IBM'S NEXT GENERATION: FROM PC TO SYSTEM

The name for IBM's new line of PCs says it all: the Personal System.
First, this unit is a system in itself, with a balanced, integrated array of
enhanced functions and streamlined parts. Second, it is part of a larger
system, a component in the IBM structure that promises to integrate micros
and mainframes seamlessly; the new PS/2 is the first IBM product line con-
ceived with IBM's Systems Application Architecture specifically in mind.
True, the second identity isn't quite here yet, and much of the Personal
Systems' power will initially be devoted to handling the newly complex,
layered software; the ultimate implementation won't be reached until an
80386-specific version is out. But the word "system" is the message.

RELEASE 0.1

This is a special "instant" issue exploring just a few aspects of the
recent IBM announcements we don't expect to see covered elsewhere.
Our next issue will appear in May, giving us some time to edit the PC
Forum transcripts. (After editing they must be laid out, interleaved
with photographs, etc. Please don't hold your breath!)

The system remains clonable, but with a lot of brute-force technology (one-
megabit chips, VLSI, new bus architecture) that competitors will be pressed
to copy at reasonable cost. The powerful systems software (with one excep-
tion) will be freely available to other pc-makers from Microsoft, although
smaller-volume manufacturers will have to wait in line and pay more than
IBM. Overall, IBM has announced an impressive new line-up of machines, with
a visual interface standard and stupendous graphics (especially from a com-
pany that previously seemed almost indifferent to visual niceties), pervas-
ive use of VLSI to conserve space and raise reliability (five-fold over the
original PC, according to IBM), a powerful new bus architecture (the Micro
Channel™, patent applied for), and a smaller, simpler physical form.

We expect the marketplace to converge around two
standards: the Industry Standard, as built by IBM
and espoused by Compaq, and the new Performance
Standard (PS), as introduced by IBM. Ultimately,
we expect Compaq and others to offer Performance-
Standard machines, for all their protestations that
IBM has "abandoned the standard." IBM has aban-
donned the standard -- in favor of something better.
In this unfair world, only IBM could afford to.
But most customers are glad of the move forward.

REMEMBER THE 80386!
despite short-term dislocations. While they may spend several months sorting out the inches-thick announcement documents, at least they have something tangible to sort out. And competitors are mostly glad, too. Third-party vendors are now free to announce their products (those in the know) and get to work on them.

Of course, the high-end systems won't be available for several months, and supporting software for months after that. (IBM gets criticized either way -- whether for announcing vaporware, or for not letting customers and competitors in on its plans. So be it.) In the meantime, IBM and Microsoft will be working closely with dealers and customer/competitors to provide appropriate support for the new systems. IBM has also worked hard to ensure appropriate dealer support, training a limited number of dealers to sell the machine, which should in turn help keep margins high and provide dealers an incentive to support the line effectively. By Comdex Fall, prices will have readjusted, and we'll see a couple of clones and a host of prototypes.

Open and closed

There's a variety of definitions of open and closed. Fundamentally, IBM's new line is open, in that its specs are published for use by makers of add-in cards, and it provides numerous hooks for software from third-party vendors. Moreover, other makers of 286 and 386 systems can buy the basic OS/2 from Microsoft to run on their machines (although they can get only the advanced BIOS interfaces, not its internal listings). As far as we know, OS/2 Extended Version (OS/2E) will run on machines such as the Compaq 80386, seeing as it will be designed to run on the PC AT.

The new PS is extremely open to add-in communications cards (for Ethernet, say, or modems), and relatively open to add-in memory. However, it is relatively closed to some other add-ins, not because of technology barriers, but because each higher-end system already includes VGA graphics support and a hard disk. This pretty much wipes out the business of enhancing new IBM PSes with graphics or internal mass storage; vendors will lose a market niche and dealers will have to adjust to a world where they can't use cheap add-ins and add-ons so liberally to build higher-margin machines. But there's still a market for memory and communications add-ins -- as well as the OEM market of clone-makers and the retail market of installed clones and PCs. (IBM's memory prices provide a nice umbrella, and the basic system configuration still lacks EMS and EEMS support, although the equivalent is provided by IBM's Expanded Memory Adapter.) The Performance Standard gives buyers a new level of graphics and other capabilities to aspire to.

That's not to say that we'd want to be in the add-on business right now. Over the next few months the board makers will have to retool to fit IBM's new bus, support its new VGA graphics standard, and assess the impact of IBM's one-megabit memory chips. Building boards becomes a more complex business, because the impact of the Micro Channel architecture pervades the Personal System. Device controllers work intimately with the Micro Channel bus in a way that may take some time to understand. "They haven't localized the functions in one place," notes Chips & Technologies' Mike Ares. "We don't know exactly what functions are in there that aren't currently used -- and that we'll only find out about later when they're needed."

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One feature -- benefit or curse depending on where you sit -- of a true operating system is that it insulates the software from the hardware, which in turn means that hardware compatibility is less of an issue -- the quirks of the hardware are blanketed by the insulating OS. It may be easier to build an entire system clone cloaked by OS/2, than to build boards that work with the quirks of IBM's new hardware components, especially the Micro Channel. Ares estimates it would take Chips nine months to a year to provide an equivalent (not necessarily compatible) machine to support OS/2.

Dbms implications

As for applications software, with OS/2 Extended IBM may do to dbms software vendors what it did to graphics vendors -- bundle in a product that had previously been mostly a third-party purchase. Traditional pc dbms vendors will find themselves competing with something quite different from IBM -- dbms not as application but as application foundation. There will be room for so-called "surfaces" -- dbms interfaces -- and dbms tools, but the internally developed dbms platform itself will be standardized and bundled in with IBM's OS/2E. Oracle, RTI and Sybase are well positioned to provide clones of that structure, but any money they make will come from the supporting tissue they also provide (also including interfaces such as Ansa's) -- whether for their own dbms or to surround IBM's DB2-like platform.

The pricing is bad news: Whatever the quality of their forthcoming OS/2 versions, IBM's is priced aggressively low as part of the proprietary $470 OS/2 extension that also includes communications protocols. The other extended functions are a variety of communications protocols that wouldn't be worthwhile for most third parties to sell except as add-ons to other makers' unextended systems: IBM can afford to on the assumption that those protocols will be used to connect to other IBM hardware.

The operating software

As expected, the operating software announced is pretty nifty. For the first time, there's a real operating system, not an I/O manager, for the AT (and the PS). It supports multi-tasking and dynamic linking, among other things. Dynamic linking lets you call a subroutine from a library so that several applications or parts of applications can share code/functions; in addition, each such module can be modified or replaced just once rather than within each program that uses it. It's also helpful in communications: A program can call a function without knowing whether it's fetching data locally or from, say, a remote file server.

RELEASE 1.1: ERRATUM. The price for The Whitewater Group's Actor is $495, not $995 (as we mistakenly listed it in a table in our last issue). Actor is a potential beneficiary of IBM's support for a Windows-based graphical user interface. The Whitewater Group is working on a new version to support IBM's Presentation Manager, which should be out no later than the PM itself. Like the original Actor, the new version will enable developers to concentrate on the functions of their applications rather than the graphical images. It will also handle the multiple threading and pipeline structures supported by OS/2. Whitewater's long-term goal is to make it possible to write a single application to be compiled into either a UNIX or OS/2 version, depending on which class library is used.
True, OS/2 takes up a lot of memory, and is more complex than DOS. Many people have no need for all the OS/2 functions and will happily continue to use DOS 3.3 on the PC/PS line. DOS 3.3 takes far less memory and imposes less overhead than OS/2 and runs equivalent software faster, so that any user wanting to run only a single standalone application at a time (without switching frequently or linking to other environments) would have absolutely no use for OS/2. In some cases, where such users could benefit from performance boosts to a single application, vendors will solve the problem by building 80386-specific versions that still avoid the overhead imposed by OS/2 -- and that exploit the 80386 rather than the 80286. (The most typical example is a dbms hampered by the need to swap code and data out to disk.)

Although IBM’s Windows-derived Presentation Manager will be included in release 1.1 of OS/2, OS/2 applications can run without it. Like DOS-based applications but less so, text-based OS/2 applications will be easier to write and will run faster, even though that’s a lesser consideration as hardware power increases. We expect to see a fair number of DOS applications ported to OS/2 in text mode…with most to follow in graphics mode. Vendors will be attracted by the knowledge that all OS/2 users have PM.

We understand that OS/2 has something like 350,000 lines of code, while OS/2E may have as much as 1.5 million -- meaning there’s an awful lot of stuff in there. One might call that a liability, not a benefit, but we’d wager it includes useful capabilities not easily replicable by third parties. Much of it may be transformed wholesale from equivalent functions in IBM’s mainframe environment -- for better or worse.

What of the 80386?

Unfortunately, missing in all the hoopla was much mention of the 80386 per se. This is natural enough, since the installed base and near-term purchase volume favor the 80286; those customers deserve some attention.

But the 80386 remains in the minds and on the drawing boards of the more foresighted players. OS/2 treats the 80386 as an afterthought because in many ways it is. The most difficult part of the transition was from DOS to OS/2 -- moving from real mode, where the software may address the hardware directly and do other little tricks, to protected mode, where it is prevented from doing so. At that point, memory management also changes: Instead of dealing with real memory, the application leaves that too up to the OS, and simply lets the OS use whatever memory is available. OS/2 takes care of swapping code and data in and out and around in real memory if not enough is available, and sharing memory among simultaneously operating applications or tasks.

Moving OS/2 from the 80286 to the 80386 -- from 16MB of addressable memory per application to 4 gigabytes, from 16 MB of real (physical) memory to 4 gigabytes, from one gigabyte of virtual memory to 64 terabytes, from one real-mode "compatibility box" to multiple virtual 8086 machines, and from the 286 instruction set to the 80386’s 32-bit instruction set -- will be easy by comparison (one year’s work versus three or four). We suspect Microsoft will already have done most of that work, except for finishing and polishing, by the time OS/2 is released. Only 10 percent of the code needs to be changed, says Bill Gates. And we expect parts of it -- notably multiple virtual machines, as shown in a recent Windows demo -- will come out sooner than others, in interim releases of OS/2. (OS/2E is an IBM-propriet-

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etary branch, not an upgrade; what we'll call OS/2-386 will also have an IBM-proprietary Extended Version.) Similar limited concurrent-DOS-session functionality is offered on 286 machines by the 3270 Workstation Program, joined with IBM's Extended Memory Adapter to provide "640KB memory relief."

For third-party software developers who follow the rules and write in high-level languages, the shift from OS/2 to OS/2-386 should be painless, but the benefits will be real in ease of development, availability of memory, and speed of execution. For those who did extra work early to benefit from the 80386 themselves, the work of transferring to OS/2-386 may be greater, and the relative benefits less. IBM/Microsoft's goal is to make the shift invisible to the applications developer, so that any OS/2 application will run better on a 386 under OS/2-386 without rewriting, while a 386-specific application can do even better. (The 286's protected mode slows down execution in a way that the 80386 does not, related to the 64K segment limits on the 286.)

The issues for the application developer are these: Memory management looks the same to the application (except for unusually large ones). The 386's ability to support more physical memory is invisible to the application, because it relies on the OS to handle memory, swapping in and out as appropriate.) Code segment size, however, is a visible restriction to the application; it is also a function of memory management and can be enlarged to 16MB on the 386 from the 86/286 limit of 64K. Existing applications can be rewritten to use larger code segments on the 80386, which offers benefits in speed and reduced size and complexity, but this is not a requirement for use of a 386 OS. New 386-specific applications are much easier to write without segment restrictions.

Waiting for GoDOS 386

Caught up in the excitement surrounding IBM's announcements, many developers who had been looking forward to writing for the 80386 will probably go ahead and do new software for OS/2 -- which means they will have done most of the work to do an 80386-specific version as soon as the 386 OS comes along.

But it takes more work to do a full-scale OS/2 application than to slip a DOS application onto the 386 with minor modifications. And 80286 protected mode, because of its handling of segments, uses up a lot more system power than 80386 protected mode for equivalent software. So some vendors of existing applications will likely do single-tasking 386-specific versions even before (or instead of) 286 versions. They will find their own way onto the 80386 with help from vendors such as Softguard (VM/Run) and Phar Lap (DOS Extender). Both companies offer the ability to execute a DOS application in 386 protected mode, above 640K. The application must be recompiled or rewritten to benefit from the lack of segment restrictions and to call the extender to make it handle memory management (where formerly the application used its own cumbersome swapping routines). The extender also grabs calls to the OS for I/O and switches back into real (DOS Extender) or virtual 8086 (VM/Run) mode to execute them via DOS. The application can still talk to the hardware directly, bypassing both DOS and its extenders.

Softguard sees extending DOS as a preliminary to its VM/386 control program, in essence a competitor to OS/2-386, while Phar Lap, less ambitious, views DOS Extender as a bridge product in a line of tools that also includes assemblers, linkers, and other tools. With VM/386, due in September, multiple

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single-tasking DOS applications could run simultaneously in virtual machines on a 386. But they would remain single-tasking applications unless re-designed; that is, within each application there would be a single thread of activity. A program written specifically for VM/386 could be multi-threaded, as could one written for OS/2.

Unfortunately, while 386 protected mode can host real mode nicely (without DOS being aware of the deception, so to speak), it can't do the same with 286 protected mode, or OS/2. DOS 3.x is surrounded, but OS/2 must be modified to run within 386 protected mode. Thus enabling an OS/2 application to take advantage of the 386 is tougher -- and is part of what IBM/Microsoft are working on in their future 386 OS. There is probably little market for such a capability from anyone other than Microsoft/IBM: While letting DOS applications run on the 386 is helpful -- a benefit with little added cost -- few vendors will want to go to the trouble of writing for a non-standard OS/2 version for the 386 when a standard one waits around the corner.

Independently of the operating system, applications can be rewritten (from assembler) or recompiled (in a high-level language such as MetaWare's High C or Professional Pascal) to use the 80386 instruction set, which can provide faster execution of computation-intensive functions. Q&A is one example.

Running DOS applications

Most DOS applications will be able to run under DOS 3.3 on the new IBM Personal Systems, direct hardware access and all. (However, copy protection gums up the works, so that many old programs can't just be reloaded onto a 3.5-inch disk.) Moreover, a single well-behaved (or rewritten) DOS application will run in the foreground within OS/2's "compatibility box"; while this happens, one or more OS/2 applications are suspended, and when the OS/2 applications execute singly or concurrently, the DOS application is suspended. OS/2 does not yet support the 80386 chip's ability to create multiple virtual machines to run multiple DOS applications simultaneously.

Who's helped?

The most obvious beneficiary of all this is, of course, Microsoft. Not only does Microsoft continue to get OS revenues from both IBM and the compatibles, it also has garnered support for its Windows -- albeit in slightly altered form. (Intriguing question that no one will answer: Does IBM get a cut each time Microsoft sells an OS/2 license, seeing that the product was jointly developed?) Perhaps the only danger now is that Microsoft become, if not the A-word, at least complacent.

Second to be helped (and more in need) is IBM. IBM has come out with a line of systems well worth waiting for. Forget clonability: IBM has made use of a wide array of brute-force technology as well. With VLSI and surface-mount technology it has raised the reliability five-fold and given the systems a smaller, tidier form factor. With internally developed technology it has improved display speed (much like the new Amstrad and Tandy machines), access times, and communications performance -- to the extent that it will avoid using megahertz ratings in its publicity because PS performance is better than those numbers indicate. Finally, to its own and competitors' benefit, IBM has dropped its costs while keeping prices relatively high. We expect prices to drop once IBM is able to meet demand -- about the time clone-makers come into the market...

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Phoenix and Chips & Technologies, as always, face a challenge that is also an opportunity. Apple won't exactly benefit, but it will feel less pressure than it would had it diffused its own identity to become a clone-maker.

Dealers, the good ones at least, will benefit from having more to offer -- and a lot more to support. Although IBM is attempting to build support in with SolutionPacs and such, lots of value will still need adding.

Much as we hate to cheerlead, users will benefit. True, there will be dislocations, but remember, nobody is forcing anybody to buy anything. (The discontinuation of the PC and most XTs has been announced; we expect the AT to be discontinued as soon as decently possible -- soon after inventories of AT boards run out and new PS boards become widely available. DOS 3.3 runs on both lines.) IBM has raised the general level of what users can expect in terms of graphics, performance, and goodness and consistency of interface. That translates into improved price-performance, and the benefits are shared: Vendors get more revenue and users get more value, as the average system price continues to go up. (One software vendor we know complains: "My guys are going to hate this! They have thousands and thousands of [5.25-inch] floppies of copied software, and now they have to build up a whole new library of the 3.5-inch disks." This, the software vendors consider a benefit!) The complex but powerful software will initially task the PS's resources, but the system should come into its own when 386 hardware and 386 software are finally matched.

Most software vendors have a chance to gain from a new environment that enables them to build better software, although there's little point and big travail in simply porting an existing application over to OS/2: If you don't care enough to improve it, why bother? The advent of OS/2 should also create an opportunity for some new players to come forward.

The overall difficulty of writing software is likely to increase, despite assistance from programs such as Actor and other better tools: There will be more things to manage. This is not a malicious plot on the part of IBM or Microsoft to keep out smaller competitors, but a result of rising customer expectations as it becomes possible for richer applications to work together. Standalone software will eventually become obsolete -- much as you wouldn't hire a secretary who refused to speak to others in your office.

Instead, off-the-shelf packages will talk nicely together, so that a wordprocessor can fetch appropriate background data from your data base as you write a letter, for example, or a spreadsheet can automatically incorporate expense account variances from a salesman's agenda manager. (Issues of privacy, and of the distinction between "reportable" and preliminary information, will need to be addressed.) Although this is all far off, specifications such as IBM's Systems Application Architecture are designed to ensure that applications are written with this in mind from the start; retrofitting is painful -- as anyone moving a simple DOS application into OS/2 will see.

Who's hurt?

Who gets hurt? IBM's advances inevitably require an investment by competitors trying to keep up, but they also provide an opportunity for the better competitors to gain ground against the lower tiers. IBM has not deigned to attack vendors at the very low end, but the price-performance shifts at the high end are likely to trickle down. Meanwhile, Compaq, to whom this an-
nouncement was hardly a surprise, will continue to stress its systems' total compatibility with the Industry Standard at a time when other third parties are saying, "We were just waiting for IBM to announce the new stuff so we could copy it." As the closest competitor to IBM at the high end, Compaq has the strongest position -- and the most to lose. We expect that Compaq will eventually buckle under and anoint the new standard -- successfully.

Certainly the board vendors stand to lose a future source of business, as a machine that was once a purchased processor and case dressed with third-party peripherals becomes a system that, IBM notes, is 80-percent blue. But the more nimble board vendors stand to gain business retrofitting existing machines and helping clones achieve the new Performance Standard.

Positioning: PS - I'm connected!

Apart from internal, functional value-added, IBM is adding value to its PS by linking it into the broader IBM environment -- the one thing totally unclonable. The SolutionPacs extend this same approach: Although they have many components, they can be purchased in a chunk, just like a standalone machine. And they come with installation assistance -- that is, built-in systems integration. They solve a customer problem -- that of buying something that works, as opposed to buying pieces that must then fit together. And they solve an IBM problem -- keeping customers from straying into third-party territory. Several of them include the PC/PS as just one component of a broader system. Quietly, IBM is getting into the turnkey system business.

Software pricing also reflects the MIS-mindedness of IBM's PC/PS line. The software announced last week and retroactively most other PC/PS packages, will include a right-to-copy price as well as unit "shrink-wrap" pricing. This approach assumes both some centralization within the purchasing organization and, implicitly, electronic connectivity that will enable the software to be distributed electronically from a central server or host.

IBM's advertising also reflects the PS's positioning as a connected machine, featuring America's favorite, archetypal team -- the guys from M*A*S*H (except for Alan Alda, whose contract with Atari expires next year, and who is surely already talking with IBM). Although the actors are not identified on-screen, they resonate with the notion of teamwork, where Charlie Chaplin embodied humanity and the individual in a mechanized world. Much as we enjoyed the ads, we were never comfortable with Charlie Chaplin's cuteness and warmth, designed to lessen fear of computers and show that anyone can use them; we prefer the archness and adulthood of the current series, designed to illustrate the computers' power and connectedness, and to show how they help people work together.

For background, please refer to our issues of 24 September (Vaporchip solidifies); 2 December (80386 hypervisors); and 24 March (DOS and ante-DOS).
BACK AT THE RANCH

Even as IBM sets the general standards, there is still room for innovation. Two recent examples, regrettably overshadowed by IBM's announcements, come from 3Com and Tandon. A diskless networkstation and a portable hard-disk cartridge, they offer novel form factors reflecting newly realizable goals of personal computing -- connectivity and mobility.

3Com's 3Station lets (or makes) the user share everything but his own processor and monitor. Hooked up to a network, the user never has to deal with boards and cards, local disks, or the noise, bulk and parts-count that they engender. Far from being closed, the $1895, 286-based system is in fact open, to peripherals and other servers shared on a network. True, the graphics configuration is limited to what 3Com puts into the box, but we expect that a 386, VGA support and other PS components will be forthcoming.

Interestingly, while other diskless workstations tout low cost -- and offer limited functionality -- the 3Station's appeal is sleekness and power, rather than low cost. Working from founder Bob Metcalfe's vision, the system provides access to network resources and to communication with a work group, rather than a standalone machine connected to other nodes and services. The distinction is fine: The center of gravity is within the network, not spread out along the periphery at people's desks. (Nor is it necessarily extended to mainframes, as IBM implicitly hopes.)

(While reading 3Com's press materials for this announcement, we came across the finest piece of product positioning we've ever seen, by Bob Metcalfe. It's too long to reprint here, and too good to paraphrase. But it's well worth reading if you're interested in the philosophy of the workgroup.)

Tandon's Personal Data Pac recognizes the fundamental issue that will keep portable computers from ever being satisfactory -- they need to be too large to be carried comfortably, in order to be large enough to use. There's just no way to miniaturize a monitor and a keyboard.

The solution: Don't carry the computer; just carry the data and code to recreate your electronic environment wherever you go. (If the world were made up of connected 3Stations, you wouldn't even have to to do that; you could just sign on anywhere...but that won't happen for a while yet.) The Portable Data Pac is a 2.5-pound, rugged hard-disk cartridge that can hold a person's total environment -- 30 megabytes of programs and data. However, it assumes that you'll find Tandon's matching Ad-PAC 2 disk drive wherever you go. It would probably be an instant success if launched by IBM.

As it is, we expect individuals who travel frequently among a limited number of sites (or just up the hall) and who can keep a suitably equipped pc at each one will find the Data Pac far handier than carrying around a luggable or a handful of floppy disks (besides, you always forget the one you really want!). We could also imagine a compact between software developers and reviewers, so that software developers don't have to tote around a luggable to show off their stuff. (Software developers must be Compaq's best penetrated market by far, both for its luggables and for the Deskpro 386). Vendors could even sell large programs re-loaded on a Data Pac. We expect and hope that a few companies will standardize on Tandon's Data Pacs (the drive can be added on to an industry-standard pc). And we hope that someone with more market power than Tandon has now will pick up this excellent idea.

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PHONE NUMBERS

Richard Schwartz, Ansa, (415) 595-4469
Mike Ares, Gordon Campbell, Chips & Technologies, (408) 434-0600
Rod Canion, Steve Flannigan, Gary Stimac, Compaq, (713) 370-0670
Sam Albert, IBM, (914) 765-3054
Ed Belove, Lotus, (617) 577-8500
Steve Ballmer, Microsoft, (206) 882-8080
Tom Pinnella, MetaWare, (408) 429-META
Richard Smith, Phar Lap, (617) 661-1510
Neil Colvin, Lance Hansche, Phoenix, (617) 769-7020
Ken Williams, Softguard, (408) 970-9240
Gordon Eubanks, Symantec, (408) 253-9600
Chris Buckham, Tandon, (805) 378-6058
Bill Krause, Bob Metcalfe, 3Com, (408) 562-6400
Mark Achler, Chuck Duff, The Whitewater Group, (312) 491-2370

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April 15 NYNEX at the analysts - New York City. Sponsored by the New York Society of Security Analysts. Contact: Judy Fontana, (212) 344-8450.

April 16 American Software at the analysts - New York City. Sponsored by the New York Society of Security Analysts. Contact: Judy Fontana, (212) 344-8450.

April 20-22 CD-ROM vs. micrographics - Monterey, CA. The transition from microfilm to CD-ROM. Sponsored by the Institute for Graphic Communications. Contact: Gail Montgomery, (617) 267-9425.

April 21 Hogan Systems at the analysts - New York City. Sponsored by the New York Society of Security Analysts. Contact: Judy Fontana, (212) 344-8450.

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April 22  "Look and feel" panel - Newton, MA. Sponsored by the Massachusetts Software Council, for members only. For information on the program or becoming a member, call Joyce Plotkin at (617) 497-5716. Then stay in town for....

April 22  Philippe Kahn at the Boston Computer Society - Boston. Unveiling yet another new product. Contact: Jon Rotenberg, (617) 367-8080.

April 22  American Management Systems at the analysts - New York City. Sponsored by the New York Society of Security Analysts. Contact: Judy Fontana, (212) 344-8450.

April 23  MCI Communications at the analysts - New York City. Sponsored by the New York Society of Security Analysts. Contact: Judy Fontana, (212) 344-8450.

April 22-24  AEA financial conference for public companies - Boston. Contact: Dave McKell at (415) 857-9300.

April 22-24  AI Long Beach - Long Beach, CA. Contact: Jim Hay at Tower Conference Management, (312) 668-8100.

April 23  Intel meetings for shareholders and analysts - San Jose. Contact: Jim Jarrett, (408) 987-8080.

April 25-26  Softeach - Chicago. Sponsored by Softsel. For information, call (800) 325-9189, (314) 225-1724, or (416) 629-2222.

April 27-May 1  Lotus Week - In and around Boston. A week of celebrations, conferences, panels, etc. For friends, developers and customers. Contact: Jill Schuman at (617) 235-5560.

April 28  DEC at the San Francisco analysts - San Francisco. With Ken Olsen himself. Call Helen Brosnan at (415) 777-0681.


May 6-8  ICP Million-Dollar Awards & Conference - Indianapolis. Sponsored by International Computer Programs, Inc. Contact: Judy Fary, (314) 844-7461.

May 7-9  Fortune/Seybold Desktop Productivity Conference - New York City. The usual stellar array. Call Beth White or Sandy Seybold, (213) 320-9151, or Carol Federighi, (408) 297-0888.

The full calendar will reappear in our next issue. Please let us know of any other significant events we should include.
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Sylvia Franklin
Associate Publisher

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