

# Data General Corporation AViiON Family



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**Product Summary**

**Description**

The AViiON series of workstations and servers employ a reduced instruction set microprocessor (RISC) that runs under DG's UNIX-based operating system.

**Strengths**

AViiON's most visible advantage is its price per MIP, which is significantly below the competition.

**Limitations**

Data General (DG) is one of the last vendors to enter the RISC-, UNIX-based workstation/server market. They may have waited too long. Many other vendors are firmly established in this marketplace and DG may find it extremely difficult to be considered as a serious contender in the market.

**Competition**

Altos, NCR Tower, Unisys, Digital VAXstation and DECstation 3100; Sun Microsystems Sun-3/Sun-4 Family; Hewlett-Packard HP 9000; Apollo Series 3500, 4500, and 10000; Zenith Data Systems Z-1000.

**Vendor**

Data General Corporation  
 4400 Computer Drive  
 Westboro, Massachusetts 01580  
 Telephone (508) 366-8911  
 Headquarters locations in Australia, Canada, Mexico, South America, Europe, and Great Britain. Offices and distributors in over 50 locations worldwide.

**Price**

Workstations from \$6,450; servers from \$52,000.

**UNIX Implementations Supported**

DG/UX Version 4.1 (supports both AT&T UNIX System V Release 3.1 and Berkeley 4.2 BSD with enhancements).

**GSA Schedule**

Yes.

# Analysis

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## Product Strategy

Spurred by the desire to participate in the open systems market, as well as to rejuvenate its workstation products, Data General (DG) introduced a line of UNIX-based workstations and servers in February, 1989, called the AViiON Series. These workstations and servers employ the Motorola 88000 reduced instruction set computing (RISC) microprocessor and run under the DG/UX 4.1, DG's version of the UNIX operating system. The new AViiON systems offer increased processing speeds at prices competitive with other workstation offerings from vendors such as Sun Microsystems, Hewlett-Packard/Apollo Computer, and Digital Equipment. Open systems that use UNIX operating systems, and especially the UNIX workstation market, small businesses, and the government, have recently emerged as hotly debated and intensely competitive arenas from which users hope to enforce industry-wide standards for computing.

**Standards Implemented:** AT&T SVID; IEEE 1003.1 POSIX; 88Open Binary Compatibility Standard (BCS); ANSI standard C; X-Windows Version 11 Release 3; VME bus; SNA/3270, SNA/RJE, TCP/IP, and NFS 4.0 communications protocols; IEEE 802.3 Ethernet.

**Consortium Memberships:** Open Software Foundation (OSF) and UNIX International (UI).

The AViiON Series addresses the commercial market, both with horizontal software such as DBMSs and compilers, and with vertical software such as accounting, manufacturing, health care, and legal. The 32-bit workstation also addresses the technical desktop user, such as software engineering and scientific research users. The 5000/6000 servers are multiuser systems aimed at customers requiring a midrange system in either a multiuser or client-server configuration.

In its strategy to address the commercial market, Data General is developing an object-oriented office system that incorporates a graphical user interface (GUI), relational database support, and the capability to integrate third-party applications. Object-oriented systems are very new and will put Data General on the leading edge of this technology in the marketplace. The drawback is that object-oriented databases are sometimes slower than relational databases, making them questionable for use in high-speed environments. For those users who require more traditional models, Data General also supports relational databases.

DG/UX was designed with consideration for future architectures and multiprocessors. Included in the design goal was scalability, the capability to move applications from small to large systems and back, without having to change the underlying application. Modularity is the key to the strategy of adapting to future requirements. Data General has engineered the system kernel and filing system to make it a modular UNIX implementation. This modularity enables the incorporation of changes and enhancements more easily than if the system contained many interdependencies. For example, hardware and peripheral support is easier because the modular system allows for the interchanging of device drivers.

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## Competitive Position

Data General has chosen to compete in the commercial application marketplace because it is still a relatively new segment of the UNIX industry. This market segment promises the greatest growth over the next few years because the commercial marketplace mostly comprises small businesses that have yet to be penetrated by computer systems—75 percent of small businesses do not yet own a computer system. Competition includes the Altos Computer 386 Series, NCR Tower, and Unisys U Series, all targeting the general commercial marketplace.

In addition to the commercial market, Data General also competes with RISC workstation vendors that dominate the market, such as Sun Microsystems Sun-3 and Sun-4 Families; Hewlett-Packard HP 9000 Series, Digital DECstation; and Apollo Computer Series 3500, 4500, and 10000.

## Company Profile Data General Corporation

### **Corporate**

#### **Headquarters:**

Data General Corporation  
4400 Computer Drive  
Westboro, MA 01580  
(508) 366-8911

#### **In Canada:**

Data General (Canada),  
Inc.  
2155 Leanne Boulevard  
Mississauga, Ontario L5K  
2K8  
(416) 823-7830  
International offices in  
Europe, Far East, and  
Australia.

#### **Officers:**

##### *Chairman:*

Edson D. de Castro

##### *Vice Chairman & CMO:*

Herbert Bridgeman

##### *President & CEO:*

Ronald L. Skates

##### *VP. & CFO:*

Michael B. Evans

##### *VP., Marketing:*

Stephen Baxter

Year Founded: 1968

No. of Systems Sold (cu-  
mulative): Over 250,000

### **Company Profile**

Data General is a promi-  
nent worldwide supplier  
of computer systems and  
associated peripherals,  
networks, communica-  
tions, software, and ser-  
vices. The products are  
used in a variety of appli-  
cations in business, in-  
dustry, government, and

scientific areas. Both di-  
rect and indirect channels  
are used to market, sell,  
and support products. In  
fiscal 1988, 49% of its  
revenues were derived  
from customers outside  
the U.S.

### **Financial Profile**

For the 1989 fiscal year  
ended September 1989,  
Data General recorded  
revenues of \$1.314 billion,  
down 3.7 percent from  
the \$1.365 of the previous  
year. Operating loss was  
\$127.4 million, up drasti-  
cally from \$5.9 million.  
Net loss increased to  
\$119.7 million from \$15.5  
million.

### **Management Statement**

Data General expects  
equipment sales to follow  
the general trend of the

midrange sector for the  
next few years. Renewed  
growth will come through  
a new set of industry dy-  
namics.

Data General's strategy  
for the 1990s comes in  
several parts. First, the  
advantages of the propri-  
etary systems will be ex-  
panded. Second, Data  
General will work to es-  
tablish itself as a leading  
supplier of industry-  
standard technology.  
Third, more emphasis will  
be placed on distributed  
applications, systems in-  
tegration, and integrated  
telecommunications.  
Fourth, Data General will  
sell new and emerging  
applications while still  
serving traditional mar-  
kets.

Data General has targeted the technical worksta-  
tion market behind the commercial because the  
major workstation players hold a strong grip on the  
market, making it more difficult to penetrate than  
the commercial market.

Data General's AViiON Series has given the  
company an immediate boost in visibility based on  
its price/performance relative to competition. For  
instance, an 8M-byte monochrome system delivers  
17 MIPS for \$7,650, a cost of \$450 per MIP; the  
DECstation 3100 delivers 5.3 MIPS for \$11,640, a  
cost of \$1,385 per MIP.

### **Sales and Distribution**

Data General has been actively recruiting software  
developers, OEMs, VARs, and system integrators  
to develop new software packages on the AViiON  
or port their already developed packages originally  
written for other machines. Target markets include  
government, technical and scientific, and vertical  
markets such as health care, insurance, retail, and

manufacturing. Data General is targeting its sales  
efforts to third parties to develop these applica-  
tions, through which it will be able to reach the end  
user. Distribution efforts will go through the fol-  
lowing stages:

- The first phase is to attract horizontal software  
platform developers to build database manage-  
ment systems, editors, compilers, and third- and  
fourth-generation languages, and, in turn, to sell  
their software along with the AViiON ma-  
chines.
- After the initial phase, Data General will recruit  
vertical market VARs and ISVs to develop soft-  
ware for their special industries, such as manu-  
facturing, medical, retail, etc.
- During both phases, Data General will supple-  
ment outside vendors with a direct sales force.  
During the vertical market phase, Data General  
will step up its internal sales force efforts.

In 1988, all of Data General's growth came from  
sales made outside the United States—primarily in

Japan and Europe. Foreign sales will continue to play a major role in the AViiON system.

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## Decision Points

As with many proprietary midrange vendors, Data General has experienced slow sales in recent years, but the company is convinced that its newfound commitment to UNIX is vital to its future. Data General's Distributed Applications Architecture (DAA) strategy for the 1990s incorporates aspects of both its proprietary systems and its new commitment to open systems. Data General plans to take advantage of RISC microprocessors, offering two to five times the performance of complex instruction set computing (CISC), as well as standard operating systems and interfaces in order to spur corporate growth.

Data General's DG/UX, introduced in 1985, is based on AT&T's System V and elements from Berkeley 4.3 BSD. The company has continued to enhance DG/UX, including building support for Sun Microsystems' Network File System (NFS) and TCP/IP communications. Data General's goal for DG/UX is to accept a wide range of commercial applications, regardless of the hardware environment in which they were developed.

Data General is intent on having a stake in the standardization of UNIX. The company is a member of both UNIX International (UI) and the Open Software Foundation (OSF), organizations that are directing future UNIX operating system and software standards. As a member of both, Data General is well positioned in the industry's technical direction and able to implement standards developed by either organization.

## Advantages and Restrictions

AViiON's most visible advantage is its price per MIP, which is significantly below the competition. Also, because it is compliant with UNIX System V and BSD versions, Data General is in a position to bid on most opportunities for UNIX systems, including government contracts, a most significant UNIX outlet.

Developers focusing on UNIX applications are assured that AViiON systems will support both UI and OSF product goals, and in so doing, will comply with any future UNIX standards.

Even though AViiON is a powerful product, Data General will face some difficult hurdles because it is a new competitor in the UNIX workstation marketplace. It will also have to convince the marketplace that it has overcome its unstable financial condition experienced in recent years. Potential customers can rest assured that Data General is actually concentrating on UNIX to place itself on firmer footing. Industry concerns about the company's stability have to be weighed against the product's price/performance—compared to leaders such as Sun and Digital, AViiON stacks up quite well. If good price/performance endures, the industry obstacles will lessen.

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# Characteristics

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## System Overview

### Specifications

#### Data Format

Basic Unit: 32-bit word.

Internal Code: Binary Compatibility Standard (BCS), which provides compatibility with IEEE POSIX and X/Open Portability Guide.

#### Main Storage

Both the AViiON workstation and the AViiON server use the Motorola MC88200 cache and memory management units (CMMUs) for data and instruction bus processing. The MC88200 CMMUs use the HCMOS VLSI, providing zero-wait-state memory management and caching. The memory management unit supports demand-paged virtual memory, which has logical addresses of up to 4 gigabytes.

Two address translation caches (ATCs) reside on the system board and provide address translation in one clock cycle for most memory accesses. There is also a page address translation cache (PATC). This cache is a 56-entry, fully associative cache containing recently used translations for 4K-byte memory pages. The PATC is maintained by the MC88200. The block

address translation cache (BATIC) is a 10-entry cache which stores translations for 512K-byte memory areas. The BATIC is maintained by software.

The MC88200 CMMU is a 16K-byte cache which is four-way, set-associative. It is used for instruction or data storage. The MC88200 was used because it supports memory update policies and cache coherency mechanisms which support applications in a multiprocessor environment. The caches use a least recently used (LRU) replacement algorithm to allocate entries. Cache coherency is maintained through a copy-back mechanism.

### **Processing Components**

The AViiON systems use the Motorola 88000 family chip set. The 88100 CPU contains an integrated floating-point unit (FPU) on the microprocessor chip. The FPU uses parallel processing to increase floating-point performance. The instruction set contains 51 instructions, almost all of which can execute in a single cycle. The AViiON workstations deliver either 17 or 20 MIPS for the 16.7MHz and the 20MHz systems, respectively, using a single microprocessor, tested with the industry-standard Dhrystone benchmark. The AViiON server incorporates either a single or dual microprocessor configuration which runs at 20MHz, and the system is field upgradable from a single to a dual processor configuration.

The Motorola MC88100 provides parallel processing through the use of four independent execution units which maintain separate, fully concurrent execution pipelines (integer, floating point, data, and instruction). If instructions are not executed within one machine cycle, they are dispatched to a concurrent pipeline in that machine cycle for execution. Common register files provide data sharing and synchronization. The MC88100 maintains separate memory ports for accessing data and instruction space, enabling simultaneous access to dedicated memory areas. Thirty-two general-purpose registers are available, and the microprocessor supports both single- and double-precision IEEE P754 floating-point arithmetic.

### **Graphics Co-processor**

The graphics hardware for the AViiON 300 Series is a monochrome or color controller resident on the system board. Both the monochrome and the color controller connect directly to the M-bus. The monochrome unit consists of:

- NEC uPD72120 Advanced Graphics Display Controller
- Eight 256K-byte video RAMs
- RS343A monitor interface
- Video timing logic
- Addressable resolution of 1,638 by 1,024
- Viewable resolution of 1,280 by 1,024; 614 by 1,024 used for off-screen storage

The color unit uses a special high-density gate array for the display and control of the video. The color unit consists of:

- Eight 256K-byte dual-ported video RAMs
- Video timing logic
- Color lookup table for 256 displayable colors from a palette of 16.7 million combinations
- Addressable resolution of 1,280 by 1,536 by 8 by 2

### **Input/output Control**

The AViiON workstations use an external small computer systems interface (SCSI) bus to connect mass storage devices. The connection is made at the back of the unit through a 50-pin DB connector. The SCSI is a small computer industry standard which specifies the data transfer mechanism between storage devices. It uses an 8-bit bus with parallel data and address information transfer.

The AViiON systems use two buses which provide all communication to the system board from other peripherals and boards. The VME bus is an industry-standard 40M byte-per-second bus. The VME bus transfers data between the system board and all controllers in the unit. The system board uses 9U form factor boards, and adapters for 6U form factor boards are available. The front panel of the 6U board must not be integral to the operation of the board and must be removable in order for the adapter to work. In order to fit within the unit, the board must not violate VME bus standards.

The Pexbus is a buffered memory bus used for communication between the system board and all on-board and expansion system memory. The bus is a functionally enhanced version of the M-bus. The Pexbus is not an industry standard and is used only by the system board and the expansion memory.

### **Communications**

AViiON systems offer asynchronous, synchronous, and LAN communications facilities conforming to both the widely established and emerging standards for communications. Data General provides two types of asynchronous communications, the hardware for which is provided by the Systech Corporation.

A terminal services host adapter allows for the concentration of terminal hookups from off-site or remote locations through a single coaxial cable. This method increases the number of devices that can be supported by each VME slot.

Two methods of asynchronous communications are provided. The VME Asynchronous Controller/16 (VAC/16) provides for RS-232 device connection for up to 16 devices. The VAC/16 contains a Motorola 68020 processor and is a 6U form factor board. On-board is a 192K-byte static RAM buffer and a 128K-byte EPROM. The VAC/16 can support a maximum of sixteen 19.2K bps full-duplex devices.

The VME Distributed Asynchronous (VDA/128) is a 6U form factor board which connects up to 128 lines per VDA. The VDA connects to the VME Distributed Cluster (VDC) via an RG62 coaxial cable. Data General recommends limiting the number of lines per VDA/128 to 64 to increase performance. The VDA is built around a 12.5MHz 68010 co-processor. The 68010 contains 512K bytes of zero-wait-state DRAM and 16K bytes of dual-ported memory. The VDA connects to distributed cluster controllers, which are based on a 10MHz 68000. The distributed clusters contain 32K bytes of static RAM, which are used for buffering. The distributed clusters available are the VDC/8 (which connects eight RS-232 lines plus a Centronics parallel port) and the VDC/16 (16 RS-232 lines). Data General plans to introduce future communications products which include an Ethernet-based terminal server capable of connecting to multiple hosts.

Synchronous communications are handled by the VME Bus Synchronous Controller (VSC/4). This 6U form factor board provides four serial communications channels with full-duplex DMA support. The board contains an 8MHz Intel 80186 co-processor with 512K bytes of zero-wait-state random access memory. Throughput for the VSC/4 is at 1.6M bps.

The VME Bus Ethernet LAN Controller (VLC), a version of the Interphase Hawk Communications controller, is a 6U form factor board which provides LAN Ethernet communications capability. The VLC supports the IEEE 802.3 Ethernet standards using an intelligent Ethernet controller chip and a 256K-byte dual-ported data buffer. The intelligent controller is responsible for communicating with on-board memory for command and data functions and also provides cache coherency and packet transfer via a software process.

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## Software

### Operating System

The operating system for all AViiON systems is the DG/UX Version 4.1. Data General's first version of DG/UX was introduced in March 1985 and was based largely on AT&T's System V. It combined elements of both the AT&T UNIX System V and Berkeley Version 4.3 BSD. Data General enhanced the DG/UX platform by building in features found in other vendors' UNIX operating systems. The DG/UX system kernel and filing system have been engineered with five basic design principles:

- Support for standard UNIX functions
- Support for "scalable" processing
- Transparent portability
- Increased reliability, maintainability, and enhanceability
- Increased performance in all its environments

The file system was designed to be independent of the kernel accessed through a special file interface which

insulates the kernel from the specific type of file system. Device drivers allow independence of the kernel from specific types of devices. The file system includes three enhancements to standard UNIX file systems: logical disks, symbolic links, and reliability provided by duplication of critical file system data.

Data General has implemented *virtual processor capability*. The virtual processor insulates the end user from the physical processors, providing processor transparency. The operating systems kernel is the only process aware of how many physical processors are available and their current loads. The virtual processor methodology makes it appear to the end user that all active processes are running in parallel, when they are actually being multiplexed among the available physical processors. Implementing the virtual processor allows DG/UX to efficiently use all available processors and evenly distribute activities. Traditional implementations of multiprocessing environments dedicate one master CPU to control all I/O and schedule other processors. DG/UX allows each processor to schedule itself, and the operating system's *Medium-Term Scheduler* ensures a fair forward progression of all current tasks.

The DG/UX Version 4.1 provides support for:

- DG/UX Version 3.10
- AT&T's UNIX System V.2.2, UNIX System V.3, System V Interface Definition (SVID), and System V Verification Suite (SVVS)
- Support of Berkeley Version 4.2 BSD
- Sun Microsystems Network File System NFS 4.0
- 88Open Binary Compatibility Standards (BCS)
- IEEE 1003.1-1988 POSIX (Portable Operating System Interface for Computer Environments) provided in DG/UX 4.1 only
- Virtual microprocessors
- ANSI standard C Compiler optimized for the RISC 88000
- X Windows Version 11, Release 3.0
- Future support for the OSF/Motif graphical user interface
- Bourne Shell and C Shell
- C, Fortran 77, and Pascal language sets
- Menu-driven tools for managing resources and streamlining performance

DG/UX provides compatibility for:

- MS-DOS applications through VP/ix
- Applications developed on any UNIX system to be ported to the DG/UX platform
- Acting as a client to a foreign server or as a server for foreign clients
- Shared file support and network boot support
- Electronic mail

**Table 1. System Comparison**

Model	AV300	AV5000	AV6000
<b>System Characteristics</b>			
Date of introduction	February 1989	February 1989	February 1989
CPU type	MC88100	MC88100	MC88100
CPU cycle time	16.67 or 20MHz	20MHz	20MHz
Operating system	DG/UX 4.1	DG/UX 4.1	DG/UX 4.1
<b>Memory</b>			
Minimum capacity (bytes)	4M	8M	8M
Maximum capacity (bytes)	28M	208M	208M
<b>Disk Storage</b>			
Minimum capacity (bytes)	0M	322M	322M
Maximum capacity (bytes)	1G	922M int./1.2G add.	922M int./1.2G add.
<b>Communications Protocols</b>			
	TCP/IP, NFS, Ethernet, IBM SNA, OSI	TCP/IP, NFS, Ethernet, IBM SNA, OSI	TCP/IP, NFS, Ethernet, IBM SNA, OSI
<b>Purchase Price</b>			
(Base configurations)	From \$6,450	From \$52,000	From \$41,500

## Applications Development Environment

Data General does not directly provide all of the applications development tools necessary for a programming environment; those that it does not support can be acquired indirectly through members of the major UNIX organizations that develop UNIX standards: UNIX International, Open Software Foundation, and the 88Open Consortium. Any software that conforms to the Binary Compatibility Standards established by 88Open will run on AViiON computers. DG/UX provides the following utilities and functions in its software development environment:

- Source Code Control System (SCCS)
- Standard UNIX compiler hosts and program maintenance tools such as yacc, lex, and make
- Support for both the portable C compiler (pcc) and ANSI C
- Source-level debugging using one of three mechanisms: dbx (for BSD environments), sdb (System V), and mxdb (DG/UX). mxdb from Data General provides access from GUIs, an extended set of functions over the UNIX-standard dbx and sdb including command line history and editing
- Standard vi editor and the GNU EMACS editor

## Database Management

Data General AViiON systems support database management systems which meet the standards established by 88Open. Many of the leading database management system developers have already ported their systems to the RISC 88000 architecture. Among those providing database management systems on the RISC 88000 platform are Informix Software, Inc. (a UNIX-based relational database management system for the 88000), Progress Software (PROGRESS fourth-generation language RDBMS), and Relational Technology, Inc. (Ingres RDBMS).

## Languages

Data General relies on the 88Open Consortium to provide computer programming language support for software developers. Data General provides GNU C with DG/UX, developed by the Free Software Foundation. The GNU C compiler provides additional functionality beyond standard portable C compiler (pcc) which is provided with the System V.3 operating system. The GNU C compiler is compatible with both the pcc and ANSI C compilers.

Green Hills C Compiler is an option, offering source code compatibility with other Green Hills C compilers running under VMS, ULTRIX, or MS-DOS. Green Hills provides ANSI C compatibility. Both GNU C and Green Hills C provide object code compatibility. Object files produced by one compiler can be linked to object files produced by the other. Data General also offers Green Hills Fortran and Green Hills Pascal compilers.

Through 88Open, the AViiON systems support other programming languages including Fortran 77, Pascal, and C compilers. Absoft Corporation, a leading supplier of Fortran compilers, has developed a Fortran compiler for the RISC 88000. Language Processors Inc. (LPI) is porting its family of compilers to the 88000 architecture. Cobol compilers are being developed for the 88000 MBP Software's visual Cobol 85, an ANSI-85 Cobol compiler, and Micro Focus' Cobol compilers and productivity tools. Other language compilers and interpreters available through 88Open will be Basic, Pick, and Ada.

## Communications

Data General DG/UX Version 4.1 provides several communications products. These products provide communications support for UNIX-to-UNIX systems, as well as to systems running in non-UNIX environments.

TCP/IP protocols over Ethernet local area networks are supported, including support of remote logins, network debugging, file and data transfers, E-Mail, and remote file access. TCP/IP further provides the

**Table 2. Disk/Diskette Devices**

Model	Winchester Disk	QIC Tape Cartridge	Reel to Reel
Size (inches)	5.25	0.25	6 to 10.5
Formatted capacity per drive (bytes)	322M	150M	1600 bpi
Interface/controller	EDSI	Single-ended SCSI	Single-ended SCSI
Number of drives per interface/controller	4	7	7
Average access time	18 ms.	NA	NA
Data transfer rate	937.5 bps	135 bps	160 bps
Purchase price	\$7,300	\$2,500	\$8,550
Comments		Can read/write 120MB QIC; can read 60MB and 40MB QIC.	Auto thread, auto load, horizontal mount.

NA—Not applicable.

Note: Half-height SCSI Winchester disk 160M-byte and 320M-byte drives and TPI diskette drives (760K bytes 3.5 inches or 1.2M bytes 5.25 inches, half height) are also available for the AV300 workstations.

transport mechanism for Sun Microsystems' ONC/NFS and for distributed X-Windows applications.

AViiON systems can connect to IBM SNA/SDLC networks in several ways. Using the VSC/4, and in conjunction with the SNA 3270 product, connection to IBM hosts can be made. SNA protocol and device support for the VSC/4 is provided in the system kernel. An SNA Gateway Bridge Daemon process provides for transparent access to SNA hosts by all DG/UX users on a network.

IBM host environments are supported by DG/UX. DG/UX SNA/3270 emulates an IBM 3274 remote cluster controller environment and allows connection to the host by a network of systems. DG/UX SNA/RJE allows an AViiON system to appear as an IBM 3770 Remote Job Entry workstation. Both SNA/3270 and SNA/RJE provide an application programming interface (API) and supporting utilities, development tools, and shell scripts.

## Applications

Through 88Open and through the incorporation and support of many features found in various UNIX environments, Data General provides a platform for applications use. Most Independent Software Vendors' (ISVs') UNIX products will be supported by DG/UX. Many ISVs that are not 88Open members will also be introducing applications which run on the DG/UX platform.

## Operating Environment

The AV 5000/6000 servers are 24.75 inches high, 17.25 inches wide, and 25.5 inches deep (62.87 centimeters high, 43.82 centimeters wide, and 64.77 centimeters deep). Fully configured with mass storage, they weigh 160 pounds (72.6 kilograms). Line voltages range from 100/120/220 V, 10/12 Amp, single phase. Recommended environment characteristics are 32 to 100 degrees Fahrenheit (0 to 38 degrees Celsius) operating, -40 to 149 degrees Fahrenheit (-40 to 65 degrees Celsius) storage. Operating humidity ranges are 20 percent

to 80 percent noncondensing, and storage humidity ranges are 10 to 90 percent noncondensing. The AV 300 workstations are 17.5 inches wide by 2.0 inches high by 16.0 inches deep and weigh 18.25 pounds. Line voltage is 120 V/220 V, and the AC operating frequency range is 47 to 63 Hz. The power supply is 78 watts. Acceptable operating temperatures range from 0 to 55 degrees Celsius (-40 to -70 degrees Celsius nonoperating). Humidity ranges are 0 percent to 80 percent operating (10 percent to 90 percent nonoperating).

## Configuration Rules

The base system AViiON workstation contains a 16.7MHz MC88100 microprocessor with 4M bytes of memory and a monochrome monitor. The monochrome monitor has a viewable resolution of 1,280 by 1,024. There is an additional availability of 614 by 1,024 pixels used for off-screen storage. The system unit contains an industry-standard IEEE 802.3 Ethernet interface (without transceiver) and a single asynchronous interface with either RS-232 or RS-422, including full modem support. The line printer interface is either a Centronics or Data Products parallel interface. The AViiON 300 uses the industry-standard SCSI interface for interfacing disk and tape storage units. The unit comes with a three-button mouse and mouse pad and has an IBM PC/AT-compatible or Japanese PC-AX-compatible 101-key keyboard. All peripherals for the AViiON workstation are mounted in a desktop housing. The high-end AViiON workstation can be used as a server and is configured with a 20MHz CPU, 12M bytes of system memory, a 322M-byte hard disk drive, and a 150M-byte QIC streaming tape drive. The AViiON workstation supports:

- 4M-byte parity memory modules, up to seven of which can be included on the system for a total of 28M bytes
- Data General's peripheral package, which includes a 179M-byte hard disk and a 150M-byte QIC streaming tape drive

**Table 3. Monitors**

Model	Monochrome	Color
<b>Display Parameters</b>		
Screen size (inches)	20	19
Total colors/no. simult. displayed	NA	16.7 million/256
Resolution (pixels)	1,280 x 1,024 x 1	1,280 x 1,024 x 1
Size of video RAMs (bytes)	256K	256K
Number of video RAMs	8	8
Purchase price	\$1,995	\$3,450

NA—Not applicable.

- Up to three 5.25-inch half-height devices, up to seven SCSI devices in up to three housing units, and up to three 322M-byte Winchester 5.25-inch full-height SCSIs (one per housing)
- 1.2M-byte and 1.4M-byte half-height flexible diskette drives

The AViiON 5000 server comes configured with one 20MHz microprocessor, 8M bytes of system memory, a 322M-byte hard disk drive, and a 150M-byte QIC streaming tape drive. The color monitor has a pixel configuration of 1,280 by 1,024 by 10. The AV5000 series is an office system with a 40-dB noise level. The AV5100 runs at 20 Dhrystone MIPS per CPU, supports single- and double-precision IEEE floating-point arithmetic using an on-processor FPU, and contains 10 VME slots which operate at 40M byte-per-second block transfer rates. The AV5000 connects up to 512 asynchronous devices using four VME slots.

The AViiON 6000 servers are rack-mount servers. The AV6000 servers are configured with a single 20MHz CPU running at 20 Dhrystone MIPS and contain 8M bytes of system memory. The same peripherals run on the AV5000s and AV6000s. The AV6000 connects up to 640 asynchronous devices using five VME slots.

The AViiON 5000/6000 servers both support a standard IEEE 802.3 Ethernet LAN interface. Both models can be configured as either multiuser systems or servers. The systems are field upgradable to include an additional 20MHz CPU. Support of multiple asynchronous devices is achieved through the use of an intelligent terminal services system, which off-loads the CPU by handling character interrupts and by buffering data at the cluster controller. The AViiON 5000/6000 servers support:

- Up to 208M bytes of ERCC memory in 16-, 32-, or 48M-byte increments
- Up to three 322M-byte 5.25-inch ESDI Winchester disk drives
- A 150M-byte SCSI QIC streaming tape drive
- A 1600 bpi SCSI reel-to-reel desktop tape unit
- ESDI and SCSI controllers

### Input/output Units

For details on specific pieces of I/O equipment, please refer to:

- Table 2 for mass storage devices;m0
- Table 3 for the basic monochrome and color displays;m0

### Other Peripherals

The Data General AViiON systems support both quarter-inch cartridge (QIC) streaming tape and reel-to-reel tape drives. The 150M-byte quarter-inch cartridge can be installed in the system unit. The AViiON systems also read and write QIC 120M-byte tapes and can read QIC 60M-byte and QIC 40M-byte tapes. The QIC tape is the standard distribution media specified by the 88Open Consortium, a group of vendors and users of Motorola 88000 family chips that promotes the 88000 architecture and defines standards for it. The QIC tape media provides full boot capability and serves as a backup medium. The QIC is a half-height 5.25-inch SCSI device. For the AV6000 rack-mount systems, the 150M-byte media is required for distribution and for software and diagnostics installation. Although not integrated in the base configuration of these systems, it can be installed in Data General's Combined Storage Subsystem.

A reel-to-reel tape option is offered for the AViiON servers. The Model 6587-A reel-to-reel housing is designed for desktop use, if desired. The Model 6586-A is a rack-mountable unit. Both the desktop and rack-mountable units operate on a SCSI bus interface. Both units are front loading and use standard half-inch magnetic tape.

### Pricing and Support

#### Service and Support

AViiON systems include a 90-day on-site warranty. AViiON system users may convert the 90-day warranty to a contract. Both cover all base system components, memory boards, and controllers. Data General provides either a 90-day on-site, one-year mail-in, or one-year

on-site warranty on all its AViiON systems peripherals and packages depending on the configuration.

Data General offers two service programs: the On-Call Agreement and the Multiyear Plus Agreement. Both include 7-day, 24-hour on-line remote diagnostic services. The On-Call Agreement allows the customer to select coverage periods and options. The monthly fee for on-site repairs includes unlimited parts, labor, and travel. The Multiyear Plus Agreement includes all the services of the On-Call Agreement, plus extra discounts.

**Education and Documentation**

DG/UX Start-up Level I includes a two-day instruction course provided on the customer site. Part 1 is "Custom Systems Engineering DG/UX Consulting Program," and Part 2 is "Introduction to UNIX Computer-Based Training (CBT)." The \$3,320 price includes a \$100 credit toward DG/UX documentation.

DG/UX Start-up Level II includes all services offered in Level I, plus an additional day of consulting by a Data General Systems Engineer, and costs \$4,460.

DG/UX Technical Consulting Level I is an advanced instruction forum designed for more technical UNIX users. The service provides two days of consultation and includes an educational credit toward any Data General UNIX training course and a \$250 credit toward UNIX documentation. The price is \$3,700.

DG/UX Technical Consulting Level II provides all of the offerings in Level I, plus an additional day of consulting. The price is \$4,845.

Data General Level III Consulting Service is available on a time and materials basis.

Data General's AViiON workstations and servers come packaged with hardware documentation. Documentation includes Owners Manuals, Technical Manuals, and Installation and Setup Guides. Also included with the DG/UX 4.1 operating systems is a Documenter's Toolkit. AT&T's Documenter's Workbench software is an option available to assist users in program documentation and document preparation. The Workbench includes text formatting and phototypesetting commands.

**Pricing**

Data General provides the AViiON systems on a purchase basis. Separately priced, fee-paid maintenance contracts are available. Discount prices are available to qualified Value-Added Resellers and Independent Software Vendors for a limited time. Data General software can be purchased with single-user or multiuser licenses. Software available includes the DG/UX 4.1 operating system in workstation or server packages and multiuser arrangements for 16, 32, 64, and unlimited users. DG/UX Version 4.1 includes the GNU C compiler. Green Hills C, Fortran, and Pascal compilers are available directly from Data General in single- or multiuser license arrangements.

**Equipment Prices**

		Purchase Price (\$)	Monthly Maint. (\$)	Four-Hour Service (\$)	Extended Warranty (\$)
<b>Workstations</b>					
70000	AVX 300 16.67MHz; 4M bytes; mono base only	6,450	NA	29	20.30
70001	AVX 300C 16.67MHz; 4M bytes; color base only	7,450	NA	34	23.80
70002	AVX 300 16.67MHz; 8M bytes; mono base only	7,650	NA	35	24.50
70003	AVX 300C 16.67MHz; 8M bytes; color base only	10,495	NA	40	28.00
70004	AVX 310 20MHz; 4M bytes; mono base only	7,600	NA	32	22.40
70005	AVX 310C 20MHz; 4M bytes; color base only	11,295	NA	37	25.90
70006	AVX 310 20MHz; 8M bytes; mono base only	9,850	NA	38	25.60
70007	AVX 310C 20MHz; 8M bytes; color base only	13,495	NA	43	30.10
70008	AVX 300 16MHz; 4M bytes; mono base—Japan (1)	6,450	NA	29	20.30
70009	AVX 300C 16MHz; 4M bytes; color base—Japan (1)	7,450	NA	34	23.80
70010	AVX 310 20MHz; 4M bytes; mono base—Japan (1)	7,600	NA	32	22.40
70011	AVX 310C 20MHz; 4M bytes; color base—Japan (1)	11,295	NA	37	25.90
70012	AVX 300 16.67MHz; 4M bytes; mono workstation	7,450	NA	60	42.00
70013	AVX 300 16.67MHz; 8M bytes; mono workstation	8,650	NA	67	46.90
70014	AVX 300C 16MHz; 8M bytes; color workstation	11,995	NA	89	62.30
70015	AVX 310 20MHz; 8M bytes; mono workstation	10,850	NA	70	49.00
70016	AVX 310C 20MHz; 8M bytes; color workstation	14,995	NA	92	64.40
70017	AVX 300 16MHz; 8M bytes; mono workstation—Japan (1)	8,750	NA	67	46.90
70018	AVX 300C 16MHz; 8M bytes; color workstation—Japan (1)	11,995	NA	89	62.30
70019	AVX 310 20MHz; 8M bytes; mono workstation—Japan (1)	10,950	NA	70	49.00
70020	AVX 310C 20MHz; 8M bytes; color workstation—Japan (1)	14,995	NA	92	64.40
70021	AVX 300 16MHz; 8M bytes; mono workstation; peripheral package (2)	14,295	NA	109	76.30

		<b>Purchase Price</b>	<b>Monthly Maint.</b>	<b>Four-Hour Service</b>	<b>Extended Warranty</b>
		<b>(\$)</b>	<b>(\$)</b>	<b>(\$)</b>	<b>(\$)</b>
70022	AVX 300C 16MHz; 8M bytes; color workstation; peripheral package (2)	17,640	NA	131	91.70
70023	AVX 310 20MHz; 8M bytes; mono workstation; peripheral package (2)	16,495	NA	112	78.40
70024	AVX 310C 20MHz; 8M bytes; color workstation; peripheral package (2)	20,640	NA	134	93.80
70025	AVX 300 16MHz; 8M bytes; mono workstation—Japan (1); peripheral package (2)	14,395	NA	109	76.30
70026	AVX 300C 16MHz; 8M bytes; color workstation—Japan (1); peripheral package (2)	17,640	NA	131	91.70
70027	AVX 310 20MHz; 8M bytes; mono workstation—Japan (1); peripheral package (2)	16,595	NA	112	78.40
70028	AVX 310C 20MHz; 8M bytes; color workstation—Japan (1); peripheral package (2)	20,640	NA	134	93.80
70029	AVX 310 20MHz; 12M-byte server; 179M bytes/150M bytes	16,245	NA	86	60.20
70030	AVX 310 20MHz; 12M-byte server; 322M bytes/150M bytes	19,995	NA	105	73.50
<b>Servers</b>					
70034	AV 5100 1-CPU/20; 8M bytes, 322M bytes, 150M bytes CTD	52,000	234	NA	NA
70035	AV 5100 1-CPU/20; 16M bytes, 322M bytes, 150M bytes CTD	55,000	250	NA	NA
70036	AV 5120 2-CPU/20; 16M bytes, 322M bytes, 15M bytes CTD	90,000	345	NA	NA
70037	AV 6100 RM; Single 20MHz CPU; 8M bytes memory	41,500	166	NA	NA
70038	AV 6100 RM; Single 20MHz CPU; 16M bytes memory	44,500	182	NA	NA
77039	AV 6120 RM; Dual 20MHz CPU; 16M bytes memory	79,500	277	NA	NA
70040	AV 5100 1-CPU/20; 8M bytes, 648M bytes, 15M bytes CTD	56,400	265	NA	NA
70041	AV 5100 1-CPU/20; 16M bytes, 648M bytes, 150M bytes CTD	59,400	281	NA	NA
70042	AV 5100 2-CPU/20; 16M bytes, 648M bytes, 150M bytes CTD	94,400	376	NA	NA
70043	AV 6100 1-CPU/20; 16M bytes, 2G bytes SMD, 150M bytes	96,575	485	NA	NA
70044	AV 6120 2-CPU/20; 16M bytes, 2G bytes SMD, 150M bytes	131,575	580	NA	NA
70045	AV 6100 1CPU/20; 16M bytes, 966M bytes SCSI, 150M bytes	69,550	405	NA	NA
70046	AV 6120 2-CPU/20; 16M bytes, 955M bytes SCSI, 150M bytes	104,550	500	NA	NA
70047	AV 6100 1-CPU/20; 16M bytes, 2G bytes SCSI, 150M bytes	81,875	498	NA	NA
70048	AV 6120 2-CPU/20; 16M bytes, 2G bytes SCSI, 150M bytes	116,875	593	NA	NA

NA—Not applicable.

(1) Customized for Japanese market.

(2) Peripheral package consists of 179M-byte disk and 150M-byte QIC tape.

## Options Prices

		<b>Purchase Price</b>
		<b>(\$)</b>
<b>Peripherals</b>		
64421	322M-byte ESDI disk drive	6,500
6486	20-inch monochrome monitor	1,995
6487	19-inch color monitor	3,450
6600	Disk package—179M bytes in peripheral housing	3,750
6601	Disk package—322M bytes in peripheral housing	7,300
6602	Tape package—150M bytes in peripheral housing	2,500
6603	Disk/tape package—179M-byte disk, 150M-byte tape	5,645
6604	Disk/tape package—322M-byte disk, 150M-byte tape	9,195
7000	4M-byte memory expansions	3,000
7001	16M-byte memory expansions	13,000
7002	32M-byte memory expansions	26,000
7003	48M-byte memory expansions	39,000
7400	VME Async controller—16 port	3,500
7401	VME distributed adapter/128	4,000
7402	VME distributed cluster/8	1,800
7403	VME distributed cluster/16	3,000
7404	VME synchronous controller/4	3,500
7405	VME IEEE 802.3 Ethernet LAN controller	2,500
7406	VME Async controller/16 (rack mount)	3,500
7407	VME SCSI controller	2,500
7408	VME SMD controller	4,500
7409	6U to 9U VME board adapter	175

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## Software Prices

	<b>License Fee (\$)</b>
<hr/> <b>DG/UX.4.1 (consists of DG/UX and a C compiler)</b>	
Workstation package	500
Server package	1,000
Multiuser (1-16)	3,000
Multiuser (1-32)	4,500
Multiuser (1-64)	7,000
Unlimited multiuser	9,500
<hr/> <b>Greenhill Compilers for AViiON Systems (1)</b>	
C single user	1,195
C multiuser	2,495
Fortran single user	1,195
Fortran multiuser	2,495
Pascal single user	1,195
Pascal multiuser	2,495

(1) All are quoted for right to use license, media, and documentation. ■