When you ask some people about backup — they back off.

And for good reason. Ask any other supplier of peripheral products for system backup, and you'll find that some can supply a disk, some can supply a cartridge recorder, others a streaming transport. But none can supply the choice which Kennedy can offer.

Kennedy is the only company that can offer an SMĐ compatible, 8" 40 MByte disk drive (Model 7800) and an 89 MByte 1 1/2" Winchester disk drive (Model 5880). To back them up, Kennedy has a 1 1/2" cartridge recorder (Model 6450), and Model 6880, a 1 1/2" Data Streamer Tape Transport.

Kennedy was the first to utilize the 1 1/2" 8M cartridge for disk backup. Kennedy was the pioneer in Winchester disk technology, and was a leader in developing a low cost streaming tape drive.

All of these products were conceived and designed to meet the need for reliable, low cost backup — for our systems or for any other system.

Kennedy has always backed its products. That's why we're No. 1.

Call or write us about your problem. We won't back off.

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(031) 374-6701 KEN 69
The AM Jacquard "114" entry-level computer system does everything for your office: word and data processing.

And it does a whole lot more. It interfaces to AM vanity printer phototypesetters, can easily communicate with mainframes, and can handle electronic mail and a multitude of tasks that other systems can't. And all for about $15,500 per screen.

This efficient office automation system can grow with your business too. Buy it now with only two workstations and add more for under $5,500 per screen as you need them. The 114 T offers ease of operation, expandable on-line storage, high-speed throughput, and comes with a choice of two laser-quality printers.

The AM Jacquard "114" is designed to boost your office's productivity and profitability. No one but no one offers such versatility and flexibility for the money. And we know what we're talking about. Our parent company, AM International, Inc., has been designing products for modern offices for more than 50 years.

If you want to know more—and you should—about the Jacquard 114, and winning the battle against AM Jacquard Systems, the information is in a division of AM International, Inc. Dept. 117
2340 Ocean Park Blvd., Santa Monica, CA 90405
1213-450-1242, Ext. 777
A Multi-User Hard Disk Small Computer for Only $4,875.*

At RAIR, we have been building advanced microcomputer systems for more than four years. That’s why our line of Black Box microcomputers offers such unbeatable price/performance.

We’ve been consistently at the forefront of compact computer technology, with 8” Winchester disks and multi-user software. And now, we’ve added, integral 5¼” hard disks—plus state-of-the-art 64k RAMs.

When you specify our latest Black Box microcomputers, you get 5¼” Winchester hard disks for high speed, high capacity storage and 64k dynamic RAMs for expanded memory. Plus an advanced MP/M operating system for multi-user, multi-tasking operation.

So if you’re searching for compact computer systems with real price/performance, evaluate our Black Box microcomputer today. For details, contact the RAIR office nearest you.

*Single-unit price for Black Box Model 3/30 evaluation system.
# FEATURES

## 34

**IN FOCUS**

Edward K. Yasaki

A look at a classic, the 1961 Stretch computer, which had a phenomenal list of "firsts." Developed by IBM and NSA, the machine never quite reached the heights anticipated for it, but the project attracted many bright young people to IBM.

## 96

**THE CHANGING ROLE OF THE DP MANAGER**

Janet Crane

The changes are seen by some MIS managers as the opportunity to play a starring role in corporate management, by others as a threat to their authority that will ultimately render them obsolete.

## 110

**TOKYO LOOKS TO THE '90S**

Edward K. Yasaki

Japan is beginning a 10-year research and development effort which it anticipates will produce a fifth generation computer system.

## 118

**COPING WITH COMPUTER CRIMINALS**

Charles L. Howe

Dp types are too unsophisticated and trusting when it comes to human relations, say experts. These qualities permit computer crime to occur.

# NEWS IN PERSPECTIVE

50 **STRATEGIES**

IBM to bite the bullet?

52 **SUPERCOMPUTERS**

Seymour leaves Cray.

61 **MAINFRAMES**

Mid-life kicker for the 4300s.

65 **COMMUNICATIONS**

Merging voice and data. Phone of the future.

72 **EDUCATION**

"Secrets" on campus.

77 **SOFTWARE**

Unix: a standard now?

80 **ELECTRONIC MAIL**

Battle over ECOM.

80-I **POLICY**

U.K. hits telecom monopoly.

88 **PRODUCTIVITY**

Let the users program.

90 **BENCHMARKS**

# DEPARTMENTS

8 **LOOKING BACK**

13 **LOOK AHEAD**

18 **CALENDAR**

23 **LETTERS**

31 **EDITOR'S READOUT**

151 **PEOPLE**

155 **HARDWARE**

163 **SOFTWARE & SERVICES**

167 **SOURCE DATA**

176 **MARKETPLACE**

184 **ADVERTISERS' INDEX**

COVER ILLUSTRATION BY RICHARD WILLIAMS
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As we all know, DEC's VAX-11 is a system of remarkable performance capabilities...a joy to engineers and scientists. But, wonderful as they are, the people at DEC don't provide VAX users with a comprehensive resource monitoring software package. And, there are people in your company who like to keep track of things.

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Behind the world's widest range of graphics: a world of system interfaces.

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Tektronix has set the world's graphics standards for more than a decade. In user considerations: precision, versatility, software, ease of use. And in system management considerations: easy interface to virtually any mainframe or minicomputer. A commitment to updating, not outdating, products. Exceptional reliability and worldwide service support.

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For more technical analysis, users may choose the unprecedented local intelligence and high information capacity of the 4112, the state-of-the-art in raster graphics. They may choose the independence of the 4052 high-speed desktop computer, with optional data communications interface. Or select the 4012, the most affordable alternative in high-resolution graphics.

With our PLOT 10 Interactive Graphics Library, (IGL) you enjoy fast start-up, easy maintenance, CPU and terminal independence. IGL is the world's most popular implementation of the 1979 ANSI proposal for a computer graphics standard.

No mainframe vendor or other supplier can begin to offer so many standard-setting graphics products—including plotters, copiers and file managers—so immediately compatible with your system and so completely compatible with each other. For additional literature, or the address and phone number of the Tektronix Sales Office nearest you, contact:

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is probably the most impor­
tant step toward saving.
For those who find saving
difficult, it’s too easy to say, “I’ll start tomorrow...or
maybe next payday...or
next month.”
Then, if you finally do
save something three or four
paydays in a row, it seems
OK to skip one or two, since
you've been doing so well.
And soon you're right back
where you started.

There is a way to take
that initial step and know
you're on the right track
toward a regular, scheduled
savings. Just join the Payroll
Savings Plan at work. A
little is taken out of each
paycheck toward the
purchase of U.S. Savings
Bonds. You never see that
little extra. You never miss
it. You don’t have to worry
about making a special effort
to put something aside each
payday. It’s all done for you.
Automatically.

The bucks start piling up,
the interest grows, and you
realize you’ve found one sure­
fire way to save. You finally
have a plan for the future.
And when the bucks
stop coming in, you’ll have
something to show for all
those years of hard work.

THE OUTLOOK

January 1962: President Kennedy had de­
clined to deliver the keynote at the Eastern
Joint Computer Conference, which took
place in Washington a fortnight before
Christmas, but Dause L. Bibby, president
of RemRand Univac, struck a theme JFK
might have liked. He warned his audience
that although the Russians were generally
behind the U.S. in computing, they could
take the lead if Americans failed to keep up
the good work.

Since it was the start of a new year,
DATAMATION asked 14 experts to speculate
about what 1962 held in store for the indus­
try. Topics included the university (which
had “largely abdicated its leadership in the
development of computation science”),
the military market (“Where will 20,000
new programmers come from?”), the stan­
dards outlook (“No industry has ever had
greater need for standardization...”), and
the business market (a likely R&D project: a
“new type of space computer,” charac­
terized by slow speed, low power consump­
tion, and high reliability).

Burton Grad, in his projections for
business data processing, said that 1962
marked a crossroads for the industry. He
noted that while business computing had
moved cautiously in the 1950s (owing to
management’s awe of “giant brains”), by
1960 the bosses were beginning to wonder
whether computers were being used to their
full potential. Grad argued that 1962 was a
“threshold of new systems concepts...” He
predicted that process control systems,
automated design engineering, and airline
reservation systems—all of which were
then in their infancy—would blossom in ‘62 and
point the way for future developments.

Harold Bergstein offered a market forecast
for the new year. He noted that
manufacturers were shifting investment
from R&D to applications, and anticipated
an increasing emphasis on fulfilling prior
commitments rather than extending main­
frame developments without comparable
advances in software. He also predicted that
hardware manufacturers would be develop­
ing their own peripherals and reducing their
reliance on suppliers. In general, Bergstein
cited a reappraisal of marketing strategies
that could be termed a “cautious, internal
retracement.”

EQUITABLE ARRANGEMENT

January 1972: After two unsuccessful at­
tempts to “corner specific industry markets
for software and services” (airline reserva­
tions and advertising), it seemed Informatics
had finally found fertile ground in the
insurance world.

The company coventured with Equitable
Life Insurance Company to form Equi­
matics, which offered “a wide range of
computer services to customers in insur­
ance, health care, and other industries.”
Informatics’ own Werner Frank (one of the
three original Informatics founders, along
with Walter Bauer and Dick Hill) headed
Equitables as president, and Equitable’s se­
nior vice president David H. Harris was
appointed the new company’s chairman of
the board. Equitable provided most of the
initial capital for the startup by purchasing
$6.2 million worth of convertible stock in
the new firm.

One of Equimaties’ first projects was to
develop a nationwide data communica­
tions network to improve the coordination
of administrative and policyholder services
between insurance company home offices
and field organizations. Frank anticipated a
“modest” first year for Equimatics—ap­
proximately $600,000 in sales, beginning
with a contract for the Home Life Insurance
Company valued at just under $500,000.
Under this contract, Equimatics would de­
sign and write specifications for a consoli­
dated system of Home Life’s individual life
insurance policyholders’ records.

—Deborah Sojka
The coming year will be an extremely successful one for you if your plans include attending a free seminar on IDMS-1982. IDMS-1982 is the most comprehensive and integrated database management system ever developed, with an array of new products, new features and new applications—all totally integrated, all dictionary-driven.

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Phone (617) 329-7700
With light-speed paging and swapping, Intel's new FAST-3815 intelligent memory system frees your 3350s (and 3380s) for the task they were meant to perform: data storage.

Priced at only $6K a megabyte, the FAST-3815 is an intelligent Random Access Memory (RAM) system. And because it handles paging and swapping faster and more economically than anything else in the market, the FAST-3815 releases your large capacity disk drives for productive use.

When compared to conventional disks, Intel's FAST-3815 offers many cost-effective advantages for IBM 4300, 158, 168, 303x and PCM users. These include:

- Improving paging and swapping up to 300 percent,
- Enhancing systems performance by reducing page service time up to 67 percent (vs. a 3350),
- Reducing users' response time and/or increasing the number of users with no degradation in response time, and
- Providing environmental savings—cooling, power and space.

Intelligent memory priced at $6K a megabyte

You won't find RAM memory anywhere priced as low as $6K a megabyte...especially intelligent RAM memory. Intel's advanced ISBC 86/12™ single-board computer equips the FAST-3815 with unparalleled intelligence that, among other functions, handles channel protocol and performs sophisticated self-healing diagnostics.

Self-healing procedures which make the FAST-3815 virtually failsafe include:

- The first commercial application of 'hot' spares and double-bit error correction with multiple-bit detection,
you free 3350s. Now.

- A unique software sweep that "scrubs" soft errors and reallocates spare memory in place of hard errors, and
- An automatic recording—in its own battery backed-up memory—of the board and device location of any errors to provide maximum service efficiency.

The FAST-3815's microcomputer also ensures complete IBM compatibility and the ability to emulate numerous direct access storage devices.

Fast access
The FAST-3815's extremely fast paging and swapping performance can release 3350s (and 3380s) to perform the function they handle best—normal data storage. The FAST-3815's 0.8 milliseconds access time is considerably faster than any IBM alternative.

By moving the paging data sets of swap files onto a single FAST-3815, you can free multiple 3350s (and 3380s) to handle your growing data storage requirements. And, Intel's FAST-3815 is available for delivery now.

The FAST-3800 family
The new FAST-3815 is an entry-level version of the Intel FAST-3805 semiconductor disk. Both devices in the FAST-3800 family offer impressive environmental savings. Power costs, cooling costs and space requirements are at least half of those of conventional disks.

Intel's FAST-3815 releases your disks for more productive use, offers increased systems performance, and is available now. Interested? Contact Intel's Market Information Office at 512/258-5171. Or mail the attached coupon today.
200 reasons to buy the BTI 8000

With one BTI 8000, you use up to 200 terminals simultaneously running programs in COBOL, FORTRAN, BASIC and PASCAL. What's more, you can run interactive and batch jobs at the same time — in any mix!

The key is BTI's exclusive Variable Resource Architecture. Starting with an entry level system, you can increase processing power by a factor of ten, by just plugging in modules — up to 8 CPUs, up to 16 Mbytes of memory and up to 8 Gbytes of mass storage. All without rewriting any software.

The BTI 8000 also features a virtual memory environment, fail-soft architecture, built-in security and privacy, and remote diagnostics. And, if all that's not enough, consider this: the base system price for the BTI 8000 is 30% lower than that for comparable systems from other “supermini” manufacturers.

As for reliability and support, they're an established BTI tradition, thanks to more than 10 years' experience with service via remote diagnostics. BTI currently supports over 3000 systems in the U.S., Canada and the United Kingdom. For even more reasons to buy the BTI 8000, contact your nearest BTI sales office.

BTI COMPUTER SYSTEMS

Corporate Offices: 870 West Maude Avenue, Sunnyvale, CA (408) 733-1122; Regional Offices: Piscataway, NJ (201) 457-0600; Palatine, IL (312) 397-9190; Atlanta, GA (404) 396-1630; Sunnyvale, CA (408) 749-0500. Sales Offices in major U.S. cities.

In the United Kingdom: Birmingham (021)-477-3846.

CIRCLE 12 ON READER CARD
### CDC SET TO ROLL OUT SOFTWARE

A bundle of software will be rolling out of Control Data this quarter for its 110 small business system. On the list will be Magic Wand, Supercalc, and an integrated general business package. They join the company's first application package, a real estate industry program introduced last month. Also in the pipeline is networking capabilities, but CDC says it won't have more to say on that subject till midyear. Declining to comment on units sold, CDC did say it now has 110s in all 30 of its Business Centers (18 cities).

### IBM's GROWING DEPENDENCE ON NETWORK SYSTEMS CORP.'S HYPERCHANNEL?

IBM's growing dependence on its VM/370 OS is now noticeable across another sector of its business, namely, satellites. Sources claim that a new project at IBM's San Jose, Calif., research lab is the marrying of OS to Network Systems Corp.'s Hyperchannel to act as a fast, local network delivery mechanism for satellite services from IBM's SBS affiliate. Maybe Big Blue will find a place in the scheme of things for all the CATV bandwidths it's been buying up as well?

### ZENITH ZEROS IN ON EM SERVICE

An electronic mail service called ZGRAM will be available on Zenith Data Systems Z90 micros this April. ZGRAM software was written in-house and is entirely menu-driven. It handles data, programs, and text, and has message checking and encryption features. Systems software costs $10,000 and interfaces to 3780-like host computers and GTE Telenet's Telemail. Workstations go for $7,500, which includes a Z90 micro, ZGRAM program for getting on Telemail, an auto-dial/answer modem, printer, and Z37 disk drive, plus Supercalc, Magic Wand, and BASIC.

### INTEL EYES CDC, UNIVAC USERS

Intel in Austin begins the New Year by offering QueX -- an update-by-example feature for its System 2000 -- to Univac users. Sometime second quarter, Intel will offer its Genius report writer to Univac and CDC users for $10,000. Both features have been available only to IBM users.

### OH YEAH?

It's no news that bad news sells better than good news, at least not to Strategic Inc. of San Jose, which is loudly hawking a $1,200 study purporting to show how Xerox will fail spectacularly in its bid for the office automation market. Strategic president Michael Killen won't give any free peeks, but claims vehemently that his "data" show "fundamental flaws" in Ethernet, the backbone of Xerox's strategy. He's so sure of his "facts"
### LOOK AHEAD

**CACHING IN**

That he's "betting (his) company" on the Xerox report. Obviously stung, Xerox shelled out the $1,200 and found little more than two out of 190 pages referring directly to Ethernet, and much of that data were "technically incorrect." Most of the rest is a history of Xerox's undeniable trip-ups in selling mainframes and broadband communications, it claims.

With battle plans drawn, Amperif is preparing for its latest foray against IBM. The California firm plans an April 1 beta test, at a site to be chosen later, of its 8870C IBM-compatible cache disk subsystem. Production of the fixed record length disk was delayed a few months, but it's now expected to be available by NCC time. The company will introduce its 8880C variable record length disk in the fourth quarter. Both products are aimed at IBM's 3350 and above customer base.

**JOL SURFACES FROM DOWN UNDER**

Watch for a new software package this month from Software Module Marketing, Sacramento. The firm has acquired U.S. marketing rights to the Job Organization Language (JOL), a high-level language developed in Australia to serve as an interface between users and IBM's MVS operating system; JOL eliminates the need to know JCL. Offered exclusively by Fujitsu in Australia, New Zealand, and Indonesia, the packages sold in those countries are bundled into Fujitsu's IBM-compatible mainframes.

**FOUNTAINHEAD FINALLY?**

When Data General started its so-called project "Fountainhead" around 1974, it was to provide the company with a new and largely incompatible high-level architecture. Developed mostly in North Carolina, Fountainhead has continued in stop/start fashion ever since. While DG is still tight-lipped on the matter, it is rumored to have spent an estimated $20 million so far. Word has it that Fountainhead will greet the light of day this year. And it's believed by one insider that the company will ensure at least some level of compatibility through an attached front-end processor.

**RUMORS AND RAW RANDOM DATA**

Not to be left in the dust, Univac is working out the bugs on a small business system, which is at the beta test stage of development....The word on Wall Street is that IBM World Trade's price cuts on large mainframes, combined with the strong dollar, will reduce its European revenues for '82 by as much as 40%....Storage Technology shortly will enhance its disk controllers with an "intelligent" cache memory. IBM's woes with the 3380 makes sales of 3350-type disk drives a cinch, ST says.
Together we can implement solutions to your most pressing DP problems:

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- Scarcity of IMS and CICS expertise
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- Demand on existing staff for increased efficiency and a higher return on DP investment

Informatics' Implementation Systems address every one of these concerns. Programmer productivity can be increased by an order of magnitude. Your application backlog can be further reduced because end users can generate their own reports, answer their own inquiries, releasing your programmers for more important tasks. Without any loss of security, your resource control implementation systems are essentially transparent to IBM environments and data bases. Even less-experienced programmers can write online programs in a fraction of the time required by conventional techniques.

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- TRANS IV™ for on-line CICS applications
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Address ________________
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Telephone ________________________ Computer _______________________
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Introducing, for PDP-11 RSX, RSTS/E, and RT-11 users

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The Time Machine

The First Dimension: Performance
Pascal-2 performs. Pascal-2 programs run as fast as FORTRAN IV-PLUS programs—or faster. (FORTRAN IV-PLUS is Digital's fastest PDP-11 high-level language.) Pascal-2 code is as small as code generated by any Digital PDP-11 compiler or interpreter—or smaller. And Pascal-2 typically compiles at 1000 lines per minute.

The Second Dimension: Structure and Portability
As a programmer, you can write in a language close to your thoughts. With Pascal's structured methods, you can do the job right the first time. It's easier to design in Pascal than it is to debug in FORTRAN, assembler, BASIC, or COBOL.

As a software manager, you will see the value of Pascal in improved communication among team members: they can understand one another's code. Pascal's portability will protect your software investment: your programs will outlive your current hardware.

The Third Dimension: Tools, Tools, Tools
The compiler precisely reports typographic or syntactic errors. The interactive, source-level debugger helps detect deep-rooted logical errors. The profiler helps identify code that can be rewritten to speed program execution. Also included are formatters, index generators, and documentation aids—a total of 70,000 lines of Pascal code.

Our 2,000 customers use Pascal for such diverse applications as general ledger and payroll, integrated circuit design graphics, word processing, typesetting, and off-track betting; for trimming integrated circuits, monitoring particle accelerators, real-time ballistics modeling, and controlling saws in a lumber mill.

The Fourth Dimension: Our Past and Future
The core of our technical group has been together more than a decade. Our Pascal-1 compiler entered commercial use in 1975. Before releasing our PDP-11 product, we delivered Pascal-2 under contract to two major computer manufacturers for three different processors. Now we're moving Pascal-2 to Motorola's MC68000, to Digital's VAX-11, and to the UNIX operating system. We're committed to Pascal for the long term.

Call or write. We'll send benchmark details, a product description, and a free copy of the Pascal-2 manual (specify RSX, RT-11, RSTS/E).

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Pascal-2: The Dimensions of Performance
Ask for a free 18" x 24" poster of this photograph.
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<th>JANUARY</th>
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<tbody>
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<td><strong>Pacific Telecommunications Conference, January 17-20, Honolulu, Hawaii.</strong></td>
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<tr>
<td>PTC will provide a broad outlook on telecommunications in the</td>
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<td>Pacific area. It is sponsored by the Pacific Telecommunications</td>
</tr>
<tr>
<td>Council. Contact Richard J. Barber, Conference Director, 1110</td>
</tr>
<tr>
<td>University Ave., Honolulu, HI 96826, (808) 949-5772.</td>
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<tr>
<td><strong>Data &amp; Telecommunications/Japan, January 20-23, Tokyo, Japan.</strong></td>
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<tr>
<td>Suppliers of PABX equipment, modems, cables, etc., from all over</td>
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<td>the world will be exhibiting at the Tokyo exposition and conference.</td>
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<tr>
<td>Contact Industrial &amp; Scientific Conference Management, Inc., 222</td>
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<tr>
<td>West Adams St., Chicago, IL 60606, (312) 253-4866.</td>
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<tr>
<td><strong>EDINFO '82, January 20-22, Madras, India.</strong></td>
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<td>The International Symposium on Education in Informatics is sponsored</td>
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<td>by the Computer Society of India. Topics will include new</td>
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<td>instructional techniques and employee and user training. Contact</td>
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<tr>
<td>T.V. Natarajan, Organizing Committee, Computronics India, 11,</td>
</tr>
<tr>
<td>Kasturi Ranga, 2nd St., Madras 600 018, India.</td>
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<tr>
<td><strong>ASEE '82, January 26-28, San Jose, California.</strong></td>
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<td>The Advanced Semiconductor Equipment Exposition is the fourth</td>
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<tr>
<td>annual expo of semiconductor processing, production, and test</td>
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<tr>
<td>equipment and materials suppliers. Contact Cartlidge &amp; Associates, Inc.,</td>
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<td>491 Macara Ave., Sunnyvale, CA 94086, (408) 245-6870.</td>
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<tr>
<td>**FEBRUARY</td>
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<tr>
<td><strong>IWP Spring Symposium, February 2-4, Anaheim, California.</strong></td>
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<td>There will be educational sessions backed by a manufacturers'</td>
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<td>exhibit at this year's spring meeting, held by the International</td>
</tr>
<tr>
<td>Information/Word Processing Association (formerly the International</td>
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<tr>
<td>Word Processing Association, still known as IWP). Contact IWP</td>
</tr>
<tr>
<td>Conference Services, 1015 North York Rd., Willow Grove, PA 19090, (215)</td>
</tr>
<tr>
<td>657-6300.</td>
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<td><strong>ISSCC, February 10-12, San Francisco.</strong></td>
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<td>The International Solid-State Circuits Conference, in its 29th year,</td>
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<td>is sponsored by the IEEE Solid-State Circuits Council, the IEEE</td>
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<tr>
<td>San Francisco Section and Bay Area Council, and the University of</td>
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<tr>
<td>Pennsylvania. Contact Lewis Winner, 301 Almeria, Box 343788, Coral</td>
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<tr>
<td>Gables, FL 33134, (305) 446-8193.</td>
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<tr>
<td>**Industrial Productivity Conference and Exposition, February 16-18,</td>
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<td>Memphis, Tennessee.**</td>
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<tr>
<td>The Society of Manufacturing Engineers (SME) is sponsoring this</td>
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<td>show, which will emphasize plant maintenance and cost-efficient</td>
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<tr>
<td>plant operations. Contact SME, PR Dept., One SME Drive, P.O. Box</td>
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<tr>
<td>930, Dearborn, MI 48128, (313) 271-1500.</td>
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<td><strong>Federal DP Expo, February 22-24, Washington, D.C.</strong></td>
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<td>This is the eighth annual conference and exposition for computer</td>
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<td>systems users in the U.S. government. Hardware and software</td>
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<td>products, and systems and services will be included in the show.</td>
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<tr>
<td>Contact The Interface Group, 160 Speen St., Framingham, MA 01701, (617)</td>
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<tr>
<td>879-4502.</td>
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<tr>
<td><strong>Comcon Spring, February 26-28, San Francisco.</strong></td>
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<tr>
<td>Sponsored by the IEEE Computer Society, this season's theme is</td>
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<tr>
<td>&quot;High Technology in the Information Industry.&quot; Contact IEEE</td>
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<tr>
<td>Computer Society, 1109 Spring St., Silver Spring, MD 20901, (301) 589-3386.</td>
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<td>**MARCH</td>
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<td><strong>Robots VI, March 1-4, Detroit.</strong></td>
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<td>Leading industrial robot manufacturers from the U.S., Europe, and</td>
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<tr>
<td>Japan will be exhibiting at the conference sponsored by Robotics</td>
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<td>International of the Society of Manufacturing Engineers. Contact</td>
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<tr>
<td>RVSME, One SME Drive, P.O. Box 930, Dearborn, MI 48128, (313) 271-1500.</td>
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<tr>
<td>**Computers/Graphics in the Building Process, March 22-26, Washington,</td>
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<td>D.C.**</td>
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<td>The conference is cohosted by the National Academy of Sciences</td>
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<td>and the World Computer Graphics Association. Contact WCGA, 2033 M</td>
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<tr>
<td>Street N.W., Suite 250, Washington, DC 20036, (202) 775-9556.</td>
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<tr>
<td><strong>Interface '82, March 22-25, Dallas.</strong></td>
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<tr>
<td>This is Interface's 10th annual appearance, and once again the</td>
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<tr>
<td>conference will be devoted to data communications, ddp, and</td>
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<tr>
<td>networking. Contact the Interface Group, 160 Speen St., P.O. Box</td>
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<tr>
<td>927, Framingham, MA 01701, (617) 879-4502.</td>
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<tr>
<td>**National Conference on Information Systems Education, March 22-24,</td>
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<tr>
<td>Chicago.**</td>
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<tr>
<td>The conference is sponsored by the Education Foundation of the Data</td>
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<tr>
<td>Processing Management Association (DPM/AEP), an organization</td>
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<td>established in 1975 to ‘‘expand the educational opportunities for</td>
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<td>system professionals and to conduct research and programs to</td>
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<tr>
<td>benefit dp industry, educators, government, and the public.’’ Contact</td>
</tr>
<tr>
<td>the Conference Manager, USPDI, 12611 Davan Dr., Silver</td>
</tr>
<tr>
<td>Spring, MD 20904, (301) 622-0066.</td>
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<td><strong>CAD '82 March 30-April 1, Sussex, England.</strong></td>
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<tr>
<td>The entire project development cycle, from concept to manufacture,</td>
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<td>will be discussed at this international conference and</td>
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<tr>
<td>exhibition on computers in design engineering. Contact Alan Pipes,</td>
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<tr>
<td>Conference Organizer, IPC Science and Technology Press, P.O. Box 63,</td>
</tr>
<tr>
<td>Westbury House, Bury St., Guildford GU258BH, England.</td>
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<td>**APRIL</td>
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<tr>
<td><strong>Info/Manufacturing '82, April 27-29, Chicago.</strong></td>
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<tr>
<td>Called the &quot;Information Management Exposition and Conference</td>
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<tr>
<td>for Manufacturing,' this show is billed as the only event devoted</td>
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<tr>
<td>exclusively to manufacturing corporations. Contact Clapp &amp; Poliak,</td>
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<tr>
<td>Inc., 245 Park Ave., New York, NY 10017, (212) 661-8410.</td>
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</table>
1. Superior reliability — 1 year failure rate under 1%.
2. Synthetic ruby print head ensures highest print quality during its entire 100-million plus character life.
3. Heavy-duty castings and high-quality metal parts throughout. Plastic parts are all high stress.
4. 100 cps print speed combined with logic seeking, bidirectional and quick-cancel printing provide higher throughput than many printers spec'd at higher print speeds.
5. Precision 9 x N matrix produces consistent, correspondence-quality printing.
6. Five unique alphabets, eight character sizes (two proportionately spaced).
7. Built-in, high-resolution graphics mode (144 x 160 positions per inch) delivers better resolution than many graphics plotters.
8. True incremental printing allows intermixed fonts on one line during one pass.
9. Variable form length and 6-channel vertical format unit for maximum flexibility.
10. Automatic vertical and horizontal tabbing.
11. Built-in bidirectional tractor and roll feed.
12. Paper cutoff less than one inch from print line.
13. 1.3K-byte buffer is standard for high-speed data transfers and more efficient utilization of computer time.
15. Dual-axis step motors for quiet operation.
16. Industry-standard parallel or serial (RS 232C) interfacing includes popular X/XON, X/OFF protocols.
17. "Microcomputer-on-a-board" technology and operator-replaceable print head provide ease of maintenance.

C. Itoh's low-profile Series 8500 Pro/Writer printer gives you all these features as standard equipment. And if you think that's shocking, wait till you see our low price.

Pro/Writer is fully backed by C. Itoh's warranty and complete support organization. And we're delivering now, so contact C. Itoh today and get the biggest value in little printers. C. Itoh Electronics, Inc. 5301 Beethoven St., Los Angeles, CA 90066 (213) 306-6700.

C. ITOH ELECTRONICS, INC.
One World of Quality

FEATURE SHOCK

CIRCLE 15 ON READER CARD
It only takes a little
to ruin everything you've worked for. That's why Nashua wages war against it.

That enormous formula you see above is the Bayesian Regression Method for finding variance, which is the primary enemy of quality control people. Variance is also the possible destroyer of your valuable data when you place it in magnetic storage.

At Nashua, we are driven by a constant and unrelenting fight against variance, using a statistical control of quality that is based upon entirely different principles than other makers of magnetic media use.

How different? Other manufacturers use inspection procedures to separate the good from the bad after a run of products have been made. At Nashua, we use statistical control (with literally hundreds of charts and records constantly updated) as part of the manufacturing process.

The result? Even our most sophisticated testing procedures seldom find a serious deviation from specifications. Quality is built in, step by manufacturing step, not inspected out.

One disk or cartridge or diskette looks very much like another. But there is one important difference with Nashua: your data is safe and secure, with other makers, it may be.

We make the world's most complete range of magnetic media and have published a handy little book to tell you how to select it. For your free copy of our 'What This What That' book, see your Nashua dealer or write to the Computer Products Division, Nashua Corporation, Nashua, NH 03060.
Just a few years ago, advanced technology and system compatibility were mutually exclusive. But when Prime began making computers, technology and compatibility became one.

**Big. Better. Best.** The Prime 50 Series includes the Prime 250-II, 550-II, 750, and the new Prime 850. The Series is so flexible, it can handle virtually any application you have. And so powerful, it can meet your most demanding needs.

If you're in a start-up mode, the perfect way to begin building your system is with the Prime 250-II. If you need more power, you'll find the solution in the Prime 550-II or the Prime 750. And if you're looking for maximum performance, the Prime 850 is the most powerful mini available today.

You should know too that any 50 Series system can be networked with any other. They can also communicate directly with mainframes. And all Prime systems support a broad band of industry-standard languages.

**The economy of compatibility.** The Prime 50 Series is designed around a single operating system, which makes all systems compatible with each other. So you can easily and economically move up to a larger system, or expand to any number of small, remote systems. And you'll have nothing new to learn because the same software goes with you.

**A spectrum of solutions.** The 50 Series was designed to provide a broad spectrum of solutions for just about any application you might have, including manufacturing, financial, education, utilities, engineering, energy, automated office, you name it.

**Consider Prime first.** Today, more than ever before, you need the compatibility and the spectrum of solutions that only Prime can offer. For more information, write to us at Prime Park, MS 15-60, Natick, Massachusetts 01760. In Europe, write Prime Europe, 6 Lampton Rd., Hounslow, Middlesex, TW3 1JL, England. Telephone: 01-570-8555.
LETTERS

ROUTE 128 REVISITED
Re: "Route 128: Boston's Hotbed of Technology" (Nov., p. 110), the article is evidence enough of why 128 eventually became known as the Golden Circle.

Initially viewed as an extravagance, its original two lanes were soon choked with commuters—so unexpected was the attraction of hi-tech industry. Highway construction has been in fact unending, continuing into the present with roadway widening and stories emerge from time to time of highway engineers who spent all of their careers on the 128 project.

Your article was excellent. Your cover pictorial had an error that was quickly apparent. MIT and Harvard are mislocated. Harvard is north and west of MIT and not on the banks of the Charles River.

PETER KUSHKOWSKI
Haddam, Connecticut

Your article conveyed the excitement and dynamics present in the high technology industry around Boston. There was only one problem. You surely know that most engineers are adamant about details. Your cover shows MIT located west of Harvard. Anyone in the area knows that MIT is located east of Harvard. Otherwise, keep up the good work.

ARNOLD J. SAVITT
Manufacturing Manager
Sylvania Systems Div.
GTE Products Corp.
Needham, Massachusetts

Your article is headlined as being about personal computers. In reality it is about relational databases, on-line access, and the data processing departments protection of its "turf," with some oblique references to personal computers and "private databases." It is not until the end of the article that the usefulness of microcomputers within an organization is shown in the commentary on Merrell's "island situations."

A middle manager does not require a mainframe computer to add a column of figures—he uses a calculator. Likewise, he does not need a mainframe computer to store name and address lists or provide accounting worksheet modeling or store personal work data—he uses a microcomputer.

Since microcomputers have the potential for substantially increasing a manager's productivity, it would be most helpful if we could read articles on their successful implementation. We don't want to keep them out—we want to put them to work.

EUGENE L. TALBOT
Assistant Vice President
Data Processing
People's Savings Bank
Bridgeport, Connecticut

Hear, hear!—Ed.

IMPROVING OS
Re: Editor's Readout (Oct., p. 25), I read with much interest and some measure of amusement your editorial comments on cumbersome and inadequate computer operating systems. I read also the additional discussions provided by the four individuals whom you asked to analyze existing computer operating software in light of the new generation commercial aircraft now entering the production stage. In this case, the major airlines exercised an unusual amount of influence concerning the overall configuration (including size) and operating efficiencies of the new airplanes.

Economic necessity, I am confident, can bring about similar results for improving the quality of computer operating software.

NEAL SEAGO
Atlanta, Georgia

UNIX ETYMOLOGY
Re: "The Trouble With UNIX" (Nov., p. 139), I may be able to shed a little light on the "amusing etymology" of the UNIX command to remove a file whose name contains an unprintable character—"dsw."

"Dsw" is a Morse code abbreviation for a common salutation used by amateur radio operators in the U.S.S.R., and by amateur radio operators in other countries who are in communication with those in the U.S.S.R. It stands for "Do Swedany," the Russian equivalent of "goodbye."

JOSEPH W. LARSON
Senior Systems Programmer
Sentry Insurance
Stevens Point, Wisconsin

EVEN MORE DBMS
Re: "The DBMS Market is Booming" (Sept., p. 153), our Relational DBMS, RELATE/3000, was incorrectly named CREATE/
The description about RELATE was correct. However, the single payment license fee is $18,500, which includes the first year of maintenance, documentation, and customer support.

RICHARD F. DUMAS
President, CRI
Mountain View, California

NOMAD has been available from National CSS since 1975. It is a heavily used (4,000-5,000 current users across the United States and Europe), user-oriented database management system. Furthermore, the notion (currently widespread) that there is no commercially available relational DBMS today ignores fact.

BRAD WHITLOCK
Product Manager
National CSS, Inc.
Santa Clara, California

INTAC, an integrated database management software package, was inadvertently left out of the list of DBMS products. INTAC was developed and is marketed exclusively by Ross Systems, Inc.

INTAC is an integrated database management system in use today by major organizations in such areas as accounting, project tracking, capital budgeting, lease equipment tracking and personnel data.

INTAC can be used on Digital Equipment Corp.’s PDP-11 computer systems running RSTS/E and VAX computers running VMS. A perpetual license costs $20,000 for the first CPU, which includes training and the first year’s maintenance. INTAC is also available through Ross Systems’ worldwide timesharing services.

Today there are approximately 20 user sites, with hundreds of user sites accessing INTAC-based systems daily.

BRUCE T. POWELL
Director, Corporate Marketing
Ross Systems, Inc.
Palo Alto, California

In view of your claim to provide a complete list of DBMS products and the rather unsubstantial commercial reputation (as in number of installations) of some of the products that were included, we felt particularly slighted in this matter.

RTFILE is a mature, interactive, relational DBMS for users of small DEC computers (PDP-11s and LSI-11s). We have approximately 100 installations representing several hundred satisfied users at universities, in factories, in government, and in commercial environments.

ROBERT C. NATALE
Product Manager
International Computing Co.
Bethesda, Maryland

**LETTERS**

**FEBRUARY**

*February 8-9, Data Communications: Concepts and Overviews, San Francisco, Hilton Hotel & Tower*

*February 8-9, Project Management, Atlanta, Southern Conference Center*

*February 8-9, Office Automation, Washington, DC, Arlington Hyatt House*

*February 8-9, Computer Graphics, New York City, The Harvard Club*

*February 9, Financial Management's Use of Computer Graphics, Scottsdale, Doubletree Inn*

*February 10, Electronic Communications: Mail, Message, Data, Washington, DC, Washington Hilton*

*February 10-11, Data Base Management, Anaheim, Hyatt Anaheim*

*February 11-12, DP Project Management, Cambridge, MA, Faculty Club*

*February 11-12, The CAD/CAM Revolution, New York City, Sheraton Russell*

*February 11-12, DP Fundamentals for Management and Users, Washington, DC, Sheraton Carleton*

*February 16-17, Reducing DP Turnover, New York City, The Harvard Club*

*February 16-17, Demonstrating DP Performance to non-DP Management, San Francisco, Holiday Inn on Union Square*

*February 18-19, Data Dictionary/Directory Systems, Cambridge, MA, Faculty Club*

*February 18-19, Management Skills for First-Line DP Supervisors, New York City, The Harvard Club*

*February 18-19, Writing Skills for DP Professionals, Washington, DC, Washington Sheraton*

*February 22, Computer Mapping, Anaheim, Hyatt Anaheim*

*February 22, Management’s Use of Computer Graphics, Cambridge, MA, Faculty Club*

**MARCH**

*March 1-2, Structured Programming, Analysis, Design, and Testing, New York City, Halloran House*

*March 1-2, Data Base Management Systems, Cambridge, MA, Faculty Club*

*March 1-2, Office Automation, New York City, The Harvard Club*

*March 3, Financial Management's Use of Computer Graphics, New York City, Halloran House*

*March 3, Electronic Communications, New York City, The Harvard Club*

*March 4-5, DP Fundamentals for Management and Users, New York City, The Harvard Club*

*March 4-5, Improving Your Leadership and Management Skills, Cambridge, MA, Faculty Club*

*March 4-5, Data Communications: Regulation, Analysis, Design, San Francisco, Hilton Hotel & Tower*

*To receive further information, contact the Datamation Seminar Center at 850 Boylston Street, Suite 415, Chestnut Hill, Massachusetts 02167; 617-738-5020.*
Add SYSTEL to VAX* 11/750-780 or PDP* 11/24-44-70 and you’ll not only bring new life to your system, but put a lot more life into your application productivity.

SYSTEL is a data-dictionary driven, high volume transaction processing monitor designed to take specific advantage of the power of the VAX*.

Written by Systime, Britain’s largest manufacturer of turnkey systems, SYSTEL embodies all the major features found in systems costing many times its price. Particular features of the system being its extensive productivity aids and programmer development facilities.

Apart from dramatically increasing processing and terminal capability — several hundred terminals per system, depending upon application, are possible with SYSTEL — it will equally dramatically decrease application development and implementation and facilitate maximum system management control.

- SYSTEL will also give transaction processing concurrent with other applications and a distributive network under a standard DEC* VMS or RSX-11M* operating system.

Other features include:
- Processor independence. SYSTEL is transportable between PDP* 11 and VAX* computer systems.
- Extensive access security on individual terminal locations, files and records.
- File journaling and recovery.
- Efficient memory management. All transactions employ multi-threading.
- Interactive forms generation.
- High level transaction control language.
- On-line program development.
- On-line training mode.

If you have a DEC* VAX* 11/750-780 or a PDP* 11/24-44-70 and want to increase its capability, let Systime demonstrate SYSTEL’s features, benefits, and total capabilities.

Contact: John Ward, SYSTIME, INC. 6890k, Route 198, COLUMBIA, Maryland 21045, USA. Telephone 301/730 4424

SYSTEL is a registered trademark in the U.K. Systime Inc., a wholly-owned subsidiary of Systime Ltd(U.K.)
"Over the past two years, we looked at several of the major security packages and have decided on TOP SECRET from CGA/Allen.

"CGA/Allen claimed TOP SECRET would be easy to install and would not require any operating system modifications, they were right on both statements. The product was installed within ten minutes. We installed it on MVS/SP1 without having to modify any part of our operating system.

"In relocating USAir's entire data center to a newly constructed facility, we had frozen all new system software implementations. We were confident that TOP SECRET was stable and independent enough for our operating systems that we felt comfortable in making an exception to our freeze. During a period of potential

![Image of Larry Dempsey, Supervisor, Systems Software, USAir.]

"system instability because of a move, installing a security package is saying a lot for the package.

"We are implementing security gradually — it might take as long as a year. We are confident that it will go smoothly with TOP SECRET. It is a very straightforward system and has facilities to secure our entire MVS/IMS/TSO operations. In our opinion, TOP SECRET is the best package on the market."

Other users say: "...Good, stable product...Very happy with support...Absolutely no operating system modifications...Superior in every way."

TOP SECRET — total resource protection, complete access control, comprehensive auditing, easy installation, no maintenance, user friendly. The MVS security system for the eighties.

For more information on TOP SECRET or CGA/Allen's other products — Super MSI, MSM, GCD, DCD II, PAC/MASTER — contact:

cga/Allen
Software Products Group, Inc.
212 West National Road
Vandalia, OH 45377
Phone: 800/543-7583
In Ohio, call collect: 513/890-1200

CIRCLE 20 ON READER CARD
Introducing NCR's user-friendly family of general purpose terminals.

Meet a new family of quality general purpose terminals featuring increased operator convenience. A new family from NCR, already a leading supplier of special purpose terminals around the world.

The whole family is ergonomic. From non-glare screens to detachable keyboards, these terminals are designed to accommodate every operator. Even the soft neutral colors are selected to resist soil and please the observer.

Ease of operation means more productivity from your system. Compact size and light weight assure adaptability to limited work areas. Rigorous testing eliminates problems due to RF interference and static discharge. And, like all NCR equipment, they are backed by NCR's quality service available almost everywhere.

For a personal introduction, just call your local NCR office, or write to EDP Systems, NCR Corporation, Box 606, Dayton, Ohio 45401.

Compact 6410 matrix printers, that print at a constant 90 LPM, are available with either tractor or friction feed. The 7900 CRTs, with models that operate in block, page or character mode, are also available with either fixed or detachable keyboards.

7900 display terminals weigh less than 25 lbs. Their versatile keyboards and non-glare green displays assure easy use and readability. 6425 non-impact printers silently produce hard copy at a steady 240 LPM and can print up to 99 copies under software control.

Open the door to your data base with our 2600 KSR terminals. Weighing less than 13 lbs., their compact size and quiet non-impact printing allow use in almost any office environment.

Our versatile CRT/printer workstation packages are available in TTY compatible models adaptable for use on a wide variety of systems or applications.
Unite under a single vendor and help conquer the threat to productivity posed by troubles, faults and interruptions in your data communications system.
When the single vendor is the Bell System, you have one supplier with a universal presence responsible for your entire network—modems, terminals and data communications lines. This saves costly time.

Bell reliability extends to such data products and services as the state-of-the-art, 3270-compatible Dataspeed® 4540 terminal. It extends to the high-performance 43 teleprinter, and to COMM-STOR* II communications storage devices. It extends to Dataphone® II service, the self-diagnostic data communications system, and to Dataphone® digital service, a digital network that speeds transmission and virtually eliminates errors.

Bell Account Executives provide you with complete communications systems that can change shape to meet your moment-to-moment needs. These same systems can be modified easily, or accept new components to keep pace with the growth of your business and with changes in technology. And your service agreement with Bell protects your system against obsolescence.

Put our knowledge to work for your future.

The knowledge business

*Registered trademark of Sykes Datatronics, Inc.
Some data base management systems are like designer jeans.

The fit is perfect as long as nothing moves.

Not ADABAS. ADABAS is the data base management system designed for organizations that don't stand still. The ones whose corporate growth profiles reflect their ability to respond quickly and decisively to changing market needs.

Responding to change is what ADABAS from Software AG is all about. ADABAS is a relational-like DBMS that maintains a perfect fit to your application requirements no matter how often or how much they change. New requirements are easy to handle because they never force you to redesign the data base or reprogram application systems.

ADABAS gives you complete freedom to move from one data structure to another. You can use relational, hierarchical, network — whichever fits your needs best. And since ADABAS keeps data and access methods in separate pockets, a diverse group of users can access the same data, each using a completely different data model perspective.

If a data base management system is part of your data processing plans, you owe it to yourself to take a closer look at ADABAS for your IBM processor or ADABAS-M for VAX/PDP systems.

Use the coupon to arrange for a fitting, or to attend one of our free seminars.

Software AG, Reston International Center
11800 Sunrise Valley Drive, Reston, Virginia 22091
(703) 860-5050

☐ I would like to arrange for an ADABAS fitting.
☐ Please send me information on your free seminars.

Name ________________________________ 
Title __________________________________ 
Company ______________________________ 
Address ________________________________ 
City ___________________________ State _____ 
Zip Code ________________ Telephone ( ) _________

Affiliates: Adabas Software Ltd., Derby, England (0332-372535) • APOYO Computational, S.A., Mexico City, Mexico (573-3922) • APS, Caracas, Venezuela (58-2-329205) • Arabian Data Systems, Jeddah, Saudi Arabia (669-3966) • Automation Centre Volmac B.V., Utrecht, Netherlands (03-334421) • CONSIST, Sao Paulo, Brazil (11-289-4445) • DataAnalysis Sverige AB, Stockholm, Sweden (08-616500) • Frasers, S.A., Madrid, Spain (456-1333) • R.D. Nichols & Associates, Inc., Ontario, Canada (519-653-6142) • Pan American Computer Systems, Buenos Aires, Argentina (923-3305) • Selesta Sistemi, S.P.A., Milan, Italy (02-573-129) • Software AG, Hanover, West Germany (0511-84072) • Software AG of Far East, Tokyo, Japan (03-278-1238) • SPL (Australia) Pty. Ltd., North Sydney, Australia (923-3208) • SPL (Israel) Ltd., Tel-Aviv, Israel (03-777-800) • Systems Programming (PTY) Ltd., Sandton, Republic of South Africa (011-4250) • TECSI, Paris, France (256-1570)

CIRCLE 23 ON READER CARD
DROP THE DRAWBRIDGE

Dp's once inviolate stronghold is under siege. Are the changes an attack or an opportunity for the dp manager?

The honeymoon is over.

Here it is, 1982, and almost overnight it seems that the good old days of data processing are kaput, finished, a fond and fading memory.

It was great while it lasted despite the fire fighting and the hassles with the machines. Remember the days when doing your budget simply meant adding 15% to 20% to last year's figures? And when some shiny new machine with a tad more throughput appeared on the market, you just went out and bought it? No fuss, no bother. Justifications were easy. Nobody else in the corporation knew what the hell you were doing down there in that room full of whirring tape reels, glowing crts, and blinking consoles. Nobody else knew the language, especially when the buzzwords were further encrypted into wondrous and arcane acronyms like JCL, VTAM, DBMS, and MVS. All the vendors had their alphabet soups, but IBM was an especially rich source of increasingly obscure initializations. The term “user friendly” hadn’t been invented yet.

It didn’t make any difference if your company was into meat packing or insurance; you and your team of systems analysts and programmers and your room full of operators had your own little fiefdom, surrounded by vast moats filled with the dark, murky waters of technology.

But alas, one day, not too long ago, you looked up and there were the users on the opposite shore, furiously building bridges and uncrating siege machines. The times, as they say, are changing.

Just look at what’s going on today. Your top management is demanding that you become part of the business. Not only do you have to know something about meat packing or insurance, you must identify with the company’s short- and long-term goals. They also want you to sit in on corporate planning and strategy meetings. (You know how those go: half the time is spent on such burning issues as canceling the outside coffee service and installing vending machines.)

What’s more, they want a real budget. What’s worse, they want you to cost justify your operation, muttering darkly about difficult economic times and keeping an eye on the bottom line.

The users have changed too. Suddenly there’s a whole rash of young middle managers who not only have no awe of computers, but actually programmed them in school. Try and slip a little harmless jargon past these people and they give you a cold eye, short shrift, and let you know they damn well don’t buy it.

And the vendors ... those guys used to be your pals. Today they’re selling distributed computing like it’s the greatest thing since sliced bread ... which is okay, except that they’re selling it to the users, not to you.

And those users! They are making subversive purchases at their local computer stores and sneaking Apples, TRS-80s, and God knows what else into the dp manager’s once inviolate stronghold is under siege. Are the changes an attack or an opportunity for the dp manager?

Just look at what’s going on today. Your top management is demanding that you become part of the business. Not only do you have to know something about meat packing or insurance, you must identify with the company’s short- and long-term goals. They also want you to sit in on corporate planning and strategy meetings. (You know how those go: half the time is spent on such burning issues as canceling the outside coffee service and installing vending machines.)

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The users have changed too. Suddenly there’s a whole rash of young middle managers who not only have no awe of computers, but actually programmed them in school. Try and slip a little harmless jargon past these people and they give you a cold eye, short shrift, and let you know they damn well don’t buy it.

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We did. And whether it's a 30-computer installation like the one at Quaker Oats or a single-computer, first-time installation like the one at Maeward, Inc., the response was almost universal: satisfaction. Satisfied users, like those listed here, are one of the strengths of Burroughs.

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FASTEST IN ITS TIME

by Edward K. Yasaki

The 1961 Stretch computer had a phenomenal list of "firsts." But the benefits to IBM extended far beyond that Ferrari of a machine.

Things just aren't the same anymore. It used to be that at this time of year there was a certain excitement as one anticipated seeing what the new cars from Detroit looked like. They would undoubtedly be longer and lower and certainly much sleeker. But the curiosity that once drew people to showrooms has passed.

And so it is with computers. For some reason, the computers of old stirred one's emotions more than the new ones do today. Maybe it's because they didn't make as many of any one model as they do today, and one could conceivably read about an exciting new mainframe and have it become obsolete before ever laying eyes on the real machine. How many people ever saw an Atlas computer, or a Univac Larc? Have you ever seen an Illiac?

One such classic is the IBM Stretch computer, in its time the world's fastest, the Ferrari of the computing scene. Some five years in gestation, Stretch's first customer shipment was in May 1961. That same month, IBM took no more orders for this sleek new computer. But more than sleekness, Stretch had a list of firsts that extended beyond one's reach. They pulled out all the stops on this one, entertaining any and every idea that young Turks just out of college could dream up. It was a sort of test bed for new features, the best of which were to appear in succeeding machines like the System/360s.

But perhaps most significantly it attracted bright young people to IBM, many of whom went on to design 360s and 370s and their software.

Perhaps most significantly, Stretch attracted bright young people to IBM, many of whom went on to design 360s and 370s and their software.

Perhaps most significantly, Stretch attracted bright young people to IBM, many of whom went on to design 360s and 370s and their software.

One little-known first on the Stretch was its use of a Selectric typewriter as a console printer. The golf ball typewriter was not officially announced as an IBM product until 1961. As a result, whenever a visitor came to the machine room at Poughkeepsie, N.Y., where a Stretch had been set up, measures had to be taken to conceal or disguise that unannounced typewriter with its odd-looking typing element. IBMers did this by devising a piece of cardboard that fit over the slot on top of the typewriter. Harwood G. Kolsky recounts an amusing incident.

"I remember one time hosting some visitors at the Poughkeepsie lab and standing around giving the standard talk. One of the visitors walked over and picked up this piece of cardboard and looked inside. I thought everybody would die! Fortunately the visitor didn't appear to have noticed anything new or different under the makeshift lid. "I looked around at the other IBMers and they were all turning pale."

People associated with the machine, either as designers, implementers, or users, had their own list of favorite firsts in the Stretch. When recalling some of those, they start with such features as the instruction look-ahead (four levels deep) or interleaved memories, the 8-bit byte and variable byte size. But Fred Brooks retrieves a list he has filed away and begins to read from it. There are the supervisory facilities, memory protection, the maskable interruption system, the concept of having the console program interpreted, rather than hardware defined. There was a separate input/output computer, the Exchange. The Stretch had bit addressing, boundary-free alignment, in the fashion of the 370s, and relative branching.

A significant feature, of course, was the use of error correction codes. The machine used 64-bit words plus eight bits of Hamming code to form a 72-bit word in memory. It had single-bit error correction, double-bit error detection. It had provisions for upper and lower case character sets, and could perform decimal, binary, and floating point arithmetic. The concept of a standard interface for I/O equipment was a first for IBM; before 1955 its computers had a different interface for each kind of I/O gear.

Of course, Stretch came originally with an oil-cooled core memory system.

Stephen W. (Red) Dunwell (at right) became IBM's scapegoat for Stretch, but was later apologized to and named an IBM Fellow. After 41 years with the company, he left to save a 110-year-old Bardavon Opera House.

PHOTOGRAPH BY JAMES JUERNS
IN FOCUS

Jack Worlton of the Los Alamos Scientific Laboratory (LASL) recalls a problem experienced during the acceptance test phase, when there was a transient memory error in the cores. The engineers worked for days to remedy the error but were unable to figure out what was going wrong. They finally hit upon the problem. As Worlton explains it, there was a piece of solder loose in the oil bath, and because the oil was constantly in circulation the solder would move and attach itself onto a core and cause an error. Then it would move and lodge onto a different core and cause an error there.

"It was the only error I know of that was corrected in a machine by giving it an oil change," Worlton quips.

In a paper presented at the 1959 Eastern Joint Computer Conference in Boston, Erich Bloch said the objective with Stretch was to achieve an improvement in performance over the 704 by a factor of 100. Bloch, up who heads the corporate technical personnel development staff, said they could see a possible sixfold improvement in memory performance over the 704 and a tenfold improvement in basic circuit speed. In his paper, he even notes that "Simulation of Stretch programs on the 704 proved a performance of 100 times 704 speed in mesh-type calculations. Higher performance figures are achievable where double or triple precision calculations are required."

In the question-and-answer period at that '59 confab, Bloch was asked how much of the speed improvement could be credited to the use of faster components and how much to changes in the system organization. He replied: "I think one order of magnitude of improvement is due to faster devices and faster circuits. The other order of magnitude of improvement is due to system organization, multiplexing, and so forth."

From this paper, too, we learn that 169,100 frames, or the equivalent of 24 different single card types and 18 different double cards. There were 24 different single card types and 18 different double cards.

But Jack Worlton, who joined the Stretch design team a year after its formation, recalls that the machine's performance never reached the heights anticipated. "The expectation was that it would run faster than it did," he says now. Even up to a few months before delivery, people who had been modeling the Stretch were forecasting that it would run 75 times faster than a 704. "In fact, to my knowledge it never ran more than 25 times faster than a 704," he says.

Harwood Kolsky of IBM, who was a physicist at Los Alamos when discussions on the Stretch began with IBM, says the initial projections of a performance 100 times that of a 704 was merely a ball park figure. But as time went on, it became an unrealistic target in the minds of the people involved. "This was one of the reasons the machine was later considered not to be successful."

He continues: "I should quickly add that it would be very easy to pick a problem that ran on Stretch and transfer it to the 704, where it could take a thousand times longer—because the problem would overflow the memory. The Stretch had more than 100K words of memory, versus something like 32K for the 704.

Worlton explains that Stretch was one of the first machines with a broad performance spectrum. Anyone who took advantage of some of the machine's features could get it to run fast, but if the job were programmed ineptly, the performance improvement might be only five or six times greater than the 704. He says the 704, 7090, and 7094, for example, didn't fluctuate in performance that much. But the Stretch made it possible for programmers to take advantage of its features to gain the speed that was inherent in the machine.

Ed Voorhees, who was assistant to group leader Bengt Carlson of the Los Alamos team, recalls that a performance up time of at least 90% was demanded by the Atomic Energy Commission (AEC), which was to be the first customer for the Stretch. He guesses that in fact actual the up time percentage averaged in the low 90s. "Not as good as today's machines, certainly," he says. But there's no doubting where Voorhees' heart is. Like so many of the LASL user community who ran jobs on the Stretch, he thought highly of the machine.

Worlton recalls the sum paid by the AEC as $4.2 million, considerably below the price tag later set on the Stretch. But he said no one paid the list price. Ed Lafferty of the Mitre Corp. in Bedford, Mass., recalls that his organization acquired a new Stretch on a lease-purchase plan. He doesn't remember how long they had it on a lease, but says when the decision was made to buy the machine the final payment was for $6 million, the first and only time he held such a sum in his hands.

The need to lower the price of a Stretch and the financial drubbing being taken by the vendor with each order received were disclosed by IBM's chairman, Thomas J. Watson Jr., at the Western Joint Computer Conference in 1961. The chairman, using the occasion to convene a press conference at the Ambassador Hotel in Los Angeles, set a cutoff date of May 15, 1961, after which no more orders were going to be taken. At that time, DATAMATION reported the price reduction was to some $8 million from an original $13.5 million, saying this was proportional to the shortfall in performance of the machine. As reported by DATAMATION, Watson said: "We undertook the Stretch contract for the Atomic Energy Commission some years ago. They asked for certain specifications that they wanted met. We said we could meet them within a certain time and then we went about doing it. The cost of building a computer was completely underestimated so that the government funds we have in Stretch are minor compared to IBM

STRETCH'S INHERITANCE FROM THE 709

In the midst of the Stretch development project, some IBM executive was in the process of building a transistorized version of the 7090 computer, offering to supply a 709 for program development until the solid-state version could be built.

The new computer, which came to be called the 7090, inherited its system design from the 709 and its hardware from the Stretch, including the emitter-coupled logic circuits, the packaging, frames, covers, power supplies, and memories. Those pieces came directly out of the supply of parts collected to produce the first Stretch. Recalls Frederick P. Brooks Jr., "Even though Philco announced a transistorized computer first, IBM delivered one first—the 7090. And George Monroe's team did that thing in six months from start to first customer delivery." Later IBM was to similarly develop the 7080 from the vacuum-tube 705 III, using Stretch componentry.

Harwood G. Kolsky, now at the IBM Palo Alto Scientific Center, recalls sitting in meetings with Monroe and suggesting that some of the weaknesses of the 709 be corrected in the new version. But Monroe, a stem engineer from the old school, was adamant in retaining the same features. Kolsky says now that Monroe was probably wise in not budging because if he had started making changes, everyone would have descended on him with their pet design features for incorporation in the new machine.

Kolsky observes, too, that the 7090 had 'one tremendous advantage, which we now understand very well but didn't at that time. The new computer already had its software written. It came from the 704 and 709 and would run on the new machine unchanged. By contrast, developers of the Stretch were still struggling with a compiler, for example. So the new 7090 was able to leapfrog the software issues," says Kolsky, "which turned out to be much larger on Stretch than anyone had anticipated."
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funds. At the end of the period [of the original contract], we were late on delivery date. And when we finally began to assemble the computer we found that though we had the world's fastest and most capable computer, the specifications were not met. . . .

"We will make delivery of the machines because we do not want to break our promise to our customers. We are going to take a good, fat loss on Stretch, but we hope that it will be the fastest and most capable computer on the market. . . . If we get enough orders at this price, we could go out of business. . . ."

Not to worry. According to one report, IBM's total loss on Stretch was a mere $20 million. While that may have seemed like a significant amount of money for IBM in the early 1960s, in retrospect the benefits that accrued to the company far outweighed any damage that may have been inflicted.

Indeed, the one damaged most may have been the man responsible for the Stretch development task, Stephen W. (Red) Dunwell, who became the scapegoat for the Stretch and calls him 'the hero of the piece." Dunwell replies, "There were lots of heroes." Then he adds, "It was a heroic effort. I might say."

For the record, it must also be noted that some people at Control Data Corp. had different ideas about Stretch. In years past, they have said that the mainframe was really designed to keep CDC out of the super-scale, scientific computer market. Perhaps one could call it a "knockout" machine, not so much Stretch as Smash.

**GENESIS OF STRETCH**

IBM alone could not afford to develop Stretch, so it asked the NSA to share the costs.

The genesis of the Stretch project, as can best be determined, seems to trace back to the National Security Agency and its need for more computing power than was available. It was easily determinable that such power could not be developed at an affordable price by using vacuum tubes, and yet it was equally obvious that an enormous investment would be required to develop the infant transistor technology. Unfortunately, IBM's policy was that the cost of such technology development had to be borne by the product for which it was incurred.

"In 1954 I believed that the only solution to that dilemma was to obtain support for early development work from an organization which could afford the new technology," recalls Stephen W. Dunwell. "Two of those organizations were the National Security Agency and the Atomic Energy Commission." In testimony presented at the IBM-Justice Dept. antitrust trial in New York City, Dunwell related how a group of engineers brainstormed the problem of overcoming the inadequacies of transistors and of manufacturing the types of solid-state devices required to build new and better computers. IBM management, including Dunwell, was then able to inform the NSA of what the company could do. "That delegation," he recalls, "made it clear to NSA that IBM alone could not afford to do what was required and asked NSA to share in the cost of developing the necessary components. Dr. Solomon Kullbach, on behalf of NSA, agreed to do so."

It was late in 1954 or early in '55, he continues, that the folks at the Lawrence Livermore Laboratory in California asked for a proposal for the fastest computer IBM could build. A similar request also went to the makers of Univac computers, with Remington Rand winning that development contract. Disheartened but not deterred, IBM turned to Livermore's sister lab in Los Alamos, New Mexico, which expressed an interest in sharing the cost of developing the necessary technology.

"In January 1956 that computer became known as Stretch," Dunwell said in his testimony at the trial "and sometime thereafter was called the IBM 7030." The computer was designed jointly by engineers at IBM and senior scientists at Los Alamos.

The timing on this development project was very fortuitous. Had it been considered two or three years later, circumstances would have been different, for it was a time when government procurement procedures were getting stricter. Harwood G. Kolsky, now at the IBM Palo Alto Scientific Center, says, "At the time the Stretch project was getting started, it was still possible for a major laboratory like Los Alamos to just enter into a contract," saying this is what we want and if you'll build it we'll buy it. "Two or three years later, they would never have been able to do something like that."

Ed Voorhees of Los Alamos, who was on the Stretch design team, would agree with that. "I always felt [the Stretch] was one of the best bargains the government ever got," says Voorhees. "But for some reason, efforts at Livermore and Los Alamos to undertake later development-type activities like this just got the cold shoulder from the AEC."

Kolsky, who was also on the Los Alamos design team before joining IBM, recalls that day when a group from IBM went to Los Alamos to make a presentation on the state of the computer art and the type of computer they thought they could build. It was Sept. 20, 1955, and the delegation was headed by Cuthbert Hunt. "They talked in terms of a 10-megapulse machine," he says, referring to the speed of the underlying transistors. Lloyd Hunter gave a presentation on magnetic cores. Dunwell spoke on machine organization, of the idea of having interlaced memories to compensate for the fact that the logic was much faster than the memory. They were talking about a two-microsecond memory and the final product ran at something like 2.25 usec, so the IBmers were very accurate on that technology forecast.

"Their estimate on the transistors turned out to be optimistic," Kolsky recalls, "not because the transistors didn't switch in the times they thought," but because the long lines that ran from one frame to the next tended to slow the clock time. But he says one must understand that they were talking about something (the transistors) just out of the research stage and destined for a giant machine. "It takes a real act of faith to do something like that," he chuckles.
**IN FOCUS**

In January 1956 Dunwell was appointed manager of the Stretch development program, and the following November the contract was signed by IBM and the AECL Los Alamos. It called for delivery in 42 months, which made it May 1960. Kolsky recalls the planning meetings. "A lot of the things that were discussed would best be classified as harebrained schemes," he says. "Somebody would come in and say, 'Why can't we do the following,' and they would spell out something or other, but it would have completely undermined the whole structure of the machine if you did something like that."

He adds: "The Stretch project attracted large numbers of fresh young graduates coming out of schools who had heard about the project and wanted to work on the biggest computer in the world. This is the sort of benefit to IBM that is hard to measure. I keep running into those people over the years. They slowly drift up into high positions in the company. They probably would not have joined IBM if it hadn't been for the Stretch project."

Among them, of course, was Frederick P. Brooks Jr., who says, "I went straight from Aiken's lab to work as an architect on Stretch. That was his first job at IBM; he went on to become principal architect of the System/360 and now heads the computer science department at the University of North Carolina. Of his experiences on the Stretch project, he says, "It was an exciting project. You had a chance to try everything you could dream up. It was thought that they could all use a piece of one. These were companies such as Lockheed, Northrup, Douglas, and North American, as well as Rand. About that same time, Herb Broun was working for a consulting company called CEIR Inc., which also announced its intention to install a Stretch in a Los Angeles service center. Both would have accomplished the same thing, allowing those same users to subscribe for some time on the machine, except that one was a commercial venture, the other a nonprofit arrangement. Neither plan was fulfilled."

In his study, with pages dated from January 1960 to June 1960, Patrick reported that the Stretch did not look attractive as a straight out-and-out computing engine, that it might cost the users more to run their workloads on the Stretch than on the machines they were then using.

"That wasn't necessarily negative as far as the Stretch was concerned," Patrick now explains. "It was just a phenomenon of the workload"—mostly short jobs. If the jobs had been weather analyses or forecasts involving massive partial differential equations, then the evaluation would likely have swung the opposite way, in favor of the Stretch. That, says Patrick, was the problem with sales of Stretch, as well as the superscale Control Data 6600 and its ilk.

Everyone had short jobs. Only the atomic energy community had jobs massive enough to require a big number cruncher.

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**THE STRETCH CLUB: IT NEVER CAME TO PASS**

A nonprofit, cooperative venture by which a number of aerospace companies in Southern California could own and share in the use of an IBM Stretch system was given serious consideration, but never came to pass. The job of studying the economic feasibility of such a plan was assigned to DATAMATION editorial advisor Robert L. Patrick, who was just starting out as an independent consultant. It was given to him by Paul Armer, who was head of computer sciences at Rand Corp., the prestigious Santa Monica, Calif., think tank. Armer, of course, was until recently the executive secretary of the Charles Babbage Institute.

"Southern California was the hotbed of cooperative ventures in the early days of computing," explains Patrick. Many space companies could not justify getting their own Stretch, but it was thought that they could all use a piece of one. These were companies such as Lockheed, Northrup, Douglas, and North American, as well as Rand. About that same time, Herb Broun was working for a consulting company called CEIR Inc., which also announced its intention to install a Stretch in a Los Angeles service center. Both would have accomplished the same thing, allowing those same users to subscribe for some time on the machine, except that one was a commercial venture, the other a nonprofit arrangement. Neither plan was fulfilled.

For Frederick P. Brooks Jr., the Stretch project was what enticed him to join IBM.

Recalls Jack Worlton of Los Alamos, who joined the design team a year after its formation. "One of the beautiful instructions we put in there that we finally had to debug was the branch on bit. You could pick out any bit in memory, examine it, and branch if it was a one or if it was a zero. But the trouble was that it took about five multiply times to accomplish this.

"Conceptually it was just a beautiful instruction," he continues, "but absolutely worthless. There are still computer designers who haven't learned that: you don't put too much complexity into the order set because it's difficult to build and maintain. If it's too complex, it'll never be used.

But Kolsky, like Brooks, is quick to heap praise on Dunwell for his management of the project. "His real genius was the fact that he saw where [IBM] should be five years hence and put together a project over the endless objections of everybody," Kolsky says. And when people came to him with technical problems, which they did daily, Dunwell would "turn them around and send them back out with the idea that 'yes, it can be solved.' " Until this project, IBM had moved cautiously, making evolutionary advances. But it was Dunwell who sought to make a factor-of-100 improvement in mainframe performance in one giant step.

Dunwell, of course, wasn't concerned only with the design features of the new computer, for engineers at IBM were also tackling the basic hardware technology on which the entire design would rest. The substitution of transistors for vacuum tubes was to reshape the system design of computers. It was like a new ball game.

It was necessary to design transistors suitable for use in computers. The solid-state devices of that time, Dunwell said in his testimony, "were neither fast enough nor had they the current-carrying capabilities necessary to control the ferrite core memories which would be needed." As in any pioneering role, it was also necessary for them to figure out how to manufacture such devices.

It was found, too, that some engineers just could not think in terms of the new solid-state technology, having been brought up on vacuum-tube devices. In an attempt to get them to redirect their thinking, Dunwell recalls, "for a time the laboratory expressly forbade anyone to have a piece of vacuum-tube equipment visible within his work area."

The design team under Dunwell tackled other problems. They had to come up with a new design for a power supply system, abandoning a 60-cycle system with transformers to go instead to a 400-cycle system with a motor generator. The back panel wiring, it was determined, was too complex to expect anyone to do the job correctly, so they got the Gardner-Denver Co. to make an automated wire-wrap machine. This device was driven by a punched card reader. And they went to Texas Instruments for the initial lot of transistors, IBM in 1956 having no such manufacturing capabilities. Burnt Corp. was the supplier for the tens of thousands of specially designed connectors needed for each computer.

"Up to that time," Dunwell said in his testimony, "all logical design had been recorded by draftsmen, but it was clearly out of the question to record the design of a machine of such complexity by manual means. A computer-generated design was necessary and a process for that purpose was developed."

When reached at his home in Poughkeepsie, where he retired in 1965, Dunwell said, "One of the fundamental things we were up against, having to do with manufacture and design, was that this machine was big enough and complex enough so we knew we would never get it right if we didn't automate the design and the manufacture." He explained that there would be so much wiring in the machine and it would involve so many drawings that they knew
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they would be forever changing drawings, correcting mistakes, and would get into a mad loop from which there would be no escape—unless things were automated.

When reminded of the book on Project Stretch, Planning a Computer System, Dunwell said, "One of the rules we had on that project was that nothing was done without first documenting carefully why it was done... so there was a great deal of documentation done, justifying the particular choices made, as we went along. And then abstracts were made from that for the Stretch book."

Fred Brooks remembers the book and especially a review of it by Lynton Strachey in the Computer Journal. In that review, Strachey said in part, "I get the impression that Stretch is in some way the end of one line of development. Like some early computer programs, it is immensely ingenious, immensely complicated, and extremely effective. But somehow at the same time crude, wasteful, and inelegant. And one feels there must be a better way of doing things."

Brooks, who used that quote in his own book, The Mythical Man-Month, says of Strachey's words, "I think that's an accurate assessment."

## STRETCH MARKS AT BYU

"A lot of people were betting money that we would never get [Stretch] operational."

"The prophets of doom were legion," says Gary Carlson, former director of computer services at Brigham Young University. Here was a small university nestled in the western foothills of the American Rockies, and it's about to take title to a 10-year-old Stretch computer installed near Boston. The intention is to dismantle it, move it to Provo, Utah, put it back together again, which would be no small feat, and get usable work out of it. No way.

"A lot of people were betting money that we would never get it operational," Carlson recalls. There was so much negative comment from his friends in the industry that he began to question his own decision. He figured it would cost the university about $50,000 to get into the game, just to see if it could be done. "So there was at least that much of a clear gamble on my part." But there appeared to be no alternative. It was 1970 and there clearly was a growing need for scientific computing capabilities on campus. "And we, like all universities, were always broke."

BYU had installed an IBM 7040 in 1963, and in 1968 installed a 360/50 that opened up computing on campus. It not only made it possible to provide computing services all over the campus but also got people interested in its applications. So, by 1970, two years after acquiring the mod 50, there was a growing demand for computing capabilities, and the Stretch would satisfy that need "at a price we could afford."

Carlson, of course, looked around to see what was commercially available, but found "the numbers were just mind-boggling." They looked into a 360/65, a Univac 1108, and a Burroughs 5700. He recalls all the prices were in the $3 million to $4 million range, and they couldn't afford that.

So how much did he figure it would cost to acquire the Stretch? "Well, Joe kept telling me that for a $5 registration fee we could get it."

Carlson says Joseph L. Wise, manager of the scientific computing facility on campus at that time, was the primary instigator. Carlson had the final say and was supported by his assistant, Willard Gardner.

Wise says that in those days he regularly scanned government publications that listed surplus equipment. In one such listing, he saw an IBM 7094-II system, so he called a man in Washington with whom he frequently chatted about surplus gear. The man said, "Why do you want a 7094 when there's a Stretch system available?" Wise took the idea to Carlson, explaining that the system was available at no cost except for those related to shipping and reassembling. Whereupon Carlson is supposed to have said, "So what if the Navy wants to give me a battleflop?" Wise says he still uses that rejoinder whenever anyone talks about getting something for nothing.

But Wise, sympathetic to the needs of researchers for computational power, was insistent. He talks of users who periodically needed four or five hours of 360/65 time and could get it only on Thanksgiving Day or New Year's Day. And there were some very large simulation runs on campus; one in particular he remembers ran on the campus Librascope L-3055 computer for some 150 hours. When asked if there were that many large jobs to be run, Wise explains that if the capacity is there, people come up with the jobs.

Gary Carlson recalls that in his presentation to the university's board of trustees he estimated the cost of getting and installing the computer at $100,000. It apparently sounded better to them than the several millions required for a new machine. He also inquired to see if IBM would maintain the Stretch and seems to think their quoted fee was almost $10,000 a month.

"You get a bargain now, but it'll eat you alive in operating costs," his detractors said. So one can imagine the reaction when Carlson told them he'd maintain it with his own people, plus a couple of students. As it turned out, BYU was able to get by with two full-time staff plus a few students.

"Bill Ivie is the superstar of this whole show," says Carlson of his manager of operations at the Stretch center. Ivie assembled the machine and, for the final seven or eight years, kept it running. Willard Gardner, who succeeded Carlson as director of computer services, says the entire operating costs, including the salaries of Ivie and students and supplies, has been less than $100,000 a year. "So we've operated it for something less than people thought it would
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Bill Ivie recollects that there were some 8,000 pounds of cabling that came with the Stretch. The cables were so long that he just ran them up and down the length of the machine room before connecting them up to their destinations. According to Willard Gardner, Ivie and his crew got the hardware running long before BYU chalked up any operational time. What held back the initiation of service was the poor software and software documentation that came with the machine.

DR. GARY CARLSON, who approved BYU’s Stretch acquisition in 1971, stands in front of the maintenance panel, which had more than 3,000 lights. About three or four of the bulbs burned out each day.

But Ivie says the longest job they ran on the Stretch was a chemistry problem that lasted for 523 hours. This was made possible by a facility developed at BYU that allowed everything in main memory to be read out onto tape, leaving the processor free to run just one job. When that job stopped, other jobs could be rolled in off tape to be run. Ivie says they ran a number of jobs that lasted for 30, even 40 hours, and some for more than 100.

Approval to acquire the Stretch came in mid-March 1971. The dismantled hardware from Mitre Corp. in Lexington, Mass., had arrived by May, new false flooring at the site had been installed by July 1, and the main units had been reassembled and recabled by the end of July. It required some 14 months, however, before the first user job could be run as a test. (In mid-November 1971, BYU also acquired the Los Alamos Stretch, and it was soon cannibalized for spare parts.) A report by Wise in January 1973, about the time the installed system appeared “capable of running programs in a general mode,” shows the university’s expenditures at some $165,000, including acquisition of the Los Alamos Stretch, site preparation, installation labor costs, and software development.

Replacing it for scientific computing on campus are a Digital Equipment Corp. PDP-10 and a VAX-11/780. Joe Wise says that although the VAX will run some jobs faster than the Stretch, “for the large compute job I don’t feel that a VAX is an appropriate replacement for the Stretch, even now.”
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The computer giant is banking heavily on System/38 in a major strategy shift.

IBM is planning to retreat from possibly the most successful business strategy of all time.

Informed sources say that IBM’s top management intends to break from the 360-compatibility which has anchored its phenomenal growth over the past 20 years.

The company intends to construct a new high-level virtual machine (VM) architecture which dispenses with the one central CPU hierarchy that has reigned so long.

The strategy will mean that the company pulls the plug on the traditional heart of its business, its 370 and now 4300 DOS users, and on the users of its VS/1 operating system.

One former IBMer said that IBM will move its 4300 systems to purchase—only as soon as it can—he said that the company’s 4321 SX announcement was an indicator of this. These machines can only be bought outright.

Many of its users’ 370/DOS machines have already been purchased, but those that haven’t will soon lose value. Early next year, when IBM starts to ship its extended 31-bit architecture, the residual value on its 24-bit machines will be crushed, said one source.

It is now emerging, sources claim, that the active agents in this strategy are the company’s mysterious System/38 and a piece of VM conversion software developed within Poughkeepsie and known internally as “the Tool.”

The Tool is not the VM/370 software that was developed by IBM users and research groups outside Poughkeepsie. Sources say that IBM’s VM Tool is largely “incompatible” with VM/370.

Sources reveal that the Tool has several purposes. One, it will help migrate IBM’s larger 370 users from their 24-bit machines to the H Series 31-bit extended architecture, MVS/3X. It is also designed to help Amdahl and other large IBM PCM users migrate from their machines to IBM.

Two, the Tool will help to strip complex and irrelevant code from MVS and slim it down to a more manageable VM-type operating system. One Arthur D. Little expert, Ted Withington, recently described MVS as “monolithic.”

And three, the Tool will be used to make a conversion path to the System/38 so that its unusual architectural features can be made available with MVS.

Why the System/38? Because, sources reveal, this novel machine is the first stage of the resurrection of IBM’s Future System (FS). They claim that when IBM discovered in the middle 1970s that its customer base wasn’t ready to convert to its multiprocessor mainframe development, it transferred the whole operation to its competing General Systems Division (GSD).

One former IBMer who worked on the FS project in Poughkeepsie said that the company’s former head, Frank Cary, wanted to set up a “contending divisions” philosophy with overlapping product developments. Consequently, FS was taken out of the hands of the mainframe people and given to the small systems people (GSD) at one of their facilities in Rochester, Minn.

What has emerged so far from under the cover of GSD is the System/38—whose unusual relational architecture and enormous addressing power has largely been developed in isolation from the rest of the IBM world.

According to one insider, System/38’s current 48-bit addressing capability hides an incredible 64-bit register which is latent within the machine. This compares with the 31-bit capability that the MVS mainframes will get in early 1983.

“IBM’s future lies with the System/38,” said one former employee now in competition with IBM. “It’s the only one they have that addresses the needs of new users and that isn’t rooted in the past.”

According to Bill Foster, president of Massachusetts-based Stratus Computer, the “new economics” of the computer age dictate that IBM must eventually shift its focus to this machine.

Says Foster, whose company has just produced an innovative new computer, “Users today want ‘user friendly’ and, above all, reliable computers. Today’s powerful microcomputer hardware is the only bargain around—costs are plummeting.”

“So it stands to reason,” says Foster, “that new reliable processing should be implemented with electronics—not with programming.”

Added Foster: “With traditional architectures such as the IBM 360-set, all processing goes through a big fat central engine and its resident operating system. The disks and memory have to run through the cpu.” He said that this wouldn’t be so bad if the operating instructions were fairly recent and had been written in a high-level lan-
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guage. "But the 360 code was written in a low-level machine language 20 years ago," says Foster.

The result is that every time an IBM programmer goes through a 360/370-type cpu, he takes a trip into the past and through an index of the history of the computer industry. "So many new layers of complexity have been added in the name of compatibility that the 370-type operating systems have become almost unworkable in a modern environment," Foster added.

According to the Yankee Group's Dale Kutnick, IBM is certainly not unaware of these problems. "But there's a big difference between intent and resolve. IBM'S users now have more power and experience than ever before—and it won't be easy for IBM to dictate its wishes."

"It might make economic sense for IBM to move to a new architecture," he adds, "but many of its users won't see it that way." Kutnick added that IBM's base had proved notoriously resistant to change. "Most recently IBM tried to distribute its user base through a non-360-compatible channel via the 8100, and its users were having none of it." He said that the users have enormous investments tied into the 360 architecture.

One former IBMer confirmed that what IBM intends to do is build FS from a meld of virtual machine MVS and the System/38, but added, "I doubt that they have the stomach for it." He suggested that what IBM'S big users want right now is a way of extending their 360 core through the compatible 4300s. "They want MVS, which is where their money is, stripped down for use remotely on the 4300s, which is where their heart is."

He added: "But they don't want 4300/DOS because once their programmers have worked on MVS they consider DOS a step down."

Recently another alternative to the IBM strategy emerged from some of its more "opportunistic" former employees. One of these, George McQuilken, formed his own company, Spartacus Computers, Lexington, Mass. Says McQuilken: "IBM is caught between what it wants and what its users want. Clearly, its users want to build distributed networks using 4300s. IBM wants them to use the 8100 and eventually the System/38."

He continued: "IBM'S users don't want to be deprived of the advantages of today's low cost hardware, so they want their 4300s to be small, inexpensive, and powerful. IBM'S quandary is that it can't run its operating systems in such machines because they are too old and too big."

McQuilken's solution is to resculpt IBM'S VM/370 operating system and run it on powerful miniaturized hardware. The solution will probably appeal to many of IBM'S users because it is a perfect compromise between what IBM wants and what its users are demanding.

Using the Tool, IBM can always do some of this itself by stripping down MVS and running it on small 4300s. But, say sources, it will always come up against the limits of the 360 architecture. "You can only transcend those limits," says Stratus Computer's Foster, "by breaking the traditional 360 architecture."

So IBM'S dilemma in a nutshell is: how do you rise to the challenge of such new wave architecture while maintaining compatibility with your customer base? Or, do you even have to do it at all?

In a sense the current market forces should ease IBM'S dilemma, experts explain. It is clear that the cry for compatibility from its mainframe users, especially DOS, is from a market growing at best at 8% a year. The System/38 is positioned in much higher growth markets, and here, among newer users, the demand for prior compatibility is much less apparent.
**NEWS IN PERSPECTIVE**

A survey of over 6,000 small computer users across the U.S. by Grumman Cowen/DATAMATION put "compatibility" as low as seventh on their list of demands.

"These are the people in the industry middle ground who are not committed either way and could go either up or down," says Yankee Group’s Kutnick.

He added: "IBM will probably pitch the System/38 at what I call the Division B companies: those in the $50 million to $250 million a year range." Division A would be the largest U.S. companies whom Kutnick says IBM is "locking in" with VM/VMS and the 4300s right now.

Kutnick and other experts concur that it is in Division C (companies below $50 million) that the real flowering of the "IBM's top people have come down on the side of the machine [the System/38], and they will persevere." computer industry will come in the late 1980s.

"I would bet," says former IBMer and now Intel software designer Glen Myers, "that IBM is much more concerned with building a bridge to these users from System/38 than going up to MVS."

"I doubt that they even want to be in the mainframe business," Myers added. He said that in a sense they already pulled out of it when they scrapped it.

So far, there has been no real evidence that IBM is constructing a bridge to its personal computers that run the portable operating standard CP/M. But Kutnick has a theory that the System/38 will, from the middle 1980s, act as a service bureau center to all these small machines. "That includes the Series 1, the System/34, the System/23, the Displaywriter, and so on," —in other words, all the elements in IBM's new Information Systems and Communications Group under John F. Akers.

According to one former IBMer, IBM has got a lot of work to do before it gets that far: "The System/38 has been a disappointment to them so far. It simply has not performed as well as expected. But IBM's top people have come down on the side of the machine, and they will persevere."

This source said that IBM would definitely release a newer and more powerful machine, twice as fast as the current System/38, later this year.

A.D. Little's Withington said that IBM management may be intending to move the superfast H series (3081) logic chips onto the System/38. IBM has developed two new evolutionary approaches to its logic chips to take advantage of modern manufacturing methods.

"The lower, and by far the slower of these, is known as the ‘master slice’ and is used in both the 4300s and System/38. The faster devices, 'thermo conduction modules' or TCM chip, are currently in use only on the 3081," he explained.

"IBM may have determined that it is economic to use its TCM chips on the System/38, not just on its high cost systems."

Said one well-placed source, "It looks as though they will try and sell off the 4300 base over the next couple of years, hold a fire sale on the old 24-bit 370s and move into a heavy development cycle on the System/38 in 1984."

With IBM planning to develop two incompatible streams around H Series/MVS (tailored by the Tool) and around the System/38, IBM's traditional heart of 360-type DOS users would appear to be caught between a rock and a hard place.

"It looks as if the plug will be pulled on them from both above and below," said one former IBMer. "The great attraction from IBM's point of view is that it also pulls the plug on the whole PC/M business at the same time; companies like IPL, Magnusson, Nixdorf, and Formation."

Nixdorf, for one, doesn’t intend to lie down and accept it. Sources close to the company say that a new line of 4300—compatible machines with Nixdorf's own extended DOS operated system is imminent—at prices below the new IBM 4321.

"IBM has nothing better right now," says Spartacus's McQuilken, "than to respond with 4300 solutions. This is why it is giving the new VM-based service bureau its head, because these people are close to user needs."

"In the short term," said one source, "IBM is expected to do even more than this especially in the VM/370 area." He said that IBM planned to release a relational database package based on its System R for 4300/VMS users, believed to be called DSSQI. So far, 4300/VMS users have been starved for a good database system and local and long haul networking links, he explained.

With these new developments pipelined, the philosophy of contending streams (4300 v. 8100 now, and 4300 v. System/38 later) is even more apparent. But this is exactly what IBM's new realignment is supposed to be getting away from by selling a simple, unified product line.

Now that the System/38 has come out from under the covers of GSD (now melded with everything else), any hidden thinking about FS that IBM has cracked it with will have to come out too. "It is decision time: which will it be?" said one source. "IBM must choose. It is either the old order or the new."

Right now IBM isn’t saying anything.

—Ralph Emmett

**SUPERCOMPUTERS**

**SEYMOUR LEAVES CRAY**

Seymour Cray has set himself up as an independent computer designer under contract to the company he founded.

On the surface it appeared to be a radical, risky change for Cray Research Inc. Seymour Cray, founder of Cray Research, gave up his title as chairman for a new role, that of independent contractor. Hours after the announcement was made, the Wall Street rumor mill was running at full tilt, spewing out speculations about a rift between the board and its founder, supposing a Gene Amdahl-like exit was in the making.

Cray’s history at Control Data Corp., another company he helped found, did little to quell the stir. He had walked away from Control Data and formed Cray Research when corporate bureaucracy began to bog down his work on supercomputers.

News of the title change came packaged inside a bigger show, the first public viewing of Cray’s technologies for the Cray-2 (see Look Ahead, Dec., p. 13). The machine will have a round frame, stand about 26 inches high, and measure about 38 inches in diameter. Jam-packed inside will be 32 million words of memory and four processors. The system will click along with a cycle time of four nanoseconds. The Cray-1, in contrast, has a 4-million-word memory, one processor, and a cycle time of 12 nanoseconds. Although price is yet to be set, expect at least a 50% increase over the model 1. As for performance, Cray was quite specific: the machine will run about six times faster in scalar and 12 times faster in vector than the Cray-1.

The company calls its four processor arrangement a multiprocessor, which implies a complete cpu per processor. In contrast, parallel processing implies only one cpu but multifunction units, capable of simultaneous calculations. The company declined to discuss what would happen if one of the four processors went down.

While power requirements are not expected to be "significantly" exceed that of the Cray-1, the cooling system has undergone a drastic change. And for good reason. Cray is packing more chips per cubic inch than ever before. Using what he refers to as his "3-D" (three dimensional) design, he is packing eight boards into one module, instead of only one board per module, the old "2-D" design. Each 3-D module stands...
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about one inch high, with about an eighth of
an inch space between each individual
board. Removing meat from that sandwich
affair becomes a real challenge. The
solution: immerse the modules, stacked 26
high, into a cooling tank filled with an inert
liquid, the same liquid used as a blood re-
placement for transfusions. To repair a
board, the tank has to be drained. The com-
pany would not discuss details about the
pump system or if bubbles forming in the
liquid could become a problem.

ECL technology continues to be
Cray's choice for chips, but he is stepping
up from 4K to 16K ECL RAMS and from two
gates to 16 gates per ECL gate array. While
the level of complexity on a chip isn't a
leading edge, it is not what one might call
low tech, said Thomas Longo, a Cray Re-
search board member and chief technical
officer for Fairchild, a division of Schlum-
berger Ltd. While a 64K DRAM is fabricated
using three-micron technology, Fairchild's
new ECL family is made using two-micron,
direct step wafer technology. The result is a
chip that will run at 300 to 500 picoseconds,

Analysts speculate that Cray's
departure is merely a way for him
to devote more time to thinking
and escape the drudgery of
management.

rather than the more common speeds of 700
to 1000 picoseconds. "We've been making
these parts with two-micron technology for
about a year now," Longo added.

Because Cray's first objective is
performance, something has to suffer, and
that's compatibility. To take full advantage
of Cray-2's performance, the Cray-1 pro-
gram code will have to be restructured. In
short, conversion will be a headache. The
up side, though, is that the compiler will
"come over quickly," as John Rollwagen
put it. (Rollwagen took over as chairman
when Cray stepped down, but continues as
president and chief executive officer.) The
compiler simply has to be recoded, not re-
structured. For those that can wait, the
company is planning a migration path to
move its Cray-1 users slowly toward the
Cray-2. In short, conversion will be a headache. The
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structured. For those that can wait, the
company is planning a migration path to
move its Cray-1 users slowly toward the
Cray-2. After the Cray-1/5 will come the 1/
X, which, it is rumored, will make use of
16K ECL RAM and 16-gate ECL gate arrays.

Meanwhile, there is much development
yet to be done on the Cray-2 as it is
phased into production over the next three
years. The target market is described by the
company as being the same 80 to 100 scien-
tific users that were targeted when the Cray-
1 was introduced. Most analysts do not
expect the Cray-2 or its announcement to have
much affect on Cray-1 sales.

Control Data, when asked what it
thought of the Cray-2 announcement, came
back with a terse, canned statement: "It
would be inappropriate for us to discuss a
competitive product announcement."
NEWS IN PERSPECTIVE

SEYMOUR CRAY (left) and JOHN ROLLWAGEN show their 3-D module for the Cray-2 computer prototype immersed in a tank of clear, inert liquid to demonstrate liquid immersion technology.

What did appear to be in limbo was the future direction of Cray Laboratories in Boulder, Colo. It had been pursuing VLSI technology for a competing Cray-2 design. Now that the company has committed to Seymour Cray's liquid immersion approach, it is not evident what Boulder will be doing in the future. Several board members said that Boulder has an important role in the company—the fact that its budget had been increased seemed to lend credit to that position—but no one volunteered any details. As part of the reorganization, Cray Labs has been renamed the Boulder Division, "something that should have been done in the first place," said Francis Driscoll, board member and managing director of New Court Securities Corp., a New York investment banking firm.

After the Cray-2 hoopla died down, the company got around to mentioning that 

"This is what is giving Seymour the greatest peace of mind."

Cray himself would be "stepping aside" as chairman and assuming the role of independent contractor "so he could devote his entire time to the Cray-2 and other design and development work." Cray fueled the rumor fire surrounding his exit as chairman when he went on record saying that there was "conflict" between his interests—"the technology of a narrow market"—and that of his company.

Little wonder there was some alarm on Wall Street. "I think the announcement was very peculiar. There are all sorts of peculiar arrangements between him and the company," began one Wall Street computer industry analyst who asked not to be identified. "I talked to a well-informed guy in the field who said this could mean trouble, like when Seymour was in the middle of the 7600 at Control Data. If I were a stockholder I'd be very uneasy."

Another computer industry analyst drew some parallels between Cray and Gene Amdahl. "First Amdahl stepped down as chief operating officer to go back and do more work in the lab. Second, he announced his semiretirement from the company and stayed under contract to help develop new technology, the 850 computer. Then he muddled around in the twilight zone before announcing his total split. There is no question in my mind that there was a clear rift internally in the Amdahl situation," added the analyst, who also asked not to be identified. Neither analyst had attended the public announcement of the Cray-2 and Cray's change in status.

Was Cray readying for a total split with his namesake? Opinions ran the full range of the spectrum, but there was a noticeable difference between the more gloomy speculations of those who had not attended the company's public announcement and the views of those who had.

"I can't believe Wall Street's reaction," said David Wu, a securities analyst with Montgomery Securities, San Francisco. "But then nobody from Wall Street was there. They didn't see Seymour give his spiel; he looked happy. Based on my own reading of the situation, I don't think it is very likely that Seymour will leave. I've talked to management and I'm convinced Seymour is going to see the Cray-2 through."

The contract causing all the consternation is only two doubled-spaced pages, and it was filed with the Securities and Exchange Commission in December. "It's kind of a living, open-ended agreement and gives Seymour ultimate leverage over the company," said Rollwagen. The contract gives Cray Research the right of first refusal on any technology that Cray puts forth. "If we don't exploit his technology properly, then he is free to go his own way," Rollwagen added.

Not filed with the SEC is an addendum to the general agreement that covers specifics on the Cray-2 project and runs through 1985. What happens after that? "In a sense, the contract could run out if Seymour decides not to do anything or if the company can't support him properly," Rollwagen explained.

The idea of Cray working as an independent contractor instead of assuming some kind of "honored employee" status continues to set some analysts on edge. Others, particularly those more familiar with the personalities involved, see the chain of events as a formal recognition of what is already in practice. "I don't think the announcement is such a big deal. Seymour hasn't been active in the management of the company for some time," observed Ulric Weil, computer industry analyst with Morgan Stanley & Co. Said Tom Niemiec, vice president and analyst with Piper, Jaffray & Hopwood, Inc., Minneapolis: "I don't see this current arrangement being all that dramatic. The recent announcement is merely a continuation of what has been."

Said board member Robert Zicarelli, chairman of Northwest Growth Fund, Inc., Minneapolis: "A lot of directions were considered before settling on the independent contractor approach. It gave Seymour the most independence and yet kept him committed to the company. With employee status there would have been a lot more accountability and red tape, something Seymour didn't want to be involved with anymore. The contract overcame that need for accountability."

A quick poll of several board members showed strong agreement with Zicarelli's explanation of events. It also showed strong support for Cray's approach to the Cray-2. "We are all extremely excited about it [the Cray-2], more so than Wall Street, apparently," Zicarelli insisted.

"Seymour's relationship with the board is outstanding. It has never been an issue, at least not in the board's mind," summarized Longo.

So what did Cray mean by his comments about conflict between his direc-
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NEWS IN PERSPECTIVE

Comparisons abound between Seymour's situation and that of Gene Amdahl, another top-ranking computer designer who founded his own firm, left it gradually, and has now formed a second venture.

With the market for the Cray-1 line expanding, the company is moving in the direction of a "stamp-em-out" company, a multiproduct company that stands at the opposite end to Cray's interests. Said Rollwagen, "I think I know Seymour well enough to say that he really has no desire to be a part of an organization like that.

"We've known from the beginning that we were creating a tension that would have to be relieved somehow. We have been talking about this for years and have taken certain steps to relieve that tension so he doesn't have to be involved in the development of the company as a commercial enterprise—first making me president, then CEO, and now chairman." The ultimate step has been taken. By becoming a free agent, "he can devote 100% of his time on what he loves to do—design the world's fastest computer," Rollwagen added.

Under the new arrangement, said Rollwagen, Seymour Cray doesn't have to worry about designing for the company. "This is what is giving him the greatest peace of mind," Rollwagen noted. Nor does Cray have to worry about corporate management. "He doesn't work for anyone, so he doesn't have to report to the company. The people working with him [soon to be located in a new facility in Chippewa Falls, Wis., that Seymour Cray is personally having built and will lease back to the company] will remain on the Cray Research payroll," said Rollwagen. The agreement, however, does give Cray complete control over Cray-2 development.

"He can change it any way he wants or cancel it any time he thinks there is a technical problem."

An ironic twist to the new arrangement, though, is that as a member of the executive board, Cray will have access to more parts of the company. As part of the reorganization plan, Les Davis, responsible for manufacturing and hardware development, and Peter Appleton Jones, responsible for marketing, field support, and software development, became executive VPs and members of the executive board. Because of these additions, Seymour Cray ends up with direct access to two areas of the company that he did not have before.

Finally, there is one other side to the Cray story: "Setting up Seymour as an independent contractor reinforces within the company the fact that Seymour Cray is mortal," stressed Rollwagen. By 1985, Cray will be 60; he turned 56 last September. "The arrangement becomes a very graceful way of easing the company onto its own two feet. Not that we wouldn't ever abandon Seymour's technology—I can't conceive of that—but that it will end sometime down the road."

—Jan Johnson

MAINFRAMES

MID-LIFE KICKER FOR 4300s

When IBM cut 3705 prices, it gave notice that a new front-end processor is due soon.

IBM broadened its already wide-ranging assault on the computer market with late November additions to its 4300 series computers and price cuts that foretell new disk and front-end processing equipment.

Following closely the latest H Series announcements (Dec., p. 36), the 4300 additions fleshed out the E Series line, filling in gaps that analysts had seen for some time, and gave the firm additional tools to fight off growing competition from mini-computer makers, particularly of the 32-bit variety. A new low-end 4321, to be sold on a purchase-only basis, and new models of the 4331 and 4341 were offered along with price cuts and volume discounting schedules for the entire 4300 and 8100 lines.

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NEWS IN PERSPECTIVE

Industry analysts saw the IBM moves as furthering its preparation for a broad attack on new markets and further penetration of current ones. For instance, the new 4321 seems designed for use as a remote "drone" computer that would tie into a central service bureau, something IBM is understood to be developing for introduction in the near future (Aug., p. 38). Moreover, the firm is wading off competition from the likes of Digital Equipment, Data General, and Perkin-Elmer, which market their 32-bit minis into the very distributed processing markets at which IBM has aimed its smaller 4300s.

"There's no doubt this is an effort to counter the 32-bit mini makers," said industry analyst Robert Fertig, head of Enterprise Information Systems, Inc., in Greenwich, Conn. "There's an obvious emphasis by IBM on distributed processing as furthering its preparation for a broad attack on new markets and further penetration of markets at which IBM has aimed its 4331s."

Like others, Fertig noted that IBM has made the 8100 compete against the 4300 in the distributed processing arena with a "may-the-best-product-win" philosophy. That approach has, according to widely reported but unofficial estimates of IBM unit sales, resulted in the 4331 product, until now the smallest 4300, exceeding the 8100 in shipments. This has been attributed to the fact that the former offers 370 software compatibility and thus a savings in program development. The 8100's operating systems, however, are said to be more compatible with the popular central operating system, MVS.

Perhaps to counter that perception, IBM came out with the SSX operating system for the 4300s, a pregenerated, easy-to-install version of DOS/VSE. The SSX software had been available as a PRPQ special-order item for several months before gaining widespread attention at a recent pep talk IBM held for third-party software vendors.

"SSX may be the solution to the operating system problem," said Fertig, noting that the 8100's DDX and DPCX operating systems "work hand in glove with MVS."

IBM described SSX as preconfigured and offering on-line productivity aids, prompts, and procedures designed to support batch, interactive, and on-line applications in standalone and distributed environments. The software is delivered on a single tape with components based on the DOS/VSE package originally introduced for 4300s. Networking support under SNA is included in the new package, the firm said, adding that SSX can also take advantage of the remote operator console facility introduced as a hardware upgrade to 4300s the month before (Dec., p. 36). Thus, it appears that IBM is intent on broadening its attack on the distributed processing market, even at the expense of other product lines.

Furthermore, the firm cut prices by 12% to 17% on its 3705 communications controllers, boxes that were introduced about a decade ago and that for several years have been seen as a weak link in IBM's overall networking plans. The price cuts were read by industry watchers as a house-cleaning move in preparation for the introduction of a new family of front-end processors which have been developed under the code names Mirage and Mistral. As reported earlier, the expected new machines are thought to be based on 4300 architecture and will offer significant new functions and cost savings for users who have through various means squeezed every last drop of power from their aging 3705s.

Bob Fertig, for instance, says Mirage's introduction is running late by about six months but is now imminent. He expects the machine to have an emulation mode for running 3705 programs already in place and a native mode for "richer functionality." Among the new functions expected is at least a partial off-loading of the VTAM communications software from the mainframe where it currently resides to the Mirage controller. That off-loading is expected to give the cpu more time to handle user tasks and to make telecommunications systems operate more efficiently.

Some analysts have suggested that IBM has been driven by economic forces to keep communications functions in-board, on the cpu rather than in a more autonomous front end. It is thought that overall more hardware could be sold to users who have very few alternatives, even though the concept of a full-fledged, programmable controller has been proven by other manufacturers starting with General Electric and its Datenet product.

Other industry sources have suggested that IBM's new communications front ends may operate outside of the firm's much-touted SNA networking scheme. This view, also reported in these columns (Feb., p. 40), maintains that SNA has grown restrictive and outdated and is due for replacement by a new networking strategy. Time will tell, of course, but in any case, a replacement for the 3705 workhorse is soon to be unveiled.

IBM also reduced prices on its 3310 8-inch disk drive and 14-inch 3340. Those cuts, of 25% and 35%, respectively, indicated to industry observers that new disk products are due soon. The 3310 will probably be upgraded with a doubling of density so that as much as 200 megabytes or so will be stored on a single spindle. IBM has recently taken that product to the oem market, hoping to sell it against the long list of 8-inch competitors that were spawned with
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the 3310/Piccolo’s introduction several years ago.

At the high end of the 4300 series, IBM came out with the 4341 Groups 10 and 11 and doubled the main memory of the 4341-2 to a maximum of 16 megabytes. This broadening of the 4341 line and expansion of main memory indicated to Fertig at Enterprise Information Systems that the 4341 will be a large system to be marketed by the same group that will market 303X and 3081 machines under the reorganization IBM is currently undergoing. Additionally, the new memory capacity will ensure that the large-scale MVS operating system will run effectively on the 4341, a consideration that struck the industry when MVS was initially supported on that machine.

In brief, IBM said the 4341-10 offers performance of about 85% of the 4341-1’s for commercial workloads and of about 95% of the Group 1’s for scientific workloads. The Group 10 has two or four megabytes of main memory and three standard channels, plus three optional ones. It also features a 4K byte high-speed buffer and eight-byte parallel dataflow structure.

The 4341-11 is 1.25 times faster than the 4341 Group 1 and comes with two, four, or eight megabytes of main memory and six standard channels. It has an 8K byte buffer. IBM said the purchase price for the Group 10 with two mgs of main memory is $178,000, while a similar Group 11 sells for $275,000. Deliveries are to begin in the first quarter of this year.

The new 4321, selling for $85,000 will replace the 4331-1, which was introduced with the unveiling of the E Series in January 1979. The new machine has a megabyte of main memory and integrated adaptors for attaching up to 15 display terminals or printers and other peripherals. It can handle up to three telecommunications lines.

—John W. Verity

COMMUNICATIONS

MERGING VOICE AND DATA

A venture startup firm is working on a system that could revolutionize corporate communications networks.

The answer to forging a marriage between the worlds of telephony and data communications may ultimately be developed in an old New England textile mill in Andover, Mass. There, in the James Bond setting of a

MICHAEL LENTO: "Our goal is to have a data call be as close as possible to a voice call."

renovated warehouse, a small group of engineers and designers are working on a system that could revolutionize corporate communications networks.

Visitors who enter a creaky elevator in the cavernous old mill are surprised to step out into the modern paneled offices of Ztel Inc., a venture startup firm. While the physical facade may be somewhat deceptive, the goals of the young company are very real, according to president Michael Lento. "We felt our uniqueness, our niche in the market, was going to be innovation in voice/data mix—not in data alone and certainly not in voice alone."

Actually, what Ztel is working toward defies a simple explanation. The merging of voice and data is only part of it. The common (or mixed) communications traffic will operate through a single PBX, or "switching mechanism" as Lento calls it, and the system will include an integral local data network tied to the common PBX. If that isn’t enough, the local network will employ a ring network structure that Lento says has not yet been used for both voice and data.

The company is a spin-off from Cambridge Telecommunications Corp. (CTX), which was acquired by GTE Telenet and is in the communications processor business. Because Lento and the other founders were well versed in data communications techniques, they realized a first priority would be to get some talent from the world of telephony.

“Our central equipment cabinet will perform the PBX switching as well as the data switching functions. Every major company needs a PBX-type voice switching network. The ones that have sufficient amounts of data communications need...
A new adaptive radar, using technology that could be applied in the future to many different weapon control systems, has completed feasibility tests. The radar, called FLEXAR (Flexible Adaptive Radar), uses a multimode transmitter and a programmable signal processor that are now in production, plus a new lightweight, low-cost electronically-scanned antenna. The antenna rotates once each second while the beam electronically scans up and down and back and forth. Waveforms are selected automatically to match the environment. Such flexibility enables the radar to adapt its waveform beamwidth and scan rate as needed to acquire and track targets. Hughes developed FLEXAR for the U.S. Navy.

A series of lightweight millimeter-wave parabolic dish antennas has been introduced by Hughes. The antennas, designated the 4581xH series, are made with a special aluminum and glass laminate. They are available in eight waveguide bands between 26.5 and 170 GHz and in six different sizes. The smallest, a 4-inch diameter dish, incorporates a prime focus feed. The others, in sizes of 10, 12, 18, 24, and 36 inches, use a Cassegrain feed. All are designed for low sidelobe performance. A typical weight is 7.5 pounds for the 12-inch model.

Satellite pictures are helping geologists understand major features around the world, including continental plates. Images from NASA's Landsat spacecraft, along with earthquake data, have given tectonics specialists insight into the relative motions of the Indian subcontinent and Eurasia. Scientists previously thought that one earthquake-prone crustal deformation was confined to a long, narrow zone -- the result of the Indian plate thrusting under Eurasia. Landsat images, however, revealed landforms that indicate the deformation extends over a large area quite similar to California's San Andreas fault. This interpretation also helps explain why earthquakes occur throughout Asia. The "cameras" on the Landsat spacecraft, called multispectral scanners, were built by Hughes.

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A new solid-state millimeter-wave sweep generator covers the entire W-band from 75 GHz to 110 GHz. The unit, designated Model 47726H, plugs into the Hewlett-Packard 8620C main frame or the new H-P B350A main frame with high-resolution digital displays. Like other Hughes sweepers, it consists of a full-band sweep source, leveling loop, and a full-band sweep plug-in. An automatic feature allows the user to select the frequency spans of interest directly on the 8350A.
some sort of data switching capability. If you combine the two, there’s an inherent saving right there in plant equipment. Part of the Ztel design concept will be to allow both voice and data operation over conventional telephone wire pair facilities, but it will also support both types of information over coaxial cable for longer distances over local data networks.

“Our goal is to have a data call be as close as possible to a voice call. Hopefully we’re going to be able to give the data user some of the neat features that the PBX people have been using for a couple of years. In our case, the telephone presents the entrance to the switching network for your terminal also. To our system, the host at some location in the plant is just like another extension off the PBX or off the network switch,” Lento explained.

The idea for a common communications system (it doesn’t have a name yet) first developed at the beginning of 1981 when Lento left CTX with three others. In addition to Lento, the group included Henry Zannini, Ztel vice president of development; William Tao, director of software development; and Richard Epstein, director of hardware development. The Ztel name was contrived from the first letters of each last name, Lento revealed.

The first major chore the group had was to convince financial backers that the plan was viable. One of the prime Ztel supporters turned out to be Frederick Adler, the venture capital expert.

{quote}
"We had some block diagrams and some paper sketches of the product concept which made sense to him as it made sense to us. Certainly, the technical implementation parts we didn’t know at that point because those are the kinds of things that you only learn by actually doing the development. The market for this product is recognized to be very large. So I think the combination of the team and the market potential offset the risk of the technical concept enough to make it a viable investment."
{quote}

In addition to funding from Adler & Co., Ztel got venture capital from Business Development Services Inc., the venture affiliate of General Electric.

From the initial group, Ztel has grown to 25 employees. By the end of 1982, Lento projects there will be close to 40. With 1982 being devoted almost entirely to product development, Lento looks to early 1983 for the first system announcements from the fledgling company.

While Ztel will be the manufacturer and distributor of its new system, the PBX-like system will be sold through the telephone interconnect industry. Reasoning that interconnected companies know the telephone installation business, Ztel will rely on these established outlets instead of having to build its own sales force. While specific components or subassemblies may come from subcontractors, system level assembly will be done by Ztel in the former textile mill.

Although Lento says it is too early to talk about the price of a typical system, he pledges that Ztel will meet the reliability standards of conventional phone systems at a per line cost that is competitive. The first systems will be most cost effective for companies that have 400 to 1,000 line PBXs.

Ztel will have some competition from digital PBX suppliers such as Datapoint, Rolm, and Lexar. And in the data switching area, Gandalf and Infotron have similar systems. But according to Lento, nobody will have the same combination of features that Ztel hopes to have ready to release early in 1983.

—Ronald A. Frank

PHONE OF THE FUTURE?

Northern Telecom offers a desktop combo: phone, modem, CRT, and microprocessor.

In the race to merge data processing with telecommunications, Northern Telecom Ltd. appears to be the first to hit the streets with a product. Called Display Phone, the device is a compact, smart-looking package that houses a telephone, a modem, and a computer, with a display screen and a pull-out keypad. It sells for about $2,000.

“We don’t think we have any competition at present,” said David Smith, director of office automation products for the Electronic Office Systems Division, Minneapolis. Smith guesses that the company has a six-month lead over its closest competitors, who he believes are Matra of France and Plessey of England. By the end of 1982, Smith expects a half-dozen or more competitors on the market.

At present, Display Phone is only...
Now, for the first time, there's a network capable of keeping up with PERQ's extraordinarily fast processing and response time. With Ethernet™ PERQ® gives you instantaneous access to all resources on the network, such as files, printers, other I/O devices— even other minicomputers—plus all the speed of a dedicated single-user computer.

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A half-dozen or more companies are expected to compete in the coming year in the advanced function telephone market.

nice. It allows you to connect to a computer on one line and still use the other line for voice. You can see the scenario: somebody calls for information and you read it right off your screen at the same time. That's something I've never seen another device do," commented Brightman. Nabisco, however, has not placed any orders for Display Phone. The $2,000 price tag is no problem. "For what you are getting I don't consider that unreasonable," said Brightman. The hangup is compatibility. "The big question for us is whether Display Phone can support our existing user-friendly, full-screen applications, for which the IBM 3277s and 3278s are well suited. Whatever we get, it pretty much has to hit our standards. We can't design just for the Northern Telecom device alone. We need something with program function keys." One approach to overcome that limitation is to use protocol conversions so a dumb terminal can be compatible with Nabisco's standard programs. "If the Northern Telecom device fits that bill," said Brightman, "it would be suitable because of the other features it possesses at that price tag."

Meanwhile, on the marketing front the Display Phone sales force is wrestling with a dilemma of its own: should they approach data processing managers or communications managers when selling this hybrid machine? Companies aren't much help, for they too are wrestling with similar issues that arise when a company tackles an application that crosses traditional boundaries. Those that have tackled electronic mail development, observed Smith, are forming separate development groups. But whether these groups report up the dp side or communications side varies from company to company.

At Nabisco the problem seems to be solving itself. "Fortunately," said Brightman, "the information services department [where the data center resides] has an advi-
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NEWS IN PERSPECTIVE

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—Jan Johnson

EDUCATION

'SECRETS' ON THE CAMPUS

Stanford University has protested a federal government request that it monitor the computer activities of foreign students.

The U.S. government, which has long controlled the export of high technology products such as computers, is now trying to get universities to similarly place export restrictions on academic teaching, on the transfer of technical data on computers and microelectronics to foreign students. The effort has been rebuffed by Stanford University.

"If the State Department is concerned about [a foreign scholar's] access to any aspects of Stanford's academic programs, it is curious that they issued him a visa to come to Stanford initially," says vice provost Gerald Lieberman, Stanford's dean of graduate studies and research. He adds that the control of technology transfer on campuses could better be controlled by those who grant visas, explaining that "Stanford has no means of monitoring [students'] activities, either on or off campus."

What brings this issue to a head is a letter from the Commerce Department to Prof. Bruce Lusignan, director of Stanford's Communication Satellite Planning Center, concerning a foreign visiting scholar program.

The letter asks that Lusignan "describe any laboratory facilities, equipment [such as computers], specialized library collections, or other special facilities" that might be used by the scholar. It also inquires into any contacts by the visitor with private industry and about any planned trips to be taken as part of the program. Lusignan, in a reply to Henry D. Mitman, director of the capital goods and production materials division of the Office of Export Administration, deemed it "inappropriate" to respond to the questionnaire concerning the applicability of Export Administration regulations to visiting scholars.

But Keith Powell II, State Department country officer for Chinese affairs, is said to have written to the University of Minnesota, seeking restrictions on a scholar in computer science there from the Peoples Republic of China.

In that letter, Powell suggested that in the Chinese student's program "there should be no access to design, construction, or maintenance of data relevant to individual items of computer hardware. There should be no access to design of microelectronics. . . . This office should be advised prior to any visits to any industrial or research facilities."

The government apparently looks into all programs of scholars from the Peoples Republic of China, and if the study program is in a subject regulated by the government, the appropriate agency—Defense, State, Commerce, or whatever—is notified and follows up.

Powell estimates there are in the U.S. some 7,000 students from China, about 10% of whom are studying subjects that prompt the State Department to make preliminary inquiries to their academic advisors. In the last couple of years, contact with an institution was made in perhaps 70 cases. "There have been a few cases where we've gone back several times trying to reach a compromise," Powell says. "In no case have we been unable to reach an agreement."

Powell also wrote to Stanford's Lusignan and to Prof. Edward McCluskey of the electrical engineering department there. According to Lieberman, Stanford permits no secret or classified research on campus. He said there are thousands of foreign students on campus, including some 140 from China.

The issue of academic freedom, especially the importance of a free flow of information among scientists and engineers, arises in the public consciousness with seeming regularity.

Back in 1978, nuclear physicist Edward Teller observed that it is precisely in those military fields where secrecy is practiced that the U.S. has lost ground in the last few decades. But he noted that the U.S. has maintained its leadership role in the field of electronics, especially in computers, where the scientific community has been relatively open.

—Edward K. Yasaki

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UNIX: A STANDARD NOW?

Western Electric has cut licensing fees drastically. What will it mean to users and vendors?

An ever-expanding user base of Bell Labs' Unix operating system may move from linear to geometric growth in the wake of a Western Electric announcement of new licensing policies for the system.

Crux of the announcement was a dramatic lowering of a fee schedule which saw a license that recently cost $2,500 drop to $250. Western made the announcement in a long anticipated, but not highly publicized meeting on the day preceding opening of the Comdex show in Las Vegas in late November. In some cases, licenses now can be had for as low as $40.

"There were 50 or 60 people crowded into a room for 25," said Jean Yates, manager of the Microprocessor/Microcomputer Industry Analysis and the Unix Information service of Gnostic Concepts, the Menlo Park, Calif.-based research and consulting firm.

"This [the Western Electric announcement] is going to make Unix the standard for low-end systems," said Bob Marsh, president of Pleerus Computers, Inc., Santa Clara, Calif. "But I always considered it the standard anyway."

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NEWS IN PERSPECTIVE

at Comdex its Z-8000-based P/40 system, which it described as “the first minicomputer specifically designed for the Unix operating system.” The P/40 combines multi-processor architecture, large main memory, intelligent communications processors, and up to 580 megabytes of high-speed disk storage.

Another Z-8000-based Unix system was being shown at Comdex by Zilog itself.

“I think it [Unix] was skyrocketing before and would have continued on that course anyway.”

Rolando C. Esteverena, vice president of Zilog’s systems division, described Unix as “the only available, portable, mature operating system with a base of followers.”

“Unix,” said Esteverena, “is used in 2,000 sites and is supported in one way or another by more than 100 commercial suppliers. There’s a synergism taking place that is dictated by market forces.”

In Santa Monica, Calif., Peter Weiner, president of Interactive Systems Corp., the first company to bring the Bell Labs operating system to the commercial marketplace, was quite pleased with the Western Electric announcement.

“There are some elements about it [Unix] we’re pleased with and some we’re not so pleased with,” said Weiner. He wouldn’t comment on the parts he didn’t like, noting that “We’ve asked Western Electric to change the parts we don’t like. We wouldn’t want to jeopardize our negotiations with them.” Of the pluses for Unix, Weiner said, “they’re good for everyone doing business with Unix.”

One of these pluses was the announcement of Release 3.0 of Unix, which Gnostic Concept’s Yates described as “finally a production version instead of an R&D version.”

Weiner sees the Western Electric licensing move as something that will push Unix into standard status. “It’s a very definite prospect now, and I applaud that.”

In Walnut Creek, Calif., Walter Zintz, organizer of the newest Unix user group, said of the Western Electric move, “I was pleased to see them do it, but I don’t think the growth in the number of Unix users is going to be as great as many are saying. Unix was skyrocketing before and would have continued on that course anyway.”

Zintz is president of Nova Venture, which is putting up a Unix-based system on a Motorola 68000 processor for a service business.

There are many firsts being claimed for Unix offerings. Gary Friedman, former president of Itel and now president of Fortune Systems Corp., a one-year-old San Carlos, Calif., firm, said his company is the first to offer a floppy version of Unix in the commercial environment.

Unix was developed in Bell Labs on a DEC PDP-7. One of its developers, Ken Thompson, wrote the first version when he became dissatisfied with available computer facilities at the laboratories. He discovered a little-used PDP-7 and set out to create a more hospitable environment. His work sparked the interest of Unix’s other designer, Dennis Ritchie, and Unix grew first to an 11/20 and later to an 11/45.

Word got out about Unix, mainly to universities, and Bell offered it to them free. Interactive Systems’ Weiner was one of the first to pay the then-$20,000 license fee to use Unix commercially when he went to Rand in 1973. He paid this amount again when he formed Interactive in 1977.

Initially what Weiner was offering was enhanced Unix software and Unix support, something Bell and Western Electric never did and still don’t offer.

More recently, Interactive began offering its IDEA (Interactive Distributed Electronic Alternative) Machine based on Unix and a Z-8000 system. This can be linked in local Ethernet-like area networks with gateways to distant networks for communica-

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tion, remote printing, and file transfer between users on other IDEA machines or on DEC POP-11 and VAX computers running Interactive software.

Not everyone likes everything about Unix. Gnostic Concepts' Yates thinks it's a step in the right direction. She, along with Dr. Rebecca Thomas, authored the first Unix primer, titled The Unix Guide to the Unix System. "We had to go through four different Bell lawyers to get the name approved," she recalls. The two authors are now at work on a more advanced version which they haven't yet named.

Yates describes Unix as "a chameleon. It takes on the attributes of the user. Someday it will be possible for a third-party sales group to build its own pipes and filters depending on what they want done with it. We're not there yet." She sees a lot of "value added" possibilities for third-party sales organizations.

But she also sees "a lot of room for cleanup, like in record locks and memory management, and for 16 bit systems. There's not a lot of application software there yet."

It's generally agreed there are several hundred vendors selling products related to Unix. The Western Electric announcement could boost this dramatically.

Zilog's Esteverna warned against look-alike products. "An operating system marketed under the label Unix-like, for example, may offer many of the same capabilities as the original, and even some added features, but internal differences such as data structures mean that weeks or months of programming time could be spent converting files when programs are transported. And there is always a risk that the supplier of a look-alike system will go out of business, leaving an oem with system software that is different from the standard and that is unsupported by any other source."

Lack of support from Bell was something of an impediment to the early spread of Unix. Weiner cited that as a reason for forming Interactive. "There were a few people out there who were paying a $20,000 license fee for an unsupported tape."

Weiner's Interactive Systems is still one of the two biggest companies supporting Unix, particularly on larger systems. The other is RLG Corp. in Washington, D.C. On micro-based systems, support is coming from the systems developers like Zilog, Fortune Systems, and Plexus, as well as from chip suppliers like Motorola and Intel.

Zintz, whose user group Uniops will hold its first conference this month in San Francisco, said he considers Unix the only complete software package. "It is everything in one—an operating system, utilities, a compiler language, and interpreter facilities."

He worried initially about lack of support from Bell but now believes that the gap is being breached by private companies. Zintz's user group might be termed the third of a big three. There are more. The first Unix user group, started by university users of the early Bell versions, is Usenix. Later came /USR/USER of which Plexus' Marsh is president. Zintz characterized the first group as mainly academic and the second as primarily vendor oriented. He called his a group of commercial users.

Software vendors are taking Unix more seriously now too. Howard M. Bing, president of The Office Manager, Inc., a Seattle, Wash., vendor of software for Wang equipment, feels he must "get out on Unix because I consider software a tool for management."

Frank Fukunaga, president of Data Technical Analysts, Inc., developer and owner of Pro, a software tool to create applications, admits his company will have to bring Pro up on Unix "because it's getting big." But he personally doesn't like Unix. "It's messy. There's no documentation."

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NEWS IN PERSPECTIVE

California-based companies including Microdata and General Automation.

Maybe Western Electric will do something about the lack of documentation, even as independents are already trying to do. Yates of Gnostic sees the recent Western Electric announcement as a move to position Bell for the time when “it is deregulated.” She feels WE has “a list of improvements coming through the ‘90s—software packages under development internally including a writer’s workbench, a tool to aid writers that will check for sentence syntax, paragraph syntax, sexist terms, among other items.” She also looks for such things from Bell as an internal text processor and a PBX switching system.

What’s not to like about the Western Electric announcement? A factor that made license fees go down according to accumulated monies paid in is gone. “We’re all starting from the same point,” said Plexus’ Marsh, one of the newer kids on the block.

In Western Electric’s Greensboro, N.C., Unix licensing office, calls were coming in thick and fast following the announcement. “This is usually a slow time of year for us,” said WE’s Bob Guffey. “It isn’t slow this year.” He said the three-man Unix licensing staff “gets 60 calls a day anyway but activity has picked up considerably since the announcement.”

Guffey said callers were divided between companies wanting to use Unix internally and those wanting to go into business with it. He predicted the peak period will continue for three to four months, then level off.

—Edith Myers

ELECTRONIC MAIL

BATTLE OVER ECOM

The U.S. Postal Service seems determined to press ahead with electronic mail despite mounting opposition.

Damn the Justice Department, National Telecommunications and Information Administration (NTIA), Postal Rate Commission, and private interconnectors. The U.S. Postal Service (USPS) is going full speed ahead with electronic computer originated mail (ECOM).

USPS, the only government organization supporting the advent of ECOM, was scheduled to begin the service on Jan. 4, culminating a stormy, controversial 39
Do your programmers need a reservation to use the computer?

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months since the idea was conceived in September 1978. In that span ECOM has changed identities more often than a chameleon. It began as a partnership between Western Union and the Postal Service, evolved into an “experimental” procedure with a termination date of Oct. 1, 1984, then metamorphosed into a full-scale service in which participating businesses will transmit messages to 25 servicing post offices. These post offices will transform the messages into hardcopy “guaranteed” to be delivered within two days.

Potential participants are advised, however, not to divest themselves of stationery and envelopes. There is one potential flaw in the Postal Service’s grand design.

“There is no authority for the Postal Service to implement ECOM on Jan. 4, 1982,” the Justice Department told the Postal Rate Commission (PRC).

An appeals court in the District of Columbia had earlier ruled against the PRC’s decision that ECOM could only be “experimental.” The PRC took that to mean full steam ahead; the Postal Service interpreted it as a nullification of its approval for ECOM.

So did many others.

“Once the ECOM approved by the PRC was reversed by the court, there was no authorized ECOM system,” said Stan Weinstein, attorney for Graphnet. That carrier has been spearheading legal activity by private sector companies opposed to the implementation of ECOM. “Any system the Postal Service institutes will be illegal and unauthorized,” Weinstein insisted.

USPS, which Justice alleged has “encouraged potential private sector competitors to stop contesting ECOM before the commission to sign interconnection agreements with it,” surely won’t cooperate voluntarily. Unless a competitor—most likely Graphnet, with tacit support from Satellite Business Systems (SBS) and GTE Telenet—goes to court and obtains a temporary restraining order, the Postal Service is free to proceed with ECOM.

“Our plans for electronic mail systems are not prompted by delusions of grandeur or a desire to displace private-sector activity,” Postmaster General William Bolger said. “The simple fact of the matter is that we must advance with the times to do our job.”

In this case USPS’ job would be simple. Mailers’ messages would be transmitted electronically by common carriers to computers in 25 serving post offices, all located in large cities. Machines in those offices would print the messages, fold them, and stuff them in envelopes for delivery through the regular mail system. Those customers who meet the service’s criteria—use transmission equipment approved by a USPS test facility, pay a $50 annual fee, maintain deposit accounts, and provide a daily quantity of 200 or more messages—can get all this for only 26 cents for the first page and a mere nickel for each succeeding page. No stuffing, folding, labeling, sealing or stamp-licking. Not a bad deal at all.

There are those observers, however, who question whether the USPS ought to engage in this line of work, regardless of how well it might perform. And the price, while comparatively fair, will certainly be higher.

The Department of Commerce (through NTIA) and Justice jointly informed the PRC earlier this year that the USPS ought to stay out of electronic mail. The agencies called a USPS-operated service “wasteful” and argued it would reduce the incentive for private firms to offer electronic mail services. The two departments were expected to reinforce that opinion in a joint policy statement scheduled to be released late last month.

Even the protagonist admitted it has exceeded its budget. When the PRC approved the ECOM proposal, it recommended spending $7.4 million. The USPS has spent $32 million, a Pentagonesque over-run of 400%. There’s probably more where that came from. Senior Assistant Postmaster General Jim Finch told the House Government Information and Individual Rights Subcommittee three months ago that “common sense would say it [the rate per page increase] would be substantial.” Finch demurred on breaking down how much “substantial” would be, saying the USPS would have to wait until ECOM was operational before filing an appropriate rate request with the PRC.

“We don’t believe the Postal Service should be involved in this business at all,” a spokesman for the Computer Business and Equipment Manufacturers’ Association (CBEMA) said. “We don’t think it’s within their purview at all. We think we should be doing it.”

Perhaps the USPS will not be allowed to go ahead. But not for nothing has it scratched and clawed for 39 months. If the switch is thrown on Jan. 4, the USPS wants the transmission wires humming. But what companies will be on-line?

“I don’t know who the customers will be,” said Mike Cavanagh, a leading Washington consultant. “There appears to be very little user interest even at 26 cents a message, which clearly is artificially low. They’re competing against a product already on the market—first class mail. All they’re doing is putting things on paper rather than trucking them on the highway.

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100 billion pieces of mail delivered each year. The Postal Service has sold ECOM as something that will reach 50 billion pieces. That’s just not going to happen. They’ll probably have a nice little business of 50 million to 60 million pieces.

Not so nice, nor so little, however, for potential competitors. Should that scenario come to pass, then the Postal Service would have an opening to do what its rivals fear most—enter the telecommunications market. As a $22 billion corporation with 650,000 employees, it would suffocate potential competitors. There are also fears among common carriers that first class mail revenues would be used to subsidize telecommunications business. Allegations abound, consistently denied by Postal Service officials, that first class mail already subsidizes lower class rates.

“The potential for cross-subsidization is enormous,” Weinstein contended. “You’d have no problems as dealing with AT&T. Actually, they’d be worse, because the USPS is a governmental agency and pays neither income taxes nor real estate taxes. Competing with the government would hardly be in our best interests. And if they’re serious about deregulating, it wouldn’t be in theirs either.”

“We are not getting into the telecommunications field,” board of governors chairman Robert Hardesty promised skeptical members of the House Subcommittee on Postal Operations and Services at a hearing last month. “We have absolutely no desire to get into telecommunications. We intend to use our leased lines the same way we use planes. We don’t own the planes, and we’re not going to own our telecommunications systems. We want to use private enterprise.”

Some parts of that entity worry they will be used in more ways than one. “There’s no big threat in the USPS beginning service on Jan. 4 if they just do physical delivery,” said Herb Jasper, executive vice president of the Ad Hoc Committee for Competitive Telecommunications (ACCT). “But if they’re talking about entry into the market as a carrier, then Justice and Commerce will scream. So will we.”

“I don’t believe the telecommunications industry is worried about ECOM’s success,” a knowledgeable source said. “They’re worried about failure. That would give the Postal Service a chance to take action—like getting into telecommunications—ostensibly to recover costs.

“But you have to wonder if they would handle the business properly. And you could certainly argue they won’t make it competitively. They’re not even making it against United Parcel delivering packages. How are they going to make it in telecommunications without any expertise and experience?”

“We’re not involved in the telecommunications phase of electronic mail at all.”

Hardesty said to the House subcommittee. “The Postal Service is instead bringing the American people the advantages of new technology the way it always has.”

Some would argue that claim too.

—Willie Schatz

POLICY

U.K. HITS TELECOM MONOPOLY

The Thatcher government moves to liberate industry from British Telecom’s bureaucratic control.

The British government is leading an attack which could crack state control over telecommunications in Europe and ultimately prove a bonanza for U.S. and Japanese vendors while providing more efficient multinational operations for users.

The attempt by the British government to “liberate” telecommunications from the bureaucratic administration of British Telecom, the U.K. PTT (Post, Telegraph, and Telephone), goes far deeper and is more aggressive than anything else yet seen in Europe.

For the first time in Europe, there will be a private rival to the publicly owned basic network transmission service. The reason: the British government plans to take out of British Telecom’s hands the authority to approve equipment attachments and value-added networks (VANS). Why? The government is determined to ensure that British Telecom is stimulated to act competitively. The U.K. PTT will not be allowed to block the liberalization thrust.

Central to this thrust is the 1981 British Telecommunications Act, which radically reduced British Telecom’s monopolistic powers. It is viewed as the most significant manifestation of Prime Minister Margaret Thatcher’s aim to “roll back the tides of government intervention.” Her policy is being enthusiastically implemented by Europe’s first Minister of Information Technology, Kenneth Baker.

Baker believes that the British approach could become a model for the rest of Europe, Japan, and other countries with state PTTs. Many telecommunications users say they hope that the U.K. initiative will spread like wildfire, although it is likely

HOW EUROPEAN PTT'S WIELD THEIR POWER

The following table was provided by British consultants Logica to a study conducted by Professor Michael Beesley, professor of economics at the London Graduate Business School for the U.K. government. The Beesley report became a blueprint for the government’s liberalization policy.

The table shows the ranking of countries by “telecommunications liberality” in 1980 (before the British Telecommunications Act). The four categories are:

- Resale of facilities to third parties
- Connection of privately supplied equipment to common carrier facilities
- Regulations governing the use of intraorganization private circuit networks
- Network charges made for private circuits

The higher the ranking, the more liberal is the régime:

- A “3” means generally permissible, few restrictions, or, for tariffs, low cost charges.
- A “2” means permitted with restrictions, or, for tariffs, moderate charges with some punitive element.
- A “1” means permitted only to government authorities, or with heavy restrictions, or complete prohibition. For tariffs, a “1” means punitive charges designed to discourage the use of private circuits.

Source: Logica Ltd
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that major countries like France and West Germany will take their time before implementing any important new moves towards liberalization.

According to Kenneth Baker, "The U.K. telecommunications framework is now unique. It is a halfway house between America's free market controlled by a regulatory authority and a Niagara of litigation, and the corporatists or national monopoly favored in Europe."

Baker accepts that standards must be set and monitored to ensure the quality of equipment attached to the network. The whole standards making process, however, is being shifted from British Telecom to the independent British Standards Institute. Another independent body, the British Electrotechnical Approvals Board, will ensure an efficient and swift method of private sector approvals.

Although the full standards will not be available until spring, Baker has insisted on interim arrangements to get approvals under way. And he is outspoken about his attitude. "The public is fed up with being told that everything will happen tomorrow. I do not intend to allow the situation to become immobilized while we wait for the full set of standards," he said sharply. "The time for game playing and foot dragging behind technicalities to defend long established restrictive practices is over.

Customers want the choice of adding to their telecommunications installations, and they want that choice as soon as possible."

Despite Baker's drive, American vendors licking their lips at the prospect of a lucrative new market may still have to wait. Full liberalization is scheduled for July 1983, when large Private Automatic Branch Exchanges (PABXs) will be freed. But before then, other equipment, including VANS, will be liberalized, mainly during this year.

In addition to meeting technical standards, the government would like to ensure that vendors will provide "some advantage to the U.K. economy." This is likely to lead to joint ventures and the establishment of U.K. manufacturing plants. Already GTE of the U.S. has teamed up with British electronics company Ferranti in a jointly owned company. Canadian telecommunications company Mitel has marketing deals with ICL and British Telecom. And British Telecom is starting an electronic mail service this year based on the system developed and operated in the U.S. by Dialcom Inc.

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NEWS IN PERSPECTIVE

may be too many fish swimming in the liberated pool. "There are likely to be about 12 companies operating in the U.K. selling PABXs. But the total PABX market is only about $100 million a year. However, the U.K. looks like a tempting prospect as a stepping-stone to the rest of Europe. In fact, the U.K. has become something of a test bed for new telecommunications approaches."

Tony Martin, U.K. technical support manager for U.S. communications vender Timeplex says that liberalization will open up "an enormous new market, particularly in low speed modems and the provision of total networks which were closed to us before." He warns U.S. manufacturers they may find some products which can be sold in the U.S. will not pass U.K. standards. But he welcomes such quality control even if it leads to a little delay in getting approval, since it will cut out cheap substandard products that could flood the market.

In the long run, however, the most significant liberalization initiative in the U.K. could be Project Mercury. This is a private network offering direct competition to British Telecom's transmission services. It is being run by a consortium of Cable & Wireless, a British communications company that was recently denationalized; oil giant British Petroleum; and Barclays Merchant Bank.

Although details of Mercury's operations and tariffs are not yet known, this move is generally recognized as the biggest breach of PTT monopoly. Derek Nicholas, telecommunications systems manager at Monsanto Europe in Brussels, believes it is an exciting experiment that will stimulate British Telecom into being more conscious of commercial factors. "British Telecom will now take on the shape of an organization more suited to today's environment and more efficient in the future than it would have been," he said.

Colin Southgate, chief executive of Britain's largest computer services company, BOC Computer Services, is not yet convinced that his company will use the Mercury network. "But its mere existence has shaken up British Telecom," he said. Southgate heads the Datastream financial information service with over 400 terminals in London's financial district. The City. British Telecom recently took a weekend to move Datastream's communications operation, and took three weeks to install new lines and advanced links, which were part of a special service to the City. "In the past we could have waited months or years for
Before you choose your backup center... ask yourself these questions.

The Recovery Center you select in your computer disaster contingency plan could some day mean the survival of your business. SUNGARD recognized the growing concern about computer dependency in 1978, and opened the first and still most comprehensive Recovery Center available. We're well down the learning curve in offering a capability designed to service the recovery needs of today's critical on-line environments. There are significant contrasts between SUNGARD Recovery Services and some of our competitors. These contrasts should be clearly understood by you and your top management if you're serious about backup. Below are some of the most pertinent questions. There are others. Give us a call at 800-523-4970. SUNGARD has the answers.

**Q. Can I be confident the Recovery Center will work?**

**A.** You can if you can demonstrate to yourself and to your management that you have a tested backup capability that runs your critical applications. SUNGARD subscribers have conducted over 600 successful tests of their backup systems. Their early and continuous testing has the support of our technical professional staff, which has the skills and experience to make that job easier.

**Q. How are tests supported?**

**A.** At SUNGARD, they're supported with qualified technical SUNGARD personnel from every appropriate discipline. If you don't think you need experienced technical support (software, telecommunications, operations) to achieve a testable backup capability, you may have too many people on your staff.

The experience gained by a Recovery Center staff in supporting customer testing improves your ability to develop an effective capability. The absence of that experience (or worse, the absence of a Recovery Center staff) has the opposite effect.

**Q. Can I back up my critical networks?**

**A.** You can at SUNGARD. Our most effective answer to this question is the many users who have a tested capability today at SUNGARD. Non-believers are converted by a visit to our centers. At our Philadelphia Centers, we have in place and operational more than 150 modems of various manufacturers. Dial backup units, central office connections, cabinets, cables, and over 100 3705 ports are in place and operational. All these elements for network backup are interconnected through a Network Control Center which allows for rapidly customizing the capability to the unique requirements of each user. And all these elements (except the modems) are in our basic price. If you can't back up your on-line systems, you haven't accomplished anything.

**Q. Is the hardware adequate to my needs, current and compatible, or is it "tired iron"?**

**A.** You shouldn't sign for a 370-based backup system when you already have the 3081 in your plans. The 165 is unsupported now. What IBM version of the SP will leave the 168 behind? At SUNGARD we have current IBM hardware installed and a firm commitment to the 3081. We replaced our 168 in 1979. And we're committed to remaining current, not only with processors, but also with peripherals.

**Q. Is the facility itself suitable and secure?**

**A.** Each of the three SUNGARD Recovery Centers has an average of more than 30,000 square feet dedicated to supporting the recovery needs of SUNGARD subscribers. This includes, in addition to the backup configuration, a ready-conditioned space in each center with sufficient cooling and power for a replacement 3033 and associated peripherals. Four thousand square feet of office and terminal space is equipped with power and telephone jacks for your recovery team. And the entire facility is secured with a controlled access system and fire detection and protection systems you should expect in a first class center.

**Q. Who are the other subscribers, and are they satisfied with their Recovery Center?**

**A.** As a SUNGARD subscriber you will have the right to know who the other users of your backup center are. As a SUNGARD prospect we'll share with you the names of Fortune 500 industrials and Fortune 200 Financial institutions which have agreed to let us refer you to them to help you evaluate SUNGARD. You'll recognize the names and appreciate their serious commitment to providing the best available Recovery Centers for their installations. Our subscribers can report to their management with confidence that they have a tested recovery capability that works.

**Q. What is the true cost of having a Recovery Center to go in the event of a computer disaster?**

**A.** We're the high-priced spread, but you get much more with SUNGARD. Our standard offering includes everything you need, so your cost with SUNGARD is very visible. Hidden costs to make other centers usable, especially network backup, can drive their price past ours.

We think that a workable disaster recovery solution is part of the cost of doing business in today's computer-dependent world. When compared with other accepted costs of doing business, your monthly recovery fee at SUNGARD is:

- Less than the cost of a security guard around the clock.
- About half of what you pay for monthly maintenance on your processor.
- Less than one string of disk drives or bank of tape drives.
- The equivalent of about $1.50 per square foot per year, including equipment, test shifts and technical support.

**Q. Can I test remotely?**

**A.** Yes. You can run your backup system without sending your recovery team to the SUNGARD Center. With remote testing and our third SUNGARD Center in Chicago in December, and our West Coast and Southwest Centers planned for 1982 and 1983, distance should not be a significant factor. And this network of SUNGARD Centers offers you added protection in the event that your primary SUNGARD Center is occupied by another subscriber experiencing a disaster.

At SUNGARD, we are committed to providing a quality nationwide service. Recovery services is SUNGARD's only business. We originated the concept and assembled an organization of talented, experienced professionals to support your needs. Nobody can touch SUNGARD's experience, commitment and capability in providing disaster recovery services.


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CIRCLE 01 ON READER CARD
Direct user applications software development must have the support of top management if it is to succeed, Martin stressed. "As soon as high management begins to realize that this is technically possible and other corporations have done it, they can start the peacemaking activities." Because of dependence on standard approaches and methods, the dp community has been slow to recognize the potential benefits of the new languages. But typical application bottlenecks make it imperative that innovative solutions be found, he said.

"There's no question that there's a whole set of techniques now which relate to the planning and design of databases. We need to get top dp management to understand that so they can make sure these methodologies are used correctly. Most of these involve getting end users and user management to help by specifying their own objectives, their own data requirements, respecting the data dictionary, helping to define the data, etc. In general, you want to draw out the knowledge of the subtleties of data which end users have, which businessmen have, which typical computer professionals may not have," Martin explained.

"Once you set up the environment where end users do it, it spreads like a drug through the organization. The message is passed very rapidly from one user to another, and they all want to get rid of their own paperwork and build their own relational facilities." Martin says that once companies get user application development in place, it is not uncommon to see a 1,000% improvement in productivity of application program creation. Companies such as The Equitable Life and the Automatic Electric division of GTE have seen dramatic results with "user-driven computing," he said.

If the new methods catch on, will programmers become obsolete? "We're still going to need very good programmers for writing compilers and for writing data-base management systems, for creating that type of software. There will be an ever-increasing demand for these types of programmers. But many things which COBOL programmers are doing today—creating typical reports in typical dp installations—will become obsolete?" he says.

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Los Angeles. Dr. Codd was selected for his
erasers. Both divisions will carry the firm’s full
DETAILS: IBM confirmed speculation that
its new marketing organization would be split
between national and single user accounts. The
new Atlanta-based National Marketing Division,
headed by current Office Products Division president R. Richard
Young, will handle all types of customer
orders throughout the U.S. The National
Accounts Division, based in White Plains
and headed by George J. Conrades, presi-
dent of the Data Processing Division, will
handle complex orders from large custom-
ers. Both divisions will carry the firm’s full
product line. Meanwhile, a third division,
Systems Supply, has been set up to sell and
distribute supplies to U.S. customers. It
is to be headed by Everett H. Van Hoesen,
currently president of the Information Rec-
ords Division. In an unrelated matter, IBM
said it expects 1981 capital spending to ex-
cede $7 billion, compared with $6.6 billion
in 1980.
LAYOFFS: A softening of orders because
of the recession and what appears to be a re-
trenchment prompted large layoffs of per-
sonnel at Raytheon Data Systems and Exxon
Office Systems, respectively. Raytheon said
it will let go of 250 employees as it consoli-
dates its Data Systems Division and elimi-
nates duplicated posts in its terminal market-
ing unit, word processing operations, and
worldwide division. Exxon said it was clos-
ing an Orlando facsimile equipment plant
where some 465 people worked, as part of an
elimination of 600 jobs, or 20% of its Office
Systems work force. The Raytheon move
was attributed to a slackening of orders, par-
ticularly in the airline terminal market, while
Exxon’s layoffs were seen as part of a con-
tinuing retrenchment the firm has had under
its management since September when staff was cut by
11%. The oil company did say, however, that
its office equipment operations would turn
their first profit in the fourth quarter of 1982.
LOSES: A bid by IBM to have charges
against it relating to alleged mispractices in
the Common Market dropped was tossed
out by the European Court of Justice in Luxemburg. The charges accuse IBM of
abusing its dominant market position in Eu-
rope and run roughly parallel to the several
antitrust suits brought unsuccessfully
against IBM in the U.S. Specifically, IBM
has been charged with withholding inter-
face specifications for peripherals from plug-compatible competitors and with bun-
dling main memory and system control pro-
grammings prices with those of cpus. Mem-
exor has been one of the most active par-
ticipants in bringing the charges, having
helped the European Commission formu-
late the accusations. Meanwhile, IBM has
replied to the commission’s charges with a
large document and is conducting meetings
with the commission.
RELATIONAL: Dr. Edgar F. Codd, an
IBM Fellow at the IBM San Jose Research
Laboratory, received the Turing Award, the
highest award given by the Association for
Computing Machinery (ACM), from ACM
president Peter Denning at ACM ’81, held in
Los Angeles. Dr. Codd was selected for his
work in the area of relational systems and
relational databases. Codd’s work has been
the basis for much of the relational database
work and products emerging recently, in-
cluding the System R, SQL, and QBE pack-
ages IBM has developed.
OUTLET: As if to show that selling soft-
ware is just like moving iron, the world’s
largest distributor of electronic products has
begun handling operating systems, pro-
gramming languages, and utilities from
Hamilton-Aviot already serves as North
American distributor for the Xerox 820 and
digital Equipment Corp. personal comput-
ers, plus the NCR ADDS Multivision comput-
ers—all CP/M-based machines—in addition
to peripherals from Compaq, Diagio, Haz-
etline, Lear Siegler, and Novation. Now it
will begin stocking software for the 820 and
the VT180 computers, plus languages for
Apple computers running under CP/M. It
will also stock the CP/M-86 operating sys-
tem for the IBM Displaywriter and the
CBASIC-86 language for the Displaywriter
and the IBM Personal Computer. The firm,
with outlets in 44 locations, already sells
business application packages from Sys-
tems Plus, another software company.
Working with Digital Research, it will be-
gin a marketing effort for programs written
by independents to run under CP/M.
SPINDLES: Announcements in recent
months of new mass storage systems from
Storage Technology Corp. and Masstor
Systems Corp. would indicate a huge mar-
ket for on-line capacity. This is confirmed by
a new study that refers to “the computer
industry’s ravenous appetite for auxiliary
data storage.”
According to the 1981 Disk/Trend
Report, worldwide sales last year of mov-
ning head rigid disk drives came to more than
$5 trillion, and worldwide revenues in 1984
are forecasted at more than $14 trillion. Ac-
Aid to James N. Porter, author of the
respected annual study, the product cate-
gory with the fastest growth rate is the fixed
disk drive with a capacity of from 30MB to
200MB, which accounted for sales last year
of almost $38 million and is expected to
grow in 1981 to $135 million and by 1984
to more than $713 million. Last year Con-
trol Data Corp. increased its share of world-
wide oem disk drive revenues, accounting
for 55.1% of the total. Says the Mountain
View, Calif., consultant, the IBM 3350-type
drives are having their biggest year yet in
1981, worldwide shipments reaching
73,600 spindles. But with volume ship-
ments of the 3370, 3375, and 3380 drives
coming up, these drives will make up 80%
of worldwide IBM and PCM shipments in
1983. He also sees 1981 shipments of 8-
inch fixed disk drives growing in quantity
by 35% over 1980 and reaching 247,500
spindles in 1984. But in that same year,
thanks to the desktop computer craze, ship-
ments of the 5.25-inch fixed disk models of
less than 30MB capacity will reach 644,000
drives.
COMPLETE: Xerox rounded out its
product line for office automation with a
family of electronic typewriters designed to
grab market share away from IBM’s domi-
nant Selectric. The new Xerox machines,
designated Memorywriters, begin at
$1,430 in single quantities and will be mar-
keted by the firm’s office systems and copi-
er sales forces. That combination is hoped
to establish Xerox in the typewriter market
at a time when it is thought customers will
likely replace their mechanical typewriters
with electronic models. Xerox claims its
machine outperforms IBM’s electronic mod-
els, and are simpler and cheaper to build as
well as more reliable. Upgrades to the new
product line will enable users to store as
much as 10 pages of text and connect their
machines into Ethernet local networks.
ENTRY: Another contender in the office
automation race is NCR, which joined the fray
with a line of systems primarily supplied by
Convergent Technologies. Deliveries are to
begin in June for the equipment which ranges
in price from below $10,000 to over
$100,000. NCR has chosen to be a systems in-
tegrator rather than a builder of the wide
range of required products, according to
Robert C. James, vice president of the Office
Systems Division. He noted that the firm
plans to target IBM equipment users as well
as NCR’s own base. Convergent builds an intel-
ligent workstation with hard disk, crt, and
microprocessor for NCR, one of its newest
machines. In an unrelated development,
Savin, the copier maker, said it would
enter the office automation market with Con-
vergent’s equipment.
MARKET: A long-time marketing ex-
ecutive for Univac, Harry A. Steinberg,
died in Philadelphia just before Thanksgiv-
ing Day. At the time of his retirement from
Univac in 1977, Steinberg, at age 57, was
executive vice president for worldwide
marketing and services, the number two
post in the firm’s computer operations. Re-
garded as the key man in Univac’s acqui-
sion of RCA’s computer business, Steinberg
had earlier served in a number of financial
management posts in Univac. Upon leav-
ing, he consulted to the industry and served
on the boards of several computer firms in-
cluding Intel, Prime Computer, and Deci-
sion Data.
Sometimes a very close look at the family can change our way of seeing. That irreversible change is one of the risks we take in making progress. Beyond the safety of a career with limited challenge and predictable future, we offer our people the opportunity to take risks. Think about it. Risks is what new growth is all about.

If you have a degree or experience in Software Design Engineering, Electronic Design Engineering, or both, we can offer you an opportunity to grow with the world leader in test and measurement, computer graphic, and microprocessor-based products.

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Bob Scully, Marketing Manager
Glorietta Foods, San Jose, CA

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It will take more than the same old song and dance to move MIS execs out of the chorus and into the corporate limelight.

THE
CHANGING
ROLE OF
THE DP
MANAGER

by Janet Crane

Following his presentation at a recent management seminar on long-range dp planning, Bob King, manager of Mobil Oil's corporate applications services department, was asked: "Bob, you have a well-run operation. Where are your best dp people going? Where do they move within your company?"

His response was not especially comforting: "Generally, nowhere outside the dp function. Unfortunately, with very few exceptions, they're not going anywhere at all."

"In spite of possessing latent talents which could be very effectively used in other areas of the company," King continued. "Computer people are not generally seen as movers. Dp people are locked in due to their own desires, their relatively high pay scales, and their image as technicians with limited business knowledge. Dp is clearly not ascending to the top management ranks of other functions as was forecast a decade ago. In fact, the reverse seems to be true: more "movers" are coming in from other functions to assume top management functions in dp. The bottom line for the dp who aspires to general management is that he should move out of dp early in his career—go away, learn the business, and become a well-rounded manager. Then he can come back into a senior dp position, maybe..."
It isn't the information resource that lies outside the mainstream; it's the information manager.

Rapid change and improved capabilities have bailed out the dp manager—made his job easier. He has reaped the benefits from externally initiated breakthroughs. While he has guided the purchase, installation, and maintenance of a rapidly changing machine shop—and its applications—unit costs in even the most poorly managed operations have come down substantially over the years.

"Thus, for years," says John Goodroe, vice president at Equitable Life, "end users didn't know of the gaps inefficiencies in data processing. The industry was, in fact, plagued with excess people and poorly used equipment. No one knew about or understood what was going on in the dp department. Equipment was often purchased because it was the latest technological goody, nice to have. Now, alternative modes of providing the same services mean that end users can utilize other means to achieve the same ends. Often they prefer to bypass the central department altogether.

"These new developments are forcing us to take a finer look at the costs benefits in the use of technology. There has been a lot of cream skimming," Goodroe adds. "Data processing is an information factor and it must be information efficient."

Hiding Behind a Screen

Rapid technological change and the use of that technology—too often considered ends in themselves—have been industry traits providing a screen dpers have successfully managed to hide behind. This occurred because dpers long liked to think of the field as unique—its complex theory and applications, rapid change, and technically oriented personnel have set dp budgeting, planning, and management apart, they say. The persistence of this attitude, however accurate it may once have been, has prolonged dp's probationary period and its general lack of accountability.

It has also contributed to a widespread disenchantment with dp management and a reassessment of the dp professional's role.

Personal qualities long spurned by dp's technical wizards are now back in demand as the field is demythologized and brought into line as one of many functional departments serving the company. "There is nothing unique about dp," maintains James Collins, corporate vice president at Johnson & Johnson. "MIS management is an integral part of every business along with such divisions as finance, distribution, and sales and marketing. All the vexing issues confronting dp are merely basic business management issues. Problems are perhaps speeded up by a rapidly changing technology, but every aspect of the field can be handled by generally sound management tools."

"A mistake that we've made," says Darwin John, "is that we've tried to make ourselves different from the rest of the business we're in; we have hidden behind the high technology and rapid change. Rather than hiding behind it, we need to get out in front and manage it. After all, that's what we're paid to do: manage change. Planning and planning techniques need to be consistently focused on where the business will be a few years out, and from that determine how to create a technology and human environment to fit that future. The business requirement is the driving force; change in technology and behavior is the manager's response to that force."

Top management is now demanding that dp operate under the same philosophy and rules as the rest of the company. Lacking appropriate management candidates nurtured within dp shops, they have had to look elsewhere for someone to run mis. Corporate management doesn't want technicians to head up even the dp operation--its role in the company's overall well-being is simply too vital to entrust to someone not part of the company's general management team. The search is for persons who are profit/balance sheet oriented, persons who have a general management orientation and experience.

Yet even in the things they know best—guiding the acquisition, installation, and utilization of technology—many dp managers have been a defensive lot, afraid of losing their empires. "Managers feel threatened and resist distributed processing," says Collins. "Yet if they resist, they are living in the past." Thus, as the industry completes the transition from batch to on-line computing, many operations lack essential guidelines and standards for the acquisition of hardware and for network design. Haphazard development in many firms has meant that the information resource is often inefficiently and illogically dispersed.

"Here is the MIS manager in charge of a specific business function," comments Ted Withington, vice president at Arthur D. Little. "It should be part of his job to elucidate the information standards, frameworks, and networks through which the company will grow and develop over a period of years. You can't know all the developments that are going to occur in the field, but you can establish effective guidelines and controls that allow for orderly transition and compatible systems."

If indeed the MIS manager's role is diminishing because technologies are developing elsewhere or exploding out from under the department's guidance, that situation is probably self-induced. As systems move on-line and installed computer power shrinks, the manager's position should be secured by influence wielded over operations and systems growth. Dollar value responsibility is
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Learning to communicate in business terms is a critical first step.

Consultant Dorn says a dp manager’s job should logically include only three major responsibilities: doing the budget, appointing a good executive officer to run the shop, and interacting with peers and top management. “The last task is by far the most important,” he emphasizes, “and the one to which the vast percentage of one’s time must be devoted.” Too many managers get caught in the trap of spending their time playing systems analyst, a situation that negatively influences careers and entire departments.

CUES ARE FROM THE TOP

Dramatically increased amounts of time working with middle and top management will be routine in any manager’s job. Younger officers in other departments are increasingly comfortable with computers as an integral part of day-to-day operations. They expect to use this tool to monitor more closely the company’s operations and to aid decision making, but their knowledge of hardware and systems specifics is limited. “The dper must simplify the computer so that management will continue to call on him and will be able to understand him,” says Imlay. “Nuts and bolts guys get nowhere. They often stifle their own growth because they don’t use analogies that business feels comfortable with.”

Another aspect of the reorientation of the dp manager’s role has to do with the idea of ownership,” says Scott Paper’s Darwin John. “Information and projects should be ‘owned’ by the using department. We’re here only to help our clients work smarter. We are delivering a set of tools and services, to support our clients as they do their jobs.

“Our past policy toward users, other than to bill them, was a void,” John continues. “Now they must be made an integral part of the planning and development of information systems and services. It is certainly in our own self-interest that we develop projects that are going places. If users participate in their planning and design, when projects are rolled out they will already have broad support. If you sit with knowledgeable people in the business and let them work on and prioritize projects, your entire operation will be more responsive and better received.”

Dp, however, must take its cues from top and functional management. “The most effective dp applications historically have lagged, or been based upon, existing management knowledge,” Bob King maintains. “Dp has generally delivered inferior products when the dpers have attempted to provide systems that reach beyond the ‘state of the art’ of the users. Our basic job, which is not necessarily simple, is to automate in a mod­ern, cost-effective way the basic activities already known and performed by the users. The challenge is to develop systems ap­
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The problem is that many dp professionals either don’t know how or don’t want to be linked to the rest of the business.

Approaches that do not get ahead of how users understand but that can be modified as users mature with regard to existing technology and create advanced needs.

“One approach to improving efficiency while fostering innovation,” King continues, “is to provide users with direct access to computing facilities—whether central or distributed—and with high-level, user-oriented utilities that allow them to implement and modify their own small systems and reports.”

“The trap many dp managers find themselves in,” says Darwin John, “is that they have been trying to design and develop information systems without knowing how their company is doing business. One approach taken at Scott has been to ask management to help us understand their business philosophy and objectives. These factors then permeate the design of systems to produce the needed information, and ultimately guide the choice of appropriate technology upon which the system is implemented.”

Access to other officers and an appropriate operating style will vary from company to company. If MIS contributes much of the final product cost—as in most financial institutions—compatibility between dp management and top management is far more essential than for some manufacturing firms where it is a less critical input. Some efforts at upgrading MIS effectiveness fail from simple misreading of the management style set by top company officers.

Harvard’s McFarlan tells of his experience with a dp manager at a southern textile company. The manager, a hands-on type, was testing out his many plans for girding up the dp operation.

“After some observation,” says McFarlan, “it became evident that much of the company’s most important business was transacted at a local country club. I advised my client to shelve his strategic plans and reinvest his energies in 15 golf lessons. The greatest impediment to that manager’s corporate success was his golf handicap.”

If dp shops are to work more closely with the companies they serve, some managers will have to reevaluate the ways they use their technical staffs. Shop employees have long displayed signs of dissatisfaction with dp management, and that high turnover rate isn’t entirely attributable to a shortage of good technicians. Systems people, cubbyholed with their machines on a single long-term project, are apt to become frustrated. Many would prefer to be working on a wide array of business and technical problems.

Happily, the same innovations that effectively address job enrichment are those that best respond to the distributed environment and projected user needs. “Companies want an increase in people involved with information interpretation,” says John Good-
be extensive interplay [between dp and the operations groups] on a daily basis. Before running off to design a system, dp discusses with user representatives what features should be incorporated into programs," he explains. "You don’t rent Carnegie Hall. It’s done on a one-to-one basis."

"We don’t want the ‘them vs. us’ attitude that used to exist," agrees Don Norman, vp of information systems for Target Stores in Minneapolis. Target has a systems planning department that contacts user departments when a project is initiated. Moreover, the dp department is broken up into four major departments that parallel user departments.

Expects Norman: "About three years ago we started using bubble charts depicting top-down design of projects to explain to users what the system was going to do for them. They took to that like a duck takes to water." He adds, "I still think we need to communicate better when talking about project features and gathering requirements." Target uses a task force approach to this—what Norman describes as "a difficult task."

ESI is organized into nine units and dp meets with the managers of each of those units monthly, at which time, according to Couchman, there is a review of the projects that the two groups are working on. In addition, there are quarterly meetings at which issues such as system availability and response times, decision support systems, and artificial intelligence are discussed.

MIS managers are learning to cope with what many perceive as yet another nemesis: the infiltration of the small computer. At the Del Monte Corp. in San Francisco, "There’s no company policy on personal computers but dp wants to get involved before everybody starts doing it independently," says Lowman McCray, assistant director of information services. According to McCray, the central dp operation in San Francisco is "taking a leadership role in the use of personal computers." In fact, the company purchased one this year and has five worked into the budget for next year.

"DP is heavily involved with the smaller computer but at the same time is not controlling what’s going on at user locations," says McCray. "By getting involved with personal computers, dp hopes to keep itself apprised of those devices and at the same time serve the user community."

Dealings with senior management represent another area that may require a reassessment of the MIS manager’s role. "The dp budget is no longer just an overall," says William Synott, manager of information systems and services at the First National Bank of Boston. "It’s a key part of corporate plans." Because of this, a new kind of "information manager" is expected to emerge. According to one dp manager "top executives are looking for tough, old-fashioned line managers to fill this role; first and foremost, they want an accomplished manager."

"Admits Synott, who came to his job through general management rather than from the technical side: "When top managers picture an information manager, they think of someone who understands the business. They don’t think of the dp manager; he’s the guy who provides the pipes, boxes, codes, and things." And, claims Synott: "This situation will persist until the dp manager sheds his technical cloak and shapes up as a general business manager."

For technical staff at First National who are highly motivated to become information managers, Synott has devised what he calls a "Trojan horse" technique to get them on the right path. These people are placed in end-user departments, often as part of a facilities management contract. "They become a dedicated resource in these departments and trade their automation skills for an on-the-job education in business methods. By acting as go-betweens and bridges between end users and top management they put their career paths on the way to the executive suite," says Synott.

"An MIS person has to understand the broader spectrum of information technology and has to concentrate on more than dp and information systems," says Reed Phillips, senior information resource management official at the Department of the Interior. "More and more MIS directors are recognizing that they must become business oriented to get involved in corporate planning. Top management has to recognize your value."

Art Dalton, vp for management information systems at Allegheny International, agrees: "It doesn’t do much good to yell that we should be at the decision table if we bring nothing to the table. If dp managers bring information that’s relevant, they’ll not only be invited [by upper management] but soon their presence will be required."

According to John Natzger, director of MIS for the Rocketdyne division of Rockwell International in Canoga Park, Calif., "Things have changed a lot in the last year. We’re definitely more a part of the overall picture." Natzger, who participates in strategic business planning at Rocketdyne, feels that the biggest change in his job has been increased control of the system development process. "There is greater emphasis on justification and project management."

Others are not as optimistic that the MIS manager will be accepted so readily into the management fold. One dp manager—in the industry for 14 years—sees his role as diminishing, not expanding. At his present job for 1 1/2 years, he says he used to report to the vp of operations and now reports to the comptroller. In the hopes of attracting the attention of upper echelon management, he’s doing some "politicizing" to change the situation via a "white paper to division management outlining the services of corporate MIS."

"Says Rhoda Mancher, deputy assis tant attorney general for litigation and management systems at the Department of Justice: "We’re still not getting the high level executive saying, ‘I know how vital information is to us and I want to know about it.’"

If someone hasn’t come from a dp environment, he or she won’t care much about MIS."

In the meantime, MIS managers are busy just trying to keep up with what seems like daily changes in their fast-moving industry.

Sumner, of Bullocks, believes self-education is the hedge an MIS director needs in coping with change: "I do my homework," he says, concentrating on communications, personal computers, large on-line systems, and arts. Similarly, Couchman recently attended a one-day executive briefing sponsored by Teknowledge, Inc.—a consulting firm in the field of knowledge engineering. Couchman calls his attendance there "technology scanning"—a way of keeping up with a changing world. "I try to maintain an awareness of what might be coming down the pike, and I assess the extent to which we might use these technologies as potential tools. If I can use them, I try to determine to what extent upper management will accept them."

If Art Dalton has his way, however, "down the road, MIS people will have to sell less and less. The kids of today have grown up with computers and will be much more attuned to their benefits."

Moreover, if MIS managers overcome the obstacles to opportunity, they’ll be part of upper management, having a greater decision-making role themselves. Says Rhoda Mancher: "Recognition is coming slowly. It’s improved in the last few years. Getting MIS people on boards and committees is closer than people think. It has to happen."
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CIRCLE 91 ON READER CARD
There is a shift away from mechanical, technical types and toward generalists.

roe. "There is a shift away from mechanical, technical types and toward generalists. We need more people who understand the application of computing to day-to-day problems. This in itself is a major argument for the decentralization of dp."

Says Mobil Oil's Bob King: "Rigid centralization, although initially good for cost and quality control, has resulted in some stifling of creativity. A period of distributed applications development could be an imaginative renaissance. There are obvious risks in a fully distributed environment, but the possibility of more creative use of dp tools can justify those risks."

Developing this interface gives the dp manager an opportunity to rectify past problems—the often inaccurate perception of and negligible commitment to the dp employee. "Dpers don't move around just because of money," maintains Imlay. "Most are changing companies because they are stuck in dull, dead-end jobs. Companies need to become more sensitive to the needs of aspiring computer professionals and show them the career options that are available. Wise companies are developing career paths for their systems people."

"Lack of job challenge and career dead-ending is a major cause of attrition," adds Thomas Bigelow, director of systems development at Allstate Life. "We now cross-train our people. We've found that they like multiple areas in a large organization. Such diversity gives them a greater sense of participation in the company, which is what they have been seeking."

Despite the widespread attitude that computer folks are technically oriented and want to stay that way, indications are that companies with low turnover rates are those that have directed attention to people management, career development, and professional advancement for their systems people. The beginning of this reorientation comes through "nurturing an environment and attitude of professionalism, a service attitude," says Darwin John. "We must stop treating dp people as technicians only and begin to appeal to their creative intelligence, their analytical skills."

"This is not a problem of too few talented people," John went on. "It is primarily a management problem. When dp people are challenged and given the opportunity to participate in the overall business thrust, turnover is almost obliterated."

"Until a couple of years ago, very few of our people had had the opportunity to be part of a highly visible project—not only using state-of-the-art technologies, but also one connected to an important business contribution. By restructuring jobs—generalizing them, taking them out of narrow boxes—we have been able to assign people of varying levels of experience to projects of varying complexity. People are now with a project from beginning to end. This gives them more satisfaction, and we get more commitment."

Apparently those people, like many other dpers, were just waiting for such opportunities. Yet aspiring professionals must not wait for the company or the boss to make all the moves, to initiate the changes. "An employee," says Imlay, "must communicate his own desires, objectives, plans, and goals to the employer. The boss will naturally want to keep an employee in a pigeon hole—after all, good programmers and analysts are hard to find. Only if the person communicates the desire to broaden, the desire to become a mover rather than remain a nuts and bolts type, will the boss understand and make provisions to accommodate that desire."

"Nor can the employee with management aspirations believe it is possible to move up without any effort, without some study directed toward that objective," continues Imlay. "A would-be manager or executive must take the initiative—enroll in night courses, request participation in a wider array of projects, seek broader exposure to company operations, get an MBA. The person in dp has the perfect lab at his fingertips—perhaps the best in business—because dp projects serve all aspects of the company. The opportunities are simply too frequently left untapped."

If these senior management people are right, the time has come for the dp department to occupy a slot along with already established departments from which top executives are traditionally nurtured and prepared. "In the '80s," says John Imlay, "the well-rounded MIS person will take a place among the professionals from finance, manufacturing, and marketing. The MIS route to chief executive officer, if properly developed, will be as strong as any in the business."

Janet Crane is a free-lance writer who covers the information processing field.
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CIRCLE 93 ON READER CARD
With some help from overseas, the Japanese are beginning a 10-year R&D effort intended to yield a fifth generation system.

TOKYO LOOKS TO THE '90s

by Edward K. Yasaki

In Japan, as elsewhere, the government is stressing the need for spending cuts. The urgency there is no less than in the Reagan Administration, which is trying to get the federal government to cut an additional 12% from nondefense agency budgets. But just when Japan's Ministry of Finance finds it must pare expenditures wherever possible, here comes the Ministry of International Trade & Industry (MITI) with a new 10-year research and development project. MITI is proposing to spend some $44.5 million over the first three years on something it calls, for lack of a better name, the fifth generation computer system project (August, p. 40).

To delineate and defend the various aspects of this project, the Japanese government invited scholars and researchers from around the world to an international conference in Tokyo in October. Those foreigners, numbering 86 out of the 300 or so in attendance, labeled the project ambitious and interesting, and they marveled at how open the Japanese have been about their plans. But behind some of the comments one could also detect some suspicion that the Japanese might not remain open about the results of their research.

Research does, indeed, seem to be the operative word. At the closing session, MITI's Sozaburo Okamatsu told attendees that the Japanese were still trying to come up with a concept for this advanced computer system. Therefore, those who came expecting to get the "complete R&D plans for the fifth generation computer might feel a bit dissatisfied." But, he added, the idea here...
FIG. 1
BASIC CONCEPT OF THE FIFTH GENERATION COMPUTER SYSTEM

- High Level Inquiry Language
- Access using natural language, speech, picture, etc.
- Core Language
- External interface of the basic software system
- Basic software system
- Knowledge base management system
- Intelligent interface system
- Problem-solving & inference system
- Logic programming language
- Abstract data type support mechanism
- Data flow processing mechanism
- Innovative von Neumann mechanism
- Intelligent interface machine
- Distributed function network systems

Source: JIPDEC
was to get an exchange of opinions during this early planning stage, not to report to the world what the Japanese had already cast in silicon.

What the conference saw, then, was a menu of research themes on computer architectures (dataflow seems to be the main entree), programming languages (they lean heavily toward Prolog), knowledge engineering (expert systems with their knowledge bases and inference mechanisms), and facilities to handle speech I/O and image I/O—all implemented in VLSI, of course, and so the need for a CAD system. With natural language processing thrown in, plus language translation and database management, there’s something for everyone.

There is a striking similarity between the structure of this project and that of the preceding national research program called the Pattern Information Processing System project. That one ran from about 1971 until last year and called for research into the recognition of characters, pictures, 3-D objects, and speech, as well as natural language processing, and into such devices as semiconductor lasers. While government funding has run out on the PIPS project, individual companies continue their research independently into such topics as scene analysis, objects, and speech, as well.

In a similar way, the FGCS project can be split into a number of component research topics that the participating domestic mainframe makers seemingly can commit to as they see fit, picking and choosing from among them to complement their in-house capabilities or lack of same. So the Japanese “conceptualization” of a computer system for the 1990s seems to be more a list of technologies in which a company would want to be involved now to prepare for that decade. Those who went to Tokyo expecting to get a peek under the Japanese exhibition tent and a glance at a detailed plan of the system for the ’90s were perhaps disappointed.

But Jonathan Allen, of the Massachusetts Institute of Technology said never before in history was there a better time for technological change, combined with the capability to effect that change. Bruce H. McCormick of the University of Illinois observed that no supercomputer project in the past—whether it be the Univac Larc or the IBM Stretch or the Illiac—came near its last year and called for research into the fifth generation system project.

In attendance at the conference were people from three Western governments—the U.K., France, and West Germany. In an exclusive interview, Tohru Moto-oka of Tokyo University said the three nations are engaged in negotiations with MITI on participating in the fifth generation project. Moto-oka, who is chairman of the project committee and who chaired the conference, said the current thinking is that participating governments would conduct their own research in parallel with the Japanese for at least the first three years. When informed that some Westerners accuse the Japanese of picking the best brains of people from around the world for what is essentially a Japanese research project, the professor didn’t deny this. But he asserts the U.S. has been doing this for decades, causing a brain drain to occur in the direction of the West by offering munificent salaries. “What’s the difference?” he asks.

In addition to those nations, participants also came from Belgium, Bulgaria, Canada, India, Italy, Mexico, the Netherlands, the Philippines, Republic of China, and Sweden. There were people from Cray Research, Digital Equipment Corp., Honeywell, IBM, NCR, Sperry Univac, and Texas Instruments, as well as from Citi-Honeywell Bull, Nixdorf, and Olivetti.

What they heard was a well-orchestrated presentation, simultaneously translated into English, on what the Japanese see as the system of the ’90s. It will have an intelligent front end capable of performing input/output operations with speech signals and graphic images. It will process natural languages, at least English and Japanese. It will perform language translation, at least 90% of it automatically, such that the cost of a translation job could be reduced by 70%.

Then there are the systems (September, p. 63) that consist of a so-called knowledge base on a narrow field of expertise and a mechanism by which inferences can be drawn from that fount of knowledge. If current machines can perform 1,000 to 10,000 of those inferences a second, the goal for the ’90s is to do 100 million to a billion of them in the same time span.

NEW MACHINES PLANNED

With the idea that this requires some advances in computer architecture, the project planners have scheduled research in the design of faster processors with which to build logic programming machines, symbol manipulation machines, relational algebra machines, and such. One of the end goals is a dataflow machine comprised of from 1,000 to 10,000 processors, storage of from one to 10 gigabytes, and a speed of from one to 10 billion instructions per second. Hoped for, as well, is a personal dataflow computer with a 10 MIPS speed. And on top is a numerical computation machine consisting of processor elements that perform 4 million floating point operations per second: by combining a thousand such PEs, it is hoped to have a 1 billion FLOPS machine.

According to Shunichi Uchida of the government Electrotechnical Laboratory (ETL), the project is divided into three stages of three, four, and three years’ duration each. Speaking on the architectures of inference mechanisms, he said they hoped to study the basic mechanisms of inference machines in the first stage, including the applicability of dataflow machines for symbol processing. In the intermediate stage they’d like to build a sequential inference machine, then a parallel machine, and then integrate the inference machine with a knowledge base machine. In the final stages they would build from scratch an integrated version of a complete system. Prototypes of the various pieces of hardware to be developed in this project are scheduled for completion in 1990. Again, that’s just a goal, not a deadline.

However close the Japanese came to achieving their goals in, say, the number of floating point operations or logical inference operations per second, the point is that they have set specific long-term goals. Even Tsume Uraki of Hitachi Ltd. was able to ignore for the moment the details and note that the major expectations of the project are to enlarge both systems capabilities and the range of computer applications, to improve software productivity, and to produce a better
ARTIFICIAL INTELLIGENCE—KEY TO THE FIFTH GENERATION

Data processing researchers are increasingly turning to artificial intelligence (AI) techniques to tackle the major computing challenge of the 1980s—improving the usability of systems.

One country particularly busy in the AI realm is Japan. In seeking changes in hardware architectural structures as part of their ambitious project to develop fifth generation computers for the 21st century, the Japanese hope to come up with new techniques that have been traditional concerns of artificial intelligence experts.

Critical to this effort is the user interface. Interactive dialogues, database interrogation, natural language communications, speech understanding, automatic programming, handwriting recognition, and computer-aided learning will all be intrinsic parts of the fifth generation design objectives.

Mainstream dp users, however, will not have to wait until the turn of the century to benefit from AI developments. Many dp vendors from Japan and other countries are already pouring considerable resources into AI activities, with some of the new techniques being incorporated into some of their current products. Philips Research Laboratories in the Netherlands, for example, has come up with a natural language question-answering system for database queries called PHILQA I. Question-answering systems have, in fact, been one of the most fruitful areas of AI research. In England, ICL's Research & Development Center has also taken a strong interest in AI techniques, which are being applied to work in such areas as speech recognition and data management.

In the States, the Xerox Palo Alto Research Center (PARC) has been zeroing in on AI for many years in an effort to produce more accessible office systems. PARC's research is paying off in the design of products like the Xerox Star workstation, which has high usability standards. Digital Equipment Corp. engineers are also using an AI setup to help configure systems. Another U.S. giant, Texas Instruments, is examining AI to try to improve the efficiency of programming environments and VLSI design. Industry leader IBM is actively evaluating AI-related systems to handle various tasks such as automatic generation of accounting programs and system fault diagnosis. The mighty company, however, wasn't always in favor of these techniques. In fact, former IBM chairman Thomas J. Watson Jr. had nixed AI because of its possible blasphemous implications.

Dr. Richard Wexelblat, director of software research for Sperry Univac, believes the surge in vendor interest over the last few years is due to the fact that AI is one of the few disciplines that has methodically studied the relationship between people and machines. "The success of a computer-based system is as much due to the user interface as to the technical functions it performs," he explains. "Absence of a learnable, usable interface can doom a system to failure."

Wexelblat staunchly maintains that these user interface requirements should not be regarded as an optional extra or add-on modification. "Learnability and usability must be designed in from the beginning," he stresses.

Virtually all computer suppliers are making some use of AI in their developments, even if they are not explicitly aware of the link. It is only in the last four or five years, however, that the practical uses of AI in dp have become apparent. Previously, and with some justification, the field was regarded as a "beyond the fringe" science.

Thomas Watson's disapproval of AI reflected a general concern in the 1960s that the artificial intelligentsia (as AI specialists are sometimes called) were intent on creating artificial human beings. Early AI experts did indeed make some unrealistic claims which led to general distrust of the field and its practitioners. As early as 1958, for example, two AI pioneers, Herbert Simon and Allen Newell, from Carnegie-Mellon University in the U.S., wrote the following: "There are now, in the world, machines that think, that learn, and that create. Moreover, their ability to do these things is going to increase rapidly until—in the visible future—the range of problems they can handle will be coextensive with the range to which the human mind has been applied."

That "visible future" is still far over the horizon. After more than 20 years, AI may have helped computers mimic many intelligent human activities, but it has made only minimal advances towards emulating genuine human thinking. During the 1960s, relatively little progress was made in the field. A combination of overblown claims and slow progress threatened the future of AI as an independent area of study.

In the U.K., for example, a report was prepared in 1972 that virtually killed AI and robotics research in that country. The damaging report was the work of a respected applied mathematician, Sir James Lighthill, who undertook an investigation of AI for the Science Research Council (SRC), which sponsors university research. In his report, Lighthill debunked AI so thoroughly that funding dried up for this field as well as the associated area of robotics.

In 1980, the SRC changed its mind. It inaugurated a $5 million support scheme for robotics, and is considering other investments in AI, including the possibility of establishing a special research center to be called the Turing Institute.

Support of AI activities has been slow in coming. Indeed, it wasn't until the 1970s that AI began to come in from the cold, gaining recognition as a credible science.

During the decade of the '70s, AI researchers lowered their theoretical sights and raised the practical elements in their work. Instead of trying to create a general purpose thinking machine to act like a person, they channeled their energies into specific tasks to help people create and use computers.

Another major change came when dp scientists and users began to realize the importance of making computers easier to use. Yet there was still very little systematic research that could realistically be applied to the problems of what marketing people began to call "user friendliness."

The human behavioral scientists, such as psychologists, also paid little attention to computer usage. Even the well-established activities of ergonomics and human factor engineering saw minimal application in computing.

Computing practitioners, on the other hand, have been primarily concerned with the technology itself and the specialist user (analyst, programmer and operator). As a result, AI developed as an offshoot of cybernetics, rather than as a branch of computer science. Cybernetics is concerned with control mechanisms which enable biological, organizational, or artificial systems to operate successfully.

AI's computer bias eventually pulled the field away from the cybernetics camp, which was concerned with more generalized systems. The link-up, nevertheless, brought the valuable cybernetic interdisciplinary approach to computing.

Developments in natural language communication with computers illustrate the path taken by AI. The main computer language research in the 1960s was in programming languages. The 1970s saw the development of database definition and access languages and information retrieval techniques, which were primarily an extension of a computer-oriented view of the user interface.

AI, however, started by trying to communicate with computers in natural languages. As part of his research on language grammar, leading American linguist Noam Chomsky studied whether it would be feasible to have an English language compiler. Chomsky concluded that the learning and understanding of natural languages was too complex to be handled by an automated system and must rely on an inherited ability unique to humans.

Most AI researchers also recommended abandoning further attempts to get computers to understand natural languages in a totally free way. Instead, attention was focused on context-dependent natural language communications. In the early 1970s, a number of interactive dialog systems were developed in the U.S.

Two main types of natural language developments emerged. One was based on the notion of "scripted dialogs." The other was designed to retrieve information from databases. Both started with primitive, su-
program he himself could write. More generalized automatic program generators, however, are unlikely to hit the market during this decade. But semiautomatic programming systems could make an impact much sooner.

Instead of expecting the computer to do all the work, semiautomatic programmers ask the user certain questions about the nature of the problem being tackled. From these answers, the systems will produce the required code. IBM is investigating this technique as a means of helping nonexperts, notably users to create accounting and business programs tailor-made to their environment.

Earlier this year DJ AI Systems in the U.K. launched a product called The Last One for the personal computer market. It uses AI techniques to generate BASIC code once the user has specified the flowcharts in an English-language format and has answered questions on such things as file sizes and error routine options.

Futurist Earl C. Joseph of Sperry Univac believes that AI techniques, particularly in the area of expert systems, will serve as "people amplifiers." Twenty-first-century technologies, along with LSI advances, he predicts, will lead within a decade to such people amplifiers as "book-on-a-chip," "teach-on-a-chip," and "doctor-on-a-chip." Such breakthroughs, he says, will give people direct access to their own expert systems.

Stanford University's Dr. Penny Nii is more skeptical. She feels it will probably take longer than 10 years for the industry to come up with a wide range of handheld expert systems.

Whatever the timetable, AI specialists agree that the future belongs to expert systems. One of them who has pushed this technology is Professor Donald Michie of the Machine Intelligence Unit at Edinburgh University. Michie maintains that expert systems are vital to mankind's survival. The world's increasing dependence on computers has made these systems a necessity, says Michie. Programmed from the start with human reasoning, these systems, according to Michie, would provide a "human window" into the "inscrutable" machine. Expert systems, he further points out, could also function as tutors, since they distill expertise into clearly defined rules.

In the future, expert systems promise to solve many of the man-machine interface problems currently hampering computer usage. In the world of today, users have already benefited from advances on the AI front. It was the early work of AI specialists, for example, that helped provide the coherent framework needed to cope with the rising demand for user-friendly systems. That demand is growing, as the Japanese are well aware. Their serious interest in knowledge-based systems virtually guarantees that artificial intelligence schemes will be central to the computing scene in the '90s.

—Malcolm Pettu

Kazuhiro Fuchi of ETL observed that research in artificial intelligence and software engineering has been conducted by separate groups in the past but that the trend was toward a merging of these efforts. He added, too, that the Japanese are less concerned with whether they'll be able to develop an "innovative" computer system and more concerned with whether they will be able to benefit society.

It was Hajime Karatsu of Matsushita Communication who headed the committee that studied the social needs of the '90s and the impact of the system. In a witty but no less serious presentation, he addressed the problems of an aging society, of industry segments suffering from a low rate of productivity, and of a shortage of energy and natural resources. He spoke of the need for continued education, and for computers in schools to lower the student dropout rate. He mentioned the impact of computers on a nation's social, industrial, international, and personal fabric, acknowledging that they cannot be described separately because of the interrelationships among them.

But when foreign participants were asked to comment on the project, a number of them avoided the technical aspects and thoughtfully questioned whether the Japanese really understood the society they were trying to influence. John Riganati of the U.S. National Bureau of Standards (NBS) referred to Studs Terkel's book Working, an eye-opening look at the attitudes of people in all walks of life toward their jobs. Riganati asked whether the Japanese had such a bottom-up knowledge of the society they wish to transform.

From the U.K.'s Interbank Research Organization, C. Read lamented the world's reliance on statistical data to justify so many things. "Least cost solutions or maximum productivity are not desirable in themselves," he averred. "Indeed, they are often very harmful." So he warned against automation in support of efficiency and productivity when it leads to a growing sense of isolation on the part of consumers.

"If the fifth generation [system] does all that is hoped for, it will make it possible for us to make proper use of nonnumeric information," he added. "... If we can do that, then we can use qualitative value judgments in our decision-making." He continued, "If that can be done, that alone would justify the fifth generation computer. I believe it is perhaps the one intellectual development that could have the greatest benefit to society by improving the quality of decision-making... particularly by our governments."

JANUARY 1982 115
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Too often MIS managers concentrate on hardware and software rather than on personnel as a means of checking computer abuse. But security is first and last a people problem.
Feel compassion for the troubled MIS manager who drifted into troubled sleep last night after reading yet another report on the purely technological aspects of computer crime. His $50 million corporation has no standing security committee, no external edp audits, and no meaningful personnel screening system. Thus, the full responsibility as the house electronics watchdog has fallen to him by default. Like most MIS types, he has been unable to properly convey his concerns about computer security to higher management, whose backgrounds run to sales and marketing.

His nightmare begins. He wanders through an air-conditioned data processing center, wearing a stethoscope and listening intently for the ticking of a logic bomb that can erase his programs. The scene shifts. Now he roams a barren desert, vainly trying to lasso a Trojan horse trained to take a swift, vicious bite out of the corporate payroll. Sight changes to sound. Can that squeak be the opening of a trapdoor that will let outsiders in to ransack the computer for privileged passwords? A pungent aroma invades his dreams. Is it the odor of a clandestine salami technique, which is quietly taking thin slices from an assortment of corporate accounts under the computer's control? Permutation follows permutation until the alarm clock goes off.

Surrealistic nightmares aside, every computer installation is vulnerable to criminal activity. White collar thieves have misused computers to embezzle funds, pilfer timesharing services and programs, eavesdrop on the bids of business competitors, divert inventory, disclose tax and banking records, snatch valuable mailing lists, monitor private medical and pharmaceutical records, print payroll checks and other documents that can be converted into ready cash, reduce or eliminate premiums on insurance and other
In some cases, nothing but a door stands between a $10 million computer installation and a criminal.

installment-type payments, and alter transcripts at colleges and universities. And in the case of a city-owned computer, dp personnel used the hardware to store programs and data on the breeding and racing of horses—to gain an edge at the racetracks.

Why do these crimes occur? Mainly because dp types are too damned unsophisticated and trusting when it comes to human relations, say the experts. Too often they concentrate on hardware and software at the expense of personnel. "Computer security is first and last a people problem," says Donn B. Parker, senior management systems consultant at SRI International, a research and consulting firm in Menlo Park, Calif. "People represent a much greater vulnerability than worrying about file access control mechanisms and installing physical access control devices. Unfortunately, computer security is usually in the hands of technologists, who study problems theoretically." As a classic example of naiveté in opening the door to computer criminals, consider the Case of the Corrupted College Computer. You've probably never heard of it, for the take was nowhere near the whopping $213,300 million-related embezzlement that hit Wells Fargo Bank in Los Angeles early last year. Nor were the two college perpetrators the Napoleons of crime that laymen might expect to find masterminding the scam. Instead, they were simply two thieves who operated with the hubris of street muggers. "This was a textbook example of computer abuse by dp personnel," says Rolf Moulton, director of the Computer Security Services Unit of New York City, who was loaned to nearby Nassau County police to investigate the crime. "It could have happened almost anywhere."

The college's acting director of the computer department (the systems programmer) and his predecessor simply used the college's Xerox Sigma-9 unlawfully to go into business for themselves, recalls Nassau County Assistant District Attorney Paul Kowina, who prosecuted the case. Over a period of at least three years the pair used minimally $200,000 worth of college computer time, selling its services to three private corporations which were unaware a crime was taking place.

College officials, who had never questioned the pair's sometimes strange behavior or their high living, finally became suspicious after beefing up the computer's work capacity and finding that it still could not handle routine chores like billing, accounting, and classroom instruction. The dp director resigned and the incoming director began a quiet investigation. Among other things, he noticed 25 modems attached to the computer when there should have been only 19. Separate recognition codes were discovered that allowed outside clients to use the computer. The college reported its suspicions to police, who called in Moulton. Here's what they discovered after a midnight raid on the facility:

- No written policy on authorized or unauthorized computer use had been issued by the college.
- No system usage statistics had been kept.
- No network documentation had been maintained. Six telephone dial-up lines had been used exclusively by the two suspects and billed to the college.
- Aside from bills and receipts, all equipment inventory records had been maintained by the suspects.
- All records of active media (disk and tape) and those in the library had been maintained by the suspects, if at all.
- A program hidden in the computer system had been capable of destroying all data stored on disks.
- The systems programmer had kept a private telephone line in his office, which he told all staff members never to use. Ironically, the phone line had also been paid for by the college.
- The suspects had been responsible for systems backups, though it was not determined whether the backup tapes had been real or dummies.
- The systems programmer had owned several expensive cars, plus a home in an exclusive neighborhood. His salary at termination: $244,000.

DEVELOPE A BASIC PLAN

A first step in developing computer abuse as an indictable crime is the issuance of a policy statement on what can, and can't, be done with the computer, says Moulton, whose unique department monitors the work of several thousand dp employees in New York City's 12 big computer centers. New York City Mayor Edward I. Koch, for example, recently distributed a directive on computer use to all heads of agencies and departments, employing some 230,000 employees. "Have top management issue a policy statement that clearly defines what's expected of every employee concerning the protection of the organization's assets, including computational time, resources, data, and computer programs," Moulton recommends. Then sit down and draw up a similar policy regarding vendors and suppliers.

A second step is to check out potential employees closely before hiring. "We find that many times the prospective employer doesn't even check to find out if the candidate has the background he claims," says John T. Errett, vice president of United Intelligence Inc. (Unitel), a New York City private detective agency that specializes in computer crime investigation. "Instead, they'll take the employee on faith or simply make one phone call to the previous employer."

One factor contributing to this is that many companies feel they'll be in violation of privacy laws if they probe too deeply. But this is not necessarily so, says Susan B. Nycum, a partner in the Palo Alto, Calif., law firm of Gasten Snow & Ely Bartlett. "Everyone has the wrong impression about how many questions you can ask," notes Nycum, who specializes in civil suits arising from alleged computer abuses.

How do you avoid asking the wrong questions of a job candidate. "Just don't go about it in an awful way," Nycum says. "Avoid setting up what can be viewed as a pattern of discrimination. Ask questions closely related to the job the potential employee is applying for. Then get his or her signature okaying the fact that you can verify the applicant's claimed background. The problem now is that many employers went too far in the past and asked all kinds of personal questions not related to the job."

Lawsuits resulted, and privacy and disclosure laws were passed that intimidated too many personnel departments, says Nycum. Review your personnel department's handling of preemployment screening and then see if it can be legally tightened by talking to house counsel.

How much time and money should you spend on a background check? It depends on the opportunities available to the employee. Clearly, a middle manager warrants a closer scrutiny than a keypunch clerk. "Obviously, you're not going to spend a helluva lot of money on a youngster who probably doesn't have much of a background to investigate," Errett says. Some firms do modest checking on a volume basis, spending from $25 to $75 and using local credit reporting agencies. A candidate, say, for a programmer's job might warrant a $200 investigation, which includes verification of dates and places of residence, a motor vehicle driving record, and other pertinent items. Equifax of Atlanta handles investigations on that level and at about that price, says Errett.

A candidate for the MIS manager's position would be worth an even closer scrutiny, says Errett. Bishop's Service, with offices in many major metropolitan areas, and Proundfoot Reports, in New York City, are two firms that handle investigations on that level, with costs ranging from $400 to $700. "And after that there's us," Errett adds, quoting rates of $300 and up for checking out the bona fides of middle-management candidates for employment.

Once you get past the basics on laying down policy and hiring practices, immediately form an information security department. "Appoint an information processing security manager with sufficient clout and staff to be effective," says Moulton. "Ev
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ery major organization should have a design-
ated information processing security func-
tion which is different from that of tradi-
tional auditing. It should be oriented to pre-
vent abuse and be prepared to detect and
then deal with actual situations of computer
abuse.

That’s fine for a large shop, but sup-
pose your business isn’t big enough to war-
rant such a move? A number of firms are
calling in experts to perform computer secu-
ity reviews, to determine assets that require
protection, the likelihood that these assets
will be threatened, and ways to protect them.
The experts then make their recommenda-
tions to management, which has the option of
implementing them.

“You can perform a thorough and
comprehensive security review for a single,
large-scale computer installation at a cost of
from $30,000 to $80,000,” says Parker.

“Don’t confuse these security reviews with
quantitative risk analysis, which is much
more expensive and may involve a lot of
overkill.”

A competent security review is done
on a contractual and fixed-price basis and
may involve sending in a team of from two
to five people for periods of up to 15 weeks to
see what needs tightening up from the stand-
point of access, protective software and hard-
ware, and other measures designed to elimi-
nate computer crime. “These reviews must
be conducted discreetly,” Parker cautions.

“It’s also important that you have the under-
standing and support of your dp people, who
could be constrained or intimidated by this
kind of study. You must have their coopera-
tion or they’ll beat you every single time!”

Part of any ongoing security program
involves keeping tabs on your people in an
informal and compassionate manner. “I’ve inter-
viewed about 30 so-called computer criminals
and among my findings were that they all had an unshareable problem they
were trying to solve,” says Parker. “Indeed,
one of the most common reasons for fraud
reported by one insurance company was dis-
vorce.

Parker cited the classic Case of Old
Silent Joe the Programmer, who sent up dan-
ger signals that management failed to per-
ceive. “He was a very introverted guy who
looked like a hippie,” Parker recalls. “He
was brilliant and knew the system at the
360/40 installation backwards and forwards.”

Joe was caught by internal audit con-
trols after stealing approximately $4,700. “I
asked his boss if he hadn’t seen anything un-
usual in Joe’s behavior prior to learning of
the crime,” Parker says. “‘The superior replied,
‘Looking back, it should have been obvious
to me. I’d been over to his apartment and saw
a $4,000 hi-fi system, not to mention the two
matching Jaguars he and his wife drove. And

I kept getting these dunning letters threaten-
ing to attach his salary, but it never dawned
on me that something crooked was going
on.’”

Even agencies that spend millions of
dollars annually on employee security re-
views can fail to get the simplest of messages
from troubled employees. Consider the case
of Joseph George Helmich Jr., recently sen-
tenced to life in prison. Helmich was an Army
code custodian with a known history of mon-
ey troubles. Indeed, his commanding officer
had told him to pay off debts of less than
$1,000 or face a court martial. The strapped
Helmich did what seemed logical—to him,
anyway. In 1964 he went to Soviet inteelli-
gence agents and received $131,000 after
selling them the maintenance manual, techni-
cal details, and key lists to the KI-7 Crypto-
system. As a result, top-secret military elec-
tronic mail and other communications were
compromised from the mid-1960s until the
crime was discovered, some 17 years later.

“Managers of every computer-orient-
ed organization should be required to receive
a certain amount of sensitivity training,”

Parker recommends. “‘Make managers sensi-
tive to the problems of their employees. This
shouldn’t be an intrusive thing. Instead, a
good manager ought to stand around the cof-
fee machine two or three times a week. Help
your employees solve their problems so that
they won’t go off and solve them in a way
that will hurt you.’

Computer criminals and their confed-
erates often spend a lot of time devising ways
to beat costly mechanical or electronic physi-
cal access barriers. In other cases, nothing
but a door stands between a $10 million com-
puter installation and a criminal. Consider an
old-fashioned guard service, says retired secu-
rity consultant Laurence Wakefield of
San Francisco, Calif. For $6 an hour you can ex-
pect a daily report on who is going where,
your own physical representative in an area
that probably ought to be looked at more than
it is, plus the periodic appearance of the
guard’s supervisor to check on his work. An
added advantage is that the guard is an outsid-
er and unlikely to develop the close relations
with dp employees that could lead to collu-
sion.

A guard is also worthwhile from the
standpoint of preventing physical damage to
your installation. “In one recent case the up-
stairs room in a building flooded. The water
leaked through the ceiling, ruining an un-
guarded and expensive computer,” says
Wakefield. “In another instance out here, a
guard saved the whole installation simply by
pulling a manual fire alarm.”

Hiring a guard service means check-
ing first with comparable firms on the reputa-
tion of the supplier. Then tell the security
service exactly what you want, and expect it
to draw up a contract for your approval. Ask
for a one-day free ‘break in’ period for in-
doctrating your guard on special require-
ments. Also demand that you get the same
guard, day after day, to avoid being saddled
with a succession of newcomers who don’t
understand your special security require-
ments.

Wakefield offers three more tips:
Don’t ask for an armed guard unless your
building is not secure; you’ll have to pay a
slight premium for that pistol, and in the long
run a loaded gun may intimidate your em-
ployees. Be suspicious of the guard agency
submitting the lowest bid. “It may be a ‘hot
uniform’ operation,” says Wakefield. “A
guy and his two cousins, all size 42 regular,
will alternate shifts using the same uniform.”

Finally, check on the guard service’s insur-
ance liability coverage. In California, the go-
ing rate is $2 million.

An internal as well as external audit-
ing system should also be set up. Firms like
Coopers & Lybrand in New York City and
the EDP Auditors Assn. near Chicago are
among those specializing in computer-related
audits. “Have an audit committee,” Susan

WHO’S DIDDLEING WHOM?

years ago the Black Panthers had a saying:
“Those who know don’t say, and those who
say don’t know.” A lot of MIS managers
would agree with that insofar as the litera-
ture on computer crime—reported and unre-
ported—is concerned. One recent account
puts the take from hundreds of reported and
unreported crimes in the United States at $3
billion annually. On the other hand, a senior
consultant with the auditing firm of Peat
Marwick Mitchell maintains that computer
crime in the United States has been vastly
overestimated, adding that only some 75
true cases were reported among some
350,000 installations in 1980, with a collect-
ine annual loss of $40.3 million. By com-
parison, fraud and embezzlement losses in
U.S. financial institutions in 1975—all ac-
complished without computers—amounted
from a whopping $181.1 million, and have
since risen.

One authority puts part of the blame

on secrecy. “There is a general reluctance
on the part of organizations victimized by
what might be termed computer frauds to
admit their losses publicly or to introduce
such cases into the public domain at court,”
he says. “Their reasons are almost always
that the expected costs exceed the benefits,
the chances of recovery or successful pros-
ecution are too low, or the indirect costs of
publicity and notoriety are too high.”

A New York City data security offi-
cer at the Irving Trust Co. takes the opposite
tack. “To propose great numbers of unre-
ported crimes is to accuse senior managers
around the country of being accessories
after the fact of crimes as well as of obstruct-
ing justice.”

Who is right? We probably won’t
find out until some single private or public
agency is charged with investigating all
computer frauds—reported and merely sus-
pected. Which means, most likely, never.
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The Value Leaders
DP employees who see a crooked colleague avoid prosecution may be tempted to do a spot of data diddling themselves.

Nycum recommends, "There is collusion involved in a number of computer-related crimes, so consider having a lot of outside members of the board of directors on the audit committee." In a nutshell, don't have all the auditors reporting solely to someone in higher management, who may be a party to an ongoing crime. Also check with your lawyer to see if state or federal law requires an audit committee. If your operation is covered by the Securities and Exchange Commission, or falls under the provisions of the Foreign Corrupt Practices Act, such a committee is mandated.

What happens when you believe a computer crime is being committed and you want to call in the police? For openers, expect them to know as much about the mechanics of your operation as you know about investigating a homicide. Prosecutors like Kowtna, however, say that there is a growing awareness in the law enforcement community about handling computer crimes. Still, be prepared to sit down and review the circumstances with them carefully, and repeatedly.

CRIME LAWS VARY

One problem facing law enforcement today is that the laws on what constitutes a computer crime vary from state to state. Indeed, only 12 states now have laws on the books particular to computer-related crimes: Arizona, California, Colorado, Georgia, Montana, Florida, Illinois, Michigan, New Mexico, North Carolina, Rhode Island, and Utah. A federal law on computer crime has been pending in Congress for years. Still, you can call in the FBI if you believe the crime involves wire fraud or a violation of some similar federal statute. More than 500 of the FBI's 7,800 special agents have received a special four-week course in detecting computer crime, and almost all of these graduates have a solid background in accountancy.

Some businesses elect to bring in private investigators when they suspect a computer-related crime is being committed. "There are some firms that do a fine job in this area," says Nycum, "but talk to your lawyer first. And be sure that you don't stub your toe by announcing that Joe Programmer is the culprit. Joe may just turn around and sue you, claiming you've ruined his life. It only takes $1,000 for a plaintiff to get into court these days, and even if he loses the suit, you'll have paid a lot of money defending yourself. In short, don't blow everything by acting precipitously."

What can you expect from private investigators? Placing the suspect under physical surveillance runs about $30 per hour, plus the operative's expenses, says Wakefield. Some agencies tout gimmicks like the voice stress analyzer or the polygraph as tools of interrogation. "They're a hinky piece of business at best," Wakefield says. How about lie detectors? "We use them very rarely and, then, most selectively," says Unitel's Errett, whose rates start at about $75 per hour. "In the long run," he adds, "nothing will replace solid evidence." There are three things worth remembering about these gadgets: you cannot fire an employee just because he refuses to submit to one, nor can you fire an employee solely because he didn't "pass" the test results. Finally, their use is prohibited in some states.

Some major businesses quietly dismiss admitted computer criminals rather than report them for possible prosecution. Consider this: you are breaking the law if you have knowledge of a crime and fail to report it.

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CIRCLE 98 ON READER CARD
Mispription of a 'felony is a little-known statute, but a hard-charging district attorney could put you in the penitentiary if a jury believed him. Moreover, the manager who fails to report a criminal act leaves himself vulnerable to blackmail. Finally, dp employees who see a crooked colleague avoid prosecution may be tempted to do a spot of data dawdling themselves.

Also, warns Nycum, failure to take appropriate action with a criminal suspect could lead to a whopping civil action, with you named as the defendant. If you knowingly pass a crooked programmer along to another firm without telling them, and that programmer continues his criminal activities, plan to spend your declining years in civil court—if not in a correctional facility. Also expect to be named in a civil suit if your firm's stockholders learn their dividends were reduced because you failed to obtain restitution.

There's yet another reason for demanding criminal prosecution. A growing number of district attorneys are seeking inventive new ways to hit white collar criminals with maximum sentences and fines. Let's return for a moment to the Case of the Corrupt College Computer.

Under New York statutes, an unimaginative prosecutor might have gone into court with only misdemeanor charges, which is how theft of services cases are usually handled in that state. A misdemeanor is punishable by only a minimal fine and up to one year's imprisonment in the county jail. Instead, Nassau County District Attorney Denis E. Dillon elected to bring third-degree larceny charges against the two defendants, upgrading their crime to a felony status. Dillon based his charges on the fact that the two had siphoned off at least $43,000 in profits by unlawfully putting the college's computer to work for them. The duo pleaded guilty, were sentenced to three years' probation, and ordered to repay the $43,000 to the college.

In the long run, prevention always beats prosecution. Bringing in private investigators and policemen will almost certainly disrupt your applications, systems, and data processing operations. The system may be shut down for password changes. Ditto for a shutdown for a day or two while programs and other data are copied for evidence or checked for alteration. Expect morale to plummet and employees to quit.

"You'll lose a lot of sleep and likely find it traumatic to watch and then to help investigators probe deeply into the personal and professional activities of your friends, colleagues, and subordinates," says Moulton, who has done his share of probing. "Your best alternative is vigilance and attention to the security implications of good systems development and operational control."
"Oh no! Somebody got into the computer room last night."

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The personal computer industry grew nearly tenfold in a four-year period. Where will it go from here?

THE FUTURE OF RABBITS

by Everett T. (Bill) Meserve

In "A History of Rabbits," (September, p. 188) Bill Meserve described how the personal computer industry got to its present stage. He also named two strategic user segments—business/professional and consumer—to which the industry must look for much of its future growth. Herewith his analysis of how those two segments may be approached and his comments on problems facing industry suppliers.

Managers at all levels are being required to operate in increasingly competitive and complex environments. For example, business decisions that were once based upon domestic market knowledge must now include consideration of foreign competitors and foreign marketing environments. Also, as the cost of capital has risen, rate-of-return requirements have increased, forcing middle managers to make sharp decisions about which products to push or prune.

Given a fixed amount of time and commonly available tools such as calculators and paper, managers would seem to face two choices—spend more time securing information and analyzing alternatives, or make less well-informed decisions. The latter is unacceptable, so managers need a new business information/analysis tool to increase productivity and to perpetuate high-quality business decisions. Also, because managers and professionals contribute disproportionately to office labor cost and organization results, improving the quality of professional and managerial output would have great impact on the overall operations of the organizations.

For some time, senior operating managers have been the beneficiaries of computer-aided business analysis provided by dedicated staff and supported by local or time-sharing computing capability. But such resources, staff, and time are seldom available to operating middle managers. A cost-effective professional productivity improvement tool, which the manager, operating alone, can use to create, manipulate, and analyze information, is needed. As the following examples indicate, the personal computer and its supporting software is emerging as such a tool.

Two years ago, a Fortune 500 industrial company made some strategic observations about the future of intelligent electronics. One result of this activity was the purchase of more than 10 personal computers for the company's operating managers. Since then, about 200 personal computers have been acquired by the company for operating personnel. Some are located in employees' homes, and others are at the office. Users range from games to the creation of specialized management decisions documents. For many operating managers, an important discovery has been made: they can use a personal computing tool to help them make better management decisions, and to improve their professional productivity.

The experience of Charlie, a regional sales manager for a large paper company, is a different example of professional productivity improvement. Charlie was intrigued with how small computers might be used in management functions, and his curiosity led to the purchase of a $250 Radio Shack pocket computer. Having satisfied his curiosity, Charlie anticipated that the computer could help monitor the monthly performance of his distributors. The reality of his first computer experience was both disappointing and encouraging. Disappointment came when he experienced the inconvenience and tedium of programming in BASIC, and when he learned there was only enough memory capacity to handle four of his 28 distributors. Encouragement came from the discovery of a "bigger brother" personal computer that could perform all his original applications plus more, and that the larger unit was much easier to use than the pocket computer. Charlie has tasted the potential of his professional productivity improvement tool, and realizes the benefits.

REAPING GREAT BENEFITS

How significantly will middle management's decision-making ability be improved upon by the personal computer? There are some indications that the benefits will be great. Senior operating executives believe that computer-aided analysis is worthwhile, and many have used it for over a decade. The cost of computing capability and special support staff has been high, but the benefits have apparently been sufficient to justify the investment. Another confirmation comes from the analysts and planners who have adopted personal computers at an unprecedented rate in the last two years. Also, line supervisors and middle managers are becoming comfortable with computer resources, but impatient with central data processing's poor responsiveness, inflexibility, and high cost. They are becoming increasingly convinced that they can become more productive with their own facilities. According to a study by Arthur D. Little, Inc. over 100,000 personal computers are being used by U.S. managers, and business and technical professionals.

One of the most significant barriers to middle management's adoption of personal computers will be the difficulty of confirming operational benefits. Management productivity is hard to measure in traditional quantitative terms—fewer units of production per hour, six more letters typed with no errors, or 200 documents printed in 10% less time. In fact, the results of management analyses and decisions are frequently not measurable until some time after actions are taken. Middle managers who invest time and money in personal computers must do so largely on faith.

Computer-aided business analysis has been expensive, and while the price of computing capability is decreasing rapidly, the cost of the people needed to support the analysis continues to rise. For many managers, this means that staff size will not increase. Thus, if managers are to make greater use of computer-aided analysis, both software and hardware must be utilized. Without easy-to-use software like VisiCalc supporting low-cost (~$2,000) personal computing hardware, managers will profit less from computer-aided business analysis.

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The personal computer industry industry is emerging as a cost-effective, professional productivity tool.

which managers now use writing instruments (pencils, pens, typewriters, word processors, and printing presses) and hardcopy media, primarily paper. Future personal computing tools will permit the user to access information databases (public or private), display information visually or have selected information spoken, manipulate information for selective analysis, and communicate to databases and other users the results of analyses and decisions. Hardware would operate standalone using local information banks and memories, operate on-line to remote information sources, be portable and occupy part of a briefcase, and respond to oral instructions. Much of the technology to accomplish these operational features is available or rapidly becoming so. Eventually, the personal computing tool may combine the portability and convenience of today’s calculator with the operational features of a standalone personal computer and a Xerox 8010 Star executive terminal system.

It will not be enough for a company merely to manufacture such a product. Distribution channels as well as products will have to demonstrate an understanding of user needs. There will have to be practical solution packages. Solutions, especially hardware, will be available from many sources, but the marketers who understand user requirements and who have local distribution will be most successful in serving operating managers.

THE CONSUMER SEGMENT

U.S. consumer electronic product sales are measured in millions of units per year: videocassette recorders, one million; color tv, 10 million; calculators, 20 million; and radios, 40 million. Consider also a consumer market of 80 million households, 70 million adults over age 25, and 23 million wage earners with annual incomes over $25,000 per year. The rewards are immense for the maker of any new electronic product accepted by this group, and personal computer suppliers are anxious to capture their share. Simple arithmetic—80 million households times $500 per computer—yields a potential market of $40 billion for personal computers in the U.S. That’s larger than the entire U.S. 1980 computer industry. But that’s only a potential market. Does the demand really exist?

Between 1979, when the first consumer-oriented personal computers were announced, and 1980, fewer than 100,000 of the devices were sold in the United States. This is about a thousandth of the potential market, and little progress has been made during the last two years. Based on past performance, and compared to other market segments of the personal computer industry, the outlook for the consumer segment is not encouraging.

For the consumer market to realize its potential, three events must take place:

- The personal computer must move from the narrow-appeal, luxury market to a broad-appeal, necessity market through the creation of primary (vs. replacement) demand.
- Personal computers must make the transition from entertaining to functional uses.
- Personal computers must move from high cost, limited application products to lower cost, broad application products.

What will it take for personal computers to reach the heart of the consumer market? First, and foremost, there will have to be a few compelling applications that will do for the consumer what VisiCalc has done for the business/professional user. Second, product prices must be reduced from the $500 to $1,000 range to $300 or less. And third, personal computer offerings must fit existing mass consumer distribution channels.

What are these compelling applications that will unlock the vast consumer market? We don’t know today, but by looking at other successful consumer software products we can find some clues. Successful consumer software offerings are:

- likely to be entertaining and produce pleasant results;
- likely to have a low price and narrow benefit; and
- likely to be an addition rather than a displacement of an existing, established application.

While the application “golden keys” may not exist today, it is widely believed that they will be discovered. All consumer computer market forecasts make this assumption.

Industry opinions point to a retail price of $300 or less for personal computer hardware. The consumer can already get interactive tv games for less than $200, sophisticated programmable calculators for less than $150, and chronographic watches for less than $50. Technology is available to produce a $300 personal computer today; what is missing is the volume of demand that would justify the manufacturing investment.

If cheaper hardware and more useful software are produced, how will over a million units per year reach a broadly dispersed consumer market that buys on impulse? If consumer demand builds quickly, as is likely after the discovery of important applications, there is only one distribution channel capable of responding to the challenge—existing retail mass merchandisers. To use this channel, hardware and software must be virtually self-demonstrating and self-selling. Mass merchandisers do not have the time, resources, or interest to educate purchasers.

The future, then, is uncertain. These projections are based on faith in yet-to-be discovered software and untested distribution channels. Others might argue that the consumer market will continue to be typified by high-priced goods offered to a select group of people.

TERMINAL VERSUS COMPUTER

The personal computer has thus far been described as a standalone device with a keyboard, semiconductor memory, microprocessor cpu, and some means for connection to a tv display. This conventional characterization does not describe other devices that could satisfy consumer needs. What the consumer really wants is a typewriter-like device that uses smart electronic stuff to entertain him, show him things, help him learn, and help him work. Thus, the consumer personal computer of tomorrow could well be what is labeled an intelligent terminal today—a keyboard connected to a tv connected to outside information resources, with processing capability and local information storage. The question of whether the consumer personal computer of the future will be a standalone device or a terminal will be heavily influenced by which of these hardware configurations first provides compelling applications and a low price.

As the personal computer industry has moved from an embryonic to a growth stage, the keys to success have changed. For example, in the embryonic stage, when the primary market was computer hobbyists, the key to success was maximum operating performance for the minimum dollars. As the market evolved to include other strategic user segments—business professional and small business users—new keys to success emerged. Application software availability and service became increasingly important.

To compete successfully in the professional and very small business segments, suppliers must provide offerings that satisfy real needs. Technical professionals are more likely to identify real needs and develop software if off-the-shelf solutions are not available. Business professionals are less inclined to do so, and very small business users have little or no expertise and interest needed for software development. Some hardware suppliers have taken a passive approach to this challenge, and have become clearinghouses of programs developed for their equipment by early users. A shortcoming to this strategy is that software creation and control, a key to success, is thus left to chance. To date, the advantages of low investment have outweighed the risks, but as the number of less technically knowledgeable users grows, there will be increased demand for software quality (e.g., debugged, goof proof, documented, forgiving, easy to learn). In essence, software, like hardware, must become more professional. If it is to succeed, a clearinghouse software strategy must emphasize quality rather than quantity.
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The filing systems team.
Simple arithmetic—80 million households times $500 per personal computer—yields a potential U.S. market of $40 billion.

CHOOSING A MARKET PLAN

Several strategies are available to suppliers wishing to participate in the personal computer market. Companies able and willing to make large up-front investments can consider providing total system solutions—hardware and application software—for mass consumers or business users, both of which are markets large enough to justify the expenditure of significant resources and effort. These systems solutions might be developed internally or in partnership with outside hardware or software producers. Such strategy carries with it both high risk and high potential rewards, and therefore is most appropriate for large, financially capable organizations like IBM, DEC, Texas Instruments, Xerox, Hitachi, Sony, and Siemens.

A second strategy is to develop an integrated package of hardware and software tailored to the needs of one or more vertical market segments. Such packages might be designed for business analysts, pension managers, stockbrokers, CPAs, educators, architects, civil engineers, or electronic design engineers. The keys to this strategy are the identification of viable market segments, the development of uniquely useful and economically justifiable offerings, and successful system marketing. Such a strategy may be appropriate for smaller hardware manufacturers, existing or new computer system houses, and business equipment marketing organizations like Victor and Monroe.

Suppliers primarily oriented toward equipment may choose to focus on technology-based users—hobbyists, engineers, scientists, and industrial users. The shortcoming of this strategy may be insufficient long-term market potential. Since hardware technology is traditionally an entry point for new suppliers, and markets may be small, there is likely to be a large number of suppliers aggressively seeking a viable position.

Finally, some companies may still be successful as oem equipment suppliers while leaving to others application software development, systems solution sales, and maintenance. This alternative is viable for firms with unique technology and hardware design skills and the ability to manufacture cheaply.

Software suppliers are also facing changing conditions. The prime source of personal computer application software has been nonprofessional, “cottage industry” personal computer enthusiasts. Programs from these sources are made available through hardware vendors that act as clearinghouses and directory publishers. Some professional software companies like Microsoft were started and staffed to create professional quality operating systems and programming language software. These organizations were followed by software marketers like Personal Software, Lifeboat Associates, and Instant Software, which market products produced by others. The trend is toward more professional independent software sources and dedicated software marketing organizations that provide distribution, software quality assurance, user application assistance, and after-sale maintenance.

Everett T. (Bill) Meserve has followed the personal computer industry for Arthur D. Little clients since 1978. For 17 years prior to joining Arthur D. Little, Meserve was an industry operating manager at TRW, Bunker Ramo, and General Instrument. He has an MBA in marketing and finance from the University of Southern California.
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CIRCLE 116 ON READER CARD
A methodology for verifying automatically that programs have been transported effectively from one host computer to another.

**PROGRAM PORTABILITY**

by Michael G. Walker and Richard G. Harrison

The purpose of program conversions is to transport the capabilities of a system from one host computer to another. Programs that can be transported without degrading their capabilities are called portable. In a successful conversion, the target computer fulfills the same processing tasks as the source computer: it accepts the input, produces the output, and stores the data necessary to complete the functions that comprise the original capability. The converted system is not less reliable, maintainable, or enhanceable. And the conversion is cheaper and more predictable than if these same capabilities were produced as part of a program development. What follows is an automated methodology for verifying program portability, for judging that transportation has been effectively carried out and that programs are portable.

Since a software system is the sum total of its programs, files, database management system, transaction processor and documentation, a conversion must transport each of these components to a target configuration. The configuration can be an upgrade within your own vendor line, a plug-compatible target, or a target host of another vendor's line. In converting, the dialect of the programs is usually changed (for instance, '68 ANS COBOL to '74 ANS COBOL) but not the language (COBOL to FORTRAN). Conversion from an assembler language to a high-order language (for instance, autocoder to COBOL), however, is not uncommon.

An example of an upgrade would be a conversion of a supply system running on a 360/40 in DOS COBOL to '74 ANS COBOL running on a 303X, or a conversion of a supply system in non-ANS COBOL running on a Univac 1108 to '74 ANS COBOL running on an 1180.

An example of a plug-to-plug conversion would be the transporting of a logistics system running in '68 ANS COBOL on a 360 to '74 ANS COBOL on an Amdahl 5806. An example of a total transportation to another vendor's line would be the conversion of a logistics system running in '68 ANS COBOL on a Honeywell 600 to '74 ANS COBOL running on an IBM 303X; the conversion of an accounting system running in autocoder on a 7080 to '74 ANS COBOL on an H6000; or a system of FORTRAN programs running on a Univac 1100 to FORTRAN running on a CDC Cyber.

One of the most difficult tasks in converting programs is verifying that the capabilities have been successfully transported. There are two steps to verifying the portability of programs: program conversion verification and program quality verification.

Program conversion verification tests the programs have been converted, the data files moved, and the documentation updated. This is the traditional method for verifying program portability. Program quality verification is more important but also more difficult. It includes tests for verifying the quality of the converted system because it tests the reliability, maintainability, and enhanceability of the converted system. The system must be reliable—it must work as the user reasonably expects; it must be maintainable—the user must be able to fix and find errors; and it must be enhanceable—the user must be able to change it. These properties are the focus of program quality verification, and since the material that is tested is the converted system, program quality verification also certifies that the conversion has worked.

Converted programs can pass program conversion verification and still be woefully unportable and the conversion effort a disastrous failure. In this case the programs would be transported and would pass acceptance tests, the files would be moved and would pass file comparison tests, and the documentation would be changed. The converted system, however, would be so unreliable, unmaintainable, and unenhanceable that the user would be unable to use it. The sad history of many program conversions is a testament to the inadequacy of program conversion verification as a sufficient verification technique.

The problems of program verification can be avoided, however, by employing an automated technology that uses a set of tools to automatically perform program quality verification for converted programs; the tools are reliable, portable, and economical, and have been found to reduce verification labor costs by as much as 90%.

Basically, the technology for verifying software portability is composed of four parts. It is a total methodology, each part contributing to the others. The four parts are static analysis, test case generation, dynamic analysis, and quantitative program evaluation. The totality of these methods verify both program conversion and program quality as shown in Fig. 1.

The first of these parts, static analysis, inspects the structure of programs, files, databases, and documentation. It verifies the quality of these components by analyzing their structure. Test case generation directly follows static analysis. Among the tasks of
static analysis is the identification of every arc in a program. An arc is a connection between decision-to-decision paths. An analyst can use the test case generator to create a set of test conditions that exercise each arc. These test conditions will be exercised during dynamic analysis. Dynamic analysis verifies the behavior of a program against live, carefully selected test data. It also instruments the program with probes, exercises the program with the carefully generated test cases, and gathers data. Dynamic analysis then interprets the gathered data, verifying the program's quality.

Quantitative program evaluation produces a quantitative picture of the program's quality. It computes statistics from the data gathered during static analysis and dynamic analysis. The numbers are compared against metrics for program quality, and a quantitative picture of the system's quality is produced. Program portability is successful if the programs have been converted and if their quality meets accepted standards. Program portability verification automatically and quantitatively measures that success.

The following four sections will discuss static analysis, test case generation, dynamic analysis, and quantitative evaluation.

**USING STATIC ANALYSIS**

- number of statements that violate ANS standards;
- number of statements that violate language architecture standards;
- number of statements that were translated from the source host to the target host;
- number of statements that violate structured programming conventions;
- syntax of the translated instructions as they appear in target environment;
- data dictionary of fields, structures, files, and their usage;
- called-calling relationships among the programs of the system; and
- parameters and data passed between programs.

These statistics give a picture of the structure of transported programs and can be used both before the conversion, as a planning tool, and after the conversion, as a verification tool. As a planning tool, they can indicate the quality of a program before conversion and thus indicate the difficulty and cost of transporting the system. As a verification tool, they can indicate the success of the conversion.

Fig. 2 shows that the static analyzer is a table-driven technology composed of the following elements:

- a universal parser that decomposes a program into a tree structure of tokens;
- a table that contains the BNF representations
TABLE I

DECISION-TO-DECISION POINT RULES FOR AUTOMATIC TEST CASE GENERATOR

<table>
<thead>
<tr>
<th>PDL CONSTRUCT</th>
<th>DECISION-TO-DECISION PATH(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF</td>
<td>One path for the true condition (IF-T) and one path for the false condition (IF-F)</td>
</tr>
<tr>
<td>DO WHILE</td>
<td>One path for the true condition (DW-T) and one path for the false condition (DW-F)</td>
</tr>
<tr>
<td>DO CASE</td>
<td>One path for each case name within DO (DC-NM) and one path for the default condition (DC-DEFAULT)</td>
</tr>
</tbody>
</table>

All other constructs do not generate any decision-to-decision paths.

FIG. 3

SAMPLE PROBLEM FLOWCHART

START

INPUT
Z,Y,Z

X=Y

Y=Z

X=Z

FLAG = 2

FLAG = 2

FLAG = 1

PRINT
XYZ

FLAG

STOP

of the source language and the target language; and
• command programs that contain sets of rules telling the universal parser what to do.

Each of the command programs operates upon the decomposed source program. The tool would operate as follows:
1. The parser decomposes the source program into a tree structure of tokens.
2. The parser uses the BNF tables to recognize the tokens.
3. Command programs perform their tasks on the decomposed program; both the evaluation command program and the documentation command program are examples of command programs.
4. The evaluation command program produces the following:
• number of statements that violate ANSI standards,
• number of statements that violate language standards,
• number of statements that violate structured programming standards,
• number of statements to be translated, and
• listing of the source program with flagged statements highlighted.
5. The documentation command program would produce the following:
• data dictionary,
• called-calling relationships, and
• parameters passed by calls.

Static analysis presents a complete picture of the syntax of a program or a system of programs. It automatically updates program documentation, giving a complete picture of a systems structure. This picture provides much of the material for the quantitative evaluation of the quality of a system of programs and gives management the ability to predict the cost and success of a conversion effort.

The test case generator automatically analyzes syntax and aids the test analyst in producing test cases that exercise each arc in a program. The output of the test case generator consists of a definition of the specific input and output conditions required to exercise each arc. The number of arcs in a program depends upon the size of the program and the structure of the program. An unstructured program, for instance a COBOL program with many GO TOs and ALTERs, may have more paths than it is economical to test. If this is the case, then the test case generator will flag the program as untestable.

The test case generator will aid the test analyst in producing a test case for each decision-to-decision, as is shown in Table I. The process produces a test matrix and a set of test procedures. For instance, a structured flow that compares three numbers and sets flags according to these values is shown in Fig. 3. It sets the following flags:
• All numbers same \( \text{FLAG} = 1 \)
• Two numbers same \( \text{FLAG} = 2 \)
• No number same \( \text{FLAG} = 3 \)

The test case generator would analyze the program that computes these values and would aid the analyst in producing a test specification matrix that looks like Table II and a test procedure that looks like Table III.

The test case generator fits into the universal parser, as shown in Fig. 2. Its output is the test specification matrix and the test procedure table. These are shown in Tables II and III. The test cases are input to the dynamic analyzer, and the combination of these tools help automate the dynamic testing process. Also, the test case generator flags programs that are untestable.

USING DYNAMIC ANALYSIS

Dynamic analysis exercises the test cases and measures the behavior of the program while the cases are being processed. During dynamic analysis, the converted programs are instrumented with probes, the test cases are exer-
cised, and statistics are generated about program behavior.

Test probes are placed in each arc of the program. These probes count the number of times the arc is entered and log critical variables and their contents. Probes not only help verify program execution but also identify and count arc traversal. This information can be used to find "inner loops" for which optimization payoffs are great. Thus, dynamic analysis is not only a verification tool but also an optimization tool.

Dynamic analysis statistics include the following information:
- ranges of variables,
- control flow and data flow information,
- data sensitivity information,
- environmental information including parameter passing and procedure evaluation environments, and
- assertion information—comparing asserted behavior to actual behavior.

This information provides a history of program execution, helps the checking of program assertion like those in the test procedures chart, and facilitates the tracing of control flow dependency and data flow dependency and thus program optimization.

Fig. 4 shows the instrumentation of our sample program. Probes have been inserted and data will be collected at execution time. The dynamic analyzes inserted test probes, and collects data on program execution of test cases. This information is input into the final step in the verification technology, quantitative program evaluation.

The quantitative program evaluation phase computes the statistics gathered during static analysis and dynamic analysis, and compares them against metrics. These metrics are measures of program quality. The comparison gives a picture of the quality of the programs and a verification of program portability.

Quantitative program evaluation measures three program attributes: program reliability, program maintainability, and program enhanceability.

Program reliability is a measure of the extent to which a program performs as the user reasonably expects; program maintainability is a measure of the effort required to locate and fix an error in an operational program; and program enhanceability is a measure of the effort required to modify an operational program.

Each of these attributes is related to criteria for program quality, as shown in Fig 5. Definitions of these criteria are given in Table IV. Notice that the attributes share criteria. For instance, both the attribute program maintainability and program enhanceability share the criterion consistency. This means that the criterion consistency contributes to both maintenance and enhancement.
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Each criterion has a set of metrics that contributes to its value, and each attribute has several criteria and each criterion several metrics. The other metrics also have equations that compute program quality. The combined outputs from these computations is a set of numbers that provide a quantitative measurement of program quality. The totality of tools, metrics, and criteria provides a verification technology that measures program quality.

HOW TO EVALUATE QUALITY

A quantitative analysis of program quality would proceed by the steps shown in Table IV.

The characteristics of the system will dictate the priority of quality attributes:
- Identify critical criteria and metrics that measure critical attributes.
- Specify rating for each metric. This is usually a range of acceptability. If a program's quality is below the range's threshold value, it is flagged. If it is within the range, it is acceptable.
- Compute statistics from data provided from the automatic static analysis and the automatic dynamic analysis. This includes computing averages and standard deviations for the system and for individual programs.
- Compare results with threshold values and give a quantitative value of system quality and quantitative value for individual programs.
- Identify those programs below average quality and look to these for improvement.

It is important to note that the total process is almost completely automated. Thus, program portability verification is inexpensive, reliable, and predictable. Since the tools that measure portability are portable, then the verification capability is also portable, and can be moved to any configuration that supports an ANS compiler.

The evaluation phase uses the results of static analysis and dynamic analysis as input. It plugs these values into its equations for computing metrics and derives a number for each quality criterion. It compares this value against a criterion for quality and either accepts or rejects the system of programs or an individual program according to this criterion. A historical database of thresholds has been established by the U.S. Air Force and can serve as a reference for quality thresholds.

There are two aspects to program portability—program conversion and program quality—and both of these need to be verified to certify a system conversion. Traditionally, only the first of these aspects has been attempted and the results have not been satisfying. Program conversion verification certifies that the programs have been converted, the files translated, and the documentation updated. It draws no conclusions about the quality

![Diagram of program quality criteria](image)

**TABLE IV**

<table>
<thead>
<tr>
<th>CRITERION</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSISTENCY</td>
<td>Those attributes of the software that support uniformity.</td>
</tr>
<tr>
<td>ACCURACY</td>
<td>Those attributes of the software that support precision in calculations and output.</td>
</tr>
<tr>
<td>ERROR TOLERANCE</td>
<td>Those attributes of the software that support fault tolerance.</td>
</tr>
<tr>
<td>SIMPLICITY</td>
<td>Those attributes of the software that support understandable programs.</td>
</tr>
<tr>
<td>MODULARITY</td>
<td>Those attributes of the software that support independent modules.</td>
</tr>
<tr>
<td>GENERALITY</td>
<td>Those attributes of the software that support breadth of function.</td>
</tr>
<tr>
<td>EXPANDABILITY</td>
<td>Those attributes of the software that support expansion of capability.</td>
</tr>
<tr>
<td>SELF-DESCRIPTIVENESS</td>
<td>Those attributes of the software that support self-examination.</td>
</tr>
<tr>
<td>EXECUTION EFFICIENCY</td>
<td>Those attributes of the software that support optimizing processing time.</td>
</tr>
<tr>
<td>STORAGE EFFICIENCY</td>
<td>Those attributes of the software that support optimizing storage.</td>
</tr>
<tr>
<td>ACCESS CONTROL</td>
<td>Those attributes of the software that control access to program and data.</td>
</tr>
<tr>
<td>SOFTWARE SYSTEM INDEPENDENCE</td>
<td>Those attributes of the software that support program independence from the supporting software environment.</td>
</tr>
<tr>
<td>MACHINE INDEPENDENCE</td>
<td>Those attributes of the software that support program independence from the supporting hardware environment.</td>
</tr>
<tr>
<td>COMMUNICATIONS COMMONALITY</td>
<td>Those attributes of the software that support standard interfaces.</td>
</tr>
<tr>
<td>DATA COMMONALITY</td>
<td>Those attributes of the software that support standard data format.</td>
</tr>
<tr>
<td>CONCISENESS</td>
<td>Those attributes of the software that minimize the amount of code.</td>
</tr>
</tbody>
</table>
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### TABLE V

**QUANTITATIVE ANALYSIS OF PROGRAM QUALITY**

1. Consider basic characteristics of the system for which the code was written:

<table>
<thead>
<tr>
<th>PROGRAM CHARACTERISTIC</th>
<th>QUALITY ATTRIBUTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human lives affected (hospital, nuclear power plant, air traffic control, etc.)</td>
<td>Reliability • Maintainability</td>
</tr>
<tr>
<td>Long life cycle (logistics, supply)</td>
<td>Maintainability • Enhanceability</td>
</tr>
<tr>
<td>Dynamic environment (financial system which changes with changing tax laws)</td>
<td>Enhanceability • Reliability</td>
</tr>
</tbody>
</table>

2. Make trade-offs among quality attributes considering the characteristics of the system:

<table>
<thead>
<tr>
<th>FACTORS COMPARED</th>
<th>CONSIDERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability vs. Maintainability</td>
<td>Efficient code seems harder to maintain; maintainable code introduces some processing and storage overhead. There is a conflict between optimizing efficiency and optimizing maintainability.</td>
</tr>
<tr>
<td>Reliability vs. Enhanceability</td>
<td>Efficient code seems harder to enhance; enhanceable code introduces some processing and storage overhead. There is a conflict between optimizing efficiency and optimizing enhanceability.</td>
</tr>
<tr>
<td>Maintainability vs. Enhanceability</td>
<td>No direct conflicts</td>
</tr>
</tbody>
</table>

If the converted programs are of poor quality, then the transported system will be of poor quality and the conversion an expensive failure. This failed system, however, may have passed traditional verification methods with the highest approval.

### REFERENCES

1. GSAFCSC, Conversion Productivity/Aids Survey, Federal Conversion Support Center, Falls Church, Va., 1981. WBGEVAL, static analyzer; WBGTTRAN, automatic program translator; WBGDOC, automatic program documenter; WBGV&V, program quality verifier. These tools are advertised as portable and reliable.

Mr. Harrison is the director of the Management Technology Center, Sterling Systems, Inc., in McLean, Va. He is responsible for the development of SYSCON, a comprehensive software portability management technology.

Dr. Walker is president of WBG, Inc., of Vienna, Va. He is the author of Managing Software Reliability: The Paradigmatic Approach.

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IN LOVE WITH LEARNING

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Minkler has been programming for 15 years, and he loves it. He didn't set out to become a programmer. He had one course in FORTRAN in college but his primary interests lay in math, psychology, and philosophy. "I skipped around a lot. I couldn't seem to think of anything to do that was important enough. I quit after three years when I realized I was only staying in to avoid the draft."

"I knew I wanted to live in New York City," so, at 22, armed with $200 from his parents, he left his North Carolina home for New York where he landed a job with IBM's (then) Service Bureau Corp. There he learned to program in APT, the standard numerical control language. "I enjoyed programming from the very beginning."

After 1 1/2 years with SBC he went into business for himself as a contract programmer. He taught himself COBOL. "One of my first programs was for a child care information system for a New York City agency. It was written in COBOL with me learning as I went along."

In addition to programming, Minkler's loves include psychology and junk mail. All three have a lot do do with what he's up to today—running the Foundation for Software Engineering in Tempe, Ariz. Part of his work is still contract programming. The rest is conducting structured COBOL Tools Workshops designed to increase programmer productivity.

"In 10 working days," proclaims his literature, "your programmers will create new programs at a rate exceeding 120 lines of high quality code per day; enjoy their work as never before; never again complain about the drudgery of COBOL coding; eagerly maintain programs developed after the workshop."

A piece of junk mail took Minkler from New York to Arizona, a fourth love in his life. It was a flyer promoting a conference on Neuro-Linguistic Programming (NLP, which has nothing to do with programming computers) in Scottsdale in October 1979. He called a number on the flyer merely to get some information on NLP and found himself talked into attending.

"It was like coming home," said Minkler, who had been in Arizona only once before in his life, at the tender age of one year. "I knew this was where I would live." He wound up 12 years' worth of activity in New York in two weeks and moved west.

He took up NLP in a big way, becoming a licensed NLP practitioner. He currently uses NLP in his foundation's workshops. Minkler describes NLP as a series of techniques that can be used to improve any kind of communication. "It's called reframing. It's based on a belief that all behavior is positively motivated and you have to separate intention from method." In his workshops he uses it to break down resistance he gets from more experienced programmers.

Part of Minkler's workshop package is a license to use his Speed COBOL, something he developed eight years ago and has rewritten five times. It consists of a number of reusable routines and trunks which, he says, cut programming time in half. But, he adds, "the quality improvement is greater than the speed improvement."

He teaches the use of "dinky' data names. That enables them to be able to write more, to be more descriptive." Minkler said the hardest thing to get across is not paying attention to how long it takes the computer to do something. "I tell them to forget about computer time entirely, that their time is more valuable."

Minkler has two separate prices for his workshops—for in town and out-of-town. "I don't really like to go out of town." Phoenix area companies pay $7,500 for the first workshop (Speed COBOL included) and $4,500 for each additional workshop. For out-of-towners it's $11,000 for the first and $7,000 each additional.

More than one workshop per firm might be needed because Minkler works only with small groups of programmers, a maximum of six at one time. And a client company gets one or more of its production programs worked on at the same time.

Minkler puts the pleasures of programming ahead of systems analysis. Bored programmers often migrate to systems analysis, he says. But he feels his structured training course has a lot of analysis in it. "Very often programmers come out of the workshops being better analysts than the analysts."

Does Minkler prefer programming or teaching? "It's like asking me what kind of potatoes I like best. I like french fries and baked potatoes."

—Edith Myers
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STAT MUXES GOOD ENOUGH TO BE CALLED RIXON

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>DCX815 STAT MUX</th>
<th>DCX836 STAT MUX</th>
<th>DCX840 NETWORK MUX</th>
<th>DCX850 SWITCHING MUX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Compatibility</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>Input Channels</td>
<td>4 to 8</td>
<td>4 to 60</td>
<td>4 to 240</td>
<td>4 to 240</td>
</tr>
<tr>
<td>17 Input Speeds, 60 to 9600 bps</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>Composite Links</td>
<td>1</td>
<td>Up to 15</td>
<td>Up to 14</td>
<td></td>
</tr>
<tr>
<td>EIA Controls (4 FDX/Channel)</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>Automatic Baud Rate Detection</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>Down Line Loading</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>Flow Control</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
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<tr>
<td>Buffer Overflow Control</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>Channel Test — Non-interfering Validation</td>
<td>✅</td>
<td>✅</td>
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</tr>
<tr>
<td>Buffer Size (BYTES)</td>
<td>5.5 K</td>
<td>64 K</td>
<td>256 K</td>
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<tr>
<td>Link Statistics Reporting</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>User Controlled Networking</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
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<tr>
<td>User Controlled Switching</td>
<td>✅</td>
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<tr>
<td>Port Contention</td>
<td>✅</td>
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<tr>
<td>Automatic Rerouting</td>
<td>✅</td>
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<tr>
<td>Event Log</td>
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<tr>
<td>Connection Statistics</td>
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<tr>
<td>Network Supervisor Terminal</td>
<td>✅</td>
<td>✅</td>
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<td>Enhanced Network Statistics</td>
<td>✅</td>
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</table>

...and many more features are common to all of our DCX Statistical Multiplexers.

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CIRCLE 124 ON READER CARD
HARDWARE

OFF-LINE
GE's Electronic Components Div. proudly announced the first six-pin optocoupler to meet the tough German VDE safety standards. Along with the announcement came a lovely 8 by 10 color photo showing a stein of beer, with a score or so of the optocouplers floating on the beer's frothy head. Hiding in the background: two bottles of Tuborg — a Danish beer, also brewed in the States.

To protect its name and maintain a reputation for service and support, Apple Computer has cracked down on mail order outfits peddling Apples. Dealers have been required to sign contract modifications banning mail order sales. Those refusing the modification have had their dealership agreements revoked. "This action will benefit both Apple and its customers," states A.C. Markkula, Jr., president and ceo of Apple. "Mail order sales are neither suited to providing consumer education nor structured to provide the consumer satisfaction that has become associated with the Apple name. Accordingly, Apple will no longer sell to dealers engaging in mail order sales of Apple products."

Avco Computing Services of Wilmington, Mass., has added a second 3033 Attached Processor system to its existing complex. Avco says its dual configuration of 3033 APs will have a total processing speed of nearly 20 MIPS, doubling Avco's throughput capacity. An extra benefit seen by Avco is increased availability because of full mainframe redundancy.

COLOR PRINTER
The Prism Printer is Integral Data Systems' new entry into the color dot matrix impact printer market. The 132-column printer uses a four-color ribbon consisting of cyan, magenta, yellow, and black; output can be produced in as many as eight colors by combining the three process colors. The printer uses the 90-character ASCII upper and lowercase character set, and includes provisions for inclusion of three additional character sets. Printing speed is 150cps, with characters formed in an overlapped, high density 24 by 9 cell. Variable pitch printing is provided at 10, 12, and 16.7 characters per inch; in the latter, densest mode, 220 characters can be printed across a 15-inch page. Proportional spacing in 1/120-inch increments and bold face printing are standard. Interfacing is rs232 with data rates ranging from 300bps to 9600bps; a Centronics-compatible parallel interface is also included. The Prism Printer sells for $1,995. Additional features are planned, including an interface card for several personal computers—Apple II and III and the IBM Personal Computer. These interfaces are to have onboard graphics drivers. ID3 also says it is working on software color graphics drivers for personal computers.

TEXT RETRIEVAL
GESCAN 2 is a high-speed, brute force text search and retrieval system made possible by a proprietary LSI text array processor that can literally scan through complete text several orders of magnitude faster than a software-based system. The unit dispenses with keywords, indexing, inverted files, and the like — it actually reads through an entire database looking for a pattern match. Exact match, fixed length "don't care," and variable length "don't care" are supported. If the application lends itself to partitioning documents, up to 256 partitions may be specified, and searches can be restricted to specified partitions. Additional search capabilities include Boolean logic, proximity search (i.e., 13th within 10 characters of Friday), and near-term match, which returns all documents containing at least n of m given search strings. Priced at $249,750, including training and installation, the basic system consists of the text array processor, a 128KB minicomputer, an 80MB disk, two 10MB cartridge disk drives, a nine-track mag tape unit, a printer, and a user terminal. GENERAL ELECTRIC CO., Military and Data Systems Operations, Arlington, Va.

FOR DATA CIRCLE 302 ON READER CARD

COMPUTER
Altos Computer Systems has entered the 16-bit world with an eight-user, Intel 8086-based system that runs a choice of four operating systems, including Xenix, Microsoft's implementation of Bell Lab's Unix version 7 timesharing operating system. With 512KB of main memory, 10MB of fixed disk, and a floppy disk drive for backup, the ACS8600 sells for $12,990. Other configurations are offered with more hard disk and either floppy or mag tape backup. In addition to Xenix, the system can operate under CP/M-86, MP/M-86, and Oasis-16. While predicting that Unix-like operating systems
HARDWARE

will become the standard for 16-bit systems. Altos offers these other systems to maintain compatibility with existing applications. Programming languages supported include FORTRAN, and several versions of COBOL, BASIC, and Pascal.

ACCS8600 hardware centers around three processors: the 8086 for system and application processing, an 8089 for I/O and DMA, and, optionally, an 8087 for floating point arithmetic. Memory includes error detection and correction, and is addressed in blocks of 64KB up to a maximum of 1MB. A memory management unit treats the 1MB address space as 256 pages of 4KB. ALTOS COMPUTER SYSTEMS, San Jose, Calif.

FOR DATA CIRCLE 303 ON READER CARD

APPLE ACCESSORY

Not too long ago, a friend told us that he was about to install a fan in his fully stuffed Apple II because he was quite concerned about all the heat generated by his Z80 Softcard, disk controllers, modem, printer interface, and other plug-ins. Tovatech may have a passive solution to his problem, in the form of the Ventop, a louvered, metal cooling panel that replaces the standard plastic cover on an Apple II. Ventop, says the vendor, will take care of dissipating heat buildup without requiring the user to install a fan. The Ventop sells for $45, plus $3 for shipping and handling. TOVATECH, Mountain View, Calif.

FOR DATA CIRCLE 306 ON READER CARD

HARDWARE SPOTLIGHT

INTERFACE LOOP

Hewlett-Packard has taken the basic listener/talker/controller philosophy of its HP-IB (aka IEEE-488 GPIB) and scaled it down from a high-speed parallel interface to a low power, low cost, portable serial Interface Loop dubbed the HP-IL (HP-Interface Loop). As an indication of the cost, power, and portability goals of HP-IL, Hewlett-Packard's first announced controller for the loop is the top of the line HP-41 handheld computer which can control a loop of up to 30 devices; HP-IL architecture will allow controllers to address as many as 960 devices. As with HP-IB, the new Interface Loop will become a corporate standard: HP's Instrument Division has announced its first HP-IL-compatible product, the $695 Model 3468A Digital Multimeter.

HP-IL is a closed loop architecture in which messages traverse the entire loop at speeds of up to 5kbaud. For links of up to 10 meters, zip-cord cables are used; links of up to 100 meters are possible using shielded cables. Each device interfaced to the loop includes a repeater; each message is received, acted upon if the device is selected, and passed on down the loop. Errors are easily detected because each message makes a complete circuit, returning to its point of origin. As with HP-IB, three classes of devices may be active on the loop: one controller, one talker, and one or more listeners.

To kick things off, HP has developed a number of HP-IL-compatible products. There are three interface modules, one for the HP-41 ($125), one for the Series 80 personal computer (about $295), and one for third parties, allowing them to interface their equipment with HP-IL. The third-party interface is offered in a prototyping kit for $395, or $1,295 for a 10-component pack. A digital cassette recorder, capable of storing 128KB on a miniature cassette, sells for $550, and a 24-column thermal printer/ploter goes for $495. The printer/ploter can print an HP-41 program in bar code readable by the currently available optical wand. To conserve power, the cassette drive and printer/ploter both have a standby mode that allows the controller to selectively power up or down the unit. New plug-in modules will be offered for use with the HP-41. The Extended I/O ROM supports the digital cassette drive, printer/ploter, and other I/O devices; it will become available in the second quarter for a price of $75. The Time Module is a quartz clock that can be used to collect data at specified times or intervals; it sells for $75. Additional HP-IL goodies in the works include an 80-column impact printer and interfaces for video monitors, RS232 devices, and GPIB devices. HEWLETT-PACKARD CO., Palo Alto, Calif.

FOR DATA CIRCLE 300 ON READER CARD

LOCAL NET ADDITIONS

Datapoint's Attached Resource Computer system, which started out in 1977 looking like nothing more than an ingenious way to build an incremental network of small computers, seems today to be perhaps the most advanced offering in the "integrated office" marketplace, surpassing all contenders, including Ethernet, in currently available functions. Since the initial announcement, Datapoint has added voice and data communications support by integrating its Infoswitch equipment into ARC, provided word processing and document archiving and retrieval, and added a new high-end processor—the 8800—and a new operating system—RMS.

Three new functions are now offered for ARC: color graphics, laser printing, and multiprotocol facsimile. The 9680 Color Business Graphics (CBG) system is a turnkey system that lets network users create, modify, store, display, print, and photographe color graphics. The basic system comprises a $12 by 482 raster scan display, input tablet and stylus, and system control- ler; options include a color dot matrix printer, and two film recorders, one for 35mm format, and one combining 35mm and 8 by 10 Polaroid prints and transparencies. Each picture can include up to 16 colors (selected from a choice of 16 million). Images may be created from data entered at a keyboard or stored in ARC files, or entered freehand on the graphics tablet. Four predefined chart formats—word, bar, pie, and graph—are available for creating charts from input or stored data. Images may be stored in presentation sequences called scripts. Graphics may be stored in libraries in standard ARC file format. Output may be directed to the desired device, and entire scripts can be generated with a single command. The 9680, including controller, monitor, and tablet, sells for $30,000. The 9694 color dot matrix printer sells for $15,000; the 35mm film recorder is $10,000, and the combined 8 by 10 and 35mm recorder is $20,000. While Datapoint's 9660 Laser Printer isn't the first or fastest on the market, it does have some features we haven't seen before. Printing at 20 surfaces per minute (roughly 1,300 1pm), the 9660 can intermix up to 32 fonts per page, select paper from any of five input drawers (selected by name, not address, as each tray is coded), and deliver output into any of up to 80 output bins. The 9660 also features secure output: output bins can hold lock boxes, and the machine is smart enough to make sure the lock box is in place before delivering confidential documents. The standard 9660 comes with 10 output bins, and seven additional sets of 10 may be added. The basic printer sells for $65,000, with a $420 maintenance charge, plus 2.6¢ per monthly copy in excess of 10,000.

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CIRCLE 125 ON READER CARD
files, and local printing on the 9660 laser printer are possible with the 9498 Facsimile Communications Interface. The PCI connects to any Datapoint processor running the RMS operating system—either stand-alone or ARC connected. The unit accepts analog fax input, in any of three formats—US1, CCITT Group I or II—and sends it on to the Datapoint processor via an RS232 interface. CCITT Group III digital format is available as an option. Messages can be saved on disk for delayed transmission (such as after communications interface for linking the unit is known as the 9498/1112 and sells for $7,450. DATAPONT CORP., San Antonio, Texas.

FOR DATA CIRCLE 301 ON READER CARD

COMMUNICATIONS INTERFACE

The IF-11/3780 is a microprocessor-based communications interface for linking PDP-11s (and VAXS in emulation mode) to IBM mainframes. The unit plugs into the PDP-11's back plane, and provides two independent 2780 or 3780 output channels that can run at data rates of up to 9600bps. IF-11/3780 handles code conversion, translating ASCII to and from EBCDIC, and includes an optional "transparent" binary data transfer mode. The interface takes care of 2780/3780 processing, including line interrupts, block check sums, space compression and expansion (for 3780 operation), multiple record transmission and reception, and automatic retry and retransmission. Data transfers between the PDF-11 and the interface are made through DMA. The IF-11/3780 operates under the control of RSX-11M and a driver program supplied with the unit. A single IF-11/3780 sells for $8,000. ASSOCIATED COMPUTER CONSULTANTS, Santa Barbara, Calif.

FOR DATA CIRCLE 307 ON READER CARD

TERMINALS

Lear Siegler has rolled out three new CRT terminals: the $695 ADM 21 editing terminal packaged in the company's "clamshell" enclosure; the $895 ADM 24 with ergonomic packaging and extended ADM 21 functionality; and the ANSI-compliant, $1,195 ADM 36 which offers a 24-line display of either 80 or 132 columns.

Both the ADM 21 and 24 operate in either conversational or block mode, and offer editing capabilities including clear screen, erase line or page, character insert and delete, and line insert and delete. Both communicate at standard data rates ranging from 75bps to 19.2Kbps. Either can be had with a green or white phosphor screen—the standard size is 12 inches (15 inches, optionally, on the ADM 24). Programmable function keys are provided on both models. The 24 also offers a 48-line display memory, horizontal split screen, and smooth or jump scrolling. Limited graphics capabilities are available for both models.

The ADM 36 also comes in an ergonomically package, with detached keyboard and a choice of 12-inch or 15-inch screens. In addition to U.S. ASCII upper and lower case characters, the adm 36 includes seven separate European character sets. Other features include editing functions, double high and double wide characters, keyboard setup of operating parameters, and VT-52 code compatibility. LEAR SIEGLER, INC., Data Products Div., Anaheim, Calif.

FOR DATA CIRCLE 305 ON READER CARD

COMPUTER

Apple Computer has essentially re-released its trouble-plagued Apple III personal computer, having doubled its main memory capacity to 256K and created a new release of the shaky SOS operating system. At the same time, the company has added a 5½-inch Winchester disk subsystem, and added or enhanced available applications software. Apple III pricing also has been pared back from the figures originally announced. The new price for an Apple III with 128K of memory and the revised SOS 1.1 operating system is $3,495; with a monitor and BUSINESS BASIC, the price is $3,945.

The Profile Personal Mass-Storage System is a 5MB, self-contained unit with an intelligent controller. It uses Winchester technology, includes its own power supply, and comes with interface card and driver software. It requires an Apple III with at least 128K of main memory, and SOS 1.1. Profile sells for $3,495. APPLE COMPUTER INC., Cupertino, Calif.

FOR DATA CIRCLE 308 ON READER CARD

EIGHT-INCH WINCHESTERS

Shugart Associates has come out with its second series of eight-inch Winchester disk drives, which offer faster access to data while maintaining an upgrade path from the existing SA1000 series. The new SA1100 line initially has two models: the SA1104 (two platters, 20.3MB unformatted, 16MB formatted), and the SA1106 (three platters, 33.9MB unformatted, 26.6MB formatted). The SA1100 series uses a new head positioning system which provides a 35msec average access time (compared to the SA1000's 70msec average access time). The new drives are physically and electrically compatible with the SA1000 series, and, like the SA1000s, they are command bus compatible with Shugart's SA801/851 line of eight-inch floppies. Additional key specs of the SA1100 series include 4.34Mbytes transfer rate, 10msec track-to-track access time, and 70msec maximum access time. In lots of 500, the SA1104 sells for $1,550, and the SA1106 is $1,875. SHUGART ASSOCIATES, Sunnyvale, Calif.

FOR DATA CIRCLE 309 ON READER CARD

DESKTOP COMPUTER

Monroe Systems For Business coined a new term to describe its initial entry into the small business microcomputer market, the Occupational Computer Model 8820. Designed and manufactured by Monroe, the 8820 comprises a Z80-based cpu with 128K of RAM, amber-phosphor nine-inch (diagonal) screen formatted as 24 lines of 80 characters, 93-key keyboard including typewriter, function, cursor control, and numeric keys, and integral dual-floppy drives (total on-line capacity: 640Kb). The OC 8820 also has three 80x32 ports with programmable protocols; one is for communications, while the other two are for attaching peripherals. Monroe includes its own operating system, extended BASIC, and ISAM file management package with the 8820; CPM and Pascal are available as options as well as adaptations of WordStar, DataStar, InfoStar, and SuperCalc. Sold through Monroe's 350 branch offices, the OC 8820 lists at $4,385. MONROE SYSTEMS FOR BUSINESS, Morris Plains, N.J.

FOR DATA CIRCLE 310 ON READER CARD
GDC High Speed modems... more revolutionary systems products from The Networking Company.

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Building a total datacomm network is as easy as GDC.
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**Plus Many Other Good Reasons!**

The reasons start with DILOG’S (Distributed Logic Corp.) full time engineering and design staff. *Not outside suppliers*. That means when you contact DILOG for product selection or after sale service, you’ll get "first hand" assistance... along with years of experience manufacturing μP based controllers that interface with DEC 11 CPUs.

The intelligent products you’ll discuss all utilize common proprietary architecture and DILOG automated design techniques — products with exceptional reliability and cost efficiency... mostly available from stock. And when you plug a DILOG controller into your DEC CPU it's ready-to-run because it's fully operating system software compatible.

These high performance data storage interface products also feature • minimum bus/space requirements • up to 60% less power • 10 to 50% lower cost • automatic self-test... and numerous other features for easy system integration.

Consult the DILOG/disc-tape compatibility table for your needs. Then ask for detailed data on existing, or future products from DILOG... #1 in single board DEC 11 compatible disc/tape controllers.

Distributed Logic Corp., 12800-G Garden Grove Blvd., Garden Grove, CA 92643, Phone: (714) 534-8950 • TELEX: 681 399 DILOG GGVE

### DISC/TAPE DRIVE MANUFACTURER COMPATIBILITY CHART

<table>
<thead>
<tr>
<th>MAGNETIC TAPE</th>
<th>DISC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1½” REEL-TO-REEL</td>
<td>2315/5440/RK05</td>
</tr>
<tr>
<td>CMD CARTRIDGE MODULE</td>
<td>SMD STORAGE MODULE</td>
</tr>
<tr>
<td>2315/5440/RK05 CARTRIDGE CLASS</td>
<td>WINCHESTER 5¼”, 8” OR 14”</td>
</tr>
<tr>
<td>1½” TAPE CARTRIDGE</td>
<td>FLOPPY DISC DRIVE</td>
</tr>
<tr>
<td>AMPLEX</td>
<td>AMPLEX</td>
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<tr>
<td>CIPHER</td>
<td>CIPHER</td>
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<tr>
<td>CONTROL DATA</td>
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<td>DIGI-DATA</td>
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<td>TANDBERG DATA (IDT)</td>
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<td>WANGCO</td>
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<td>CENTURY DATA</td>
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<td>BASF</td>
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UPDATES

Quietly, a Japanese company has begun exporting a COBOL documentation generator to the U.S. Japanese giant Hitachi has concluded a distribution agreement with Synco of Englewood Cliffs, N.J., for Sydco, as the productivity tool is known. It became available to IBM and compatible mainframe users last October.

First Bank System, Inc. of Minneapolis/St. Paul has selected the French videotex system, known as Télétel, to provide what is claimed to be the "first fully transactional videotex system in this country." Test plans call for the installation of 285 terminals, some in the suburbs of the Twin Cities, but most in agricultural areas around three North Dakota cities: Fargo, Wahpeton, and Valley City. Fargo got 15 pilot terminals in December, with the rest to be installed over a three-month period.

RCA's Government Systems Div. has given Plessey Peripheral Systems the nod to supply $2.5 million worth of front-end data communications systems for use in the Postal Service's Electronic Computer Originated Mail (E-COM) service. Scheduled for service this year, E-COM will let mailers send communications over common carriers to 25 Serving Post Offices around the country. At the SP0s, messages will be automatically printed, stuffed into first class envelopes, and delivered. The P.O. claims that E-COM will provide two-day service anywhere within the continental U.S. The Plessey front end will accept messages in IBM 2780/3780 protocol or CCITT X.25.

MICRO APPLICATIONS

Instant Software has a pair of interesting new programs, one for the TRS-80 Models I and III, the other for the Apple. For Radio Shack users, the cassette-based Electronic Breadboard provides an automatic aid to designing and verifying analog circuits. Technicians, engineers, and students can evaluate voltages, currents, impedance, and frequency responses by using the program, thus avoiding the time-consuming task of actually building and then debugging a breadboard. The package requires a 16kb computer. The program comes on cassette tape and includes a provision for saving designs on tape. It is priced at $49.95.

OFFICE AUTOMATION

DEC is the latest mini maker to enter the combined office and data processing markets with the introduction of its Office Plus concept, combining data processing with word processing, electronic mail, and phototypesetting functions in VAX-hosted systems and networks. Office Plus is bound together with DECmail, a VAX electronic mail system; it also includes the previously announced DEcmate, DECword, DEctype, and DEcset, an electronic publishing system that can drive phototypesetters or laser printers.

Comprising text editing (a subset of DEcword, DEcmate, and ws200 word processing editors), electronic mail, and filing capabilities, DECmail is designed to operate on the 32-bit VAX series of computers. It is for offered $20,000 fully supported or $12,000 for a license only; DECmail also can be had for use with VT100w word processing terminals, with prices ranging from $20,180 for software license and four terminals to $183,680 for the software with support for up to 96 terminals. Deliveries are slated for February. While the VT100w is DEC's terminal of choice for use with DECmail, any of the firm's word processors, printing terminals, and the entire VT100 family can be used to access DECmail. The system is designed for both neophytes and experienced personnel, since it offers both direct command-mode operation as well as menu-driven use. Computer-based training and a help function that can be called up with two keystrokes simplify bringing new users up to speed.

DECmail uses the "electronic file cabinet" concept in which each user has an electronic file drawer containing a number of "folders." Each user has an "unread" file for incoming messages, and an "un­sent" folder for messages created but not yet mailed. Once sent, the message moves into a "sent" folder in the originator's file drawer, and the unread folder in the recipient's file drawer. The user can create other folders as needed; old memos can be recalled from the file and incorporated into new messages. A search and editing facility allows users to set up tickler files by date. Each user also has a "wastebasket" where discarded messages go; these messages can be retrieved until the user dumps his wastebasket.

SOFTWARE SPOTLIGHT

DIGITAL EQUIPMENT CORP., Maynard, Mass.

FOR DATA CIRCLE 325 ON READER CARD

In an entirely different vein, the Apple package teaches Russian. The diskette-based package includes two sets of programs. The first teaches the Cyrillic alphabet, initially introducing those characters that have English counterparts, then presenting the more alien characters bit by bit. The second set of programs helps develop
SOFTWARE AND SERVICES

the student’s Russian reading ability and increase his or her vocabulary. The package sells for $24.95. INSTANT SOFTWARE, Peterborough, N.H.

FOR DATA CIRCLE 326 ON READER CARD

DECISION SUPPORT

Present is Data General’s software package to support management needs for data selection, manipulation, computation, and presentation. Users may interactively request information from a database or system file using multiple selection criteria. Requests can generate output in the form of new data files, screen-displayed output, printed reports, and both screen and hardcopy graphics. Present combines in one package for the business professional the functions generally handled by separate graphics, query, report writing, and data extraction programs. DG also says that Present should help dp professionals build applications, such as periodic business reports or ad-hoc graphics, without resorting to conventional programming languages. Present works in conjunction with DG/DBMS, the company’s CODASYL-compliant database system, and operates under AOS or AOS/VS. Graphics capabilities are optional, requiring the Trendview graphics package. Communications—both local and remote—are available to Present users whose systems have DG’s Xodiac network management software. Depending on configuration, Present licenses for $3,000 to $11,000—$3,000 for Present, $6,000 for Present with the DMBS option (both for AOS systems). For AOS/VS systems, the respective prices are $4,000 and $11,000. DATA GENERAL CORP., Westboro, Mass.

FOR DATA CIRCLE 327 ON READER CARD

CP/M COMMAND

A command file from Stok Computer Interface allows CP/M users to specify a string of multiple CP/M commands for execution in sequence. With DO.COM, the user can type a command stream, then walk away and let the machine process each command—as opposed to typing a command, waiting for it to complete, then typing the next command, etc. An example would be DO ASM PROG1; LOAD PROG1; ASM PROG2; LOAD PROG2. DO.COM is supplied with 8080 source code on 8-inch standard CP/M soft sectored diskette or Superbrain 5½-inch diskette for a price of $29. STOK COMPUTER INTERFACE, Woodside, N.Y.

FOR DATA CIRCLE 328 ON READER CARD

BUDGETING

Easy-Plan is a simplified, on-line budgeting tool for use with MSA’s General Ledger System. Designed to make budgeting a less tedious task for accountants and financial managers, Easy-Plan allows users to enter budget values, review budget spreadsheets, and pose “what if?” questions, with updated results displayed interactively. English-like planning calculations can be entered by financial users to define budget models, specify relationships, and perform automatic projections using data already held in current General Ledger Budget files. Once the manager is satisfied with his or her proposed budget, the resulting figures can be entered into the G-L database. Easy-Plan is offered with the MSA G-L system for IBM 0S and DOS-VSE environments. It operates with a number of on-line monitors, including TSO, ICCF, and CMS. Pricing ranges from $20,000 to $25,000, depending on options selected. MANAGEMENT SCIENCE AMERICA, INC., Atlanta, Ga.

FOR DATA CIRCLE 330 ON READER CARD

COBOL CONVERSION

Arkansas Systems has developed a COBOL conversion utility to make transferring COBOL programs between IBM mainframes and System/34 a simpler task. Most syntax differences are detected and corrected automatically. The COBOL conversion package runs on the System/34, and currently supports mainframe COBOL compilers operating in a DOS or DOS/VSE environment. The package sells for $850. ARKANSAS SYSTEMS, INC., Little Rock, Ark.

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JOB COSTING
Kommand Online Costing (OLC) is an additional capability of Pace Applied Technology's Kommand family of costing and chargeback systems. Capable of operating standalone or in conjunction with the Data Acquisition System of the Kommand Job Accounting System, OLC automatically attaches cost information to jobs and job steps as they run, both on-line for TSO sessions and at the end of batch jobs. OLC provides users and management with a better picture of where the money is going, and it can help programmers identify and correct bottlenecks in their systems. As an add-on to the Job Accounting System, OLC sells for $3,000; as a standalone program it goes for $6,000. PACE APPLIED TECHNOLOGY, INC., Manassas, VA.

FOR DATA CIRCLE 331 ON READER CARD

HASP COMMUNICATIONS
MDI/Mohawk Data Sciences has a new HASP Multi-Interleaving/Interleaving Terminal Emulator package for use on its Series 21 line of distributed processing systems. The emulator can communicate (at up to 9600bps) with hosts running a compatible JDE system, such as HASP 4, RES, JES2 or JES3. EBCDIC transmission—with or without transparency—is supported. Other features include message blocking/deblocking for records of up to 4,096 characters, and data compression and decompression. Local spooling is also supported. Multileaving allows the concurrent operation of up to five I/O devices: console, reader, printer, printer, and punch; interleaving allows simultaneous bidirectional communication. The package is offered for $25 a month per system, or $2,500 per customer for unlimited use. MDS-MOHAWK DATA SCIENCES, Parsippany, N.J.

FOR DATA CIRCLE 334 ON READER CARD

FINANCIAL MODELING
Since their introduction, financial modeling systems for microcomputers have become perhaps the most popular business applications in the realm of micros. Unfortunately, real memory constraints have limited the size of the models appropriate for such systems—it gets mighty aggravating to spend several hours setting up a model, only to run out of memory just as you are adding the final few model statements. Ferox Microsystems now offers a package with virtual matrix capabilities, allowing the definition of spreadsheets of up to 32,000 cells. Dubbed Micro-DSS/Finance, the package handles such chores as "what if" financial analysis, new venture analysis, financial statements, budgets, and the likes. Written for the Apple II with 64KB of memory and Pascal, the package also includes report generation, command files, and color graphics support. It sells for $1,500. FEROX MICROSYSTEMS INC., Arlington, VA.

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JANUARY 1982 165
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A HISTORY OF COMPUTING IN THE TWENTIETH CENTURY
edited by N. Metropolis, J. Howard, and Gian-Carlo Rota

The making of history, as the late professor Kenneth O. May notes in this volume, is somewhat different than the actuality of events. While theoretically we should all be concerned with the invention of computers, as May reminds us, it is the development of computers and computing that is the really important happening.

Prof. May was speaking at the International Research Conference on the History of Computing, held at the Los Alamos Scientific Laboratory, June 10-15, 1976. The original papers from that conference have been polished, tightened, shined up beyond belief, and reprinted in this delayed but thoroughly useful collection of essays.

In the intervening years, some of the participants have retired, a few have died, and a great deal of additional material about the history of computing has appeared. But this conference was the first to look at the history in a major conference with heavyweight participants. One cannot help but wonder if the editors have helped or hindered the growth in awareness of computer history by the long delay in putting this book together.

It is clear, however, that a serious awareness of computer history can be said to have truly begun that week in 1976.

It would be almost impossible to go through the 38 papers in the book and offer yeas or nays about each. Some are long; others are short. Some are highly academic articles that deal with the inner workings of now long-forgotten machines or languages; others are extremely personal memoirs that offer some of the character of the people involved.

One of the strong points of the book and the conference was the special effort to bring out the international flavor of the early developments. While most Americans know about the work of Aiken, Eckert, Mauchley et al., few are very familiar even today with the developments in the U.S.S.R., or with Zuse's work in Germany. In point of fact, it was at this conference that a great many supposed experts were startled to find out just how far the U.K. had come with its COLOSSUS systems.

For those who have forgotten, the U.K. apparently made a decision to keep COLOSSUS secret, and this attitude carried forward until just a few years ago. Thus, knowledge of a monumental landmark was confined to just a handful of people, mostly those who had worked at Bletchley Park on code breaking during World War II.

If you are looking for a final, definitive statement regarding the role of John von Neumann, you won't find it in this book. It is clear that von Neumann was a carrier, a transmitter of ideas. What he picked up in one laboratory would be left to ripen in another. It will never be clear just how much of von Neumann's thinking was original and how much was mere reshaping of the ideas of others. There's no final answer here to the stored program controversy, nor will there ever be.

If your particular pleasure is programming languages, the almost "Olympian" (as the editors describe it) survey of early programming languages by Knuth is highly recommended. It is a detailed, carefully written, well-documented piece worthy of careful reading.

Everett's short paper describing WHIRLWIND really doesn't do justice to the massiveness of the effort, nor does it describe in any detail the way Forrester switched the project from a flight simulator to digital computation. But the thousands of SAGE graduates still in the industry can read it to find out where the concepts originated. Bits of the WHIRLWIND still exist in Maynard, Mass., thanks to Ken Olsen, now president of DEC but long ago the designer of the memory circuitry on WHIRLWIND.

Did you think remote computing was invented in the 1950s at MIT? Wrong. See the Stibitz paper on early relay computers at Bell Labs. In September 1940, A Teletype at Dartmouth was connected to a computer in New York.

How did IBM build machines in the early years? See Hurd's extremely interest-
BOOK BRIEF

MICROELECTRONICS AND SOCIETY
edited by Trevor Jones

There is a continual dialog in Scandinavia, Japan, and the U.K. over the impact of microelectronics on contemporary society. This slim volume is a set of brief essays by leading U.K. authorities with something to say about the social issues surrounding microelectronics proliferation.

In the United States there has been almost no discussion of such subjects as the decline of long-term, high employment industries (steel or automobiles), the potential impact of continued high unemployment on basic social structures, the way in which education should integrate computing, and the possible dangers of artificial intelligence gone out of control.

For American readers not familiar with the issues and the critical trade union responses, the Cockcroft essay is especially recommended, even though the author assumes some understanding of the U.K. union establishment.

A therton's piece dealing with the penetration of microcomputers into secondary education is highly recommended for educators and school officials. Even with tight budgets and the ongoing pressure to reduce expenditures, much can be done without heavy investments. American readers will be startled by the picture of an unbalanced U.K. Like this country, Great Britain has some school districts forging ahead while others fall behind.

Miche's brief and somewhat complicated discussion of the AI world and its potential dangers to society has some of the now predictable AI advertising and public relations cant. Little is said to justify the expenditures of the past two decades. On the other hand, Miche describes some of the more promising developments from this computing schnip with more than willing to own up to potential dangers.

It will surprise many readers to note the number of important references and suggested readings included with these essays. To an American, it may be a great shock to discover how few U.S. publications are cited. These issues, important as they are, do not seem to attract much attention on this side of the Atlantic except for the outraged screams of technocrats demanding more and more progress. DATAMATION has twice published pieces suggesting that there may be some problems.

Philip H. Dorn
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SOURCE DATA

ing. Traditional manufacturing is giving way to service- and information-based economies. It is past time for Americans to begin to consider such fundamental cultural questions as the meaning and importance of work, the structural changes resulting from the decline of labor-intensive manufacturing, and the impact of microelectronics on society. This brief set of readings can help create some solid underpinnings for any such discussion. The Open University Press, England; or Methuen Publications, Agincourt, Ontario (1980, 240 pp., $18.75).

—P.H.D.

USING COMPUTERS—A MANAGER’S GUIDE by Malcolm Peltu

Malcolm Peltu, London correspondent for this magazine, has written a book “aimed at any person with responsibility for putting computing power to effective use in any organization, big or small. It assumes no previous computing knowledge, and explains why good management practices rather than technical expertise are the key to the success of a computing project.” Although the book is written for a British audience, the advice should travel well. Section I, “Computing in Perspective,” offers an introduction to the technology, a sketch of the industry, and some lessons on things like human factors and the importance of standards. Section II explains how to go about setting management objectives. Section III details how the reader can prepare for computer service; chapter titles include “Feasibility Studies” and “Technical Evaluation and Specification.” The fourth and final section, “Providing the Computing Service,” gives specifics on things like systems implementation, postimplementation evaluation, and computer service management. The volume also includes a glossary of terms and abbreviations. National Computing Center Publications, Manchester, England (1981, 199 pp., $20). American distributors: International Publications Services, Inc., New York.

REPORTS & REFERENCES

ADAPSO ON TAXATION

The Association of Data Processing Service Organizations (ADAPSO) has published a 129-page survey of the state sales and use tax laws covering computer and computer services transactions in the U.S. The “ADAPSO Sales and Use Tax Survey” is written to ensure that any purchaser or vendor of remote processing services, computer hardware, software, professional services, custom programming, raw computer time, integrated computer hardware/software systems and computer maintenance is paying the right amount of tax for each transaction. Non-ADAPSO members will be charged $150 for the survey; members will receive it automatically. Contact ADAPSO, 1300 North Seventeenth St., Arlington, VA 22209, (703) 522-5055.

DATAPRO REPORTS

“All About Japanese Computers” is a 74-page report containing comparative information on over 200 Japanese-manufactured computers. The report covers 47 minicomputers from 11 vendors, 124 small business computers from 32 vendors, and 35 personal computers from 20 vendors. Prices, specifications, options, hardware, software, and support services are included. The report was excerpted and translated into English from the 3400-page “Nikkei Datapro Computer Files” study, and it is the first in a series of reports on the Japanese computer industry by Datapro. The price is $29; contact Datapro Research Corp., 1805 Underwood Blvd., Delran, NJ 08075, (800) 257-9406.

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The early sun broke through the trees lining the drive that led to a small cluster of buildings. Shivering in the chill of the New England fall, Buzz North, Toasta General’s top engineer, guided his Audi into a parking space. He asked the fuzzy dice hanging on the rear view mirror: “When is a literary hotshot going to write a bestseller about me and my machine?”

Let’s backtrack for a moment.

Toasta General was the brainchild of the gutsy, unpredictable Benito DeBatista. Since 1967, the feisty company had been jabbing a thorn in the side of the polite but staid New England Chef Corp. That thorn was TG’s powerful little 16-slice unit, which could toast NEC’s brand of whole wheat faster than NEC’s own machine. DeBatista liked to boast at annual meetings (held in a circus tent near Manchester) that Toasta General made a machine that could “beat the pants off NEC, then sell them back, allowing for shrinkage and inflation simultaneously.”

But now it was 1981. The toaster industry was getting crowded and the company was managing to hold its own only because of its hungry young whiz kids (“no lunch, period!”), the cutthroat ethics of its marketing/jugular division, and the binary management philosophy of “All work and no pay makes Jack a company boy.”

Now, Toasta General desperately needed a winner: a 32-slice supermini that could walk out the door in jiffy time, like a Harold Robbins’ novel doing a two-step out of a suburban book mart. DeBatista believed in, and also systematically tortured, Buzz North.

As a child prodigy, North had taken apart and repaired his family’s DeSoto, transforming it somehow into a two-door Studebaker. The man made things happen, the kids said near the coffee maker, which often contained 30 doses of gun-grade Benzodrine. He inspired fanatical devotion from his team of engineers, the so-called Ellipsis Group. He nevertheless remained an enigma to the youngsters, seldom speaking to them in the halls, preferring instead to use complicated hand signals.

His hardware team, the Spin and Martys, worked in tandem with Tom and the Thumbs, the shift and subtle promulgators of the mystical microcoder. North promised Ellipsis members stock in the company if the new machine, the Parakeet, became a success. “Stock, a great toaster, and your name in a goddamn bestselling book,” he told his protégés.

The Ellipsis Group worked double shifts over the winter. While the basement maze hummed during the day, North barricaded himself in his office. Frantic, and hallucinating about royal-ties, he called the offices of New York mega-agents: “You don’t understand, Sheldon, I’m quotable. The stuff of electrical legends. I’m a question mark, even to my wife. You’ve got to hook me up with a Smart Guy Writer so he can observe me at close range. We’re talking New Yorker excerpts. I’m talented, eccentric, yet self-effacing. Damn it! I’m good copy.”

At night, North tossed in bed. Nightmares about the Parakeet Project. Bloated faces of electronics teachers from the past. All of them. Laughing at him.

“I hear the demons,” he said to his wife over coffee. “They say I’m wasting pots of Toasta General greenbacks on a pipe dream of a machine. I should have stayed in the hat business. I’m good copy. You don’t understand, Sheldon, I’m quotable. The stuff of electrical legends. I’m a question mark, even to my wife. You’ve got to hook me up with a Smart Guy Writer so he can observe me at close range. We’re talking New Yorker excerpts. I’m talented, eccentric, yet self-effacing. Damn it! I’m good copy.”

But the Spin and Martys knew that they were building a device that made other 32-slice toasters perform like the Rockettes on seconal. Tom and his Thumbs worked 18-hour shifts writing the mind-boggling microcode. A few of them burned out. Daryl “Mr. Nichrome” Webster used cream cheese to scrawl a message for the group on his personal toaster. North found it the next morning:

I’M CRAZEE, NOT ALWAYS FUNCTIONAL
AND OFF TO DEEPER MEXICO

Ferguson took over for Webster and dashed off hot, effortless microcode.

North was enraged by an article in Quest magazine about an Indiana beekeeper with real pluck. “Pluck! I’m the real item! Who needs this pointy-head jerk who gets stung all the time!” That February, when the snow dusted the windowsills, the playful DeBatista sent North a hangman’s noose via interoffice mail.

In March, the whiz kids were starting to bounce off the walls. The Spin and Martys were busy debugging the supermini. If Parakeet was to work, North reasoned, they would have to throw out the rule book. DeBatista was beginning to put the hammer down. Toasta General’s Tuscaloosa plant was rushing along with the Romulus 3000, a machine that could process Roman Meal at unimaginable speed. The whole industry was watching and hoping to see the startup company fall flat. DeBatista said that if New Hampshire couldn’t cut the marmalade, he’d put North to work designing extension cords.

North pleaded for more time. Then, he stepped out of line and requested a reporter who “could eat nuance for breakfast.”

“You don’t understand,” he told DeBatista, who was playing with his cattle prod. “I’m the stuff of good paperback deals. The public is missing page after page of bon mots. Book clubs are quietly weeping.”

DeBatista merely grunted.

The Thumbs finished their microcode. The circuit boards were completed. North knew that the Ellipsis Group could wrap up the whole Parakeet Project in a month. He became more taciturn than ever. His young wizards avoided him. In the lab, he took to striking heroic poses over the two prototypes.
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READERS' FORUM

Finally, all the bugs in Parakeet were found. The Group threw a series of parties to celebrate their success and ward off postcreation blues. They had beaten the money men in Tuscaloosa by three months. The Romulus 3000 had developed circuit board problems and could barely heat Pop Tarts. The Parakeet Project had drawn unanimous praise and promised to make the bottom line black as night.

In New York, at a press conference/breakfast at the St. Regis, Toasta General execs and engineers sat with reporters and nibbled salmon, eggs, and the most beautifully browned triangles of Wonder Bread anyone present had ever seen. North, feeling his oats, grandly accepted congratulations from the circuitry groupies at his table.

Across the room, DeBatista slipped the busboy a sawbuck. The busboy crept to the pedestal where the sleek, 32-slice supermini was displayed and jammed an oversized cheese danish into one of the slots. The machine buzzed and sparked, filling the air with acrid smoke.

North found himself shoved to the front. DeBatista bel­lowed: “You built the kludgey thing. Now fix it! It’s turning that danish into another Piltdown Man.” North plucked a serving fork from a nearby buffet table and jabbed furiously at the offending pastry. The tines struck the painstakingly constructed electronic grid that was the soul of the new machine, and 6,000 volts of Con Ed’s finest raced through North’s body. He ended up on the floral arrangement at the center of the Business Week table and, later in the week, on the cover of that magazine.

He was famous.

—Tim McGinnis
New York, New York

THE TROUBLE WITH NETWORKS

Computer networks are in everyone’s future, the prophets tell us, and will bring about new styles of communication. How will the changes affect us? The following, a personal case study in the sociology of computer networks, may provide a few clues.

One weekend, when I should have been doing something else, and when I had once more made a minor error while working at my computer terminal, I collected my frustrations together into the paper “The Trouble with UNIX” (November, p. 139). Little did I know that I was thereby setting into motion a chain of events that would occupy me for many months. A draft of my article was circulated on a national computer network, and soon brought me fame and insult.

My computer is part of a hardwired campus network of computers that use the UNIX operating system. This local campus network is, in turn, part of a statewide telephone UNIX network that interconnects many campuses of the University of California. The campus network is connected to a nationwide dial-up network of UNIX users, which was started, I believe, by people at various Bell Laboratories in New Jersey and elsewhere. The campus network is also connected to the Defense Department’s packet-switching net­work (ARPANET). In addition to distributing messages, manus­cripts, programs, and documentation, the net also provides a num­ber of “bulletin boards.” These are collections of messages con­structed so that people who are interested in related topics can hold discussions, ask specialized questions of one another, and pass on information thought to be of general interest.

One day, someone logged onto my computer, found the file in which the paper was located, and distributed it through the network bulletin board called “UNIX-wizards..” From there it was distributed over at least one other bulletin board, and probably over many individual messages and to many different locations. Thus,
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REaders' Forum

the paper was sent all over the country, to large numbers of sites and possibly thousands of readers. This was done without my knowledge (and therefore, without my permission, although I would have granted permission had I been asked). In addition, the culprit managed to disguise the transmission so that the source could not be identified.

How did that happen? Well, we run an open computer facility, and users are allowed to look over other people's files. We can and do protect confidential material. The rule is that people may look freely, and if users wish some things to be private, they must protect the access to those files. The location of my paper was well known because I had asked people to read it and give me feedback. The thief was probably someone authorized to use our machine, and probably an expert systems person who had the knowledge and authorization to disguise the source of the transmission.

The first news I had that my paper had been distributed was when a local systems programmer sent me a copy of a message he was sending in response to someone at Bell Labs, agreeing with the Bell Labs person that my article was appalling. The only part of the original message from Bell Labs that I was allowed to see said, "Who is Don Norman and why is he saying those terrible things about me?"

From that point on, things got hectic. A flurry of comments appeared on several of the bulletin boards. The article was a disaster, said one. Another person agreed with many of the observations, but thought "the paper should not be a criticism of UNIX itself, but rather a criticism of how people use UNIX." Some people said the piece was correct. Others claimed it was all wrong, and that anyone who had problems with UNIX didn't deserve to be using it in the first place. Eventually, people discovered my proper network address and began sending mail directly to me, bypassing the bulletin boards. I was flooded with comments. "DATAMATION readers are typically IBM users," said one note, "and they will now say 'You see? UNIX is poorly designed, this psychologist says so. Wake me up when you have an operating system better than IBM's.' . . . I hope that both of you live happily ever after." From Texas, Utah, Toronto, from the various Bell Labs, from California, from Massachusetts—the notes kept coming. Soon I was spending over an hour each morning just reading the previous day's accumulation and answering them. When I printed out all the messages that I had received on a hardcopy terminal, it took 32 single-spaced pages.

The majority of these comments were laudatory. Several people wanted advice on systems they were working on. I had useful interchanges with them and, in the process, clarified my own understanding of the issues. A manager of a major system—call it System X—gave me a computer account on X (and promised to send the manuals), asking me to do a similar analysis on it so that his team could improve it. He did lay down the restriction that I not write a new article called "The Truth About System X." Although we are not yet finished with our analysis (the manuals haven't arrived yet), interaction like this is quite gratifying—the kind of thing one hopes for.

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The most positive interactions, however, took place with people at Bell Laboratories—people who had been on the receiving end of my criticisms. After a somewhat hesitant start, our dialog became quite useful. We have discussed a number of issues and agreed upon some points that need further treatment. I sent them the box describing UNIX that was published alongside my article, and they rewrote it to clarify points and correct errors. They sent me the rebuttal they were writing, and I thought it a good one (it too was published alongside my article). I sent them several papers that I was working on and they sent me reprints of their published papers on UNIX. One of our current graduate students sent descriptions of the menu-driven command interpreter for the UNIX shell that he was developing, and so on. These interchanges have helped clarify issues on all sides, eventually leading all of us to a better understanding of the constraints on system design and release, and to an awareness of the needs and limitations of a wide variety of users.

The weaknesses and the strengths of computer networking derive from the same feature: it is easy to send messages to anyone who has access to the network. Because a new message is so easily generated, it can be composed immediately upon the receipt of one that has aroused the emotions. But if a message is composed in the heat of passion, the passion may distort it, so that the result is not always as effective as one might hope.

The ease with which people can generate additions to the bulletin board and messages to others has another major drawback: electronic junk mail. Many of my colleagues and I have stopped reading the network news and bulletin boards because we cannot afford the time to do so every day. (I did not know my paper had been distributed and would not have discovered the flurry it created had others not alerted me to it.) This will be less of a problem when we have intelligent programs that can aid in browsing through tables of contents, perhaps with intelligent keyword or content specified searches to winnow through the accumulation. Perhaps we can put together some quasi-intelligent text-understanding systems that can help sort through the material. However, until something is done to improve the organization, the very success of these message systems and bulletin boards will threaten their usefulness.

Another interesting social phenomenon that may occur within an organization possessing an effective computer mail system is that people will tend to use it in preference to talking. Computer mail is much more efficient than telephone calls or visits because you can generate it whenever you wish without concern for whether the recipient is in. Similarly, the recipient can read and answer messages at leisure. It is better than postal mail or interoffice memos because it is easier, less formal, and can be almost instantaneous if the recipient wishes it to be. In our laboratory, this sometimes leads to strange behavior. It is not unheard of for one person to see another in the hall and to say “I am going to send you a message,” and then go do so, forgetting that the information could simply have been spoken.

The positive side of these networks overcomes the negative. People can communicate their ideas to others across the country, quickly and effectively. In turn, the recipients can respond, criticizing, sharing, and improving the product. The network communications keep me informed on a variety of issues from substantive research topics to trip and conference schedules. I can count on my colleagues who do read the bulletin boards to alert me to relevant articles, just as I pass on the interesting messages that I receive. Small communities of people with shared concerns can quickly be formed to hold constructive discussion about an issue. The interchanges can be quite effective, in part because of the rapidity with which messages are generated and sent: it only takes a few hours for a comment to spread out over the community.

The unauthorized distribution of my paper has been a useful sociological experience—a true test case of what will indeed be in all our futures: interactive journals, computer bulletin boards, and readily available computer message systems.

—Donald A. Norman
La Jolla, California
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