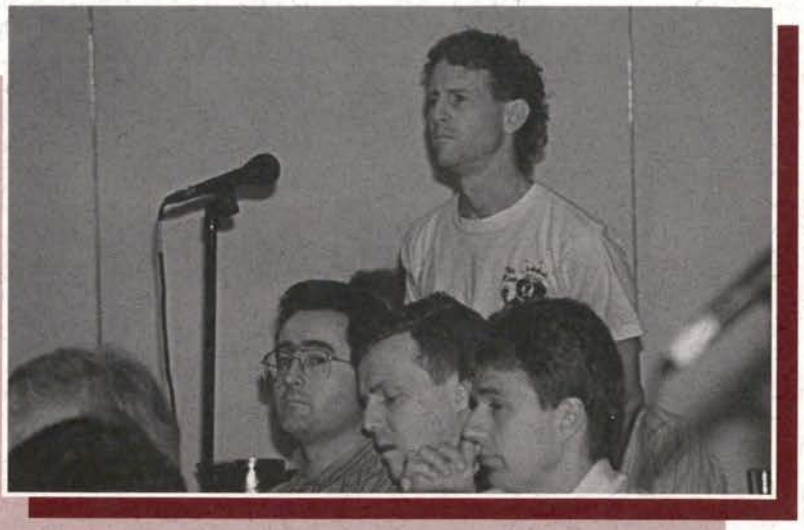
Ken Swanton, Manager OpenVMS Marketing, shows the VMSclusters insert from Datamation as part of new OpenVMS advertising campaign.



Vice President Bob Supnik presents a Digital engineering technology update.

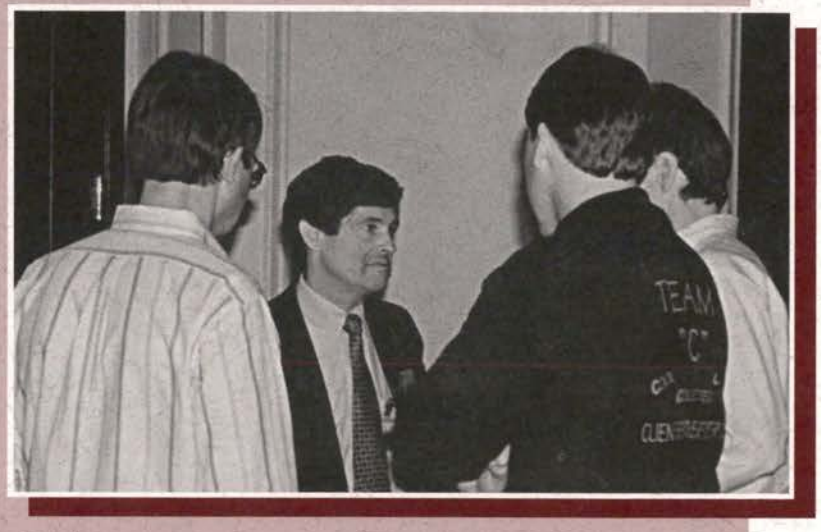


Jesse Lipcon, VP OpenVMS Systems, addresses the OpenVMS Partners meeting.



Brendan Eagan, OpenVMS Partner from Dallas, asks a pointed question.

Nancy Strecker, VP Software Product Management, shares Digital's Software Business Group strategy.



After his session, Jesse takes time to address issues one-on-one.

Hallway discussions enliven the OpenVMS Partners meeting.

Consultant Promotions

By Philippe Ribeyre

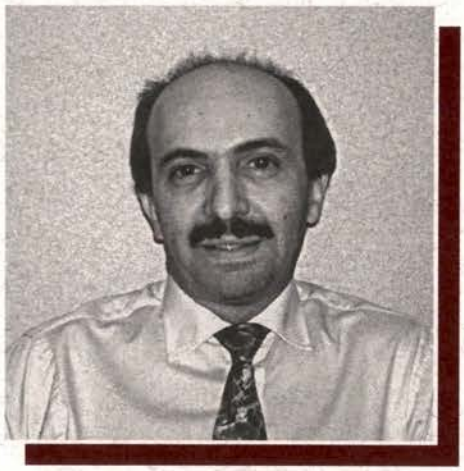
The Consulting Engineer Review Board (CERB) recently approved the promotion of Reza Sisakhti and Peggy Piz to the position of Senior Consulting Information Designer. They are the first two instructional designers to be recognized for this senior position within the Company.

Peggy Piz Promoted To Senior Consulting Information Designer

Peggy Piz has made outstanding contributions over the past fourteen years in applying instructional design and media design to create innovative information products. Some of Peggy's major achievements include:

- Designing and developing a series of international seminars that focus on multimedia design and functionality. Originally the seminars were developed to aid Digital APA Sales to create a presence in the PC market, and were designed to illustrate and demonstrate a combination of all the capabilities possible in the PC multimedia environment. The seminars have been updated on an ongoing basis to include new multimedia applications and capabilities. The current version demonstrates network distribution of PC interactive multimedia applications and is planned for delivery on the Internet.
- Designing and developing the New South Africa Vocational Skills Program. Peggy defined the requirements and provided leadership in developing the design specifications and implementation plan for the New South Africa Feasibility Study for Vocational Skills training. Peggy's work in this area was significant because it was responsible for opening the South African emerging market to Digital products and services.
- Implementing the Digital Customer Video Network Program. In her capacity as Program Manager, Peggy designed, developed, and implemented a media architecture that combined elements of curriculum design and media programming to showcase Digital's products and services.

Peggy has an Ed.S. in Instructional Systems Technology from Indiana University (with a Doctoral Minor in Film Studies), an M.S. in Telecommunications and Instructional Systems Technology from Indiana University, and a B.S. in English and Pre-Law from Gonzaga University. In addition, she has completed the course work for an Ed.D. in Instructional Design.



Reza Sisakhti Promoted To Senior Consulting Information Designer

Throughout his eleven-year career at Digital, Reza Sisakhti has used his business and information solution knowledge to design and develop learning and information vehicles that have positively impacted his clients' organizations. Two such recent outstanding contributions which were significant factors in Reza's promotion include:

- Developing a Human Performance System Architecture (PSA) for Software Product Services in Multivendor Customer Services (MCS).
- Providing technical leadership in the successful implementation of PSA in System Management Services.

The reusable Performance System Architecture provides instructional designers with processes, tools, and guidelines for addressing the skill and workplace requirements needed to

meet business metrics. PSA also orients business managers to critical factors impacting human performance, the interrelationship of these factors, and their impact on business success.

A single implementation of PSA in System Management Services allowed that organization to avoid service delivery costs by 20 to 25%, which is contributing to approximately $8 million in cost savings this year alone. In addition, implementation of PSA led to enhanced revenue and improved customer satisfaction.

Reza completed his Ph.D. in Instructional Systems Technology from Indiana University in 1982 where he taught and served as an instructional design consultant prior to joining Digital. His dissertation was selected as the Indiana University School of Education's 1982 Proffitt Dissertation Award for Meritorious Achievement. He completed his post-doctorate work in instructional computing at Indiana University in 1983. He also completed his Executive MBA from the University of New Hampshire in 1992.

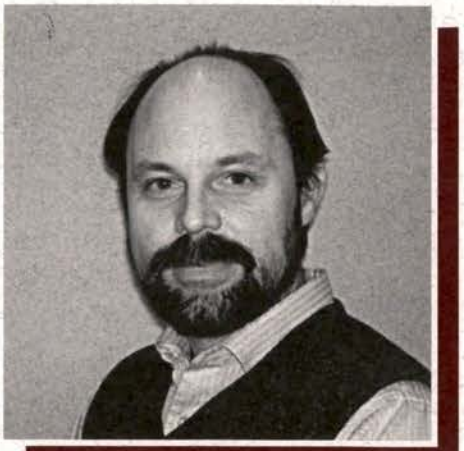
Mike Burrows Promoted To Consulting Engineer

The Advanced Technology Group is pleased to announce the promotion of Michael Burrows to Consulting Engineer. Mike has been with Digital's Systems Research Center in Palo Alto, California, since receiving his Ph.D. from Cambridge University (England) in 1988. His promotion is in recognition of his substantial contributions to Digital's ATM networking products as well as his research on authentication protocols, data compression, text indexing, performance monitoring, and high-speed communications.

Mike is a key member of the combined Systems Research Center-Networks Engineering team that has brought to market Digital's first ATM network product. The GigaSwitch/ATM makes 12.8 Gb/s of switching bandwidth available for up to 56 fiber-optic links operating at 155 Mb/s. ATM networks handle 53 byte cells and are well suited to carrying high volumes of mixed traffic. Several such switches can be combined to form a very high-capacity Local Area Network or Enterprise Backbone Network. An ATM network can also provide the high-performance interconnect needed for a workstation farm. Mike was one of the designers/implementors of GigaSwitch/ATM and the associated host adaptors.

In his six years at SRC, Mike has built a solid reputation for excellent research and technology development in a range of areas. His data compression expertise is helping Digital product designers shoehorn code into boot ROMs. His non-disruptive, kernel-level performance monitoring tools are helping make NT run fast on Alpha. His work on authentication protocols is helping to make distributed systems more secure. His indexing software is being used to provide full-text searching of Digital's internal World Wide Web pages. His knowledge of data structures has helped in the design of a new Digital product file system.

Mike can be contacted by e-mail to <burrows@pa.dec.com>.



Dave Butchart Promoted To Consulting Software Engineer

In recognition of his contributions to Digital for the past 20 years, Dave Butchart has been promoted to Consulting Software Engineer. This promotion is a result of Dave's work in ensuring that the commercial performance of Alpha was "best in class in the industry" with our initial commercial market release.

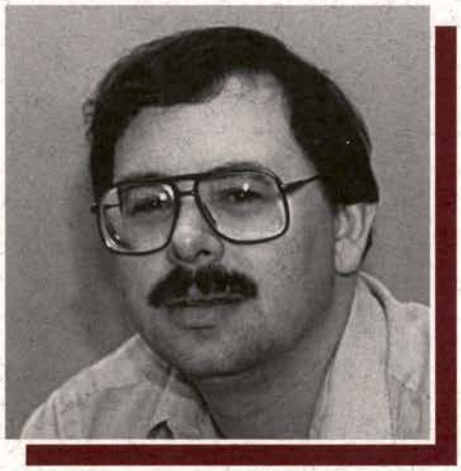
Dave started with Digital in 1974, and participated in the design and implementation of some of the first successful large database and OLTP systems in the company. He has been working on performance of database, transaction processing, office/workgroup, and operating system products for over a decade, and has recently been appointed technical director of Performance Expertise Center, responsible for defining and coordinating technical strategy for PEC's performance management products.

Steve DiPirro Promoted To Consulting Software Engineer

Steve DiPirro, of the OpenVMS Kernel Group, has been promoted to Consulting Software Engineer. Steve's promotion is the result of several outstanding accomplishments in the past five years in the OpenVMS Group and in his previous seven years at Digital. In particular Steve's promotion was awarded in recognition of his leadership in providing the ability for systems coding in C for OpenVMS, and as the C as a Systems Programming Language architect and project leader for OpenVMS AXP version 6.1.

Steve is a graduate of Bates College and received a Masters in Computer Science from Boston University. He began his software career at Systems Architects, Inc., where he was a DBMS developer. He next worked at GTE's Strategic Systems Division on the C^3 simulator for the MX missile system. In 1982, Steve joined Digital and first worked in the VAXstation 100 where he contributed to the system display architecture. Steve was the VAXstation 8000 software project leader, and received 6 patents on work associated with that project. Steve led the SPX (Scanproc) graphics software project for the VAX 3100 workstation line. Many of these systems are still in use today.

In 1989, Steve joined the Alpha VMS Development Group. He was a major contributor to the Alpha VMS Working Design Document, and subsequently wrote the DELTA and XDELTA debuggers for OpenVMS AXP version 1.0. Steve led the team that provided the kernel tools suite for version 1.0, 1.5, and 6.1 of OpenVMS AXP, including, in addition to the debuggers, SDA, BUGCHECK, WATCHPOINT, ANALYZE/PROCESS, and aids to removing alignment faults. With his leadership of the C as a Systems Programming project, OpenVMS AXP was provided with systems coding capability in C, which has been used extensively in providing new hardware support for Sable and subsequent systems. The ability to code in C for OpenVMS has enabled common code with OSF/1 in some areas. In addition, as a part of this project a remote System Code Debugger was delivered which is rapidly replacing XDELTA for many uses.



Andrew Eisenberg Promoted To Consulting Engineer

Andrew Eisenberg has been promoted to Consulting Engineer for his contributions as one of the architects in the development and standardization of the SQL language, which is used to access relational databases.

Andrew has served as a member or alternate member of the ANSI X3H2 database committee since 1985. He joined Digital in 1988, and has worked on the SQL language used for DEC Rdb, DBI database integrator, DEC Data Distributor, and the Database Gateway products. Andrew is a graduate of MIT, and holds S.B. and S.M. degrees in Computer Science.

Kent Glossop Promoted To Software Engineer Consultant

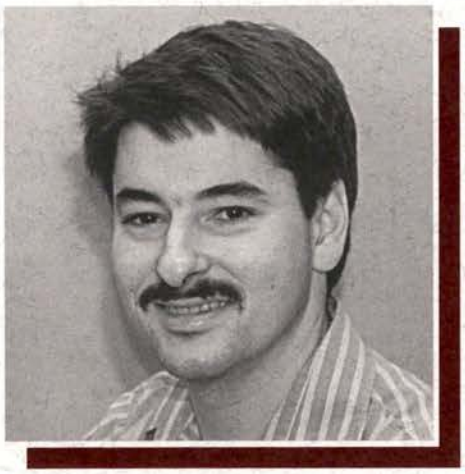
Kent Glossop was recently promoted to Software Engineer Consultant in the Core Technology Group. His promotion is the result of his contributions to Digital's compiler technology by delivering Gem support for compiler products for MIPS and Alpha AXP performance leadership. And for advanced development work which is leading to the modernization and evolution of the Gem code base while minimizing the impact upon product delivery. Gem is a retargetable, rehostable, state-of-the-art compilation system that is used by most of Digital's compilers.

Kent is currently a senior member of the Gem code generation team and is one of its principal designers. He is the architect for the Alpha AXP code scheduler and designed both target dependent and independent parts, including excellent parameterization for support of EV-4 and EV-5 dual- and quad-issue code scheduling.

As part of the Advanced Compiler Techniques AD team he designed and implemented a system to allow writing Gem header file code in C++. This is a key component in enabling the use of C++ for new Gem development.

Kent's previous project accomplishments in The Languages Group included assignments on VAX Debug, VAX PCA, and VAX PL/I development and project leading. He was a member of the team that developed and delivered a new,

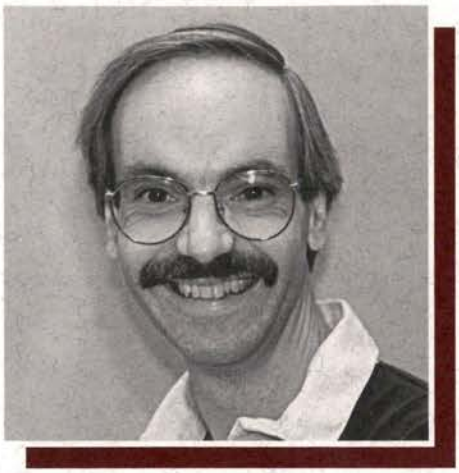
highly-optimized compiler back end for early PRISM development that evolved into Gem and was ported to MIPS and finally to Alpha AXP.



Todd Guay Promoted To Consulting Software Engineer

Todd Guay was recently promoted to Consulting Software Engineer in the Digital consulting group. Todd was promoted for his leadership in applying relational database technology across a broad range of challenging customer problems and for his development work in the database tuning area. Todd is currently working on the development of our next generation of database tuning tools.

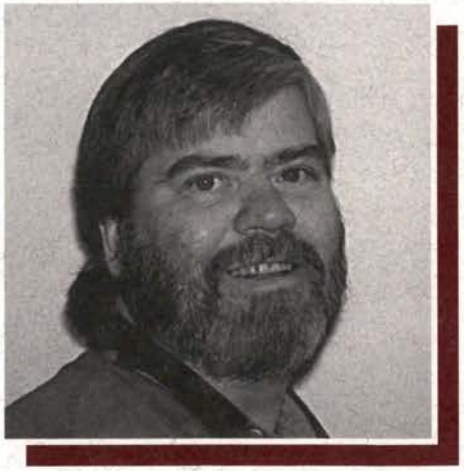
Todd has been actively involved with relational database technology and performance for over 10 years. His accomplishments include the design and development of HART, a decision support system for the RA90 product, consulting with our strategic CIM partners to resolve technical roadblocks in moving their products to Digital's database solutions. Todd has been the database consultant on many multi-million dollar opportunities, and his tuning expertise has directly contributed to many wins for Digital. Todd's most recent work includes the implementation of the dynamic tuning capability which will be introduced in RdbExpert Version 3.0.



Lenny Szubowicz Promoted To Consulting Software Engineer

In recognition of his eight years of accomplishments in OpenVMS Engineering, Lenny Szubowicz has been promoted to Consulting Software Engineer. The promotion is a result of Lenny's outstanding performance as architect and Project Leader for the High Level Language Device Driver development effort, which provided the capability to write device drivers in a high-level language on OpenVMS, as well as restructured the IO subsystem in OpenVMS AXP to simplify IO interfaces to device drivers. As a result of this project, the cost of developing device drivers is greatly reduced, and development of device drivers on OpenVMS AXP is far more attractive to third parties.

Lenny has been with Digital for 11 years. Beginning with Software Services in 1983 he worked on design and implementation of a factory automation system for Pratt and Whitney Aircraft. He later joined the RMS project team and became project leader for RMS/DDTM, which modified RMS Journaling to use DEC Distributed Transaction Manager. Since May, 1990, Lenny has been part of the OpenVMS IO development group, assuming a technical leadership role for the port of OpenVMS IO Executive Subsystem from VAX to AXP, the High Level Language Device Driver project, and currently for I/O related support of 64-Bit virtual address space.



Phil Wells Promoted To Consulting Engineer

Phil joined Digital in 1976 as a Computer Operator in the IPC organization. Since then he has held software development positions in the ISWS and Digital Telecommunications organizations.

A key contributor to the PATHWORKS product set since 1986, his most recent role is as server architect for the project that defines Digital's next-generation PATHWORKS server architecture.

His architecture provides a common framework for integrating desktop Network Operating Systems such as Microsoft's LAN Manager™, Apple's AppleShare™ and Novell's NetWare™. This is the project that resulted in his promotion to Consulting Engineer.

He is known corporate wide for his expert knowledge of PC integration technologies, OpenVMS internals and network transports.

His numerous contributions to the PATHWORKS product set over the last 8 years were key to making PATHWORKS Digital's highest volume (over 2 million users) software business.

He holds one patent (multiple inventors) related to Digital's Local Area System Transport technology and another patent is pending. LAST technology is integral to both Digital's PATHWORKS and InfoServer products.

Patent Awards

Recipients of Digital Patent Awards

Dave Roville, CSD Patent Engineer, and Vice President Bill Demmer congratulate recent recipients of Digital Patent Awards.

Patent Award Team – Front row, left to right: Bill McKeeman, Doug Williams, Dennis Rogers, Bob Ulichney, Stan Stefanik, Bob Hellweg, Colin Brench, Rick Hetherington. Back row, left to right: Dave Roville, Dileep Bhandarkar, Jeff Motzger, Steve Ho, Steve Hobbs, Dave Fenwick, Tom Benson, Bimal Sareen, and Vice President Bill Demmer.

Server Business Segment Wins Awards

By Jeff Robie, Product Manager

The DEC 7000 Model 700, Digital's highest performing and most expandable server, has been awarded "Best Overall Performer" and "Best Throughput Performance" by AIM Technology.

The awards were presented to Pauline Nist, Vice President of the Server Business Segment of the Alpha Systems Business group, on October 4th at UNIX Expo in New York City. AIM Technology is an independent organization based in Santa Clara, California. Being an independent organization, in contrast to vendor consortiums, allows AIM to bring an expert eye to performance measurement that is not restrained by objectives of consortium members. AIM helps customers evaluate new UNIX-based systems by providing them with unbiased performance tests.

The DEC 7000 Model 700 achieved its top position for configured systems between $100,000 and $500,000 as recorded by the AIM Suite VII benchmark. The Suite VII benchmark, which replaces the Suite III benchmark, was designed to test Open System multi-user environments. An application mix of office automation, word processing, e-mail, database, payroll and data processing are employed to test small memory/user, heavy tasking (medium IPC), light floating point (medium I/O), and lots of shell and string routines.

Testing was performed on a five cpu system with four gigabytes of memory, 29+ gigabytes of storage and prestoserve. The details of the tests results are 6306.6 maximum throughput rating (jobs/minute) and a 643.5 overall AIM rating. Both numbers best the previous highs set by the DEC 7000 Model 700's predecessor, the DEC 7000 Model 600. Those marks were 5053 for maximum throughput and 515.7 for the overall AIM rating. The DEC 7000 Model 700's numbers far exceeded those of its direct competitors that have also been run through the Suite VII benchmarks, which include systems from Data General (AViiON 9500 with an AIM rating of 456.6), Sun (SPARCcenter 2000 with an AIM rating of 259.5), Hewlett-Packard (G70 with an AIM rating of 177.6) and Silicon Graphics (Challenge L with an AIM rating of 245.8).

The DEC 7000 Model 700 first revenue shipped on September 10th thanks to the dedication of the entire team. On November 3rd, it was officially announced to the press and analysts.

ARGON DEC 7000 Model 700 Team – Left to Right: Jim Whitaker, Al Michaud, Doug Williams, Betty Ann Tyson, Larry DeRenne, Jeff Robie, Bill Cummins, Mark Stefanik, Steve Holms, Jim Coleman, Ali Rafieymehr, Howard Drobner, Bob Cansler, Jim Doiron, Bruce Ferjulian, Gary Kushner. Not present: Dennis Hayes, Dave Urban.

Accessing The Web

By Russ Jones
Director of Internet Program Office

The World Wide Web is a wide-area hypermedia information built on top of the Internet. Hypertext is an information presentation methodology that allows highlighted words and pictures to point (or link) to other documents. Hyperlinks are followed by simply pointing and clicking on the link. The Web is often referred to as a hypermedia environment because hypertext documents may also contain links to video and audio in addition to the usual inline text and images. The World Wide Web was developed primarily at CERN, the European Particle Physics Laboratory, but significant work was also done at the National Center of Supercomputer Applications (NCSA) in Urbana- Champaign, Illinois. Now, much of the innovative Web development is happening in the commercial sector.

What is extraordinary is how quickly and widely the World Wide Web has been embraced by the marketplace. In the span of 18 months, the number of Web servers has exploded from less than 100 to well over 10,000 in late 1994. From an initial handful of Web servers scattered across research and university communities, the Web today is built from servers located in all corners of the business world. From book publishers, to car dealers, and even real-estate agencies – all have come online in 1994. What is more, they are not just coming online for market visibility, but are starting to compete for customers in a very dynamic, online global marketplace.

Companies in the computer industry are at the forefront of using the World Wide Web for business purposes. Digital was the first computer vendor, actually the first Fortune 500 company, to come online with a Web server. Digital's Web server is accessed 22,000 times a day on average by employees, customers, prospects, partners, and competitors all looking for the latest product and service information from Digital.

Inside Digital, an internal World Wide Web has also emerged. Product groups, vertical marketing organizations, and field offices all over the world are bringing up Web servers containing content reflective of their role and mission inside the corporation. Digital has over 175 internal Web servers containing information for internal use only. This information, like the rest of Digital's computing resources and confidential information, is protected from external access by a number of secure firewalls. The firewalls prevent the "bad guys" from getting in, but are designed to let the "good guys" pass through and easily retrieve the information they need to do their job. Locating information in a hypermedia environment with no starting point is one of the more challenging aspects of the World Wide Web. To simplify this problem, NCSA started maintaining a list of "What's New" on the Web. CERN maintains the official listing of all Web servers by country. Other organizations on the Web maintain meta-libraries, meta-indexes, and subject indexes. There are also alphabetized listings of all commercial companies on the Web, as well as one for all non-profit organizations.

Just like the external Web, Digital's internal Web also has:

- A "What's New" listing
- A Web server index alphabetized by organization
- A company-wide searchable index

The searchable index allows Web users to perform a quick, full-text search across the full contents of Digital's internal Web. Gateways to DEC NOTES, VTX, STARS and ELF also exist. These gateways allow Web users to interact with existing information systems in the corporation from a single point-and-click interface. Likewise, these same information systems, via the gateways, can be hyperlinked into new Web servers that are springing up all over the corporation.

There are between 15,000 and 20,000 Web users inside Digital and the number is growing every week. Employees use the Web to not only access internal information and resources, but more importantly to access external servers on the Web. Product marketing uses the Web to gather market intelligence directly from competitors. Engineers use the Web to grab productivity tools and other freely available software tools.

World Wide Web Architecture

The World Wide Web is one of many client/server applications built on top of the Internet. The server component is actually an HTTP server, but is generally referred to as a Web server. The client is called a Web browser. Web servers and Web browsers are available for all of the major operating environments – Windows, Macintosh, OpenVMS, all variations of UNIX. Web browsers also have the added functionality of being able to interact with Gopher, ftp, and news servers. It is this functionality that makes a Web browser the Cadillac of Internet access tools. Web browsers can also launch telnet sessions, and, via gateways, access WAIS servers.

With the World Wide Web, resources are uniquely identified by a Uniform Resource Locator, or URL. URLs are used to identify everything from a hypertext page on a Web server, to a file on an ftp archive. Given a URL, a Web browser can access richly formatted hypertext, PostScript documents, DOS executables, compressed tar files, MPEG motion picture clips, and even audio files. URLs are generally formatted as:

access-method://host-name/directory/file.ext

For example, a marketing specialist wishing to get the latest product specifications from Hewlett-Packard would point-and-click their way to HP, or directly use the URL:

http://www.hp.com/

Alternately, the latest emacs binary for the Macintosh could be retrieved from a directory off an ftp archive using a URL:

ftp://gatekeeper.dec.com/pub/BSD/NetBSD_Mac/ports/bin/

The contents of the directory is displayed on the screen of the Web browser. You can then switch to "Load To Local Disk" mode and click on the compressed binary kit you want to retrieve. After saving on the local disk, be sure to switch off "Load To Local Disk."

Firewalls and Proxy Servers

Transparent access to external, Internet servers is accomplished by the use of proxy servers associated with both the Palo Alto and Cambridge Internet gateways. The proxy server sets on the gateway and listens for request for external URLs. When a request is made, the proxy server will actually make the external request on behalf of an internal client. Once the information is retrieved over the Internet back to the proxy server, it is cached for future use and then returned to the requesting Web browser.

Using this technique, the next time a Web user makes a request for the same URL, the proxy server will directly return the cached version of the information. This results in faster response for Web users and more efficient utilization of Internet bandwidth. Additionally, the proxy server cache feeds the company-wide Web index.

The use of proxy servers has recently replaced the non-standard SOCKS approach originally employed in 1993. The SOCKS approach required that Web browser code be modified to invoke the SOCKS interface for external Internet access. The proxy server approach allows internal Digital users to use off-the-shelf Web browsers with no need to modify the code.

Web Browser Overview

Using a Web browser, users have access to all of the information on the Internet – from anywhere in the world – and do not need to understand the underlying commands, protocols, and technical details to access that information. The only real technical requirement is TCP/IP connectivity. With a Web browser, the user is truly in the driver's seat and controls the document-to-document navigation sequence by clicking on a hyperlink, launching a search, backing up through the navigation chain, or by opening a direct document by direct URL. In addition to reading a hypertext document, users can also save the document to a local file or send it to another user via an e-mail message. In either case the user can choose a variety of formats – plain ASCII text, PostScript, or HTML (the HyperText Markup Language used on the Web).

Although more than a dozen Web browsers are available, there are generally two graphical Web browsers that are used heavily inside Digital:

- Mosaic is the original graphical Web browser that triggered the World Wide Web explosion. It was developed by NCSA and is now being commercially distributed by SpyGlass. Mosaic is available for ULTRIX, OpenVMS (VAX and Alpha), DEC OSF/1, Windows, Windows NT and the Macintosh. The UNIX and OpenVMS versions support the X Window System and, in general, have more mature functionality than the Windows, Windows NT, and Macintosh versions.
- NetScape is the other graphical Web browser that has emerged onto the scene. It was developed by NetScape Communications Corp. and is a true commercial-quality Web browser. Although still in beta testing, early results indicate a substantial performance improvement over Mosaic. NetScape is available for DEC OSF/1 and Windows.

Another Web browser used extensively throughout Digital is Lynx. It is a character-cell Web browser and is the browser of choice for terminal users. For more information on obtaining, configuring, and using a Web browser visit the SOFBAS::INTERNET_TOOLS notes conference. Besides the basic Web browser, you will also want to obtain a number of add-on tools to assist your Web browser. Such tools include an image display utility, a motion picture player, and an audio player if you have audio capabilities on your desktop system.

Other Resources

Once you have your Web browser running, there are a number of resources to help you locate information inside the company and correctly configure the Web browser to access the proxy servers. The internal corporate home page is the most important and can be accessed by pointing your Web browser at:

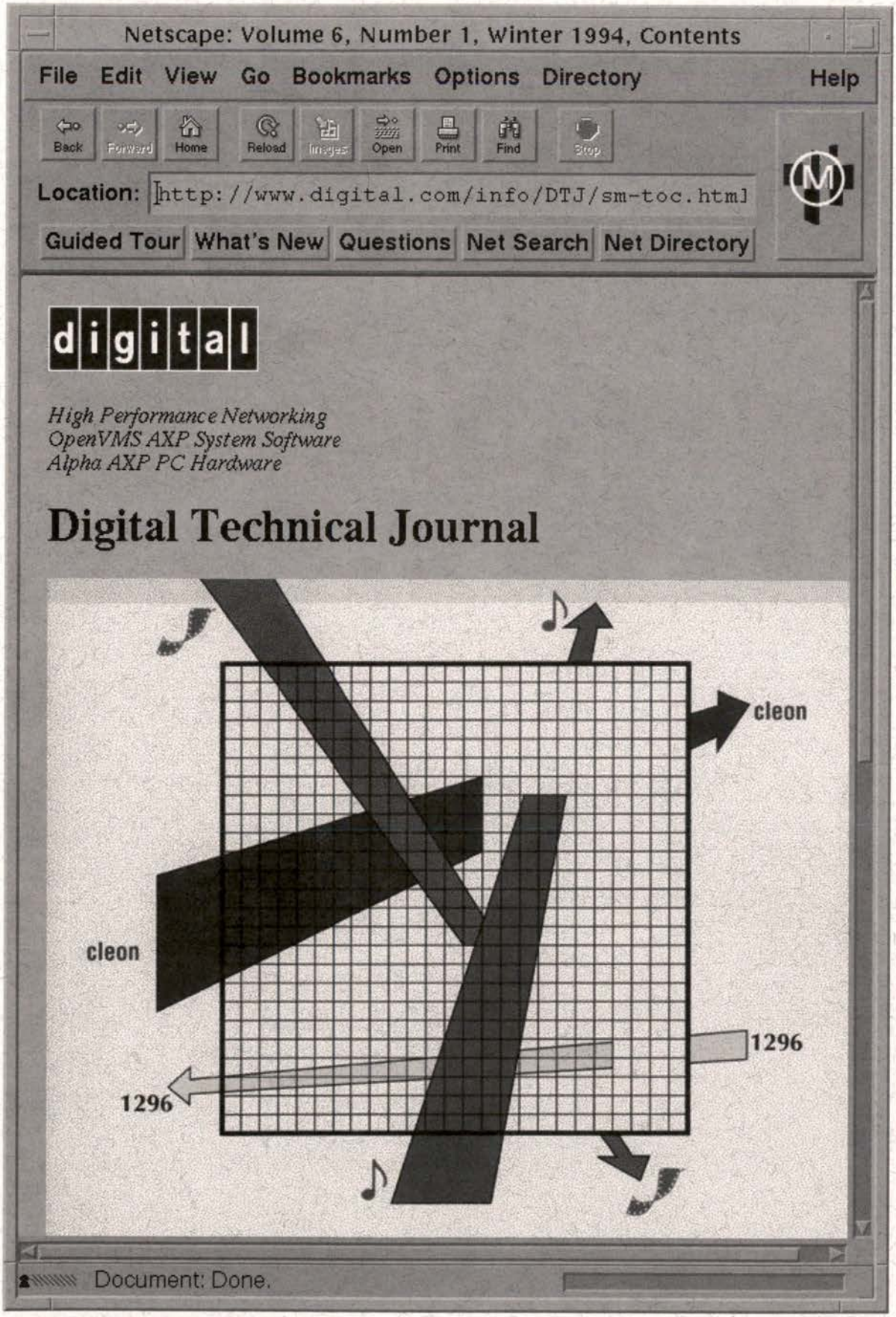
http://www.crl.dec.com/Digital/home.html

From there you can access the company-wide search capability, the alphabetic index of Web servers and find out "what's new" on Digital's Web. Also be sure to check out the recently redesigned external home page located at URL:

http://www.digital.com/

This is what our customers see and the main entry point where you will want to refer customers.

Russ Jones
Director of Program Office
Internet Business Group



The internal corporate home page on the Web.

UNIX Sales Support Technical Training Held Recently

By Dianna Ellis, UNIX Base Product Marketing

The fall training event for UNIX sales support was held in Nashua, NH, at the end of October. The event is also open to UNIX workstation sales specialists, distributors, and ISVs.

Two hundred fifty attendees were present for a full week of activity. One of the newer aspects of the training was the inclusion of two Digital Partner Days as part of the overall event. Twenty-five key ISVs were invited to share a morning with Digital executives to understand and learn more about Digital's U.S. field organization, the Channels organization, our ISV business partner programs and an update in UNIX marketing activities. We wanted to bring our Partners closer into a real business relationship and make them feel more connected to the work that is happening around UNIX.

During the afternoon, ISVs had scheduled speaking slots to deliver presentations to the field on their applications. The next day, the ISVs joined our UNIX field organization in attending many of the product sessions that were scheduled.

Additionally, as part of our Partner Days, a sales/sales support incentive program was put in place with cash awards to the participants in the field who brought qualified leads back with them to the ISVs during their afternoon scheduled appointments. A total of 100 leads were collected. The ISVs were also excited about this program, leaving with some interesting opportunities!

Many thanks to Duncan Anderson (sponsor of the program) and Lee Gricci for pulling it all together. The UNIX Sales Support Technical Training event is a team effort that crosses many organizations. Thanks to all the speakers who faithfully supported our events, and everyone else who helped make this event so successful.

As we continue to plan for future events, our goal is to expand our Partner participation to the fullest.

Here's a list of the ISVs who walked away with leads, and the names of field participants who received their cash awards during a dinner that evening.

Boston Business Computing
Cincom Systems
Cognos
Corel Corporation
ESRI
Information Dimensions
Object Design
Objectivity
Openware Technologies
Progress
Raxco
SAP
Saros Corporation
Section 7

Lee Gricci and Duncan Anderson presenting cash awards.

Softool
Unidata
Uniface
Vmark Software
Visual Numerics
Wall Data

Field Winners:

Kelly Boelema	$1000	GJO
Tim Matthews	$1000	IVO
John Maria	$1000	KKO
Jennifer Fung	$ 500	WRO
Forough Ghahramani	$ 500	CPO
Sara de los Reyes	$ 200	NYO
Fred Hutchinson	$ 200	RTP
Munir Majdalawieh	$ 200	DCO
Mike Eschenbach	$ 200	MWO
John Bloeser	$ 200	KZO
Tom Bowman	$ 200	MKO
David Painter	$ 200	SDO
Cloyce Carlen	$ 200	TLO
Gary Helton	$ 200	OPK

Dinner with UNIX Field Attendees, ISV's, and distributors.

Field discussing potential leads with ISV's.

John O'Keefe, Vice President UNIX Systems Marketing, Tim Yeaton, Director UNIX Product Marketing and Development, Lee Gricci, and Duncan Anderson, ISV Business Partner Development Group gather with some of the Field recipient Award winners.

Workstation Business Wins Awards

This fall at UNIX Expo in New York, AIM Technology announced the winners of their "HOT IRON" awards. Out of eight categories, Digital has WON five. The Workstations Business Segment is proud to announce that the DEC 3000 Alpha Workstations have collected two of those wins, as well as four seconds; in two cases, placing first and second in the same category.

The awards were presented to Philippe Ribeyre, Vice President of the Workstations Business Segment of the Alpha Systems Business Unit. Congratulations to the hardware engineering teams, O/S groups and performance teams that continue to ensure that Digital retains our leadership position in the industry.

The Awards won by the Workstations Business Segment are:

Category Award System

Workstations Best Performer
WINNER – DEC 3000/900

Workstation Mix
SECOND – DEC 3000/600

Best Price Performance
WINNER – DEC 3000/600

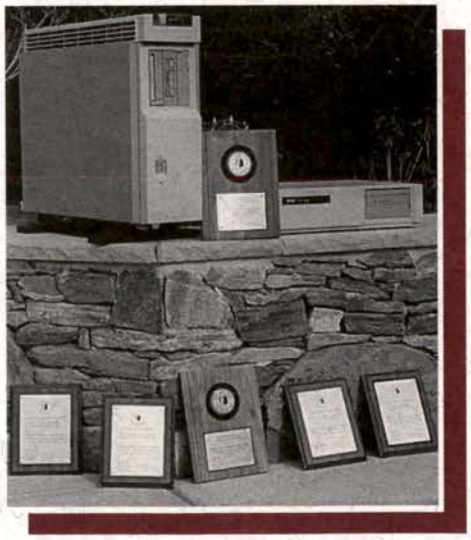
Workstation Mix
SECOND – DEC 3000/900

Multi-user Shared Systems Mix
SECOND – DEC 3000/700

File Servers Best Throughput Performer
SECOND – DEC 3000/900

The awards are based on performance of systems under the new proprietary workstation and server benchmark suites from AIM Technology of Santa Clara, Calif., Suites VI, VII and IX. More information on these benchmark suites can be obtained by contacting the CSG Performance Group (MSBCS::CSGPERF).

The Model 900, announced in July 1994, is the fastest workstation in the industry, offering 189 SPECint92 and 264 SPECfp92 performance. Digital also has the fastest desktop workstation in the industry – the Model 700. It is the follow-on to the Model 600, offering 42% higher performance. The Model 600, announced in October 1993, is now Digital's entry-level mid-range desktop machine.



Digital 3000 Workstations Team – Third row: John Ethier, Tom Thorp, Phil Puris, Bill Zaharchuk, Todd Dutton, Dennis Kaszynski. Second row: Greg Konar, Marcia Sailor, Ken Lowman, Rick Rudman, Larry Narhi, Jim Grillo, Al Baum, Robin Stewart, Mark Haq, Chris Gianos. First row: John Caporal, Hugh Kurth, Chris Estes, Fred Roemer, Bob Clark, Steve Boulay. Kneeling: Dave Sacra, Jim Reisert, Leon Hesch, Bob DeCosta, Pete Scantlebury.

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Let it be known *that the United States of America has recognized this inventor's original creation with the granting of a* **United States Patent.**

Digital Equipment Corporation acknowledges your outstanding achievement and salutes you in your accomplishment.

TurboLaser Announcement
– SEE PAGE 4 –

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TurboLaser and Oracle Light Up the Big Apple–and Beyond

By Kenneth McDonnell
Public Relations Manager, AlphaServers

For a day, at least, on April 11, Digital owned the Big Apple, using the scale and excitement of The City as a backdrop to introduce the world's most powerful enterprise server, until now the domain of mainframes and supercomputers. Herewith, an eyewitness account.

TurboLaser architect Dave Fenwick was exuberant. On the eve of what Bob Palmer called "the most significant announcement of my tenure" as President and CEO, Dave was positively bubbling with excitement – even more so than usual.

"For four years," Fenwick was heard to say, "Engineering has worked night and day to build TurboLaser into a machine none of our competitors can touch for some time to come!"

Gathered with engineering, product management, and marketing colleagues from Digital and strategic partner Oracle Corporation, Fenwick and friends could finally sit back and relish both the teamwork that brought TurboLaser to New York City for its gala coming-out party, and the future success forecast for TurboLaser by analysts, customers and the press. (See box "Customers, Analysts, Partners Praise Alpha")

Consider the results of their work: AlphaServer 8400 enterprise server – packing up to 12 300MHz Alpha 21164 "BIPS" (billion instructions per second) microprocessors, up to 14Gb of memory, the industry's best balance of processor performance, memory, I/O bandwidth, and bus choices, including PCI. Plus, raw performance to spare: the industry's first system to deliver performance of more than 300 SPECint92, nearly three times the performance of the next closest competitive system, IBM's SP-2 mainframe; more than three times the maximum SPECrate_int performance of HP's most powerful server, the HP 9000-800 T500 system, and more than twice that of Sun's SPARCcenter 2000E system; twice the I/O bandwidth, more than twice the memory capacity, and more than eight times the storage capacity of these competitive commercial SMP platforms.

In technical computing, the AlphaServer 8400 system is the industry's first to deliver performance results of more than 500 SPECfp92, which is more than 60 percent better than the closest competitor, SGI's PowerChallenge XL system; more than 20 percent higher Linpack multiprocessor performance, and 82 percent better price/performance results on the NAS parallel benchmark than SGI's 18-processor PowerChallenge XL system; more than three times better price/performance than IBM's SP2-T2 system – all for $195,000 for a uniprocessor system. And consider the 8400's sibling – the AlphaServer 8200 departmental server, with up to six 21164 microprocessors and up to 6Gb of memory, providing more than 60 percent higher SPECfp92 performance than SGI's PowerChallenge L system, and an entry price of just $100,000.

To be sure, it was a night for celebrating, for sharing war stories on the road to the Big Apple, and for looking ahead. But few could anticipate the excitement the next day's events would generate. The morning brought sunny, warm April skies to midtown Manhattan, and with it not another understated Digital hardware announcement, but rather a "rock concert" setting, as one Digital engineer quipped a few days later back in Maynard.

It was pure Broadway – complete with pounding music as a backdrop, a laser light show, staged smoke, and a standing-room-only auditorium of some 400 customers, partners, press, analysts, and Digital and Oracle reps.

Enrico Pesatori, Computer Systems Division vice president, opened the show, welcoming the crowd, speaking of the strategic importance of the Digital-Oracle partnership in bringing customers to a new plateau in computing performance.

"The pure power of the new AlphaServer systems, coupled with very large memory capacity and the Oracle7 database, offers customers a whole new level of balanced performance for commercial and technical applications," said Enrico.

"With the AlphaServer 8400 and 8200 systems," said Pauline Nist, vice president of the Alpha Server Business Segment, "we've truly capitalized on the 64-bit architecture. Alpha 64-bit systems are not constrained by the 2Gb memory limits of 32-bit systems. Now Digital can put up to 14Gb of physical memory into the 8400.

"This gives us some stupendous performance advantages. In fact, the more complicated a transaction gets, the faster the performance speed-up is. This may seem counter-intuitive, until you understand what's going on."

TurboLaser's New York debut was meant to do just that – to help customers, partners, press and analysts grasp just how much more powerful Digital's new servers are than anything else out there. For example, Oracle has found in its own lab tests that the AlphaServer 8400, using the unique Very Large Memory option now available in Oracle7 only on the Alpha platform, runs the database portion of applications at speeds of not 20%, or even 200% faster than those of conventional 32-bit systems, but more than *200 times* faster! With those sorts of numbers, well, a little skepticism is to be expected.

Pauline – and the AlphaServer 8400 – gave a dramatic, live, on-stage demonstration of this capability. First, without the VLM capability of Oracle7 in operation, the 8400 server performed a typical large database operation in about 17 minutes. Then with the VLM option turned on, the same operation took under *18 seconds!*

Bob Palmer talked about the applications for this breakthrough technology, such as data warehousing, micromarketing, video-on-demand, online transaction processing (OLTP), computational fluid dynamics, molecular modeling, and genetic engineering.

"This exciting new technology demonstrates the capabilities of Alpha," Bob said. "Commercial customers running decision-support applications can extract vital information from mountains of data faster and more economically than ever before. We believe database access is the first 'killer application' for 64-bit computing. Today, we are demonstrating to customers what the power of 64-bit computing is all about."

Yet, appropriately, it was Larry Ellison, President and CEO of Oracle, who provided perhaps the day's most convincing endorsement of TurboLaser and Alpha itself.

"Accessing database information stored in RAM is 10,000 to 100,000 times faster than accessing data stored on disk," Larry said. Oracle7 Very Large Memory runs so much faster on a TurboLaser than on the fastest 32-bit platform for Oracle (also a Digital system, by the way) that, "when I first got the results of our testing, I simply didn't believe them."

For customers, Larry said, TurboLaser has several immediate and lasting benefits: performance, beyond mainframe functionality at open systems prices, and the reliability of Oracle's core technology.

In fact, Oracle is putting its money where its mouth is. The company is buying several TurboLaser systems to run its day-to-day operations, and is moving to implement 64-bit technology throughout the organization. He also said Digital UNIX is the fastest growing UNIX platform for Oracle7, growing in excess of 100% per quarter.

Tandem Computers, Larry noted, currently holds the record for TPC-C performance, at about 20,000 tpsC. "Oracle is convinced the TurboLaser-Oracle7 VLM combo can beat Tandem – hands down!"

Advanced Technology Components

The combination of Digital's 64-bit UNIX, the 64-bit Alpha architecture, and the Oracle7 64-bit database is the ideal combination for achieving unsurpassed performance gains. By using large amounts of main memory to store data, this end-to-end 64-bit solution leaves behind the current 32-bit barriers, such as number of users, performance and overall size of the database.

For its part, Oracle7 includes two significant technology components: Large Systems Global Area (LSGA) and Big Oracle Blocks (BOBs). "It was Engineering that named it BOB," Larry said, "not Marketing and not me, even though Bob [Palmer] is a great guy to partner with!"

LSGAs take advantage of Digital's 64-bit UNIX. The goal of the Oracle and Digital LSGA effort is to improve access of very large databases and make in-memory relational databases a market reality. LSGAs result in an increase in database blocks cached, more data in memory, and fast I/O completion compared to previous implementations. Rapid disk to memory transfer is achieved with BOBs, which enable blocks of data to reach up to 32Kb in size. This results in more contiguous data, more rows per block, fewer chained blocks, flatter b-tree index structures, and a very high number of extents per tablespace.

Support for OpenVMS, Rdb, Memory Channel

Oracle and Digital engineers are working on support of Very Large Memory technology in both Oracle7 and Oracle Rdb for OpenVMS Alpha systems. Digital expects this capability will follow soon after the implementation of 64-bit OpenVMS, at the end of this calendar year.

In addition, within six months, Digital will roll out enhanced UNIX cluster and new PCI Memory Channel technologies to further enhance the availability, scalability, and parallel processing of the combined Digital-Oracle solution.

Early Orders for TurboLaser, Alpha Milestone

On announcement day, Digital demonstrated that early demand for TurboLaser has been exceptional. Digital has already received more than 75 orders for the new machines. According to analysts at PaineWebber, Digital should

be able to sell more than 300 units in Q4, which could add as much as $100 million in revenue in the quarter and $50 million in gross profits.

Further, PaineWebber says, Wall Street may be underestimating the potential significance of Digital's leadership in 64-bit technology. TurboLaser will not only serve as a catalyst for revenue growth in 1996, but will also generate very positive excitement for Digital's midrange and low-end 64-bit products, the firm said.

Digital also announced shipment of its 100,000th Alpha system – to SmithKline Beckman, Philadelphia, which will use it for complex DNA sequence analysis. With this sale, total product and services revenues from the Alpha systems family have surpassed $3 billion. And Digital has shipped more than 13,000 AlphaServer 2100-class systems in just 12 months.

"At this rate, Bob Palmer said, "we expect to have reached $4.5 billion worth of Alpha systems and services before our major competitors – HP, IBM, and Sun – ship their first 64-bit system."

But Wait, There's More!

TurboLaser was not the only song sung just off Broadway that day. Digital announced that IBM's widely used CICS/6000 transaction processing monitor now is available for Alpha systems running the Digital UNIX operating system.

To help customers and independent software developers take advantage of AlphaServer performance, Digital is opening Database Technology Centers in the U.S., Japan, and Europe. Expertise will be provided to application developers for optimizing the performance of database applications, and migrating applications to AlphaServer systems.

Digital also is establishing a worldwide network of Expertise Centers for end-users, focused on key industries and disciplines: finance, manufacturing, telecommunications, and solution integration. They will provide practical demonstrations of Digital's cross-industry and industry-specific solutions and support services. Functions will include sales support and consulting services in information technology, systems integration, and systems engineering.

AlphaServer 2100 System

Digital also introduced the AlphaServer 2100 5/250 system. Priced from $59,960, this is the latest model of the award-winning AlphaServer 2100 family introduced a year ago. It incorporates the Alpha BIPS chip, and is the industry's most powerful system under $100,000.

In addition to these new AlphaServer systems, Digital introduced lower-end AlphaServer family models. They include the AlphaServer 2100 4/233, the AlphaServer 2000 4/275, and the AlphaServer 2000 4/233. Family members now deliver performance from 100 to more than 3,000 transactions per second (tps). Digital also introduced three new VAX systems that deliver 20 percent greater performance with no increase in price; SCSI-based OpenVMS Cluster systems; and the StorageWorks TL810 automated tape library. In addition, Digital announced performance-enhanced versions of the DECforms development and runtime product for OpenVMS VAX and OpenVMS Alpha systems, and the DEC Ada compiler.

"It's Merely About Speed, Right?"

Customers and partners continued their introduction to the new solutions from Digital and Oracle with a series of technical breakout sessions and a product showcase featuring demo's of applications in the four target market segments for the new AlphaServer 8000 products: database performance, mainframe solutions, high-performance technical computing, and the Digital installed base.

Press and analysts, meanwhile, met with Digital and Oracle executives for what turned into an unusually long Q&A session. Queried one punky European reporter of Larry Ellison, "...so what you're announcing is merely more memory inside a box, just more speed, right?" Larry's quick response crystallized the essence of the day – the fireworks of the formal announcement, the speeches, the demo's, the excitement Dave Fenwick and friends toasted the night before. "You don't seem to get it," Larry corrected the young reporter. "Speed? Yes, that's the message today. But 'just' more speed? Look at it this way: Columbus came over on a tiny ship, right? And you came across on a 747, right? So all we're talking about is speed, right?"

AlphaServer 8400 Shatters SAP R/3 Transaction Records

A day after TurboLaser took New York by storm, word came from SAP AG in Walldorf, Germany, by way of SAP America in Philadelphia, of results of the first benchmark for SAP's R/3 software on Digital's new AlphaServer 8400 5/300 system. The tests show that the R/3 SD (Sales and Distribution) benchmark running on Digital UNIX provides transaction throughput equivalent to mainframe-class performance.

Running on the new Digital AlphaServer 8400 5/300 configured with 8 CPUs, 6GB memory, Digital UNIX V3.2 and Oracle V7.1.4, SAP's SD benchmark achieved 36,000 transactions per hour with a response time under 1.5 seconds. This performance equates to 300 SD benchmark users supported on a single server.

"We are gratified by the flexibility and power 64-bit technology provides to our customers," said Paul Wahl, executive vice president of marketing for SAP AG. "With the AlphaServer 8400 we reached a new plateau of performance and scalability for our sophisticated mission-critical R/3 applications."

"With the AlphaServer 8000-series family, we can configure R/3 systems to support several thousand users, providing a comprehensive solution for customers requiring one central integrated database to manage extremely large projects with SAP's PS system," said Bertram Mandel, Digital's SAP marketing manager. "Using this combination of technologies, customers can maintain millions of accounts receivable, update huge numbers of master records, explode complex bills of materials in minutes rather than days, and process thousands of salary transactions in a few hours. This is the business environment that the AlphaServer 8000 family supports best."

Customers, Analysts, Partners Praise Alpha

Baxter Healthcare

Baxter Healthcare is replacing mainframes with AlphaServer 8400 systems running SAP R/3 and the Oracle7 database.

"The healthcare industry is changing and Baxter is changing with it," says Director of Technology Neal B. Ebert.

"The business is re-engineering our core business processes to improve service to our customers and reduce cost. Information technology is a key component to insuring the success of the re-engineering effort," he said. "We're melding our businesses to provide an integrated face to our customers. In addition, our customers are outsourcing their warehousing to us. That's great, but it means that we have to respond to their needs even better than they had responded themselves.

"The AlphaServer 8400 is a very fast box. It can be clustered, and gives us the reliability that's necessary. With its large memory and scalability, it gives us the processing power to run a $9 billion business.

"A fast box alone is not the answer. We wanted to buy from a company that has the services infrastructure to support us 24 hours a day, seven days a week. Digital has that capability."

Swiss Telecom PTT

Swiss Telecom PTT will run an enormous amount of finance, logistics, and project management applications on SAP R/3, using the power of two AlphaServer 8400 systems and Digital UNIX.

"Telecom PTT decided to purchase existing software and run it on an open, distributed client/server solution that could support more than 2,000 concurrent SAP R/3 users," says Jorg Boehlen, head of the Telecom PTT's R/3 Competence Centre.

"The role of the central database server is crucial in such a large client/server solution," Boehlen adds. "We chose the Digital AlphaServer 8400s because of their performance, 64-bit architecture, and scalable and expandable design."

First Data Health Systems Corporation

Current trends in the healthcare industry demand timely access to information. As consolidation and managed care models continue to impact healthcare, the need to access extremely large, complex databases grows exponentially. Add to this the challenge of including multimedia and expert systems, and the growing complexity of healthcare transactions becomes clear.

To address this need, First Data has developed information solutions that require powerful UNIX servers and an Oracle high-performance relational database. Digital's announcement of its Alpha 8400 and 8200 systems, which can store many gigabytes of an Oracle7 database in main memory, gives First Data customers a significant performance advantage not available on any other platform.

Telkom SA

Four Digital AlphaServer 8400s and the Oracle7 Very Large Memory database technology will power one of the largest UNIX-based client/server implementations in South Africa. The AlphaServer 8400 systems will connect through Digital's FDDI GIGAswitch to smaller AlphaServer 2100s linked to over 8,000 PC clients across the country.

"The ability of both the AlphaServer 8400s and the Oracle7 database to address more than 2Gb of memory was an important factor in our choice," said a spokesperson. "We wanted to put some of the database tables in memory to provide three-second response time to so many users.

"Digital's Alpha architecture provides the performance and growth capabilities central to the project's success. By starting off with 64-bit systems, Telkom has the advantage of being at the beginning of a new technology that can sustain growth for a considerable period of time without a change in architecture or operating system."

Maruti Udyog Limited

India's Maruti Udyog Ltd. will gain open systems technology, scalability and expandability, from its decision to replace its mainframe with a client/server environment built on four AlphaServer 8400 systems, says G.V.N. Sastry, Deputy General Manager, Information Services Division. Maruti Udyog collaborates with Suzuki Motor Co. of Japan to manufacture 70 percent of the passenger cars sold in India.

"We selected Digital's AlphaServers because of their awesome power and 64-bit technology, which will ensure longer life span of the systems compared to 32-bit technology," Sastry says.

"The scalable and expandable nature of the AlphaServer 8400 was also a factor in our decision. The AlphaServer 8400 is cost effective to support and to expand because its architecture is based on standards like the PCI bus."

Nanyang Technological University

Nanyang Technological University (NTU) is one of the premier universities in the Republic of Singapore. NTU's computer center provides both academic and administrative support for the university's 12,000 students. Low Kin Kiong directs the center:

"Digital's AlphaServer 8400 with the 300MHz 21164 chip is certainly a technological advancement. The performance per dollar is very attractive compared to Digital's competitors. NTU will certainly benefit from the system's power as we continue to expand our academic and administrative services."

Software Partners

SAS Institute

"When they jumped on the downsizing bandwagon, many SAS customers found that large applications didn't perform as well on 32-bit RISC servers as they expected," said Barrett Joyner, SAS Insti-

tute's Vice President of Sales and Marketing. "With the new 64-bit AlphaServer 8000 systems, these customers now have a viable platform to run their largest applications.

"For many of our customers, the ability to address very large memory is not only a significant advance, it is a necessity. We have optimized SAS for 64-bit addressing. Our customers who use it with very large memory will see significant performance improvements."

Red Brick Systems

"Customers looking for both performance beyond what any mainframe can deliver and high value for their IT investments can now have the best of both worlds," said Ram Srinivasan, Product Marketing Director of Red Brick Systems. "Scalable SMP combined with the raw speed and large main memory of Digital's AlphaServer 8400 systems complement Red Brick's parallel processing design. Response times are dramatically reduced, while a greater number of users gain simultaneous access to information. That's a tremendous competitive advantage."

Dun & Bradstreet Software Services

"The results achieved with Open Millennium on the Alpha platform are truly remarkable. Alpha provides the mainframe class processing power necessary for large companies to meet their changing business needs," said Mike Biery, Vice President of Millennium Development.

Information Builders, Inc.

"The performance and price/performance of the new AlphaServer line is outstanding. IBI's FOCUS on Digital's AlphaServer 8400 runs up to five times faster at one-tenth the published price of a comparable IBM ES/9021 mainframe. Significant performance gains were realized simply by increasing the AlphaServer's physical memory, which is inexpensive compared with the price of mainframe memory," said Mike Flom, General Manager, Digital Division.

"We anticipate significant increases in the number of concurrent interactive users as well. We believe IBI's partnership with Digital delivers a unique business value to our customers. The price/performance of Digital's new AlphaServers allows managers better insight into their business by permitting analysis to be done faster, better, and less expensively. Such analysis will separate the winners from the losers for the rest of the 1990s."

Channels Partners

Pioneer Standard

According to Pat O'Connor, Senior Corporate Marketing Manager for North America, "As Digital's largest selling partner, Pioneer is excited by the breadth of opportunities afforded by the new AlphaServer 8000 systems. Today's mainframe users want to re-engineer their businesses and implement client/server technologies. The new AlphaServer 8000 systems provide them with unprecedented performance at unprecedented prices.

"As an Oracle Business Alliance Partner, Pioneer anticipates that customers running Oracle7 Very Large Memory capability will see huge performance improvements with the very large memory solution Oracle and Digital offer on the AlphaServer 8000s."

Avnet Computer

"When you watch a demo that shows Oracle7 completing queries in seconds on an Alpha server with very large memory, compared with minutes on a system without it, your mind opens to opportunities you hadn't thought possible," says Bob Braverman, vice president, Digital Business Development, Avnet Computer.

"You think immediately of video-on-demand, data warehousing, worldwide geographic information systems, large on-line transaction processing applications. All of those were realistic only on mainframes. Now our customers can run them on AlphaServer 8400s at one-tenth the cost."

From Analysts...

"If Oracle runs much faster, that makes it a killer application that can change hearts and minds."
– *Jonathan Eunice, Illuminata.*

"This will be very helpful to selling Alpha to existing customers."
– *Barry Willman, Goldman Sachs.*

"For large Digital customers who need the headroom of more than four processors, this just might open the floodgates."
– *Chris Christiansen, IDC.*

"They clearly have the potential to maintain industry-leading price-performance with the Alpha [21164]."
– *Jim Brennan, Workgroup Technologies.*

"[Oracle] is an A-1 kind of partner."
– *Shau Wang, Smith Barney.*

"They may sell a lot of these puppies."
– *Tom Willmott, Aberdeen Group.*

...And the Press

Digital and Oracle effectively presented a strong and clear business news story that resulted in the widest coverage of any Digital product announcement to date. Coverage was exceptionally favorable and thorough.

At press time, 70 articles have appeared in business and trade publications and wire services in the Americas, Europe, and Asia/Pacific regions. These publications reach 6.6 million subscribers in the U.S. alone, and millions more through wire service stories in local papers.

The announcement also received more television and radio coverage than any previous Digital product announcement, reaching nearly 6 million viewers and listeners. Additional coverage is expected in monthly publications and as the product rollout continues worldwide.

Setting Up & Getting Ready

UNIX clusters

Digital UNIX

Rehearsal & Surprise Visitors

AlphaStation 2100

Senator Dole

AlphaServer 2100

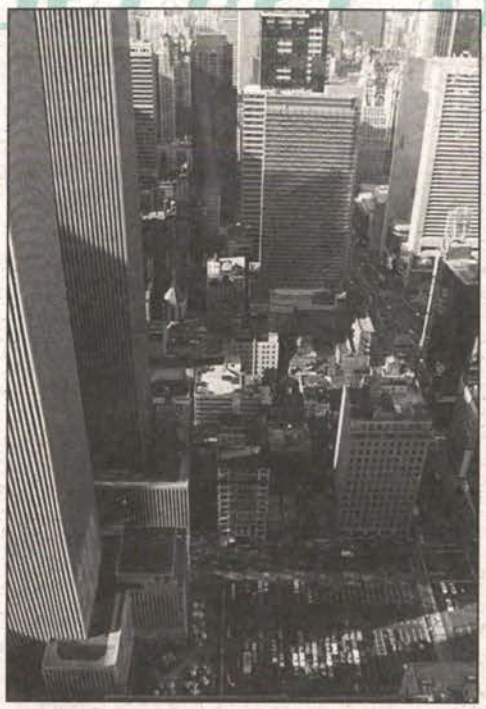
NY Senator D'Amato

AlphaServer 84

NY Governor Pataki

Multia

Executive Breakfast

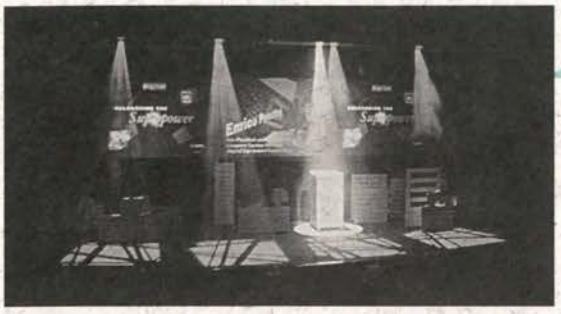


AlphaServer 8200

lphaStation 250

nVMS

The Event



April 11th New Product Showcase

– Lucien R. Philippon, AlphaServers Announcement and Communications Manager

As part of the Announcement activities on April 11th, Digital demonstrated most of the products and capabilities announced in a "SHOWCASE" at the Sheraton Towers Hotel, across the street from the "Main Event" in the Equitable Building. The objective of the SHOWCASE was to demonstrate the leadership performance of our newest products under four marketing initiatives: Database Performance, Technical Computing Performance, Beyond the Mainframe, and Installed Base Investment Protection.

Among the products displayed were:

AlphaStation 200
AlphaStation 250
AlphaStation 400

Multia Desktop Client
Celebris PCs

AlphaServer 400
AlphaServer 1000
AlphaServer 2000
AlphaServer 2100
AlphaServer 8200
AlphaServer 8400

Internet Server
SCSI-based cluster
Digital UNIX Clusters
StorageWorks Products
TL810 Automated Tape Library
CICS from Digital UNIX
Digital UNIX
OpenVMS
Windows NT

Within the SHOWCASE Digital had the privilege of being joined by a number of our outstanding Partners: Oracle Corporation; SAS Institute, Inc.; SAP of America, Inc.; Parametric Technology Corporation; Harlequin, Inc.; Scientific Visualization, Inc.; OpenVision Technologies; IBS Conversions, Inc.; Best Buy, Inc., Andersen Consulting.

Senator Dole's Presidential Campaign Comes to the Digital Product Showcase

Presidential candidate, Senator Robert (Bob) Dole and his organizing committee, in New York on April 10th for his New York campaign kick-off, asked the Alpha Servers group for use of our New Products SHOWCASE area as an "assembly room" before and after Senator Dole's formal announcement of his presidential campaign. This provided us with an opportunity for some photographs of Dole and his New York state Republican party against a backdrop of our new systems (see photo collage).


Partial Customer List

Digital Participates in Massachusetts Governor Bill Weld's Trade Mission to India

By Dick Willett

Bimal Sareen from the AlphaServers Business was recently invited to participate in Gov. Bill Weld's Trade Mission to India. *FOREFRONT* compiled a list of questions for Bimal to answer on Digital's participation on the trade mission.

Was the trip productive? Did the taxpayers pay for it?

The trip was extremely productive and hectic. Everyone worked very hard. Between the business and political events, the meetings with customers and partners, meetings with leading government officials and industry forums and chambers of commerce, one did not have much time to do much of anything else. I remember a lot of us complaining that it would have been great if there was at least a day that the delegates were free to have the option to rest. The trip was not paid by the taxpayers as each of the participating companies paid their own way.

How positive was the press in India?

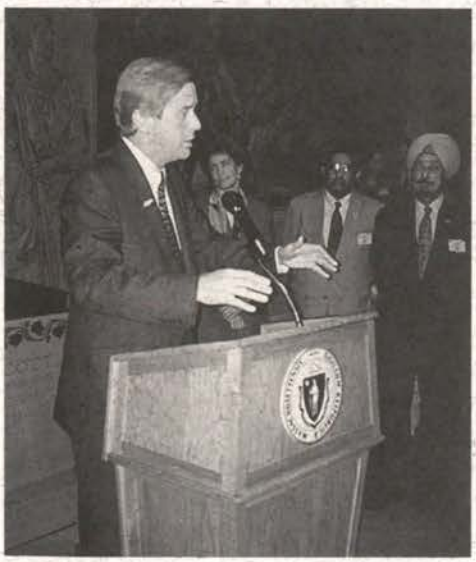
The press in India was extremely positive towards the delegation. They provided extensive coverage and provided a positive forum and platform for communication. They played an important role in making our trip successful. I came back with the impression that the press was pro-business and was becoming an integral part of creating a positive business environment in India.

What were Digital's goals? Were they accomplished?

From a corporate standpoint, we are aware of increasing investments by international companies from all over the world in the Indian economy. The investments are primarily focused on priority sectors consisting of Telecommunications, Power, Banking and Financial Services, and Manufacturing. For international companies to compete in India, they will have to transfer existing processes and create new ones for the local environment. This allows for significant opportunities for the IT industry and Digital.

As a result, Digital's goal was to raise the visibility of our company by marketing itself as a leading supplier of Information Technology equipment, solutions and services in these key priority sectors. Even though we have an existing operation in India, we felt that it was necessary to leverage the visibility provided by Gov. Weld's trade mission to promote our company at senior levels of government and business in these priority sectors of the Indian economy.

This goal was met with the visibility Digital got from this trip in India. Not only were we able to meet with, and market our capabilities with leading people in these key industries, but, to top it all, Bill Weld did an outstanding job in raising Digital's visibility and marketing our business.



Governor Weld describing his recent trade mission to India and thanking Digital for its participation.

Left to right: Vice President Mahendra Patel, Governor Bill Weld, Vice President Pauline Nist, Mr. & Mrs. Steve Holmes, Mr. & Mrs. Bimal Sareen.

Were there other benefits to Digital from this trip?

We were fortunate to have some business wins during this trip.

– I was able to convince a large international consumer products company to use Digital's Alpha technology for their newly evolving distributed distribution network. This win (they had earlier decided to go with a leading competitor) is expected to bring Digital in excess of $2 million over the next two years. They were sufficiently impressed with our story that I have been asked to present at the annual conference of CSI (Computer Society of India) later this year. (It turned out that the CIO who I sold to was also on the Executive Committee of CSI.)

– I was also able to convince a parallel supercomputer vendor based in India to migrate the implementation of their next generation architecture from a competitor to Digital's AlphaServer products. We expect to get in excess of $2 million over the next two years from this account. I feel confident stating that our participation was well worth our investment.

Did Digital have any events with the Trade Mission in India?

Digital India did an outstanding job hosting a reception for the Delegation. This was a good Public Relations and Marketing event. As a matter of fact, Digital, Mass., recently sponsored a reception at the State House for a high-powered Trade Delegation from India from the IACC (Indo-American Chamber of Commerce). Some event photographs are enclosed.

What did you think of the official delegation (Gov. Weld and his staff)?

Skepticism turns to Optimism: With an earlier impression that all Government equates to inefficiency at the expense of us taxpayers, I was pleasantly surprised, and actually quite impressed, with the staff that went along. The people I met and observed worked extremely hard. I didn't find any individual who did not add value, from the Secretary of Economic Affairs, Education, Environmental Affairs to the State Representative, from the head of the International Trade department to the various staff

Pauline Nist, VP Digital, describing Digital's recent successes in the market to Governor Bill Weld (center). Digital's Bimal Sareen (left) and IACC's president, Mr. S.S. Kanwar (right) look on.

people, they all worked hard and added value.

What did you think of the Indian market? What opportunities do you believe Digital has in India?

The Indian market is in an unprecedented boom. They have finally liberalized certain sectors of their economy for investment and international participation. When you combine this with a middle class of over 220 million people in the largest democracy in the world, the market is quite attractive for international businesses around the world. The liberalization of the economic policies has also withstood some significant changes in the political scene in India, and is now generally viewed as having crossed a point of no return.

The business fervor is intense from an international standpoint. Let me provide an example: I went to meet the head of the Department of Telecommunications through some family contacts to raise Digital's visibility in these markets and to analyze IT opportunities in this priority industry. It was interesting to meet the SVP of US West and New Zealand Telecom with their entourages waiting to get an audience with this person. I later discovered that his calendar was overflowing with international companies seeking an audience with him in order to penetrate this market.

International companies are all making, or willing to make, significant investments in India. Various countries around the world are sending trade delegations to understand and invest in these market opportunities.

After an analysis, in my opinion, Digital is well positioned with its existing presence in India. However, I also believe that there are opportunities for Digital to expand its focus by providing IT solutions in these key sectors where tremendous spending is, or is expected, to take place, e.g., telecommunications, power, banking and financial services and manufacturing. Competition is becoming more intense as international players from all over the globe are converging to take advantage of significant market opportunities. The business environment is extremely dynamic and new business models are evolving to take advantage of this situation. We have an unprecedented opportunity to take advantage of these business dynamics.

About...Bimal Sareen

Bimal Sareen has worked at Digital for 12 years. He runs New Business Development for their Network AlphaServers business (a $1B product line of Digital). He is active in the International Trade Committee of the Massachusetts Telecommunications Council, a member of the Massachusetts Software Council and is participating in the Commonwealth Exchange project. In his spare time, he is a volunteer for the MassTech Corps, an industry effort to help select school districts with computerization.

He has also created an Education Initiative where he is forming a partnership with the Massachusetts Executive Office of Education, the Governor's office, and India to create a schooling system in India that is modeled on the combination of the best of the Massachusetts and Indian schooling systems. This initiative already has $1 million of initial funding. He will also be hosting senior political and business figures from India over the next few months.

Digital Sponsors Reception at State House with Governor Bill Weld

Digital recently sponsored a reception at the Massachusetts State House for a business delegation from India representing the Indo-American Chamber of Commerce (IACC). Governor Bill Weld, Secretary of Economic Affairs – Gloria Larson, Secretary of Education – Piedad Robertson, Executive Director for International Trade – Nick Rostow, Director of Asia Trade – Kathleen Molony, and State Representative Rob Kraus were amongst the State Government attendees.

The IACC delegation was led by IACC President S.S. Kanwar, IACC VP Hemant Sonawala (also Chairman of Hinditron, Digital India's Joint Venture partner) and IACC VP Raghu Mody. The Digital attendees included VP Pauline Nist, VP Mahendra Patel, Steve Holmes, Bimal Sareen, Ann Hurd, Tom Ehrgood, Vijay Thakur, and Dick Willett.

Vice President Mahendra Patel of Digital officially thanks Governor Weld at the reception.

Vice President Pauline Nist (right) with Hinditron's Chairman and Digital India's Joint Venture Partner Mr. Hemant Sonawala (center) and IACC's president, Mr. S.S. Kanwar.

Digital's Bimal Sareen, Governor Weld, S.S. Kanwar (IACC president), and Steve Holmes, Director, Digital's AlphaServers Business.

Chairman Hemant Sonawala of Hinditron (VP of IACC delegation), Bimal Sareen of the AlphaServer Business and Ian Davison, Chairman of Loren International.

Governor Bill Weld with Digital's Bimal Sareen.

Central Part/Product/Service Identification Function

By June Davenport
Manager, Chief Engineer's Office

Everyone is familiar with the many changes that have occurred within Digital over the past year. As a result, some people may not know that there is a central place to go for part numbers and part number related issues.

While we are the Unified Identification Domain, we are probably best known as the Chief Engineer's Office, one of the few group names that has remained consistent over the past many years. It is important that people know who we are and where to find us, particularly in the midst of so much organizational change. Dick Best was Digital's Chief Engineer from 1959 until his retirement in 1992. In the early days, all the engineers worked for Dick and he supervised all circuit design. Dick was the architect of Digital's Unified Identification System and the functional identification model that won our part numbering system a Best-In-Class rating by Booz-Allen. The functional classification structure supports design reuse and allows us to use model numbers as a simple language to enhance communication. The center of expertise for part/product/service identification has continued to reside in the Chief Engineer's Office as an enterprise-wide function with a worldwide focus.

In the new corporate structure, the Chief Engineer's Office, or Unified Identification Domain, is under the Corporate Standards organization in ATG. This ensures that this critical function continues with continuity across the enterprise, independent of organizational change, and reinforces the worldwide scope of the domain.

Many of you may be familiar with the 2-5-2 or 2-5-2.4 format for Digital part numbers or part identifiers that is described in Digital Standard 012-0. It may be surprising, however, to know that our 2-5-2.4 structure is less than ten years old. As late as 1969, all options and modules were identified by 4 characters or less. Our processors such as the PDP-4 and PDP-8 were designated as 11/04 and PDP8. Dick Best created the Unified Numbering System by attaching the 2-character classification that was used to group purchased discrete components to the model number. Salable hardware first used 2-5-2 model numbers in 1977, and then only for packaged systems. Salable software began using a 2-5-2 structure in 1988, only seven years ago. The .4 portion of the 2-5-2.4 part identifier represents revision and was formalized in 1986. It is used to manage the engineering development and manufacturing processes and to enable the field to understand the full configuration implications of a customer installation for both servicing and follow-on business. Digital does not price or quote by revision.

Within any class of parts or part class, there is the potential for 78 billion parts. Fifty-eight percent (approximately 650) of the possible part classes have been assigned or reserved for use. About 1.5 million parts have been assigned over the history of the company in these part classes. While this is certainly a large number of parts, we are in no danger of running out of numbers. We do have to be efficient about how we structure part numbers and assign part classes, however, so that we are effectively managing our part identification system as an asset and ensuring its extensibility over time to new products, new technology, and new business models.

While our functional responsibility for overall management of Digital's Unified Identification System has been centrally positioned, much actual part number administration has been distributed. Digital Standard 012-2 documents the part classes that have been assigned for use and to whom we have delegated administrative responsibility. We continue to be directly responsible for all hardware part/product numbering conventions and administration, for software numbering conventions (Digital Standard 012-4) and for Manufacturing intraplant numbering conventions (Digital Standard 012-5).

The Option/Module System supports our management of the overall Unified Identification Domain and the hardware part/product numbering conventions and process. Online inquiry is available to all internal Digital employees through VTX CEO. A recent enhancement now provides flexible multifield inquiry, eliminating the limitation of inquiry by product/part number.

The Chief Engineer's Office has strongly advocated using vendor and third-party part numbers internally to eliminate the need for creating a second (and sometimes a third) layer of Digital internal part numbers along with associated product information. This is a common theme that has many supporters across the company. There are a number of internal constraints, both process and systemic, to this, however. One of the most obvious is the field length for part numbers, which in our internal systems is limited to 5-2,

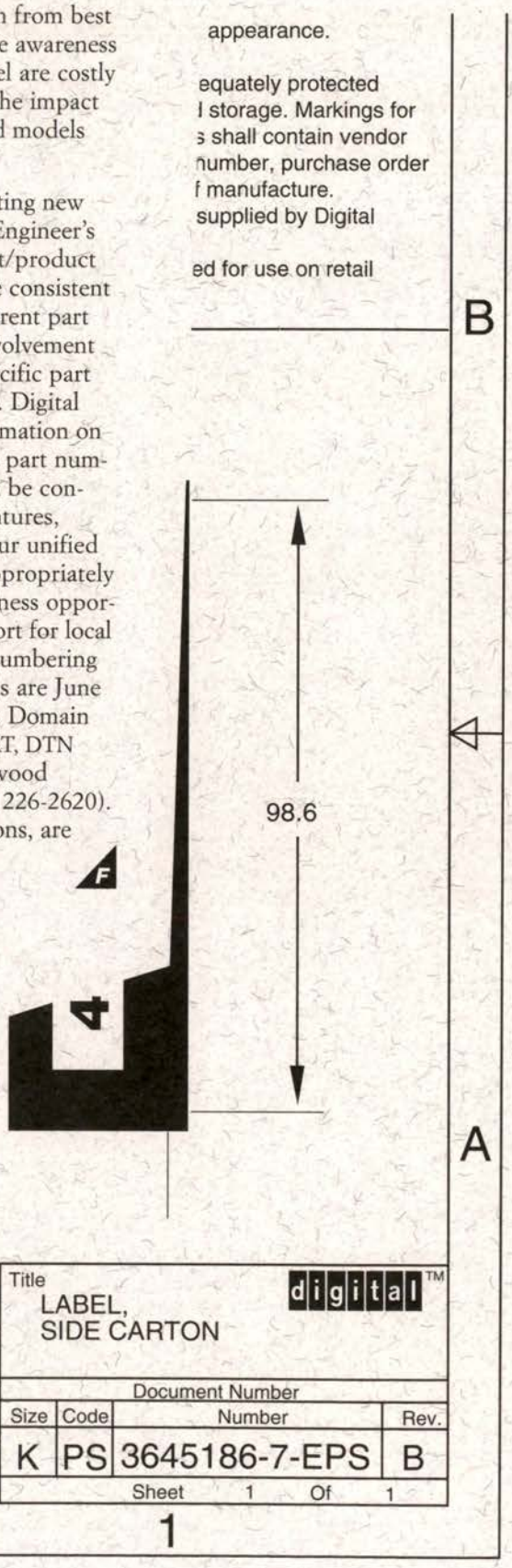
2-5-2, or 2-5-2.4. The industry standard for EDI is 35 characters. SAP R/3 has a part number field length of only 18 characters, however, and will need to be enhanced to handle a 35 character field. We need to understand what it would take to move to multiple field lengths and multiple part formats and how they would successfully coexist in Digital's systems and processes. We, as a company, stand to gain a great deal if we can successfully integrate customer, partner, supplier, and Digital part identifiers.

In spite of our Best-In-Class rating by Booz-Allen, there are several areas where we as a company are inconsistent with best practices for part/product/service identification. Our data reference model of a 1:1 relationship between part number and price, part number and source/supplier (and associated leadtime), part number and segment code, and so on, while sufficient to support Digital's business at one time, are not adequate for the current business model. The result is that part numbers have become the mechanism to implement non product attributes, such as different pricing and business practices, revenue credit to different business units or channels, local versus corporate sourcing, and so on. While this certainly has enabled business and marketing strategies, it has not been without cost. Managing the complexity of multiple orderable part numbers, multiple BOMs, multiple configurations, multiple prices, and the resulting confusion in the field and sales organizations ultimately impacts Digital's bottom line.

Reinforcing the functional classification model for product identification provides a significant opportunity to reduce internal costs. In those areas where we as a company are not consistent with this model, our goals are to influence the necessary changes to move us back toward alignment.

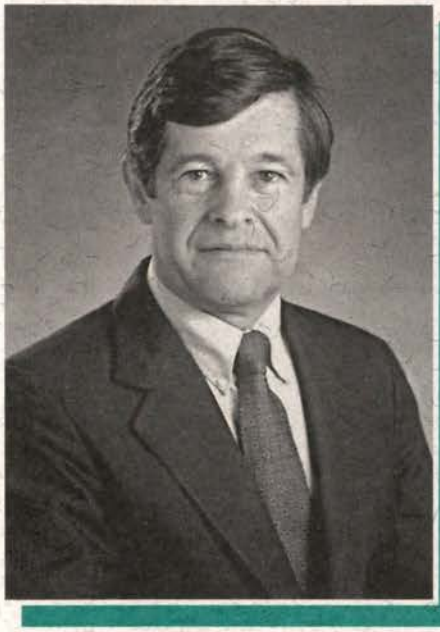
In areas where new business models or practices will cause a deviation from best practices, our goals are to raise awareness that deviations from this model are costly to the company and to make the impact of these business practices and models visible.

It is important for people starting new projects to contact the Chief Engineer's Office so we can establish part/product numbering algorithms that are consistent with best practices and a coherent part identification model. Early involvement will eliminate delays when specific part numbers are required later on. Digital Standard 012-2 provides information on the contacts for non hardware part numbering. In addition, we should be contacted when there are new ventures, acquisitions, and so forth so our unified identification model can be appropriately extended to support new business opportunities. We also provide support for local and geographic specific part numbering requirements. Primary contacts are June Davenport, Part Identification Domain Manager (JOKUR::DAVENPORT, DTN 226-2611) and George Greenwood (JOKUR::GREENWOOD, DTN 226-2620). Digital Standard 012, all sections, are available through VTX SMC.



Promotions and Management Changes

By Dick Willett



Vice President Jesse Lipcon Assumes New Responsibility

Jesse Lipcon has assumed responsibility for Product Management and Development for the SBU's Systems Business Group. The Systems Business Group was formed by combining the current Alpha Systems Business Group and the OpenVMS Systems Business Group.

This consolidation is a further evolution of the PM&D organization, building on the synergy among the Alpha/VAX platforms to enable greater customer satisfaction. The single focused leadership this combination allows will, among other advantages, encourage better management of the mix of Digital offerings.

In this capacity, Jesse is responsible for ensuring the completion of the PM&D implementation. Under his guidance, the existing PM&Ds will continue their progress toward stand-alone businesses that deliver high-quality, low-cost systems to Digital's customers.

Reporting to Jesse are:

- Workstation Business Segment, Philippe Ribeyre
- Server Business Segment, Pauline Nist
- UNIX Business Segment, Don Harbert
- Windows NT Business Segment, Lucia Quinn
- OpenVMS Systems Business, Wes Melling

Vice President Enrico Pesatori said, "Jesse has shown great success in sustaining OpenVMS customer satisfaction and revenue. He has over 29 years of engineering experience, including the last 23 years with Digital and carries the prestigious Corporate Consulting Engineer title. Jesse holds bachelor's and master's degrees in electrical engineering from the Massachusetts Institute of Technology, where he was elected to Tau Beta Pi and Eta Kappa Nu. Please join in wishing Jesse continued success in his new role."

Lucia Quinn Takes Over Windows NT Business Segment

Lucia Luce Quinn has been appointed Vice President, Windows NT Business Segment, reporting to Jesse Lipcon, Vice President, Systems Business Group.

The mission of the Windows NT Business Segment is to establish Digital as the leading systems vendor for Windows NT, creating robust, reliable, and scalable systems solutions for a broad range of customers on both Alpha and Intel platforms. Lucia will lead the Windows NT Business Segment team in working collaboratively with internal platform partners, ISVs, and Microsoft to develop and market superior products supporting NT, PC interoperability with VMS and UNIX Systems, ease-of-use products to support PC enterprise setup and configuration, and award-winning NT cluster technology.

Lucia has most recently served the Computer Systems Division as Vice President, Business Strategy Group. In this role, she led efforts to develop the strategic framework for the Division and to define the questions and recommendations for issues of strategic importance to CSD and the Corporation in the areas of platform and product strategy, investments and divestitures, and market segmentation.

Prior to joining CSD, Lucia was Vice President, Corporate Strategy and Alliances. Among many contributions in this role, she and her group laid the market-facing, layered IT industry framework that supports Digital's current Business Unit and Division structuring.

Before joining Digital, Lucia spent three years as Vice President and Senior Partner at Harbor Research Corporation of Boston, Massachusetts, a strategy and technology consulting and research firm. She also worked for seven years at Westinghouse Electric Corporation in strategic planning and communications for the advanced technology business units.

Lucia earned a B.A. in Management from Simmons College, Boston, Massachusetts, and is listed in the 1993/94 Who's Who Registry of Global Business Leaders. Please join in wishing Lucia continued success in her new role.

Wes Melling Joins Digital as VP OpenVMS Business Segment

Wes Melling has joined Digital Equipment Corporation as Vice President for the OpenVMS Systems Business, reporting to Jesse Lipcon. In this position, Wes is responsible for sustaining OpenVMS customer satisfaction and revenue, a role for which he is uniquely suited, having "industry watched" Digital over the past four years as Program Director for Midrange Computing Strategies in the Gartner Group.

Vice President Jesse Lipcon said, "We are very excited about Wes joining the Digital team. His strategic background, forecasting capabilities, special consulting expertise in the areas of open systems, mission-critical transaction processing, and the development of enterprise information architectures will be welcome in the OpenVMS Business, the Systems Business Group and the entire Corporation. Furthermore, during his most recent experience within the Gartner Group, he has developed strong relationships with several hundred large OpenVMS customers.

"Before Gartner, Wes was Senior Vice President of Information Resource Management at the Ingram Distribution Group, Inc., where he was responsible for systems support for the nation's largest book distributor and third largest video distributor. He has also been President of Managed Healthcare Systems, a consulting firm specializing in strategic and MIS planning for the healthcare industry, and was the Chief Information Officer of HealthAmerica Corporation, where he ran a $12 billion business on a network of OpenVMS systems. Wes worked at Digital between 1979-1985, in product marketing and software product management roles. His first position within the computer industry involved selling IBM mainframes to large New York banks.

"Wes graduated from Trinity College after receiving a full scholarship, with a B.A. degree in Psychology and Economics. Please join in welcoming Wes back to Digital!"

Steven Hobbs Promoted to Senior Consultant Engineer

In recognition of his contributions to Digital's compiler technology and system architecture technology, Steven Hobbs has been promoted to Software Engineering Senior Consultant in the Core Technologies Group.

Steve has been instrumental in designing and implementing GEM optimizer technology that has helped provide Alpha with record-setting SPEC performance as described in The Race for 500 SPECfp article also appearing in this *FOREFRONT* issue. Specifically, Steve was responsible for software pipelining and for working with the Semiconductor group to transfer advanced development on speculative execution into production in GEM. In addition, he was a founding member of the "Riscy VAX" committee that did the initial design of what became the Alpha architecture and he has been a corporate resource on IEEE Floating Point support in both hardware and software.

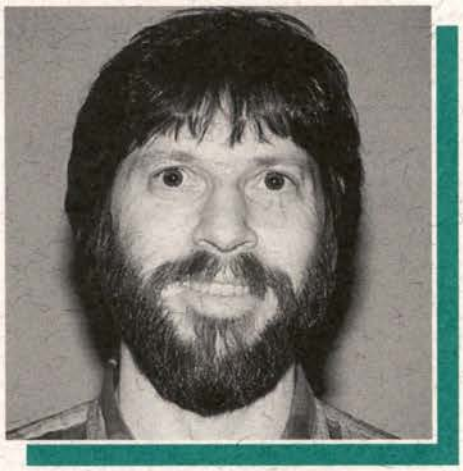
Before his current assignment on the GEM team, Steve also worked on the VAX FORTRAN compiler and was project leader for the VAX PASCAL compiler. He was a member of the A/D project that was the precursor of the GEM project. Steve also worked at Alliant Computer Systems Corporation as the compiler architect, designing new compiler optimizations in support of vectorization, concurrency, and memory hierarchy. In addition to his engineering work, Steve has taught graduate computer science courses at the University of Lowell.

Steve did his undergraduate work at Dartmouth College where he worked on the original Dartmouth BASIC. He did graduate work at University of Michigan and Carnegie Mellon University. In his spare time, Steve likes to do competitive orienteering.

Charlie Mitchell Promoted to Senior Software Consulting Engineer

Charlie Mitchell of the Core Technology Group was recently promoted to Senior Software Consulting Engineer. Charlie was promoted for his leadership in delivering the robust and financially successful DEC Ada product portfolio, for his engineering process leadership, and for his significant consulting role on Ada product and languages issues. He is currently leading the DEC C++ compiler team.

Charlie's work on Ada resulted in a VAX compiler which established the standard among compilers in the industry for Ada language fidelity, robustness, and performance. Over the past ten years, Digital's Ada product family has earned over 100 million dollars in software revenue and leveraged over a billion dollars in system and service revenues. As DEC Ada project leader during those years, Charlie's excellent engineering process leadership, ability to develop and maintain a cohesive and productive team, and superb technical leadership all contributed to the result. Charlie has been a primary corporate contact for Ada language and product-related issues and an advocate of direct customer and field contact. He provided extensive customer consulting and was a major factor in business wins. He also served in an industry consulting role through his language standards effort for Ada 83 and Ada 9X, serving as a member of the international standards group responsible for Ada from 1988 through 1993. In 1989, Charlie was invited to join the Ada 9X Distinguished Reviewer design board.



Tom Van Baak Promoted to Senior Consultant Engineer

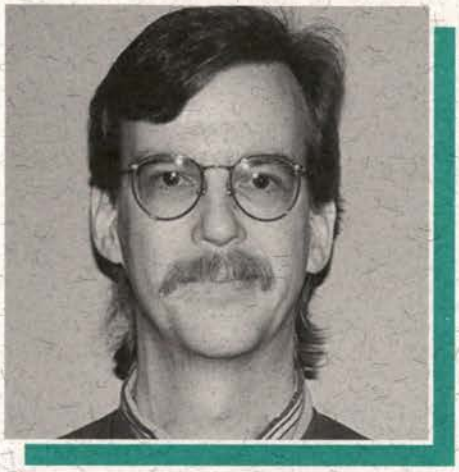
Tom Van Baak was recently promoted to Senior Consulting Engineer. Tom was one of the primary contributors to the initial port of Windows NT to Alpha, focusing on run-time libraries, Structured Exception Handling, Floating Point emulation, and other software architecture issues. Since the first release, Tom has been working on system performance issues, and was instrumental in helping to significantly improve the performance of Windows NT on Alpha for the recent V3.5 release. Most recently, with the help of the Windows NT and GEM compiler teams, Tom has started looking into the issues around supporting byte and word instructions on Alpha, and has already run the VI editor in his Alpha-on-Alpha emulator.

Todd Dutton Promoted to Consultant Engineer

Todd Dutton was recently promoted to Consulting Engineer in the Alpha Personal Systems Group. Todd was promoted for his leadership in the architectural definition and development of the AlphaServer 1000 product, as well as his leadership in the development of the DEC 3000 Model 600, 700, 800, and 900 workstations. Each of these products have been industry-leading products in the area of high performance and/or price/performance.

Todd joined Digital in 1987 as project leader for the vector processor design of an advanced development system project, and worked on several other advanced development projects. He holds a patent on vector register file design stemming from this work. In 1990, Todd joined the Alpha Personal Systems Group as a member of the DEC 3000 development team. He was a major contributor to the architectural and timing verification specifications, and subsequently led the development of the system module design of the DEC 3000 Model 400 and 500. Following this, Todd led the team that delivered the higher-performance models of the DEC 3000. In large part due to Todd's personal efforts on the DEC 3000 program and follow-on products, Digital has continued to maintain a leadership role in workstation performance across the industry for the past two years.

Prior to joining Digital, Todd worked for Numerix Corporation, where he was project leader for the NMX-432 array processor, and for Signal Processing Systems, Inc., where he was a member of the SPS-1000 development team. Todd is a graduate of MIT, and holds an S.B. in Computer Science.



Steve Jenness Promoted to Software Consulting Engineer

Steve Jenness was recently promoted to Software Consulting Engineer. Steve was the project leader for the initial port of Windows NT to Alpha, and had his hands in many areas across the system during the port project. Following the first release, Steve was the project leader for the Windows NT AlphaServer 2xxx project, and implemented all the Alpha-specific multiprocessor support. Most recently, Steve has assumed responsibility for the ongoing engineering relationship with Microsoft, and is leading a team of engineers in addressing the many issues that arise as the future versions of Windows NT are developed.

Paula Long Promoted to Software Consultant Engineer

Paula Long was promoted for her work as the technical project leader for the symmetric multiprocessing (SMP) super project within USG for V3.0 of DEC OSF/1. A super project within USG is defined to be a technically complex project, like SMP, which has wide implications across the operating system as a whole.

Paula joined Digital in 1986. At Digital, Paula has worked in the UNIX Systems Group since February 1992. Paula worked for the Realtime Group in Marlboro, MA before joining the UNIX systems group. Prior to Digital, Paula worked for the LFE Corporation for two years and the N.S.W.C. for half a year.

Paula joined USG in February 1992. In USG she has successfully completed a number of assignments. Paula led a team of engineers in the evaluation/port of the OSF/1 R1.1 to the Alpha platform. She was the SMP Super Project leader. Paula functions as a general consultant on threads, realtime, SMP, etc. She, as Kernel tools project leader, led the investigation for support of large memory configurations (14gb).

Paula has written numerous internal documents and has given numerous internal and external talks on subjects ranging from Realtime to SMP.

Education: B.S.C.S. 1983, Westfield State College.

Mike Rosenblum Promoted to Consulting Engineer

Throughout his 12-year career at Digital, Mike Rosenblum has used his systems and computer graphics knowledge to design and develop Digital's graphics terminal and workstation products. Two recent outstanding contributions were significant factors in his promotion to consulting engineer:

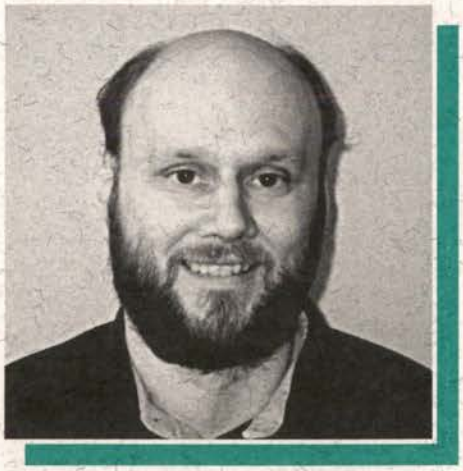
- leading the graphics software team for SPX graphics, the fastest 2D graphics ever shipped on a VAXstation.
- leading the Xserver development for Pixelvision 3D graphics, now shipping as the ZLX-M family of midrange graphics options.

Mike started at Digital in 1981 working with the VMS development group in Nashua as a summer student. In 1983, after his graduation from Worcester Polytechnical Institute, Mike took a full-time job in VMS and began his career in graphics with the responsibility for VMS terminal services. Since then he has been working on window systems, graphics drivers, and graphics systems design. Currently he is manager of the X windows engineering team in the Workstations PMD.

Andy Russo Promoted to Hardware Consultant Engineer

Andy was recently promoted to Hardware Consultant Engineer for his significant contributions and/or intellectual property toward: the AlphaServer 2100 PCI subsystem; DEMFA XMI to FDDI high-speed adapter and error detection technology. Since joining Digital in 1983, Andy has been a project leader for several internal organizations, including the Mid-range I/O Options Group, Fault Tolerant Systems Group and the Server Business Segment.

While at Digital, Andy has contributed to the architecture and design of several high-performance ASICs and modules for many successful products. Andy holds several patents; has authored several papers and has conducted PCI seminars for other engineering groups within Digital. Andy has been working closely with the Video On Demand (VOD) group to help characterize the necessary features required for servers to meet the demands of video server applications. Andy received a B.S. in Computer Engineering from Boston University.



Al Wojtas Promoted to Consultant Writer

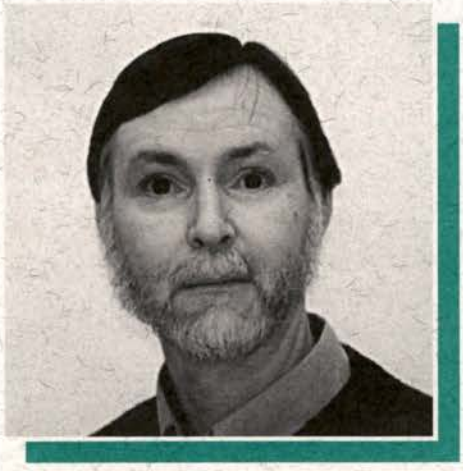
Al Wojtas has been promoted to Consultant Writer in the UNIX Software Publications Group. Al was promoted for his work on documenting how to write device drivers for DEC OSF/1 systems.

The audience for Al's work is Digital and third-party engineers who write device drivers for DEC OSF/1 systems. The driver documentation set, which Al planned and wrote, includes tutorial, reference, and bus-specific books. All the books make extensive use of examples. For example, the *Tutorial* integrates the code for an entire driver into the book, explaining each topic in relation to the relevant portion of driver code. The *Tutorial* and *Reference* books are being published by Digital Press as a single volume, *Writing Device Drivers: Tutorial and Reference.*

Al is an expert in the area of modular documentation. He is a co-developer of a string replacement utility, strep, for which he is a co-holder of the patent "Document Generation Using Information Engineeering." The strep utility allows a writer to put text into "information objects" that are called into a document using tags. Writers in the UNIX Software Publications Group and other writing groups have used this utility to take advantage of the features it provides for creating modular, reusable documentation.

Al joined Digital in 1982 as a writer for the RSTS/E Group and has been a mem-

ber of the UNIX Software Publications Group since 1985. He was a contributing author to the first edition of the book *X Window System – C Library and Protocol Reference.* Al has taught technical writing courses at the Wang Institute of Boston University and at Rivier College. He has a B.A. (cum laude) in English from the University of Lowell and an M.A. in Technical and Professional Writing from Northeastern University.



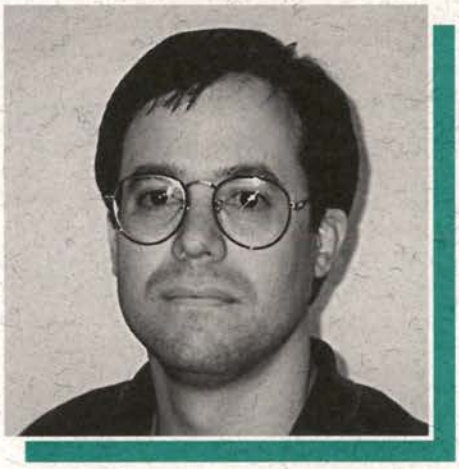
Dan Wissell Promoted to Consultant Engineer

Dan Wissell has been promoted to the position of Hardware Consulting Engineer within the Server Business Segment Platform Development Organization. Dan has more than 20 years of industry experience in analog and digital circuit design and test. He has been at Digital for 14 years and has worked within the server organization since 1989. He has contributed heavily to the Laser platform which has been shipping for over two years and to Turbo Laser which is about to ship. He has become a recognized expert across the company in the areas of distributed power systems, on-module energy management and high-speed clock systems. Dan developed the ultra low skew sinewave rf clock generation and distribution circuits for the CPU and system for both Laser and Turbo Laser products. Dan also had the design responsibility for module energy management and power control. The distributed power systems filtering, decoupling and power sequencing techniques had extraordinary requirements that demanded unique solutions.

Currently, Dan is designing the power control and power distribution system for Digital's next generation of servers. His extensive background in signal integrity, microwave domain signaling, EMI/RFI and power systems make him a key technical contributor in the development of this new platform.

Since starting with Digital in 1980, he has been awarded several patents for his test methods and apparatus for interconnect and his power supply interlock for distributed power systems. Several more patents were filed on his Laser and Turbo Laser work. He also has authored papers and presented to the IEEE community.

Dan graduated from Keene College with a B.S. in Electro-Mechanical Engineering.



Jim Woodward Promoted to Consultant Engineer

Jim Woodward was promoted to Consultant Engineer as the result of his outstanding contributions over the past ten years in the UNIX Systems Group and specific contributions as the DEC OSF/1 Technical Leader for the SMP kernel project. Jim has been actively involved in SMP related issues for a number of years. He was the Technical Project Leader for SMP on ULTRIX. He also performed an evaluation of the OSF/1 R1.0 and OSF/1 R1.1 SMP implementations and provided a detailed analysis of strengths and weaknesses.

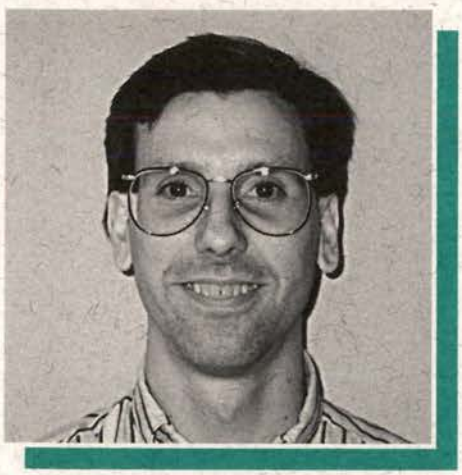
In Jim's role as the DEC OSF/1 Technical Leader for the SMP kernel project, he led a team of five engineers in the parallelization of the process management subsystem and he worked with VM, File System and Networking Engineers on the parallelization of their components. The role also encompassed working with the hardware support teams in the parallelization of platform specific SMP issues.

Jim joined USG in 1984 as a VAX8200 System Port Project Leader. He was Technical Project Leader for ULTRIX SMP project, 1987-1991.

Jim was a Technical Team Leader for Server Hardware Ports, 1984-1989. Finally, he was a Microcode Development Team member for VAX8200, 1981-1984.

Education: University of Michigan, B.S.E.E. 1981.

Worcester Polytechnic Institute, Graduate Courses 1982-1983.



Steve Zalewski Promoted to Consulting Software Engineer

Steve Zalewski has been promoted to Consulting Software Engineer. Steve's promotion is the result of his many accomplishments over the past 13 years in the OpenVMS Group at Digital. In particular, Steve's promotion was awarded in recognition of his leadership in delivering the Polycenter Software Installation product and associated architecture (SPIA) in OpenVMS version 6.1.

Steve is a graduate of Worcester Polytechnic Institute, where he received a bachelor's degree in Computer Science. In 1981, Steve joined the OpenVMS group. Over the years, Steve has held a variety of technical contributor and project leader positions with OpenVMS. His span of technical responsibilities have included RMS file sharing, VAXstation graphics device drivers, project leader for the VAXstation 3100 workstation and project leader for DesktopVMS.

Steve is currently the technical leader for the Enabling Technologies Group within OpenVMS, which is focused on delivering technology that will attract applications to OpenVMS.

Patent Award Recipients

Several distinguished guests, including Vice President Jesse Lipcon, Vice President Larry Walker, Assistant General Counsel/Intellectual Property Law Art Fisher, PM&D Patent Engineer Joe Jasniewski and Networks and Storage Patent Engineer Dave Rouille, attended Vice President Bill Demmer's quarterly patent award recipients breakfast. These gentlemen were there to offer their support and congratulate the patent recipients. The patent recipients included people from Product Management and Development, Storage Architecture Group, Networks Products Group, Components Group and Peripherals Group. Seated, left to right: Mike Romm, Bob Simcoe, Nitin Godiwala, Joe Jasniewski, Jesse Lipcon, Dave Rouille, Larry Palmer, John Benson, Jim Fritscher. Standing, left to right: Russell Iknaian, Art Fisher, Ricky Palmer, Larry Walker, Philip McKinley, William Gist, Jeffrey Metzger, David Tatosian, Dan Belanger, Don Smelser, Larry Mazzone, John Grooms, Paul Wade, Matt Benson, Paul Goodwin, Bob Willard, Barry Maskas, Bill Demmer.

Colorado Springs Patent Award recipients:
Mike Tusler, Clark Lubbers, Richie Lary (l to r).

Uncovering Our Hidden Assets – Patents

by Art Fisher, Assistant General Counsel, Intellectual Property Law

This is an exciting time in the world of patents. Corporations, individuals and governments are becoming more aware of patents and are actively exploiting them. Increasingly, many companies are using patents to protect their market share, meet the onslaught of increased competition and boost profits through expanded patent licensing fees.

So, just what is a patent? A patent is a government grant of a limited monopoly (i.e., the right to exclude others from making, using or selling an invention for a period of 20 years) in return for disclosure to the public. Every industrialized country in the world has a patent system. Recently, as you may have read in the newspapers, there has been a global attempt through the GATT Uruguay Rounds to harmonize the patent process worldwide. No doubt, this effort was driven by the growing importance of patents to the global economy.

At Digital, we have a rich history and a bright future of engineering and design excellence. In recent years, Digital has grown its patent portfolio in recognition of that excellence and as a necessity to compete in today's world of heightened patent awareness. For example, Digital has one of the most extensive portfolios of Software, Networking and System patents in the industry. In addition, we are also growing a very respectable portfolio of semi-conductor patents.

To maximize the value of our patent portfolio, Digital's Patent Law Group has begun to work with Business Units more closely to help them achieve their business objectives with effective patent strategies. These patent strategies or business plans will include competitive analysis and identification of technologies for patenting to support current and future Business Unit objectives.

As a result of these efforts, Business Units will be able to use their patent portfolios to help stake out present and future market opportunities and to generate royalty income. To insure the success of the latter, the Patent Law Group is actively seeking to expand the charter of the Corporate Licensing Office by urging that they be given a corporate mandate and increased resources to support more expansive licensing activity.

By working with the Patent Law Group and the Corporate Licensing Office, Digital's Business Units can uncover and take full advantage of their hidden assets.

AlphaServer 2000 and 2100 Family Continues to Shine

By Kathe Rhoades, AlphaServer Engineering

Digital is enhancing its AlphaServer 2100 and AlphaServer 2000 families with the addition of higher-performance models and upgrades, and is continuing to garner awards for its established models. The new models provide leadership performance and price/performance for environments that require quick response times, fast application processing, and uninterrupted service.

Since their introduction only a year ago, AlphaServer 2100 systems have established an enviable reputation in the Alpha-based server market. With processors based on Alpha microprocessors, symmetric multiprocessing up to four processors (two processors in the AlphaServer 2000 system), and high-performance, industry-standard PCI I/O, these systems have demonstrated exceptional throughput to meet rigorous application processing requirements.

In March 1995, Digital and Sybase, Inc., announced the fastest TPC-C performance ever achieved for Sybase SQL Server System 10, using Digital's four-processor AlphaServer 2100 4/275 system running the Digital UNIX operating system. Sybase SQL Server 10 achieved a transaction rate of 1,708.12 transactions per minute (tpmC) (four processors at $555/tmp-C), establishing a new performance benchmark.

This spring Digital introduced the highest performing model in the series yet, the AlphaServer 2100 5/250, based on the second-generation implementation of the Alpha architecture, the Alpha 21164 microprocessor. Digital also offered in-cabinet processor upgrades based on the first-generation Alpha 21064A microprocessor and the second-generation Alpha 21164 microprocessor. These product introductions will ensure that Alpha-based servers continue to maintain their competitive edge by offering cost-effective incremental expansion and providing a very high degree of investment protection.

AlphaServer 2100 5/250

The powerful new AlphaServer 2100 5/250 provides the highest level of performance in the AlphaServer 2100 series through its use of the new Alpha 21164 microprocessor, a super-scalar, super-pipelined implementation of the Alpha architecture with low average cycles per instruction due to quad instruction issue. The system runs at 250 MHz with a second-level, 96-kilobyte, on-chip 3-way set associative write-back cache and a third-level, 4-megabyte on-board cache.

The system derives its performance excellence from:

- Architectural improvements provided by the Alpha 21164 microprocessor
- Synchronous design of the third-level cache and system interface
- Implementation of a duplicate tag of the third-level cache
- Implementation of a write invalidate cache coherence protocol for the multiprocessing system bus.

Additional features such as read miss pipelining, system bus grant parking, hidden coherence transactions to the duplicate tag, and Alpha 21164 microprocessor write to the system bus back-off and replay also combine to boost performance.

AlphaServer 2100 systems, using 4/200, 4/233, or 4/275 processor modules can be upgraded to a 5/250 system through a cost-effective processor and firmware swap.

AlphaServer 2000 4/275

The model 4/275, added to the AlphaServer 2100 line in January 1995, uses the Alpha 21064A chip running at 275 MHz with a 4-megabyte secondary cache. The model 4/275 is now being introduced in the AlphaServer 2000 line. AlphaServer 2000 4/200 systems can be upgraded to the higher performance 4/275 system through a processor module swap.

AlphaServer 2000 and AlphaServer 2100 4/233

The model 4/233 is the new entry system for the AlphaServer 2000 and AlphaServer 2100 family, replacing the model 4/200. It uses the Alpha 21064A microprocessor at 233 MHz with a 1-megabyte secondary cache.

Storage Enhancements

To complement high-performance fast, wide SCSI-2 PCI storage options, the entry configurations of all AlphaServer 2100 and AlphaServer 2000 systems now include a fast, wide SCSI-2 capable storage enclosure and a 2-gigabyte wide capable SCSI disk. Additional high-performance PCI storage options being added include the KZPSC fast, wide single-ended adapters. The single-channel KZPSC supports up to seven disks, and the three-channel model supports up to twenty-one disks.

New Awards

The AlphaServer 2100 system picked up two new awards from influential publications, DATAMATION magazine and the UNIX System Buyer's Guide.

In a double coup, both DATAMATION readers and the magazine's editors selected the AlphaServer 2100 4/275 as Server of the Year in its annual Products of the Year awards. The award reflects readers' and editors' choices of the products that best help them do their jobs. According to DATAMATION editors, "You won't find a more flexible high-end symmetric multiprocessing system shipping. The 64-bit machine runs OpenVMS, UNIX, and NT today, satisfying the crying needs of the huge installed base to support legacy applications while moving into the 21st century."

The AlphaServer 2100 also won a Spring 1995 Hot Iron Award from the UNIX System Buyer's Guide for Best Price/Performance Throughput, Multiuser Shared System Mix. This award acknowledges superior performance in a multiuser environment, where cost and throughput are equally important.

The AlphaServer 2100 5/250 Core Development Team (Gamma Team) – left to right, seated: Nitin Godiwala, Barry Maskas; left to right, standing: James Padgett, Harold Buckingham, Gary Zeltser, Dick Beaven, Ginny Lamere, Kevin Peterson, Chet Pawlowski, Steven Shirron, Peter Woods, Andy Ebert, Abdoulla Ataie, Vice President Pauline Nist; missing from photo: Don Caley, Erik Debriae, Traci Post, Janet Walsh, Norbert Eng, Jeff Kerrigan, Fran Zdrojkowski.

Digital's Software Strategy Database

By Al Smith, General Manager, Software Programs
and Dave Ellison, MCS Systems Engineering

The Software Business Group has established a focused source of information that contains the *official product strategy of record* for each of Digital's key software product offerings. This database provides Digital employees with official direction and planning information from software product management. The consistent use of this information in this database to address inquiries from customers, the press, industry analysts, our partners, and other employees is important to the successful implementation of Digital's software strategy.

Software Strategies Database Architecture

The Software Strategies Database covers Digital's Client/Server frameworks, operating systems, layered software products and an overview of Digital's software strategy. A rolling four quarter look ahead is provided in each of the strategies with application partner and service references where appropriate.

Over 125 software products are described using a consistent format. The first section, *product background,* includes information regarding the product description, customer benefits, product family members, and installed base/market positioning. This is followed by the *product strategy of record* section which details the planned functionality, platform support, product positioning, sales resources and marketing resources. The third section presents *typical questions with answers* that are based on inquiries from customers, business partners, and employees.

The Program Office

The Software Program Office was formed to provide the focus and support needed to keep current information available on the Software Strategies Database and answer inquiries resulting from the use of the database.

The program office is led by the Software Business Group and is comprised of members from the operating system segments, layered software segments, application partner business groups and Software Product Services. Members are responsible for providing the initial input to the database, continuous review and updates of those inputs, and response to employee software strategy inquiries within 72 clock hours.

Software Strategy inquiries are processed through an automated mail handler developed by MCS Systems Engineering. Inquiries are automatically routed to the appropriate software group for disposition. The answer to the inquiry is sent back to the employee and archived for future use. If a question goes unanswered for more than 72 hours the mail handler automatically escalates the request to senior management.

Initial Use and Benefits

The Software Strategies Database has been accessed over 45,000 times in the first eight months of on-line operation. Software strategy questions submitted via the mail handler have been answered with an average turnaround time of less than 38 hours (72 hour goal).

The benefits of the system as an information source have been widespread and align with the following categories:

- Customer planning efforts
- Digital direct and business partner sales support
- Speculation and rumor control
- Customer briefings
- Industry Analyst, Press, and Business Partner inquiries
- Internal planning efforts

Accessing the Software Strategies Database

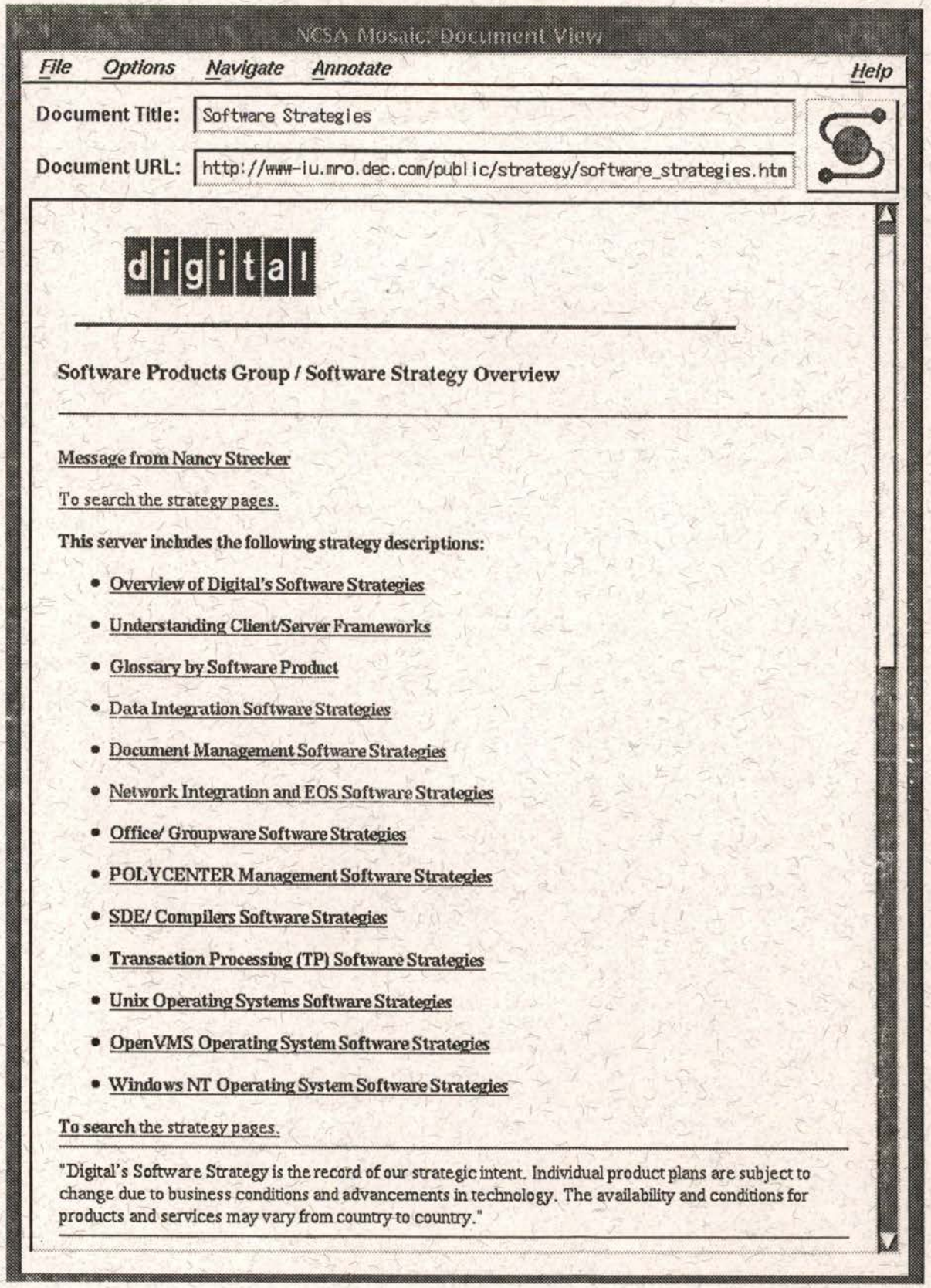
The information in this database is available around the clock and around the globe in Digital's Integrated Repository and in Digital's internal World Wide Web.

The information in the Integrated Repository can be accessed through VTX. At the system prompt type VTX IR. Once in VTX select NEW/REVISED by typing 2 then the enter key. At the Information Categories screen select Software Strategies by typing SS then pressing the form and enter keys. You will now see the index of documents available in the software strategies database.

The information housed in the Software Strategies Web server can be accessed via your favorite Web browser such as Mosaic, Lynx, or Netscape. The URL for the Software Strategies Web Server is:

http://www-iu.mro.dec.com/public/strategy/software_strategies.html

This is the internal software strategies home page that you will see. The VTX IR will have a similar table of contents with the most recent document listed first.



The Internal Software Strategies Home Page on the Web.

Business Ethics and Engineering

by Victor Pompa
Digital Ethics Office

Digital's ethical standards apply across all of its business activities, even though it might not be intuitively obvious that the work you are doing raises any ethical questions. Digital is widely respected for ethical conduct in the marketplace and in the community at large. Recently the company received a national Business Ethics award for environmental protection programs and contributions to the community. But there are many business practices in technical fields as well as in other business areas which can raise questions about ethics.

- Are you thinking of starting a consulting business after hours? Will that be a conflict of interest?
- How does your employee agreement define the ownership of intellectual property?
- Have you been invited to join the Board of Directors of a start-up company? Will that create divided loyalties for you?
- Have you been using the Internet to discuss company politics with an ex-Deccie who now works in Silicon Valley? Does that create any risk for Digital?
- Can you assume that technical information you find on the Internet is public domain and free to use?
- When you last traveled overseas, did the local customs agent "request" a few dollars to pass your luggage through? Is that a violation of US law, the local law, or Digital policy?
- Is there unlicensed software on your PC?
- Can you hire a former Digital employee as a consultant on your project?

Making the Right Choice – Digital's Code of Business Conduct – deals with those questions and many others about Digital's business conduct standards. In it, Digital provides guidelines in those areas which are company value-based, such as use of company assets, and competitive practices. There are also explicit rules where the law defines the standard, such as foreign trade, environmental health and safety, securities trading. Finally, the Code provides a decision model to help you achieve the best, most informed decision in complicated situations where the rules are not clear.

The Ethics Office is also a resource for questions about the ethics of business decisions and business practices. The helpline DTN 223-INFO (223-4636) is available to all employees, worldwide. Information is kept confidential at the caller's request. Callers may even remain anonymous.

Watch for future ethics columns on topics of specific interest to the engineering community. *FOREFRONT* and the Ethics Office also invite questions about Digital's business ethics. Discussion and answers will be published in upcoming issues.

FOREFRONT Wins STC Award

by Margie Sherlock
Principal Technical Writer

Dick Willett, the Managing Editor of *FOREFRONT* magazine, has received an award from the Society of Technical Communications for Outstanding Achievement. Each year the STC sponsors a publication competition, which honors writers, editors, and artists for outstanding work in their fields. *FOREFRONT* competed with 270 other entries from other computer companies as well as other industries.

Started by Vice President Bill Demmer, *FOREFRONT* is one of Digital's longest-running internal quarterly engineering news publications. The magazine is an active forum for the entire product management and development community to share information, directions, and key accomplishments in all its functional dimensions – that is, customers, markets, engineering, and manufacturing. *FOREFRONT*'s main goal is to highlight technical efforts and successes that lead to new products and markets for Digital.

FOREFRONT provides technical articles that focus on sharing useful information such as new design tools, standards, and technologies. The magazine also covers a wide range of leadership building and morale boosting subjects. Every issue features individual and group accomplishments that include promotions, achievement awards, and patent awards.

Dick Willett is very pleased and delighted with *FOREFRONT*'s STC award. Dick has been a Digital employee for 18 years and worked in the Power Design Group for 12 years. He began his engineering career in 1963 working with Doc Edgeton at Edgerton, Germanhausen and Grier in Boston. He worked on a team assignment with Doctor Draper at Draper Labs at MIT; and he holds several microwave and radar patents. Before coming to Digital Dick worked for seven years in R&D at the Raytheon Missile Systems Division in Bedford. While in the power supply design group, Dick designed and published the Power Supply Catalog, Metrics Report and the Power Supply Journal.

Dick believes that his engineering background has been a valuable asset in producing *FOREFRONT* articles that inform and educate the engineering design community and their support organizations.

In his own words, "It has been my extreme pleasure to report the accomplishments and successes of Digital's engineering community. Digital possesses some of the finest engineering talent in the world. I always feel proud and privileged to meet these outstanding individuals and to report their achievements.

"Having taken a product from conception to market, I understand firsthand the frustrations and success that engineering teams endure during this process. My own experiences have definitely helped me to produce a high-quality quarterly publication that can be of value to everyone."

Dick Willett, the Managing Editor of *FOREFRONT* magazine, is shown receiving an award for outstanding achievement from Ellen Lehrer, President of the Society for Technical Communication.

The Race for 500 SPECfp

By John Shakshober and John Henning
CSD Performance Group

On January 12, 1995, an AlphaServer achieved floating point performance of more than 500 times the VAX 11/780. On January 13, the same feat was accomplished by an AlphaStation. And on January 17th, Digital submitted record-setting SPEC performance results to the SPEC newsletter for the AlphaStation 500 5/266.

These systems use the newest generation of Alpha superscalar RISC microprocessors, namely the 21164 (also known as EV5). There are several reasons Digital needed to announce performance of a system based on the 21164 chip:

- Maintain Alpha leadership in CPU performance over IBM, HP, SGI, SUN.
- Report actual SPEC92 versus other vendors' SPEC92 estimates for systems that are not due to ship for another 1 to 2 years.
- Provide industry-standard benchmarks that document our advertising claims about Alpha as the world's fastest chip.
- Follow through on performance estimates published in September 1994: EV5 @ 300 Mhz will reach 330 SPECint92 and 500 SPECfp92.

This article describes the EV5 performance tuning process and the race for 500 SPECfp, which was a result of many groups within Digital combining efforts to implement state-of-the-art hardware and software technology.

Contributions came from hardware engineering, software engineering, and performance engineering to reach these ambitious goals. Several of the technologies that have been newly implemented are also described.

To begin, let's look at 2 years of competitive history as seen through SPEC.

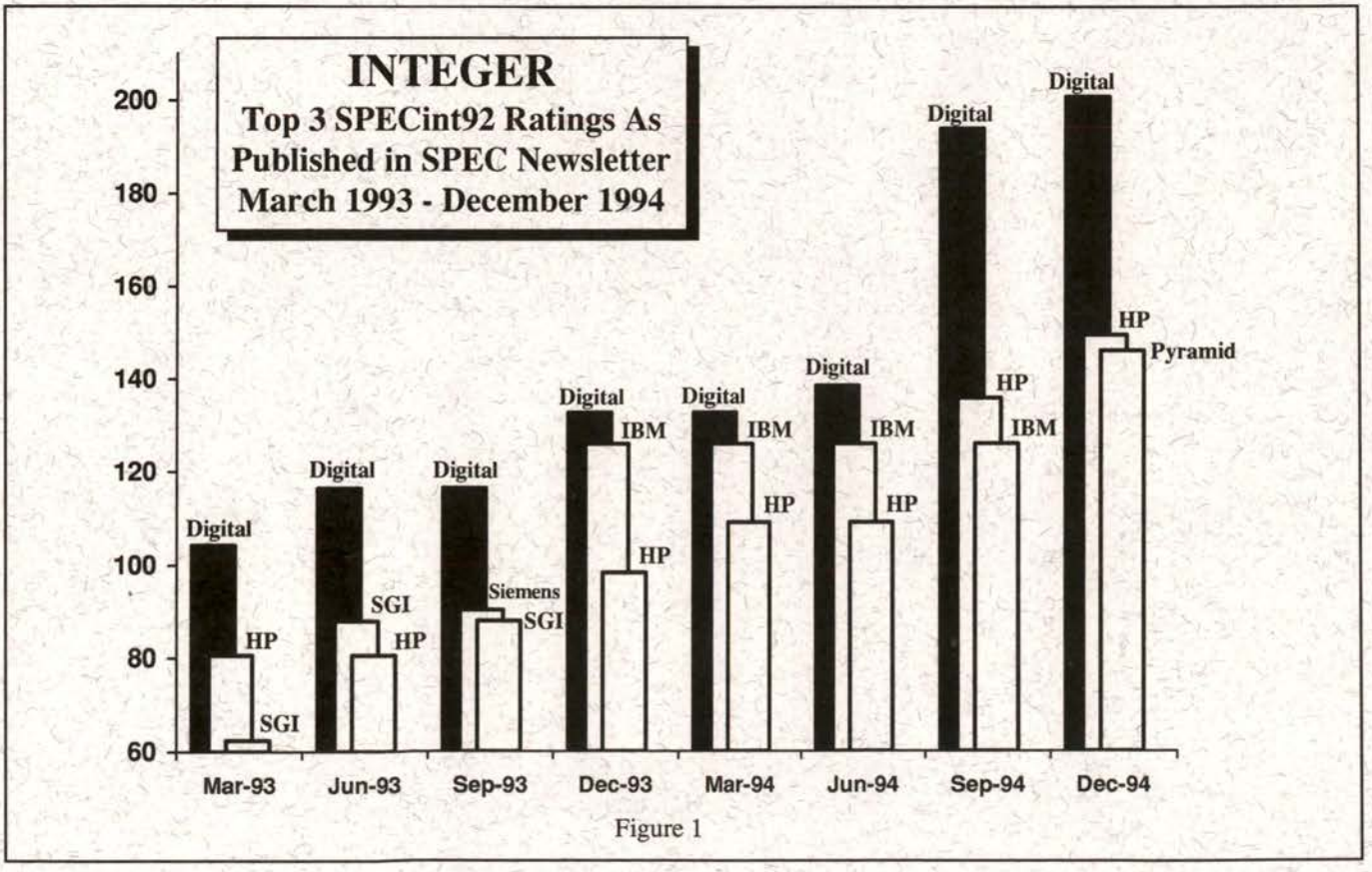


Figure 1

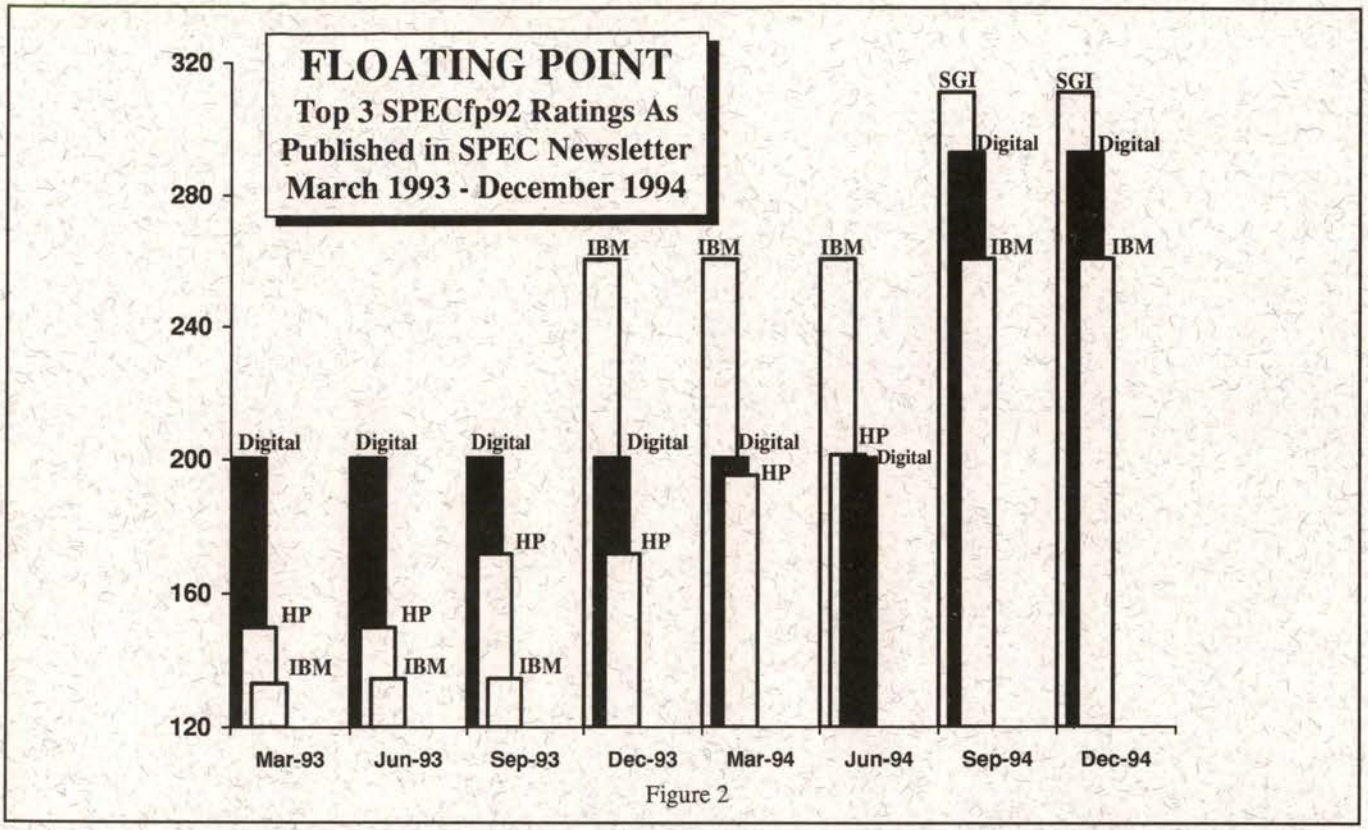


Figure 2

Alpha SPEC Leadership

Since November 12th, 1992, Digital Equipment Corporation has been a leader of the computer industry in its SPEC ratings. SPEC, the Standard Performance Evaluation Corporation, defines what may be the best known of the many computer benchmarks. Ratings are defined for both integer (SPECint92) and floating point (SPECfp92) performance, with higher values indicating faster systems. SPECint92 is the geometric mean of the ratios by which six integer benchmarks, written in "C," exceed the performance of the VAX 11/780. SPECfp92 is the geometric mean of the ratios by which 14 floating point benchmarks (12 FORTRAN, 2 C) exceed the performance of the VAX 11/780.

The 21064 @ 200 Mhz was the first chip to break 100 SPECint92 and 200 SPECfp92 and, when announced, led the industry using Alpha's dual issue and high clock speeds.

Alpha has consistently led in SPECint92 (see Figure 1). Its initial rating of 104.3 (DEC 10000 Model 610), published in the SPEC newsletter of March 1993, was not matched by a competitor until nine months later when IBM reached 125.9 (RS/6000 Model 990) – but by then Digital had broken 130 for both a server and a workstation (DEC 7000 Model 610, DEC 3000 Model 800). This level was not touched by a competitor for another nine months, when HP reached 135.7 (HP 9000 735/125), but by then Digital had a server at 193.8 (DEC 7000 Model 710) and a workstation at 189.3 (DEC 3000 Model 900).

As of the time of this writing, Digital has 2 servers and 1 workstation published to the SPEC newsletter with SPECint92 ratings over 200 (DEC 3000 Model 900, DEC 7000 Model 700, AlphaServer 2100 4/275), and no competitor has broken 150.

Note: this article concentrates on SPEC ratings as published in the SPEC newsletter. Newsletter publication requires full disclosure of measurements and test methods for full systems, not just raw chips.

Although Alpha has consistently led in SPECint92, for SPECfp92 the fight has been more difficult.

SPECfp Competitors

Figure 2 shows the top three SPECfp92 vendors as published in SPEC newsletters during 1993 and 1994. At first, Alpha had a substantial lead with 200.5 SPECfp92 (DEC 10000 Model 610), well ahead of second-place HP at 149.8 (HP 9000/735). But over the following four issues of the newsletter HP crept upwards, until in June 1994 HP just barely passed Digital with a rating of 201.3 (HP 9000 735/125).

Meanwhile, IBM announced systems based on Power2, a 6-chip set microprocessor, and published a SPECfp92 rating of 260.4 in December 1993 (RS/6000 POWERSERVER 990). Between IBM and HP, by the June 1994 issue, Digital had fallen to third place, although the difference between second and third place was less than ½ percent.

If IBM and HP had been the only competitors, Digital would have quickly regained SPECfp92 leadership with the July 22, 1994 announcement of systems based on the 21064A chip (also known as EV45). But even with the September

issue of the SPEC newsletter and the publication of both a workstation and a server that pulled ahead of IBM (DEC 7000 Model 700 at 292.6; DEC 3000 Model 900 at 264.1), Digital remained in second place, because SGI had shipped the long-awaited R8000 and published a SPECfp92 rating of 310.8 (PowerChallenge). The R8000 was code-named TFP, for Tremendous Floating Point, and its SPECfp92 rating seemed to match its name.

Would TFP's first place rating be sustained?

The Next Quantum Leap

At the same time the competition approached Alpha's 21064A, engineers within Digital were measuring the first prototypes of the 21164 (EV5) Alpha chip. EV5 advanced features include quad instruction issue, dual issue floating point pipelines, multiple outstanding memory references, large 3-way set associative 2nd level on-chip cache, and high clock speeds of 250-300 Mhz. EV5 therefore had great potential for gains in the SPECfp92 race. Digital's Semiconductor Group, in Hudson, Massachusetts, wanted to gain industry mindshare by publicizing EV5 and its expected leadership.

But, as mentioned above, the SPEC newsletter does not accept results that are solely for a chip; the chip must be incorporated into a complete hardware product. During 1994, Digital was not ready to announce any systems using the EV5 chip.

On June 27th, Hudson proposed a solution, which led to an intense summer for the performance community and for the team that is responsible for the actual machine instructions emitted, namely the GEM compiler technology team.

Hot Chips

At the end of June, it was proposed that the EV5 chip be announced with estimated SPEC ratings in September, and that a preview be given during August at the Hot Chips conference in Silicon Valley. Although such estimates would not be suitable for publication in a SPEC newsletter, they would serve as a signal that the Alpha architecture is a long-term leader on all dimensions, and would attract hardware vendors to build systems based on the chip.

Hudson's goal was that the September estimate be at least 500 SPECfp. This was a new, more aggressive goal than had formerly been stated (1.5x clock speed, or 450) and was substantially more than the best measured SPECfp as of June – only 444! A gain of 13% was therefore needed, which is a far from trivial improvement. Recall that the SPEC92 suite has been available for study for years; the "easy gains" have already been obtained.

Since Digital takes pride in not promising more than can be delivered, the engineers set out to see how much the gap to 500 SPECfp could be narrowed by August. GEM support for EV5 had been under development almost as long as EV5 itself, but it was now time to begin detailed tuning of the compiler and the hardware. The next two sections provide information about the EV5 memory system and an overview of some of the compiler challenges to take the best advantage thereof.

EV5 Memory Hierarchy

EV5 can issue up to 4 instructions in a cycle. When operating at 250 Mhz or above, this means that it can achieve or exceed one billion instructions per second. Can this peak actually be achieved in practice?

Certainly one could issue one billion instructions per second if all operations were strictly on the internal processor registers. But doing so would not produce any visible effects outside of the chip. When running a real program, such as the SPEC benchmarks, data must make its way through the various levels of the memory hierarchy. The levels include:

Registers – There are 32 integer registers and 32 floating point registers. Instructions access these registers directly.

D cache – The level 1 data cache holds 8KB. Data can be retrieved 2 CPU cycles after it is requested. (There is also an 8KB level 1 instruction cache called the I cache.)

S cache – The level 2 cache is located on the EV5 chip and holds 96KB. It has very high bandwidth, and can be accessed in 9 cycles.

B cache – EV5 allows an optional level 3 cache on the CPU board of 1 to 64MB. Depending on the particular hardware platform, 15 or more cycles may be required before data located in the B cache can be used by an instruction.

Memory – Access times for main memory depend on the hardware platform, but are typically more than 60 cycles.

Disks – If the needed data is on disk, access may easily require more than one million cycles.

A compiler must produce code that works well within this memory hierarchy. When it generates an instruction that uses a value in a register, the instruction that fills that register must be issued the right number of cycles earlier. This is one example of what is known as a scheduling problem.

Scheduling

It may be useful to consider an analogy with scheduling a construction project: to keep the workers busy, one must order materials well before they are needed. And there are a number of interesting challenges:

– How far in advance should an order be placed?

If an order is placed too late, it may not be filled when needed, and work will stop. During the summer and fall of 1994, many tuning experiments were carried out to determine the effects of earlier or later scheduling of data requests, as the compilers provided internal-use-only switches that allowed access to its scheduling model. Using these switches, the performance teams had detailed control over the number of cycles GEM would expect to elapse between a load and the data becoming available, for all three levels of the cache.

– How far away is it?

The number of cycles required to fetch data varies with its location in the memory hierarchy. If the compiler can estimate the likely location of the data, it can

determine how early to place the order. An area constantly under development in GEM is to continue to refine the accuracy of such estimates. But note that the estimates will never be perfect; for example, after an operating system context switch, the caches are littered with data from the previous process.

– How many orders can be placed at one time?

References within the chip on both EV4 (21064) and EV5 (21164) are fully pipelined – that is, after a request is made for a data item, as long as it is located somewhere on the chip, instructions that use other registers will continue to be issued while waiting for the requested item to come back. Off-chip references, on the other hand, will stall EV4; but EV5 introduces the ability to have two off-chip references pending, and will not stall until the third simultaneous off-chip reference is attempted.

– Where to put it?

If you have ordered lumber, when the truck pulls up there had better be a place ready for the lumber to be unloaded. For a compiler, this is actually one of the bigger challenges. Suppose GEM decides that newly arriving data shall be placed directly into registers. Since the goal is to keep the machine busy, and since up to two instructions of a given type (integer or floating point) may be issued in a cycle, the number of registers which must be set aside to hold incoming data is 2*L, where L is the latency to the expected data location. Thus, if the data is expected to be in the D cache, only four registers must be set aside; if it is expected to be in the S cache, 18 registers (out of 32); and it would not be practical to set aside enough registers to hold two incoming data streams from the B cache (15 cycles x 2 streams would tie up almost all registers).

– How about a lay-away plan?

An alternative to tying up 2*L registers is to do "prefetching." The intent of prefetching is to bring the data closer, but not actually deliver it until it is needed. To return to the analogy with the construction project, suppose the project needs a rare lumber found only on the other side of the planet. Instead of ordering for direct delivery it might be better to place two orders – the first would have it brought to a local lumberyard; the second would bring it from there to the actual work site. There is some extra overhead in having to generate two orders, but it may be the only way to keep the project on schedule.

EV5 supports two kinds of prefetching. A load to integer register 31 will bring the requested data into the D cache; a load to floating register 31 will typically bring the data into the S cache.

Thus two kinds of prefetch/scheduling strategies came to be considered:

A. Floating prefetch + schedule for S cache latency (9 cycles)
B. Integer prefetch + schedule for D cache latency (2 cycles)

During the summer and fall of 1994, numerous experiments were conducted with variations of the above strategies to discover which would be most useful. Eventually, it was determined that although strategy A is sometimes better, strategy B is, in fact, more broadly applicable to a wider range of program codes, and has the big advantage of tying up fewer registers.

As of August 10, the best that had been achieved through the various tuning attempts was 480 SPECfp92. The publication deadline for the September chip announcement was fast approaching, as was the Hot Chips conference. But in August it was not known whether all of the compiler tuning features that were being exercised would, in fact, be available in a shipping product. For example, some of the SPEC component benchmarks seemed to benefit from one combination of the above strategies, and others seemed to benefit from different combinations; the compiler would not be able to ship all possible combinations.

Therefore, some engineers felt that the announcement should be scaled back to the 450-480 range, rather than 500. Other engineers suggested that since there would likely be six months between the chip announcement and actual system announcements, there was still time remaining to achieve 500.

Modelling and work in progress indicated some technical grounds to believe that 500 could be reached; for example, two software technologies were cited as likely to help in the succeeding months: "profile-based optimization" and "speculative execution," which are described in more detail below.

In the end, the estimate of 500 gained support and was published in September. But, as mentioned before, the estimate is meaningless unless hardware products ship with actual performance at the same level.

Hardware Engineering

In parallel with the development of the EV5 chip and the software technology to take advantage of it, hardware engineering has been developing several systems that will employ the chip:

– TurboLaser: a high-end SMP server

– Gamma: a mid-range SMP server

– Alcor: a high-end workstation

Each of these hardware development efforts have done experiments to determine the performance effects of hardware options such as CPU Mhz, cache size, cache speed, memory speeds, and chip settings such as wave pipelining (described below).

TurboLaser (now known to customers as the AlphaServer 8200 5/300 and the AlphaServer 8400 5/300) was the first to boot EV5 and the first to run at 300 Mhz. It was the basis for the summer 1994 EV5 estimates, clocking 444 SPECfp92 in June and 480 in August. TurboLaser was also the test platform for the summer 1994 compiler tuning experiments described in the preceding section. And by a margin of 24 hours, it was the first system to break 500 SPECfp92.

Alcor (now known to customers as the AlphaStation 500 5/266) was the first EV5 system to submit SPECfp92 results, as described in the opening sentence of this article. It was used intensely in the final weeks leading up to January 17th for a wide variety of experiments.

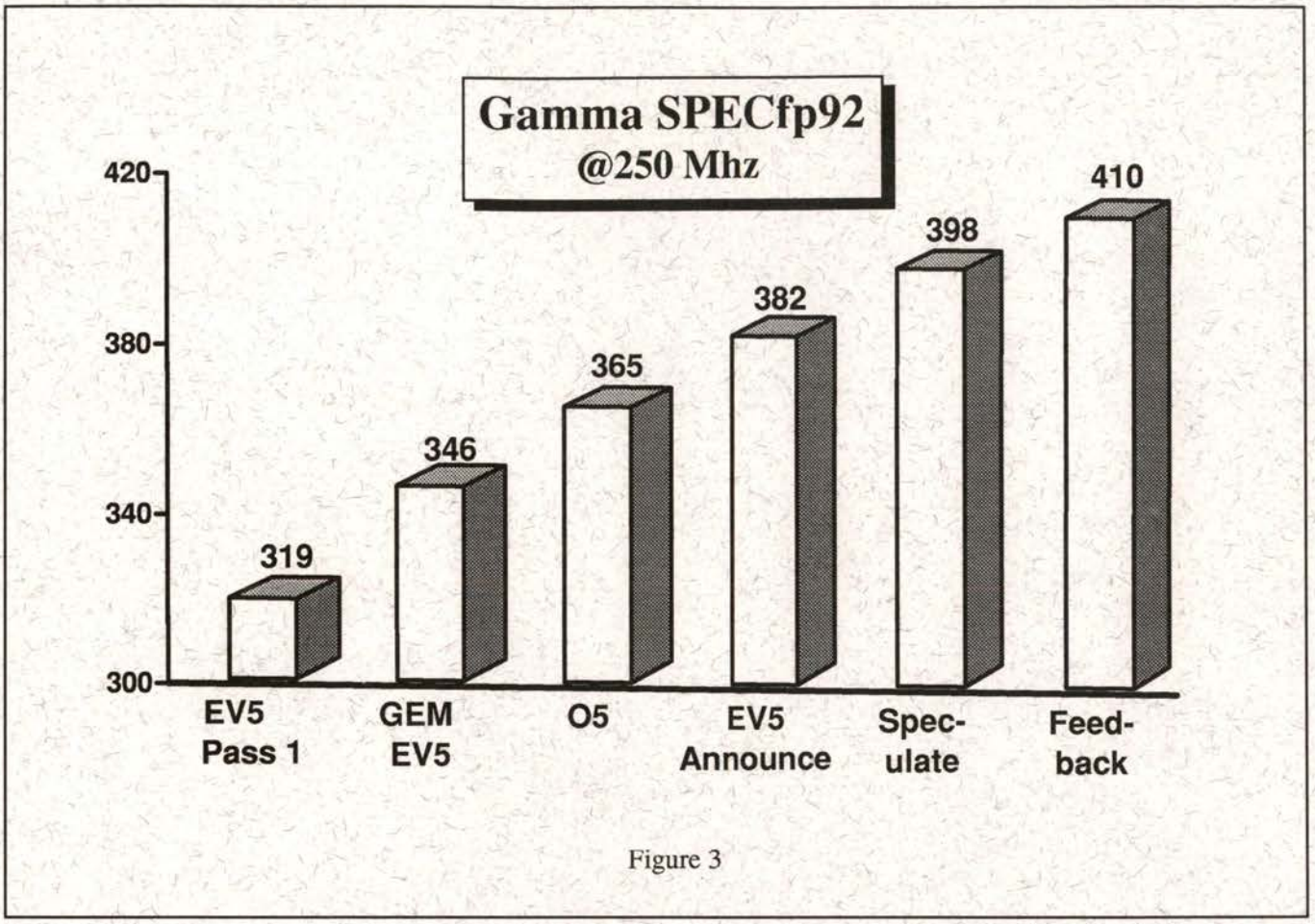


Figure 3

The engineering group for Gamma (now known to customers as the AlphaServer 2100 5/250) provided an early prototype dedicated to the CSG Performance Group. Several improvements to software, hardware, and SPEC tuning can be observed by following the details of Gamma performance ratings during 1994.

Gamma SPECfp92 History

Please see Figure 3, which traces the evolution of Gamma SPECfp92 ratings.

– EV5 Pass 1, June 1994

Performance testing of Gamma with the first EV5 prototypes began in June 1994. Prototype hardware had Pass 1 EV5 chips with limited functions. In particular, EV5 uses a feature called "load merging" to improve memory access, combining what may be several memory references from the CPU's point of view into a single request to the memory system. But this feature was not present in the Pass 1 systems.

Another important performance feature is called "wave pipelining." For EV5, the B cache entries can be either 32 or 64 bytes. Since 16 bytes are transferred from the B cache to the chip at a time, either 2 or 4 transfers are required to read a full cache "line." Wave pipelining allows the successive reads from a single cache line to occur more quickly than the first read; but for systems with a 32-byte B cache line, such as Gamma, this feature was not available in Pass 1.

Finally, it should be noted that the SPEC kit had not yet been adapted to EV5. Although hardware vendors do not change the source code of the SPEC benchmarks, they are allowed to write "scripts" or "makefiles" that control how the benchmarks are optimized. Vendors apply substantial performance engineering effort to these scripts. In June, this effort had not yet been undertaken for EV5. Therefore, the first test results graphed in Figure 3 represent the starting point for Gamma, namely 319 SPECfp92.

– EV5 Switch, June 1994

The GEM compiler team had been working on support for EV5 for well over a year, in parallel with EV5 development. The DEC FORTRAN and DEC C compilers both use the same GEM code generator and both provided an internal-use-only switch for EV5 code generation. The switch causes code to be targeted for EV5's quad issue and dual floating point pipelines, with instructions aligned for EV5's instruction ordering scheme. The switch has subsequently been released for external use as "-tune ev5."

Programs do not have to be recompiled in order to run on EV5; but they may run more quickly if they are.

The first step in tuning the SPEC kit for EV5 was to try out the new switch on the 14 benchmarks that make up the SPECfp92 suite. As a result, tomcatv improved by 21%, and four other benchmarks improved by 17-19%. Overall, SPECfp92 improved by 8% (2nd point in Figure 3).

– O5 switch – Sept 1994

The next increment of Gamma performance improvement came from a compiler technique known as "software pipelining," which is related to the techniques discussed above in the section titled "Scheduling." To explain software pipelining, a brief detour must first be taken into "loop unrolling."

Recall that a goal of scheduling is to load data from memory as early as practical, but not too early. Sometimes, this is difficult, as when one has a simple loop that looks like this:

```
 DO 10 I = 1, N
   A(I) = K * B(I)
10 CONTINUE
```

If the body of the loop is directly translated into machine instructions, it will not contain much more than a load instruction for the current element of B, a multiply, and a store. Since the multiply immediately follows the load, the machine will stall until the load is complete.

To solve this problem, the FORTRAN compiler has long been able to unroll such loops. The above loop might then behave as if it had been written:

```
 DO 10 I = 1, N, 4
   A(I) = K * B(I)
   A(I+1) = K * B(I+1)
   A(I+2) = K * B(I+2)
   A(I+3) = K * B(I+3)
10 CONTINUE
```

One advantage of unrolling is that the compiler can schedule all the loads at the beginning of the loop, thus overlapping at least some of the multiplies with some of the loads, roughly as:

```
loop:
  request loads for
    A(I), A(I+1), A(I+2), A(I+3)
  arithmetic ops for
    A(I), A(I+1), A(I+2), A(I+3)
  stores for
    A(I), A(I+1), A(I+2), A(I+3)
end_loop
```

The disadvantage is that additional space is used, and there is some overhead (not shown here) in the loop prolog/epilog to handle cases such as a loop trip count that is not evenly divisible by the unrolling factor. Typically the advantages far outweigh the disadvantages.

Notice, though, that the top of each iteration of the loop is still likely to stall waiting for the loads to complete, especially if they depend on access to main memory. Software pipelining lets the code instead look more like this:

```
loop:
  request loads for
    A(I+4), A(I+5), A(I+6), A(I+7)
  arithmetic operations for
    A(I), A(I+1), A(I+2), A(I+3)
  stores for
    A(I-4), A(I-3), A(I-2), A(I-1)
end_loop
```

This example is oversimplified and does not show loop prolog/epilogs, but is intended to show that software pipelining tries to reduce stalls by getting the loads into the memory pipeline for the next iteration while working on the current iteration and doing the stores of the previous iteration as its arithmetic operations complete (write-behind).

The GEM team had implemented software pipelining during 1993. It has been shipping in the FORTRAN compiler for over a year and is accessible via the switch -O5. But O5 had limited success on EV4 since the first load or store which missed the on-chip cache would stall the pipeline. O5 is much more effective for EV5 since EV5 will handle multiple outstanding load misses without stalling the CPU. This effect improved SPECfp92 an additional 5% (3rd data point in Figure 3).

– EV5 announcement of SPEC92 estimates – September 1994

As mentioned above, the compiler and SPEC tuning efforts that led up to the September chip announcement produced a peak of 480 SPECfp92 on a 300 Mhz TurboLaser. When the same tuning was applied to the 250 Mhz Gamma, it gained another 5% for 382 SPECfp92 (4th point in Figure 3).

– SPEC Submission – January 1995

The start of a new year meant another SPEC submission deadline. Although product announcements for most EV5-based systems were planned for Q4 FY95, SPEC allows vendors a six-month grace period to ship all hardware and software components reported. Because Alcor systems will begin shipping well within the six-month window, the workstation group supported submitting SPEC92 results of their EV5 systems.

In addition, a television network required supporting data for Digital's Alpha advertisements which state "world's fastest" microprocessors, workstations, and servers. Although systems that incorporate the 21064A at 275 Mhz win SPECint92, AIM III, AIM VI, AIM VII, and X11 perf, they fall just short of SGI's SPECfp92. Having SPECfp92 leadership with EV5 systems would certainly make it easier to support the advertisements.

Thus the race to complete the EV5 SPECfp92 tuning was on. The deadline: January 17, 1995, for submission to the March 1995 SPEC newsletter.

Two new software technologies were employed, namely speculative execution and profile-based optimization.

– Speculative Execution, January 1995

Suppose a code fragment looks like this:

```
IF (A .NE. 0) B(J) = B(J) * A
```

A difficulty with this code is that the load instruction for B(J) may take longer than the other operations. It would be useful to start the load as early as possible, so that its results are available to later instructions when they are needed.

As the program is written, the load is, apparently, constrained to wait until after the comparison is complete. In general, the more tightly constrained the timing of instructions, the less freedom the compiler has to rearrange them into an order that will take the best advantage of EV5's quad-issue.

With a new switch introduced in 1994, "-speculate," the compiler will speculate

that usually A will not equal zero. In other words, it will ignore the apparent constraint and start the load and the multiply earlier.

There are some complicated problems here: what about the cases when A is, in fact, zero? The compiler still does the comparison, and will not store an erroneous result. But what if the speculatively-executed operation runs into an exception? For example, if J is out of range, a memory addressing exception could occur. It would confuse the programmer if an exception occurs for a case where A is zero; so the extraneous exceptions must be automatically dismissed. But dismissing exceptions takes time; if they occur frequently, the program may run more slowly than if speculation had not occurred. This effect can be reduced by exception handling run more quickly. Finally, there have to be some clear rules about what kinds of exceptions will be automatically dismissed; if the operating system dismisses all such exceptions, this too could be surprising unless the behavior is clearly documented.

Throughout 1994, the GEM team and the SEG AD advanced development group worked together to implement solutions to each of these technical issues. In January 1995, GEM, SEG AD, and the CSG Performance Group tested the effect on SPECfp92. As a result, 5 of the 12 SPECfp92 component benchmarks began to use the feature. The most significant improvements were a 36% improvement for mdljsp2, and a 23% improvement for mdljpd2; overall, Gamma performance improved by 4% to 398 SPECfp92 (4th point in figure 3).

– Profile-based optimization, January 1995

At compile time, the compiler does not know which way a branch will go; does not know which code segments are most likely to benefit from speculation; and does not know which routines are called most often. Therefore, the compiler has to guess at the answers to each of these. For example, it may decide to reproduce the code for a called routine directly in the line of the caller in order to eliminate the overhead of a procedure call; but if the routine is a rarely-called error handler, this "inlining" decision will not gain any performance.

Profile-based optimization gathers information about the actual run-time behavior (profile) of a program and feeds it back to the compiler, thus allowing better decisions. It requires several steps: the program must be compiled, run with profile collection enabled, and then compiled again.

Throughout 1994 the GEM and SEG AD teams had a joint project to implement new techniques for profile-based optimization in the compiler. With these features now complete, the SPEC tuning effort began to make use of them.

In addition, there are certain optimizations that cannot be done by the compiler even in the presence of profile feedback. The most important of these is placement of code to optimize cache usage. With the exception of the S cache, all of the EV5 caches described in this article are "direct mapped" – that is, the cache location of a data item brought in from main memory depends strictly on the lower order address bits of the data

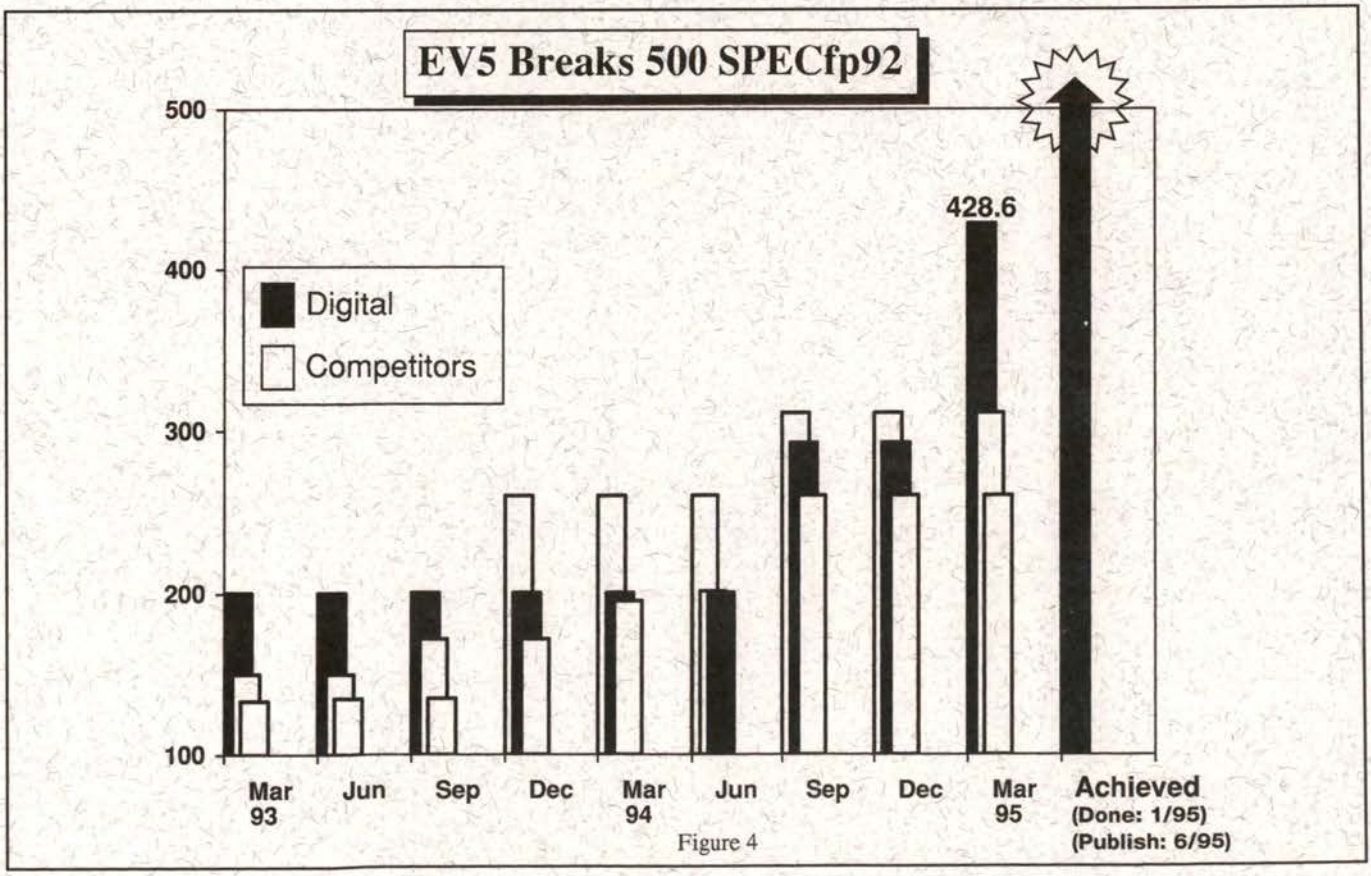


Figure 4

item. Since there are many fewer cache locations than there are main memory locations, one may find that, for example, a called routine occupies the same cache lines as its caller. If the routine is called inside of a tight loop, the routines will constantly displace each other in the cache and performance will suffer.

Techniques to place routines for better cache performance are employed as the last stage after all routines have been compiled and linked. The linked image is run, a profile is collected, and then the image is relinked with feedback. The DEC OSF/1 operating system (now known as Digital UNIX) has supported use of the "cord" option for feedback, as have other vendors; but in 1994 with DEC OSF/1 V3.0 support was added for an advanced form of optimization known as "om."

Om was developed by Digital's Western Research Laboratory. It is invoked by the linker to detect various performance opportunities. For example, in addition to program rearrangement for cache placement, om can remove certain instructions by recognizing when less general forms of addressing are sufficient; quadword align branch labels; re-resolve all affected addresses; and re-schedule the instructions. It does this by reverse engineering the linked image and building data dependency flow graphs – an advanced form of optimization that is a competitive advantage for Alpha.

The final tuning improvement for the SPECfp92 suite was to use profile-based optimization at both compile and link time for several benchmarks: spice2g6 gained 22%, and three other benchmarks gained 5-6%, for an overall gain of 3%. The result was that Gamma reached 410 SPECfp92.

– Other enhancements, 1990 through 1995

Although for purposes of simplicity this article describes several changes to performance as if they happened one at a time, in truth the picture was much more complex. Multiple performance improvement efforts are constantly in progress at many different hardware and software levels. An improvement which is first measured in 1995 may be the result of performance foundations that were laid in 1990, engineering that was completed in 1993, features that shipped in 1994, and tests that applied the features in a new way during 1995. So, although the above chronology is a reasonable view of the performance improvements through the development of Gamma, it is far from being the whole story.

500 SPECfp92 Achieved

Adding together all the improvements that brought Gamma to 410 at 250 Mhz, and applying them to 300 Mhz systems resulted in January measurements of 509.3 SPECfp92 on TurboLaser, and 503.2 on Alcor! In addition, a 266 Mhz Alcor achieved 428.6 SPECfp92. These results are shown in graphic form in Figure 4.

In the end, it was decided to publish only the 266 Mhz results to the March 1995 issue of the newsletter. But the 500 SPECfp92 result was achieved in January, a remarkable achievement by a large group of people. And on April 11, 1995 Digital announced the final results for TurboLaser: 512.9 SPECfp92, which will be published in the SPEC newsletter in June 1995, along with Gamma's 410.4 SPECfp92.

Contributors

The EV5 SPEC performance effort included contributions from many groups within the company. John Shakshober of CSGPG provided the initial kits, consulted on their use, led the efforts for Gamma and Alcor, and submitted the results to SPEC. Zarka Cvetanovic and George Chrysos of AVS performed initial evaluation and tuning of SPEC92 on EV5/TurboLaser for the EV5 announcement, were the first to break 500 SPECfp92, and provided detailed input for compiler tuning. Steve Hobbs (GEM) implemented software pipelining and tuned it for EV5, and Kent Glossop (GEM) developed EV5 quad-issue instruction scheduling. Robert Cohn of SEG AD implemented profile-based optimization and was a co-developer of speculative execution. Michael Adler (SEG AD) worked on the runtime support for speculative execution, resolving many issues in the interface between the compiler and the DEC OSF/1 operating system. Amitabh Srivastava led the development of the om optimizer. Jeannie Lieb (GEM) tracked SPEC benchmarks through many intermediate baselevels of the compiler and suggested several enhancements to the SPEC scripts. David Fenwick and David Hartwell provided a TurboLaser prototype for the early SPEC92 tuning. Barry Maskas provided a Gamma prototype dedicated to the effort. Paul Lemmon, Ed Arthur, and Jay Wilkinson attempted several variations on Alcor memory timing and options. Geoff Lowney (SEG AD) drove several of the cross-team efforts described in this paper, with clear insight into performance, compilers, and hardware design. Numerous other engineers contributed to the effort, including but not limited to Pete Bannon, Tau Chen, Caroline Davidson, John Edmondson, Tryggve Fossum, Nitin Godiwala, Lucy Hamnett, Bob Hanek, Greg Lueck, John Murray, Bob Nix, Bill Noyce, Mike Rickabaugh, Steve Root, Paula Smith, Stan Whitlock, and Jeff Zeeb.

For Further Reading

Information about FORTRAN compiler options through V3.5 may be found in chapters 2 and 4 of the DEC FORTRAN User Manual for DEC OSF/1 AXP Systems, order number AA-PW81B-TE, September 1994. O5 is described there. Newer switches, such as "-tune ev5," are described in the manpages for the most recent DEC OSF/1 version of FORTRAN.

Om is described under the manpage for "cc." For more information about om, send email to wrl-techreports@decwrl.dec.com with the subject line "help," and follow the instructions to retrieve report 94/1, or point your web browser at http://www.research.digital.com/wrl/home.html.

More information on GEM may be found in the Digital Technical Journal, Volume 4, Number 4, Special Issue 1992.

The 21164 chip is described in the Alpha 21164 Microprocessor Hardware Reference Manual, Order Number EC-QAEQA-TE.

Digital Clusters for Windows NT Captures COMDEX Award

By Sharon Woodruff, Digital Clusters for Windows NT Marketing

Digital's award-winning clustering technology will give customers the best return on their Windows NT investment

In client/server LAN environments – where many PCs and workstations depend on services provided by specialized server systems – a cost-effective way to ensure system reliability is particularly crucial. While fault-tolerant systems can provide full or partial functionality in the event of a failure, they're not an economical way to achieve high levels of availability.

Digital pioneered clustering technology with VMSclusters in the mid-1980s and has led the industry ever since. Today, Digital is using that expertise and experience and developing a new cluster technology, this time designed specifically for client/server and the Windows NT operating system.

The Digital Clusters for Windows NT project is developed in the NT Systems Group, managed by Jeff Schriesheim. Jeff invited Scott H. Davis, a Consulting Engineer who had made significant contributions to our VMS clusters technology, to design clusters for Windows NT.

Since starting the project, the NT Systems Group has evolved through some organizational changes, and is now the engineering and product development arm of the Windows NT Segment in the PM&D. Recently appointed manager of the Windows NT Segment, Vice President Lucia Quinn acknowledged the durability and importance of the technologies developed in NTSG: "We will remain focused on ensuring that Digital is the leader in providing value-added software for the emerging NT client/server market."

In addition to the award-winning clusters technology, the Windows NT PM&D is responsible for supporting Microsoft's Windows NT on all key Digital hardware platforms, for PC interoperability products, like eXcursion; and software and firmware that supports the ease of configuration and installation of Digital's Windows NT products. It is also providing leadership for cross-organizational and cross-divisional business opportunities for Digital in the market for advanced Windows computing.

Clusters Captures BYTE's Best New Technology Award at COMDEX

The NT Clusters development team developed a technology demonstration, first shown at Fall COMDEX. The demonstration won the "Best of COMDEX" award in the category of "Most Significant Technology." A videotape of this demonstration, available through the Integrated Repository, is being distributed throughout the world, and the demonstration itself is also being shown in numerous locations and shows around the world.

Since COMDEX, the Digital clusters team has grown to include the following members: Bob Guilbert, Will Lees, Carl Appellof, Jim Teague, Joe Mitchell, Jeff Wong, Bob McCarty, Ed Ferris, Mike Maffa, Hsin Lee. The development work is carried on in Littleton, MA and in Bellevue, WA.

About the Best of BYTE Award:

When evaluating eligible products, BYTE editors look for innovative new products that show strong potential influence on business computing worldwide, and have a strong impact on show attendees.

Working on this project is very exciting to the engineers, product managers, and marketing people involved. The engineering project leader, Scott Davis says, "It's an opportunity to build an important, valuable technology, and a unique opportunity to be a leader in a new, high-volume market. It has great potential for follow-on NT Server products. And, customers, OEMs, and ISVs are all really excited about it."

What Is a Cluster?

A cluster is a loosely coupled set of systems that behaves like a single system, but protects against failure through redundant CPUs, storage, and data paths. Unlike fault-tolerant designs, which typically use passive standby components to cope with hardware problems, cluster backup systems don't stand idle until there's a failure. The active backup subsystems of a cluster perform routine functions and even act as primary servers for a given set of cluster resources. Clusters are also highly scalable – which means customers can add CPU, I/O, storage and application resources incrementally to grow their computing capacity efficiently.

Digital Enhances Windows NT with Clusters

With the introduction of Clusters for Windows NT, Digital will be able to offer these valuable capabilities in a way that's designed to complement the Windows NT operating system and meet the needs of client/server LANs. As a LAN server platform, Windows NT delivers the power customers need to run client/server applications – not to mention ease of operation, manageability, a broad application base, and easy integration with existing LAN components. By combining these strengths with the distributed availability and scalability provided by clusters, Digital raises a proven technology to a new level of performance.

Clusters for Windows NT will not just be a port of existing VMScluster technology. Rather, Digital is designing it from the ground up to function in a client/server environment. With the support of industry-standard hardware and communications protocols, a clustered set of servers will export resources and services to a variety of clients, including PCs, Macintosh systems, and workstations. The cluster design will also let clients view the cluster as a single server and to access the resources transparently as if they were local.

Scott Davis accepting the BYTE award at COMDEX.

Affordable Technology

Digital Clusters for Windows NT will assure customers of high availability and system scalability in a cost-effective manner. Customers can continue to use existing hardware and software and can also grow cluster resources by adding low-cost commodity hardware and software when they are needed. Add to this Digital's worldwide multivendor customer support and your customer has the most reliable, cost-effective clustering solution around.

If you have a customer or partner who would like additional information on this product, contact one of the following people:

Scott H. Davis, Technical Director/ Engineering Manager (LJSRV1::Davis)
Carole Greenfield, Business Management (LJSRV1::Greenfield)
Sharon Woodruff, Product Marketing (LJSRV1::Woodruff)

Good Things Come in Small Packages – Low End AlphaServers

By Dick Willett

The AlphaServer 1000 was announced and shipped in November of 1994. Since its introduction it has achieved all of the goals determined by the business segment. The Low End Server Group has also introduced (in February) the AlphaServer 400, the lowest end of the AlphaServer line.

Designed from its inception to achieve leadership price/performance in the industry the AlphaServer 1000 achieved 174 tpsB at $413/tpsB, the best in the industry. Both systems are also some of the most reliable systems in the world. They all come with a three-year on-site warranty.

The entire core hardware team consisted of five development engineers managed by Frank Bomba with product requirements defined by then product manager, now Marketing Manager, Carl Coken. The FRS of the product culminated an extremely aggressive development program given the size of the team.

The Low End Server Engineering organization is part of the overall Workstations and Low End Server Business Segment organized under Vice President Philippe Ribeyre. The Low End Server business is now planning and developing a roadmap of follow-on products to its initial two AlphaServer product families. The group is growing in both the business and engineering areas to enable it to support these plans.

The Low End Server Group Hardware Engineering Team – seated, left to right: Jeff Collentro, System Integration, Frank Bomba, Engineering Manager; standing, left to right: Donald Denning, CPU Module Designer, Todd Dutton, System Architect, Leon Hesch, System Module Designer, Tom Thorp, System Engineer, and Carl Coken, Product Manager. Displayed on the table, left to right, are the two Low End Server products: the AlphaServer 1000 4/200 and the AlphaServer 400 4/166.

DEC 3000 Systems Set the Stage for the New AlphaStation 250 4/266

By Dick Willett

Digital took top honors in AIM Technology's 1995 Hot Iron Awards for Multiuser Shared UNIX systems for the second year in a row. The DEC 3000 workstations won three awards:

- Best Throughput Performance, Multiuser Shared System Mix: Less than $50,000 – DEC 3000 Model 700
- Best Performer Workstation Mix: Less than $25,000 – DEC 3000 Model 600 Over $25,000 – DEC 3000 Model 900

The DEC 3000 Model 600, 700 and 900 systems have been consistent winners of the Hot Iron awards since their announcement, setting the stage for the new AlphaStation Performance Line of workstations. The AlphaStation 250 4/266 system was announced on April 3, 1995. It is the world's fastest workstation and continues the performance and price/performance leadership of Digital's Alpha workstations.

Members of the DEC 3000 Hardware Engineering Team – front, left to right: Chris Estes, Leon Hesch, Fred Roemer, Phil Puris; rear, left to right: Steve Boulay, John Ethier, Mark Haq, Larry Narhi, Lloyd Deis, Jim Reisert, Hugh Kurth, Robin Stewart, Dennis Hayes, Kenny House.

Peter F. Conklin

Many of you are familiar with Peter's numerous technical contributions in support of Digital. However there is more to the story to tell regarding Peter's impact on people as well as technology. We have been fortunate to come across a document that was created by Peter's Engineering Excellence Program Office and presented to him in February of 1994. This document is the essence of the feelings and thoughts that describe Peter and his relationships with colleagues from across the corporation. Please take a few moments to read and reflect on these words as you remember an individual who will be greatly missed.

Peter Conklin is indelibly associated with key milestones in Digital's history: the DEC-10, the VAX, and Alpha. But even more importantly, he embodied and practiced what was best in the company's culture: do the right thing, get to a win-win answer, bring out the best in people, and above all, make things happen.

"Thank You" Peter

- *There would be no focus on this work, Engineering Excellence, without you.*
- *You assume we are knowledgeable, professional, competent people regardless of the "container" in which we reside.*
- *You are willing to learn and willing to teach.*
- *You affirm our contributions.*
- *You have taken a great career risk by agreeing to lead the EE work. We recognize and applaud the courage it took (and still takes) to take that risk.*
- *You have the willingness and ability to look at the large picture.*
- *We really appreciate the way you care about each of us and the company.*
- *You are sincere and genuine.*
- *You smile when you greet people.*
- *You are tenacious despite adversity.*
- *You've brought the EE Program from diagnosis, to focus areas, to pilot, to projects.*
- *You established the leadership area despite its contentiousness and your discomfort with it.*
- *You continually demonstrate your commitment to us and your faith and belief in us.*
- *You possess a broad understanding, knowledge and appreciation for the technology/products, the processes, and the needs of people – a highly unusual combination.*
- *You follow through on what you believe in. You have the discipline and the persistence to stick with what you believe is right for the company, e.g., CVC.*
- *We've learned a lot from you.*

– February 21, 1994

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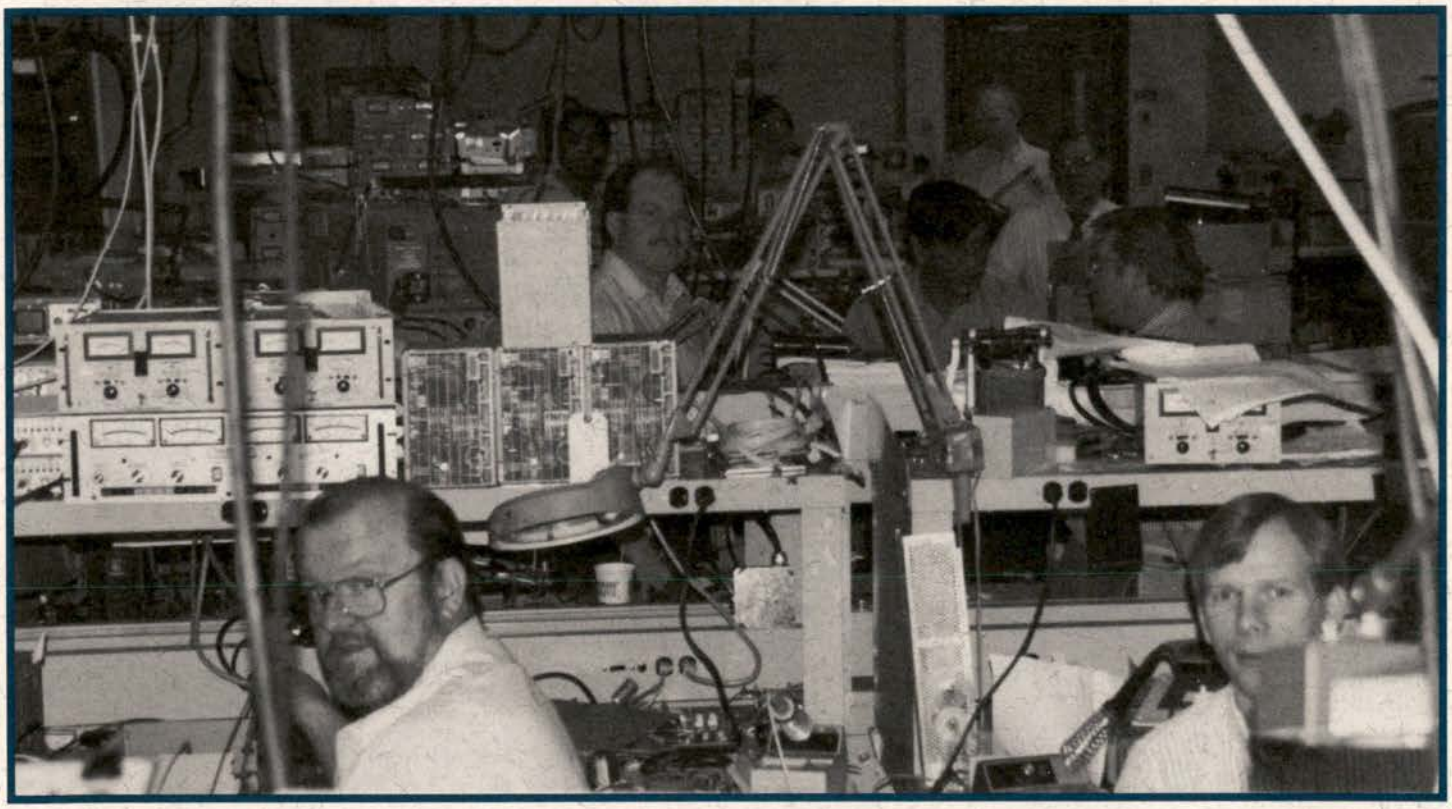
Power Systems Consulting and Engineering Services



Forefront receives Two Awards from The Society for Technical Communication

Bill Hawe Receives 20th Patent
– SEE PAGE 22 –

A Product Management and Development Quarterly Publication

***FOREFRONT** strives to support a forum for the entire PM&D WW community to share information, directions, and key accomplishments in all its functional dimensions, that is, customers, markets, engineering, and manufacturing. Its goal is to highlight technical efforts and successes that lead to new products and markets for Digital.*

This is your information forum. Your participation is vital to its continuation and success. You are encouraged to contribute articles that are of interest to the engineering community. The deadline for submitting articles for the next edition is April 5th, 1996.

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Windows NT Business Segment – Lucia Quinn
Workstation Business Segment – Philippe Ribeyre

Photography by Dick Willett

We are pleased to announce that FOREFRONT recently received two awards from the Society for Technical Communication for outstanding merit. Each year the STC sponsors a publication competition, which honors writers, editors, and artists for outstanding work in their fields. In this year's competition, FOREFRONT competed with 235 entries from other computer companies including Sun and HP, as well as other industries.

I want to thank all of you who have supported FOREFRONT. Your participation has been vital to its continuation and success. You certainly share in this honor. It's been my pleasure to report the accomplishments and successes of the engineering community. The award will be presented to Digital at the Society for Technical Communication awards banquet in March.

Dick Willett
Managing Editor

Printed on Recycled Paper.

Q2-3 FY96

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Power Systems Consulting and Engineering Services

By Derrick Chin and Raoji Patel

The Technical Consulting Services Power Group is a consolidation of power engineering groups from Boxboro, Marlboro, and the Mill. We offer services on a contractual basis. Thus, our viability is dependent on customer satisfaction. Our services can be categorized into the following areas:

1. **Develop power systems and/or, with vendors, jointly develop power supplies for new Servers and Workstations systems.**
2. **With vendors, jointly develop cost-reduced or second-sourced power supplies.**
3. **Provide power consulting and engineering support for ongoing Servers and Workstations systems.**
4. **Anticipate future power needs of Servers and Workstations groups, and conduct power AD work possibly leading to development of future power solutions for these needs.**
5. **Provide product safety consulting and engineering services.**

Power Systems/Supplies Development

Some people think that if a product line contracted a power supply vendor to design and manufacture a power supply, magically, without any power engineering work on Digital's part, units would arrive on schedule with all regulatory labels affixed and meeting all specifications. In the real world, especially for Servers and Workstations systems, form factor and specialized technical requirements usually dictate a custom design with its attendant numerous technical problems.

TCS power engineers usually participate at the start of the program in estimating current requirements, negotiating cost, NRE terms and warranties where requested, writing vendor justification memos where requested, participating in vendor selection, writing engineering specifications, working out all technical issues with the vendors, evaluating and debugging multiple versions of prototypes, traveling to the vendor to solve tough technical problems, working with the vendor to ensure the supply meets all applicable Digital qualification standards, and supporting the program into manufacturing.

In many instances, TCS power engineers have to solve design issues when the vendor is unable to do so because of limited allocated vendor engineers, lack of proper test equipment, or schedule constraints.

Fig. 2 illustrates the relative amount of time spent in resolving these issues. In descending order of impact on FRS are:

- EMC Emission and Immunity – This is the area that requires the greatest amount of attention. The test data is available at a bad time, namely, two to three months before production build, and the unit invariably requires design changes. The tighter we cram together components, the more we can expect undesirable electromagnetic coupling to bypass the AC filter.

Electrical Issues –

- Control Loop Instability – When the power supply is integrated with the rest of the system, the output voltages may oscillate due to system parasitics, load capacitances, and interaction between output voltages.
- Developing and Interpreting Specifications – First draft of the specifications are written during the initial phase of the project. Now that many of our vendors are external to the US, telephone discussions with vendors whose primary language is not English is a wonderful classroom for any of us in appreciating simplicity and clarity of expression, and the meaning of words.

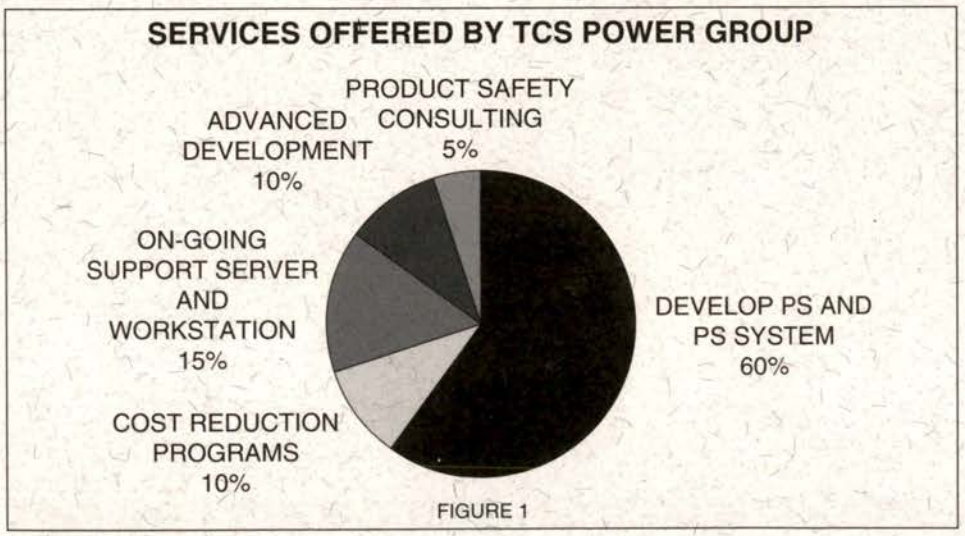


FIGURE 1

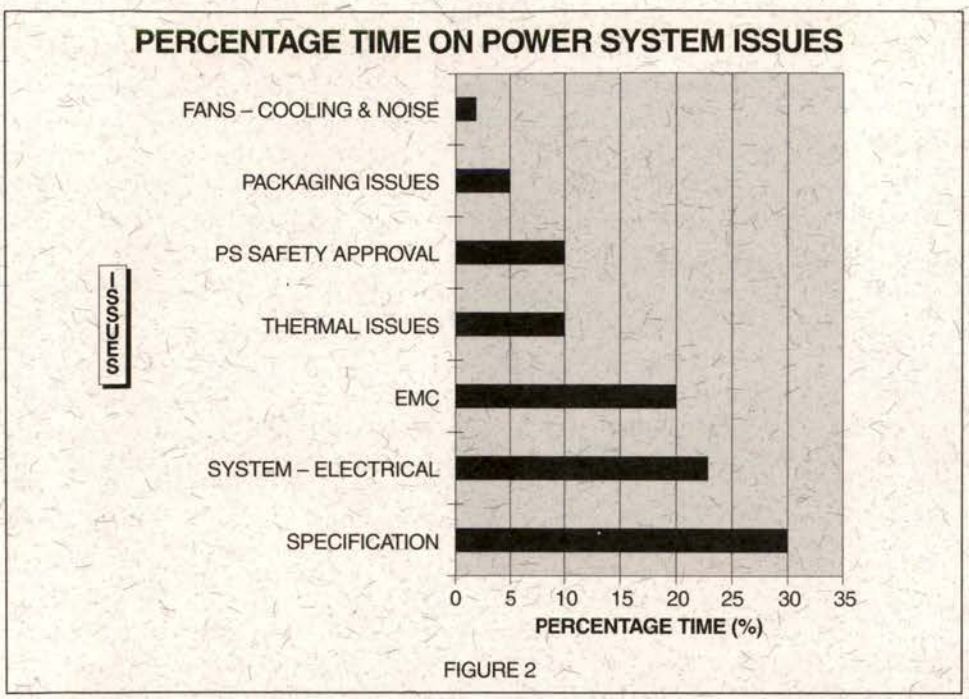


FIGURE 2

- Hot Spots – Individual components running too hot. Impacts the vendor getting safety approval in time for FRS.
- Power Supply Safety Approval – Like death and taxes, you can plan on the product safety approval process by the vendor to put the power supply on the critical path. Vendor testing time, getting in the safety agency test queue, and getting safety agency approval will teach you the meaning of patience. And as a reward for your patience, you later may get erroneously an extra bill by the agency for agency work done for another customer within Digital.
- Packaging Issues – If the harness shape, length, or location do not trip you up, the mounting holes or fit and finish will. And then, with luck, some heavy component falls off during vibration or drop testing, or the shipping carton proves inadequate.
- Parallelability – Tying two or more power supplies together to increase max current capability or for redundancy. It usually takes several tries to get this right since control loop stability is involved.
- Fan Speed – Sufficiently cooling hot spots without being too audibly noisy is another gotcha. And then the fan won't start up consistently because the fan voltage is too low. Of course, we can ask the customer to give the fan blade a starting push to get it going.
- Manufacturability – Hey, we have a solution to a design problem. It may cost a few dollars more to implement for the first hundred production units, but we can make FRS with this solution until a more buildable version can be phased in. But NO! The vendor wants a more "buildable" solution because, unbeknownst to you, the program's business manager is holding a gun to the vendor's head to hold to agreed-on cost. The extra development cost to find a "buildable" solution usually negates any total savings for this portion of the program.
- Spec Changes – How to jerk around the vendor while trying to maintain schedule. With the density of small supplies, any physical changes such as moving the harness around internally in the power supply entail major redesign.
- Vendor Working Relationship – On the previous program, we told the vendor we needed 20,000 power supplies. And the program wound up buying 4000 lifetime. Now we are asking him to enter a joint development which requires that he shorten his development schedule by 33%. Ha! Ha!

Examples of development work are the LEAN Alpha notebook power supply, AlphaServer 8400/8200 power systems, Rawhide power system, the cost-reduced Sable, Mustang, LX3, Wide Tower, and Maverick power supplies, and a family of cost-reduced 48VDC to 3.3/5/12VDC converters.

Recently, we have proposed and are developing power solutions for TurboLaser using EV56 and EV6.

When possible, we have looked for commonality in power solutions for both Servers and Workstation products. Examples are the Wide Tower supply used in DemiSable, Alcor, and Mikasa.

Cost Reduction or Second Sourcing

Sometimes for business reasons, a second source of a power supply or a cost-reduced version is needed. The cost-reduced version of the Sable power supply from a different vendor is an example where we provided the technical expertise to help make this program a success.

Supporting Ongoing Products

Power supplies fail. High failure rates or attention-grabbing failures will usually result in a request for action. If the failure cannot be solved through normal channels, we may be called in; by this time, the failure has escalated into an emergency. Examples of support of ongoing products are solving a Laser battery problem, and solving Flamingo and Sable shutdown problems.

Although our major customers are Servers and Workstations systems, now and then we are called on to solve a power supply problem for NIO, AYO, MKO, or for the MCS group.

Anticipating Customer Power Needs

In the summer of 1993, the TCS Power Group identified a need for powering future Alpha EVXX chips near the 2VDC level. No vendor could be expected to develop supplies for technology-leading chips with low volumes and non-standard voltages. He proposed development of an inexpensive, small 2VDC converter that could be powered from 3.3VDC or 5VDC and could be plugged in next to the EVXX chip. AD funding was obtained in the fall of 1993 and a working breadboard was demonstrated by June 1994.

In January 1995 Rawhide decided to productize the design for powering EV56. Volume availability was planned for June 1996. In June 1995, Bret decided to also use this converter and requested a development speedup for prototype availability by the end of September 1995.

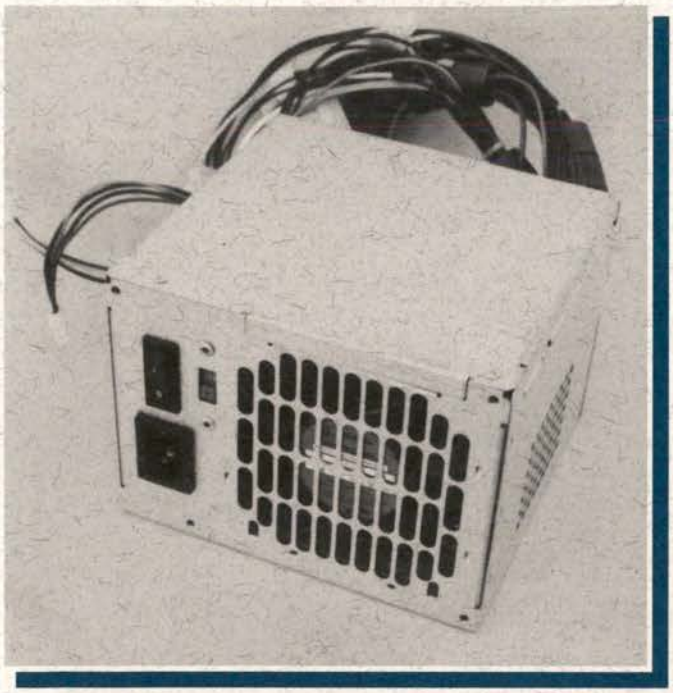
By this time, the EV56 max current requirement had increased from 10 amps to 14 amps. Five samples were delivered on schedule and a search for a vendor is underway. Miata is now considering a more integrated version that can be placed directly onto the mother board to further lower cost.

For a multiple EV6 product, we are considering AD work to address technical questions arising from multiple parallelable AC front ends, and multiple parallelable distributed DC to AC converters. We are also considering AD work for EV7.

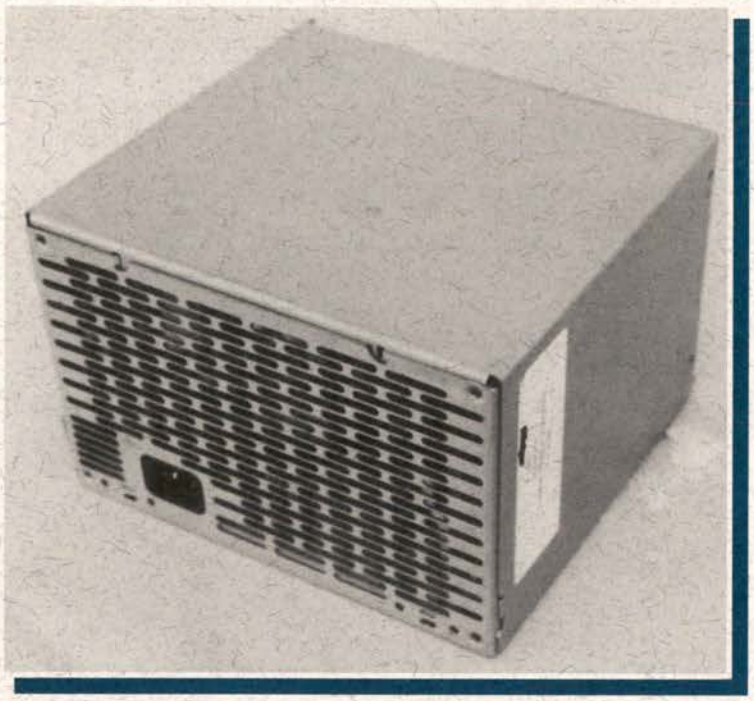
Product Safety Engineering Services

Every Servers system requires product safety engineering and worldwide agency approvals. Larry Sieminski has been providing this service for systems such as Laser, AlphaServers 8400/8200 and Rawhide.

Front row, left to right: Chuck Botala, Robert Guenther, Derrick Chin, Bob Wolf, Ray Pelletier, Raoji Patel. Back row, left to right: Jim Drew, John Arduino, Frantz Jean-Gilles, Larry Sieminski, and Jonathan Johnson.

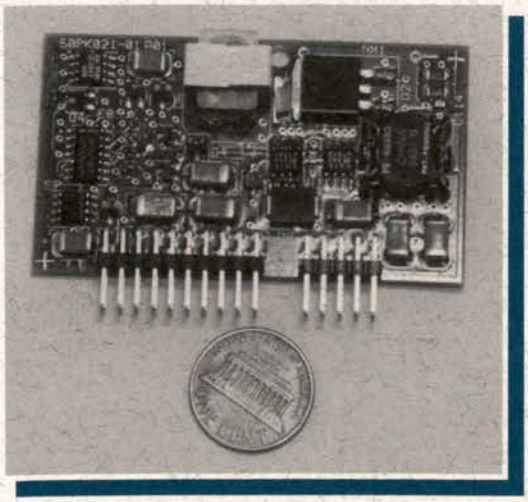


Maverick Power Supply.

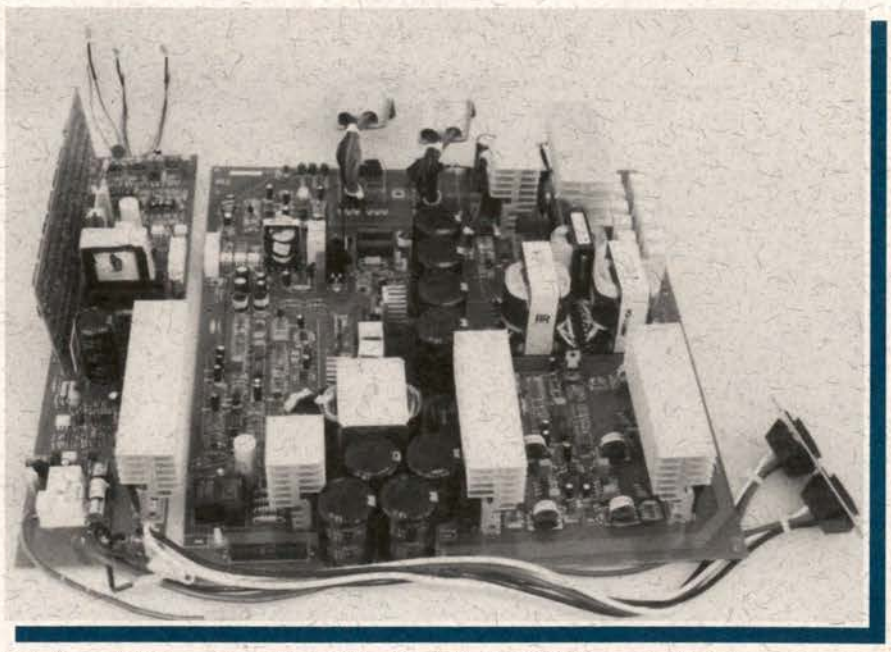


Rawhide Power Supply.

Recent Product Developments



EV56 2.5V Converter.



AlphaServer 8200 Power Front End. BBU option (left). 2400W 48V converter (right).

Vice President Bill Demmer Recognized at DECUS

In San Francisco on December 4, 1995 a special recognition reception was held in Bill Demmer's honor for his "lifetime" years of support to DECUS. Nancy Strecker was the Master of Ceremonies for the evening. Bill Mayhew, U.S. President of DECUS, told the audience that Bill Demmer's most memorable DECUS was when the VAX was first introduced. Guest speakers for the evening included Jesse Lipcon, Don Harbert, and Pauline Nist who all shared their memories and stories of Bill's involvement with DECUS over the years as well as of the leadership and guidance Bill has provided so many people (including themselves) in his 22 years with Digital.

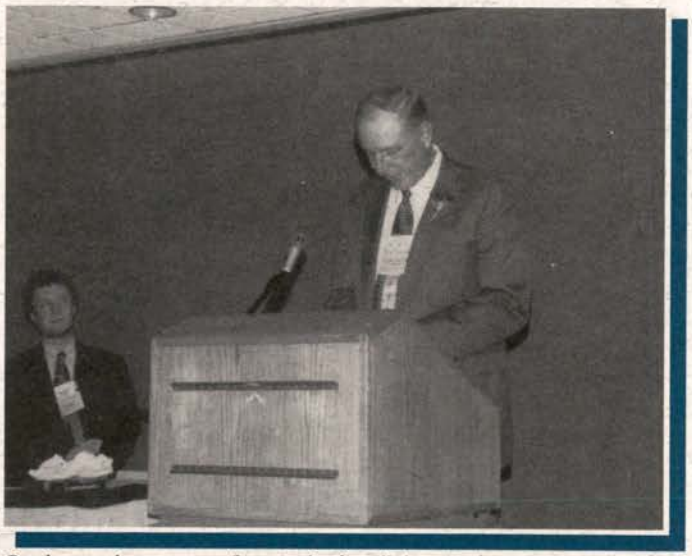
Bill Mayhew, U.S. President of DECUS, recognizes Bill Demmer . . .

and congratulates him for being honored by DECUS.

Jesse Lipcon recognizes Bill and offers some choice anecdotes.

Don Harbert recognizes Bill and adds his insights.

Pauline Nist recognizes Bill and shares her stories with the audience.



Our honored guest says a few words after all the speeches.

Left to right: Bill Mayhew, Pauline Nist, Bill Demmer, Don Harbert, Jesse Lipcon, and Nancy Strecker.

Cheryl Galvin Manages Hub Products Engineering Group

Cheryl Galvin has assumed responsibility for the Hub Products Engineering Group within the Network Product Business (NPB) reporting to Bill Maro, Vice President of Network Product Engineering.

Digital's Hub Product group develops manageable, intelligent hub products for large and small networks. The DEChub family includes the DEChub 90 Ethernet Hub, DEChub 900 Multiswitch Enterprise Hub, and the Multistack Ethernet Hubs. The DEChub family of products combine high-performance network functionality with an integrated, scalable approach to enterprise network development. From small remote networks to large global enterprise communications, DEChub products make it easy and cost effective to keep pace with growing and increasingly demanding network environments. The product development efforts support NPB's CLearVISN strategy.

Hub products play a critical role in the Network Product Business. The Hub products business has grown tremendously in the past three years and contributes enormously to the business unit revenue.

Cheryl Galvin is an experienced manager and product developer who is a driving force in bringing the DEChub 900 product set to market. Cheryl has held various positions in the networks business since joining Digital in 1982. Her positions have included firmware and diagnostic development and management. Most recently, Cheryl managed the firmware development for the DEChub 900 products. She is a well respected manager who brings inspirational leadership to engineers.

Cheryl has deep understanding and technical knowledge of networking products. She led the management architecture for the group's product set. Her technical depth allows her to participate in setting market direction, in supporting customer sales, and in assimilating and responding to competitors' products.

Please join us in wishing Cheryl continued success in her new role.

Promotions and Management Changes

By Dick Willett

Bill Strecker named Vice President of Corporate Strategy and Technology

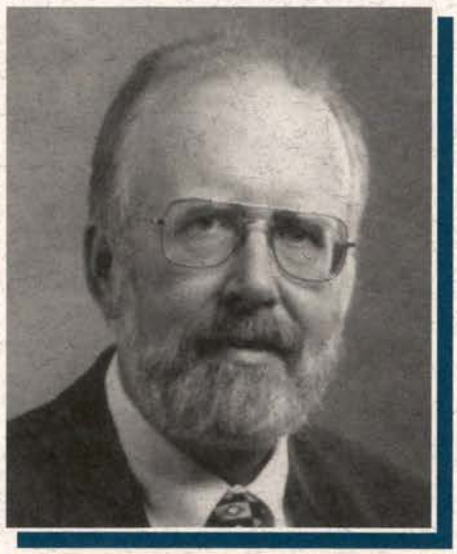
Digital Chairman, President, and Chief Executive Officer Bob Palmer has named Bill Strecker Vice President of Corporate Strategy and Technology. In his announcement, Bob Palmer said, "Over the past few years, we have been focusing primarily on the financial transformation of Digital. With that focus we have developed a sound business structure and delivered five quarters of profitability. More recently, we began an effort to advance the strategic transformation of Digital, which is based on customer focus, innovation, and excellence, and will result in sustained, profitable growth.

"The work of corporate strategy is diverse, including identifying promising market opportunities, choosing our business unit focus, identifying synergies across our business units, and augmenting our competencies and capabilities through alliances and partnerships. Much of this work will be done within our business units, but we also must have strong leadership, coordination, and integration at the corporate level.

"I have asked Bill Strecker, in addition to his roles as Chief Technical Officer and vice president of the Advanced Technology Group, to lead our corporate strategy work. Appropriate to this expanded role, Bill's group will be renamed the Corporate Strategy and Technology Group. Its activities will include research, technology strategy, and corporate strategy. In a later announcement Bill will provide more details on the Corporate Strategy and Technology group.

"For many years Bill has played a key role in various facets of our strategy, beginning with technology and products over a decade ago; leading and/or development of key alliances with Oracle and Microsoft; and culminating recently in our public declarations of a strategy for growth and the formation of the new Connectivity Software Business Unit. His understanding of technology and of Digital, combined with his understanding of the computer industry, make him an ideal person to head up these efforts.

"This is a challenging corporate role that will operate across Digital's business units and divisions. I am pleased that Bill has accepted this role and ask you to support him fully in this very important work."



Sam Fuller Promoted to Vice President of Corporate Technology Strategy and Chief Scientist for the Corporation

Bob Palmer and Bill Strecker recently announced the appointment of Sam Fuller to the new position of Vice President, Corporate Technology Strategy, and his promotion to Chief Scientist for the Corporation. Sam will be a member of the management team of the new Corporate Strategy and Technology Group (CST) and will report to Bill Strecker, Vice President of CST and Chief Technical Officer.

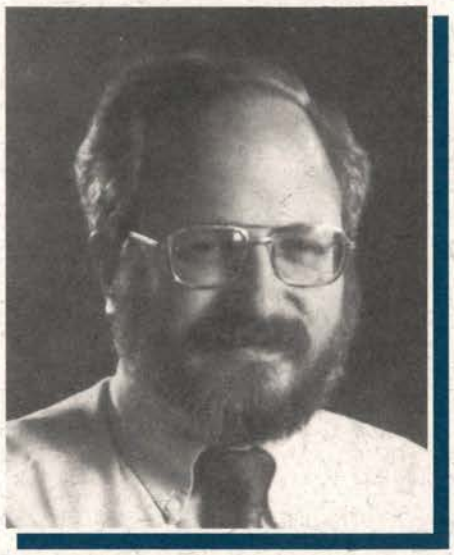
In his new role, Sam will manage the development and execution of technology strategy to support Digital's corporate strategy. Sam will ensure that our business units have clear, competitive technology strategies. Additionally, he will participate in, and provide technical

inputs to, strategy development with the Operations Committee and Board of Directors. Sam will assume leadership of the Technical Strategy Group (TSG), which is a forum of senior technical leaders from the business units.

Other aspects of technology strategy that Sam will continue or assume responsibility for include Corporate Standards; External Research; the Corporate Patent Program; the Technology Sourcing Program; and Corporate Technical Information Services, including the Technical Competency Development Group, Corporate Libraries, and the Digital Technical Journal. In addition, Sam will lead efforts to ensure that our technical community is fully engaged and continues to be one of Digital's key strengths.

Sam has been Vice President of Research since 1983. His appointment to the position of Chief Scientist recognizes his many contributions not only to Corporate Research but to the company as a whole. Sam has played critical roles as a key spokesperson for Digital in industry and governmental arenas, as the architect and driver of Digital's technical career ladder, and as the chairperson and corporate sponsor of the Consulting Engineering Review Board. He has provided support and insight in countless technology efforts over the years. Most recently, he has worked extensively to support Digital's leadership of the Computer Systems Policy Project, which is chaired by Bob Palmer. It is expected that his efforts in all these areas will continue and be enhanced with his new corporate perspectives.

Bob and Bill ask us to join them in congratulating Sam on his new role and to give him our continued support.



Bob Supnik Promoted to Vice President of Corporate Research and Advanced Development

Bob Palmer, Enrico Pesatori, and Bill Strecker announced the appointment of Bob Supnik to Vice President, Corporate Research and Advanced Development. Bob will be a member of the new Corporate Strategy and Technology Management Team reporting to Bill Strecker, Vice President of Corporate Strategy and Technology, and Chief Technical Officer.

In his new assignment, Bob will drive the newly revised research plan and focus on the rapid transformation of innovative technology into products. He will assume management of our Research Labs in Palo Alto, California and Cambridge, Massachusetts replacing Sam Fuller, who has been appointed Vice President, Corporate Technology Strategy, and Chief Scientist.

Bob has a long record of technical contributions to Digital, most notably as a leader in the Alpha development program and numerous VAX implementations. He is a recognized leader of and outspoken advocate for the technical community. He is frequently called upon to speak with Digital's leading customers about the company's strategy. Within the industry, he is recognized for his work in semiconductors. Bob, who most recently served as Vice President of Architecture and Technology for the Computer Systems Division, is also one of four Senior Corporate Consulting Engineers at Digital.

He brings to this new role a passion for the excellence of Digital's products and for the importance of technology as a competitive advantage. Bob, Enrico, and Bill look forward to his leadership of Digital's world-class research organization and to everyone's support of his efforts.

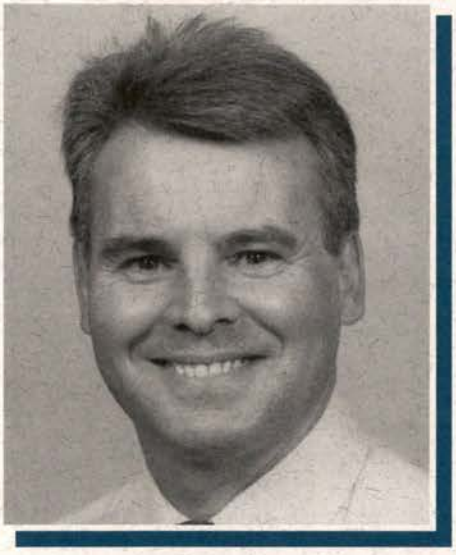
Jeanette Horan Promoted to Vice President of Product Development

Ilene H. Lang, Vice President of the Connectivity Software Business Unit, has announced the promotion of Jeanette Horan to Vice President of Product Development.

Jeanette brings 19 years of experience in software product development and business management to this position. Most recently at Digital she was director of Business Operations for the Software Business Group. She previously spent four years at the Open Software Foundation as Vice President of Technology, delivering OSF/Motif and the OSF/1 operating system to the industry. She also spent eight years with Gould Computer Systems in various management positions within the software engineering organization. Jeanette began her career with Thorn EMI in the UK and moved on to

Singer Link, developing flight simulators. She holds a Bachelor's degree in Mathematics from the University of London and an MBA from Boston University.

Jeanette's promotion to vice president in the CSBU recognizes the breadth of her background, contributions, and leadership. During the transition to the new CSBU organization, Jeanette will also continue her responsibilities for the Software Business Practices group and the Software Pricing Committee, supporting all Digital software organizations.



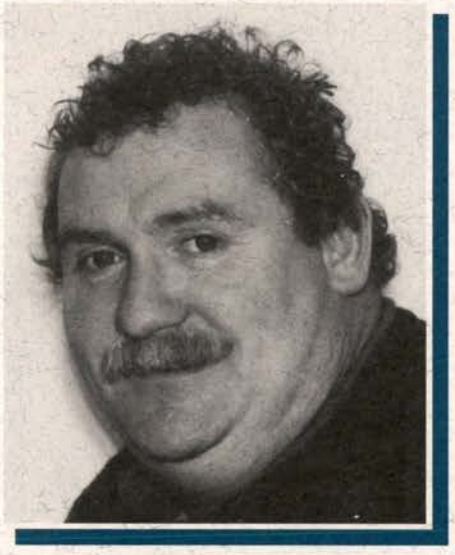
Bill Laing Promoted to Corporate Consulting Engineer

It has been announced that Bill Laing has been promoted to the position of Corporate Consulting Engineer.

Bill has a record of achievement at Digital that spans over 15 years. He has made significant contributions to Digital's software strategies and in representing and fostering the European technical strategy and technical community.

Bill joined Digital in 1981, spending five years in the United States and the rest in Europe. During his career at Digital, Bill has worked on VMS Systems performance analysis, VAXcluster design and development, Operating Systems development, and Transaction Processing. He has been Technical Director of OpenVMS Engineering, Technical Director of Engineering in Europe, and is currently in the Technology and Architecture Group of the Computer Systems Division focusing on Software.

Prior to joining Digital, Bill held research and teaching posts in Operating Systems at the University of Edinburgh, Scotland, where he worked on the EMAS operating system. He was also part of the start-up of European Silicon Structures (ES2), an ambitious pan-European company. He holds Undergraduate and Post Graduate degrees in Computer Science from the University of Edinburgh. Bill is married and lives with his wife and two teenage children in Scotland.

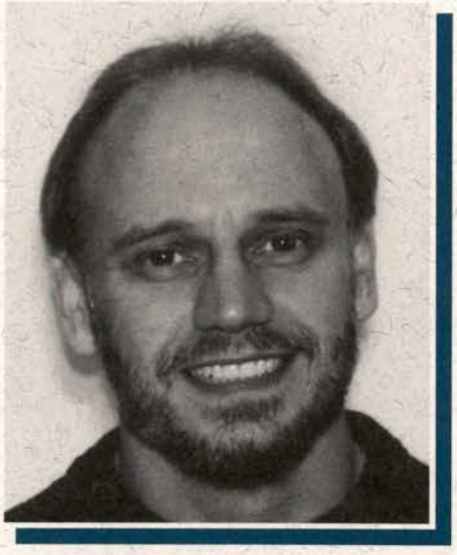


David Fenwick Promoted to Hardware Senior Consulting Engineer

David Fenwick, of the Alpha Server Development group, was promoted to the position of Hardware Senior Consulting Engineer. David's promotion is in recognition of his outstanding contributions to the company over the past 15 years, and most recently for his achievements on the TurboLaser program. He was the architect and technical leader and driving force behind TurboLaser, from the early stages of advanced development until its FRS in May 1995.

David earned his B.Sc. in Electrical and Electronic Engineering with 1st class Honours in 1973 in the U.K. He joined Digital in 1980 as a U.K. Field Service Regional Support representative. He came to the United States in 1985 as the BI CAD Manager. He then architected and led the implementation of the Rigel (VAX 6000-400) Vector processor. David's advanced development work, examining the viability of an Alpha Vector Architecture, led to the proposal for the development of an EV5-based Enterprise Server System, and eventually a proposal for the development of TurboLaser.

David is presently working on the next generation Server platform.



John Zurawski Promoted to Hardware Senior Consulting Engineer

John Zurawski has been promoted to Hardware Senior Consulting Engineer. John's promotion is a result of his many accomplishments over the past ten years in Mid-Range Systems and later in Alpha Personal Systems. In particular, John's promotion was the result of his last two projects, Alcor, the AlphaStation 600, and R4000 upgrade to the DECstation 5000 workstations.

John has a B.S. in Physics and an M.S. and Ph.D. in Computer Science, all from Manchester University in England. He came to Digital in 1982 and held a variety of positions in Mid-Range Systems,

starting with the development of the two full custom floating point ICs for the VAX8800, which led to his promotion to Consultant Engineer. After that, John worked on several processor development projects including: Argonaut, Kestrel, and RVAX. He came to APS in 1991 to develop and lead the verification effort for Flamingo.

John is currently managing the development of Neon, a mid-range graphics accelerator for OpenGL.

Miche Baker-Harvey Promoted to Consulting Engineer

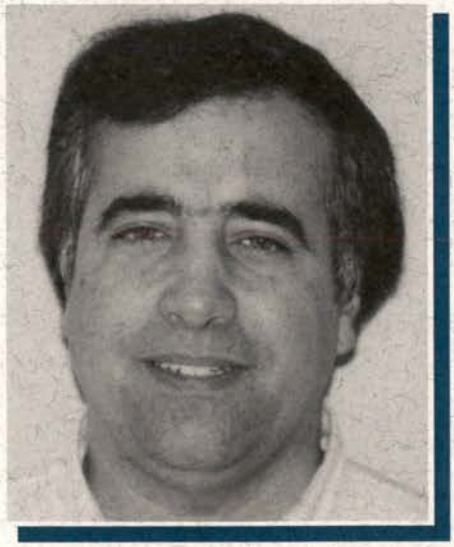
Miche Baker-Harvey has been with Digital since 1987, and has been in the NT Systems Group at DECwest since 1992.

During her tenure at DECwest, she was a key contributor to the first alpha port of NT. She worked extensively on the NT Debuggers for Alpha, first porting basic functionality such as register support, breakpointing, and single stepping. Then she added significant new functionality to get at Alpha-specific features, such as 64-bit register support, Alpha function calling, and other kernel extensions.

Miche was a focal point in the early phases of the NT Performance War, managing an initiative to drive Alpha performance issues to resolution for the NT 3.5 release. This short-term, broadly focused activity involved a substantial number of senior technical contributors throughout the NT Systems Group, the compiler team, the CSD Performance Group, SRC, and the Palo Alto Design Center.

Previous to NT, she was a significant contributor to the OSF effort, involved in the original formation of the Foundation, evaluation of the OSF/1 technology, and serving as Digital's primary Technical Liaison.

Outside of work, Miche serves on the Usenix Program Committee for the upcoming Winter Usenix, has presented at the Berkeley UNIX Conference on Multiprocessing, and has recently been nominated to secretary/treasurer of ACM/SIGOPS.



Frank Caccavale Promoted to Software Consulting Engineer

Frank Caccavale was promoted to Software Consulting Engineer as a result of his invention and productization of leadership Network Operating System (NOS) performance measurement technology and his endless contributions to the ongoing improvement of PATHWORKS product performance.

Since joining Digital and the PATHWORKS team in 1988 Frank has led efforts of critical path analysis of PATHWORKS performance as well as measurement and evaluation of PATHWORKS competitive performance against other NOS products. The knowledge obtained from these activities positioned Frank to work directly with PATHWORKS development teams to analyze code path efficiency and make recommendations for improvement as part of the ongoing product development process.

As an outgrowth of this work Frank proposed and received approval to begin a development effort aimed at producing a set of models to analyze NOS performance in a PC client/server environment independent of any specific vendors' implementation. The result was a set of NOS-independent analytical models for which Frank holds one patent and has two patent applications pending.

To demonstrate the vendor-independent nature of these models, Frank has consulted on and contributed to their implementation in the PATHWORKS for VMS Server V5.0, in a native Netware environment via the ManageWORKS Performance Administrator for Netware, and currently an NT server implementation is being planned.

Frank holds an M.A. in Linguistics from Middlebury College, an M.A.T. in Physics from Bridgewater State College, and a B.A. in Mathematics from Northeastern University.

Tom Graves Promoted to Software Consulting Engineer

Tom Graves has recently been promoted to Software Consulting Engineer. This promotion is the result of Tom's many contributions to OpenVMS. Tom has held multiple leadership positions in the area of Release Management – specifically as Project Leader and Project Manager of releases, while also contributing the added role of Technical Consultant for many contributing projects to a release.

Some of the achievements that this promotion recognized were:

- Leadership in delivering the OpenVMS VAX V6.1 release in March 1994; Tom was the Technical Project Leader for this release.
- Leadership in the ongoing analysis, planning, and tracking of Functional Equivalence for the OpenVMS V6.1 release pair. The functional equivalence requirement was one that was introduced late in the V6.1 release.
- Leadership in providing technical guidance to a multitude of projects across a suite of releases.

Tom has held a variety of positions throughout his career. Since 1989, Tom has worked in OpenVMS Engineering, beginning with supervising and development activities in the System Integration and System Management Group and migrating to operating system release roles starting with Project Leadership of the VAX VMS V5.5 release. Prior to this, he worked in the High Performance Systems Group as a developer in the HPS Tools Group & Systems Consultant for the HPS CAD Tools Group. Before coming to Digital, Tom worked for the Foxboro Company where he held several positions, including project architect, lead developer on the FOXNET Gateway project, and hardware design and system support engineer for a variety of process control system I/O modules. Tom was awarded a U.S. patent for process control system with improved fault isolation. He also worked at Texas Instruments, where he was a manufacturing engineer.

Tom holds a Master's of Science in Computer Engineering from Boston University and a Bachelor's degree in Electrical Engineering from Worcester Polytechnic Institute.

Chris Gunner Promoted to Consulting Engineer

Chris Gunner was promoted to Consulting Engineer in recognition of his contributions to Digital's router products. Chris joined Digital in Reading, UK in 1986 after several years of developing networks in an academic environment. He holds a Ph.D. in Biomechanical Engineering from Polytechnic of Central London, UK.

Chris's contributions to Digital's networks organization extend over several years and several areas of work. The areas of contribution for which he was promoted to Consulting Engineer are his contributions to the multi-protocol router products that were recently shipped by the Networks Products Group, his work on the NASDAQ network project, his work in the standards area, and his contributions to the DECnis and Wanrouter products.

Chris's initial work in Reading was on OSI products. He was responsible for the design and implementation of several components of the VAX FTAM product.

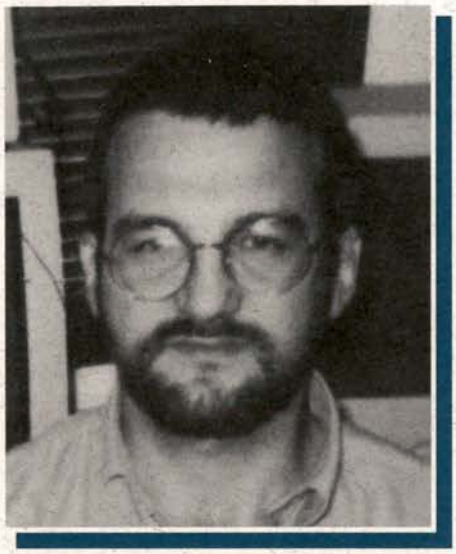
Chris transferred to Littleton in 1992 to join the Architecture Group. During this period he represented Digital at the IETF and served as co-chair of the Integrated IS-IS working group.

Chris took a leading role in bringing out Digital's new family of multi-protocol routers. He was a member of the small group that evaluated the alternative sources of routing code and made the final selection. He took responsibility for a number of the protocols and led a team to ensure the quality of the products. In doing so, he solved a variety of problems and worked with others to resolve issues gating product release.

Prior to the multi-protocol router effort, Chris designed the NASDAQ/MCI network. The NASDAQ/MCI project represented a major opportunity for Digital to demonstrate its ability to design and install a large IP-based network. Chris designed the network, choosing the components and specifying the network topology. The network has been in successful production use for nearly a year. Parts of the network have recently won a Smithsonian Institution award.

As a member of the Reading and then Littleton Networks Architecture Groups, Chris was responsible for a number of DECnet, OSI, and Internet standards. He worked with members of the DECnis and Wanrouter 90 teams to implement these standards in the products.

Chris brings a unique blend of implementation skills to his architecture knowledge. This, and his ability to guide and mentor others, led to the achievements that qualified him for promotion to Consulting Engineer.



Philippe Klein Promoted to Consulting Engineer

Philippe Klein joined Digital's Technical Center in Jerusalem at its opening in July 1985 and was the developer of the firmware of the SGEC (Ethernet controller), the first project of the center. As the SGEC worldwide support representative, he was involved in its implementation on numerous Digital products.

He then developed the firmware of the TGEC, the follow-up of the SGEC, before relocating, from 1990 to 1993, with the Entry Business Group in Maynard where he developed the firmware of a very innovative Futurebus+ exercizer and was a member of the team that developed the console of the first Alpha server (DEC21000).

In fall 1992, Philippe started developing NDIS3 (Windows NT and Windows 95) drivers for the Digital Semiconductor's DS21x4 controller family (PCI/Ethernet and Fast Ethernet controllers) designed at the Jerusalem Center. The challenge was to develop and deliver a working driver on a very burgeoning operating system under development which did not support PCI in its early versions and to create strong development channels with Microsoft (not a straightforward task when you are 9000 miles away from Redmond with a 10 hour time difference).

Besides developing drivers Philippe is involved in the architecture and interface design of the communication controller project in Jerusalem.

His professionnal interests include the areas of high-speed data acquisition and electronic communication (videoconference,Web, etc.).

Philippe received a Master's degree in Electrical Engineering and Automation from the University of Haute-Alsace in France in 1979 and a Ph.D. in Electronics and Nuclear Instrumentation from the Louis Pasteur University in 1982. His thesis research on high-speed data acquisition was done at the CERN, the European Center for Nuclear Physics in Geneva.

Dave Mayo Promoted to Software Consulting Engineer

Dave Mayo was recently promoted to Software Consulting Engineer for his contributions to the successful delivery of TurboLaser. His efforts in EV5 PALcode, ISP modeling, and console development were crucial to the roll out of TurboLaser with OpenVMS V6.2 and Digital UNIX V3.2. His track record for consistently significant contributions to many other successful products were also factored into this promotion.

Since coming to Digital as an Electrical Engineer 14 years ago from Cornell University, Dave has been a team player on numerous VAX mid-range systems and Alpha high-end servers. He has provided functional project leadership on several of these products, as well as being an exemplary individual contributor. He was accepted into GEEP and completed a Master's degree at Cornell University. Dave has evolved from a diagnostic engineer to a CAD developer to a console engineer and most recently to a PALcode and ISP modeling specialist. He is recognized by his peers, other consulting engineers, and management as an expert in a number of technical domains.

Dave Mayo is currently responsible for the Rawhide ISP model, OpenVMS and Digital UNIX EV5 PALcode, and key components of the SRM console. Dave provides ongoing consulting and mentoring to Revenue Systems Engineering for support of both AlphaServer 8400 (TurboLaser) and DEC 10000 (Ruby Laser). Dave represents the firmware and systems engineering group with the operating system groups, the Alpha SRM committee, and the Hudson Silicon Engineering Group.

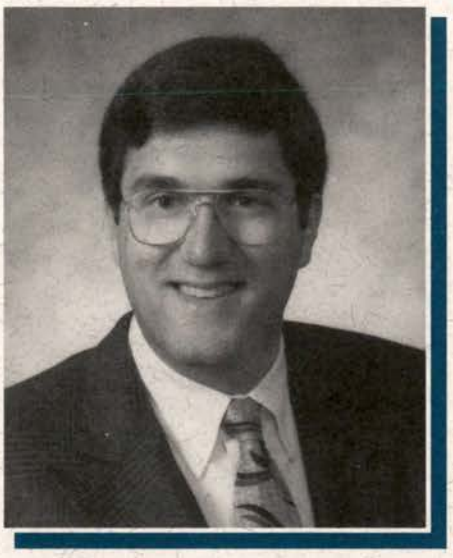
Kaizad Mistry Promoted to Consulting Engineer

Kaizad Mistry joined Digital in 1986 after obtaining a Master's degree from the University of Southern California, where he completed a thesis on the use of SPICE for modeling hot carrier effects. Kaizad is currently the manager of the Device and Interconnect Physics group within the Semiconductor Wafer Manufacturing and Technology organization. Over the past nine years, Kaizad has made several outstanding contributions in the area of device design for performance and reliability.

During his first several years at Digital, Kaizad worked on developing a strategy for the protection of CMOS products against electrostatic discharge (ESD). Kaizad invented a novel ESD protection structure in which the silicide layer normally covering the source and drain regions of a transistor is selectively blocked. The selective blocking of silicide formation allows transistors to be created which can withstand much higher current levels during ESD than would otherwise be possible. Protection structures based on this concept (for which Kaizad was granted a patent) have successfully been used in Digital products produced in the CMOS-3, CMOS-4, and CMOS-5 technologies.

In addition to ESD, Kaizad has also worked in the area of drain design for hot carrier robustness. One of Kaizad's first major accomplishments in drain design was the development of a "double MDD" structure for the CMOS-4 and CMOS-4s processes which allowed the performance of the transistors to be increased significantly. Although 200MHz EV4 products had been announced, the manufacturing line was producing only a small number of these parts which did not meet the customer demand. A solution to this problem was to reduce the transistor gate length in order to increase the transistor drive current to obtain faster parts. However, the reduced gate length also reduced the lifetime due to hot carrier degradation so it was necessary to introduce another change which would improve the reliability while maintaining the increased performance. The double MDD structure accomplished this, and has become the process of record for the CMOS-4 and CMOS-4s technologies.

For the CMOS-5 technology, Kaizad pioneered the use of Large Angle Tilted Implanted Drain (LATID) structures. Use of LATID allows the lateral doping profile in the drain to be decoupled from the vertical profile of the drain junction and therefore provides additional degrees of freedom in creating drain structures.



Larry Palmer Promoted to Consulting Engineer

It is with great pleasure that I announce the promotion of Larry Palmer to Consulting Engineer. Larry has made significant contributions to low latency networking for multimedia applications over FDDI with DECspin. Larry architected and developed a patented synchronization protocol which allowed teleconferences to proceed on existing data networks. Prior to his work on DECspin Larry made substantial contributions to Digital products with the port of Ultrix to the MIPS-based system products. He also worked on advanced microkernel message-based operating system.

Ricky Palmer Promoted to Consulting Engineer

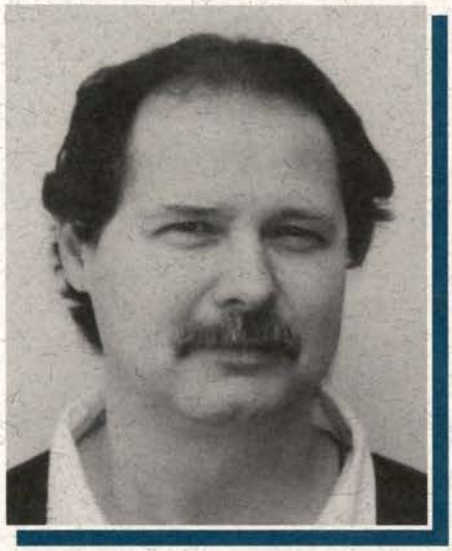
It is with great pleasure that I announce the promotion of Ricky Palmer to Consulting Engineer. Ricky has brought significant innovation and invention to several major products. His contribution to DECspin with the Graphical user interface was very intuitive and the hierarchically structured on-line graphics user help resource won awards. Also, his invention for data scaling gave the user great flexibility in display arrangements. Prior to his DECspin work he was also very active in the advanced development role specifically developing and demonstrating microkernel, message-based operating system technology.

Thomas Rodeheffer Promoted to Consulting Engineer

The Corporate Research Group is pleased to announce the promotion of Thomas L. Rodeheffer to Consulting Engineer. Tom has been with Digital's Systems Research Center in Palo Alto, California, since receiving his Ph.D. from Carnegie Mellon University in 1985. His promotion is in recognition of his substantial contributions to Digital's ATM networking products.

Tom is a key member of the combined Systems Research Center / Networks Engineering team that brought to market Digital's first ATM network products. The GigaSwitch/ATM makes 12.8 Gb/s of switching bandwidth available for up to 56 fiber optic links operating at 155 Mb/s. ATM networks handle 53 byte cells and are well suited to carrying high volumes of mixed traffic. Several such switches can be combined to form a very high-capacity Local Area Network or Enterprise Backbone Network. An ATM network can also provide the high-performance interconnect needed for a workstation farm. Tom was one of the designers/implementors of GigaSwitch/ATM and the associated host adaptors.

In his ten years at SRC, Tom has designed and implemented both the hardware and the low-level software of several research prototype network switches and adaptors. He played a major role in developing and implementing the algorithms that allow switch-based LANs to automatically reconfigure themselves to bypass faulty components. With these algorithms, reconfiguration is fast enough that TCP connections between hosts are not disrupted. This fast reconfiguration technology is unique to Digital's ATM products.



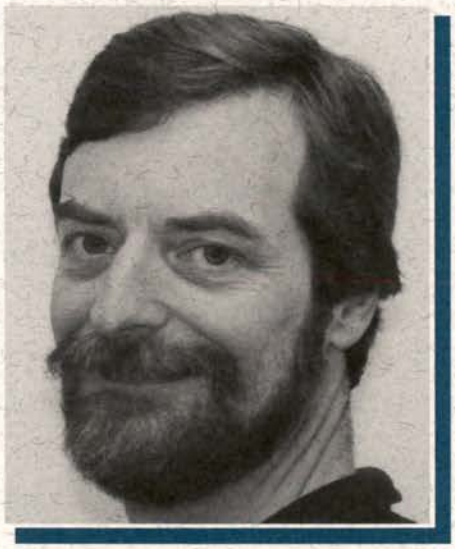
Bruce Schofield Promoted to Consulting Engineer

Bruce is a hardware engineer in the High Performance Networks (HPN) group of the Networks business unit. He has been with Digital since 1980 and, for the last eight years, has been a technical leader and major contributor to the physical layer designs related to Asychronous Transfer Mode (ATM) and Fiber Distributed Data Interface (FDDI) products. During this time, Bruce has become well known in the industry on the topics of Phase-Locked Loop (PLL) design, multimode optics, and single-mode optics including laser technology. He has contributed to technology development, product development, and the public standards.

Most recently, Bruce contributed to the development of ATM physical layer technology and related products. Bruce worked closely with the Systems Research Center (SRC) on the west coast and with HPN engineers in the development of the first DEC ATM switch (AN2) and adapter (Otto). Later, he contributed to the DEC ATM products: Gigaswitch/ATM, the ATMworks 750 adapter, and the ATM modPHY media interface modules. He has also developed an OC12 (622Mb/s) interface to be used with new switch and adapter products.

In the past, Bruce was a major contributor in the optical technology and product development for FDDI, a 100 Mb/s token ring network. Also, he has worked on Advanced-Development projects like the All Optical Network and the Gigalink. Bruce is unique at Digital by having experience in designing all-optical networks with 1000 Gb/s capacity and traditional electronic networks with up to 1.5 Gb/s transmission rates.

Bruce's promotion recognizes the uniqueness of his skills and how he has contributed to enabling technologies for product and market development.



Dave Shurtleff Promoted to Consulting Engineer

Dave Shurtleff was promoted to Consulting Engineer for his work in the areas of systems engineering and systems integration. In his current assignment in the Systems Engineering (SE) Consulting and Architecture Group, Dave consults in support of major systems integration projects, and participates in SE initiatives to help ensure that Digital's engineering processes are customer-solution focused.

In his nomination for Consulting Engineer, Dave's recent achievements in Systems Engineering consulting activities were cited as examples of his outstanding contributions to Digital. Primary examples included 1) a complex network and systems integration project implementing a large-scale stock quote distribution network, in which Dave served as network and systems management project leader, management solutions architect and lead designer, and technical advisor to the program managers, and 2) Several RFP bid response projects, in which Dave served as a network and systems management solutions architect, lead proposal writer, and technical advisor to the team manager.

Before joining the SE group in November 1992, Dave worked on the specification of EMA Director architectures and the development of ISO/IEC systems management standards for the EMA Architecture group. Prior to that, Dave worked as a senior technical resource for both the DECmcc Strategic Vendor Program (SVP) and the DECmcc engineering group.

Prior to joining Digital in 1988, Dave spent 8 years at Bolt, Beranek and Newman Inc. in Cambridge, MA where he specialized in network management and packet switching technologies. Before joining BBN, Dave was at Evans and Sutherland Computer Corp. in Salt Lake City, Utah.

Harry Siegler Promoted to Software Consulting Engineer

Harry Siegler was recently promoted to Software Consulting Engineer. This promotion is an acknowledgment of his most recent contributions and leadership in the architecture and development of the SDD/DECevent tools, as well as his many other technical accomplishments and contributions to Digital. Furthermore, this promotion represents a major milestone in Harry's successful career at Digital and MCS. It also signifies strong support and appreciation of his work and contributions by the Digital technical community at large.

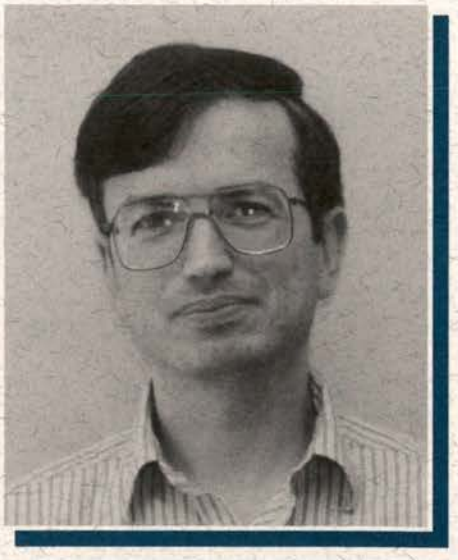
DECevent is the newest generation of MCS's symptom-directed diagnostic tools suite. Unlike its predecessors (VAXsim and VAXsimPLUS) DECevent is capable of being ported to multiple platforms (OpenVMS VAX, OpenVMS Alpha, Digital UNIX, WNT) and can provide predicative service analysis in complex multivendor/heterogeneous environments. It is one of the most significant and effective cost-saving tools in use by the many MCS Supporter Centers in operation around the world.

The specific focus is on his design and more than timely development of the Rule-Based Implementation Language and compiler coined RUBIL. In addition, his knowledge of hardware processor architectures became manifest in his design of the software engine architecture, the basis of the DECevent product itself.

When Harry joined the DECevent project, he brought with him the knowledge and expertise that solidified the engineering organization. Following are some of the highlights of Harry's contributions to the DECevent project:

- designed and implemented RUle-Based Implementation Language (RUBIL) optimizing compiler
- undertook the architectural specification of the software engines
- developed the ALU portion of the virtual machine code
- mentored the DECevent organization, and matured the software development methodologies that were in use

Most recently Harry focused on the optimization of the DECevent knowledge libraries (databases). This encompassed several months of code modification and reengineering, writing tools to convert the old databases into the new form, and extensive testing. It was a massive effort which involved most of the DECevent code.



Robert Walsh Promoted to Consulting Engineer

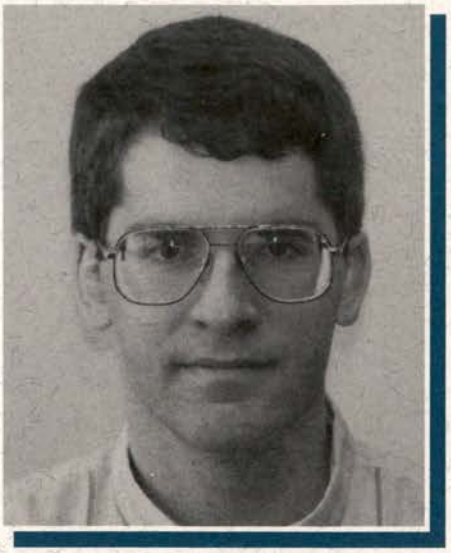
Robert (Bob) Walsh has been promoted to Consulting Engineer for Digital's

Network Product Business (NPB). The business unit develops, manufactures, markets, and sells network infrastructure products worldwide. Bob is currently working in the ATM Development Group within NPB.

Bob was promoted based on his outstanding technical and leadership contributions to the delivery of the GIGAswitch/FDDI. The GIGAswitch was the first, and remains the only, high-end FDDI switch in the industry with enterprise class performance. This is an extremely complicated product which required a world-class network development team, of which Bob was a significant part. His individual technical contributions to the development of the switch software, his training of others in GIGAswitch software development, and the momentum he brought to the overall development and debugging of the product were exceptional. The product is currently shipping in record volumes.

Bob is currently the project leader for the 622 Mb/s ATM adapter for the PCI bus code-named Dart. Like the GIGAswitch, DART is a leadership technology project. Dart requires the development of a high performance ASIC and associated UNIX modifications. Bob has combined his extensive operating system software and networking skills with a thorough mastery of hardware logic design and simulation.

Bob joined Digital in June 1989 following completion of his Ph.D. in Computer Science at Harvard University, where his research included parallel and hybrid 3-D graphics rendering algorithms. His initial stint at Digital was in the Semiconductor Engineering Group where he contributed to the architecture of, and developed a C compiler and run-time library for, an SIMD machine. Bob continued that work within the High Performance Business Unit. In late 1990, Bob joined the Telecommunications and Networks Advanced Development Group where he worked on the GIGAswitch development. In 1994, Bob moved into the High Performance Networks Group, where he has been working on ATM development.



Greg Waters Promoted to Consulting Engineer

It is with great pleasure that I announce the promotion of Greg Waters to Consulting Engineer. Greg has made many significant contributions to the development of a variety of products such as the GIGAswitch/ATM, the GIGAswitch/FDDI, and the FDDI Ring Memory Controller chip. He also collaborated closely with the Systems Research Center on ATM.

Greg has a wide range of experience in hardware and system design from custom VLSI chips, platforms such as GIGAswitch/FDDI and GIGAswitch/ATM, and network architecture.

Greg is presently contributing to the architecture and product development of ATM switch products as part of Networks Engineering.

Riaz Zolfonoon Promoted to Software Consulting Engineer

Riaz Zolfonoon of the Distributed Computing Environment (DCE) Engineering Group was recently promoted to Software Consulting Engineer. This promotion is in recognition of Riaz's outstanding contributions to the company over the past thirteen years. Riaz's most recent achievement was to work successfully with Microsoft to design and deliver distributed security, UDP/IP datagram transport, and authenticated datagram support in the Microsoft RPC. These features were critical to Digital's successful development and delivery of the V1.1 DCE for Windows NT product family.

Prior to working on DCE, Riaz was a key architect in the design of the Remote Task Invocation (RTI) architecture, in support of the MIA (Multi-vendor Integrated Architecture) program. RTI was adopted into the MIA specification, and is now part of the SPIRIT standard.

Riaz has a long history of delivering and leading product development at Digital. Besides being a leader and architect of the V1.0 DCE for Windows NT product, and a significant contributor to the V1.1 DCE for Windows NT product family, Riaz also took key roles in the delivery of V1.0 of OSI/TP, V2.0 of VMS/SNA, and V2.0 of SNA Gateway.

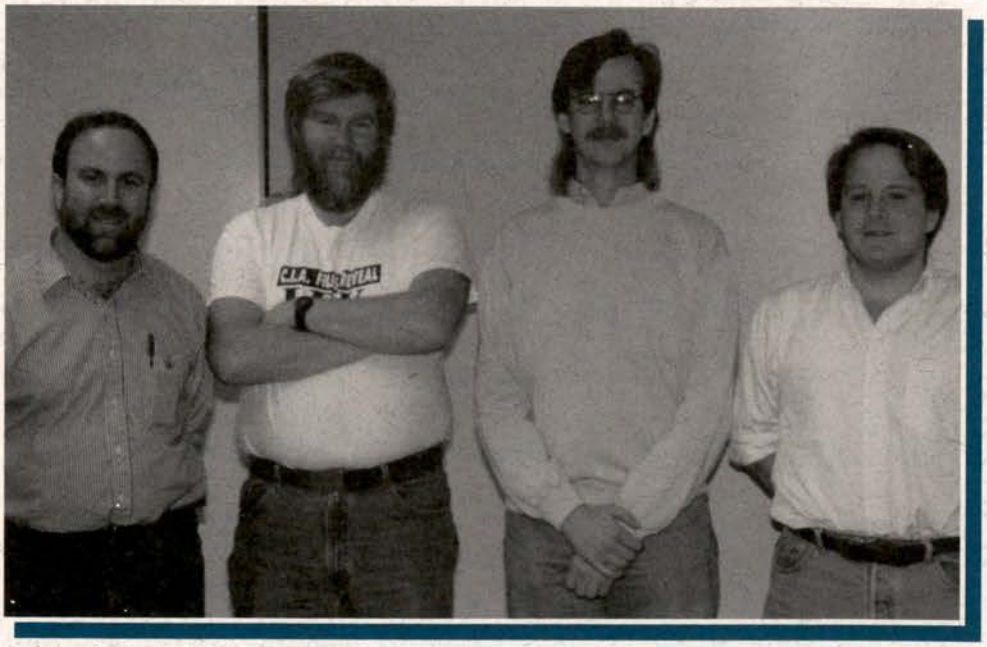
F

Patent Award Recipients

Several Vice Presidents Honor Patent Award Recipients

Seated, left to right: Nick Warchol, Paul Goodwin, Corporate Consultant Bill Hawe, Vice President and Corporate Consultant Jesse Lipcon, Robert Curtin, Don Smelser, Jeff Lewis, and Dave Fenwick. Standing, left to right: Vice President Bill Demmer, Keith Niskala, Mike Carrafiello, Bill Gist, Patent Engineer Joe Jasniewski, David Tatosian, Carl Bloch, Phil McKinley, Vice President Don Harbert, Vice President Larry Walker, and Doug Williams.

DECwest Patent Award Recipients



Left to right: Benn Schreiber, Dennis Doherty, Steve Jenness, and Wim Colgate.

Bill Hawe Honored for 20th Patent with Digital

Bill Hawe has received his 20th patent with Digital. Bill joined Digital's Corporate Research Group in 1980 and was one of the key engineers who collaborated with Xerox and Intel on the creation of the 10 Mbps Ethernet. Throughout his career at Digital he has been involved in many networking technology inventions and product efforts which include leading the architecture initiatives in Ethernet, FDDI, Extended LANs, DECnet, and Internet, within the networks organization. Currently, Bill is the Technical Director for the Network Products Business.

Vice President Larry Walker presents Corporate Consultant Bill Hawe with a plaque commemorating his 20th Digital patent.

At a recent Network Product Business Quarterly Communications meeting, Bill Hawe was recognized for his outstanding accomplishments in the patent arena in having his 20th patent issued – a notable milestone within Digital. A special "Hall of Fame" plaque listing his 20 patents was presented by Larry Walker, vice president and general manager of the Network Product Business, and Art Fisher, Assistant General Counsel. Bill joins the ranks of only 4 other people at Digital who have been issued 20 patents or more. No inventors yet have reached the next level of 25 patents. Digital is a recognized leader in networks technology with a premier patent portfolio. Several of Bill's patents are now, or soon to be, the subject of active industry licensing programs for the Network Product Business. Bill was joined on this occasion by his wife Charlene and two children, Jocelyn and Garett.

Patent Program Guidelines Accessible on WWW

Digital's Corporate Patent Program functions under the auspices of the Chief Technology Officer; and in conjunction with the Technology Strategy Group, serves as the mechanism through which patentable inventions are protected, and resulting patent rights are effectively managed in support of Digital's Technology Strategy.

In an effort to provide timely access to useful information regarding Digital's Corporate Patent Program, the "Digital Guide to the Patent Process" and the "Digital Corporate Patent Award Policy" have been placed on the internal World Wide Web. The "Digital Guide to the Patent Process" (also called the Gray Book) has been updated to reflect changes in the law, while the "Digital Corporate Patent Award Policy" was updated to include consideration for Digital employees and intellectual property affected by divestiture.

The URL for the Corporate Patent Program is http://www.ljo.dec.com/IP/ip.html

(Note that the URL is case sensitive.)

In addition, a hardcopy of the "Digital Corporate Patent Award Policy" is available from the Integrated Repository (IR) – Document number CI002E. You can access this document via VTX IR, selecting the "Search by Document ID" option.

For more information, please contact Sharon Lipp at DTN 226-2486 or Bob Reed at DTN 226-2977 at LJO.

Information Technology Product and Process Exposition

Sponsored by Shared Engineering Services

By Roland Toscano

Preserving Digital's intellectual property, keeping it "fresh," and ensuring that the appropriate employees, partners, and customers have easy access to the information, is a critical business function and a competitive differentiator. This past fall, Shared Engineering Services (SES) demonstrated many of its leading-edge information products. In addition, SES demonstrated the information-creation, distribution, and preservation processes that clearly establish the organization as a primary caretaker of Digital's knowledge.

The quarterly product and process exposition is one component of an Enriched Information and Support Environment (EISE) that SES has established to keep its employees and clients informed.

"A study of design practices in SES suggested that a vehicle was necessary to disseminate design innovations, strategies, and examples quickly through the organization," said Reza Sisakhti, a Senior Information Design Consultant. "We developed EISE in response to that need."

Meeting the Challenge!

The two-day exposition was titled Meeting the Challenge! During the kick-off session, Roland Toscano, an Instructional Design Consultant, explained the slogan. "Our clients continually challenge us to craft our solutions faster, better, and cheaper . . . to do more for less. To meet this challenge, we continually seek out and leverage new technologies, continually explore and apply new methodologies, and continually reevaluate and reengineer our processes. The purpose of this event is to share what we have learned and what we are learning during this journey."

The Meeting the Challenge! exposition consisted of over 30 sessions, presented by and for SES contributors. The sessions demonstrated and communicated new concepts and practices, project accomplishments, success stories, and project experiences based on actual work or work-in-progress.

The sessions were organized around four themes:

- Designing Information for the Next Millennium
- Choosing the Right Tool for the Job
- Getting Solutions to Market
- Getting Started with Windows 95

In Addition, the exposition featured a hands-on exhibit showcasing 14 information products for which SES won awards at the 1994 Society for Technical Communication (STC) competition. The impressive display of award-winning documents, help files, product introductions, tutorials, computer-based training (CBT) programs, and online information libraries confirmed SES's professional standing in the industry.

Designing Information for the Next Millennium

During these sessions, SES contributors presented information design strategies. In addition, the presenters demonstrated products that enable knowledge workers to rapidly find information, and to quickly cultivate critical business skills on-the-job.

To set the foundation for this series, Reza Sisakhti discussed the issues related to creating, updating, and disseminating information. In addition, Nasrin Malayery explained Gloria Gery's view of performance-centered software product design; George Cope examined design principles and practices that make tutorials effective; Burt Parcels shared his review of literature on the topic of online help systems; and Rande Neukam provided information about how the concepts of learner and end user are changing, and what these changes mean for information designers.

Two sessions focused on the World Wide Web as an evolving delivery channel for information and training. Kathy Haramundanis and Joy Tucker discussed how Web technology is being leveraged to help SES contributors share information. Patti Armstrong discussed implementation and design considerations for Web-distributed, computer-based training (CBT) programs.

Two other presentations focused on large information sets. Linda Marsh demonstrated Version 1.0 of an online library, and discussed the findings of its usability test. Kathy Icenogle explored ideas for integrating online training and documentation.

Many of the individuals who attended the Designing Information for the Next Millennium series said that the series provided a good balance between job support information and future trend information.

Choosing the Right Tool for the Job

During this series of presentations, SES contributors brought together an eclectic array of powerful writing, CBT, and browsing tools. Kathy Haramundanis, Leslie Barrett, Dan Mendelsohn, and Bob Gravina provided background for this series during a panel discussion that focused on helping practitioners select tools to meet project and client requirements. Other presenters included Peter LaQuerre, who discussed advantages and disadvantages of using RoboHelp to develop an online help library, and Jim Carrig, who described how to create online help and manuals using Doc-To-Help.

In addition, Dae Cho discussed the advantages and disadvantages of Multimedia Viewer, an authoring tool used to create multimedia hyperinformation environments. Steve Staszewski demonstrated how to create a custom viewer or browser using Media View and TouchSend Tools. The DynaText Online Browser, an industrial strength, cross-platform browser designed for large information sets, was demonstrated by Kathy Greenleaf and Tracy Parker.

Three sessions focused on CBT and online tutorial development. Through demonstration and discussion, Gayle Procopio and Tara Pangakis explained development challenges, such as graphics development and cross-platform testing; Linda Mandra and Carmie Boutin presented CBIquick, an authoring tool used to create interactive simulations of PC application software; and Christine Thompson provided an overview of several Asymetrix Multimedia Toolbook applications developed by SES.

The tools series clearly demonstrated that SES is able to draw from a robust tool repository to meet its project and client needs.

Getting Solutions to Market

This presentation series focused on SES's delivery channels, submission procedures and requirements, and organization-wide programs that support Digital initiatives. These sessions acknowledged the challenge that shrinking development schedules and budgets, and simultaneous geographic rollouts are posing. The sessions described the development processes and distribution strategies that SES has created, through continual improvement activities, to meet this challenge.

John Lucas established the foundation for this process-oriented series by describing how SES archives Digital-owned intellectual property and releases it simultaneously to channels worldwide. In a complementary session, Barry Lein demonstrated the application of this technology in his presentation about the MCS Learning Utility.

Other presenters included Alice Phalen, who described SES's complete range of delivery channels and channel submission standards; Sue Morrissey, who discussed the role of SES Delivery Specialists, the services they provide, and product submission procedures; Phil Fotos and Mike Plourde, who discussed graphics services and submission procedures; and Ron Plourde, who discussed online submissions and kit building services. Phil, Mike, and Ron also cited inappropriate development practices that tend to affect quality, increase costs, and delay product availability.

John Verrilli explained how PATHWORKS writers worked with SES's translation organization to include translated documentation in the first shipment of the product to customers. Janice Sahagian and Alice Phalen presented the building blocks of Digital's Worldwide Brand Identity Program as they relate to product packaging, documentation covers, screen layout, and the design of WWW pages.

During the final session, Implementing ISO 9001 in SES, Jean Sadlowski explained the importance of the program, and related it to the many processes and requirements that were discussed throughout this process-oriented, job-centered series.

Getting Started with Windows 95

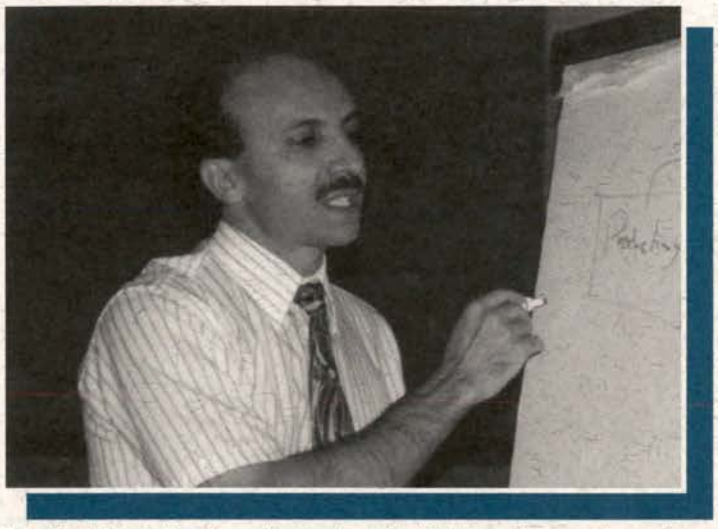
Unless you live in a yurt in outer Mongolia, you're probably aware of Microsoft's new operating system – Windows 95. During this presentation series, Rod Jack discussed SES's business strategy for transitioning to Windows 95; Paul Wittman described the new operating system's capabilities and demonstrated how to perform typical user tasks using the new interface.

The Meeting the Challenge! exposition clearly portrayed the breadth of competencies that characterize Shared Engineering Services. It exemplified how an organization can effectively share knowledge during the endless journey to remain competitive.

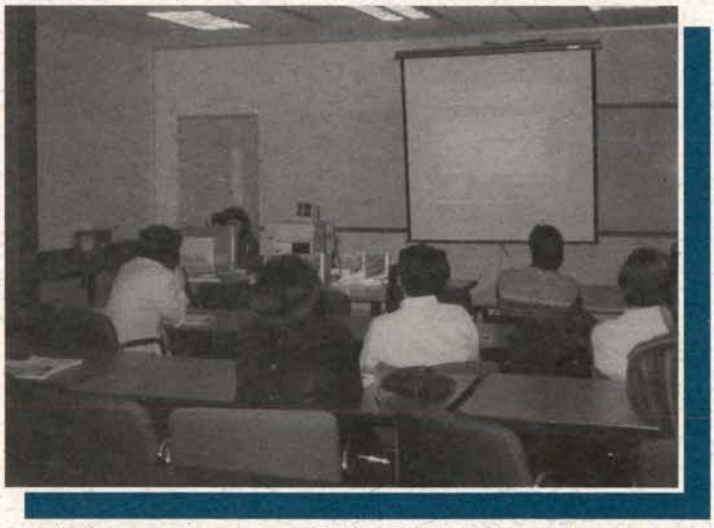
If you are not a member of Shared Engineering Services and would like to be added to the mailing list, please send mail to Charlotte Timlege (HANNAH::TIMLEGE).

Janice Sahagian presents the building blocks of Digital's Worldwide Brand Identity Program.

Tara Pangakis (L) and Gayle Procopio (R) explain development challenges associated with multimedia production.



Reza Sisakhti explains the attributes of a desirable information-creation and dissemination environment.



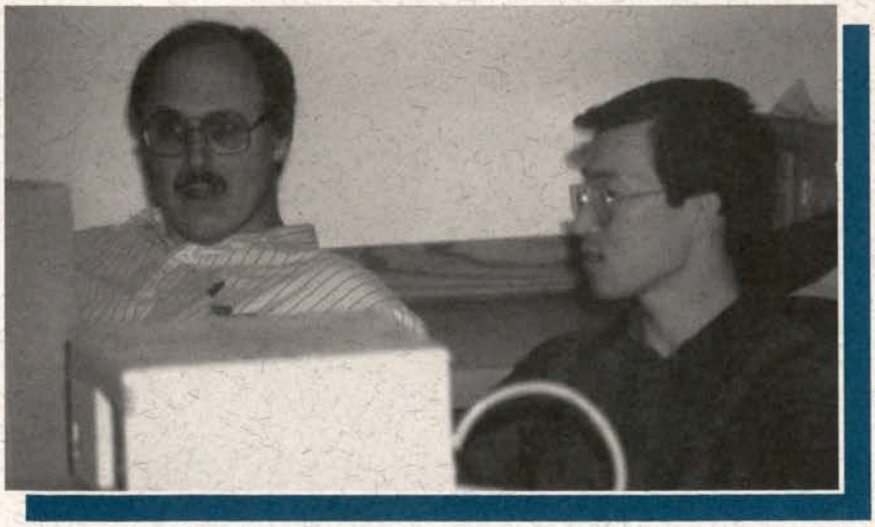
Christine Thompson demonstrates Multimedia applications developed by SES.

Barry Lein demonstrates the MCS Learning Utility.

Leslie Barrett discusses how to select the most appropriate development tool.

(L to R) Bob Gravina, Leslie Barrett, Kathy Haramundanis, and Dan Mendelsohn discuss a tool selection process that focuses on project and client requirements.

Roland Toscano kicks off the exposition at ZKO, "We are here to share what we have learned and are learning . . ."



Dae Cho (R) explains how to create multimedia hyperinformation environments.

Shared Engineering Services Group Receives Prestigious STC Awards

By Liz Gabel

A number of Digital technical publications recently received awards, including the coveted Best of Show, in the annual competition held by the Boston and New England chapters of the Society for Technical Communication (STC).

The STC is an international organization of technical communication professionals dedicated to improving the quality and effectiveness of technical communication for audiences worldwide. Members represent a wide array of disciplines, including writing, editing, graphic design, photography, management, education, and audiovisual communications.

Competitors are judged in the categories of Publications, Online Communication, Technical Art, and Video.

Digital's award winners are employees of Digital's Shared Engineering Services (SES) information design group. Several of their entries will advance to the international STC competition.

Winners of the award for Distinguished Technical Communication and Best of Show were Terry Donald and Carmen Wheatcroft. Their AlphaStation 200 Series Service Information provides an easy-to-use, task-oriented interface to information for service personnel and business partners who service and maintain AlphaStation 200 systems.

STC recognized two projects with Awards of Excellence:
Windows 95 for Users, which is a multimedia course on the Windows 95 operating system, and Version 2 of the PATHWORKS Information Shelf, a compendium of information about Digital's PC networking product and associated components.

Awards of Merit were won for the OpenVMS and Digital UNIX Interoperability Guide and for the DCE Director online help system.

Achievement Awards were won by the creators of the PATHWORKS Client V6.0 Basics Tutorial, the PATHWORKS Workstation Manager online help system, and the lecture lab course, Client/Server Environments: System Management Practices.

Seated, from left to right: Marion Hamblett, Ellen Brace, Janet Clifford, Linda Marsh, Alison Martin, and Gillian Orlinsky.
Standing, from left to right: Lyn Higgs, Joy Tucker, Joe McMullen, Paul Wittman, Gayle Procopio, Cynthia Rainis, David Ebert, and Jack Downing.
Not pictured: Laura Baumann, Mingling Chang, Carol Deluca, Terry Donald, Judy Egan, Francisco Faria, Cynthia Fleming-Wood, Jonathan George, David Grebow, Ray Laurencelle, Barry Lein, Sandy MacLeod, Craig Meyer, Bill Nimz, Mary Orcutt, Sue Ries, Gary Schmitt, Deborah Smith, Carl Sorenson, Carmen Wheatcroft, and George Wisnowski.

Information Ownership

By Victor Pompa

Some months ago, an extended debate arose in the NOTES file over the ownership of information – intellectual property. The debate began after the Ethics Office said that Digital expected employees to protect Digital's intellectual property and proprietary information; not to disclose it without permission or use it for personal gain. We argued that it is unethical to treat Digital's information as if it were not an asset.

However, a strong opposite position was voiced by one noter and supported by others. He/she(?) argued that information should not be considered property or treated like property: that there was nothing unethical about disclosing even proprietary information.

The noter gave 2 reasons for that position. The first reason was that information is not like physical property. More than one person can hold it. So for example, two people can know something and neither of them has less of the knowledge if the other has it. You don't lose anything. It isn't like a bike. If I take your bike, you can't ride it. You lose something.

The second argument was that information, especially technical information, is the means by which science advances and mankind improves itself. No one person creates all the knowledge necessary for technological advance. Every researcher is dependent on the information generated by others. So researchers (knowledge workers) have an obligation to share information because others have shared with them.

Both interesting arguments. But in a practical sense, they don't stand up to scrutiny.

It is true that information is not like a bicycle: more than one person can have it and use it at the same time. But, that doesn't mean that one person having it doesn't take something away from the other person. Take an unlisted phone number for example. If you have it without my permission, you can call me, even if I don't want you to. You have reduced my ability to protect my privacy, even though I demonstrated that I wanted that measure of protection by getting an unlisted number. The loss of my privacy is a real loss to me. I lose some control over my life – who I want to speak with on the phone in this example. (This argument has been developed most fully by Sisela Bok in two fine books titled *Secrecy* and *Lying*.)

Let's translate that example to unauthorized access to Digital's proprietary information. First, let's look at the idea that we don't lose value if a second party has information we own. That is not accurate. The information has greater market value if it is not available for general use. That's why there are so many legal protections built into our economic system to protect innovations. It is true that if someone else had access to Digital proprietary information, Digital could still use it, but we would be competing with our own idea. And probably, the other user didn't invest anything to develop it. So we have to compete with someone who has lower (perhaps zero) cost to have the same market opportunity using our asset. That puts us at an unfair disadvantage.

As for the second idea, that technology advances because of the contributions of many, there is no argument with that. But, the implication that this is an altruistic enterprise is suspect. Anyone who has read *The Double Helix,* the story of Crick and Watson's furiously paced research to discover the basic form of DNA, knows that even in academia, researchers are not always motivated solely by altruism and the love of knowledge. Each of the researchers in the DNA story wanted public and material rewards for their work. That's why they struggled so hard to be first with the results.

In the commercial arena, the motivations are generally more apparent. We develop ideas to meet a market need to make a profit. There are established conventions and practices for making innovations available commercially, so that companies like Digital can be rewarded for the investments we make with shareholder money.

In the end, the rules are the rules. Digital expects employees to protect its information as any other asset. But that is an unsatisfying answer for intelligent people. We hope that this brief essay also shows that the philosophical arguments which might lead some employees to believe the rules are not justified, simply do not stand up to close scrutiny.

Standards – A Tool for Management by Documentation

By Eric Falkof, Standards and Methods Control

Abstract

Using the development of standards as a vehicle to enhance communications and ensure consistency of procedures, Management by Documentation also promotes supportive group dynamics and supports an organization's structure.

Standards – What Are They?

Standards are documents that describe management, engineering, and manufacturing processes. These processes are the methods used to implement policies or strategic directions for a company or organization. The actual methods may vary as long as the standards' requirements are met.

Standards are intended to be used as tools that describe a procedure or process, and as they are used, they deliver a message of consistency and unity. The message is delivered internally through consistency of process and externally as an indication of quality.

Dr. Arati Prabhakar, Director, National Institute of Standards and Technology (NIST), has stated, "Standards are coming to the fore as a corporate strategic tool, very important for our companies, for their ability to compete, and therefore for our entire economy." It stands to reason that we develop and use our strategic tools properly.

Business Week, in its October 16, 1995 issue, included a special supplement entitled, "Competing through Standardization." The lead sentence strikes at the significance and importance of standards' activities:

> "As global competition intensifies, leading American businesses are increasingly adopting an emerging management discipline as part of their business strategy."

The activities concerning the development of a standard within Digital Equipment Corporation are well publicized and the activities are defined for external participation in various standards consortia. Standards are developed internally using a model similar to that of the external standards and regulatory bodies. The Corporate Standards Group is the focal point for Digital's external and internal development activities. Its value as a strategic tool has been acknowledged by its position in the Corporate Strategy and Technology Group, where it can provide central information across divisions of the Corporation.

The value of standards is not disputed and, indeed, their importance has been mentioned many times within Digital and other companies. Many companies also have standards development divisions or departments to ensure there is a consistent level of quality in their manufactured products. Perhaps less well known are the related benefits of standards activities.

Standards provide a tool to develop cohesiveness within the organization. The cohesiveness becomes the structure of the organization and, therefore, also becomes the infrastructure by which goals are established and tasks are performed. If procedures cannot be developed, or if they seem inadequate for the purpose, there may be underlying dynamics that interfere with process development.

Group Dynamics: A Simplified Primer

When disagreements arise in management or manufacturing, it is often a result of conflict in one of the following: goals, roles, procedures, or interpersonal relations. These concepts manifest themselves in organizational dynamics in this manner:

- If agreement on GOALS is reached, then we can assign roles.
- If agreement on ROLES is reached, then we can develop procedures.
- If agreement on PROCEDURES is reached, then we can build positive interpersonal relations.
- When agreeable INTERPERSONAL RELATIONS are attained, we have an effective, working business system.

In most organizations, goals and roles are defined. We are told what our goals are, and we perform specific jobs for our departments. We cannot change this. Therefore, if pursuit of an effective business system is our goal, and since our roles are defined by our jobs, we must concentrate on developing effective procedures. We need a neutral, objective vehicle that can help us build positive interpersonal relations while eliminating or reducing negative interpersonal influences that can interfere with the development of those effective procedures.

If during the development of procedures, we discover an ineffective role or goal, we can use the effectivity of procedures (or inability to define them!) as a means to drive and implement change. A mutually agreed-upon process for introducing

changes also helps to maximize the effectiveness of the changes introduced by reducing opportunities for dispute.

Effectiveness and Efficiency

To be effective, standards must be implemented universally and without deviation by all affected organizations, functions, or personnel. Adherence to the standard, if not enforced by high-level ultimatum, is likely to be most effective when agreement to the standards is obtained. That is, the goals are set, the right people are doing their jobs, the sequence or process is viable, and everyone works in harmony. Disagreements can lead to less (emotional) investment and possible inefficiency.

Efficiency or inefficiency refers to reduced adherence to standards (procedures) as measured by acceptance of inferior products or unproductive process through negligence or even sabotage. Effective operations mean operations working as expected to produce the desired outcome. Agreement to the standard ensures adherence to its requirements, accountability, and promotes credibility in the standard as an agreed-upon tool.

Rationale for Management by Documentation

A company today exists because of the implied relation of employer and employees of all levels. Typically, goals and roles are determined at an organizational level higher than any single person and, most often, attainment of goals requires sharing materials with others. Materials may be raw goods, work in process, or information. It is mandatory that effective interactions occur to meet required efficiency goals. The people who share or exchange the material or information may function on a shop floor or at an executive level. In either case, agreements about how the exchange should occur are required. When the parties work together, they may develop their own agreements and there may be no need for a formal arrangement. However, formal arrangements may be desirable to document procedures or methods. Training, method validation, and certification requirements may determine how the arrangement is formalized. However, when parties cannot or will not work together, an external, objective structure may be required to formalize an arrangement. Standards may be the appropriate tool for management to use to formalize agreements between agreeable, as well as disputing, parties.

People often feel more comfortable discussing and changing a tangible product, whereas ideas and concepts may be vague and subject to (mis)interpretation and misuse. By focusing on a document instead of relations, parties begin the process of defining their procedures. By concentrating on the document, combined efforts produce superior organizations that can fulfill their goals.

Management by Documentation – A Management Tool

Management by Documentation is a tool to reach agreement or resolve responsibility ("turf") issues. Top-down directives may be interpreted differently by people; in other words, people may see directives as directed *to* them or directed *at* them. If agreements are reached by affected people (or people who manage affected groups or functions), then work can progress. When disagreement is found (or felt), a neutral, objective tool must be used to encourage agreement and restore effective operation. (Note – effective operation may not be efficient, and efficient operation may not be effective.)

Standards, as documents, are neutral in their bias and objective in their process. At Digital, standards are developed according to a process that builds toward concensus to ensure agreement, and so effective operation. A benefit that has not been exploited is the discipline that the standard's process imposes to ensure procedures are agreed to, and the resultant minimization of negative interpersonal relations; therefore, efficiency.

The Digital Standards Process (refer to Digital Standard 001-0 Management of Technical Standards and Related Documentation), itself the result of concensus-building, exists as a tool for Management by Documentation. By concentrating on procedures, personal concerns can be set aside and the larger organization's goals can be kept in focus. Roles can be clarified and appropriate adjustments made. By focusing on procedures that must be defined in writing, in a hardcopy document, personal issues or agendas are set aside and a participatory, mutual effort results in an effective operation and a coherent team environment; therefore, effectiveness.

Summary

Management by Documentation is a document-focused tool that encourages effective management activity and, purposefully, produces documents that reinforce management's decisions. As a business, adherence to decisions promotes efficiency in operations.

Standards are documents used as tools for creating uniformity in product, consistency in design and manufacturing, and for maintenance and distribution of information. While focusing on developing a document, full attention is given to the topic and documentation development procedure. Since this focus is on a neutral, objective item – a document – personal agendas are ignored and attention is placed where it is most productive.

The standards development process is a tool that brings people together and builds unity by encouraging active communication and participation. These two concepts, communication and participation, demand involvement by interested and concerned contributors to ensure clarity and completeness.

Managing the standards development process is a core competency that enhances corporate strategies. Management by Documentation is a tool that provides a strategic advantage.

Digital Achieves Leadership in Performance and Price/Performance Under Industry Benchmarks

By Bhagyam Moses

In recent months, the CSD Performance Group has demonstrated that Digital Alpha products are capable of shattering world records on performance and price/performance.

Since the introduction of the Alpha chip, Digital has claimed record-breaking speed with its 64-bit architecture and technology, but it was not until we demonstrated the power of these features through the industry-standard TPC benchmarks that the industry stopped and recognized our product capabilities in the commercial environment. As the old saying goes "the proof of the pudding is in eating."

After the announcement of AlphaServer 8400 TPC performance at 9414tpmC @$316/tpmC, which shattered the world record, Gartner Group is quoted to have said: "Digital's benchmark coup should persuade users concerned about high performance and scalability in OLTP and data warehousing applications to consider Digital as a serious contender. The results validate the promise of 64-bit, large-memory configurations. . . . The benchmark confirms the commercial viability of Digital's RISC technology and architecture . . ."

The TPC data points spanned across three operating systems and five databases.

This places Digital in the unique position of being able to demonstrate the true meaning of Open systems – regardless of which operating system, layered software, or database is used, Digital systems offer leadership performance.

Industry-Standard Performance Benchmarks and Their Importance

Digital has invested substantially in the industry-standard performance consortia over the past several years. And it is now paying off. Every vendor understands the critical role these benchmarks play in positioning their products competitively and therefore have invested as well. Industry-standard benchmarks have become extremely important to both vendors and customers.

The objective of each Industry-Standard Performance Consortium is to develop benchmarks that represent current computing environment. Although some people question the real-life representativeness of these benchmarks, experience has shown that when vendors are competing on a bid, the performance data provided by running the industry-standard benchmarks can become either the gating item or the deciding factor in the sale. As mentioned earlier, the press and analysts depend on this data as proof points to do their analysis of the capabilities of vendors' products.

Digital is currently active in the following Industry-Standard Performance Consortia:

TPC – Transaction Processing Performance Evaluation Council

SPEC – Standard Performance Evaluation Corporation

BAPCo – Business Application Performance Corporation

GPC – Graphics Performance Characterization Committee

Each of these consortia attempts to address a specific segment of the market.

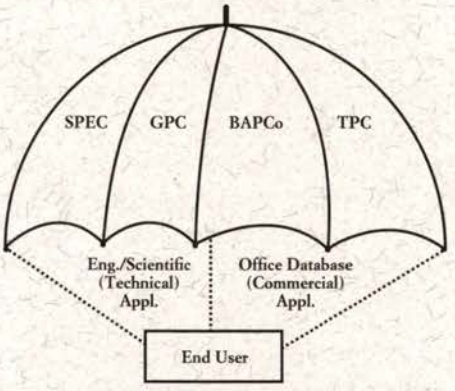


Fig. 1 – The Benchmark Umbrella

Although the intent of each of the consortia is to represent the end-user environment fully and completely, there are limitations and constraints in developing workloads and in setting these evironments in a lab situation. To avoid developing a benchmark that will be impossible to test, various abstractions are made to represent the real environment. Some consortia provide the actual code as in SPEC, BAPCO, and GPC while TPC provides a specification. Working with a specification introduces the possibility that one test sponsor might interpret and implement the specification differently from another sponsor. In order to address this issue, TPC requires that TPC tests and results are audited by an independent agency that is certified by TPC. This helps to ensure a level playing field across vendors for this particular test.

Since computing environments change constantly, the consortia are forced to upgrade their existing benchmarks or develop ones to represent the new environments. When a benchmark is around for a lengthy period of time (2-3 yrs), the potential for the benchmarks to be "cooked" by vendors increases. Therefore, by changing the workload, consortia limit the ability of vendors to overly optimize the benchmarks. Whether one wants to accept it or not, every vendor optimizes their products to perform well on these benchmarks. The way this happens is by the consortia developing workloads to closely represent the end-user environment, then the engineering/design community takes these benchmarks and designs their product to perform well on these products. Once the performance measurements are done on the products, the marketing/sales departments use the data to compete with the performance results. When the customer buys the product and runs his/her workload on the product and it performs as well as it performed on the benchmarks, then, the customer is happy and we have done our job well. This is the ideal to be reached!

However, if the performance on these benchmarks is great and the performance at the end-user level is really poor, then, we have a problem. To avoid this scenario is the most critical goal of the industry-standard performance consortia. Consortia must and do make every effort to develop end-user representative workloads. The consortia try to keep abreast of changes in computing environment, and try not to allow "heroic" efforts in tuning that are not available to the end-user. In this way, they strive to bridge the gap between the industry-standard benchmark performance and end-user performance.

Overall, the contributions of the consortia are remarkably successful in making vendors compete fairly and in improving performance for the end-user, which is very different from when we did not have the industry-standard benchmark consortia. The cyclic nature of this process is very effective in helping the consortia, computer vendor, and the end-user work together toward a common goal – to build better performing systems for the end-user!

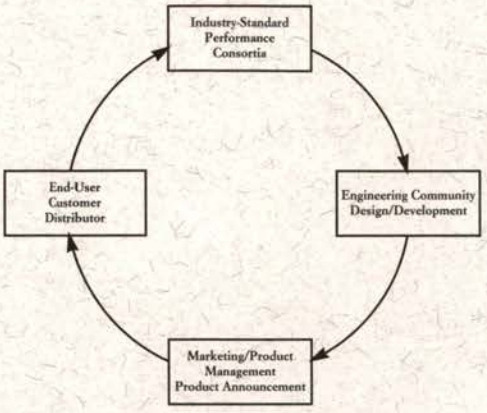


Fig. 2 – The Benchmark Cycle

Every computer vendor strives to be the leader in performance and price/performance on industry-standard benchmarks. Once accomplished and publicized, it has a positive impact on sales and contributes to the healthy image of the company. For example, the following quote appeared in *The Wall Street Journal* on December 5, 1995, one day after Digital announced record-breaking AlphaServer 2100 5/300 with 3 CPUs under Windows NT running Microsoft SQL Server TPC-C price/performance marks (3,516 tpmC at $196/tpmC). "Shares in computer-maker Digital Equipment, meanwhile, soared 4⅝ to 62½ amid increasing optimism that the company's high-speed Alpha chip technology is paying off. Yesterday, Digital and Microsoft announced new benchmark results supporting claims that Digital servers running Microsoft Windows NT offered the most cost-effective database management system. 'The new performance benchmarks show Alpha in its best light,' said Stephen Smith, technology analyst at Paine Webber in New York, who said Digital is extending its lead as the fastest database platform. Traders also noted growing expectations that Digital will post strong results in the current quarter, maintaining momentum set in the last quarter."

TPC – Transaction Processing Performance Evaluation Council

TPC benchmark and its Performance:

The Transaction Processing Performance Council develops benchmarks to evaluate performance of databases. There are two major types of benchmarks – OLTP (On-Line Transaction Processing) and Decision support. The OLTP benchmarks include TPC-A, TPC-B, TPC-C, TPC-S, TPC-C/S and TPC-E and there is only one benchmark in the Decision support area. TPC-A and TPC-B are obsolete, TPC-C is the current most popular TPC benchmark, TPC-D is the new workload with its first result posted a few weeks ago and the rest of the workloads are in development.

Digital achieved performance leadership in October 1995 with the AlphaServer 8400 and broke its own record three times. Price/performance leadership in December 1995 with the AlphaServer 2100 and Compaq tried to regain its position as the price-performance leader within a few weeks only to lose it to Sun almost immediately. See Bar Graph 1 on page 35.

At the enterprise level, Digital is clearly the leader by beating the competition by a factor of 2. Although Tandem has challenged everyone with 20198tpmC on their Himalaya series, the industry did not pay as much attention to it because it was on its proprietary database. In fact, Tandem published data in an open environment and came out at 50% of Digital's 11,456tpmC number. See Bar Graph 2 on page 36.

Digital is clearly the leader in the NT/Microsoft SQL server environment. Compaq has shown better performance with Oracle and we know that with Oracle Sybase and Informix we can provide better performance. We will be publishing this data shortly. See Bar Graph 3 on page 36.

In the low end, price/performance seems to be higher across the systems. The lower throughput does not help the price/performance to go down. Digital seems to be in a great position on both price and price/performance.

Note: As you are aware, Digital has violated the TPC fair use policies. Currently, we are in a great position to use this TPC data effectively to earn bragging rights as well as volume sales. So please adhere to the TPC rules while using the TPC data. If you don't know the rules, please do not make assumptions, just contact the author (your TPC rep). We cannot afford to give our competition the pleasure of overshadowing our leadership performance with fair use policy violations.

For more information on TPC, please refer to TPC home page: http://www.tpc.org/

SPEC and its Performance:

SPEC develops benchmarks to evaluate the compute-intensive features of the system and the NFS features. SPEC provides the CPU suite, SFS suite and the HPSC suite. The CPU suite had three major releases – SPEC89, SPEC92 and SPEC95. SPEC89 has been obsolete for a while, SPEC92 is in the process of being obsolete while SPEC95 has recently been introduced.

On SPEC89 and SPEC92, Digital has shown clear leadership. The large caches on our systems did provide us with an advantage compared to our competition. See Bar Graphs 4 and 5 on page 37.

On SPECrate_92, SMP systems with 64 processors gained leadership while we were limited with 12 processors on our SMP systems. However, with our 12 processors we outperformed systems with 16, 20 and 24 processors. See Bar Graphs 6 and 7 on page 38.

SPEC95 suite has larger and more complex benchmarks compared to SPEC92. Large caches no longer provide us with an advantage here. Since the introduction of SPEC95 and the introduction of some competitive systems, Digital has initiated some aggressive efforts to sustain our leadership on SPEC benchmarks. See Bar Graphs 8 and 9 on page 39.

On SPECrate_95, with the introduction of cluster methodology by SPEC and the introduction of TruClusters, Digital will be able to regain leadership here.

Initial attempts show that we need more work in SPECrate_fp area to gain leadership and we will focus our efforts in this direction. See Bar Graphs 10 and 11 on page 40.

For more information on SPEC, refer to its home page: http://www.specbench.org/

BAPCo and its Performance:

Business Applications Performance Corp (BAPCo) develops benchmarks to evaluate PC environments. These benchmarks are based on software packages commonly found in retail computer software stores. BAPCo produces both desktop and server benchmarks, The desktop benchmarks include SYSmark92, SYSmark 93, and SYSmark95. SYSmark95 for Windows is intended to be used by those interested in evaluating system-level performance of PCs running Windows applications. SYSmark/FS for Servers is intended to be used as a tool to evaluate the performance of a file-server in a network environment servicing requests from network clients. See Bar Graph 12 on page 41.

A few weeks ago, Digital's leadership was greatly threatened. Heroic efforts helped us regain our leadership under this workload.

For more information on BAPCo, please refer to its home page:

http://www.bapco.com/

GPC and its Performance:

GPC (Graphics Performance Characterization) has three major benchmark efforts – PLB (Picture-Level Benchmark), XPC (X Performance Characterization) and OPC (OpenGL Performance Characterization). In this article, we will focus on XPC. X11perf tests various aspects of X server performance including simple 2D graphics, window management functions, and X-specific operations.

X11perf employs an accurate client-server synchronization technique to measure graphics operations' completion times. X11perf tests both graphics-primitive drawing speeds and window-environment manipulation.

Xmark93 is equal to the weighted geometric mean of X11perf's individual X primitive tests divided by the precomputed weighted geometric mean of X11perf running on Sun's SPARCstation 1 See Bar Graph 13 on page 41.

Digital systems offer clear leadership on these workloads. For more information on GPC, please refer to its home page: http://sunsite.unc.edu/gpc.gpc.html

FY'96 has offered CSD Performance Group many challenges across all the industry-standard benchmarks. Performance battles for leadership never end. It is the skill set, dedication, and perseverance of the CSD Performance Group that has helped us achieve these impossible goals. The team has been recognized both inside and outside of Digital for its efforts and I would like to thank them on behalf of Digital for their commitment to the NEW Digital and its success!

AIM – Hot Iron Awards

CSD has captured 6 awards and the PCBU has taken another 5 for a total of 11 Digital awards out of 20 possible awards.

WORKSTATION

Suite VI

DEC 3000 Model 600 – Best Performance for systems under $25K (for the third time in a row! AIM said the competition was gunning for this one but couldn't take it).

AlphaStation 600 5/300 – Best Performance for systems over $25K

SERVERS

Suite VII Shared Systems

AlphaServer 2100 5/250 – Best Throughput Performance for systems $50K-$150K

AlphaServer 8400 5/350 – Best Throughput Performance for systems over $150K

Digital Prioris XL 5100BP – Best Price/Performance for systems under $25K

Suite VII File Server Systems

AlphaServer 2100 5/300 – Best Throughput Performance for systems over $150K

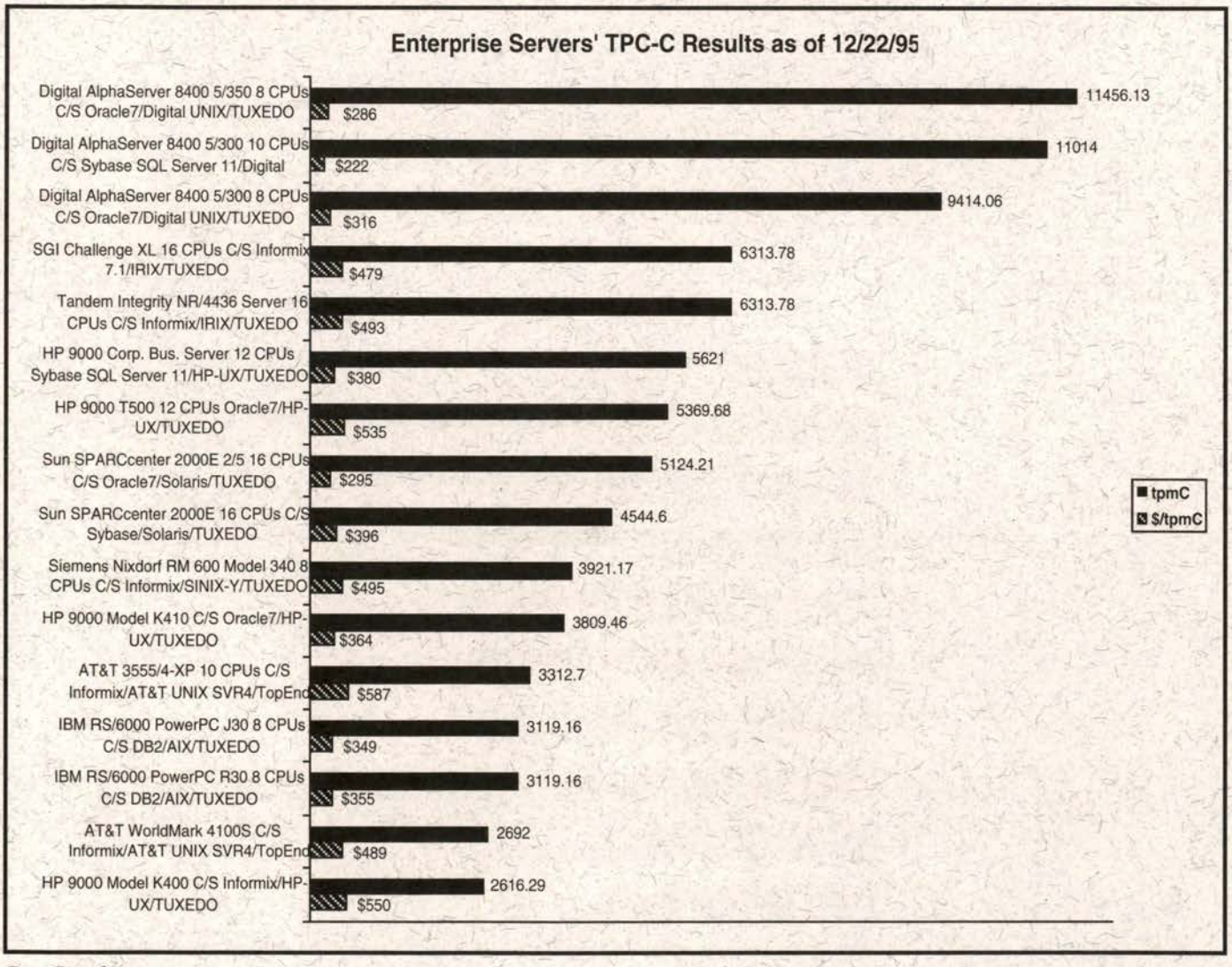
AlphaServer 2100 5/300 – Best Price/Performance for systems over $150K

Digital Prioris LX 5120 – Best Throughput Performance for systems under $25K

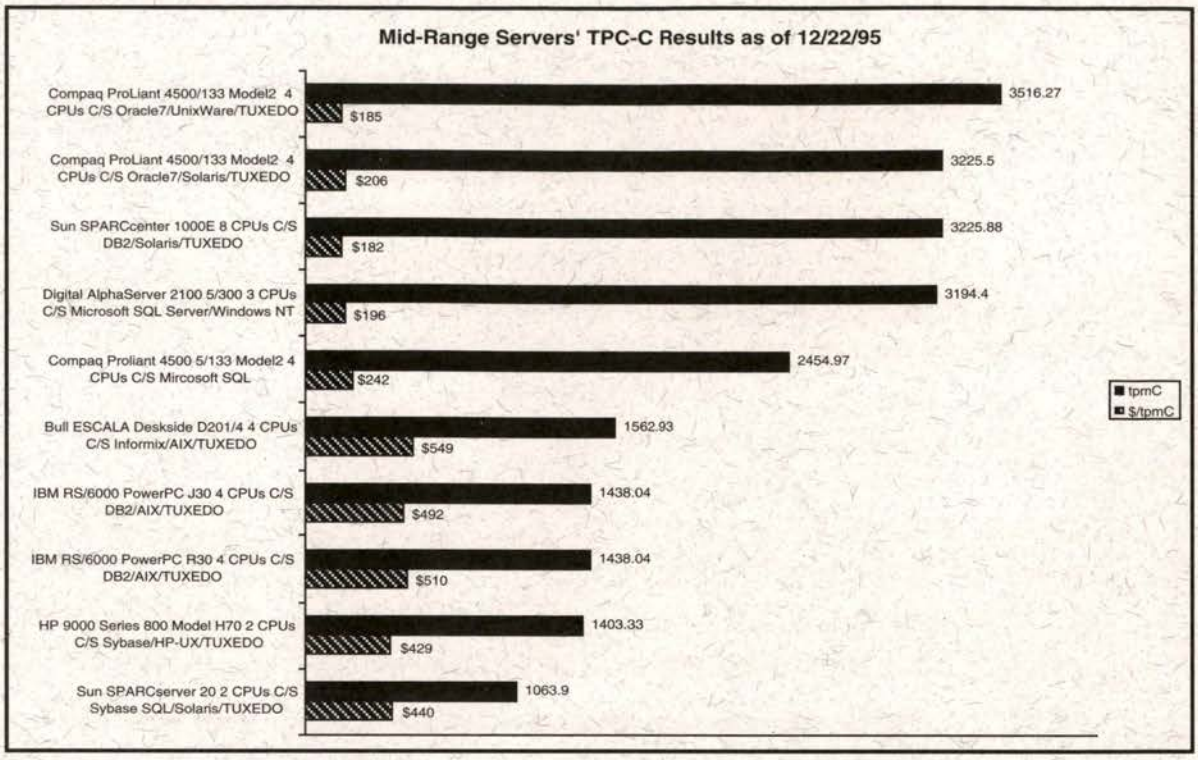
Digital Prioris LX 5120 – Best Price/Performance for systems under $25K

Digital Prioris ZX 5133 MP2 – Best Throughput Performance for systems $25K-$50K

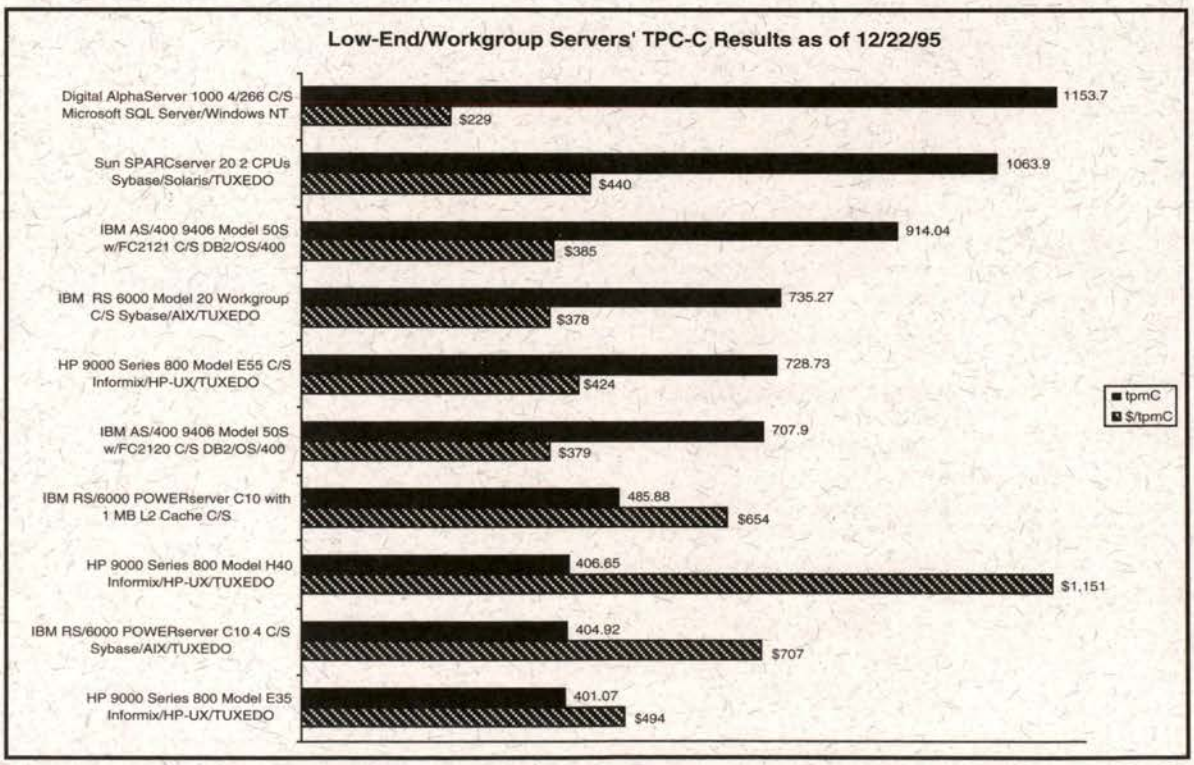
Digital Prioris ZX 5133 MP2 – Best Price/Performance for systems $25K-$50K



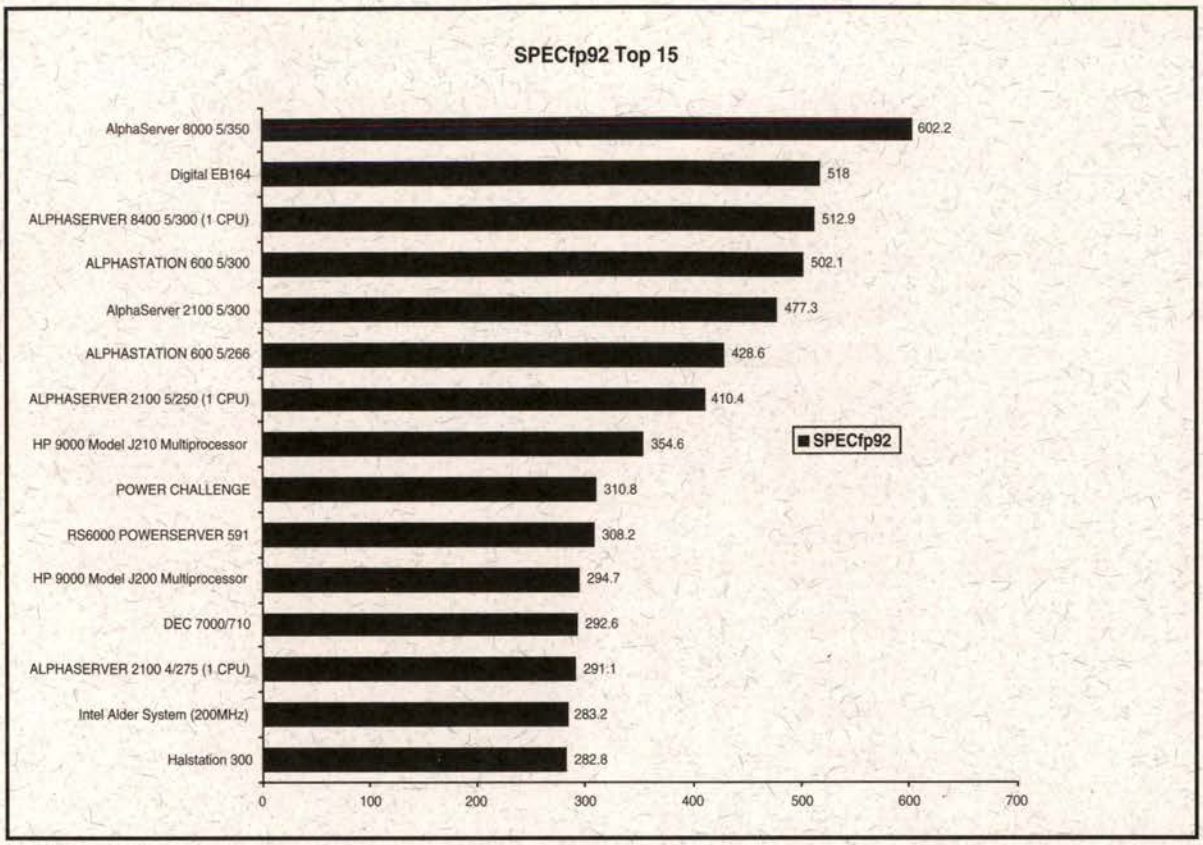
Bar Graph 1



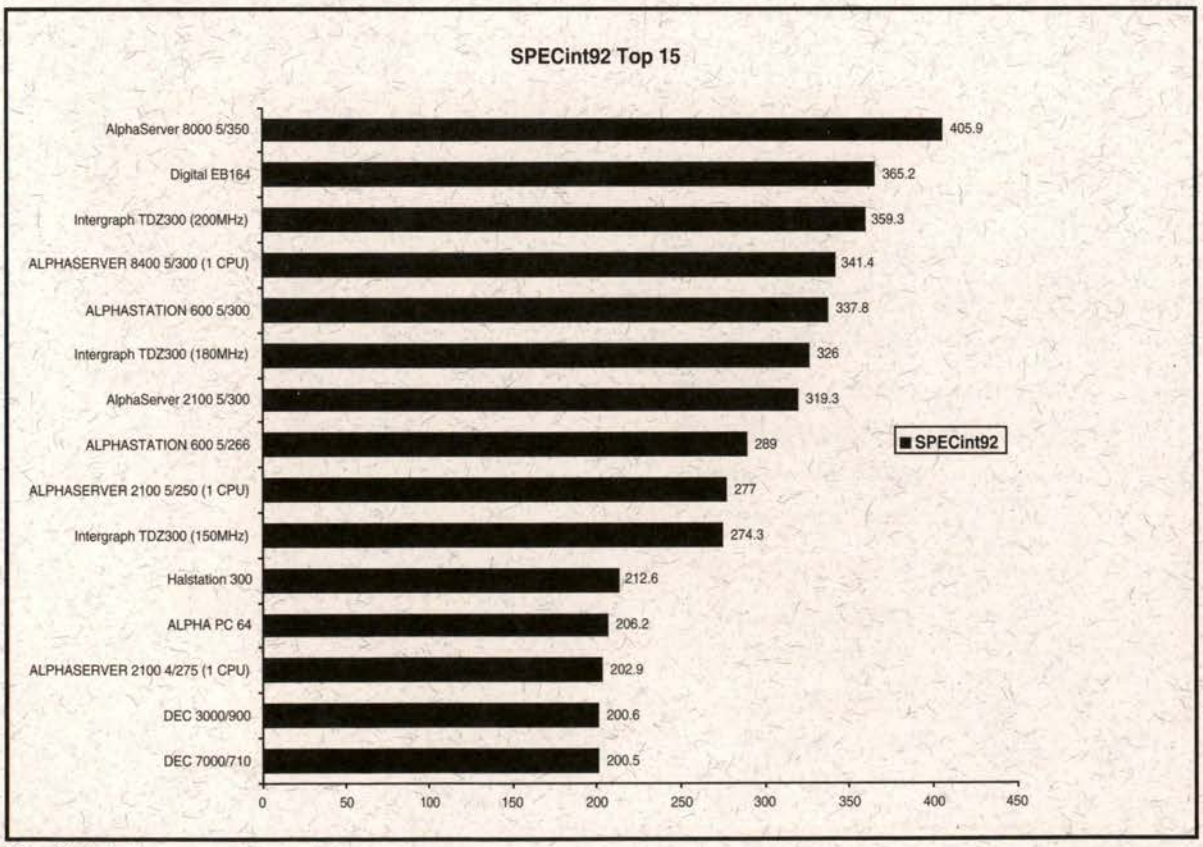
Bar Graph 2



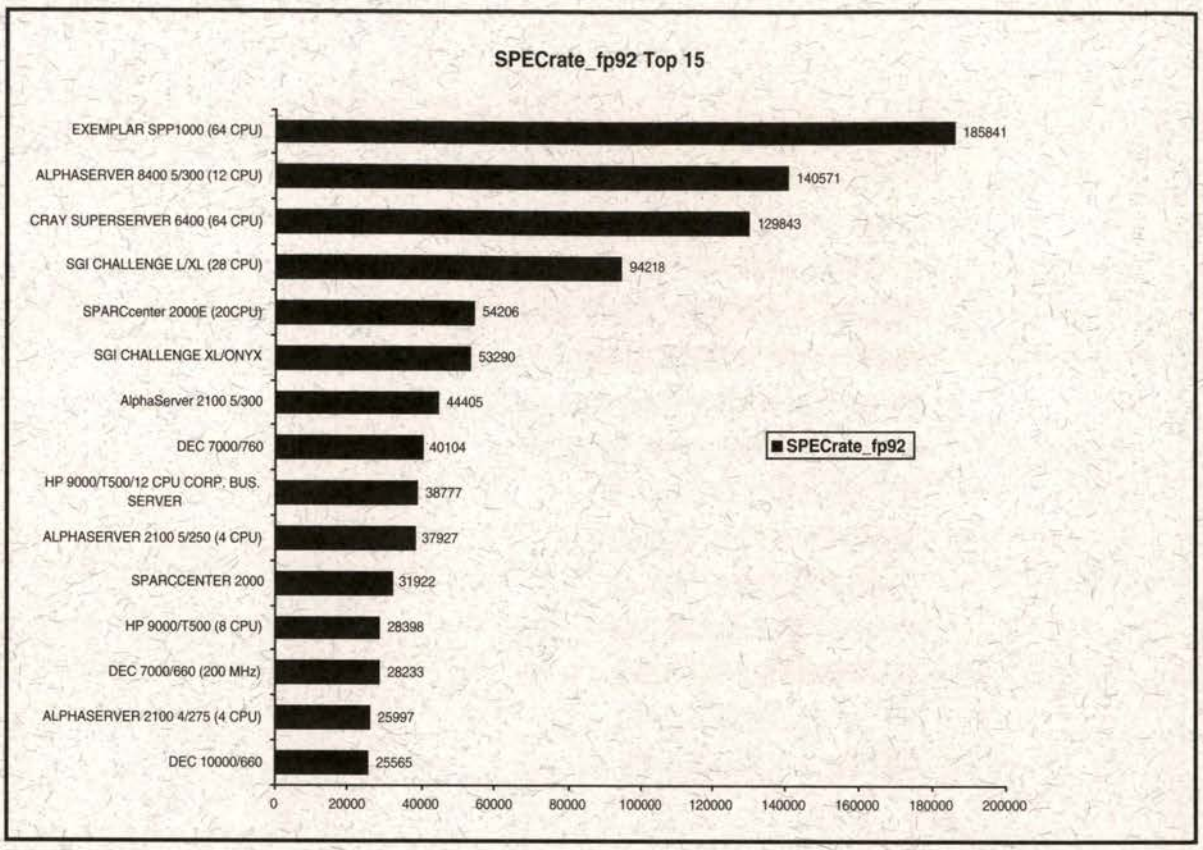
Bar Graph 3



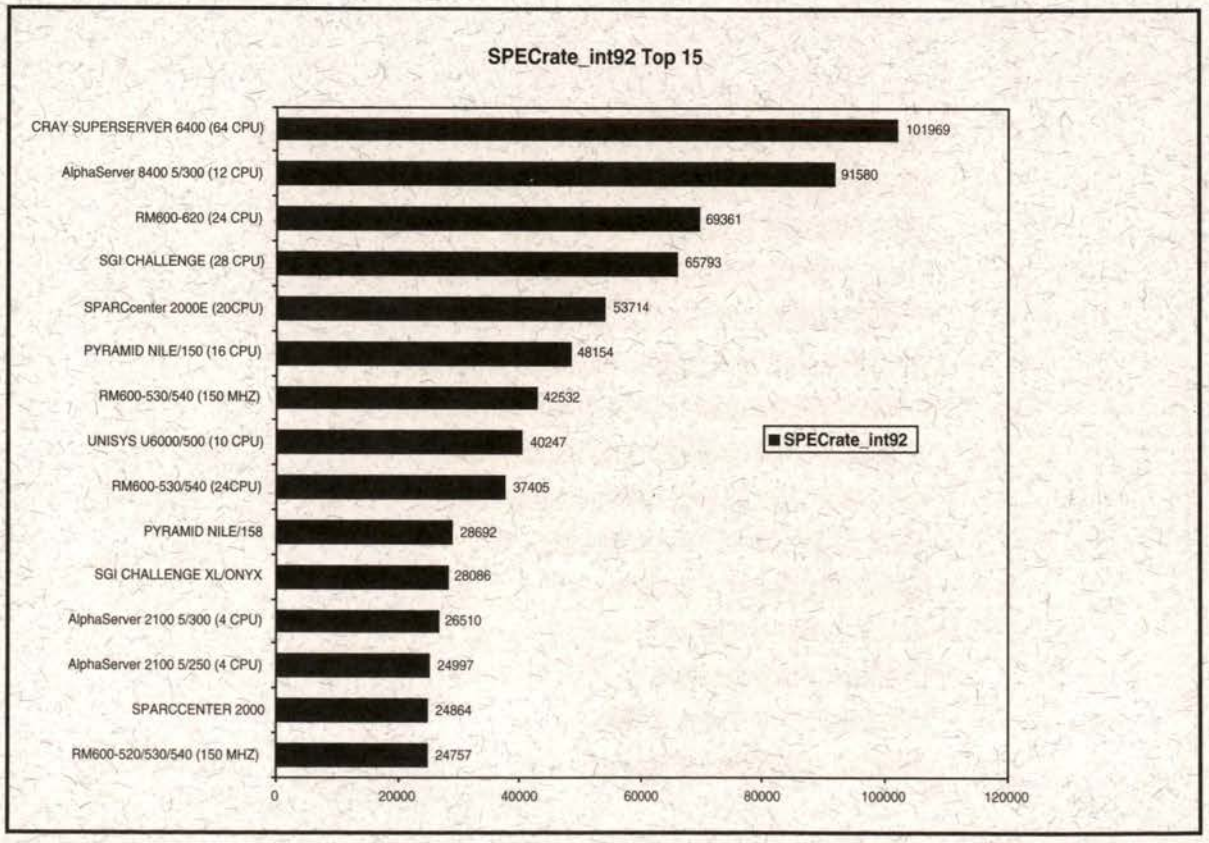
Bar Graph 4



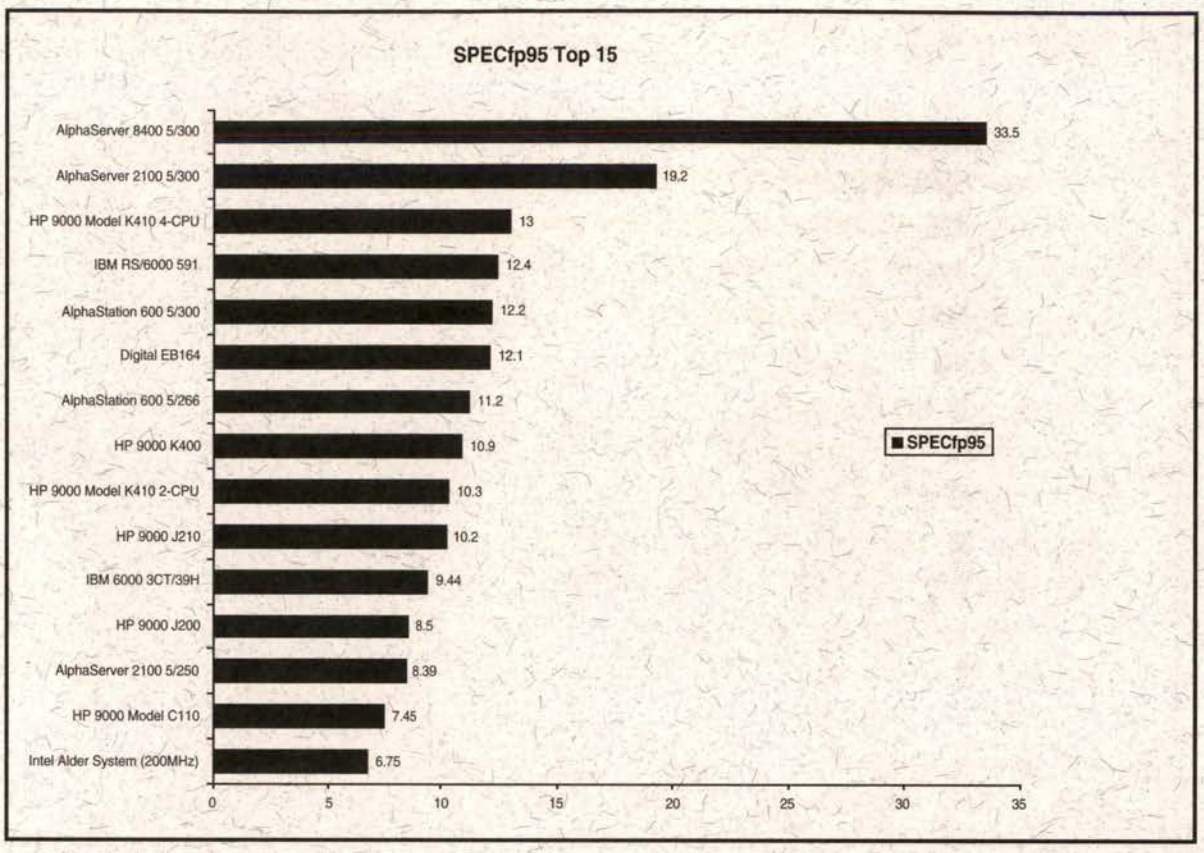
Bar Graph 5



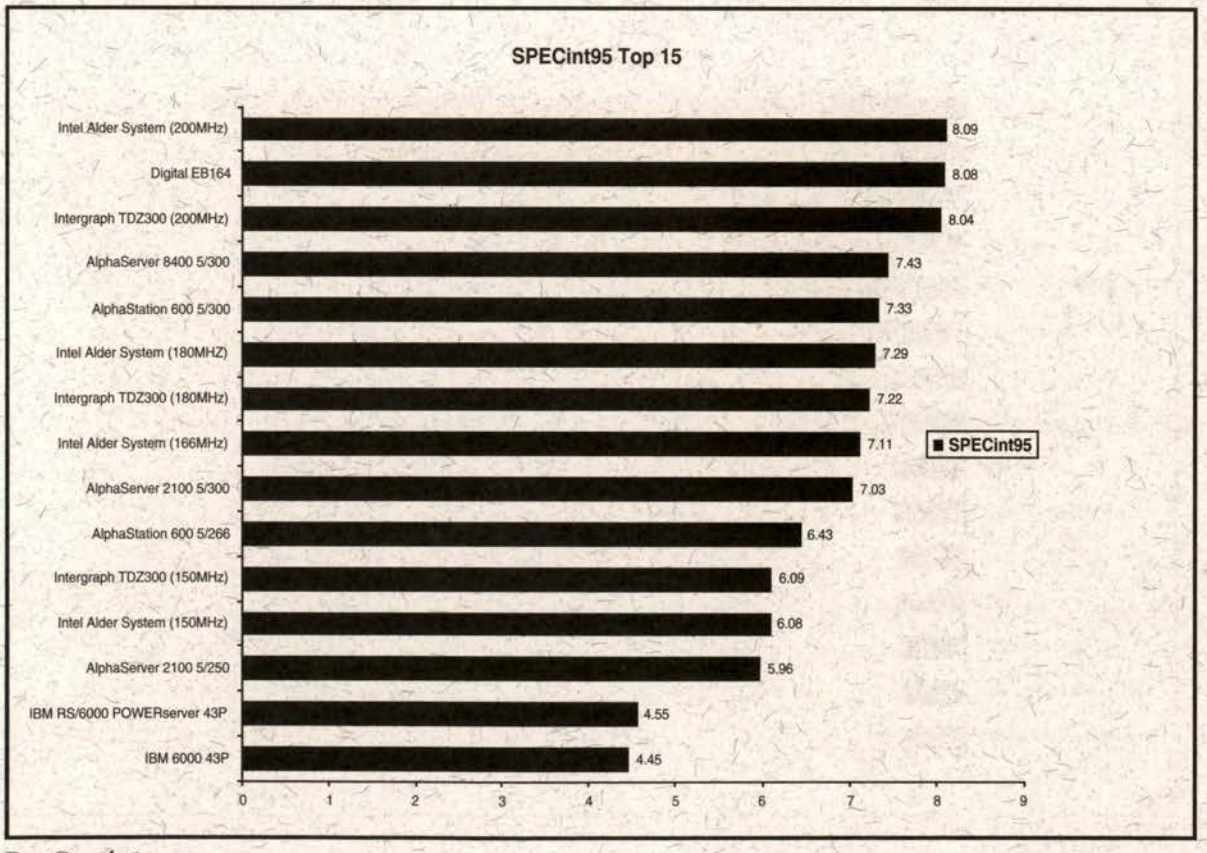
Bar Graph 6



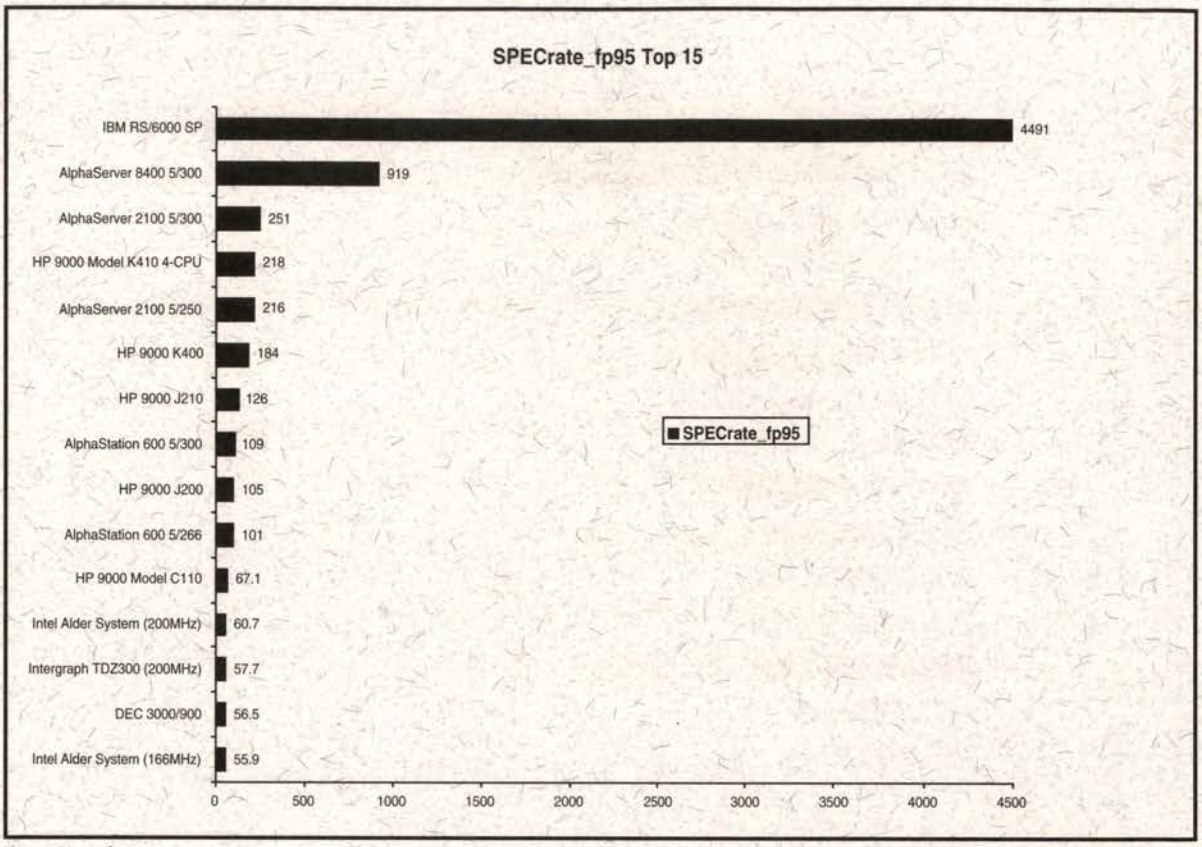
Bar Graph 7



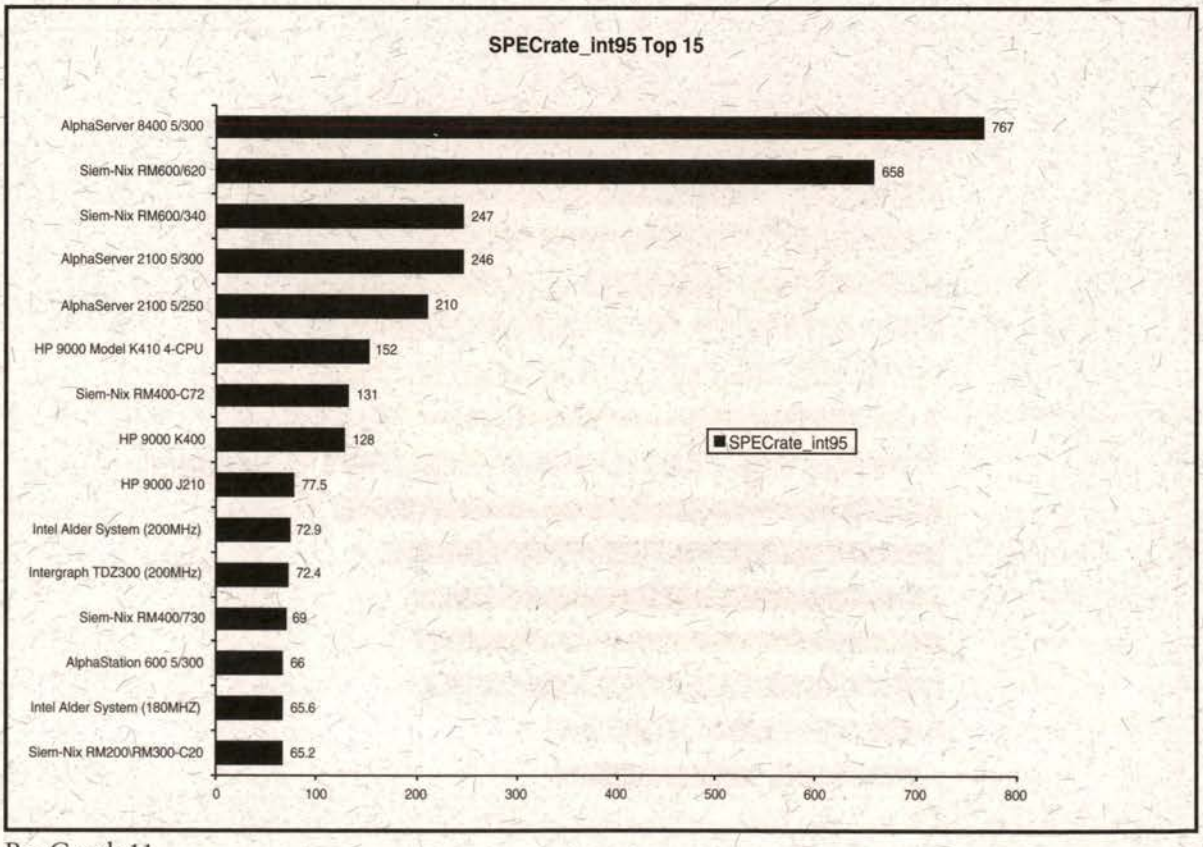
Bar Graph 8



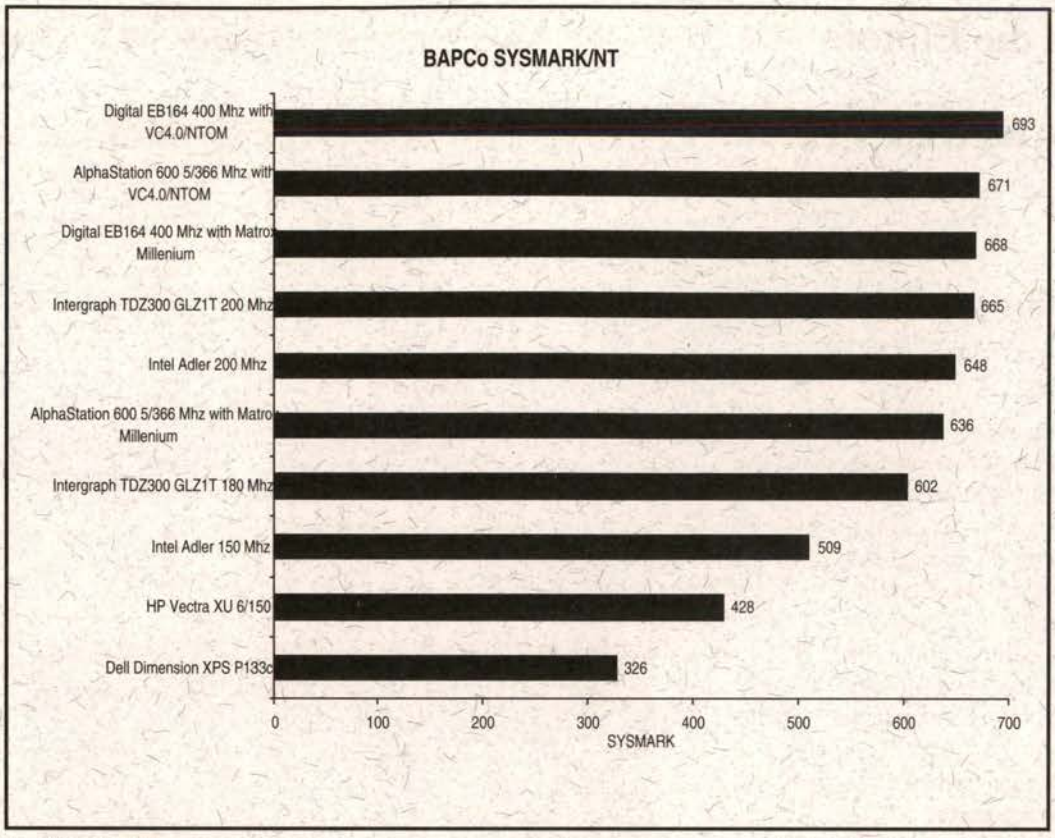
Bar Graph 9



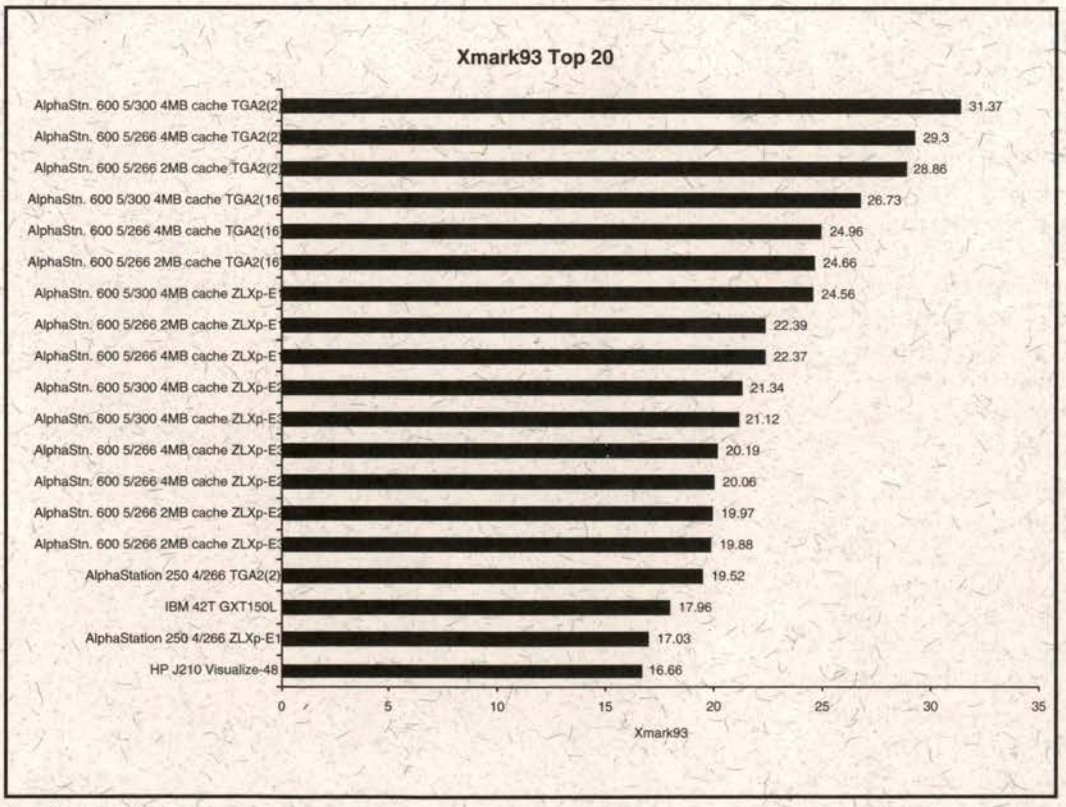
Bar Graph 10



Bar Graph 11



Bar Graph 12



Bar Graph 13

Letter from the Editor:

Final Issue of FOREFRONT as a PM&D Publication

Dear FOREFRONT readers,

This is the final issue of FOREFRONT as a PM&D Publication.

Over the years I have received many congratulatory notes and messages that praised the efforts of my staff for producing a fine publication. As a staff of one, I have been flattered and encouraged by this support. I published the magazine for an annual budget of $60,000. Soliciting, editing, and writing some of the articles, taking all the photographs, and laying out the magazine have required many extra hours. The one thing that has made this job so satisfactory is your positive feedback.

Not only have I received many letters of thanks and support, but I have also received letters and gifts from employees' parents and spouses thanking me for publishing photos or articles of their relatives. These letters of thanks and support often kept my energy levels high!

Recently, PM&D management circulated a questionnaire about the value of FOREFRONT. Many of you sent me copies of your feedback answers. I can't thank you enough for the numerous words of praise and support for the magazine. Your positive and constructive remarks meant more to me than the two Society of Technical Publications awards that the magazine just received.

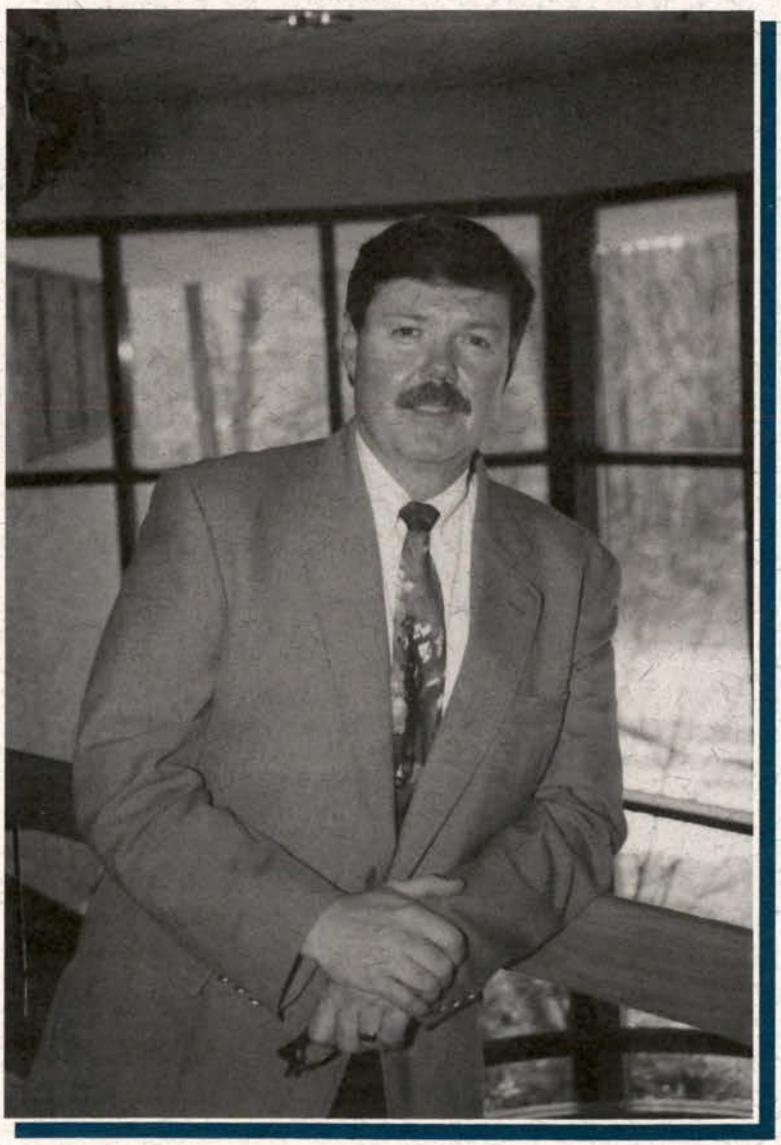
I want to thank Vice President Bill Demmer for sponsoring and funding FOREFRONT. I want to thank all the busy people who took the time to submit articles and those who took the time to offer ideas and constructive criticism. I want to thank the Unix and OpenVMS Partners for their constant participation and support, and the patent engineers for assisting me with the Patent group photo as well as the vice presidents and corporate consultants who came to the photo sessions and congratulated the patent award engineers.

As this issue of FOREFRONT goes to press, the future of FOREFRONT is uncertain.

I hope the magazine is able to continue under a new organization. Many outstanding engineers and designers work at Digital, and it's been my pleasure to meet so many of you and record your impressive accomplishments.

Sincerely,

Dick Willett



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