

June 1992

FOCUS

The Magazine of the North American Data General Users Group



In Focus

CPU idle time

Well-fed and humming along

Whetstones, Dhrystones, and MFLOPS

Plus

Happy tuning

Yes, *sar*

Real-world report writing

The new MVs

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

CURRY

VISUAL CYBERQUERY. THE BEST REPORT WRITER BY ANY CRITERIA.

Visual Cyberquery (VCQ), The New Report Writer From Cyberscience, Is Indisputably The Best. Here's Why.

CYBERSCIENCE Corporation, developers of CQCS, the preferred 4GL for DG, announces a revolutionary new concept in report writers. Visual Cyberquery (VCQ) is not one but a family of reporting software products designed to allow any user to create and share query applications and data using an interface appropriate to their needs and experience.

1 POWERFUL FUNCTIONALITY FOR ALL YOUR USERS.

New and infrequent users start with VCQ Level I. It's menu-driven interface is easy to use and provides instantaneous help all the way. Using VCQ as an intelligent text editor, its report specification language offers increasing power and functionality from Level I, through Level II (Intermediate), to Level III (Advanced) so that experienced users can create the most sophisticated reports. Uniquely, VCQ caters to the entire user spectrum with just one product to license, learn and support.

2 DESIGN REPORTS IN A FRACTION OF THE TIME.

You can create reports up to 100 times faster using VCQ rather than COBOL.

3 OUTSTANDING RUN TIME PERFORMANCE.

VCQ can process thousands of database records per second. A report that takes 5 minutes to run in VCQ may take an hour or more to run with other products.

4 IT'S PART OF CQCS, THE LEADING 4GL.

Using the comprehensive application development environment provided by CQCS, end-users and MIS professionals can work together to create even the most sophisticated applications 10 to 40 times faster than using 3GLs such as COBOL.

5 DATABASE AND ENVIRONMENT INDEPENDENT.

CQCS is the *only* 4GL that provides simultaneous support for all of DG's most popular databases, including INFOS, ICOBOL, BBASIC and DG/SQL. Naturally, support for DEC's Rdb and RMS, Informix, ORACLE and many more strategic databases is also available. VCQ is 100% compatible across Data General AOS/VS and AViiON, DEC VAX/VMS, strategic UNIX platforms, MS DOS, and PC networks. You can retrofit quickly and easily to existing applications or combine relational and non-relational data in the same reports.

6 IT'S THE ONLY REPORT WRITER YOU'LL EVER NEED, NOW OR IN THE FUTURE.

No other product *protects* your investment AND *maximizes* your return on investment like VCQ. It extends the life of your computer systems, making it the best investment you've made since the day you bought your computer.

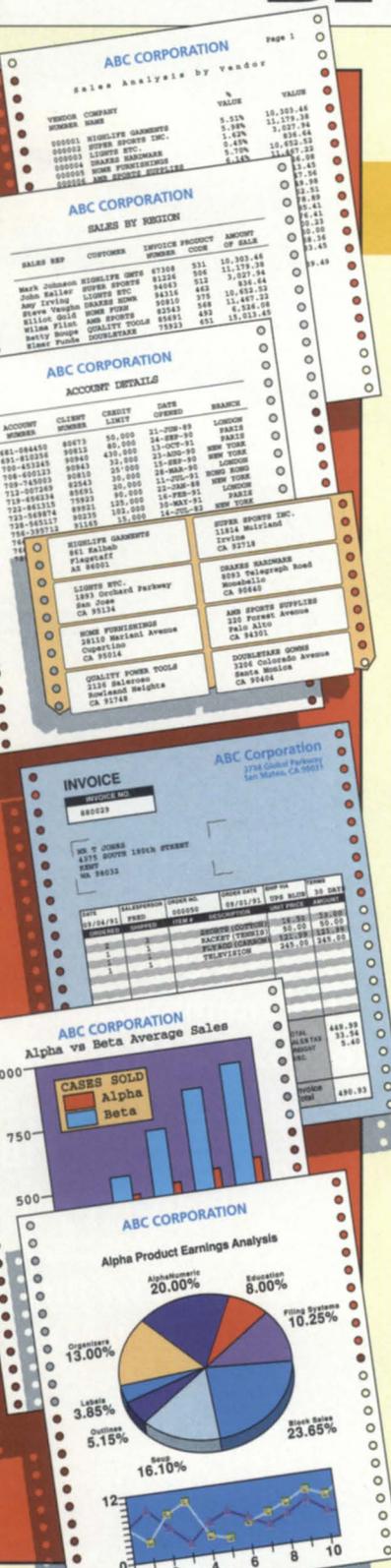
**WANT TO SEE THE BEST?
CALL US!**

1-800-451-1544

Cyberscience

C O R P O R A T I O N

Productivity with Performance



FOCUS

The Magazine of the North American Data General Users Group

EXECUTIVE MESSAGE

NADGUG Busy-ness

by Dennis Doyle

2

CONFERENCE REPORT

Lines of communication

Get in on the STR and RFE process for AOS/VS and AOS/VS II. Your ideas will make a difference

by Edward Lindberg

4

SYSTEM MANAGER'S LOG

Happy tuning

Bj returns to system performance analysis and tuning, because it's one subject that bears repeating

by Brian Johnson

18

UNIX NOTEBOOK

Yes, sar

Although DG/UX system performance measuring tools are not spectacular, they are adequate

by David Novy

26

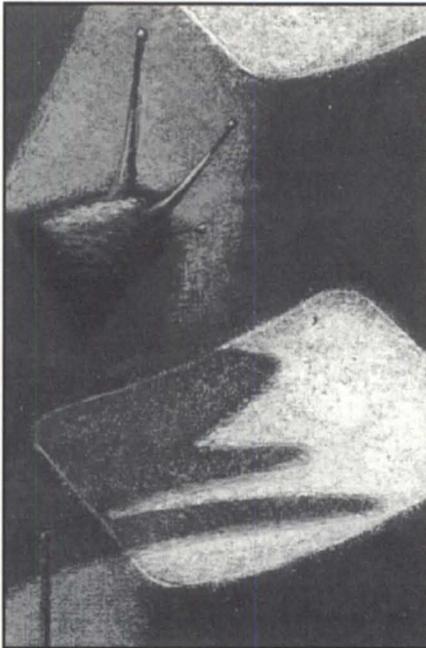
AHEAD WITH RAD

Real-world report writing

This article is the sixth in a series, examining a software development project using RAD tools and techniques.

by Kim Medlin

28



FOCUS ON: SYSTEM PERFORMANCE & TUNING

It ain't necessarily so

Idle time on your CPU always means the operating system has nothing to do. That can be good or bad. You must be the judge

by Don Thomas

6

Whetstones, Dhrystones, and MFLOPS

Freedom of choice in open systems means doing a little comparison shopping—and that leads us directly to benchmarks

by Thomas E. Soukup
and Edward A. Sepich III

10

Well-fed and humming along

Don't forsake common sense when it comes to tuning your computer system. And when common sense is lacking—

throw more memory at it

by Rick Havourd

14

PRODUCT ANNOUNCEMENT

New family members

Six generations of anything is quite an accomplishment. For Data General and its recently announced mid-range and high-end MV minicomputers, six generations represent a commitment to a product line and a long-range strategy

by Doug Johnson

33

BULLETIN BOARD

Bits and bytes

36

PRODUCTS AND SERVICES

The latest products for Data General systems

37

ON-LINE HELP

Who to call for information about NADGUG and Focus

38

IN GENERAL

News briefs from the Data General community

40

Cover illustration by Tom Curry

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 located at Livingston Building, Suite 250, 3420 Executive Center Dr., Austin, TX 78731, phone 512/345-5316. 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.

Postmaster: Send address changes to Subscription Department, Turnkey Publishing, Livingston Building, Suite 250, 3420 Executive Center Dr., Austin, TX 78731.

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. 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.

Copyright © 1992 by the North American Data General Users Group. All rights reserved. Reproduction or transmission of contents in whole or in part is prohibited without written permission of the Publisher. The Publisher assumes no responsibility for the care and return of unsolicited materials. Return postage must accompany all material if it is to be returned. In no event shall receipt of unsolicited material subject this magazine to any claim for holding fees or similar charges. Volume 8, Issue 6.

NORTH AMERICAN
DATA GENERAL
USERS GROUP

NADGUG busy-ness

by Dennis Doyle
NADGUG President

Greetings from Kansas City!

The spring board meeting was held here April 4 at the NADGUG flagship hotel, the Allis Plaza. The meeting and the executive board session immediately preceding it capped a busy six-week period for me as your representative in a variety of situations.

The intense six weeks of NADGUG business began in late February with a working review session at our management firm's offices in Sudbury, Massachusetts. Issues relating to both the spring board meeting and ongoing business were covered by Danieli & O'Keefe staff. Of particular importance was the definition and costing of the proposed projects in the area of membership growth and conference attendance, and their impact on the new fiscal year budget. I also met in Westboro with Data General support staff and Steve Baxter, vice president of corporate marketing. Past NADGUG president Frank Perry joined us, and we carefully revisited plans for the coming year.

In early March, Frank and I found ourselves traveling on the "wrong" side of the road on the way to Birmingham, England, to attend the United Kingdom DG user group's annual conference. The two-day event was provocative as well as educational. Many thanks to retiring Chairman Nigel Ockenden for his gracious hospitality. We look forward to introducing his successor, Jon Guthrie of Scotland, to many of you at NADGUG 92. It was also a great pleasure to meet Olga Kennedy, the outgoing chair of the Irish user group, as well

as David Judge, the incoming chair.

We also met with Jean Mouleyre, general director of DG France and International Distributors. We discussed ways to promote NADGUG throughout France and in countries that his staff calls on. Ways to encourage European attendance at the Kansas City conference were also suggested.

Shortly after returning home, it was on to Kansas City for the spring board meeting. Attending were many familiar contributors, committee chairs, a past president or two, and some new folks. For copies of the proceeding's transcript, please contact Tim Boyer, NADGUG's recording secretary. Highlights of reports centered around plans to increase membership, the upcoming KC conference, current financials, and the budget. We will try to present details of these topics in *Focus* as space and time permit.

NADGUG's financial position is on solid ground. We anticipate that it will only get better as we move through the next fiscal year. Implementation of plans to grow the membership base will begin in early summer, and will stay well within budgetary guidelines.

Part of my report to those in attendance in Kansas City was an update on the request for enhancement (RFE) review process. It has begun in earnest, and my thanks go to Linda Klatt, Tim Boyer, Ed Lindberg, David Novy, and to members of their special interest groups for helping to get it off the ground.

Please join us at SIG meetings in Kansas City to participate in rating RFEs, and helping draft new ones.

Kansas City, here we come Δ

FOCUS

The Magazine of the North American
Data General Users Group

NADGUG LEADERSHIP

President
Dennis Doyle

**Vice President/
Conference Committee**
Jan Grossman

Treasurer
Steve Pounds

Recording Secretary
Tim Boyer

Audit Committee
Calvin Durden

Membership Committee
Chris Thorpe

Planning Committee
Frank Perry

Publications Committee
Maggie Morris

RIG/SIG Committee
Bart Bates

FOCUS MAGAZINE

Publisher
Greg Farman, Ph.D.

Editor
Doug Johnson

Contributing Editors
Tim Boyer, Brian Johnson,
Doug Kaye, Kim Medlin, David Novy

Contributors
Dennis Doyle, Rick Havourd,
Edward Lindberg, Edward A. Sepich III,
Thomas E. Soukup, Don Thomas

Advertising Manager
Michelle Sentenne

Art Director
Pat McMurray

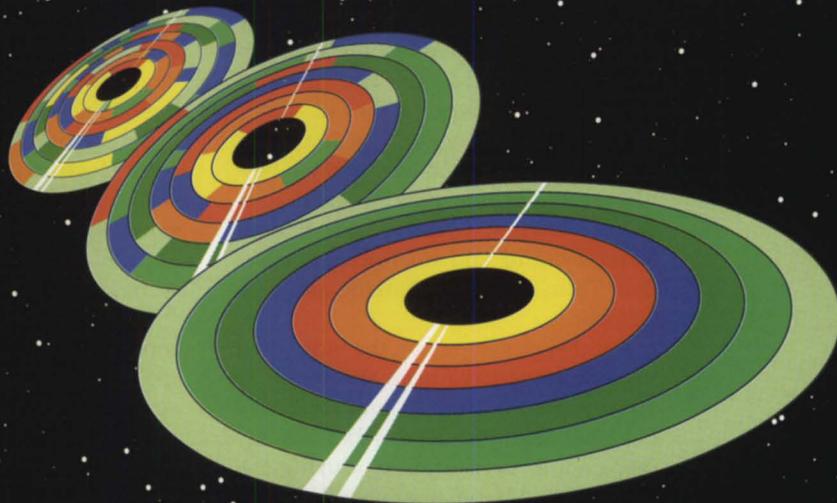
Production Artist
Casey Hunter

Office Manager
Paula Minton

Administrative Assistant
Tammy Agnew

**To Boldly Go
Where No One
Has Gone Before**

DISK_PAK™ OnLine!™



**Now You Can Optimize Any Disk With All Systems GO!
No Downtime Required.**



Call Today For Details 1-800-477-5432

P.O.Box 16 \ Salina, Kansas 67402-0016 \ Phone: (913) 823-7257 \ FAX (913) 823-6185

Circle 19 on reader service card.

Lines of communication

by Ed Lindberg
AOS/VS SIG

SYNOPSIS

Get in on the STR and RFE process for AOS/VS and AOS/VS II. Your ideas will make a difference.

I would like to update any interested readers on the activities of the AOS/VS Special Interest Group, as well as provide any other general information that may assist users of Data General products.

The first thing that comes to mind is my recent trip to Kansas City for the NADGUG Spring Board Meeting. We had a very productive session, and I am looking forward to the annual NADGUG Conference in the fall.

As I am sure you will hear from a variety of sources, the meeting will be a little different this year. We will start the sessions on Tuesday, rather than Monday, and end on Friday, rather than Thursday. Start thinking ahead to October.

Another development: the individual presentations have been shortened to 50 minutes, with a 10-minute break between sessions. This will allow for many more presentations during the three-day period. Consider having more than one person from your company attend the meeting, so your business can take better advantage of the program.

Unfortunately, it was still necessary to schedule the Operating Systems Roundtable last in the program. Please plan to attend this session. Although it's the final NADGUG 92 session, it has been moved to earlier in the afternoon, so you will still be able to catch a plane for home if you need to travel on Friday.

We will want to discuss the new Software Trouble Report (STR) and Request for Enhancement (RFE) process at our Special Interest Group meeting. Currently, the SIGs are participating in the RFE process. I want to update you on our progress to this point in time. I

have already received two packets of STRs, which earlier had been identified as RFEs to AOS/VS or AOS/VS II by the software developers.

The idea is to provide information regarding the importance of these requests to the development group. The presumption has been made that we might be able to influence the priorities of the developers if we detect an important request that they feel is not significant. Four of us have rated approximately 30 AOS/VS or AOS/VS II STRs that were originally classified as RFEs. Some of these we feel are "bugs," and as such should not be classified as enhancements. If it can be established that they are "bugs," they will be dropped from this procedure and corrected.

We rated the STRs on a scale of 1 to 5: 1 being "important to a lot of members of the SIG;" 5 being a "waste of time." These have been returned to the developers, and now we are waiting for their responses to our input.

By the time you read this, we will have classified many more STRs, and we hope we will have established a good line of communication and an appeals process if we can't reach agreement with the developers.

I would like to comment on this concept and its importance. First, many of us have stopped submitting STRs against Data General software products. Now is the time to review our actions. This could be an opportunity to correct problems or get enhancements that we as users have needed for years.

Here at Western New England College, we have an MV/10000 and an MV/20000, as well as an Aviion. We are "out of revision" on AOS/VS, Cobol, and Infos II. I have not seriously considered running AOS/VS II, although we're licensed to run it on our MV/20000. With renewed lines of communications and the influence of your interest groups, we may be able to enhance your operations without increasing your costs.

How about participating? Δ

Ed Lindberg is chairperson of the AOS/VS SIG. He may be reached at 1215 Wilbraham Rd., Springfield, MA 01119; 413/782-1246.



Put Your ICOBOL Applications On The Fast Track.

With Choice!™ and Axis™ from Wild Hare. Only Choice!, Wild Hare's run-time system, lets you run your ICOBOL object programs and data files totally unmodified on any popular computer system. Without

Choice! and Axis currently run on:

MS-DOS	VAX/VMS
OS/2	AOS/VS
PC NETWORKS	MACINTOSH
UNIX	AViON
XENIX	MCS
AIX	...and others

recompilation, translation or even reorganization. Any object file works on any platform. In any new market. With virtually unlimited sales potential.

And Axis, the world's fastest ICOBOL compiler, keeps you ahead of the pack by letting you develop your applications on almost any hardware, and under any popular operating system. Which means if you would rather work under UNIX than AOS/VS, or MS-DOS than VAX/VMS, no problem. Just order the specific Axis for your favorite development environment and you're off.

Put Axis and Choice! on your ICOBOL application team and discover what thousands of others already know: When it comes to turning your application into a runaway success story, place your bets on the Hare.

Call Wild Hare at (303) 442-0324 for more information.



Wild Hare Computer Systems, Inc. 2820 Wilderness Place Boulder, Colorado 80301 USA Fax: (303) 440-7916 Tel: (303) 442-0324
Axis and Choice! are trademarks of Wild Hare Computer Systems, Inc. All other trademarks and registered trademarks are the property of their respective owners. Copyright © 1991 Wild Hare Computer Systems, Inc. All rights reserved.

Circle 40 on reader service card.

It ain't necessarily so

SYNOPSIS

Idle time on your CPU always means the operating system has nothing to do. That can be good or bad. You must be the judge.

by Don Thomas
Special to Focus

If you are reading this article, then chances are good that you have or had responsibility for an MV family CPU. If you have responsibility for a system, then you are concerned about getting the best performance from that system. The question is: what is best performance?

There is no black-and-white explanation about system performance. There are many performance gurus with as many ideas about what will increase your system throughput.

Throughput is what we are talking about here. I've always said that you will never get MV/40000 performance from your MV/9300. You *can* get MV/9300 performance from your MV/40000, if you aren't careful. The real objective is to get everything you are entitled to from the CPU you currently have.

The major goal for most system administrators is to increase system idle time. After all, the more idle time the better, right? It ain't necessarily so. Idle users may be a better gauge of system performance than idle CPU time.

System users are the ultimate system performance monitor. They are why the system exists. They are why you, as system administrator, have a job. The reason system users are not generally selected as a monitor of choice is because the information is difficult to formulate into charts and graphs.

Users will reschedule jobs outside peak periods to avoid a poorly performing system. This plays havoc with system idle time. You will see unexplained peaks in idle time when the users are rescheduling. It's wild!

Idle time means the system has nothing to do. The system is never *really* idle. Even when it's idle, it's check-summing memory, just waiting for an event to occur. This means that idle time is excess CPU time. Why do you want your system to waste time? No idle time means your system is performing work all the time, and that's good, right? It ain't necessarily so.

No idle time and poor system response may indicate the need for more hardware resources. While plenty (10 to 40 percent) of idle time and poor performance may indicate the need for more hardware resources. It sounds the same, but the solutions can be completely different.

More power

The first case—poor performance and no idle time—may indicate the need for a more powerful CPU. I would look at the percentage of system time and user time. A higher percentage of system time may be a symptom of an application bottleneck. Adding a more powerful CPU may solve the problem temporarily. Identifying the application bottleneck and solving that problem is the best long-term strategy.

Here is a scenario I have seen again

Setting New Performance Records with Disk, Tape, and Optical



Zetaco's newest peripheral controller, Model SCZ-6, implements fast SCSI-2 technology to support the latest and fastest SCSI disk, tape, and optical drives.

With its 10 MB/sec data transfer rate, SCZ-6 will help you set new MV system performance records in the key events of your daily data storage race—such as speedy transfers of large data blocks, less bus contention in multiple-drive subsystems, decreased backup times, and overall faster response time at the terminals. SCZ-6 is designed for highest performance in multi-drive subsystems.

Go for the gold—the SCZ-6 Multifunction Controller—and discover the speed and endurance you need to win the data storage race. Call us toll-free: **1-800-423-3020**.



Zetaco, Inc.
Subsidiary of
Carlisle Corporation
11400 Rupp Drive
Burnsville MN 55337
612-890-5135, FAX 612-890-0791

Call the Authorized Zetaco Distributor nearest you for complete subsystems and service:

Eastern U.S.
Design Data Systems
Suite 200, 40 W. Gude Drive
Rockville MD 20850
phone (301) 424-7870

Western & Northern U.S.
BLM Systems
Suite C, 145 Webster Street
Hanover MA 02339
phone (617) 982-9664

Canada
Lasbert TRI-COM, Ltd.
3325 River Road, Unit 5
Gloucester, Ontario K1G 3N3
phone (613) 521-5152

"IN THE KNOW!"

Did you know that Motorola was the first company to ever win the Malcolm Baldrige National Quality Award!?!? Motorola has also won similar awards throughout the world including Japan, Europe and Israel, competing against some of the world's toughest competitors. Motorola is striving to achieve the highest goal of any computer manufacturer in the world, Six Sigma quality. This is a defect rate of just 3.4 defects per million units manufactured. Currently Motorola is still leading the computer industry at 5.4 Sigma, which is only 40 defects per million units manufactured. It is through this Six Sigma philosophy that Motorola has become known worldwide as the leader in quality.

"IN THE KNOW!" is a monthly service of McIntyre's for today's MIS and DP managers and personnel!

Whether you have a need to buy, sell or upgrade call McIntyre's and deal direct with

"YOUR DG AND MOTOROLA MARKETPLACE"

1-800-968-7775



2660 Auburn Rd., Suite 700, Auburn Hills, MI 48326
(313) 853-9800 • (800) 968-7775 • FAX (313) 853-0013

DATARAM
AUTHORIZED DISTRIBUTOR



Circle 24 on reader service card.

Why Join NADGUG?

Reason #18

A collective voice

Do you have a concern that needs to be addressed by Data General? Have you been looking for answers? There is a way to get your concerns and needs addressed by Data General—the North American Data General Users Group.

**NORTH AMERICAN
DATA GENERAL**

**USERS
GROUP**

1-800-253-3902

(continental U.S. only)

508/443-3330

NADGUG is an effective two-way communication channel between Data General and the people who use DG equipment.

Be part of NADGUG's collective voice—join the users group today!

and again. A client has an application that needs to be rewritten, but the only solution ever proposed has been to buy a bigger and faster CPU. The client has the top-of-the-line CPU and the system performance is starting to deteriorate. What's to be done? They can't move up to a more powerful CPU because it's not available yet.

In comes another hardware vendor with facts, figures, studies, and testimonials about why their hardware outperforms the present gear. The client is sold, but has to convert the application to the new platform.

As promised, the application runs faster than ever on the new hardware. Yep, this was a good move, although an expensive one. Right? It ain't necessarily so.

It's just as likely that the same results could have been achieved by doing the application rewrite on the original hardware platform. The client would have saved the cost of the hardware, retraining, and confusion associated with changing hardware vendors.

Lots of idle time and poor performance means there is a resource bottleneck somewhere. It could be either hardware or software. Gee, I really narrowed that right down!

Disks are a good example of this type of bottleneck. I know you have perfectly balanced disk utilization, and that none of your disks are more than 65 percent full. Congratulations. You probably are not afflicted with this phenomenon. However, it is possible that all your application software must reference information on a particular disk, and that these requests tend to pile up. The users have nothing to do while the request is processed. The system has nothing to do while waiting for the requests to the disk unit to complete. When the system has no users to run, or no work to do, it goes into the idle loop. Now you have poor system throughput and great idle time.

More memory

Not enough memory can cause poor performance and increased idle time. If you add more work, then the system is out of tune and the symptom may be poor throughput. The solution may be more memory.

AOS/VS operates best when there is

Circle 26 on reader service card.

Data General Professional Services

- ✓ Consulting
- ✓ Custom Software
- ✓ Systems Integration
- ✓ Performance Analysis
- ✓ Software Conversion
- ✓ Network Services

Don't you deserve the best?

 **Data General**

Systems Engineering
Call 1-800-DATA GEN

FREE trial Software Available -- Call TODAY!

Circle 12 on reader service card.

just enough memory for all the jobs that need running at any given time. AOS/VS is a demand-paging operating system. That means it will try to keep only active pages in memory. Too much demand for memory turns ugly when AOS/VS must start swapping processes to satisfy the demand for memory. This places extra demands on the CPU and disk subsystems. The natural symptom is decreased throughput.

However, adding more memory might lead to a CPU bottleneck. Great! You then should buy a new, more powerful CPU, with tons of memory. Well, you *can* do that. However, you might find you now have a bottleneck with your disk subsystem.

We are looking at a phenomenon where too much memory can cause an increase in system overhead. Bill Means offers the theory that we might be able to improve AOS/VS or AOS/VS II throughput in certain large memory configurations by modifying the way the operating system handles memory pages. If you would like to participate in this project, call me.

There are few quick solutions to performance issues. Anyone offering a canned answer without a thorough investigation of your system configuration, operating environment, application, and business growth potential, should be avoided. It takes work and effort to manage a system that is a business productivity tool. Never make a decision about your system without an eye on the future.

You are the best-qualified person to answer the question, "What is good system performance?" Because you see what is happening with your system daily, you (and your system users) are the best judge of system performance. You will need to find a reliable professional to help you identify bottlenecks, and recommend long-term solutions to your throughput issues.

Remember, idle time can indicate many things. It always means the operating system has nothing to do. That can be good or bad. You have to be the judge. △

Don Thomas is president of NSTS, Inc. He may be reached by phone at 404/923-1383, or by fax at 404/923-3998.

SYSGEN DATA Ltd. MARKETING

 **Data General COMPUTERS & PERIPHERALS WORLDWIDE**

MV 15000 MOD 10, 8MB	\$9,850	TCB-8 and 16	\$200
MV 15000 MOD 10, CPU Board	4,995	MCP 1 w/TCB	1,200
MV 15000 MID Board	2,250	LAC 12	500
MV 15000 MOD 20 CPU W/Fit. Pl.	13,750	DG 70MB Drive (2000 Format)	400
MV 2000 4MB, Flpy	1,800	DG 160 MB Disk	995
MV 20000 Model 2 Upgrade	8,500	4327 B300	600
MV 15000/20000 Floating Point	2,500	Genicom 3320/3318 Printers	250
6239 S/S 592MB	2,850	Zetaco BMX2	650
4307H Tape Drive/Complete Parts	1,500	32 MB Memory (MV 20000 Style)	9,000
MV 2500, 322MB Drive,Tape	8,995	16MB Memory (MV 15000 style)	3,750
CSS w/3x 322MB Disk, Tape S/S	9,500	6236 S/S...1,250 D210	150
WI0C (MV 10000)	750	D460.....215 D410	195
LAN BOARD (15000 Style)	2,850	D411.....225 D211	175
LAN BOARD (2000 Style)	750	D214.....175 D215	225
MV 4 & 10 Memory 2MB	450	D216 New....365 D412	325
LAC 32	2,750	DG Walkabout	295
IAC 16 (RS 232) w/TCB 16	1,200	Dataram 16MB (MV 15000)	2,500
IAC 16 (RS 422)	1,200	8MB Memory MV 20000 Style	1,500
IAC 8-2	950	DG 6321 Printer w/ Sheet Feeder	195

SYSGEN SPECIAL DG 6321 Printer\$195 MV 20000 MOD II Board\$7,850
ILC Board 4532-A2,850 Motorola Delta 8000 CALL

DATARAM
AUTHORIZED DISTRIBUTOR

SCIP

BUY • SELL • TRADE • LEASE

PRICING SUBJECT TO CHANGE WITHOUT NOTICE
ALL EQUIPMENT SOLD IS WARRANTED FOR 30 DAYS

Authorized
WordPerfect
Motorola VAR

12 ELKLAND ROAD, MELVILLE, NY 11747 (516)491-1100 fax: (516)491-1559

Circle 35 on reader service card.

Whetstones, Dhrystones, and MFLOPs

by Thomas E. Soukup
and Edward A. Sepich III
Special to Focus

SYNOPSIS

Freedom of choice in open systems means doing a little comparison shopping—and that leads us directly to benchmarks.

In today's world of high technology and the rapidly advancing environment of computer systems, a business' accurate selection of a computer system is the key to its success. Unlike proprietary computer systems of the past, which limited a customer's hardware and software options, open systems now afford users the freedom of choice.

Once a final decision is made to move to an open systems platform, decision-makers face the dilemma of which open

systems vendor to choose. Many standard benchmarks attempt to rank open system platforms, but have they made the choice any easier?

Each standard benchmark measures different aspects of open systems platforms. Some benchmarks measure only the hardware subsystem, such as:

- Central processing unit (CPU)—how fast the computer processes instructions
- Memory system—how fast the CPU interfaces with memory (primary storage)
- Disk input/output (I/O)—how fast it interfaces with disk (mass storage)

Figure 1: Hardware & Software Subsystems Measured

CPU	Memory	Disk I/O	OS	RDBMS	Async I/O	LAN I/O
Standard Benchmarks						
Whetstones						
Dhrystones						
Linpack						
SPEC Suite						
AIM System Benchmark (Suite III)						
TPC Benchmark B (TPC-B)						
TPC Benchmark A (TPC-A)						
Computing Environments						
Scientific/Engineering Workstations						
Small Server Systems						
Multi-User Server Systems						

- Terminal input/output—how fast it processes characters to and from the screen/printer and other asynchronous devices
- Network input/output—how fast it processes network traffic to and from other computers.

Meanwhile, other standard benchmarks measure software subsystem-related aspects, such as:

- Operating system efficiency—how fast the computer executes applications, stores and retrieves files, and manages multiple on-line and batch applications running simultaneously
- Relational data base system performance—how fast it runs data base applications
- Multi-user performance—how fast it manages a certain mix of on-line and batch tasks.

Rules of thumb

Open systems vendors are continually working to improve operating systems and the data base products they support.

Thus, standard benchmark results change so rapidly that there is no fixed result. Simultaneously, as vendors continue improving software and hardware, each revision of a standard benchmark may change the way the benchmark tests a certain subsystem, or may begin testing an entirely different set of subsystems.

How to proceed in such an environment? A few rules of thumb:

- Select standard benchmarks that best resemble your current or proposed computing environment
- Choose a vendor that best addresses your present and future goals, one whose solution addresses system expansion
- Choose a vendor that demonstrates

interoperability (communicating within a multi-vendor environment)

- Choose a vendor whose service organization will assist in meeting your short-term and long-term goals on an ongoing basis.

Data General Corporation's open systems platform, the Aviion family, as well as the company's proprietary Eclipse MV product lines, continue to outperform the competition in the multi-user server and network server markets. The results of the AIM System Benchmarks, TPC-B and TPC-A Benchmarks, prove this market advantage.

Benchmarks

Benchmarks are set of one or more application programs used to measure and predict the performance of open systems platforms.

When using standard benchmarks as a basis for predicting how an application or data base product will perform, you should select those measuring subsystems based on your particular application needs.

Standard CPU benchmarks

Workstation users often use standard CPU benchmarks to measure a workstation's pure number-crunching ability. These benchmarks predict how CPU-intensive applications will perform.

Whetstones—"KWhets"

KWhets (thousands of Whetstone instructions per second) is a measuring rod for system performance in scientific or engineering application environments. Operations measured include floating-point and integer calculations, transcendental functions, conditional branching, and array manipulations.

Whetstones is antiquated. The Dhrystones benchmark is currently the

Each standard benchmark measures different aspects of open systems platforms.

AViION™

UPGRADES DONE RIGHT

HDSI specializes in disk and peripheral upgrades for Aviion systems.

Expertise in both the UNIX and MAGIC world

Very competitive pricing

Call for a quote before you buy

Hanson is still your best source for used D.G. equipment

12 years of experience

Full technical support

Competitive pricing

90 day warranty

**If you need to
Buy - Sell - Trade
CALL TODAY**

Hanson Data Systems, Inc.
734 Forest Street
Marlboro, MA 01752
508-481-3901
800-879-4374
FAX 508-460-0593

TRADE MARK OF DATA GENERAL CORPORATION

industry's trend for predicting how CPU-intensive applications will perform. *Subsystem(s) measured: CPU. Example computing environments: scientific and engineering research environments.*

Dhrystones: "Dhrys"

Revision 2.1

Dhrys (Dhrystone instructions per second) is a relative measure of

computing power along with compiler efficiency. *Subsystem(s) measured: CPU. Example computing environments: scientific and engineering research environments interested in CPU/compiler performance.*

Linkpack: "MFLOPS"

MFLOPS (millions of floating-point

operations per second) is a relative measure of floating-point throughput for both single- and double-precision arithmetic. It predicts CPU speed and Fortran compiler efficiency. *Subsystem(s) measured: CPU. Example computing environments: scientific and engineering research environments depending heavily on Fortran.*

Spec Suite Revision 1.2

Ten compute-intensive programs: Six floating-point F77 double-precision and four non-floating-point "C" programs.

Specmark reflects computation speed. Specthruput reflects computation capacity. Specint reflects integer speed, and Specfg reflects floating-point speed. Floating-point and the compiler's pre-processor performance heavily influence the results. *Subsystem(s) measured: CPU. Example computing environments: scientific and engineering environments depending heavily on "C".*

Standard multi-user benchmarks

Time-sharing users often use standard multi-user benchmarks to measure a server's ability to handle several hundred users performing a certain mix of tasks. These benchmarks predict the number of users a system can handle in a server-like environment.

AIM System benchmark (Suite III) Revision 3.1

The AIM Performance Rating reflects the peak performance of an open system platform measured in AIM multi-user performance units. Performance ratings of a wide range of Unix systems can be compared using available AIM performance reports. *Subsystem(s) measured: CPU, memory, disk, and operating system efficiency. Example: computing environments: custom recordkeeping, accounting, and inventory applications written in "C", Cobol, and other languages.*

Standard data base benchmarks

Data base users often use benchmarks to predict the performance of a specific data base product. Data bases commonly tested include Oracle, Informix, Sybase, Progress, Ingres, and Unify, as well as others.

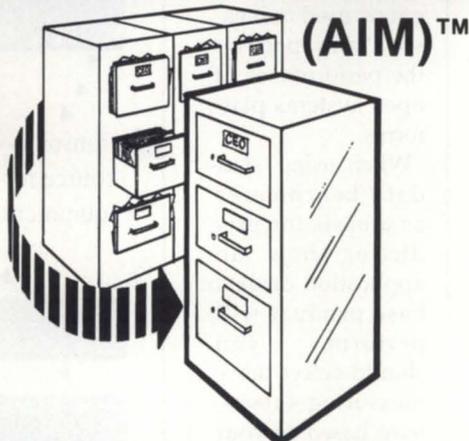
TPC benchmark B (TPC-B)

TPC-B is an on-line transaction pro-

The product CEO system managers and users have been waiting for.

ARChive Interface Module

Now With Automatic ARCHiving



Compress CEO Documents with Immediate, On-Line Restoration

As a CEO public application:

- Relieves the system manager of the responsibility to restore user's documents.
- Saves disk space by compressing the files into an ARC® library.
- Keeps CEO users happy by allowing them to restore their own documents.
- Works either with, or independently of the CEO archiver, and will restore documents previously archived to tape.

Call, Write or FAX for AIM on a 30 Day Approval!

CORPORATE LICENSES AVAILABLE *



Data Bank Associates, Inc.

20010 Century Blvd., Suite 104
Germantown, Maryland 20874
Telephone (301) 540-5562
or FAX (301) 540-8105



ARC is a registered trademark of System Enhancement Associates, CEO is a registered trademark of Data General Corp.

*Must also purchase a license for ARC.

Circle 8 on reader service card.

cessing data base stress test that simulates a banking industry application. It reports results as transactions per second (TPS) and a five-year cost per TPS. *Subsystem(s) measured: CPU, memory, disk and operating system efficiency, with a specific relational data base product. Example computing environments: recordkeeping, accounting and inventory applications written in a specific relational data base language.*

TPC Benchmark A (TPC-A)

TPC-A is an on-line transaction processing data base stress test that simulates a complete automatic teller machine system. The TPC-A Benchmark reports results as transactions per second (TPS) and a five-year cost per TPS. *Subsystem(s) measured: CPU, memory, disk and operating system efficiency, with a specific relational data base product, local area or wide area network terminal I/O. Example computing environments: record-keeping, accounting and inventory applications written in a specific data base language with heavy terminal and local or wide area network terminal users.*

How to obtain specific vendor results

Open systems vendors can supply the most up-to-date standard benchmark results for their product lines. In addition, many Unix publications and specific benchmarking test organizations provide vendor competitive reports. A few quick references:

- Whetstones: Published in *UNIX Review*, March 1990, & other Unix publications.
- Dhrystones: Published in *UNIX Review*, March 1990, & other Unix publications.
- LINKPACK: Published in various Unix publications.

Thomas E. Soukup is the America Sales and Service Division Benchmark Coordinator, and a member of the Western Area Technical Services Group at Data General Corporation, Schaumburg, IL. Edward A. Sepich III is founder, chairman, and president of Total Environmental Systems Services Corporation, (Schaumburg, IL), a management advisory company.

- SPEC Suite: SPEC publishes results in the SPEC newsletter. Mail orders to: SPEC c/o National Computer Graphics Association (NCGSA), 2722 Merilee Drive, Suite 200 Fairfax, VA 22031; 703/698-9600, ext. 318
- AIMS System Benchmark Suite III: AIM Technology publishes a quarterly *Unix System Price Performance Guide*. To order, call 800/848-UNIX, or

write to: AIM Technology, 4699 Old Ironside Drive, Suite 150, Santa Clara, CA 95054.

- TPC Benchmark B (TPC-B): Published by the TPC Council, c/o Shanley Public Relations, 777 North First Street, Suite 600, San Jose, CA 95112-6311; phone 408/295-8894, or fax 408/295-2613.
- TPC Benchmark A (TPC-A): same as for TPC Benchmark B. △

NEW!

The acclaimed utility program just got better.

ARC version 2

with ARCTape

**Take
the Disk
Equivalent
of . . .**



**And
Reduce it
to this.**



ARC version 2 can now process an **unlimited** number of input files.

The New ARCTape is up to 6 TIMES as fast!

- Proven, reliable compression, up to 90%+
- With ARCTape, unattended backups to a single tape
- ARCmerge combines Archive libraries
- ARC is officially approved by the creators of ARC on the PC

THE PACKAGE INCLUDES:

- ARC Version 2 • ARCTape • ARCmerge
- A low level version for Unix • a commercial license for the PC version
- 1 year software subscription and hotline support

And The Perfect Complement to ARC . . .

TurboTran™

Xmodem/Ymodem Protocol

provides **ERROR-FREE** file transfer to and from **ANY** PC, using almost any emulator, at speeds up to 38,000 baud.

The Smart Connection™

Complete PC integration with SmarTerm™ products and perfect integration with CEO.

HERE IS WHAT YOU GET . . .

- Efficient, fully supported DG/PC integration • Software subscription
- Hotline support • CEO integration • PC support • AOS or AOS/VS
- Low, low CPU impact • Runs at baud rates up to 38.4 KB • And more!

Call, Write or FAX for ARC or TurboTran on a 30 Day Approval!

CORPORATE LICENSES AVAILABLE



Data Bank Associates, Inc.

20010 Century Blvd., Suite 104
Germantown, Maryland 20874
Telephone (301) 540-5562
or FAX (301) 540-8105



ARC is a registered trademark of System Enhancement Associates, SmarTerm is a registered trademark of Perisoft Corp., CEO is a registered trademark of Data General Corp.

Circle 9 on reader service card.

Well-fed and humming along

SYNOPSIS

Don't forsake common sense when it comes to tuning your computer system. And when common sense is lacking—throw more memory at it.

by Rick Havourd
Special to Focus

The whole issue of system performance and tuning really comes down to what your own needs and desires are for the computer system you manage. What are you doing with your machine? What do you expect to get from your machine?

How you use it will play the biggest role in the system's overall performance. Using your workstation for desktop publishing or application development certainly is different from using a server as a data base engine or traditional timesharing system.

There are a number of issues common to all of these environments, and that's what I'll be covering in the rest of this article. You may then test these ideas (and some of your own). Keep the ones that work for you, discard those that don't. But you shouldn't be expecting miracles. Computer performance is a lot like that of an automobile: when you first purchase it you're amazed at the speed, agility, and overall handling. But as time goes on it just doesn't seem as fast as it used to. Tune-ups, small repairs, and high-quality gasoline all improve the vehicle's performance, but in isolation none will amaze you.

The memory issue

With the Aviiion and with RISC systems in general, there is a very simple and limited instruction set. With 51 dif-

ferent instructions it takes quite a bit to piece them together into something meaningful, i.e. your program. Because of this, your machine is going to run through 16 million to 33 million instructions every single second. The problem is that 33 million instructions probably take up most if not all of your system's memory. For those who missed it, our first keyword is: *memory*.

With complicated programs made of simple instructions, it's going to take quite a bit of memory to keep the processor well-fed and humming along. Save all that money trying to figure out where machine cycles are going and load up your machine with memory.

In an earlier *Focus* article, I said I was running on an AV 310c with 12 MB memory. You want to talk about a performance dog? Well, this one came with fleas! I was never quite alone, as my disk drive kept me company with its incessant chatter (paging entire applications between memory and disk makes a lot of noise).

The other day we finally broke down and purchased more memory: 16 MB from SCIP systems cost us less than \$1,500 and it's the best thing I ever did. So now with 28 MB my machine has been transformed from the swapmeister into the real screamer the salesperson sold me.

A little experimenting has shown us that approximately 5 MB is used by DG/UX; 4-6 MB for X11 and Motif. Add to that other, noncritical but useful utilities for 2-4 MB, and you're sitting at a bare minimum of 12 MB. Once you break the 16 MB barrier, life improves rapidly.

To test your own memory utilization, here's a command you can use: `sar -r 1 1` will give you the instantaneous free memory pages and free swap blocks.

Presenting the
ECLIPSE MV/60000 HA™



It's the dawn of a new age of corporate computing!

Welcome to the 6th generation of ECLIPSE®—the generation that reaches new heights

in corporate computing while protecting your software investments. The MV/60000 HA gives you:

MORE POWER—100 real MV MIPS supporting over 1000 CEO® or database users with up to 4 CPUs and 1 GB of memory.

GREATER SYSTEM AVAILABILITY—including integrated diagnostics, N+1 power and cooling, AOS/V5 II, MRC, and the NEW H.A.D.A./MV disk array.

BREAKTHROUGH TECHNOLOGY—single board 27 MIP CPU, latest Motorola gate arrays, 600 MB/sec asynchronous bus, mid-plane design.

ALL LEADING INDUSTRY STANDARDS—supports SCSI II, TCP/IP, NetBEUI, AppleTalk®, Novell® OSI, SNA, X.25, and more!

MEETING YOUR NEEDS NOW—whether you require increased processing power, system consolidation, or mission critical confidence, the MV/60000 HA will take you into a new age of corporate computing.

Call **1-800-DATA GEN**

ECLIPSE MV/60000 HA is a trademark of Data General Corporation.
ECLIPSE and CEO are registered trademarks of Data General Corporation.
AppleTalk is a registered trademark of Apple Computer.
Novell is a registered trademark of Novell, Inc.
© 1992 Data General Corporation



Circle 10 on reader service card.

This is useful in determining overall memory/swap utilization. Each page is 4,096 bytes, and each block is 512 bytes. The more free pages available, the better. As fewer free pages are available, swapping will increase.

The disk issue

The next major subsystem on your machine is the disk. The Avion inte-

grates a state-of-the-art SCSI (small computer system interface) controller directly on the system. This allows us to use the latest in disk technology—very fast disk drives that typically have an access time between 12-15 ms. Between the computer and the disk drive, data passes over the bus at 2 MB per second. This provides a high-quality, high-speed storage solution. For the most

part disks won't be a major bottleneck for you, but let's consider a couple of situations that could use a little help.

A data base server is a prime candidate for disk bottlenecks. Many of today's RDBMSs feature transaction control mechanisms and data integrity features, such as two-phase commit and transaction rollback facilities. Quite a bit more disk activity per record update occurs than with earlier record management techniques. By utilizing multiple disk drives, you can potentially improve performance.

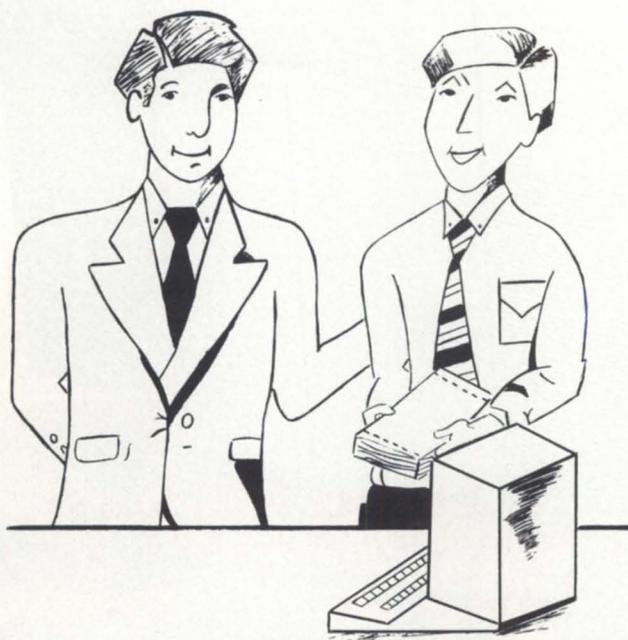
The simplest method for doing this is to place the data base file on one spindle, and the before-image or data integrity file on a different spindle. ("Before-image" is the term used by Progress to indicate a secondary file the RDBMS uses to store an image of the record prior to making modifications—substitute your own terminology here.)

Moving your swap file system to another drive can help if your system does a fair amount of paging. I'm really not very keen on spreading individual file systems across disks because the segments spanning multiple disks are allocated one disk at a time. So if you have a 300 MB file system, with two 150 MB segments on two drives, the second 150 MB will not be used until the first has been filled. When the first fills, all new allocations will occur on the secondary drive, thus moving all that activity from one disk to the other—not balancing the load the way we want. With multiple disk drives, you want to attempt to balance the data access evenly across as many drives as possible. Nobody really cares if you have equal amounts of storage allocated. It's the number and size of data accesses that will affect your performance.

The terminal issue

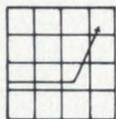
One seldom considers the impact that ASCII terminals may have on a system. Each and every time you press a key, the processor must be interrupted to service it. At the very least, the character is buffered and then echoed back to you. Put a bunch of touch-typists on your machine and this can become quite a chore. The use of VDA/VDCs (direct connect terminals) don't provide you with much choice in the matter, but this type of access is pretty basic and

Feel Sharp!



DataGen

Cobol Screen Generator



Productivity Systems
Development Corporation
Business Computer Programming

P.O. Box 1931, Summerville, S.C. 29484-1931

(803) 851-6577

Circle 29 on reader service card.

incurs little overhead.

On the other hand, in our modern networked society we have the terminal server. A terminal server is a device used to connect ASCII terminals to a computer via ethernet. It's a great device that provides a lot of flexibility, but it brings its own problems as well. Terminal servers on a TCP/IP network use telnet protocol to communicate with the host. This is an expensive method because each key you press is packaged up in a TCP packet and fired off. The host must receive the packet, interpret the data, pass your single keystroke off to the terminal handler, take the echoed character, create a new packet, and send it back to the terminal server. As you can see, this is quite a bit more involved than a direct connect.

For sites with high terminal counts, and yet need the benefits of a terminal server, DG offers a nifty little device called a VME Terminal Controller. It allows terminal counts close to "direct connect" numbers without significantly affecting performance. This is accomplished by offloading the networking overhead associated with telnet sessions to the controller, so the computer need only deal with the individual characters.

The common sense issue

Let's not forget everything we've learned about computers and performance. Just because you've got this rocket sitting next to you doesn't mean it'll never run out of power. There will always be jobs to run that aren't as necessary or time critical as others. DG/UX provides those time-tested notions of batch processing and job priority.

Jobs can be scheduled to run at off-peak hours using the *at* and *cron* programs. The *nice* and *renice* commands allow you to increase or decrease the scheduling priority of individual processes. Typing *renice 19 -p 123* will adjust process #123 so that it will run only when the computer has nothing else to do. On the other hand, *renice -20 -p 123* will cause this process to run at

Rick Havourd is a partner with Micro Sage Software Systems and may be contacted at 130 South First Street, Ann Arbor, MI 48104; 313/663-0444.

the expense of all other jobs. Let's not go crazy with these commands; it is a bad idea to monkey around with the priorities of system processes. You may feel comfortable adjusting them so long as a little common sense is used. For example, if your data base application seems a bit sluggish, raise the priority (*nice--5* or *renice -5*) of the server; do not raise the priority of the people using it.

That's all I have for this time. If you get anything out of this, I hope that it's a respect for common sense. And when common sense is lacking—throw more memory at it. You may also wish to spend some time getting acquainted with *sar*, the System Activity Reporter. Congratulations, you can now safely go out and tune-a-Aviion but, I'm sorry to say that you still can't tune-a-fish! Δ

D470C
D462
D411
W460
VT320
VT100
VT52

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

TEXT
BINARY
XMODEM
YMODEM
KERMIT
DOS
OS/2
WINDOWS
DESQVIEW

Check it out! Rhintek's emulation capabilities will meet your needs.

***VT Emulation for DEC, UNIX and AViiON**

- *PC/TCP KERNEL INTERFACE**
- *SCROLL BACK BUFFER**
- *D462 EMULATION**

Network Support
150+ Macro Keys
Compressed Mode
Built-In Diagnostics
Command Language
Script Files
International Keyboards
Code Pages 850, 437

File Transfers
Complete Printer Support
Graphics on IBM Proprinters and HP LaserJets
Auto Dial, Logon & Logoff
Unlimited Configuration Files
Mouse Compatibility
Very, Very fast!

*New for Version 4.0

Version 4.0
EMU/470
DG Color Graphics Terminal Emulation for IBM Micros

Then grab a copy of Rhintek's EMU/470, V4.0.

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
 VISA and MC Accepted (410) 730-2575

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

Circle 32 on reader service card.



Brian Johnson

Happy tuning

SYNOPSIS

BJ returns to system performance analysis and tuning, because it's one subject that bears repeating.

It's appropriate that the theme of this month's issue is system performance analysis and tuning. Just last week I got reminded that just because I covered some aspect of system performance in detail during the last five and a half years, that doesn't mean that it doesn't bear repeating occasionally. So, this month I'm going to do a review of some of the basic principles involved with AOS/VS [II] system performance analysis and tuning.

If you want more detail on any particular issue, you can check the index for all my past columns, available on the :SYSMGR BBS, and then download the particular columns involved.

Unless specifically noted, everything I'm about to tell you applies equally to both AOS/VS and AOS/VS II. In fact, it also applies generally to just about every other operating system on the planet. Galaxy-wide, I'm less sure.

:BACK_TO_BASICS

In any situation where multiple consumers share a limited set of resources, clearly the problem of supply versus demand is critical. The job of any time-sharing operating system is to apportion access to the shared resources among competing users according to a set of rules that determine how sharing takes place and how to resolve conflicts.

The first step is to identify the shared resources. There are lots of them, but the three major ones we're going to concern ourselves with here are memory, CPU, and disk I/O.

The second step is to get your hands on a piece of software that will help you accomplish the job of analyzing and monitoring system performance. AOS/VS [II] has the unfortunate distinction of being one of the few operating systems that requires that you answer questions (like system cache size), and then gives you no way to find out how good your answer was. Rather than mention my product and have to give equal time to my competitors, I'll just leave it to you to figure out what's available and from whom.

:QUEUEING_THEORY

Classic queueing theory offers interesting insights into what happens to systems that involve a shared resource, and consumers who make random demands (e.g., interactive users).

There are many ways to organize a system, but one of the simplest to analyze is what the queueing theorists refer to as an M/M/1 system. The assumptions made for an M/M/1 system are:

1. Requests for service arrive at an average of t_1 time units with a Poisson distribution.

2. The time it takes to honor a request for service is also described by a Poisson distribution with an average of t_2 time units.

3. The service is not preemptible; if the service provider is busy when a new request arrives, the new request enters a queue to wait for service using a simple FIFO priority.

The graph describing average queue length and its standard deviation (a measure of expected variability) is shown in Figure 1 (page 20).

Based on the predictions that the theory makes about the behavior of M/M/1 systems, we can safely state the following rules:

- If demand exceeds supply, an infinite length queue of requests is the result
- As demand rises, the length of the queue of waiting requests grows according to an inverse function (i.e., slowly at first, very quickly as the service provider gets busier)
- The unpredictability of the average queue length grows according to an inverse square function (i.e., stability gets worse faster than the average queue length does).

The rule for the memory resource is simple: you gotta have whatever you need.

Probably the most non-intuitive result from queuing theory is that in a system involving random requests for resources, you can never use all of the available resources. In fact, you have to limit your use to a relatively small fraction of the total resource in order to ensure that consumers will receive both timely and predictable response time. "Timely" means that the average queue length is reasonably short; "predictable" means that the queue length is generally the same size over time.

:MEMORY

Because users tend to acquire memory at the beginning of their lifetimes and hold onto most of it until they terminate, memory violates assumption No. 1 for an M/M/1 system. The results of queuing theory generally don't apply until you run out of memory and stealing and/or swapping starts to occur.

In addition, the relative cost of

resolving a memory resource conflict (i.e., the time it takes to steal a page and load its contents) are orders of magnitude more expensive than when no conflict exists (zero cost), so it is generally impractical to have less memory than the total of what's required by all users at peak times.

Based on this, the rule for the memory resource is simple: you gotta have

whatever you need. The cost of violating this rule is terrible, and common strategies to minimize its impact are generally ineffective, and result in nowhere near the speed-up that is obtained by simply adding more physical memory.

:CPU

Most operating systems include fairly



What Do:

Naval Surface Warfare Center
Public Works Canada
Lord Chancellor's Department (U.K.)
New York State Assembly
3M Health Information Systems
Exxon Chemical Corporation
Harp Ireland, Ltd. (Eire)
ESPN
Thomson-CSF (France)
Citicorp Information Resources
AT & T Bell Laboratories
Handelsbanken (Sweden)

North Carolina Central University
U.S. Department of Justice
California Credit Union League
New Zealand Industrial Gases
U.S. Federal Aviation Adm.
Waste Management of NSW (Australia)
Southwestern Bell
Texaco, Inc.
Rockwell International
British Broadcasting Corporation
and hundreds more...

Have In Common?

GUARDIAN

ACCESS CONTROL & INTERNAL SECURITY

- Automatic Password Control
- Control access by time with Automatic Log Off
- Control access by group
- Restrict access by console
- XODIAC Support
- Batch creation of profiles
- Detailed Management Reports
- 500,000 easy to remember password phrases
- Set 61 User Privileges with one screen & window

DataLynx • 6659 Convoy Ct. • San Diego, CA 92111
(619) 560-8112 • FAX (619) 560-8114

Le Software Man • Box 545 • London N78DF U.K. • 01-809-2762

Circle 14 on reader service card.

sophisticated algorithms for resolving competition for the CPU: simple FIFO as assumed for an M/M/1 system is rarely the algorithm used. In addition,

CPU violates assumption No. 3 because it is relatively inexpensive to interrupt servicing one request in order to honor another (presumably) higher priority

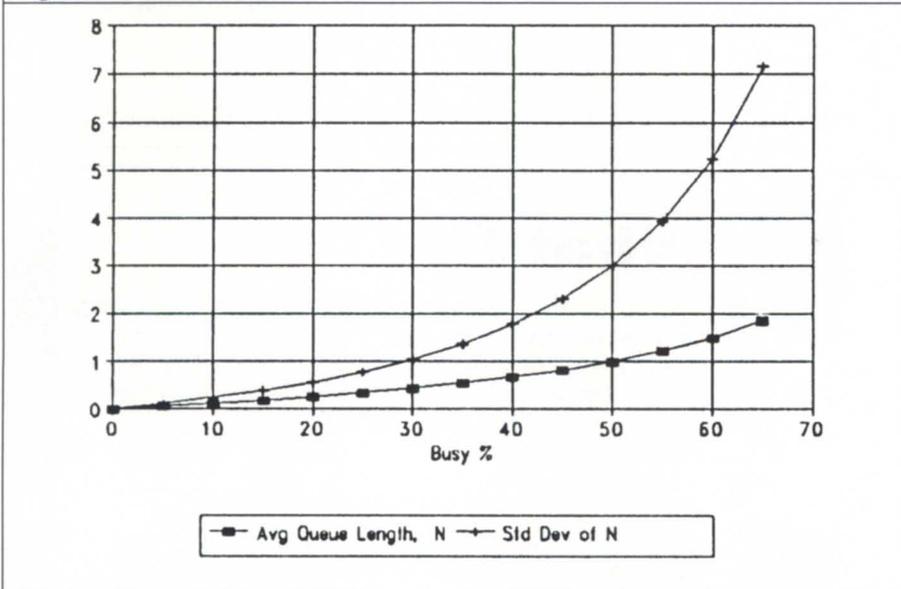
request. The net effect of these modifications is to move the knee of the curve in Figure 1 down and to the right, making the corner occur much lower and later (at about 85 percent), and be much sharper. As a result, you can generally run preemptive resources much closer to their limit than non-preemptive resources before long queues occur.

In order to postpone CPU contention for as long as possible, the AOS/VS scheduler allows three kinds of prioritization:

- Explicit process priorities
- Adjustment within a priority based on interactive versus batch-like process behavior (i.e., heuristic scheduling)
- Process class (or group) priorities and/or allocation by percentage (requires the optional CLASP package).

In addition, the AOS/VS scheduler contains some sophisticated and effective logic that attempts to keep the scheduler overhead from being far less than a

Figure 1: M/M/1 Behavior



Data General • Buy • Sell • Trade

<p>Processors:</p> <p>MV40000 32MB SAVE \$</p> <p>MV30000 Model 1 Call</p> <p>MV30000 Models 2,3,4 CPU upgrade Call</p> <p>MV20000 Model 1 16MB SAVE \$</p> <p>MV20000 Model 2 16MB SAVE \$</p> <p>MV20000 Model 1 to Model 2 upgrade SAVE \$</p> <p>MV15000 Model 20 8MB SAVE \$</p> <p>MV15000 Model 8 to Model 20 upgrade SAVE \$</p> <p>MV15000 Model 10 to Model 20 upgrade SAVE \$</p> <p>MV10000 4MB Meter high cabinet \$2,000</p> <p>MV8000-II 8MB Meter high cabinet 900</p> <p>MV9500 CPU w/32MB 30,000</p> <p>MV9600 CPU w/32MB 36,000</p> <p>AViiON All Models SAVE \$</p> <p>MV8000 Model 9300 800</p> <p>MV7800 4MB 16 slot chassis 1,900</p> <p>MV7800XP 4MB 2,900</p> <p>MV4000 2MB 700</p> <p>MV4000DC 2MB, 120MB, floppy 1,200</p> <p>MV2000 Enhanced 4MB 160 MB disk 3,200</p> <p>MP100 8520-D 350</p> <p>S-140 256KB Floating point 1,500</p> <p>Desktops All Models SAVE \$</p> <p>S-120 256K 16 slot 550</p> <p>S-280 2MB 1,900</p>	<p>4463-ZT USAM-4 \$275</p> <p>4380 ISC-2 (Synch) 450</p> <p>4370 IAC-16 RS232, 20MA, W TCB 950</p> <p>4623 IAC-24 w/TCB-24 4,400</p> <p>4367 IAC-8 RS232, 20MA Modem Cnt 850</p> <p>4532-A ILC 2,900</p> <p>4560 LAC-12 850</p> <p>4608 10 Port term. serv 2,800</p> <p>Disk Storage Units:</p> <p>6161 147MB Disk subsystem \$850</p> <p>6236 354MB Disk subsystem 950</p> <p>6239 592MB Disk subsystem 2,750</p> <p>6329 120MB MV2000/MV1400 800</p> <p>6363 160MB MV2000/MV1400 900</p> <p>6491 322MB for MV2500 or CSS 1,800</p> <p>6554 662MB for MV2500 or CSS 2,300</p> <p>6581 500MB R.A.M.S. Disk Call</p> <p>6720 CSS2 1.0GB Disk subsystem 8,500</p> <p>6685 1.0GB Disk Drive A/O 4,300</p> <p>2351 Fujitsu w/BMX3 2,900</p> <p>6061/6122 Zebra Disks or Parts Offer</p> <p>Zetaco ARZ and SKS subsystems Call</p> <p>Zetaco Laser Disk subsystem Call</p>	<p>Terminals:</p> <p>6165 D460 Monitor with keyboard \$160</p> <p>6166-X D410 Monitor with keyboard 140</p> <p>6169-X D211 Monitor with keyboard 125</p> <p>6391-X D214 Monitor with keyboard 145</p> <p>6392-X D215 Monitor with keyboard 145</p> <p>6393-X D411 Monitor with keyboard 155</p> <p>6394-X D461 Monitor with keyboard 300</p> <p>6500 D216 Monitor with keyboard 195</p> <p>6682-A D217 Monitor with keyboard-new 365</p> <p>6567 D412 Monitor with keyboard 270</p> <p>6568 D462 Monitor with keyboard-new 795</p> <p>Tapes:</p> <p>6021 800 BPI new style \$400</p> <p>6026 800/1600 BPI Brown, FCC compliant 1,250</p> <p>6125 1600 BPI Streamer, FCC compliant 500</p> <p>6311 15MB Cartridge MV4 DC/7800DC 650</p> <p>6341-A 1600 BPI Streaming Tape 3,500</p> <p>6270 15MB Cartridge for Desktop 650</p> <p>6299/6300 1600/6250 BPI Subsystems 2,900</p> <p>6586-A Galaxy Tape 5,200</p> <p>6590M 2GB Tape Backup add-on for CSS 3,500</p> <p>Megatape 2GB Subsystem Call</p> <p>CDC 6250 BPI-BMX2 S/S Call</p>
---	---	--

Specials

D 411 Terminal \$165

CSS (SCSI) Disk & Tape Subsystems Call

International Computing Systems

P.O. Box 343 • Hopkins, MN 55343

1-800-522-ICSC (4272)

(612) 935-8112

FAX 612/935-2580

Circle 21 on reader service card.

linear function of PID count.

One thing is important to bear in mind about CPU priority schemes: they have no effect unless contention is

occurring. Think about that for a second; if there generally is idle CPU, then everyone is getting all they want by definition. Even if there's no idle CPU,

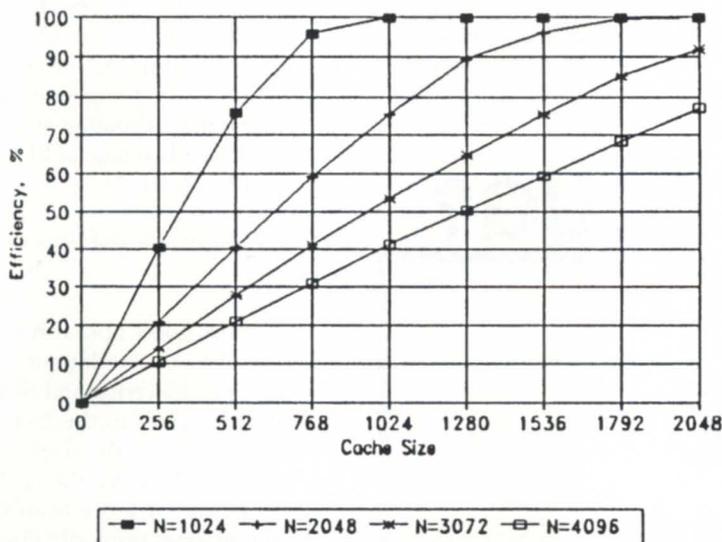
things still might be all right.

Consider the case in which 100 PIDs are using 50 percent of the CPU and several batch jobs running at an explicitly lower priority are using the other 50 percent. Except for some tiny delays imposed by virtue of queues that can form at the entrance to single-threaded paths in the operating system, the on-line users (i.e., the ones who collect a salary) are going as fast as if batch jobs were not running.

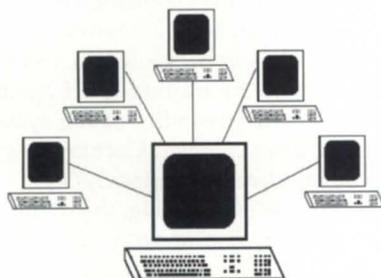
I've conveniently ignored contention due to both on-line users and batch jobs beating on the same disks, but we'll talk about that shortly. The point I'm trying to make here is the importance of running batch jobs at a priority below the on-line users, in order to keep the on-line users running as fast as possible.

So what happens if the on-line users alone are trying to consume more than 85 percent of the CPU? Easy: response time starts to go to hell, rapidly and massively. Will explicit prioritization solve this problem? Only if you're one

Figure 2: Cache Behavior



Turn on Eight terminals with just one!



With MultiView Windows and just one console line you can have the equivalent of eight terminals.

DEMO ONLY \$49



DIGITAL DYNAMICS INC.

3055 Plymouth Road, Ann Arbor, MI 48105
(313) 995-2400 FAX (313) 995-3232

Circle 18 on reader service card.

Compatible Memory

now available for the
AV4600 & AV4300
at a fraction of the OEM price.

Our model number DDS-4600 is the newest member of a world renowned, quality memory product line. Offered exclusively by Digital Data Systems, Inc., the DDS-4600 is available in 8MB and 32MB capacities.

Purchase your new computer with minimum memory and let us show you how to save money with your initial requirement as well as future expansion needs.

Our DG compatible products include memory for traditional MV computers thru models for the latest AViiON systems including the AV5000/6000. Hard drive sub-systems and tape back-up units are also available.

Memory Specialists Since 1976



DIGITAL DATA SYSTEMS, Inc.



MV & AViiON are registered trade marks of Data General Corp.

1551 N.W. 65th Avenue
Ft. Lauderdale, FL 33313

TEL: 305-792-3290
FAX: 305-581-1325

1-800-762-7811

Circle 17 on reader service card.

of the lucky ones who get the high priority. The operating system can't manufacture CPU out of thin air, or trade it off for any other resource.

The only way to solve a problem where the on-line users are persistently attempting to consume more than 85 percent of the CPU is to a) buy a faster CPU; b) reduce the CPU consumption of the user programs; or c) keep taking

users out to the parking lot and shooting them until 15 percent average idle is achieved.

:DISK_IO

Of the three system resources, disk I/O is the one that most closely behaves the way that an M/M/1 system does. Requests arrive pretty much randomly and are not preemptible (you can't

cheaply switch to another request in mid-request).

Because of the relatively large cost of disk I/O (measured in tens of milliseconds as opposed to nanoseconds), the effect of doing excessive disk I/O is gruesome. The designers of early operating systems quickly recognized this fact and took steps to reduce the susceptibility of systems to disk bottlenecks. The most common strategy they use is to take advantage of BJ's Rule No. 1 Regarding Disk I/O:

RULE 1: The fastest disk access is one that is avoided.

Like most good operating systems, AOS/VS uses two techniques to avoid disk accesses: buffering and caching.

Buffering refers to the technique of reading more than the user asked for, on the assumption that the next request will be asking for more from the same area. Buffering is primarily effective for sequential I/O.

Caching refers to the technique of trading off physical memory for disk activity by keeping copies of the most recently accessed N blocks in memory, and managing them using an algorithm that attempts to predict which blocks are most likely to be referenced again. In addition, there are both read/write (e.g., AOS/VS system and shared page LRU cache) and write-thru caches (e.g., AOS/VS II disk data cache). Read/write caches achieve lower overall physical I/O by trading it off against the increased possibility of file system damage after a crash. Caching is primarily effective for random I/O.

In the case of buffering, the optimum strategy is to read or write as much as possible each time you access the disk. How this is accomplished depends on the language you're using. Consult the section of the manual on optimization for clues. Of course, everything has a point of diminishing returns, and in the case of sequential I/O that point is usually in the neighborhood of 12 to 16 kilobytes at a time (24 to 32 disk blocks). Needless to say, massive buffering makes sense only if you have enough spare memory to do it without causing paging or swapping.

In the case of caching, the general behavior of LRU-based schemes (the

Why Join NADGUG?

Reason #24

Fast Solutions

Software problems?
Hardware problems? Need an answer fast? The North American Data General Users Group (NADGUG) has your answer. NADGUG offers help when you need solutions — fast. Meet with other DG users at the annual NADGUG conference or at regional and special interest group meetings. This networking can lead you to contacts that are only a phone call away when you

need help. Maybe picking up a back issue of *Focus* to find just the right article is all you need. The electronic bulletin boards are also available for you to post whatever problem you may have, and have it read by people who can give you a solution — right away. All of these problem-solving strategies are available to you as a member of NADGUG. Don't wait until you need a fast solution — be ahead! Join NADGUG today•

**NORTH AMERICAN
DATA GENERAL**

**USERS
GROUP**

1-800-253-3902

(continental U.S. only)

508/443-3330

Circle 25 on reader service card.

kind used by AOS/VS) is shown in Figure 2 (page 21). This graph was produced using a simulation program where the number of blocks competing for the cache was 1024, 2048, 3072, and 4096, and requests were subject to a statistically normal distribution. Here again, we see that there is a point of diminishing returns in the tradeoff between memory (cache size) and disk activity reduction (efficiency). In addition, an oversized cache imposes a slight increase in CPU consumption due to the overhead of searching an excessively long buffer list for each failed request.

The high efficiencies that read/write caches typically are capable of (98 percent or better versus 30 percent to 50 percent for a write-thru) is both a boon and a bane. On one hand, the reduction in disk activity is formidable (50:1 in the case of a 98 percent efficiency), but on the other hand even a slight change in efficiency of 1 percent when running at 98 percent can either double or halve the amount of disk activity due to cache misses. It is critical that you monitor efficiency closely and respond to any significant change quickly.

In the case of caches, the optimum strategies are to a) make sure the cache is sized at least as large as the point of diminishing returns; and b) reduce the number of blocks competing for the cache as much as possible.

The first part is easy: you try various cache sizes and plot the efficiency to find the point of diminishing return.

The second part is trickier: you have to identify which kinds of blocks are competing for the cache, and then try to reduce the number of them. In the case of the system cache, the culprits on most systems are random index blocks (RIBs), directory, bitmap blocks, and IPC spool blocks (in order of activity). In the case of the shared page LRU cache, the culprits are program file (.PR) and shared data base pages.

Reducing random index blocks is easy: simply change the element size of all active files to have no more than one index level. Contiguous files (zero index levels) are only marginally better in terms of reducing cache activity, and generally not worth the system management headaches they cause (e.g., Error: insufficient contiguous blocks).

On AOS/VS Classic, reducing directory blocks is a bit trickier. Changing the hash frame size is helpful, but pales in comparison to the effect of the sheer size of the directory itself. Unfortunately, convincing users to break up huge directories into a series of smaller sub-directories is an ongoing battle for most system managers.

The internal directory structure used

by AOS/VS II is quite a bit different from that used by Classic, and some early experiments I did by varying the File Information Table (FIT) element size for the LDU showed that the cache activity is relatively immune to changes in the FIT size, and more a function of the sheer size of the directory. This makes it effectively a parallel to the situation under Classic (unfortunately).

FROM THE COMPANY THAT WROTE THE BOOK ON MANUFACTURING SOFTWARE

The JAI Software Library™

Designed by manufacturing people and written in manufacturing words—the JAI Software Library is in a class by itself.

Built on a modular basis, the Library allows you to mix and match as you choose to get a fully integrated system that's just right for you. And for people who want to customize, there's plenty of room for that too.

You can expect immediate results like improved customer delivery, lower investment, greater visibility of operations, and improved financial controls. All conveniently provided by a company with over 18 years of hands-on experience.

To learn more about our vast selection of Library programs, give us a call today.

JAI: Our Experience Speaks Volumes



JACOBSEN & ASSOCIATES, INC.

10229 Lower Azusa Road, Temple City, California 91780
(818) 575-7504 • (818) 283-5347 • FAX (818) 575-7550

Circle 23 on reader service card.

Activity due to bitmap and IPC spool blocks is generally an order of magnitude less than that due to RIBs and directory blocks, so they generally aren't worth worrying about (yes, Virginia, there *are* exceptions).

By now you probably noticed that I haven't said anything about disk space. The reason is because disk space is not really a performance issue in most cases, it's simply a management headache. While it is true that disks that are more than 90 percent full are significantly slower to access than those less than 90 percent full, the benefits do not continue as the percent full drops below about 80 percent.

The simple reason for this is that real-world disk requests tend to violate the assumptions of M/M/1 in a couple of subtle ways: first, requests tend to arrive in bursts as opposed to more evenly spaced (e.g., it might take 5 or 10 I/Os to open a file); and the requests tend to cluster tightly on the disk (e.g., an open hits a relatively small area of a

single directory file).

This explains the apparent anomaly that you see when you look at average seek distances on DISCO. If requests to the disk were truly random, we would expect to see an average seek distance of 1/3 the number of cylinders in use (e.g., about 250 for a 90 percent full 354 MB disk). Instead the average seek distances are typically a fraction of that; more like 100 or less.

Check it out for yourself on your own system. I just did, and the disk I'm sitting on right now—which incidentally hasn't been reloaded in more than three years—has an average seek of 52 cylinders. It is precisely this effect that makes the seek time for a disk relatively immune to how full it is and how well it's organized.

The only exception to this is during single-user sequential processing, like batch and DUMP/LOAD, where caching is relatively ineffective due to the low probability of reuse. As a result, average seek distances usually go up

during these activities.

:FILE_SPACE_EXHAUSTED

Well, I'm outta space again and I still haven't gotten to the bulging file of fresh clippings from the wild and wacky world of the trade rags, so I guess that'll have to wait until next month. Happy tuning. Δ

Copyright © 1992 B.J. Inc. All Rights Reserved. BJ is the President of B.J. Inc., a San Francisco based consultancy specializing in system auditing, system management, and performance analysis. :SYSMGR is a division of B.J. Inc. BJ can be reached at 109 Minna St., Suite 215, San Francisco, CA 94105, 415/550-1444 (voice) or 415/550-1072 (fax). The :SYSMGR bulletin board number is 415/391-6531 (300/1200/2400 with optional MNP class 5, CHAR/605X/CHARLEN=8/PARITY=NONE/AUTOBAUD) or 415/550-1454 (voice).

DATA GENERAL

BUY • SELL • TRADE

* SPECIAL OF THE MONTH *

MV Upgrade!! CSS-2 Chassis, 6433 Host Adapter, 6685 1.0 GB Disk Drive (Qty 2), 6590 2.0 GB Cart. Tape Drive.....\$15,900

PROCESSORS

AViiON, Full line	SAVE\$
MV9500 with 8MB Memory	\$29,900
MV20000 Mod 1	14,900
MV15000, Mod 8	9,900
MV2500 8MB Mem, 322MB-H/D LAC 12	8,900
MV7800XP 4MB Mem, complete w/chassis	2,900
MV10000 or S280 w/BMC	2,500
MV2000 MOD II 4MB Memory, 160MB H/D	2,900
DG500 512KB 20MB H/D Cart.	1,900

MEMORIES

MV 7800XP 24MB Memory	\$5,900
AViiON, 32 MB Memory	9,900
8990E 32MB MV20/MV15 Memory	8,900
4MB MV3500 Memory	900
8941 8MB MV2500 Memory	2,900
8940 10MB MV7800XP Memory	2,900
8928 8MB MV2 Mod II Memory	1,900

DISK DRIVES

6716 1.4GB Disk for MV or AViiON	4,500
6685 CSS 1.0 GB DISK	\$3,900
6685 1.0 GB DISK AViiON	2,900
6491 322MB Disk Drive	1,400
6554 662MB Disk Drive	2,400

TAPE DRIVES

6590M 2.0GB Tape	\$2,700
6299/6300 6250 BPI Tape Subsystem	3,900
6587 10-1/2" Reel 1600 BPI tabletop	3,500
STC 2920 6250 BPI Tape	1,900

TERMINALS

6682 D217 CRT w/keyboard	\$325
6502 D462 CRT w/keyboard	345
6501 D412 CRT w/keyboard	325
6500 D216 CRT w/keyboard	275
6392 D215 CRT w/keyboard	185
6256 D460 CRT w/keyboard	175
6196 D211 CRT w/keyboard	159

PRINTERS

4599 2000 LPM Band Printer	\$8,900
6596 600 LPM Band Printer (refurbished)	1,900
6598 1500 LPM Printer (refurbished)	9,800
6475 12 PPM Laser Printer dual bin	1,490
6454 8PPM Laser Printer	1,190

COMMUNICATIONS AND CONTROLLERS

AViiON Terminal Servers	SAVE\$
4623 IAC 24	\$4,800
4626 LAC 32 w/TCB	3,200
4532A LAN Controller	2,900
4370 IAC 16	690
DG500 8 Line ASYNC	590

DATA GENERAL COMPATIBLES

BMX 1 Controllers	\$750
BMX 3 Controllers	1,800
Zetaco 295 Controller	950
Fuji 2351 Eagles	750

Power Windows!

CQC'S COBOL
WordPerfect

PL/I B32
"Running the programs in Turbo mode caused such a difference that the users thought we had upgraded the CPU!"
CEO
C CLI

—D.G. Review,
April 1991

Oracle Powerhouse
FORTRAN

SCREEN DEMON

Threshold, Inc.
118 N. Ross Street
Auburn, AL 36830

(205) 821-0075
Fax (205) 821-0122

All products are trademarks of their respective companies.



COMPUTER WHOLESALERS

3246 Marjan Drive 800/229-2897 404-455-4542
Doraville, Georgia 30340 FAX 404/457/5841

Circle 4 on reader service card.

Circle 38 on reader service card.

YOU'RE LOOKING AT TWO 8MM TAPE DRIVES.



THAT'S RIGHT.

Our CY-8500 now gives you complete backwards compatibility with our popular CY-8200. With the flip of a switch, the CY-8500 can read and write tapes in CY-8200 mode. Making it possible for one tape drive to store between 2.5 and 25 GB, completely unattended. It's like getting two drives for the price of one.

Data transfer rates of up to 90 MB per minute let you backup fast and unattended. So you won't have to wait around to change tapes. You'll save money in reduced media, storage and shipping costs, too. Add hardware data compression and multiply capacity, speed – and savings – by up to five times. Of course, data compression is switch-selectable, so you can read and write tapes without compression for compatibility with other sites.



The CY-CHS10i features an 8200 or 8500, ten tapes, and stores up to 250 GB.

We're pushing the limits of flexibility, making tape drives that will perform exceptionally today – and tomorrow. Giving you true "plug and play" compatibility with the widest range of system interfaces on the market. Plus a clear upgrade path through the product line.

TRUE "PLUG-AND-PLAY" COMPATIBILITY WITH:

Alliant	Gould/Encore	PS/2
Alpha Micro	HP	PC 386/ix
Altos	IBM AS/400	PC MS-DOS
Apollo	IBM Mainframe	PC Xenix/Unix
Arix	IBM RISC/6000	Pertec
AT&T	IBM RT	Plexus
Basic-4	IBM S/38	Prime
Concurrent	ICL	Pyramid
Convergent	Intergraph	Sequent
DataGeneral	Motorola	Silicon Graphics
DEC 3100/5000	Macintosh	Stratus
DEC BI-Bus	McDonnell Douglas	Sun
DEC HSC	NCR	Texas Instruments
DEC Q-Bus	NeXT	Unisys
DEC TU/TA81	Novell	Wang
DEC Unibus	OS/2	and more

Our complete family of data storage subsystems includes QIC tape streamers, magneto-optical disk drives, 8mm tape drives and 8mm tape libraries.

There's no better value in 8mm tape backup than the

CY-8500. Call today for complete information at (804) 873-9000.

Rock Landing Corporate Center • 11846 Rock Landing, Newport News, VA 23606
FAX 804/873-8836

Europe Tel: +31 8385 51708 FAX: +31 8385 50596 Scandinavia Tel: +47 2 79 58 80 FAX: +47 2 78 36 01
France Tel: +33 88 67 12 45 FAX: +33 88 66 79 19 Japan Tel: +81 3 3639 5841 FAX: +91 3 3639 5865
U.K. Tel: +44 7373 73544 FAX: +44 7373 62813 New Zealand Tel: +64 9 479 1100 FAX: +64 9 479 8009
R.O.C. Tel: +886 2 5068702 FAX: +886 2 5014198 U.S. FAX: 804 873 8836

Circle 5 on reader service card.

CONTEMPORARY
CYBERNETICS
Group



David Novy

Yes, *sar*

SYNOPSIS

Although DG/UX system performance measuring tools are not spectacular, they are adequate.

This month's issue of *Focus* is dedicated to performance monitoring and tuning. At present, there is not a broad suite of performance monitoring tools available for DG/UX. All that's officially available is the Unix *sar* command.

The *sar* command is a batch process that is not capable of doing real-time analysis of Unix system performance. It does give the system manager the capability of capturing system performance for a number of intervals over a specific period of time, so *sar* can help a system manager determine the need for more CPU, memory, or disks.

However, *sar* is a DG/UX feature badly needing a facelift. Today's system managers expect real-time data capture and analysis, preferably displayed in graphical form; *sar* cannot do this.

Fortunately, help is on the way. It appears that the DG/UX development team is working on enhancements to *sar* that will modernize it and increase its usefulness to those concerned with performance measurement and tuning. It would also appear that the *sar* enhancements will be available before the end of 1992.

If the end of 1992 comes and the *sar* enhancements are still not available, then blame the author and not Data General. The time estimate was made

by the author based on pure emotion. DG has given no official response as to when the *sar* enhancements will be available. However, the DG/UX development team has been very responsive to user requests, and the request for *sar* enhancements was a primary concern to the attendees at the 1991 NADGUG Conference.

If you need to use *sar* in its present form, a very good explanation of how to do so can be found in the man pages. The man pages explain the use of each of the *sar* switches. They also explain how to run *sar* as a background process.

If you want to give *sar* a try, here are a couple of sample commands that will give you some useful information regarding system performance. The first command is:

```
sar -o temp 60 10
```

This command starts the *sar* process, and has it run for 10 intervals of 60 seconds each. This command's output is CPU usage on the basis of user, system, and idle. The data are also sent to a file named *temp*.

Another useful *sar* command:

```
sar -d -f temp
```

This command gives an analysis of disk usage information using the same *temp* file created by the first *sar* command example.

Managing DG/UX machines

It should be noted that, although the DG/UX system performance measuring tools are not spectacular, they are adequate. Also, since open systems memory and peripherals are not as expensive as DG MV memory and peripherals, then system performance is not as critical as it is with DG proprietary equipment. Some concepts found to be useful

in helping me manage my DG/UX machines are as follows:

1) The *sar* command can be used to determine CPU utilization.

2) The *dfk* command may be used to determine disk capacity at any given time. For optimum performance, you should try to keep disk capacity below 70 percent. Disk performance degrades dramatically if this level is exceeded.

3) Use the *sar* command to determine disk memory and swap disk utilization. The most efficient systems are those in which there is no swap disk utilization. This is because accessing information from disk is at least 1,000 times slower than accessing information from memory. Installing additional memory is probably the least expensive means of increasing system performance. When increasing Unix workstation memory from 16 MB to 32 MB in a CAD/CAM environment, I have observed 100-percent improvements in system performance. Going from 32 MB to 48 MB resulted in significant performance increases.

4) Consider using third-party memory. Third-party memory generally costs at least 50 percent less than proprietary memory, and it usually comes with a lifetime warranty and overnight replacement. You need to realize that memory has become a commodity item. Both proprietary memory boards and third-party memory boards use the same chips. DG does make very good memory products, but so do the larger third-party memory vendors.

5) When making recommendations to users regarding system configuration cost estimates, err on the side of too much. Never err on the side of too little. It is easier to allocate more money than you actually need for the purchase of computer equipment if it is part of the official budgetary process, than to overcome performance bottlenecks by trying to find additional money outside of the official budgetary process. I have had customers tell me that I let them down when I told them they needed to spend an unbudgeted \$5,000 to overcome a bottleneck. This \$5,000 was within 10 percent of my original cost estimate, so I originally felt rather satisfied with my forecasting ability. However, my customers soon informed me that forecasting 10 percent too little is a lot worse than 25 percent too much. If you are going to fight a budget battle to obtain funds for a computer system, make sure that you only have to fight the battle once.

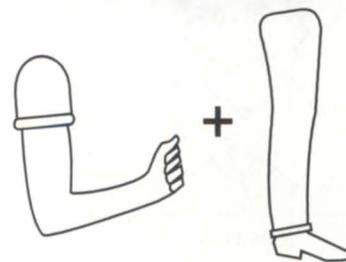
The *sar* command is an adequate tool for determining the system performance of DG/UX, but it needs to be made easier to use and it needs to be able to give real-time performance information. Fortunately, the cost of open systems hardware and peripherals is much lower than that of proprietary hardware, so system tuning is not as critical. Fundamental DG/UX performance considerations are to have plenty of memory, do not overload the disks, and purchase a CPU large enough to do the job. Δ

peripherals is much lower than that of proprietary hardware, so system tuning is not as critical. Fundamental DG/UX performance considerations are to have plenty of memory, do not overload the disks, and purchase a CPU large enough to do the job. Δ

David Novy is a technical computing 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.

The *sar* command is an adequate tool for determining the system performance of DG/UX, but it needs to be made easier to use and it needs to be able to give real-time performance information

Why pay this



for memory?

With SCIP memory, you don't have to.

We design and manufacture value priced memory that will boost your system to full power.

A full line,even for the newest and most popular DG processors, like the.....

MV5600

MV9600

MV15000

thru

MV20000

AViiON's

Bottom line....

- ✓ a fraction of the cost
- ✓ 100% compatible
- ✓ lifetime warranty
- ✓ 24 hour exchange
- ✓ trial evaluation

...give us a call

(310) 282-8700

FAX 310/839-4464

SCIP

**441 S. Beverly Dr. #2
Beverly Hills, CA 90212**



Kim Medlin

Real-world report writing

SYNOPSIS

This article is the sixth in a series, examining a software development project using RAD tools and techniques.

In this series of articles, we are following a logical progression of software development steps for a real-life application called the Loan Tracking System. Specifically, the tools we are using allow for "rapid application development," or RAD. Previously, we explored the analysis and design phases of development using a CASE tool (computer-aided software engineering). Next, we began developing the individual application functions using a fourth-generation language (4GL).

Now, we continue in this vein with a look at one of the most powerful report-writing tools on the market today: Oracle's SQL*Reportwriter. Bear in mind that other 4GLs contain report writers, also. I am merely using Oracle here as an example of the types of functionality that can be found in current RAD tools.

It is hard to overstate the impressive abilities of current 4GLs. Real-world application software can be generated in a fraction of the time expected with a 3GL like Cobol or C. On top of that, the quality and stability of functions written with a 4GL are often superior to that of a 3GL.

Here at Data General's Systems Integration Services (formerly Solution Services), we write custom software for Data General customers every day. I personally have been designing and writing software applications for 12 years, and I am truly amazed at the speed and precision with which a good 4GL creates software.

The simple case

Let's take a look at how we would

Figure 1: The Simple Case

Student Status Codes	
Code	Description
A	Active
C	Collections
F	Forgiven
I	Inactive
J	Judgment
P	Paid
*** End of Report ***	

tackle a simple reporting function with SQL*Reportwriter. Let's assume that all we need to do is list the contents of the student status table. This table contains only two fields: the student status code and description. The table contains only a small number of records. Our objective is to print all records on the page.

Because 4GLs are written to take advantage of the structured query language (SQL; pronounced like "sequel"), the development of this report will take only a few minutes. The heart of the effort is in specifying the SQL statement that will retrieve the desired records:

```
select
    sst.code,
    sst.descr
from sst
order by sst.code
```

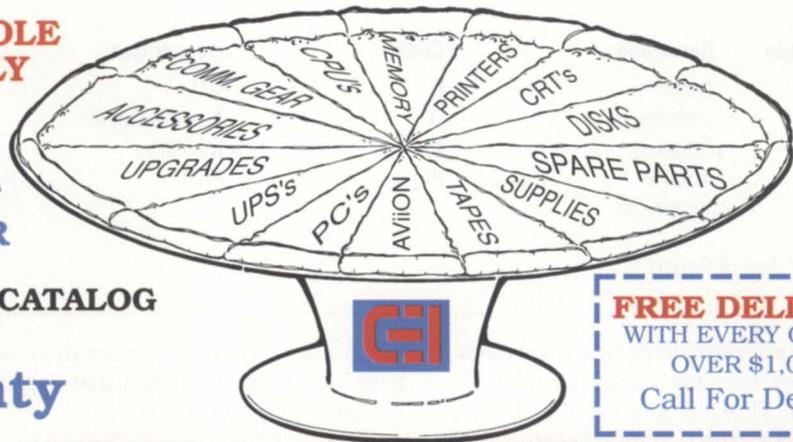
This SQL statement is as straightforward as it appears. "sst" is the name of the table; "code" and "descr" are the names of the two fields. The statement simply selects the fields we require



**WHY PAY FOR THE WHOLE
PIZZA WHEN YOU ONLY
NEED A SLICE?**

**•BUY •SELL •TRADE •DEPOT
REPAIR**

**CALL FOR A FREE PRICE CATALOG
800-462-CEII
60 Day Warranty**



**FREE DELIVERY
WITH EVERY ORDER
OVER \$1,000
Call For Details**

PRINTERS

BP-2000 2000 LPM Band Printer.....	\$12,900
4596 600 LPM Quietized (LB615).....	4,500
B-600 600 LPM Serial Band Printer.....	2,500
4327 300 LPM Band Printer S/S.....	700
M-200 340 CPS Serial Printer.....	750
6215 Draft Quality Serial Printer.....	750
6474 12 PPM Laser Printer w/Dual Feeder....	1,650
4557 8 PPM Text Laser.....	650
6194 180 CPS Serial Printer w/keybrd.....	350
4433 150 CPS Dot Matrix Printer.....	350
6321 40 CPS Letter Quality Printer.....	225
005-8096 Data Channel Printer Controller.....	195

CPUs

MV/20000 Mod 1.....	\$13,950
MV/15000 Mod 20.....	13,750
MV/15000 Mod 8.....	6,500
MV/10000 w/4MB.....	750
MV/9500 w/8MB.....	27,500
MV/8000 w/8MB.....	1,295
MV/7800XP w/4MB.....	3,495
MV/4000 w/4MB.....	450
S280 w/2MB, BMC.....	1,495
S/140 w/512KB, Floating Pt.....	1,495
Nova 4/X w/256KB, 16 slot.....	595
Nova 3/12 w/64KB, 12 slot.....	695

CRTs

D217, D413, D463 (New).....	Call
6501 D412 w/KB.....	\$350
6500 D216 w/KB.....	225
6566 D216+ w/KB.....	305
6308 D470 Color w/KB.....	550
6394 D461 w/KB.....	275
6393 D411 w/KB.....	250
6392 D215 w/KB.....	185
6391 D214 w/KB.....	175
6167 D460 w/KB.....	185
6166 D410 w/KB.....	175
6169 D211 w/KB.....	145

MEMORY

80108 MV/9500-9600 32MB Memory.....	\$15,750
7002 AViON 32MB Memory.....	9,500
8990-E MV/15000-MV/20000 32MB Memory.....	7,495
8990-D MV/15000-MV/20000 16MB Memory.....	3,250
8990-C MV/15000-MV/20000 8MB Memory.....	895
8939 MV/7800XP 4MB Memory.....	1,500
8901 MV/7800 4MB Memory.....	750
8765 MV/4000-MV/10000 2MB Memory.....	100
8708 MV/6000-MV/8000 2MB Memory.....	150
8754 S/140 512KB Memory.....	195
8387 Nova 4 256KB Memory.....	175
8545 Nova 3 16KW Core Memory.....	195

COMM. GEAR

4623 IAC-24 w/TCB.....	\$3,950
4532-A Ethernet LAN Controller.....	2,700
4586 ITC-128.....	4,750
4010-A Interlan Ethernet Controller.....	695
4370 IAC-16 w/TCB-16.....	685
4369 IAC-8 w/TCB-8.....	350
4342 ATI-16 w/Daughter Boards.....	150
4463-ZT USAM-4 for Desktop.....	100
4207-S Async Interface for Desktop.....	150
4340 AMI-8.....	50
4380 ISC-2.....	250
4817 Termserver 2000.....	Call

DISKS

6236 354MB Disk S/S.....	\$895
005-17820 HDA for 354MB Disk.....	450
6239 592MB Disk S/S.....	2,700
6685 1.0GB SCSI Disk A/O.....	4,500
6554 662MB SCSI Disk A/O.....	2,995
6491 322MB SCSI Disk A/O.....	1,395
6161 147MB Disk S/S.....	475
6160 73MB Disk S/S.....	225
6336 71MB Disk/Desktop.....	595
6581-A 500MB RAMS Disk A/O.....	7,495
6621-A 1.2GB RAMS Disk A/O.....	13,500
BMX-1 Zetaco Disk Controller.....	295

MV/DC

MV/2000 w/2MB, CTD, LAC-12.....	\$895
MV/1400 w/4MB, CTD, 160MB.....	2,350
MV/2500 w/8MB, 130MB CTD, 662MB Disk.....	9,650
005-30768 MV/2000 Enhanced CPU w/4MB.....	1,295
6363 160MB Disk.....	875
6329 120MB Disk.....	595
6328 70MB Disk.....	495
6309 737KB Floppy.....	195
6351 24MB Cartridge Tape.....	350
4562 LAN Controller.....	495
4627 LAC-32.....	2,995
4560 LAC-12.....	395

TAPES

6590 2GB Cart. Tape w/CSS Chassis.....	\$6,150
6299-A 1600/6250 BPI Tape A/O.....	2,795
6300-A 1600/6250 BPI Tape A/O.....	2,695
6125 1600 BPI Streaming Tape S/S.....	150
6123 1600 BPI Streaming Tape/Desktop.....	495
6026 800/1600 BPI Tape S/S.....	500
6270-B 15MB Cart. Tape/Desktop.....	225
6676 525MB Cart. Tape A/O.....	4,100
6435 SCSI Tape Controller.....	2,495
005-21691 Tape Controller for 6299/6300.....	495
005-8584 Tape Controller for 6026.....	150
BMX-2 Zetaco Tape Controller.....	1,295

UPGRADES/PARTS

005-15633 S/140 ERCC/BMC.....	\$1,295
8991 MV/15000-MV/20000 F.P.U.....	1,395
8819 MV/10000 IOC-2.....	595
8997 MV/15000-MV/20000 Expansion Chassis.....	2,200
8992 MV/15000-MV/20000 Bus Repeater.....	2,200
8772 S/280 BMC.....	695
8883 MV/7800 Chassis, 16 Slot.....	895
8395 Nova 4 Chassis, 16 Slot.....	425
8760 MV/4000 Chassis, 16 Slot.....	375
8749 BBU for MV/10000.....	795
UPG MV/20000 Mod I to Mod II.....	8,000
AViON Processor Boards - Various.....	Call

Figure 2: One More Step

04/01/1992	
Student Status Codes	
Code	Description
A	Active
C	Collections
F	Forgiven
I	Inactive
J	Judgment
*** End of Report ***	
Grant Status Codes	
Code	Description
O	N/A
D	Medical Doctor
M	Ministry
P	Paid

from the appropriate table and specifies the order in which they should be returned. This is a key benefit of SQL (and 4GLs, too). A SQL statement declares *what* information you need. It is the responsibility of the SQL engine to determine *how* to physically fulfill your request.

After adding a report title line (which

takes about two more minutes), we have generated the report that appears in Figure 1 (page 28).

One more step

The status report example is about as simple as they get! Almost any report writer could handle that requirement with ease. Now, let's say we want to

modify the report and print the "grant codes" to the right of the student status codes, and on the same page.

No problem. Just add another SQL select statement to the report definition. In this case, we would add the statement:

```
select
    grnt.code,
    grnt.descr
from grnt
order by grnt.code
```

We would also specify that the group of records selected from this query should appear to the right of the first set of records. The entire time spent to add the second list to the report is no more than five minutes. After some simple formatting adjustments, the report now appears in Figure 2.

It is important to realize that this seemingly simple functional enhancement would have blown some supposedly production-quality report writers

DATA INVESTORS CORPORATION

22 E. Lafayette Street
Hackensack, NJ 07601
(201) 343-8875
FAX# (201) 489-5633

COMMUNICATIONS

4370 IAC-16 RS-232	\$685
4368 IAC-8 RS-232	450
4370-A IAC-16 RS-422	500
4368-A IAC-8 RS-422	450
4380 ISC-2	300
4560 LAC-12	550
4561 LSC MV/2000	400
4342 ATI-16	150
4543-B MCP-1	1,150
4463ZT USAM-4 DESKTOP	150
4532 ILC W/ACCESSORIES	2,800

SYSTEMS & PROCESSORS

MV/20000 MOD1 8MB	\$11,400
8952 MV/15000 MOD-8 8MB	9,800
MOD-20 CPU BOARD UPGRADE REV.79	5,900
8994 IOC-2/3 MV20000	2,400
MV10000 CPU-0-MEM	1,100
8888 MV/7800XP 4MB	5,200
MV/7800XP 4MB CPU BOARD	4,800
MV/7800 4MB CPU BOARD	900
91547 MV/2000 4MB 160 DISK TAPE NEW STYLE	2,400
8760 MV/4000 2MB	1,400
8770 S/280 2MB W/BMC	1,150
8678N S/140 256KB	900
8395N NOVA 4X 256KB 16 SLOT	750
DESKTOP SYSTEMS & PERIPHERALS	CALL
005-1563 S/140 BMC MOD	1,200

DISK DRIVES & MAG. TAPE

6239 592MB ARGUS S/S	\$2,300
6236 354MB ARGUS S/S	1,300
6581 500MB RAMS DISK S/S	7,500
6581-A 500MB RAMS DISK ADD ON	5,000
6461 CSS 130MB TAPE 322 & 234 DISKS	5,000
6161 147MB WINCHESTER S/S	1,100
6122 277MB DISK S/S	900
6554 662MB FOR CSS	2,900
6491 322MB FOR CSS	1,400
6329 120MB MV/2000	600
6363 160MB MV/2000	850
6100 25MB WINCHESTER W1/28	900
4307T 800/1600/6250 MAG TAPE S/S	1,800
6300/6299 1600/6250 MAG TAPE S/S	2,700
6026 DUAL MAG TAPE S/S BROWN	850
6123 MICRO STREAMER BROWN	500
6270 DESKTOP CARTRIDGE TAPE	450
6125 STREAMER MAG TAPE S/S	500
DMX-3 CONTROLLER	1,300
BMX 2 CONTROLLER	950
005-2169/6299/6300 CONTROLLER	350

MEMORIES

80108 32MB MV/9500/9600	\$12,500
8990-D 16MB MV/20000/15000	3,300
8990-C 8MB MV/20000/15000	1,400
8871 8MB MV/4000/10000	1,100
8927 4MB MV/2000 NEW STYLE	1,150
8870 4MB MV/4000/10000	450
8765 2MB MV/4000/10000	200
8940 10MB MV/7800XP	3,500
8708 2MB MV/8000	200
8754 512KB S/140	300
8687 256KB S/140	200
8387 256KB NOVA/4	200
8656 256KB ECLIPSE	200
DESKTOP MEMORY	CALL

TERMINALS & PRINTERS

D-216, D-412, D-462, D-470C	Start at \$225
D-214, D-215, D-411, D-461, D-220C	Start at 155
D-210, D-211, D-410, D-460	Start at 120
B1000 PRINTER	2,800
4364 600 LPM BAND S/S	1,800
4327 300 LPM BAND S/S	900
4433 150 CPS PRINTER	400
4434 160 CPS PRINTER	500
GENICOM MOD #3180	325
6475 12 PPM GRAPHICS LASER	1,800
4374 1200 LPM S/S	1,900

Data Investors is a worldwide specialist in Data General Equipment. We have been for 14 years buying and selling pre-owned Data General Equipment. All equipment is shipped from our own facilities, thoroughly tested and guaranteed eligible for Data General Maintenance.

Circle 13 on reader service card.

right out of the water! That is because some SQL-based report writers allow only one select statement per report definition. In contrast, we have never found even a single report that SQL*Reportwriter cannot produce.

This emphasizes the importance and value of selecting an appropriate 4GL for the requirements of an application. Bear in mind that evaluating the major 4GLs on the market is no trivial task. Before selecting a 4GL for serious development, it is wise to seek the advice of a consultant competent in such matters.

A real-world report

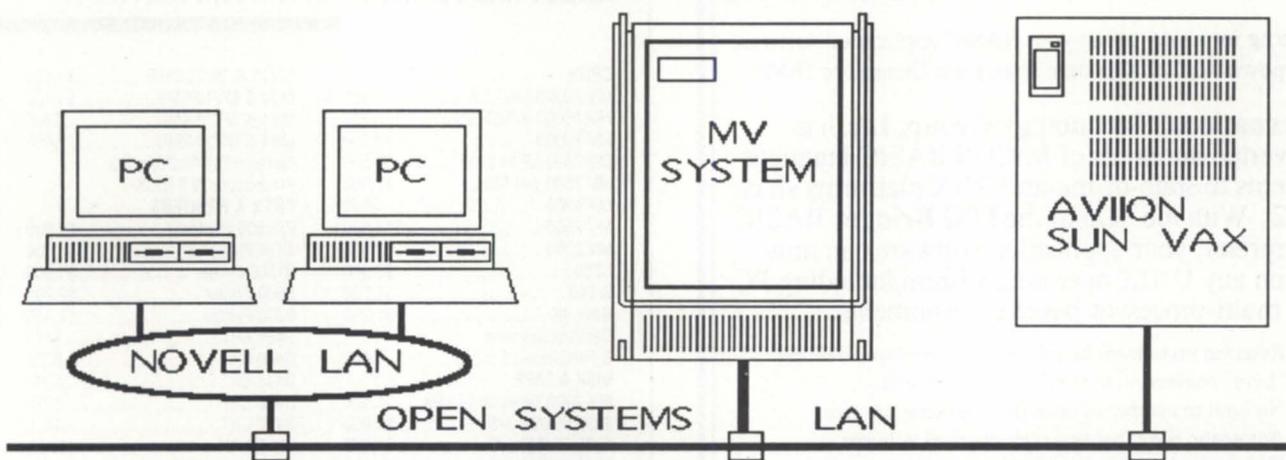
No more kid stuff. Let's see what a more realistic report definition looks like. From the Loan Tracking System, I will select the Payments Due Schools By Date report.

This report lists due dates and amounts for payments to individual schools. This allows the application administrator to project upcoming allo-

Figure 3: Payments Due Schools By Date

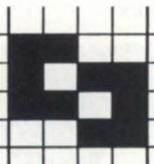
<u>Due Date</u>	<u>School Name</u>	<u>Due to School</u>
12/01/1992	Anderson University	1,000.00
	East Carolina University	6,800.00
	High Point College	1,400.00
	University of N.C. at Charlotte	8,750.00
	University of N.C. at Greensboro	7,250.00
	Due Date Total:	25,200.00
12/15/1992	Brigham Young University	1,000.00
	St. Andrews Presbyterian College	900.00
	University of N.C. at Wilmington	900.00
	Western Carolina University	4,000.00
	Wingate College	2,000.00
	Winston-Salem State University	750.00
	Due Date Total:	9,550.00
*** End of Report ***		

INTEROPERATION



- * NFS for AOS/VS and AOS/VS II
- * TCP/IP for AOS/VS and AOS/VS II
- * ETHERNET FILE TRANSFER
- * REMOTE PROGRAM EXECUTION

- * LPR - REMOTE PRINTING
- * FULL SCREEN VIRTUAL TERMINAL
- * REMOTE BACKUP
- * TCP/IP for RDOS and AOS



Clafin & Clayton, Inc.

203 Southwest Cutoff

Northboro, MA 01532

FAX (508) 393-8788

Telephone (508) 393-7979

Circle 2 on reader service card.

cations from the foundation's checking account.

Just as in the simple reports, we specify with a SQL select statement which records should be reported. The select statement required in this case will extract records at the same time from two individual tables; the loan due table (*ldu*) and the school table (*sch*). The act of retrieving records from more than one table is called a "join."

The following select statement retrieves the desired data:

```
select
  to_char(ldu.due_date, 'mm/dd/yyyy')
due_date,
  sch.name,
  sum(ldu.due_amt) tot_due
from ldu, sch
where ldu.sch_code = sch.code
  and ldu.due_date between :beg_date and
:end_date
group by ldu.due_date, sch.name
order by ldu.due_date,
```

Once again, the statement first lists the individual fields to be returned. This is very straightforward except for the due date. The "to_char" function returns the date as a character item in the format of "mm/dd/yyyy." Had this function not been used, only a two-digit year would have been returned. Notice also that SQL is calculating a total for each date and school combination with the "sum" and "group by" clauses. The second part of the "where" clause ensures only records within a user-specified date range are selected.

When the data structures were specified during the design phase, a one-to-many relationship was defined between the *sch* table and the *ldu* table. That is, for each *sch* record there exists one or more *ldu* records. The information that relates these tables together is the common field *sch_code* (school code). It is this ability of SQL to relate tables with common fields that causes us to refer to this type of data base as "relational." The actual join is defined with the state-

ment, *where ldu.sch_code = sch.code*.

After adding several report formatting parameters, the finished report appears in Figure 3 (page 31).

If it looked simple to create this report, you are right. Once you know SQL and a good 4GL reporting tool like SQL*Reportwriter, a task like this is easy and quick to implement. This particular report took less than an hour to write from scratch. When compared to writing a report program in Cobol or C, I think you will agree that this meets any realistic expectation of "rapid application development." Δ

Kim Medlin is a Senior Consultant with Data General's Systems Integration Services group in Atlanta, Georgia. Systems Integration Services specializes in custom software design, development, implementation, and consulting. His address is 3617 Parkway Lane, Norcross, GA 30092. He may be reached at 404/448-6072, ext. 2007.

MiCOS BASIC Users...

Looking for a way to run your BASIC application software on a powerful UNIX system from Data General or IBM?

International Technology Group, Inc. has converted hundreds of MiCOS BASIC language systems to state-of-the-art UNIX platforms since 1982. With the help of the ITG Bridge® BASIC Interpreter, your application software can now run on any UNIX operating system including PC and multi-processor based environments.

- Retained investment in software and employee training
- "Live" conversion to UNIX over a weekend
- No limit to number of open files and program size
- Automatic file expansion over physical volumes
- CALL to subroutines in other languages

International Technology Group
877 Kings Highway
Woodbury, NJ 08096
(609-848-3627)

Strength In
Computing
Power,
Quality From
Experience.



Circle 22 on reader service card.

**YOU NEED DATA GENERAL EQUIPMENT.
YOU NEED IT NOW. YOU NEED IT PRICED RIGHT.
AND IT HAS TO MEET YOUR SPECIFICATIONS.**

CPU's	MV15 & MV20 8MB	\$1,500
MV 20000 Mod 1 & 2	CALL	
MV 15000 w/AOS/VS	CALL	
MV 10000	\$4,900	
MV 7800 XP w/4 MB	\$3,500	
MV 7800 w/4 MB	\$2,900	
MV 4000	\$900	
MV 2500	\$14,500	
MV 2000	\$2,900	
S280	\$2,500	
S/140	\$1,500	
Nova 4X	\$1,200	
Desktop Systems & Peripherals	CALL	
DISK & TAPE		
MV 2000 Disks and Tapes	CALL	
6239 592MB S/S	\$4,900	
6236 354MB S/S	\$1,900	
6161 147MB S/S	\$1,000	
6299 6250 BPI Tape	\$4,900	
6125 Tape S/S	\$795	
6026 Tape S/S	\$1,750	
MEMORY		
MV15 & MV20 32MB	\$11,500	
MV15 & MV20 16MB	\$5,500	
MV4 & MV10 8MB	\$1,100	
MV4 & MV10 4MB	\$800	
MV4 & MV10 2MB	\$400	
Memory For All Other DG Processors IN STOCK		
CRT's & PRINTERS		
BP1500 Printer	\$8,900	
4374 Printer	\$5,000	
B1000 Printer	\$3,900	
B600 Printer	\$2,200	
B300 Printer	\$1,450	
D461 CRT	\$475	
D460 CRT	\$325	
D411 CRT	\$395	
D410 CRT	\$275	
D462 CRT	CALL	
D216 CRT	CALL	
COMMUNICATIONS		
IAC/16	\$1,500	
IAC/B	\$500	
ATI/16	\$400	
AMI/B	\$200	
LAN Controller	\$3,000	
LAC-12	\$900	

LARGE SELECTION OF EARLY-MODEL EQUIPMENT

MINNESOTA
Phone: (612) 227-5683
FAX: (612) 223-5524
622 Rossmor Building
500 N. Robert Street
St. Paul, MN 55101

ARIZONA
Phone: (602) 861-0165
FAX: (602) 861-0313
11426 N. Cave Creek Rd.
Suite E
Phoenix, AZ 85020



Circle 34 on reader service card.

New family members

SYNOPSIS

Six generations of anything is quite an accomplishment. For Data General and its recently announced mid-range and high-end MV minicomputers, six generations represent a commitment to a product line and a long-range strategy.

by Doug Johnson
Focus staff

Trek backward six generations in an American family and you could run across a Revolutionary War veteran. Such a journey reaches back a long time. But genealogy races swiftly in the computer industry. Six generations of high technology may flash past in . . . oh, say about a dozen years.

Six generations of anything is quite an accomplishment. And it should at least indicate something about commitment and long-range goals.

Data General Corporation, once a brash upstart with no family connections to speak of, now boasts six generations of the Eclipse MV minicomputer line it began producing in 1980.

"The fact that you're at that high a number means this is not just some short-term strategy," said Dave Ellenberger, DG's vice president of Eclipse marketing. "I think one thing it means to our customers is that they continue to have a combination of leading-edge technology and a protection of their investment."

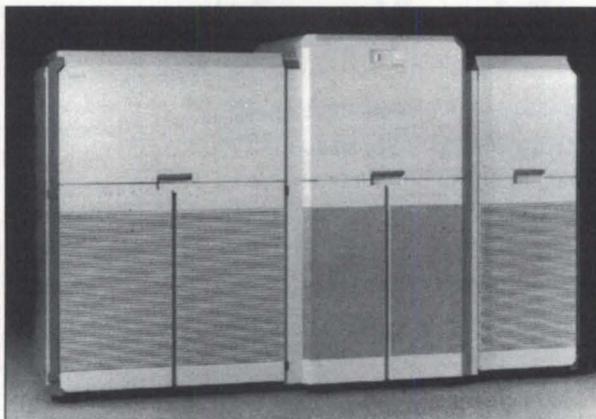
A gala event

Exhibiting its commitment to the continuing MV product line, DG on April 8 did just that: put on an exhibition. During a much-publicized executive business symposium the company hosted and sponsored at Harvard University, attendees heard leading economists and technology futurists discuss America's ability to compete in tomorrow's global marketplace, and observed demonstrations of the two newest MV systems, as well as a new MV disk array subsystem.

In action were the MV/60000 HA high-end system, the MV/35000 mid-range system, and a mass storage subsystem for the entire MV family called the H.A.D.A./MV (high availability disk array).

"These products demonstrate how Data General has taken advantage of technological change to keep our MV family on the leading edge," said Joel Schwartz, DG vice president and general manager.

Ellenberger termed the event "a first-class unveiling."



MV/60000 HA

- How much memory do I need?
- How many disc drives do I need?
- How many users can I support?
- What's my response time?

:PERFMGR can help you find the answers to these and other questions about your configuration.

Includes a tutorial on AOS & AOS/VS system performance measurement and analysis.

AOS/VS :PERFMGR	\$750
AOS/VS II :PERFMGR	\$750
10 DAY TRIAL COPY	FREE!

:SYSMGR

Software for System Managers
A Division of B.J. Inc.

109 Minna Street, Suite 215
San Francisco, CA 94105
(415) 550-1454 Fax (415) 550-1072

Circle 36 on reader service card.



ParkPlace International

250 PARK PLACE
CHAGRIN FALLS, OHIO 44022

**DATA GENERAL
COMPUTER
HARDWARE
SPECIALISTS**

**The Place to Buy, Sell,
Lease Pre-owned and New
Data General Micro-
computers, Minicomputers,
and Peripherals**

(216) 247-2650
FAX (216) 247-2604

Circle 28 on reader service card.

"I guess I would be boasting if I said that it was the best announced event in our history, but I have had that feedback," he said. "I think we had well over a hundred customers, top executives from our top customers around the world, represented at the event. And we had a set of world-class business speakers." The theme, "How to Win in a Changing World," featured

Lester Thurow, dean of MIT's Sloan School of Management; *Megatrends* author John Naisbitt; *2020 Vision* author Stan Davis; and Tom West, DG's senior vice president of advanced systems development.

Product demonstrations were conducted right after lunch.

"That [session] was packed, with people trying to get in to see those

machines," Ellenberger added.

MV/60000 HA

A new, multiprocessor high-end computer system representing one of Data General's largest-ever product developments, the MV/60000 HA is intended for customers supporting large numbers of users, and those seeking to consolidate current computer applications and operations onto a single system.

"We've done more simulation with this machine than any other in [our] history," says Ellenberger.

According to Schwartz, "The MV/60000 HA doubles the performance of our high-end MV/40000, offering mainframe power with a single-board CPU."

Based on Motorola's ECL gate array technology, the MV/60000 HA employs a scalable, multiprocessing architecture that provides 27 to 108 Dhrystone MIPS (million instructions per second). The cache design, memory architecture, and high-performance system bus increase performance incrementally as more processors are added, enabling the MV/60000 HA to support more than 1,500 users in a commercial environment.

"To reach those levels, you need to make sure that your software is tuned," said Ellenberger. "So a lot of effort was involved there, in software development, and ensuring that we can reach these unprecedented levels of support."

The MV/60000 HA can accommodate from one to four job processors, from 128 MB to 1 GB of memory, 2 to 6 I/O channels, and up to 720 GB of direct mass storage. The system will also offer full interoperability with DG's Aviiion systems and Dasher PCs. Pricing for the MV/60000 HA starts at \$750,000, and will begin shipping in August.

MV/35000

The MV/35000 is a mid-range system designed for multi-user systems and servers. It offers the distinction of being the first DG system designed for six-way multiprocessing, while providing substantially increased performance over previous mid-range MVs. An improved version of DG's customer CMOS microprocessor provides 40 per-

Now: NetWare[®] for AOS/VS!

Now you can link your MS-DOS and OS/2 PCs and your Macs to your DG Mini with Novell's Netware.

Your desktops can share files and printers with each other, with standard AOS/VS applications and with any NetWare server in your network. And they'll be doing it with the one LAN system that doesn't lock you into a single-vendor proprietary architecture. Rational Data Systems, Data General and

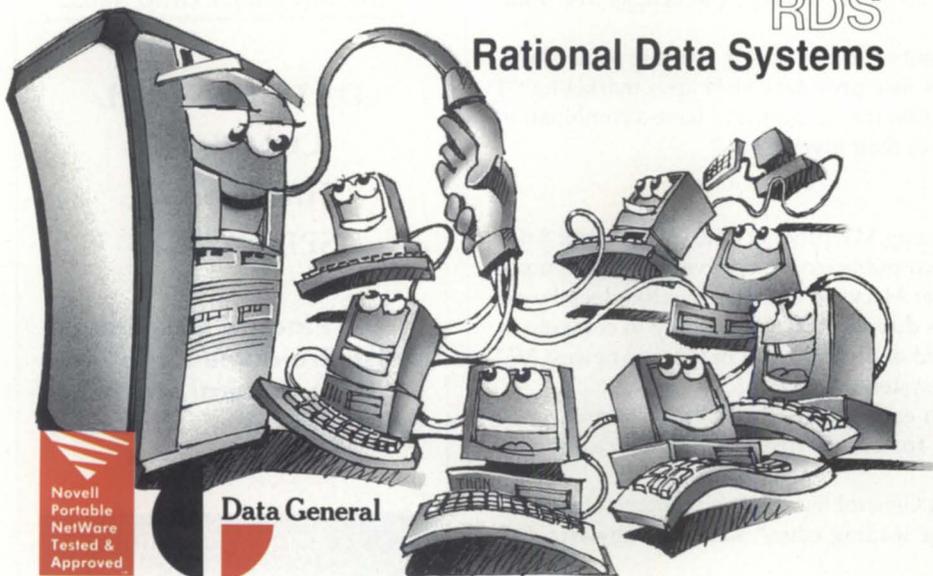
Novell spent two years developing NetWare for AOS/VS, so you get broad, multi-vendor support. It works with other RDS software, like PC/VS and PopTerm/410. And it's ready to go, right now. All the components, accessories and support you need, from a single source: Rational Data Systems.

Call us at 1-800-743-3054.

Or write us at 1050 Northgate Drive, San Rafael, CA 94903.



Rational Data Systems



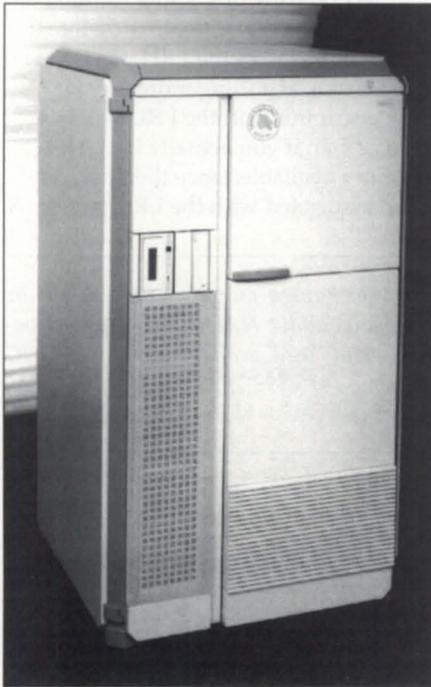
Novell
Portable
NetWare
Tested &
Approved

Data General

PC/VS is a trademark of Rational Data Systems, Inc. Novell and NetWare are registered trademarks of Novell, Inc. Circle 30 on reader service card.

cent or greater performance than a comparably configured MV/30000.

A scalable multiprocessor, the MV/35000 is configurable with up to six CPUs, 512 MB of memory, three I/O channels, and up to 360 GB of direct mass storage. System performance ranges from 9 Dhrystone MIPS using a single processor, to 54 Dhrystone MIPS using all six processors.



H.A.D.A./MV

Existing MV/30000 users can upgrade their systems by changing boards. Those with other mid-range DG systems can trade in and retain complete hardware and software compatibility. Pricing for the MV/35000 system starts at \$177,000. It will be available beginning this month.

H.A.D.A./MV

The newest member of Data General's growing disk array family, the H.A.D.A./MV, brings to the MV family capabilities that Aviiion users already enjoy. It is a 2.5 GB to 30 GB high-performance, transaction-oriented disk array supporting multiple levels of RAID (redundant array of inexpensive disk) technology.

The system provides a high degree of fault tolerance, to virtually eliminate system downtime from disk failure. The H.A.D.A./MV provides concurrent

support for RAID 0, RAID 1, and RAID 5 levels, as well as independent drive operation. It is designed for flexible configuration and scalable storage capability, supporting both 1 GB and 500 MB Winchester disk drives. The system can be configured to include industry standard 8 mm, 4 mm DAT, and QIC tape drives for data backup.

Pricing for the H.A.D.A./MV starts

at \$42,000, available this month.

More on the way

"I don't see it slowing down," said Ellenberger of future MV product development. "We're bringing out new MVs more rapidly than we have at any point in our history. So basically, what that says is you have to move quickly to keep up with technology." Δ

If you're talking workstations

Rave buys surplus Aviiion/Data General. Top dollar paid.

Data General/Aviiion

Disk Upgrade	2GB Tape Addition	AV 4100
DG & Comp Memory	AV 6220	AV 200/300
AV 410	Monitors	VME Cluster
VME Adapters	Quick Tapes	

MUCH MORE INVENTORY IN STOCK

90-Day Warranty

We get rave reviews

**Buy...Sell...
Trade...
Lease**



(313) 939-8230
1-800-966-RAVE
(313) 939-7431
FAX

Rave Computer Association, Inc.
36960 Metro Court, Sterling Heights, MI 48312

Circle 31 on reader service card.

Bits and bytes

Performance not there



From: Jim Bageant

We have recently upgraded our MV/20000 to a Mod 2 and are not getting the increase in performance we expected (in fact, it feels a little slower at the user console). We looked at all three hardware areas before the upgrade (CPU, memory, disk) and decided to upgrade the CPU first. BJ's :PERFMON always reported some free memory and a large LRU (free averaged about 1 MB and LRU 10 MB). Disk drives are old Argus and Fujis (on BMX-3s), but disk wait queues and seek numbers are within BJ's suggested parameters. After the upgrade, free memory is always 0. The LRU chain is still averaging over 10 MB. Why did this occur? Does the second processor

partition the memory somehow? Our DG salesperson says we are out of memory, although my tests show swapping is nonexistent. Additional memory is not a large dollar issue, but I don't want to do another upgrade and not have a performance increase visible at the user console. Any ideas?

From: Matt Koch

Sounds to me like your engineer is right. We had a machine that always showed sufficient memory in the LRU chain, but no free memory. Averaging the :PERFMGR reports over 1 minute revealed the problem. When the reports were averaged over 2 minutes, the problem was not apparent. As to why memory has become a problem now, I would think that with the second CPU there are now more active PIDs,

increasing the demand for memory.

From: Doug Rady

Your 1 MB free memory was probably consumed by the private data of that second copy of VS now running on your second CPU. If you're down to 0 free with 10 MB of the LRU, then you should look at adding more memory. Always running off the LRU will be slower than if you actually have free memory available, since there is overhead associated with the LRU pages. Δ

Do you have a question, comment, or answer? Call the NADGUG/RDS electronic bulletin board, available to all NADGUG members, 415/499-7628. No fees other than phone charges.

DG TERMINAL SWAPOUT/REPAIR

SERVICING ALL DATA GENERAL TERMINALS

From **\$59**

LESS TURNAROUND TIME... WE'LL SHIP YOUR ADVANCE TERMINAL TODAY!

Call for all of your self-maintenance requirements.



DIGITAL COMPUTER CONSULTING, INC.

Boston

Tel: (617) 837-7255

Fax: (617) 837-9641

Baltimore

Tel: (410) 750-7200

Fax: (410) 750-7202

Circle 16 on reader service card.

DG & MOTOROLA BUY • SELL • LEASE

CPU

MOT 8220, 8420, 8620
MOT 8440, 8640, 8840
MV/15000, 20000
MV/10000, 18000
MV/8000
MV/7800
MV/4000, 4000DC
MV/2000, 2500
NOVA 4-C, S/20
S/140, S/280, C350

MEMORY

MV & ECLIPSE
NOVA & MICRO NOVA

PRINTERS

4320 55CPS LQ
GENICOM 3318
Data Prod B300, B600
Printronic P-300
HP LASER JET I, II

DESKTOP

DG/10, 20, 30 PKG
DISK UPGRADES
USAM-4, USAM -1
CARTRIDGE TAPE
MEMORY

COMMUNICATIONS

IAC-8, 16, 24
TCBs
COM BASIC I/O
ATI-16, AMI-8
ALM-8, ALM-16
LAC-12, 16, 32

DISK / TAPE

322, 332, 662MB
500MB, 1.2GB
354, 592 MB
96, 192 MB
10, 12.5, 20, 25 MB
6231 CART N/E
6026, 6123, 6125
6299, 6300, 6021

CRT'S

6053, D-100, D-200
D-210, 211, 410, 460
D-214, 215, 411, 461
D-216, 412, 462, 470
D-217, 413, 463

COMPATIBLES

ZETACO CDC
FUJITSU SCIP
DATARAM STC

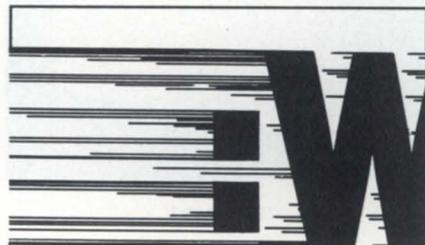
WANTED
★★★★

MOTOROLA VARS

AMES SCIENCES, INC.

1787 Chancellor Point Rd., Trappe, MD 21673
(410) 476-3200 • Fax 410-476-3396

Circle 1 on reader service card.



:WFFCA World's Fastest File Compressor & Archiver.

:WFFCA compresses files and archives them faster and with less impact on other users than any other similar utility available on DG systems. Dramatically reduce disk storage used by infrequently accessed files maintained for historical purposes. A typical SYSLOG file compresses better than 7 to 1.

:WFFCA has the ability to handle archives in the popular PC ARC™ format significantly reducing file transfer time.

Initial AOS/VS and AOS/VS II License: \$499
10 Day Trial Copy: FREE!

ARC™ is a registered trademark of Systems Enhancement Associates

A Division of B.J. Inc.

:SYSMGR

Software for System Managers
109 Minna St., Suite 215
San Francisco, CA 94105
(415) 550-1454 FAX (415) 550-1072

Circle 37 on reader service card.

The latest products for DG systems

High-performance PCs



Westboro—Data General Corporation announced two additions to its PC product line.

The Dasher II-386/33L, a high-performance IBM PC-AT compatible featuring the Intel 33 MHz 80386 processor, offers a base configuration including the CPU, 4 MB of memory, a socket for an optional 80387 math coprocessor, and a 64 KB external cache for improved processor performance.

The Dasher II-486SX/20A, based on the 20 MHz Intel 80486SX processor, provides sufficient mass storage and available I/O slots to serve as either a local area network (LAN) server or Unix platform. It may be upgraded to a 33 MHz 80486DX system by switching

the CPU chip. Prices for the Dasher II-386/33L begin at \$2,445, while the Dasher II-486SX/20A starts at \$2,545.

Data General Corporation, 3400 Computer Drive, Westboro, MA 01580; 508/898-4288.

Circle 45 on reader service card.

4 mm DAT tape drive



Westboro—Data General has introduced the model 6762 4 mm DAT (digital audio tape) cartridge tape drive for Eclipse/MV and Aviion systems. Using the helical scan recording method, this single-ended SCSI-2 tape drive offers speed and storage capacity needed for backup of large disk subsystems.

A 1 MB onboard data buffer and high-speed search/rewind operations

support an average sustainable data transfer rate of 183 KB per second (native mode). High-speed ECC and read-after-write verification are used to ensure data reliability. Priced at \$5,500 for an add-on drive, the model 6762 4 mm DAT tape drive is also available as packaged storage subsystems, starting at \$11,000.

Data General Corporation, 3400 Computer Drive, Westboro, MA 01580; 508/898-4246.

Circle 46 on reader service card.

VT emulation



Columbia, MD—Rhitek, Inc., introduced its enhanced version of EMU/470, incorporating VT320 and

Continued on page 39

FREE! to NADGUG members!

- Focus Magazine/12 issues
- Electronic Bulletin Boards
- NADGUG software library
- Member Directory
- Networking with other DG users
- Access to RIG/SIG network
- Communication channel to DG
- Discounts on annual conferences

Make use of all the benefits of belonging to the North American Data General Users Group. Contact NADGUG staff for further information at

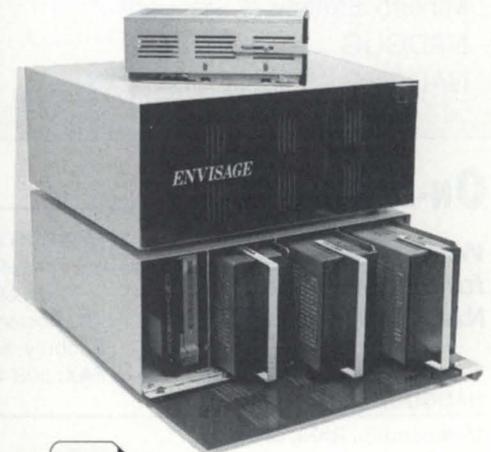
1-800-253-3902
508/443-3330 (Outside the U.S.).

Circle 27 on reader service card.

NEW FOR MV-AVIION Self-Maintenance\Security\Hot Swap

Features:

- 100,000+ insertion cycles per slot
- Individual bay or unit power shutdown
- Accommodates up to 7 SCSI devices
- Carrier is designed for 5 1/4" & 3 1/2" drives
- Lightweight design with maximum air flow
- External termination and SCSI ID selection



DIGITAL COMPUTER CONSULTING, INC.

P.O. Box 1472
Marshfield, MA 02050

For more information call (617) 837-7255

Circle 15 on reader service card.

AD INDEX

Company	PG#	RS#	Company	PG#	RS#
Ames Sciences, Inc.	36	1	NADGUG	37	27
Clafin & Clayton	31	2	Park Place International	33	28
Compuplan International, Inc.	39	-	Productivity Systems		
Computer Engineering International	29	3	Development Corporation	16	29
Computer Wholesalers	24	4	Rational Data Systems	34	30
Contemporary Cybernetics Group	25	5	RAVE Computer Association	35	31
Cyberscience Corporation	C2	6	Rhintek, Inc.	17	32
Data Assurance Corporation	40	7	SCIP	27	33
Data Bank Associates, Inc.	12	8	Security Computer Sales	32	34
Data Bank Associates, Inc.	13	9	Sysgen Data Ltd.	9	35
Data General Corporation	15	10	:SYSMGR, a division of B.J. Inc.	33	36
Data General Corporation	C3	11	:SYSMGR, a division of B.J. Inc.	36	37
Data General Professional Services	9	12	:SYSMGR Bulletin Board	39	-
Data Investors Corporation	30	13	Systems Management Consultant	39	-
DataLynx, Inc.	19	14	Threshold, Inc.	24	38
Digital Computer Consulting	37	15	TLC, Inc.	C4	39
Digital Computer Consulting	36	16	Wild Hare Computer Systems, Inc.	5	40
Digital Data Systems	21	17	Zetaco	7	41
Digital Dynamics	21	18			
Eagle Software, Inc.	3	19			
Eagle Software, Inc.	39	-			
Flying Point Software	39	-			
Hanson Data Systems	11	20			
International Computing Systems	20	21			
International Technology Group	32	22			
Jacobsen & Associates, Inc.	23	23			
McIntyre's Mini-Computer					
Sales Group, Inc.	8	24			
Minitab Statistical Software	39	-			
NADGUG	22	25			
NADGUG	8	26			

PRODUCTS AND SERVICES

Company	PG#	RS#
Data General Corporation	37	45
Data General Corporation	37	46
DMS Systems, Inc.	39	47
Rhintek, Inc.	39	48
R.B. Zack & Associates, Inc.	39	49

ON-LINE HELP

Who to call for answers about NADGUG and FOCUS

NADGUG address:
c/o Danieli & O'Keefe Associates, 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.) **508/443-3330**

Electronic bulletin board

(300 or 1200 baud modem)
Rational Data Systems **415/499-7628**

FOCUS Magazine address:

c/o Turnkey Publishing, Inc.
Livingston Building, Suite 250
3420 Executive Center Dr.
Austin, TX 78731
FAX: 512/343-7633

FOCUS Magazine

512/345-5316

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

Information about advertising.....Michelle Sentenne

FOCUS back issuesTurnkey Publishing staff

*Products and Services:
continued from page 37*

VT100 emulation. Version 4.0 provides compatibility with Data General's Avion workstations and Digital Equipment Corporation's VAX minicomputers. This revision supports six of the most popular network interfaces, including PC/TCP (FTP Software's TCP/IP kernel).

EMU/470 enables users to unite the diverse requirements of PC networks, remote dial-in, and direct connect with minicomputer systems. Users guide operations with EMU's intuitive, multi-tiered menu system. EMU/470 Version 4.0 retails for \$249 (foreign orders \$269 US).

Rhintek, Inc., 8835 Columbia 100 Parkway, Columbia, MD 21045; 410/730-2575.

Circle 48 on reader service card.

MV-to-PC



Rancho Palos Verdes, CA—Now MV users can convert and transfer data to a DIF or ASCII format readable by PCs.

Xport from R.B. Zack & Associates, Inc., works in two steps, in which the user is guided by the utility. The "strip" step allows the user to select the desired content by omitting unwanted information; the "create" step reformats information. Xport is available at an introductory price of \$1,995.

R.B. Zack & Associates, Inc., 29000 S. Western Avenue, Suite 401, Rancho Palos Verdes, CA 90732; 310/833-0211.

Circle 49 on reader service card.

New Genisys options



Salt Lake City, UT—A new version of Genisys, the data base management system from DMS Systems, Inc., has added macro options to increase the user's ability to customize applications, allowing branching, looping, and conditional statements.

Other enhancements include form-level aggregate functions to utilize user-defined memory variables, setting a string variable to a given value, and the ability to hot key to the CLI or Word-perfect Office.

DMS Systems, Inc., 1111 Brickyard Road, Salt Lake City, UT 84106; 801/484-3333. △

Circle 47 on reader service card.

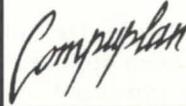
EQUIPMENT

**AVIION
LINE PRINTERS**

450/LPM - \$5,550.00

800/LPM - \$6,350.00

*** NEW * WITH WARRANTY**



1-800-228-8889
Texas or Nationally
FAX: 214-224-3281

DIAL-UP BULLETIN BOARDS

:SYSMGR BBS specializes in file transfer of RDOS and AOS[VS] DUMP files - no messaging facilities. XMODEM, YMODEM, and KERMIT supported. 415/391-6531 (one line), 2400 baud (Microcom AX9624c), 8 data bits, 1 start / stop bit or 415/550-1454 (voice). System is MV/4000, terminal mode is CHAR/605X.

**for NADGUG
Membership information
contact:**

Danieli & O'Keefe Associates, Inc.
1-800-253-3902 (continental U.S. only)
508-443-3330

*The North
American
Data General
Users Group
is an incredible
resource when you
need answers*

*So, don't
go it alone—
join **NADGUG**
today!*

SERVICES

EAGLE SOFTWARE

Can Help You With

- ✓ CEO Conversions
- ✓ INFOS File Reconstruction
- ✓ Disk Recovery Services
- ✓ GSA Contract Pricing

CALL TODAY!

1-800-477-5432



P.O. BOX 16
SALINA, KS • 67402-0016
Phone: (913) 823-7257
FAX: (913) 823-6185

SOFTWARE

**Statistical
Software**

- Powerful
- Fast
- Easy-to-use
- Inexpensive

MINITAB

STATISTICAL SOFTWARE
3081 Enterprise Dr., State College, PA 16801

814-238-3280

Terminal Emulation

@Con/PC & @Con/PC Plus - Complete D210-D411 DG terminal emulation. Plus version includes fast, error-free file transfer (with software for MV), and script language (macros). Network licenses and volume discounts available.

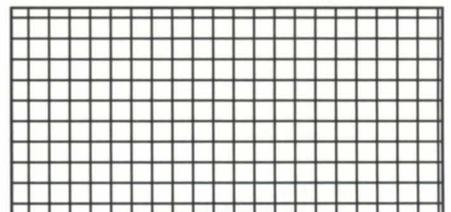
Still only \$99 & \$149
Flying Point Sales - (516) 725-3622

CONSULTING

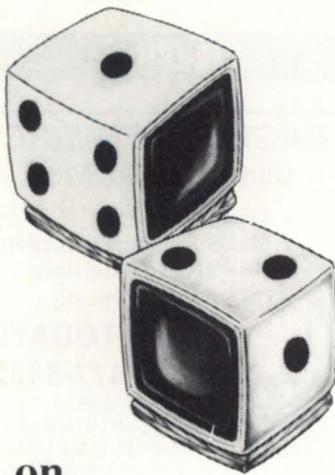
DOWNTIME GOT YOU DOWN?

I'll keep your DG ECLIPSE systems running until you catch up with them.

Stephen J. Maroulis,
Systems Management Consultant
P.O. Box 3642, Poughkeepsie, NY 12603
Phone: 914-452-1178, Fax: 914-452-8180



Why gamble...



...on someone offering disaster recovery as a sideline?

With DG/hot site from Data Assurance, you get:

- Dedicated DG computers
- Dedicated Communications
- Dedicated Recovery Experts

Over 250 DG users, spanning the U.S. and Canada, don't gamble with their information based assets - or their choice for a hot site. They use the dedicated people, experienced in actual recoveries and hundreds of tests, and dedicated disaster recovery resources of

Data Assurance Corporation

Denver • Detroit • Philadelphia

(800) 654-1689

12503 E. Euclid Dr., Ste 250, Englewood, CO 80111
(303) 792-5544 • FAX (303) 792-0218

Data General has qualified DAC as a provider of DG/hot site, based on criteria established by DG. DAC is an independent company offering its disaster recovery services to users of

 **Data General**
equipment.

Circle 7 on reader service card.

IN GENERAL

Data Specific

DG's new chief financial officer



Arthur DeMelle

Arthur W. DeMelle has been appointed vice president and chief financial officer at **Data General**. DeMelle, who brings nearly 30 years of corporate financial experience to his new position, will report to DG President and Chief Executive Officer **Ronald L. Skates**.

"Art DeMelle brings a broad range of corporate financial experience and expertise to Data General," said Skates. "He will be a great addition to our management team."

DeMelle will direct DG's worldwide financial operations, investor relations, and the company's internal information systems management group.

For the past two years, DeMelle has served as senior vice president of finance and administration at a privately held company, *Chep USA* of Park Ridge, New Jersey. Prior to that, he was executive vice president and chief financial officer at *Emery Air Freight* for two years; executive vice president of finance at *Purolator Courier Corporation* from 1980 to 1987; and vice president of finance at *Interpace Corporation* from 1978 to 1980.

From 1963 to 1978, DeMelle worked at *Price Waterhouse & Company* in Newark and Morristown, New Jersey, where he was an audit partner. DeMelle holds an MBA degree from *Rutgers University*, and a bachelor's degree in economics from *Bowdoin College*.

A large family

In the dozen years since Data General introduced the MV/8000 system, marking the company's entry into the 32-bit

computing world, more than 50 different MV class machines have been brought out to augment the product line. This vast array was depicted quite strikingly in a wide, wide timeline diagram across the bottom of several pages in *Data General Universe*, the Eclipse Business Unit's quarterly publication.

The timeline shows a proliferating number of models through the 1980s, filling an ever wider variety of computing niches, culminating with the most recently announced MV/35000-1 through 4 and MV/60000 HA-1 through HA-4. At the far end beyond 1992 stand several more, intriguingly labeled, "Future." No doubt more family additions are on the way.

Workforce reduction

Data General announced April 1 that it will record a charge of approximately \$46 million against its second quarter, which ended March 28, as a result of costs associated with a worldwide workforce reduction of about 1,000.

The company also said that while revenues for its Aviiion family continue to be strong, preliminary indications are that total second-quarter revenues will be lower than what most industry analysts have projected. This is due to weakness in DG's other product lines, competitive pricing pressures, and a weak worldwide economy. The company said it may report an operating loss for the quarter, prior to the restructuring charge.

DG reports that its workforce reduction will include a significant number of administrative positions being eliminated from international operations.

The workforce reduction "is a painful but necessary step," said Ronald L. Skates, president and chief executive officer. "This action will make Data General an even more efficient producer of high-quality products, and will not impact our ability to provide service to our customers."

DG's financial position continues to be strong, said Skates. The company had cash and marketable securities of \$249 million at the end of the first quarter. DG employed 8,100 at the end of that quarter, which ended December 28, 1991. Δ

6

great reasons to dash to Data General!

1. DASHER II—
386/33L™

2. DASHER II—
486/33LE™

3. DASHER II—
386SX/20A™

4. DASHER II—
486SX/20A™

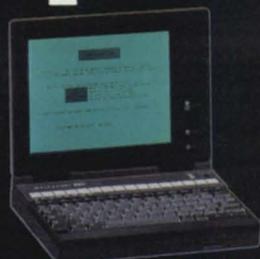
5. DASHER II—
386SX/16z™



6. DASHER II—
486/33TE™

(And 1 super reason to walk.)

The six Data General DASHER® PC models and the Data General WALKABOUT/320 Notebook PC are all you need to run in a variety of application environments. They are all IBM compatible using the latest Intel® technology at prices that leave the competition in the dust! Our total lineup means a single-source total solution: Computer systems. PCs. Software. Installation. And *ON-SITE* service by the same people who support your existing DG systems. Data General PCs are fully Novell®-certified. We even provide a 1-year warranty on every model. If you want to win the PC productivity race, then dash, walk, whatever, just get to your phone and call **1-800-DATA GEN**



WALKABOUT®
/320

DASHER and WALKABOUT are registered trademarks of Data General Corporation
DASHER II—386SX/16z DASHER II—386SX/20A DASHER II—386/33L
DASHER II—486SX/20A DASHER II—486/33LE DASHER II—486/33TE
are all trademarks of Data General Corporation
Novell is a registered trademark of Novell, Inc.
© 1992 Data General Corporation
The Intel Inside logo is a trademark and Intel is a registered trademark of Intel Corporation

Circle 11 on reader service card.



Data General
Where the World is going!



*Everyone
can use a little
Tender Loving Care.*

With some companies tender loving care is a luxury. But, at TLC it's our way of doing business. Our customers deserve the best and they get it.

HARDWARE SALES, SERVICE AND DEPOT REPAIR

HIGH TRADE IN ALLOWANCES ON EQUIPMENT UPGRADES

180 DAY END-USER WARRANTY ON ALL PURCHASES

100% SATISFACTION OR YOUR MONEY BACK

All available to you from a staff with over 150 years of Data General experience.



TLC

TECHNICAL & LOGISTICAL
CONSULTANTS, INC.

4 Spaceway Lane, Hopedale, MA 01747 508-478-8211, (FAX) 508-473-3109

 Data General
VALUE-ADDED RESELLER

Circle 39 on reader service card.