March 1994

# FOCUS

The Magazine of the North American Data General Users Group

## The transformed computing model

Open,
freely distributed,
sensibly decentralized,
continuously evolving

## In Focus

**Open enterprise computing: Supporting new business models**

**The client-server toolbox**

**Unix Notebook: Internet surfing**

## Plus

**Infos IIFC checkpointing**

**Fine-tuning Unix**

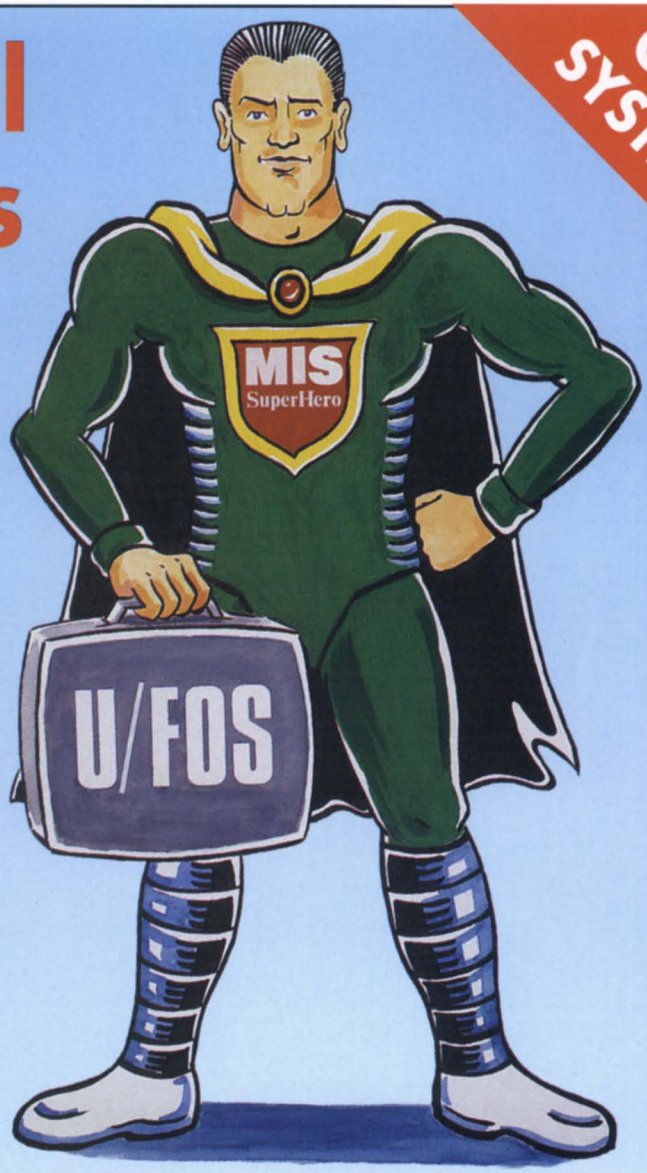
**Data modeling: Ensuring a firm foundation**

Bulk Rate
U.S. Postage
Paid
Permit No. 38
Fulton, MO

# Attention all INFOS® users

OPEN SYSTEMS

# Become an MIS SuperHero with AIM™ Automated INFOS Migration




Based on U/FOS™, the first UNIX implementation of INFOS, the Transoft AIM products and supporting consultancy give you – for the first time ever – a smooth, rapid and cost-effective migration route to a choice of major Open Systems platforms.

## The AIM product set

### U/FOS: INFOS on UNIX:

- full INFOS functionality
- automatic data migration
- added functionality and better utilities.

### UAC: U/FOS Access Converter:

- converts INFOS I/O statements to U/FOS I/O calls.

### UCC: Universal COBOL Converter:

- converts other AOS/VS COBOL code
- to ANSI-standard ACUCOBOL or Micro Focus COBOL.

### APIs for Fortan and C

## The same – only much better

Better database management, better reporting, better COBOL development environment... U/FOS gives you powerful additional features, including improved data compression and checkpointing. We are also adding RDBMS-level data integrity and recovery, plus SQL reporting using our proven U/SQL technology. COBOL users also benefit from the modern, more powerful development environments of ACUCOBOL and Micro Focus COBOL.

## Transoft – the low risk option

Ours is the low risk solution, in terms of both the company and the technology. Transoft is an established, profitable, growth company. It commenced trading in 1987 and revenue and profits have increased every year since. With seven years' experience, Transoft has unrivalled migration expertise and is a leading international supplier of Open Systems tools to the Data General community. With our products and methodology you eleminate the enormous risks, as well as the costs, of re-engineering.

## Largest team

Transoft has the largest team in the world dedicated full time to migrating *your* INFOS applications to *a choice* of Open Systems.

## Benefits and savings – now

Why wait? Get the financial and operational benefits of this Open Systems solution now.

Don't delay, contact us today:
TRANSOFT INC, 1899 Powers Ferry Road, Suite 420, Marietta, GA 30067, USA.
Tel: (404) 933 1965 Fax: (404) 933 3464
TRANSOFT LTD, Nash House, Datchet Road, Slough, SL3 7LR, England.
Tel: 0753 692332 (Int + 44 753 692332)
Fax: 0753 694251 (Int + 44 753 694251)

**TRANSOFT™**

Portability & Productivity

D470C D463 D430C D413 W460 VT320 VT100 TEK4010

SVGA XGA VGA MCGA EGA CGA MDA COMPATIBLES PS/2 AT PC

TEXT BINARY XMODEM YMODEM KERMIT DOS OS/2 WINDOWS DESQVIEW

# Check out EMU/470 Version 5.0!

## Rhintek now provides complete emulation for all current DG Dasher Terminals.

NEW! ❑ Complete D463 Emulation, including: Double high / double wide characters; Selectable 25th line; Downloadable function keys; Tektronix emulation; UNIX mode.

NEW! ❑ D430C Emulation

❑ VT Emulation for DEC, UNIX, and AViiON

❑ PC/TCP Kernel Interface

❑ Scroll back buffer

❑ Network Support

❑ 190+ Macro Keys

❑ Compressed Mode

❑ Built-In Diagnostics

❑ Command Language

❑ Script Files

❑ International Keyboards

❑ Code Pages 850, 437

❑ File Transfers

❑ Complete Printer Support

❑ Auto Dial, Logon & Logoff

***Very, Very fast!***

**EMU/470**

DG Color Graphics Terminal Emulation for IBM Micros

## Then call 1-800-234-4546 to get your own copy of Rhintek's EMU/470, Version 5.0.

Rhintek offers products spanning the entire Dasher Terminal Line, priced from $95 to $249. We offer volume discounts and unlimited free technical support. Call us and we'll FAX the Facts! Your complete satisfaction is always guaranteed.

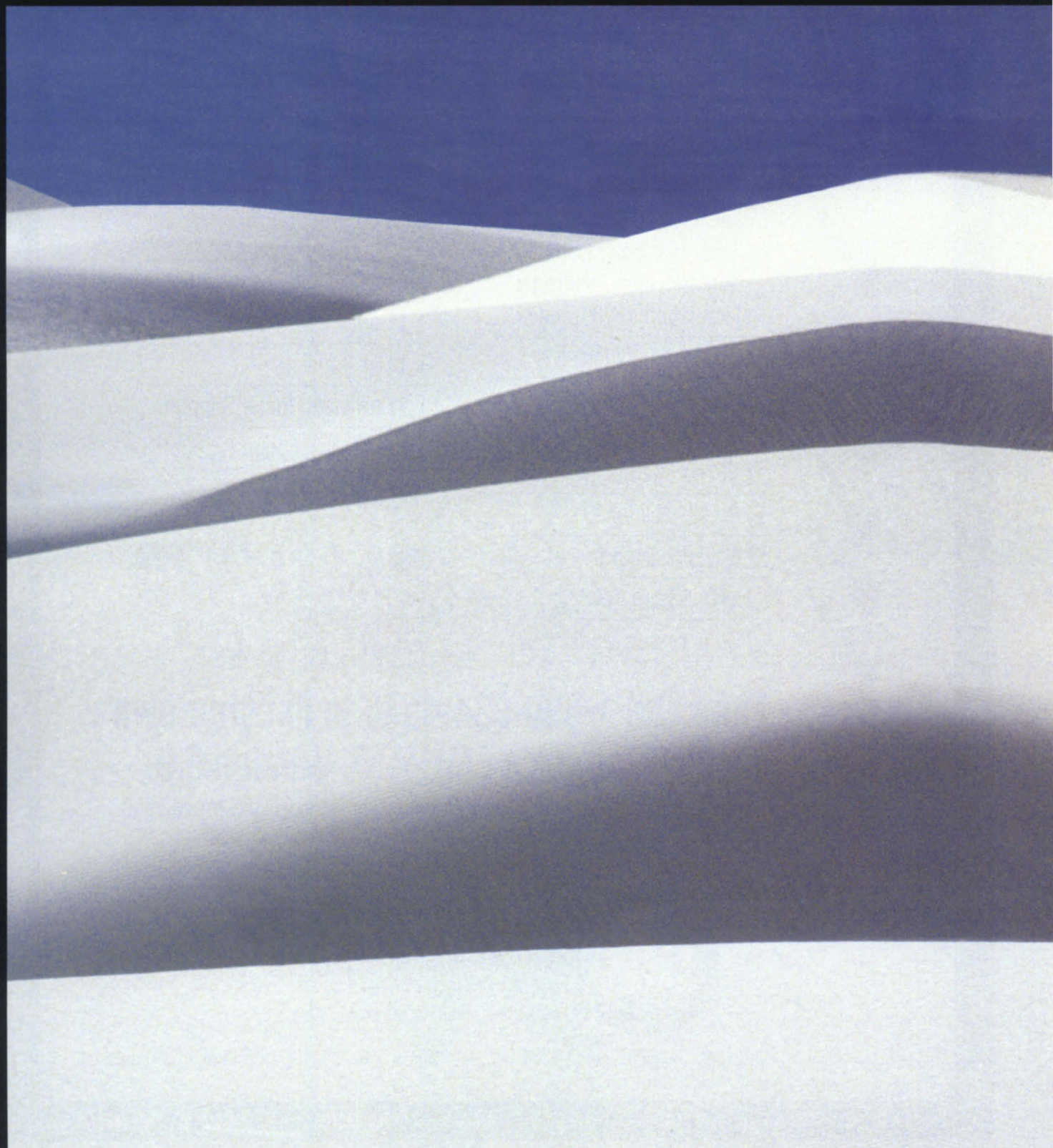
**Rhintek, Inc.**
**Computer Engineering**
P.O. Box 220, Columbia, Maryland 21045

Visit us on CompuServe (GO PCVENC); Tech Support 410-730-2575; VISA and MC Accepted

PC/TCP INT14 NACS NASI BAPI NETBIOS TCP/IP NOVELL

Circle 37 on reader service card.

# CLARiiON welcomes you



# to the new Peace Movement.

## Find peace of mind with CLARiiON™ Disk and Tape Arrays.

Did you know there are people at more than 2,500 sites worldwide who don't worry about losing data. Who don't fret over destroying data. Who don't lose sleep over data damage. Who have total data peace of mind.

These peaceful open systems users have all joined the Peace Movement to CLARiiON Disk and Tape Arrays.

With CLARiiON systems, you too can enjoy peace of mind thanks to unmatched data integrity, ultimate flexibility, and reassuring quality.

Now our new Series 1000 Disk Arrays offer economical entry-level storage solutions for small to medium-scale enterprises. And our unique caching feature delivers overall enhanced system performance – across our entire family of disk arrays.

So whether you're an IBM, SUN or Novell user; whether you're a VAR or distributor; whether your enterprise is large or small; find true data peace of mind with CLARiiON.

Call 1-800-67-ARRAY

With over 15 million hours of customer satisfaction we're...

## Leading the Peace Movement

CLARiiON **Advanced Storage Solutions**

A Business Unit of Data General The Open Systems Experts

Circle 2 on reader service card.

# FOCUS

## The Magazine of the North American Data General Users Group




*Cover design by Ann Soto*


*FOCUS, the Magazine of the North American Data General Users Group* (ISSN 0883-8194) is the official publication of the North American Data General Users Group (NADGUG) in cooperation with Turnkey Publishing.

Editorial and business offices are at P.O. Box 200549, Austin, TX 78720, phone 512/335-2286. NADGUG headquarters are located at NADGUG, c/o Danieli & O'Keefe Associates, Inc., Chiswick Park, 490 Boston Post Rd., Sudbury, MA 01776, phone 508/443-3330.

*FOCUS, the Magazine of the North American Data General Users Group* is distributed to members of the North American Data General Users Group. Membership fees are $60 per person ($110 outside North America). A one-year (12 issues) subscription to *FOCUS, the Magazine of the North American Data General Users Group*, costs $48. For memberships and subscriptions outside the U.S., add $50 to defray the cost of mailing.

The cost of single copies is $4. Requests to replace missing issues free of charge are honored only up to six months after date of issue. Send request to *FOCUS, the Magazine of the North American Data General Users Group*, c/o Turnkey Publishing.

NADGUG is an independent association of computer users; it is not affiliated with Data General Corporation, nor does it represent the policies or opinions of Data General Corporation. The views expressed herein are the opinions of the authors, and do not necessarily represent the policies or opinions of NADGUG or of Turnkey Publishing, Inc.

Advertisements in *FOCUS, the Magazine of the North American Data General Users Group* do not constitute an endorsement of the advertised products by NADGUG or Turnkey Publishing, Inc.





Volume 10, Issue 3.


NORTH AMERICAN DATA GENERAL USERS GROUP

# From MV40000's to Laptops, RAVE Has It All.

**"At RAVE, we supply a winning combination of Data General products and business solutions."** - RICK DARTER

**BUY, SELL, LEASE or TRADE**

Sun Microsystems also Available

*Announcing -*

## RAVE FINANCIAL SERVICES, INC.

- Complete In-House Financing
- Custom Leasing Packages
- Long or Short Term Programs
- Rentals Available

**RAVE Computer Association, Inc.**
36960 Metro Court
Sterling Heights, MI 48312
(313) 939-8230 / Fax: 939-7431
**1-800-966-7283**

Circle 36 on reader service card.

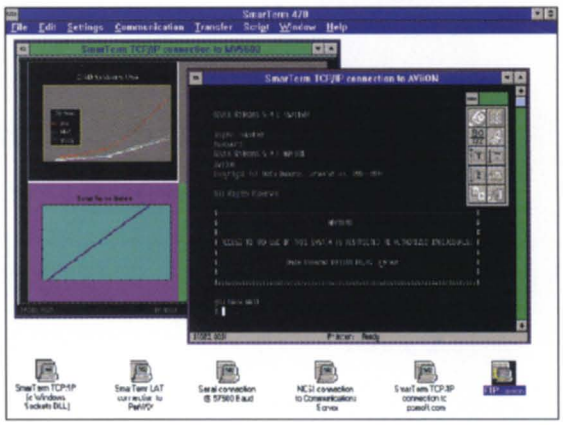
## *Discover the basic principle of connectivity ...*

# Look to SmarTerm for visionary DG and VT emulation.

**It's a basic principle worthy of Galileo:**
SmarTerm's stellar PC-to-host connectivity puts you at the center of your system. New version 3.0 of SmarTerm 470 for Windows is the only software that provides precise, full-featured D470C, VT420, and ANSI-BBS emulation with connectivity to MV and AViiON hosts.

**Free Windows Sockets TCP/IP stack and more!**
Assure your system a window on the future with great features like SmarTerm TCP/IP stack as a Windows Sockets DLL, drag-and-drop FTP client and server, a connections directory, a script recorder, and *SmartMouse*™ programmable mouse support for host applications.

**Test a proven theory for reducing support costs.**
It's a fact. You'll save time and money with SmarTerm's pioneering corporate support tools and utilities. These corporate support tools include simplified keyboard remapping, a pop-up keyboard, a customizable help system, and enhanced button palettes with graphics and text.



*SmarTerm 470 for Windows provides Dasher graphics terminal emulation and VT text terminal emulation in a true MDI (Multiple Document Interface) format for multiple sessions.*

**Discover SmarTerm.**
SmarTerm 470 for Windows is the only emulation software that includes LAT and SmarTerm TCP/IP (a $199 value) FREE! Discover the basic principle of connectivity today.

Call **1-800-EMULATE (1-800-368-5283).**

persoft®
CONNECTIVITY SOLUTIONS
DOS • Windows • Ethernet • Token Ring

**Persoft U.S.A.** 465 Science Dr. • Box 44953 Madison, WI 53744-4953 • Phone (608) 273-6000 • Fax (608) 273-8227
**Persoft Europe** World Trade Center • Beursplein 37 • Box 30237 • 3001 DE Rotterdam, The Netherlands • Phone +31 10 405.3560 • Fax +31 10 405.5073

FOCUS
The Magazine of the North American Data General Users Group





# No better time than now


by Allen Devitt
Special to Focus

There's no better time to be active in NADGUG than 1994!

Hi, I'm Allen Devitt, the new treasurer of NADGUG. But I'm also the director of information systems for Sarpy County, Nebraska. Our county is a suburban part of the Omaha metropolitan area. We are one of the fastest-growing counties in the nation.

Our information processing has been undergoing constant modernization. In the past eight years we have grown from a C350 with 25 online devices (terminals, printers, etc.), through an MV/20000, to our present MV/30000 with 300 devices, plus 75 dial-in customers. In addition, we have five separate local area networks (LANs) in place.

We now have a customer base that includes:

- Police and emergency services
- Jail
- Court
- Prosecutor
- Motor vehicles
- Real property records
- Tax collection
- Administration
- Roads

We have been honored four times by the National Association of County Officials with achievement awards for our information modernization. Needless to say, our government is extremely dependent on us for timely support.

So why do I mention all of this? Where do we go from here? What should our information systems architecture look like in the near future? I'm sure you all share the same questions in your organizations.

We will be in Nashville in October for the NADGUG 94 conference, just as we were in Atlanta last October for NADGUG 93, and in Kansas City for NADGUG 92, Denver for NADGUG 91, and New Orleans for NADGUG 90, to attend sessions, to exchange ideas with contemporaries, to visit exhibits from various vendors, and most of all to learn.

Our management understands and appreciates the value we're receiving from these conferences. With what we learn at NADGUG each year, and with our active participation in the special interest group, the Law Enforcement Data General Users Group (LEDGUG), we can plot our path.

I'm available to discuss matters concerning local government in general, its information processing in particular, and certainly how you can participate more in NADGUG. Δ

*Allen Devitt can be reached at 402/593-2324, fax 402/593-4304.*

# News and notes from the greater Data General Community

## Off to a slow start

A dramatic drop in Eclipse MV revenue, combined with disappointing sales overseas, was blamed for Data General's net loss of $21.1 million (or 60 cents per share) for the first quarter of fiscal year 1994, which ended December 25, 1993.

For its first quarter of last year the company reported net income of $800,000. Revenues for the first quarter were $261.2 million, compared with revenues of $279.6 million for the first quarter of last year.

Commenting on the results, Data General President and Chief Executive Officer Ronald L. Skates said, "We were very disappointed with our financial results. Revenues from our traditional computer line, the Eclipse family, were down about 50 percent compared with both the prior quarter and year over year. Performance in Europe was also very disappointing, with product revenues 30 percent lower than both the prior quarter and last year's first quarter."

Total Aviion revenues again grew compared to both the prior quarter and last year's comparable quarter, the company reported. In particular, the high end AV 9500 is being "very well received by the marketplace," Mr. Skates said.

Highlights of the first quarter include:

- Announcement that more than 20 leading enterprise software vendors have agreed to port their software to the Aviion platform. More than 3,000 applications now run on the Aviion.
- Formation of the Systems Integration Business Unit under the direction of Vice President Don Zereski.

In addition, in late January the company's Clariion Business Unit expanded its Series 2000 disk array product line with a new high-performance model and introduced an economical entry-level Series 1000 disk array family. The new models feature a high-speed "mirrored-cache" capability, previously available only in mainframe computer environments.

"Despite the disappointing financial results, Data General's financial position remains strong with cash and marketable securities of $168 million at the end of the quarter," Mr. Skates said. "In light of first-quarter results we are accelerating adjustments to our cost structure to bring it more in line with revenues and margins."

## Aviion gets high marks, again

For the second year in a row, DG's Aviion received the highest overall satisfaction rating in *COMPUTERWORLD* magazine's comparison of RISC servers. In a "Buyers' Satisfaction Scorecard" feature that appeared in the publication's Jan. 31, 1994, issue, *COMPUTERWORLD* rated the Aviion 5000 line and the new AV 8500 RISC server against comparable machines from other manufacturers (see chart).

**Buyers' Satisfaction Scorecard**

| Source: Computerworld | *Total scores* |
|---|---|
| *Data General Corp.* Aviion 5000 line and 8500 | **87** |
| *Hewlett-Packard Co.* HP 9000 Series 800 | **79** |
| *Digital Equipment Corp.* DEC 4000 AXP | **79** |
| *IBM* Powerserver 500 line | **77** |
| *Sun Microsystems, Inc.* Sparcserver 1000 | **75** |

Users judged the machines' performances in the following areas: sufficient storage, overall reliability, amount of system uptime, compatibility with installed equipment, processing performance, and value to the dollar.

## New features: fixed prices for service

One of the first announcements from Data General's new Systems Integration Business Unit is a schedule of fixed prices for services to help customers implement their open systems enterprise solutions.

The significance of the announcement is that most companies charge time and materials for similar services, explained corporate spokesperson Bob Palmer. "Time & material can be a black hole sometimes. Often, people don't know what they're really spending."

The fixed-price packages will help customers budget for their implementation and provide a statement of work, or roadmap, against which to measure results.

The list ranges from AV 5500 start-up service ($1,950 per system) to AV onGO implementation services ($7,500 for a 20-user implementation). Δ

*In General is compiled by Robin Perry. Editorial contributions may be sent to:* FOCUS *magazine, P.O. Box 200549, Austin, TX 78720; 512/335-2286 phone or 512/335-3083 fax.*

# Supporting new business models

**SYNOPSIS**

The computing model for the Decade of the Enterprise features the predominance of open systems and freely distributed access to data, information, resources, and people.

by Katherine Jones, Ph.D.
Special to Focus

The computing model for competitive businesses is changing. The concerns of the past few years:

- getting a terminal or PC on an employee's desk; or
- attaching a small Netware local area network (LAN) to the corporate network

are rapidly becoming history.

Mirroring change in business models, the next few years may be known as the Decade of the Enterprise—the time period in business and industry when computing truly becomes corporatewide; when access to data is accommodated at all levels of the organization, and when inter-business communication is increasingly electronic.

**Yesterday's model, today's paradigm**

Computing models mirror business models. Previous business models were structured on the classic Weberian hierarchical model. Task alignment was by function; mass production was the focus. Competition was viewed primarily as regional or at best national. Change, when it occurred, was incremental—and employees were valued for their contribution to production.

The accompanying computing model was large, complex, hierarchical—usually time-shared terminals on behemoth mainframes. Applications were functional, with little cross-function communication. Control was centralized. MIS departments were in charge of decisionmaking. Users were powerless.

Business has changed. The horizontal organizations of today are marked by cross-functional workgroups and matrixed teams. "Value-add" has replaced the focus on raw production as corporations have recognized that the competition and the opportunity are global, not local. Workers are increasingly valued for their knowledge rather than for their production-line skills. And corporate goals address continual improvement rather than incremental change.

And the computing model has changed. Rarely in the 1990s are personal computers or workstations isolated in standalone configurations. Almost as rare are the small local-area networks through which workgroups communicated but did not interoperate across departments. First through multi-LAN connectivity and then through the addition of server technology, desktop devices have the advantage of power and access as never before. Servers provide control and consolidation of vital business activities through messaging, shared office automation and data base access, and support for specialized applications, such as imaging programs.

The tying together of local area networks—networks which in some cases were inaccessible because of protocol incompatibility—has created the paradigm of the corporate backbone to which disparate LANs are attached. The result today is freely distributed access to data, information, resources, and people.

**The role of open systems**

Most significant in this paradigm is the predominance of the open systems platform in supporting

mission-critical, sophisticated applications central to the conduct of business and industry. Once solely the purview of the mainframe, through efforts sometimes called "downsizing," "rightsizing," or "smartsizing," the core of a corporation's business is moving from the mainframe to a distributed server architecture.

Although often prompted by cost, issues like performance, ease of procurement, "open" vendor selection, and efficiency also affect the choice to rehost an application from the mainframe to the server, or in fact to re-engineer the application altogether to run in an open environment. Fewer companies today are developing new, sophisticated business applications for the mainframe environment. More are analyzing their business and matching their needs with applications that exist. When corporations decide to engineer their own applications or outsource that engineering, they inevitably host those new applications on Unix-based servers.

As networks themselves grow and change (no one has *EVER* had a network get smaller!), the conduct of business often itself changes. Applications are moving closer to the employees who use them. More applications that address very specific business questions are becoming wider spread as businesses seek to decrease inventory and rely on "just in time" order fulfillment.

For example, sophisticated programs in movie theaters track sales of concessions: not only do the owners avoid inventory of candy bars, but the consumers get fresher products. The programs have become simple enough that the high school student behind the counter can scan in the product codes or enter a number for each brand purchased. Purchasing for restocking has become automatic—and the billing for that purchase can be virtually an instant electronic data interchange (EDI) application that can bill immediately.

**Open access in the open enterprise**

The use of open systems platforms permeates the entire enterprise. Access, simplified because of adherence to formal and *de facto* standards, puts data bases, online transaction-processing applications, complete business packages like financials, human-resource management and the like, on the desktop of the users, regardless of what device they have on those desktops. Personal computers, X-terminals, asynchronous terminals (often called "dumb tubes"), workstations running IBM's OS/2, Microsoft's Windows NT, and Unix, Next stations, and the ever-popular Apple Macintosh can be connected to open systems hosts used as servers for LAN operating systems like Novell's Netware and Microsoft's LAN Manager. In addition, servers can support shared access through communications products such as the Network File System, Appleshare, or Locus' PCI—Personal Computer Integration.

Through open systems servers, users across ethernet, token ring, ATM (asynchronous transfer mode), FDDI

Figure 1


local area networks or X.25 or frame relay wide area networks (WANs), can access corporate data bases and fourth-generation languages (4GLs), or use shared applications like office automation, imaging and video features, and the widely used electronic-mail services.

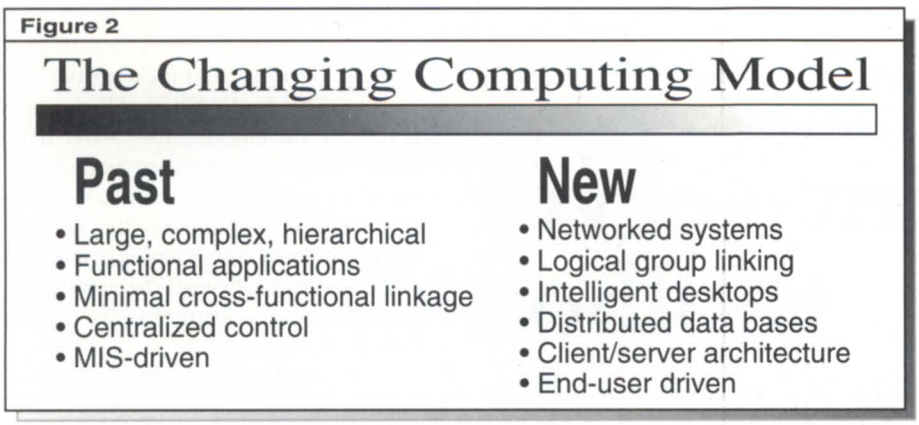
Access is not only from the desktop out to the server, however. Access can mean that the terminals and users who in the past were directly tied to the mainframe can, through the server, have access for the first time to the entire enterprise. As expensive applications are rehosted from the mainframe to Unix, economical access is possible. Through products like Integris' Unikix, IBM's CICS applications can be rehosted with virtually no changes to the DG/UX environment, creating a savings to the MIS director in mainframe upgrade costs. Economical development tools are available on Unix. The tools with Unikix, as solely one example, allow a programmer to develop online transaction-processing applications that can run on a Unix platform running Unikix or on the mainframe running CICS.

**Managing the infrastructure**

Only recently have the applications that support the infrastructure been available in the Unix environment. From network management to distributed systems management, vendors like Data General today are providing administrators with the tools to conduct the operations, backup and restoration, software distribution, license management, and security features necessary in a distributed enterprise. Products like OS/EYE*NODE for Aviion systems or the widely used Openview, both SNMP-based network management products, allowed network administrators to "see" the state of their farflung networks.

Tools like Legato's Networker allow backup of networked systems. Sterling's CONNECT:QUEUE manages batch processing in the Unix environment. Tivoli's TME—Tivoli Management Environment—offers a distributed framework for the develop-

**Figure 2**




ment and implementation of Unix systems management. As the basis of the now-defunct Open Software Foundation's Distributed Management Environment (DME), Tivoli is a well-known name in the nascent distributed Unix and DCE (Distributed Computing Environment) systems management arenas.

Integrated system management platforms like Computer Associates' sophisticated CA-Unicenter go beyond the point products common today and offer a total framework synthesizing the functionality that information technology directors recognize as critical to their data centers. Long a familiar vendor in the IBM mainframe-based data center, the Computer Associates products for Unix demonstrate the awareness of the MIS director's needs and concerns—based on CA's experience in addressing the requirements of the data center.

It is products such as these, all of which are or will be supported by Data General's Aviion family of open enterprise servers, which enable MIS professionals to better address user access to the information and applications they require.

The economics of access improvement cover the conversion and the transfer of applications off the mainframe. The business-based policies and procedures of access improvement accommodate the streamlined principles of today's organizations. As the walls of the "glass house" crack to admit management and control of the creeping LANs that proliferated in the past decade, so will they become more cost-effective as they admit open systems platforms through the doors of the data centers in the decade ahead. Δ

*Dr. Katherine Jones is an independent consultant in Shrewsbury, Massachusetts.*

# The client-server toolbox

**SYNOPSIS**

With all the hype and controversy of the past few years, client-server computing could stand to benefit from becoming unamazing.

by Doug Johnson
Focus Editor

Is it "client-server" with a "-" or "client/server" with a "/"? *Some*body needs to decide and let the rest of us know. Personally, I prefer "client-server" because the hyphen helps the word-processor break this unwieldy compound word at the end of a line; the "/" forces treatment of "client/server" as a single word, and certainly that is a vital consideration. Perhaps with the great Dash vs. Slash Question settled, the whole industry can move on to a new era, in which the whole concept of distributed computing is as normal and unnoticed as breathing.

Questions about client-server computing traverse the spectrum, from the entirely clueless "What the #*@$!%^!* is it, anyway?" to the keenly hysterical "Why the #*@$!%^!* am I spending so much money on training and support?" Articles in the news and trade media are nothing if not numerous. To set out to learn about client-server computing is to be drenched in an unrelenting flood of information. Not just information overload but info *AVALANCHE.*

An International Data Corporation (IDC) "White Paper" insert in the Jan. 31 *COMPUTERWORLD* put it rather succinctly: ". . . the enormous amount of vendor hype surrounding client/server computing often drowns out what few facts are known about the movement." At the same time, IDC noted: "Based on all the facts, there is no excuse for ignoring the client/server movement." Such a statement assigns a certain steamroller inevitability to the notion, which can be simultaneously comforting and unsettling.

*PC MAGAZINE'S* inimitable John C. Dvorak lends a more sarcastically humorous air to the discussion in a recent appearance of his "Inside Track" column, in which he passes along some client-server folklore that had been floating around on IBM's VMSHARE forum. "Client/Server Is Like Teenage Sex," it goes—and note the use of the "/". Client-server falls into the "Teenage Sex" category because:

- It's on everyone's mind all the time.
- Everyone is talking about it all the time.
- Everyone thinks everyone is doing it.
- The few who ***are*** doing it are: a) doing it poorly; b) sure it will be better next time; or c) not practicing it safely.
- Everyone is bragging about their successes all the time, although very few have actually had any successes.

In the February '94 issue of Unix World's *OPEN COMPUTING* magazine, "Reality Check" columnist Marc Dodge commented that it "has become fashionable to slam-dunk client-server computing (note the "-") because of its high costs. But client-server computing is coming, even as we muck up the first steps." The rest of his column was about the development of better help-desk software and third-party tools. Behind the perception of difficulties was that sense of inevitability: "It's all right to worry about client-server computing costs. But don't dust off the mainframe: client-server computing is a sure thing."

"In Analysis" columnist Michael Goulde in the same *OPEN COMPUTING* issue surveyed the state of things and observed wryly: "Everyone has been so eager to jump on the client-server bandwagon that nobody has bothered to check whether it has any wheels." Goulde did add that client-server computing's paradigm shift from centralization to decentralization ultimately makes sense, but he cautioned: "Take some advice. First, learn a lot more about distributed computing before you embark on these essentially uncharted waters. Don't be seduced by the conferences, ads, and vendor pitches." The column's parting thought was: "If you don't know what you're doing, hire someone who does. It's cheaper."

Stephen Gardner, Data General Corporation's vice president of corporate marketing, concedes readily that the industry has overhyped client-server computing. But the character of the controversy he perceives these days is changing more toward ***how*** to make it work, rather than arguing over whether it can be done at all. Earlier this year, Mr. Gardner attended a big meeting in Phoenix with representatives from about 100 computer-industry companies. His overriding impression about where client-server computing stands was how *normal* it's getting to be. "None of this is very remarkable." he said. "We've evolved a great deal in a very short time."

According to Mr. Gardner, client-server computing will benefit from becoming ***un***amazing. Instead of a technology-driven issue, it becomes a business-application-driven issue. "Flexibility" becomes the operative word A huge data base and application tools, for instance, might be very expensive to make distributed. You might want everything centralized

except for those few people who need the power on the desktops. So client-server computing can actually be as centralized or decentralized as it's needed to be—different businesses can tailor the approach to specific concerns. To grab onto a metaphor, think of client-server computing as a great big toolbox. You reach in to select the right tool to do the job. Maybe in the past there wasn't much beyond one-size-fits-all hammers and wrenches. Today there are more tools available than ever before, especially with Data General's recent software partnership announcements. Open the toolbox and take your pick.

Our transformed computing future will be more open and more freely distributed, and those concepts embrace sensible decentralization and a sense of continuous evolution toward something (or an array of somethings) that works better. Will it be easy? No. Do you have a lot of studying and learning to do? Yes. Δ

# Top this

Westboro—Data General announced new Transaction Processing Benchmark-A (TPC-A) price-performance results for two members of its Aviion family of Unix-based, symmetric multiprocessing RISC servers. DG's 8-processor AV 9500 server was measured at 523.64 transactions per second. It offers a cost of $5,357 per tps-A, the best value for high-end commercial systems (those running at more than 500 tps) of the Unix server market.

The tps-A measurements were done with Clariion disk arrays and Oracle7.

"Employing Clariion configurations in the TPC tests were an important decision for us," said Joel Schwartz, vice president of the Aviion Business Unit. "Large commercial enterprises require highly robust, dependable, and expandable systems, and that is what the Aviion/Clariion combination delivers."

The 8-processor version of the AV 9500 server was also certified at 456.6 AIMs, and a maximum user load of 4286, in tests conducted by AIM Technology. The AV 9500 ratings were as much as 44-percent higher than those of the previous top-performing system on AIM's tests, and were achieved with a system costing nearly one-quarter the price. AV 9500 models start at $79,985.

DG's AV 5500 server, configured with two processors, was measured at 130.19 transactions per second. It offers a cost of $5,780 per tps-A, markedly lower than any other RISC server at the low end or midrange of the Unix server market. AV 5500 models start at $14,495.

Developed by the Transaction Processing Performance Council, the TPC-A benchmark is a recognized standard of transaction processing performance. It emulates online transaction processing in a simple banking environment, allowing users to compare vendor-to-vendor performance and value on an equal basis.

The AIM System Benchmark, (AIM Suite III), developed by AIM Technology, characterizes Unix systems used as centralized multiuser servers or file servers, supporting many users at workstations or terminals. Aviion servers have consistently led the competition in AIM performance since Data General began shipping the Unix-based systems in 1989. Δ

*David Novy*

# Grab your (key)board and go Internet surfing with me

**SYNOPSIS**

Right now it's still the equivalent of an overcrowded 4-lane road, but the Internet really will lead the way to the "information superhighway" of the future.

If the terms "network surfing," "gopher," and "archie" don't mean much to you today, I'm willing to bet they will in less than 12 months. These terms are used when talking about the Internet, the world's largest computer network with in excess of 15 million users today and thousands more gaining access every day.

The Internet is also the basis of the so-called "information superhighway" that President Clinton and Vice President Gore have been promoting heavily. But at present, despite the rosy predictions, the Internet can be compared to a limited-access, 4-lane road. A 4-lane road is generally an efficient way to drive to a destination, but it was never meant to carry the traffic that a superhighway can, nor is it as safe. The Internet is generally quite an efficient means of information travel. But because of rapidly increasing demand, traffic jams are beginning to develop and it is sometimes hard to get on the road. Once you obtain access, be prepared to be overwhelmed by the sheer amount of information available that is usually free for the taking.

How did the Internet come about? About 10 or 12 years ago, a minor revolution began with the introduction of the personal computer. Within a few years, most people had access to one, either at home or at the office. Most of the time they were used to write letters, run spreadsheets, and (for the really daring) to balance checkbooks. At the same time, some visionaries saw the computer as an information-access tool: you could use the computer to get stock quotations, do library searches, buy airline tickets, or get direct news feeds. However, the time when such capabilities would be available to the masses at a reasonable price seemed very remote.

After a period of time a second revolution began to occur. People began linking computers together. Computers by themselves on a single desktop certainly offered some interesting capabilities, but networked computers allow people access to the power of cooperative thinking and instant accessibility.

The Internet has allowed computer networking to come of age. The use of computers as information-access tools, which seemed a dream only five years ago, has become a reality. Some of the information on the Internet has to be purchased, but most of it is available for free. By means of electronic mail and bulletin boards ("news-groups" in the Internet vernacular), you can obtain access to a very special type of resource: a worldwide supply of very knowledgeable people.

The importance of the Internet grows daily. It has become a major forum for public debate. The Clinton healthcare proposal was available on the Internet the day it was released to the public on paper. It has allowed people to become involved in serious relationships with people all over the globe, many of whom have never met face to face. It has also developed its own rules for propriety and conduct. Those who violate the Internet rule of conduct run the risk of being "flamed," the Internet equivalent of being shunned. The hardware to connect to the Internet is not complicated. All you need is a real terminal (like a Digital Equipment VT100) or a terminal-emulation program that makes the fanciest computer act like a VT100 terminal. Sun PC-NFS Version 5 has an excellent VT100 emulator. Most Unix workstations support the ***xterm*** program, a very good VT100 emulator.

The use of a terminal or terminal emulator will allow character and command access to the Internet. This is usually all anyone needs. There is graphical information on the Internet, but most people do not have the network speed to take direct advantage of this information. In order to access graphical information, most people download a graphics file and then use an appropriate viewer.

To use the Internet, you must find a way to connect to it. Most people do not connect to the Internet directly. Instead, they connect via a modem to a computer on the Internet. As for which type of modem to use, the faster the better. As a minimum, I would recommend a modem with a speed of at least 9600 baud. The price of 9600-baud modems has plummeted in the last two years. Good 9600-baud modems are available for less than $200.

Being connected to the Internet has several meanings. Generally it means, can you do the things you want on the Internet from your terminal? Many people who use only electronic mail think they are connected to the Internet, when in fact they are not. To determine if you are connected to the Internet, you must first understand what a connection means. Then you can determine if you already have one. If you do not, you can determine what kind of connection service you want to buy and how much you are willing to pay.

There are many services available

on the Internet, including electronic mail, bulletin boards, file transfer, remote login, and index programs. To obtain the full range of services you will need a TCP/IP connection to the system. This makes your computer a part of the network, and then your computer knows how to contact every computer service on the Internet, although you may need special software to use some of them. TCP/IP connectivity allows you to do any type of activity that networked computers can do.

If you need only a few services, then you do not need full connectivity. All you need to do is to beg, borrow, or buy an account on a computer connected to the Internet. (Notice that stealing is *NOT* an accepted access method.) Then you can use a terminal emulator and a modem to connect you to the Internet machine: log in, read your mail, download files, and do whatever else you want. You can say truly that you have an Internet connection because you can do everything you want to do, on a remote machine.

Remote Internet access is not the same as being able to say that your computer is connected to the Internet, but it is a fine point best left to an after-hours discussion in a local pub where drinking beer and talking smart is the norm. There is still another form of limited access available. If you use Compuserve or several other computer service organizations, you can send mail to the Internet and read Internet bulletin boards.

Many people may have an Internet connection but don't realize it. If you work for a large corporation or have access to a university computer system, you may already have Internet access. Ask your system administrator if your company or school is connected. You may be pleasantly surprised.

If you are not connected, there are several ways to obtain a connection. One of the best ways to learn about obtaining a connection is to purchase the book, *THE WHOLE INTERNET USER'S GUIDE & CATALOG*, by Ed Krol, published by O'Reilly & Associates, Inc., 103 Morris Street, Suite A, Sebastopol, CA 95472; 800/998-9938. It will discuss Internet access and give a thorough explanation of Internet services.

In the coming months I hope to explain more about Internet services. If you cannot wait several months to learn about the Internet through this column, then I suggest you purchase the above-mentioned book or a copy of *INTERNET WORLD* magazine. Either the book or the magazine is fascinating reading. Please excuse me for not explaining the terms "network surfing," "gopher," and "archie." This introduction to the Internet took more space than I had planned. I will address them in future columns. Δ

***David Novy** is a technical computer specialist at 3M in St. Paul, Minnesota. He is past chairman of the AOS/VS special interest group, and current chairman of NADGUG's SIG/UX.*

# Making the most of checkpointing in Infos IIFC

**SYNOPSIS**

The author concludes a discussion of the effects on checkpoint performance when using a new version of the Infos product, Infos IIFC. Part 2 of 2.

by Tony Coor
Special to Focus

There are two features in the Infos IIFC product that contribute to the improved performance of checkpointing;

- use of block I/O for all data transfer operations;
- multiple checkpointing tasks to allow more than a single checkpoint to take place at the same time.

Of course, simply loading Infos IIFC onto a system does not automatically guarantee that these features are being utilized to their fullest potential, or even at all.

It is likely that some percentage of improvement—although it may be small—will be present. But to achieve the best performance, consideration must be given to possible changes in checkpointing methods currently in use. Doing so will ensure that an environment is taking full advantage of these features. Furthermore, this will involve some level of experimentation with the Infos IIFC configuration to attain application performance as well as checkpointing performance.

**The flush phase**

Use of block I/O to transfer data from memory to disk, or from one disk file to another, does offer some advantages over the use of ***SPAGE*** I/O. However, if there is memory contention present on a system under Infos II, then it's likely the flush phase of the checkpoint process may take less time than it does in Infos IIFC.

The reason is simply that under Infos II, the modified pages of Infos data may have already been forced to disk by other activities on the system. Thus the ***?ESFF*** issued during this phase will have less work to do. Under Infos IIFC the modified data may stay in memory on the Infos LRU because other system activities cannot affect them; only other Infos requests can. Therefore, in the flush phase there may be more I/O requests executed under Infos IIFC than under Infos II. If there is no memory contention present under Infos II, then the flush phase should not be a concern, as the number and relative speed of this operation will be much the same.

There are a couple of ways to minimize this effect under Infos IIFC. One is to experiment with the slot switch settings, ***SMALLSLOTS*** and ***LARGESLOTS.*** These can be found in the ***INFOS_SWITCHES.CLI*** file. The release notice for Infos IIFC suggests a range of 10 to 25 per user—that's a pretty broad range. Try moving this number around within that range to see how it affects throughput in the application environment. The fewer slots available, the more likely it is that frequently modified pages of Infos data will remain in memory, while those less active will be forced back to disk sooner. On the other hand, don't reduce this number to the point that application response suffers due to the high number of physical faults occurring to keep active pages in memory. This reintroduces the condition that the Infos IIFC buffer manager was designed to minimize.

Another option would be to increase the checkpointing frequency of your critical or high-activity Infos files. As experience is gained with Infos IIFC and its features, you may see that improvements in this area of your application allow an opportunity to revisit the checkpointing strategy. Increasing the frequency of checkpoints may be possible without introducing any impact to online performance. This option will limit the number of pages that must be flushed to those on which modifications are occurring most often—these are commonly referred to by the developers as "hot pages." Utilizing this option will also enhance recovery by shrinking the window of vulnerability for applications data.

Still other customers request checkpoints for Infos files only after they have been closed by all applications programs. These customers will most likely be unaffected by the flush phase. If these files are using explicit checkpoint mode, the Infos data will have already been written to disk by the final

close processing. If any of the other differential file modes are in use, a checkpoint would have already completed during the last close of the Infos file from the application. If the strategy is to checkpoint Infos files only at times in the day when they are normally closed, the suggestions above will not be effective.

In any event, working with the strategies here should ensure that flushing within the Infos IIFC environment are not adversely affecting checkpoint and online performance. Now it is time to look into the "Stuff" phase under Infos IIFC.

**The "Stuff" phase**

As discussed previously, the block I/O transfer used by Infos IIFC offers considerable advantages over the *?SPAGE*, copy and *?ESFF* method used in Infos II. But of utmost importance is the point made earlier that this transfer under Infos IIFC can move up to 252 blocks of modified Infos data at a time. The question now is how to ensure that this is the case the majority of the time, and how far the recovery strategy in use will allow changes for improvement.

There are two styles of checkpointing strategy that will see improvements in this phase without much change. Customers whose Infos files stay in a constant state of growth (that is the number of new pages being added to the file exceed the number of modified existing pages) should see improvements with every checkpoint. These files are the best case for Infos IIFC because there will always be contiguous pages of data that can be transferred in a single *?RDB/WRB* call. This would be true for these files even if the frequency of checkpointing were increased and increasing the frequency could yield better performance if the recovery strategy will allow it.

The second strategy applies to customers who checkpoint their files only at the start and end of the processing day. By allowing that amount of activity to wait until a single checkpoint, they are creating a case in which the largest number of modified pages possible for that file is available. However, as explained earlier, depending on how sparse the location of these modified pages may be within the differential volume, they may fall into the worst-case scenario, especially if the net result is that every other page in the file gets modified, even with this high level of activity.

Of course this method also means that the window of recovery spans an entire processing day, should it be necessary. Checkpointing these files more frequently will show improvements because even if there is a low occurrence of contiguous pages, the number of requests to transfer the data will be balanced across several checkpoints, therefore resulting in a net savings in overall processing time and impact to application users.

For other customers currently using a more complex

checkpointing strategy, some things can be done to maximize performance in this phase. The first step is to know how many modified pages currently are being checkpointed per file. Then use this information to see where your recovery strategy will allow changes to affect some improvement. The net result is to make sure there are modified pages to checkpoint when a checkpoint is requested—and if possible find a number that yields a greater likelihood that contiguous pages are present.

The basic principle is that the larger the number of modified pages, the greater the likelihood that many are in contiguous blocks of data. The more frequent the occurrence of contiguous data, the lower the number of block I/O requests needed to transfer those data. But be careful not to let this number get too large, because the net results may send performance in the opposite direction.

If it's not already in place, put in place a tracking mechanism for the number of modified pages occurring in each checkpoint request for each Infos file. If you're using the ***CHECKPOINT.CLI*** macro, add a "/L=" to each execution so this information may be output to a listing file. If you use a program to automate checkpoints through the program controlled checkpoint (PCC), then save all data returned in a report file for each checkpointed Infos file.

If you are equally concerned about the time to checkpoint, add a line before the ***CHECKPOINT.PR*** program is executed to output the current system date and time to the same listing file. ***CHECKPOINT*** already reports the date and time completed. These can be used together to analyze this aspect of your checkpoint strategy.

Once data are available, study them carefully. Look for occurrences of files that report not needing checkpointing, 0 modified pages, or (depending on the time interval between checkpoints) those showing relatively low numbers of modified pages compared to all other Infos files on the system. These files may not be taking full advantage of this feature, and are robbing processing time from Infos files that have higher numbers. And just as important, from other system activities including the Infos application.

If possible, segregate these files in groups to be checkpointed over a longer time interval. The additional activity will help these files attain the modification rates of the other Infos files on the system. Of course if there are reasons why these files have to be included with the others for the sake of application consistency, then this suggestion must be used only on files that do not have this restriction.

Even if your recovery strategy allows for limited or no change on the basis of the "Stuff" phase, there still may be room for improving checkpoint performance in Infos IIFC. If you have multiple files being checkpointed at the same time, then the next section can offer a suggestion to address the overall time to checkpoint.

### Multiple concurrent checkpoints

There is a feature in Infos IIFC that is most important for applications that checkpoint more than a single Infos file. If an application requires more than a single Infos file to be checkpointed at a time, the best way to improve overall checkpoint performance is to use multiple-concurrent checkpoints. The section above describes how to make best use of the block I/O

transfer of the modified data for each Infos file. However, whether that exercise is of use to you or not, under Infos II an application is still locked into a single checkpoint being performed at a time. If the level of performance you attain could be experienced for every file being checkpointed in the same instance, your overall time to checkpoint would be reduced.

Revision 1.10 of Infos IIFC came with two new switches—*CKPTTASKS* and *FLUSHTASKS*. These specify the number of tasks (up to a maximum of 23) that can be dedicated to each of these activities within Infos IIFC. Together, the values for these cannot exceed a total of 24 tasks. By default they come configured at 12 each (look at the file in the *:INFOS* directory called *INFOS_SWITCHES_DEFAULT.CLI*). The release notice and accompanying manual update pages expand on these switch settings as well.

Each checkpoint task performs its own flushing, so don't feel compelled to keep these two switch values consistent at 12 each. The flush tasks are for other types of Infos IIFC flushing such as on a final close of an Infos file, or when a new page needs to be read into a slot of memory where resides another, less-frequently-used page. If using the default settings, the application can already submit up to 12 checkpoint requests for 12 different Infos files concurrently. And by increasing the *CKPTTASKS* switch settings, more are possible.

So how can you submit multiple-concurrent checkpoint requests? If you use a macro to call the *CHECKPOINT.CLI* file for submitting checkpoint requests, then the change is quite simple. Look at *CHECKPOINT.CLI* and you will notice it simply executes the program called *CHECKPOINT.PR*. Create a macro for your use to call this same program, except use a *PROCESS/NOBLOCK* execution. This will cause each checkpoint request to start a new process and allow execution to proceed on to the next file while it remains in progress.

More elaborate methods can be implemented by developing a program that, based on a time interval, creates a separate process for each Infos file in a list of files to be checkpointed. This program could monitor process load to ensure that all the tasks are busy, or to submit all the files and let Infos IIFC manage the list itself. This implementation does offer a number of choices including whether to use the *CHECKPOINT.PR* program as above, or the program controlled checkpoint (PCC) command available in Infos IIFC. When all files have been checkpointed, the program could pause until the next appointed time for the checkpoint cycle to begin.

**Know your application and do what makes sense**

These are just a few considerations intended to aid in understanding the checkpoint process and examining ways to improve performance under Infos IIFC. The most important thing to remember is that you know your application and user community better than anybody. Use this information to help meet your checkpointing needs. Δ

*Tony Coor is a principal software engineer with Intelligent Information Systems, Inc. He may be reached at 62 T.W. Alexander Drive, Research Triangle Park, NC 27709; phone 919/248-6104 or fax 919/248-5989.*

Kim Medlin

# Data modeling: Ensuring a firm foundation

**SYNOPSIS**

This article outlines the data-modeling process using ERwin/SQL, and how automated tools can assist in this once-tedious task.

by Kim Medlin
Special to Focus

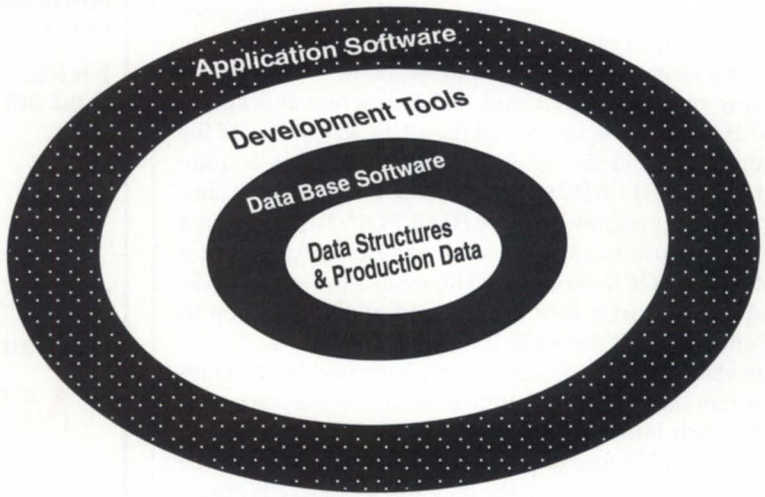
Application development is somewhat analogous to building a house. Without a firm foundation, even the most expensive new home will soon develop uneven floors and bowed walls—and lose value all the while. Like a new home, custom software development can be expensive. It is, therefore, critical that its foundation be solid, which ensures a stable production environment as well as a flexible maintenance basis.

The "onion ring" diagram in Figure 1 shows the layered nature of the business-software environment. The data base and its data are without question the foundation of application development. This is especially true when using a relational data base management system (RDBMS). Further, the data base and its data must correctly represent the needs of the business. The bottom line of state-of-the-art application software development is this:

## The data base design must accurately reflect the rules of the business

Anything short of this goal results in the inefficient use of development tools, which could nullify a significant portion of the cost-savings offered by relational data bases and current development tools. So the developer's primary concern is to record the business rules into what's known as the data model, which is sometimes also referred to as an information model.

**Figure 1: Layered structure of business environment**




Besides containing the business rules, a data model contains the specifications of the data structures to be accessed by the application. If the data model does not accurately represent the business rules of the enterprise, development will be hampered, particularly when using fourth-generation language (4GL) tools and end-user tools. Here at Data General Systems Integration Project Services, we allocate much of our effort to developing custom software. We dedicate most of the early phases of application development to capturing the business rules of our customers and embodying many of these rules in the data model.

The data model is composed of a ***logical*** design and a ***physical*** design. The logical data model is prepared first. It's a rendering of data structures and business rules, and is independent of any specific DBMS product. Interestingly, before network and relational DBMSs were commonly implemented, many designers omitted the logical modeling task from their project plans. Since physical implementations of the older hierarchical file systems were so dramatically different from the logical model, the usefulness of a logical model was greatly diminished. During my tenure as a consultant for Systems Integration Solutions I've witnessed many situations where a business' primary application would have virtually no data base documentation. The reason: it was too difficult to accomplish

with older technologies, such as hierarchical filing systems.

Fortunately, RDBMSs are now a prevalent component of software development. With an RDBMS, such as Oracle, the physical model is usually quite similar to the logical model. Data modeling has thus assumed a much more important role in the software development cycle. It is not unusual for people to specialize in this area and spend relatively little time in other software development pursuits.

Several data modeling methodologies have surfaced as leading candidates to become industry standards. One such methodology is called IDEF1X (pronounced Eye-Def-One-X). It is a simple methodology with very few modeling symbols, yet powerful enough to model very complex data base structures.

One of the leading products that supports the IDEF1X methodology is called ERwin/SQL from Logic Works, Inc., of Princeton, New Jersey. Its basic function is to automate the task of data modeling. It runs under Microsoft Windows and can easily utilize a client-server configuration so that the actual data model resides on a server, such as an Aviion.

**Table 1: Corresponding data base concepts**

| | Hierarchical (Infos) | Network or CODASYL (DG/DBMS or IDMS) | Relational (DG/SQL or Oracle) |
|---|---|---|---|
| **Entity** | File or record | Record type | Table |
| **Attribute** | Field | Field | Column |
| **Relationship** | Index or sub-Index | Set | Relationship |

The primary symbols of data modeling represent "entities" and "relationships." Thus, the IDEF1X diagrams are often called ERDs, or Entity-Relationship Diagrams. An entity, which has "attributes," is a distinguishable person, place, thing, event, or concept about which common information is kept. An attribute is an elementary piece of information pertaining to an entity. A relationship is an association between two entities that forms some kind of a one-to-many relationship. These concepts are consistent no matter what type of DBMS is under consideration, as shown in the following table that maps these concepts to other common DBMSs.

**Building ERDs**

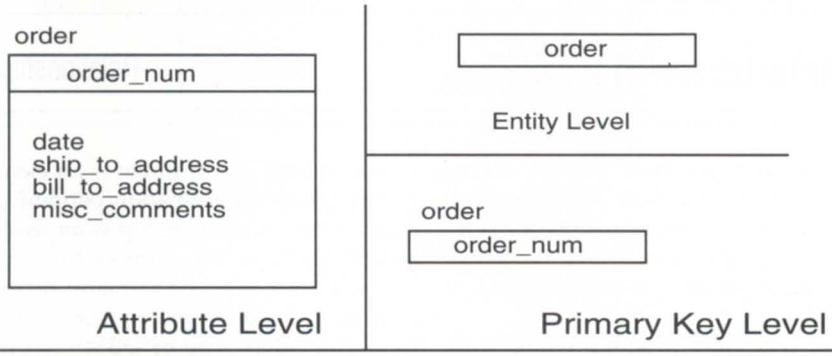
Suppose you are designing an order-entry application. Certainly one of

your entities would represent the order itself. Figure 2 shows the entity called "order" along with its primary key (order_num) and non-key attributes.

The diagrams shown in this article were generated at the Attribute Level, but because real-world data base designs can become quite complex, it is more common to see either Entity or Primary Key level diagrams on a day-to-day basis. Figure 2 also shows the ERD viewing modes that ERwin/SQL allows.

RDBMSs such as Oracle don't require that an entity contain a primary key. But a primary key is required as part of first normal form. Since one of the foremost objectives of data modeling is to create normalized data structures, it's generally a good practice to include a primary key for each entity. Sound principles of data normalization need to form the foundation of any data base design. Δ

**Figure 2: Entities in view modes**




| This mode... | Displays... |
|---|---|
| Attribute Level | The entity name above the box, the primary key above the horizontal line, and the non-key attributes below the horizontal line. |
| Entity Level | Only the entity name inside of the box. |
| Primary Key Level | The entity name above the box and the primary key inside the box. |

*Kim Medlin is a senior consultant with Data General's Systems Integration Solutions group in Atlanta, Georgia. Systems Integration Solutions specializes in custom software design, development, implementation, and consulting. Kim's address is 4170 Ashford Dunwoody Road, Suite 300, Atlanta, GA 30319. He can be reached at 404/705-2653; klm@atlanta.dg.com.*

# Fine-tuning Unix

**SYNOPSIS**

The author continues a series explaining application and kernel tuning utilities available for solving some of the most common bottlenecks that affect DG/UX overall system performance in a multi-user server environment.

by Thomas Soukup
Special to Focus

There are numerous debugging and profiling tools available to assist you in debugging and analyzing your application code. These tools help you fix mistakes and identify where time may be wasted in your application code. You may then try alternative coding solutions. If your application still is not performing as expected, other possibilities include using different compilers or different compiler options (using *gcc* instead of *cc*, or *-O2* instead or *-O* in GNU C 2.0). For example, the on-line manual pages for the *gcc* C compiler offer more than six pages of options that could potentially affect the performance of a program.

Once you have completely debugged and optimized your application, make sure you have recompiled the executable without any debugging information (unless you need to do debugging on a production executable). The executable should be stripped and contain no debugging information. This will allow the executable to perform optimally and reduce its file size and load time.

You must plan and monitor your RDBMS installation. Modifications to the DG/UX kernel and file system or raw-disk configuration can increase overall system performance. However, if the RDBMS is not tuned properly, overall system performance may deteriorate. Use the monitoring and tuning techniques contained in this guide to assist in attaining the best overall system performance.

### Other programming support tools

The *prof* command works with C, Green Hills Pascal, and Green Hills F77 compilers to generate profiling information, from which you can determine which routines in your application consume the most execution time.

Another user-profiling method is the *profil()* system call, which can be placed in the application code. With this method, only the suspect address range of code is profiled, instead of profiling the whole program. The drawbacks are that you must write the profile data to a file, and then create applications to analyze the profile information. However, this method can be used to give more exact profiling information (by instruction if needed), or can be used in very large, complex applications.

The *cflow* command generates a C flow graph of external references in C, *yacc*, *lex*, assembler, and object files. Used in conjunction with the *lint* command, complex applications can be simplified. Other commands, such as *ctrace*, that lets

**Figure 1:**
**AT&T System V to DG/UX kernel cross-reference table**

***STREAMS TUNABLES:***

| *System V* | *DG/UX* | *Defaults/Description* |
|---|---|---|
| | PERCENTSTR | 20; % of system memory reserved for stream buffers |
| NMUXLINKS | NMUXLINK | 1024; # of mutiplexor links |
| NSTRPUSH | NSTRPUSH | 9; max # of stream event calls |
| NSTREVENT | NSTEVENT | 2048; initial # of stream event calls |
| MAXSEPGCNT | | page limit for event cell allocation |
| STRMSGSZ | STRMSGSZ | 1; max stream message size |
| STRCTLSZ | STRCTLSZ | 1024; max size of ctl part of message |
| STRLOGRAC | | max low priority block usage |
| STRMEDGRAC | | max medium priority block usage |
| | NLOG | 16; max # of log devices available |
| | NPIPE | 64; max # of streams pipe devices available |
| | BSIZE | 20; max # of log messages allow to be enqueued |

***NFS & TCP/IP TUNABLES:***

| *System V* | *DG/UX* | *Defaults/Description* |
|---|---|---|
| | PTYCOUNT | 64; # of pseduo-terminal devices |
| | PMTCOUN | 20; # of pseudo-mag-tape devices |

***IPC MESSAGES TUNABLES:***

| *System V* | *DG/UX* | *Defaults/Description* |
|---|---|---|
| MSGMAP | | entries in msg map |
| MSGMAX | MSGMAX | 2048; max message size |
| MSGMNB | MSGMNB | 4096; max bytes on queue |
| MSGMNI | MSGMNI | 1024; message queue identifiers |
| MSGSSZ | | message segment size |
| MSGTQL | MSGTQL | 1024; system message headers |
| MSGSEG | | message segments |

***IPC SEMAPHORE TUNABLES:***

| *System V* | *DG/UX* | *Defaults/Description* |
|---|---|---|
| SEMMAP | | entries in semaphore map |
| SEMMNI | SEMMNI | 1024; semaphore identifiers |
| SEMMNS | | semaphores in system |
| SEMMNU | SEMAPM | 16384; undo structures in system |
| SEMMSL | SEMMSL | 256; max semaphores per set |
| SEMOPM | SEMOPM | 10; max ops per semop call |
| SEMUME | SEMUME | 10; max undo entries per process |
| SEMVMX | SEMMAX | 32767; semaphore maximum value |

***IPC SHARED-MEMORY TUNABLES:***

you follow statement by statement the execution of a C program, and the command *cxref*, which analyzes a group of C source code files and builds a cross-reference table of automatic, ***static***, and global symbols in each file, will assist you in analyzing your applications.

**Data base products**

Relational data base management system (RDBMS) products can be extremely resource-intensive, and cause poor overall system performance if not tuned properly. Most packages require numerous customized changes to DG/UX kernel parameters. Figure 1 is a cross-reference table of AT&T Unix System V kernel-parameter names in relation to DG/UX kernel-parameter names. Use this chart if the installation guides give generic names for kernel-tunable parameters.

Some RDBMS products include specific DG/UX release and installation notices. Others contain only generic Unix release and installation notices. Many RDBMS product managers at Data General have prepared specific guides for most of the current releases of common RDBMS products. Customers can a request copies of installation and tuning guides from their system engineers or sales representatives. These guides are extremely useful in setting up and configuring an RDBMS environment with DG/UX, and on specific Aviion hardware.

Many RDBMS products use raw

| *System V* | *DG/UX* | *Defaults/Description* |
|---|---|---|
| SHMMAX | SEMMAX | 4MB; max shared memory segment size |
| SHMMIN | SHMMIN | 1; min shared memory segment size |
| SHMMNI | SHMMNI | 1024; shared memory identifiers |
| SHMSEG | SHMSEG | 256; max attached shm segments per process |
| SHMALL | | max in use shared memory |

***MEMORY, PROCESS, & SYSTEM TABLE TUNABLES:***

| *System V* | *DG/UX* | *Defaults/Description* |
|---|---|---|
| CDLIMIT | CDLIMIT | 2GB; maximum size a file may assume |
| PERCENTBUF | | 100; % of system memory reserved for data buffers |
| NBUF | PERCENTBUF | 100; buffers in buffer cache |
| NHBUF | PERCENTBUF | 100; hash slots for buffer cache |
| HPBUF | PERCENTBUF | 100; buffers for physical I/O |
| NINODE | | inodes |
| NS5INODE | | s5inodes |
| FREEINODE | | 4; max ratio of in-use inodes to free inodes |
| FREERNODES | | 4; max ration of in-use rnodes to free rnodes |
| NFILE | HDESLIM | 64; entries in file table |
| NMOUNT | | entries in mount table |
| NCALL | | entries in callout table |
| NPROC | NPROC | 256 entries in process table |
| MAXSLICE | | 500; max time (ms) a process can run before suspended |
| NREGION | | entries in shared region table |
| NCLIST | | clist buffers |
| MAXUP | MAXUP | 50; processes per user id |
| SPTMAP | | size of system virtual space |
| VHNDFRAC | | fraction of memory for vhandlow |
| MAXPMEM | | max physical memory to use |
| MAXBUFAGE | | 60; max time in secs before a buffer is written to disk |
| NAUTOUP | MAXBUFAGE | 60; auto update time limit in seconds |
| AGEINTERVAL | MAXBUFAGE | 60; page aging interval |
| BDFLUSHR | MAXBUFAGE | 60; bdflush run rate |
| NOFILES | SDESLIM | 64; soft max of open files per process |
| | HDESLIM | 64; hard max of open files per process |
| FLCKREC | USERLOCKLIMIT | 2048; record locks per user configured on system |
| NQUEUE | NQUEUE | 2048; # of stream queues |
| NSTREAM | | # of stream head structures |
| MAXUMEM | | max size of user's virtual address space in pages |
| MAXMEM | | for package compatibility equal to MAXUMEM |
| GPGSLO | | page stealing low water mark |
| GPGHI | | page stealing high water mark |
| MINRESMEM | | min resident memory for avoiding deadlock |
| MAXRESMEM | | max resident memory for avoiding deadlock |
| MAXSC | | max # of pages swapped out |
| MAXFC | | max # of pages saved |

**Figure 2: Term & TTY environmental variables**

***Assigning TERM only***
FILE: /etc/saf/ttymon1/tty01
assign TERM=vt100

***Assigning TERM and TTY***
FILE: /etc/saf/ttymon1/tty01
assign TERM=vt100
assign TTY=/dev/tty01

**Figure 3: Creating a new pseudoterminal**

```
{
int master, slave;
char *slavename;

master = open ("/dev/ptmx", O_RDWR);
if (master 0) {
      perror ("master open");
      exit (1);
}
slavename = ptsname (master);
if (NULL == slavename) {
   fprintf (stderr, "NULL slavename()");
   exit (1);
}
unlockpt (master);
slave = open (slavename, O_RDWR);
if (slave 0) {
      perror ("slave open");
      exit (1);
}

/* program continues.../*
```

disk instead of a file system. This allows the RDBMS to perform I/O faster and more efficiently. Some RDBMS products offer the user a choice. For the best overall performance choose the raw-disk option.

**Unix: shells and defaults**

Depending on your preference, you can use the Bourne shell, C shell, or kourne shell. In addition, you may enable the DG/UX ***editread*** feature. The creation of the shell, as well as the setup of your application or development environment, can affect overall system performance; ***editread*** also adds overhead and will interfere with some application screen handlers.

In some cases the login script to start an application run may be set up inefficiently. A common mistake is to start an initial shell and then spawn an application program from that initial shell. Spawning an application from the

initial shell wastes memory and adds to process table maintenance. For each user there are two processes running, the original login shell and the spawned application. To determine if you are running two or more processes per user login, use the Unix */etc/whodo* command. If you determine that your original login shell is still running, you need to modify your login script to use the Unix *exec* command to start the application program. Thus, the application replaces the initial shell, and only one process is run per user.

When testing applications, another common mistake is to test them as the superuser. The root can override limits imposed on normal system users. Therefore, depending on the shell used, you may need to adjust users' *ulimit* and *umask*. These commands will list limitations set for a normal user.

Non-superuser users can write only to file systems that are less than 10 percent full. If non-superuser users are receiving write errors, use the Unix *df-k* command to determine if the file system is 100-percent full (in reality 90-percent full). If a file system is reaching 100-percent full (as displayed with the Unix *df-k* command), use the *grow file system* utility in *sysadm* to enlarge the file systems. At times you may notice a file system that is more than 100-percent full. When this occurs it is most likely the root user who can override the 10-percent free limit has written files into the file system or system log files. File system performance will deteriorate logarithmically as the file system becomes more than 90-percent full (displayed as 100-percent full with the *df -k* command). You will notice long delays when writing or appending to files. In addition, fragmentation of files will increase as the Unix operating system searches for free blocks.

The common practice for login scripts is to use the startup shell (*.profile*, *.login*, *.cshrc*, etc.) to set up your working environment. The Unix *$PATH* variable is searched with each command execution. Before outputting "not found", the system searches every directory in the *$PATH* variable. These searches require both processor and disk time. The *$PATH* variable is searched from left to right. The most commonly accessed directories should be listed first. In addition, searching large directories should be avoided.

**Dumb terminals**

The */dev* directory may contain thousands of entries. Doing searches of your TTY device name is quite resource-intensive. If you need to know your TTY device name, set the *$TTY* environmental variable in */etc/saf/ttymon_name/tty###*. By default, only the terminal type variable is set, i.e., the *TERM* environmental variable. A sample *tty###* file for *tty01* controlled by *ttymon1* will read as shown in Figure 2: Modify this file to contain also the TTY environmental variable and any other environmental variables that are retrieved often by the application. If a

*Continued on page 32*

# The latest products for Data General systems

## FACTS, Version 6.2

Duluth, Georgia—Software Solutions, Inc., began shipping the newest version of its FACTS software for distributors. Version 6.2 now comes bundled with a 30-day trial version of FacetTerm, a session and window manager for terminals under Unix systems, and new FACTS Finder menus.

The new FACTS finder menus allow users to navigate quickly through the system using pulldown, tiled, and wrap-around menus and windows. Other Version 6.2 enhancements include:

- An improved link to the FACTS fully integrated electronic data interchange (EDI) module.
- Synchronization of customer, vendor, or item inquiry with any of the sales order entry programs.
- A 4GL data dictionary to speed up creation of personalized reports and programs.
- Installation programs that make it quicker to install a new system or add-ons.
- A pop-up, windowed calendar available from any input.
- FaxLink, the fully integrated fax module for FACTS, is now available on a variety of Unix platforms, including Data General's Aviion.

***Software Solutions, Inc.,** 3425 B Corporate Way, Duluth, GA 30316; 404/418-2000.*

## Better debugging

New York, NY—Version 2.0 of the Sentinel debugging environment from Virtual Technologies, Inc., improves integration and features a new graphical user interface (GUI). Sentinel is a library of routines that can be linked into Unix C and C++ programs to help programmers locate and resolve hidden bugs in the use of dynamic memory.

Sentinel 2.0 will support Hewlett-Packard's SoftBench on HP and Sun platforms, and IBM's implementation of the system on the RS/6000. Sentinel's new GUI will be available on all currently supported platforms, including Data General's Aviion.

Virtual Technologies also announced that users will have their choice of three licensing options with Sentinel 2.0:

- Host-based licensing, allowing any number of users on the host to access Sentinel.
- Floating network licensing, providing licensed access to any one user on a network at any one time.
- Floating registered user licensing, designating one person per site by name as the licensed user.

Sentinel is priced between $595 and $1,895 and is platform-specific. Discounts apply for multiple-unit purchases.

***Virtual Technologies, Inc.,*** *46030 Manekin Plaza, Suite 160, Dulles, VA 20166; 703/430-9247.*

## ARC Version 2.50

Germantown, MD—Data Bank Associates, Inc., announced Version 2.50 of its ARC for Data General systems. The new release offers functional enhancements to provide full support for data encryption with the Unix, MS-DOS, and OS/2 versions of ARC. The software release includes "ZARC" to complement AOS/VS ARC libraries on PCs. ZARC permits full access to the "longer" AOS/VS and Unix filenames while under DOS or OS/2. ZARC is being distributed as "freeware" to any licensed ARC user.

Files that are added or accessed can be encrypted through the use of password protection. Since the password is not stored in any form within the ARC library, a file that has been encrypted may be accessed only by someone who already knows the password.

The ARC program for Data General systems is sold at a single price regardless of system size, and includes ARC, ARCtape, ARCmerge, one commercial license for PC version 6.03, and unlimited use of ZARC. Initial licenses include one year of software subscription and hotlne support. Corporate licenses and discounts are available as well as reseller pricing. Current clients under yearly software support will receive their product upgrade automatically.

***Data Bank Associates, Inc.,*** *20010 Century Blvd., Suite 104, Germantown, MD 20874-1118; 301/540-5562.* Δ

*Continued from page 29*

shell program needs to retrieve the TTY device name, the ***$TTY*** environmental variable is set. If a C program needs to retrieve the TTY device name, the C routine ***getenv("TTY")*** can be used rather than the resource-intensive C routine ***ttyname()***. Using the C routine ***getenv()*** is more efficient than the C routine ***ttyname()***, which must search through thousands of files in the */dev* directory.

In DG/UX 5.4 the naming conventions for pseudoterminals (PTYs) have changed. AT&T V Release 4 PTY names have been added. The new nodes in DG/UX 5.4 are */dev/ptmx*, a clone-able PTY master device, and */dev/pts/N*, the PTY salve nodes. Use the clone-able PTY master driver for PTY allocation instead of looping through the list of PTY masters, attempting to open each until an open succeeds. The new code is straightforward and more efficient; it requires only one open. An example of cloning a PTY and determining its name appears in Figure 3 (page 28).

If you don't get an error condition due to a limitation, then you now have successfully cloned a new PTY and know its name, ****slavename***. If you get an error you may need to increase the ***PTYCOUNT*** kernel parameter variable. By default it is set to 64 PTYs.

**Directory sizes**

In addition to optimizing the ***$PATH*** environmental variable, large directories should be broken into smaller directories. Use the ***find*** command to search for large directories (those with more than 320 entries) and consider breaking them into smaller directories.

A common mistake users make is placing application, source, and object code files all in the same directory. To reduce directory search time the solution is to create three directories: one for the application executables, another for the source code; and a third for the object code. For application users, include only the application executables' directory in their search ***$PATH***.

Use the following ***find*** command to search for and list large directories:

```
# find / -type d -size +8 -print
```

If possible, avoid placing large directories in your ***$PATH***. When possible, divide large directories into smaller subdirectories.

**Shell programming**

Shell programs are fast and easy to create; however, shell programs incur more overhead than if the task were written in a programming language. In a production environment, commonly used shell programs should be converted to C programs.

From the above discussion, many Unix environmental variables can have an affect on the overall system performance of your multi-user system server. In addition, there are optimim approaches for interfacing to the Unix environment. Not only are third-generation language applications affected by how the Unix enviroment is set up, but also relational database management systems.

**Summary**

In investigating user mode (*%USR*) time utilization, application profilers can be used. From the performance data collected, you can determine where the greatest amount of time is being spent in application code. After profiling an application, you can test different coding or data-access schemes, different compilers or different compilation options.

Although performance monitoring and tuning are not an exact science, Data General includes numerous utilities to assist in analyzing performance data and for taking corrective action when necessary. Often the task may be too complicated and time-consuming for customers or value-added resellers (VARs) to solve on their own. In these cases Data General's System Evaluation and Performance Analysis Center (SEPAC) can assist with additional performance expertise. Δ

*Thomas E. Soukup is a member of the Technical Services Group at Data General Corporation in Altlanta, Georgia. Currently serving as the worldwide benchmark coordinator, he has been active in benchmark performance at DG for the past five years. He has also been involved with assisting system engineers worldwide with DG/UX performance tuning and monitoring.* 

## CLASSIFIEDS

## SOFTWARE

## ON-LINE HELP

***Who to call for answers about***
**NADGUG *and* FOCUS**

**FOCUS Magazine address:**
c/o Turnkey Publishing, Inc.
P.O. Box 200549
Austin, TX 78720
**FAX:** 512/335-3083

**NADGUG address:**
c/o Danieli & O'Keefe Assoc., Inc.
Chiswick Park, 490 Boston Post Rd.
Sudbury, MA 01776
**FAX:** 508/443-4715

**NADGUG**

**Membership, RIGs, SIGs**
NADGUG staff ..... **800/253-3902**
(Outside the U.S and Canada.) ..... **508/443-3330**

**Electronic bulletin boards**
(300,1200, 2400, or 9600 baud modem)
Rational Data Systems ..... **415/499-7628**
DASH bulletin board (2400 bps modem) ..... **800/DASH-CSC**
Data General Customer Support Center ..... **800/344-3577**

**FOCUS Magazine**

**512/335-2286**

**Editorial comments, article suggestions**.....Doug Johnson
(please send product announcements to the address listed above)

**Information about advertising**.....Susan de Blanc

**FOCUS back issues** .....Turnkey Publishing staff

## AD INDEX



## PRODUCTS AND SERVICES

**COMPUTER ENGINEERING INT'L. INC.**
2231 STAR COURT • P.O. BOX 81755
ROCHESTER, MI 48308 • FAX (313) 853-0775

**MILLION DOLLAR INVENTORY TO SUPPLY ALL YOUR NEEDS FOR:**

- **MV SERIES UPGRADES**
- **UNIX & PC BASED SOLUTIONS**
- **NOVA/ECLIPSE SPARES**
- **COMPATIBLE PERIPHERALS**
- **MONITOR & PRINTER REPAIR**
- **ADD-ON COMM. GEAR, DISKS, TAPES, MEMORY, PROCESSORS**

**WE STOCK THOSE ODD PIECES THAT OTHERS DON'T CARRY.**

# CALL 800 462 CEII (2344)

IN MICHIGAN (313) 853-0770
OUR COMMITMENT TO SERVICE WILL MAKE IT SEEM THAT WE ARE RIGHT NEXT DOOR

**BUY** **SELL** **TRADE**

**COMPUTER ENGINEERING INT'L. INC.**
2231 STAR COURT • P.O. BOX 81755
ROCHESTER, MI 48308 • FAX (313) 853-0775

VISA

MasterCard

Circle 8 on reader service card.

## DASH Items...

### Category: AOS/VS

Author: DOUG POULIN
Subject: ***Kermit for AOS***

Does anyone know where I can get a copy of Kermit for AOS? I need to transfer some files from an MV to an Aviion, and have no networking hardware.

Reply by: TIM BOYER

The NADGUG software library tape has a version or two, I believe. Also Xmodem, etc. If you're a member, leave a note for Michelle Dube in the NADGUG section here, and she'll get you the details.

### Category: Networking

Author: BILL MILLER
Subject: ***BOOTPD for Aviion 4625***

I am looking for a copy of ***bootpd*** for my Aviion 4625, 5.4 R2.01. Please e-mail me with info. I would like a precompiled version if possible.

Author: RITA EATON
Subject: ***Aliasing***

We need to know how to handle aliasing with two ethernet controllers in the AV 410. Please advise on any changes that need to be made to the hosts file, etc.

Reply by: DG CUSTOMER SUPPORT

In general, each controller would have its own IP address in the ***/etc/hosts*** file. You can place multiple names in the ***/etc/hosts*** file for the controllers. For example:

```
111.222.333.444      host1      andy
```

would assign the names ***host1*** and ***andy*** to the same IP address. Note that both these names are part of the same record. Do *NOT* put in multiple records with the same IP address.

### Category: Hardware

Author: DG SUPPORT
Subject: ***Clariion subsystem problem***

**Important Notice**

The 1.2 GB disk modules in Clarion subsystems do not work properly with spindle sync enabled. Spindle sync is turned on by Rev 5.56 of Clariion microcode. If you have 1.2 GB modules in a Clariion, *DO NOT* install Rev 5.56 microcode.

Rev. 5.58, which fixes the problem, will be distributed very shortly to the field. If you have already installed Rev 5.56 and have 1.2 GB modules in your Clariion subsystems, please contact the Data General Customer Support Center in Norcross, Georgia, at 1-800-DG-HELPS (800/344-3577).

---

*DASH runs on an Aviion 5200 server at the Customer Support Center in Norcross, GA—24 hours per day, 7 days per week, free of charge. Accessible via Internet address 128.222.159.141, or by calling 1-800-DASH-CSC (1-800-327-4272) for the modem rotary.*

---

## Bits and bytes

### Category: AOS/VS

From: RICK MARNELL
Subject: ***New utilities for the NADGUG software library***

I recently uploaded two Shareware utilities to the :SYSMGR bulletin board: "BGREPE15.DMP" (Benchmark GREP) and "QKSE302.DMP" (Quicksilver). Both dump files are in ":AOSVS16:UTILS." Please add these programs to your NADGUG software tape. Benchmark GREP replaces FIND; Quicksilver is new—it's an interactive file-perusal and edit utility. Also please update Benchmark DOS with ":AOSVS16:UTILS:BDOSE210.DMP" if you haven't already. The release notice in each package gives a summary of what the program does.

From: TIM BOYER

Thanks for the submissions! I'll add 'em to the tape. (***Editor's Note:*** Order the NADGUG software library by contacting Michelle M. Dube, NADGUG Association Manager, c/o Danieli & O'Keefe Associates, Inc., Chiswick Park, 490 Boston Post Road, Sudbury, MA 01776. Call 800/253-3902 (continental U.S. only) or 508/443-3330; fax 508/443-4715.

From: ANDY BOOTS
Subject: ***Zmodem for AOS***

Anyone have a port of the Zmodem protocol driver for AOS/VS II?

From: TIM BOYER

It ain't Zmodem, I know, but the [NADGUG software] library tape has both X and Ymodem.

From: OLAV TORVUND
Subject: ***RJE80***

I am in a situation where I have to find a way to submit a dial string to a modem (RACAL RMD3222) from RJE80/GSMGR in synchronous mode. Does anyone know how this might be accomplished? If I had to dial only to one location it would be no problem, since the modem then would be able to store the number—and I can use DTR-dialing. But I have to transmit to several locations, and since the modem is at a remote location I have to somehow get the remote modem to dial different numbers from the DG (AOS/VS 7.69) using RJE80. Hope someone can give me a hint . . . . Regards. Δ

---

*The NADGUG/Rational Data Systems electronic bulletin board is available to all NADGUG members. Call 415/499-7628. There are no fees other than telephone charges.*

---

# SCOTT McINTYRE & ASSOCIATES, INC.

"YOUR GLOBAL COMPUTER SOLUTION!"

**313-299-0040**

## *Get Lucky with These St. Patrick's Day Specials!*

### CPU's

MV2000II W/4MB & 21MB CTD $795
MV2500 W/8MB & 21MB CTD $2,500
MV3500 W/8MB &150MB $5,900
MV9500 W/8MB $9,500
AV4300 W/16MB & 525MB CTD $6,500
AV4605 W/32MB & 525MB CTD $7,500
AV5225 W/32MB & 525MB CTD $19,995
MV1000 W/4MB & 21MB CTD $1,500
DG500 W/512KB & 21MB CTD $550

### DISK & TAPE

6239-A 592MB Disk $995
6685 1GB SCSI Disk $1,450
6799 520MB SCSI Disk $895
6588 1600/6250BPI Tape $7,995
6591 2GB SCSI CTD $1,450
6363 160MB Disk $595
6631-A 600MB Disk $1,595
6675 525MB SCSI CTD $1,475
7908-ZA 500MB Disk For Clariion $2,695

### CRT's

D211 CRT W/KB $110
D214 CRT W/KB $135
D410 CRT W/KB $135
D216 CRT W/KB $185
D470 CRT W/KB $195
D1400I CRT W/KB $450
D411 CRT W/KB $195
D461 CRT W/KB $225
D413 CRT W/KB $450

### MEMORY

8926 2MB For MV2000II $150
8972 4MB For MV2000II $350
8941 8MB For MV2500 $1,950
8942-C 16MB For MV2500 $3,500
80108-C 32MB For MV9XXX $4,995
8990-E 32MB MV15/20000 $3,750
7015-C 64MB For AV5/6000 $6,500
7016-C 128MB For AV5/6000 $12,900
7019-C 32MB For AV4300 $2,900

### COMMUNICATION

4370 IAC-16 $325
4560 LAC-12 $125
4532 ILC $1,250
4712 LAC-16 RS422 $495
4714 Sync Cont. $695
4623 IAC-24 $1,495
7419 VDC-16 $1,495
7425-L VME Term. Cont. $3,250
4626 LAC-32 $995

### MISC./PRINTERS

6433 SCSI Tape Cont. $995
6435 SCSI Tape & Disk Cont. $1,750
005-15633 ERCC/BMC For S-140 $995
8771 S-280 Flt. Pt. $900
6786/87 SCSI II Cont. $5,500
6215 180CPS Printer $625
4364 600LPM $950
7430 SCSI Cont For AV $1,500
8995/6 Add-On P/S For MV2000 $525

**"WE HAVE OVER $1,000,000 OF EQUIPMENT IN STOCK AND READY TO SHIP!"**

**BUY! SELL! TRADE!**

*** DATA GENERAL * HEWLETT-PACKARD * SUN * IBM * UNISYS ***

GLOBAL REFERENCES AVAILABLE
UPON REQUEST!

## *CALL TODAY!*

*Scott McIntyre *Terry Smith*
*Robert McIntyre * Michael Nowacki *
* Lorraine LaCroix

SCOTT McINTYRE & ASSOCIATES, INC.

**313-299-0040**
FAX: 313-299-0041

P.O. BOX 82115
ROCHESTER, MI 48308-2115

VISA MasterCard AMERICAN EXPRESS

Circle 40 on reader service card.

# Plug And Play And Rock All Day!

***NOW PLAYING from* Monarch Software** ♪♪
Here's what you've been waiting for! The first indisputably easy migration path to DG/UX® for **INFOS**® and **CEO**® users.

## *OPEN ELECTRONIC OFFICE ™ (OEO ™)*

**Open Electronic Office** is the only easy migration path for **CEO** users moving to DG/UX. **OEO** is keystroke-for-keystroke compatible with **CEO** and provides a familiar setting that ensures users will maintain, and even improve, their productivity. **OEO** also provides multiple choices in PC integration and MV interoperability.

## *OPEN FILE MANAGER ™ (OFM ™)*

**Open File Manager** is the only high performance, high reliability migration path to DG/UX for **INFOS** applications. **OFM** uses the **INFOS** API so your programs won't have to change to take advantage of the improved performance and greater recoverability features designed into **OFM**. We also offer a VS COBOL-compatible run-time system and a sort/merge, all in one cost-effective bundle.

***For More Information about easy migration to open systems call: 1-800-MIGRATE***

Monarch™ Software

*4904 Waters Edge Dr. • Raleigh, NC 27606*
*Phone: (919) 851-5408*
*Fax: (919) 851-9508*
*E-Mail: info @ monarch.com*



Circle 28 on reader service card.