

Release Notice:
DG/UX™ System for AViiON®
Computers
Release 5.4.2

Part number 085-600317-00

This release notice applies to the following models:

P001A
Q001A

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1 Introduction

This release notice describes release 5.4.2 of the DG/UX™ operating system for Data General's family of AViiON® computers. It draws attention to features that are new or changed since DG/UX Release 5.4 Update 1, and includes information or corrections that developed after the manuals were printed.

DG/UX Release 5.4.2 is available in a base model and a workstation model. This release notice, which accompanies both, describes the base model. The workstation model includes the features described here, plus additional features appropriate to workstations and workstation servers. If you are using the workstation model, see in addition the X Window System and (if relevant) Looking Glass® release notices. They describe graphics and windowing topics, including OSF/Motif™, for DG/UX Release 5.4.2.

In previous releases, the TCP/IP and ONC™/NFS® packages had their own separate release notices. Effective with this release, release information about TCP/IP and NFS is included in this release notice. However, during installation, you can choose not to install these packages, as in the past.

There is still a separate release notice for the GNU C compiler. See it for information about compilation in DG/UX Release 5.4.2.

An online version of this release notice, suitable for lineprinters, is in the file `/usr/release/dgux_5.4.2.rn`. Should you find discrepancies between the typeset and online versions, this typeset version takes precedence.

2 Product Description

This is the second full release of Data General's implementation of UNIX® System V Release 4. For discussions of major DG/UX enhancements and important topics in open systems computing, obtain these technical briefs from your Data General representative:

<i>A Second Look at Multiprocessor SMPs</i>	(012-003886-03)
<i>Taking Advantage of Symmetric Multiprocessor Systems</i>	(012-004177-00)
<i>A Look at High Availability Disk Systems</i>	(012-004035-01)
<i>The DG/UX File System</i>	(012-004054-01)
<i>Physical Disk Failover in the DG/UX 5.4.2 Operating System</i>	(012-004186-00)
<i>Open Systems Terminology</i>	(012-004093-01)

New or expanded features in DG/UX Release 5.4.2 include:

- Support for new computer systems and hardware, described in the section "New Hardware" below
- Support for the X Window System Revision 11 Release 5 (X11R5), OSF/Motif 1.2, and PHIGS Extension to X (PEX). See the DG/UX X Window System Release Notice for descriptions.

- Redesign of the TCP/IP software for improved performance
- The ability to configure disk and tape devices with two hosts (*dual-initiator configuration*), and to reassign a disk from a failed host to a secondary system (*failover*)
- CD-ROM installation
- File buffering enhancements
- Support for uninterruptible power supplies
- Support for automated error-reporting (AV/ALERT)
- Improved support for multiple languages and cultural conventions
- Archiving improvements
- Printer enhancements

3 Environment

This release can be installed from scratch on a new system or overloaded on DG/UX Release 5.4 or DG/UX Release 5.4 Update 1. If you are updating a system running a DG/UX version earlier than release 5.4, upgrade the system to DG/UX Release 5.4 before installing DG/UX Release 5.4.2.

Note that the minimum memory requirement has increased from 8MB to 12MB: on workstations, 16MB is recommended. Do not attempt to install DG/UX Release 5.4.2 on an AViiON system that has less than 12MB of memory.

The default OS client swap size has been changed from 16MB (~32,000 blocks) to 24MB (~50,000 blocks) to be consistent with previously-documented swap space requirements. While this change will not affect existing clients created with the old default, you may wish to increase their swap space allocation to the recommended value if they are running large applications or if they are receiving "out of paging area space" messages.

The minimum disk storage requirement (322MB) is unchanged since DG/UX Release 5.4.

The disk space requirements in the */root* and */usr* file systems are unchanged since DG/UX Release 5.4 Update 1. For the workstation model (P001A), the space requirement in */usr/opt/X11* has increased by 45,000 blocks since DG/UX Release 5.4 Update 1. If you have this model, see the DG/UX™ X Window System Release 5 Release Notice before starting installation.

The manual *Installing the DG/UX System* (093-701087-02), Chapter 2, contains detailed disk space storage requirements. If you are upgrading from DG/UX Release 5.4, consult these tables before beginning installation.

DG/UX Release 5.4.2 includes fixes which were previously released as patches. If any problem that was previously fixed by a patch reappears in this release, contact Data General. *Do not attempt to install any patches for previous releases on DG/UX Release 5.4.2.*

3.1 Required PROM Revisions

You may need to install a new boot PROM revision in these two cases:

- You are installing DG/UX Release 5.4.2 from a CD-ROM drive.
- You plan to boot from a disk or tape device accessed through the **dgsc** controller (for example, from a H.A.D.A. II disk array, a SCSI-2 disk, or a SCSI-2 tape drive).

The revisions vary depending on your AViiON model, as indicated below. The number that appears when you power on your system should be equal to or greater than the numbers listed in column 1 (for CD-ROM installation) and column 2 (for booting through the **dgsc** controller). Contact Data General if you require a new PROM revision.

For CD-ROM	For dgsc	For AViiON models
1.13	1.13	AV4600, AV4605, AV4620, AV4625, AV530
9.19	9.20	AV5000/5100/5200, AV5020/5120/5220, AV5225 AV6000/6100/6200, AV6020/6120/6220, AV6225
8.09	8.10	AV5240, AV6240, AV7000, AV8000
9.03	*	AV100, AV210, AV300/300C/300CD/300D, AV310/310C/310CD
6.00	*	AV400, AV410, AV3200FS, AV4000, AV4100

* **dgsc** not supported on these models

3.2 Using Layered Software Products

Before attempting to use a layered software product with DG/UX Release 5.4.2, ask your Data General representative or the vendor about the product. Some layered products may require a particular DG/UX release.

4 Enhancements and Changes

4.1 New Hardware

Support for the following hardware is new or enhanced in this release. For detailed lists of features, functions, and specifications, request product briefs from your Data General representative.

When installing new hardware, be sure to read the accompanying release notice and installation manual. Special instructions or restrictions may apply with different DG/UX releases.

4.1.1 AV6280 and AV8000-8 High Availability Servers

The AViiON 6280 is the new high-end system in the 62XX family of rack-mounted servers, providing eight 25MHz 88100-based CPUs in a 20-slot chassis. The 6280 provides a straightforward upgrade path for 62XX customers by supporting most VME (AViiON Host Bus) controllers and memory boards used in current systems. The AV8000-8 is a packaged system that includes a 6280 CPU and H.A.D.A. II subsystem, with optional UPS (Uninterruptible Power Supply). Applications running under DG/UX Release 5.4 run without change on 6280 systems.

The AViiON 6280 and AV8000-8 systems provide the following features and benefits:

- Eight 25MHz Motorola 88100 CMOS/RISC CPUs
- New two-level cache design that provides 64KB of instruction cache and 64KB of data cache per CPU, and a secondary cache of 1MB per CPU pair, totalling 5MB of cache per system
- Dual memory buses, which provide twice the memory bandwidth of 6240 systems
- Intelligent interrupt handling by VIO (VME I/O) board, which distributes the interrupt load evenly across all CPU boards
- High performance dual-channel SCSI-2 controller, which improves performance and increases disk storage
- 11 VME I/O slots
- Supports AV/Alert service, which allows machine-initiated diagnostic calls to a DG response center for remote service by DGC personnel
- Supports both H.A.D.A. II and original H.A.D.A. disk arrays
- Compact packaging allows CPU and 20GB of disk storage to be configured in a single 59-inch cabinet

4.1.2 AViiON AV 4600 Series Multi-User Servers

The AViiON AV 4600 series provides a powerful yet economical computing resource for multi-user timesharing applications, a high performance network server, or a combination of the two. In a timesharing environment, an AV 4600 server can support up to 258 asynchronous devices. As a server, it can be connected to other network resources including Ethernet or token ring Local Area Networks (LANs), using TCP/IP, DECnet™, AppleTalk®, and NetWare® transports.

The AV 4600 series can participate in Wide Area Network (WAN) environments including IBM SNA and Open Systems Interconnection Government OSI Profile (OSI GOSIP)-compliant products. The OSI product set includes X.25, X.400, FTAM, VTP, and CMIP.

The AV 4600 series consists of two systems based on the powerful 33-MHz Motorola 88100 Reduced Instruction Set Computer (RISC) processor. The AV 4605 (single processor) and AV 4625 (dual processor) use six Motorola 88200 CMMUs, providing 96KB cache per processor for high performance memory access and hardware support for multiprocessing.

The AV 4600 series provides a great deal of configuration flexibility. The system supports from 32MB to 128MB of ECC memory, upgradable in 8MB or 32MB increments, and provides from 520MB to 58GB of magnetic disk capacity.

The high-density system board not only houses both CPUs and 128MB of memory, but also supports one or two mass storage controllers, three asynchronous ports, two synchronous communications ports, one or two Ethernet ports, and a parallel printer port. The two VME slots available for other I/O systems are typically used for asynchronous terminal connections or additional WAN/LAN interfaces.

For detailed lists of features, functions, and specifications, obtain the *AViiON AV 4600 Series Multi-User Servers* product brief (Order Number 012-004037) from your Data General representative.

4.1.3 Communications Controllers

Three new communications controllers, listed below, are supported. Data General expects to release these controllers during the last three months of 1992.

4.1.3.1 VLCi Ethernet Controller

The VLCi, or VME LAN Controller, is a single-line, IEEE 802.3 Ethernet LAN adapter. The VLC is a 6U (230mm by 160mm) VME adapter, but is available with a 9U (400mm by 366.66mm) adapter kit for a 9U chassis. The VLCi supports all local area networking protocols, including TCP/IP, ISO TP/IP, DECnet™ (DNI), Novell IPX®/SPX, DG/NETBEUI, and AppleTalk® (OpenMAC™/Services).

The VLCi runs the link layer code (IEEE802.2) on the adapter, along with the physical layer interface (IEEE802.3). Network and transport layer software for stacks execute on the host. All of Data General's network protocols that support IEEE802.3 Ethernet can run simultaneously on the host, and can simultaneously share the Ethernet VLCi LAN.

The VLCi requires release 5.4.2 of the DG/UX system.

A new device driver, **cien**, supports this high-performance network controller. See **cien(7)** for device driver syntax, and the manual *VLCi Ethernet LAN Controller (CMC-130) Reference Guide* (014-002152-00) for installation and setup of the hardware.

4.1.3.2 VFDDI Fiber Optic LAN Controller

Data General's VME FDDI Controller, the VFC, is a RISC-based, high performance node processor for high-speed fiber optic FDDI (Fiber Distributed Data Interface) networks. FDDI is a communications standard that incorporates advances in speed, availability, and management through a token passing, counter-rotating, dual-ring network.

The VFC allows AViiON servers and the AViiON 530 workstation to connect directly to the fiber network, or to connect to concentrators attached to the FDDI ring. The VFC supports all Data General VME block mode systems.

The VFC provides the following features and benefits:

- Because it complies fully with the FDDI and VME specifications, interoperability is assured.
- Its RISC-based processor makes it capable of processing at high speeds over an optical link.
- Because it can process SMT (Station Management Software) on-board, it supports ring management.
- Its fast VMEbus interface assures the FDDI network won't monopolize the VME bandwidth.
- It supports single- or dual-attached stations and single MAC (Media Access Control) configurations.
- Its 1MB communications buffer enhances performance by accelerating throughput of the node.

A new device driver, **pefn**, supports this controller for fiber optic networks. See **pefn(7)** for device driver syntax, and the manual *VFDDI (4211 Peregrine) User's Guide* (014-002154-00) for installation and setup of the hardware.

4.1.3.3 VSC3i Synchronous Controller

Data General's new VME (AViiON Host Bus) Synchronous Controller provides high performance and throughput over 56K and 64Kbps telecommunications lines in various synchronous environments. The VSC3i supports multiple line interfaces that can be individually configured for each of the three ports. Together with the driver software, the VSC3i supports different protocols on each synchronous line as well, thus permitting any mix of X.25 and SNA/SDLC connections.

The VSC3i supports the RS232, RS449, RS530, and V.35 electrical interface standards. Additionally, Data General allows each port interface to be set to whatever interface you require. Each VSC3i line can be configured for the RS232, RS422, and V.35 electrical interfaces, as well as the RS449 and RS530 physical interfaces.

The device driver **vsxb** supports this synchronous controller for wide area X.25 networks. See **vsxb(7)** for device driver syntax, and the manual *Configuring and Installing VSC3i Controllers in AViiON Systems* (014-002151-00) for installation and setup of the hardware. (Note: the X.25 software is a separate, optional software package.)

4.1.3.3.1 Problems to Avoid: VTRC Controller

DG/UX Release 5.4.2 requires revision 7 of the VME Token Ring Controller (Models 7416, 7416-K, 7416-W). Call Data General if you need to upgrade your board.

4.1.4 Disk Devices

4.1.4.1 High Availability Disk Array (H.A.D.A. II)

The DG/UX Release 5.4.2 system supports the new H.A.D.A. II mass storage system. The H.A.D.A. II system supports twenty disks and two controllers (input-output processors, or IOPs). Each disk is an independent Field Replaceable Unit (FRU), which may be removed or replaced while the system is in use. Each IOP provides an independent path to the H.A.D.A. II system and is capable of supporting all its disks. Using the GridMgr software that comes with the H.A.D.A. II system, you can divide the disks between the IOPs.

Should one IOP fail, you can switch its disk units to the other IOP while the system is in use, then switch them back after the failed IOP is replaced. See "Operator-Initiated Failover" for a brief description of this new feature, and the document *Physical Disk Failover in DG/UX 5.4.2* (012-004186-00) for a fuller introduction. (The file `/usr/release/failover.ps` is a Postscript® version of this document.)

You can configure the H.A.D.A. II to be shared by two AViiON servers. See "Dual-Initiator Configurations" for a description. When so configured, using the failover feature, you can reassign the disks in the H.A.D.A. II system to either AViiON host, while both hosts are running or after one of them has failed.

The H.A.D.A. II system sends error and status information to the specified host. See "H.A.D.A. II and SCSI-2 Message Logging" for a description. Optionally, status messages from the H.A.D.A. II system may be reported directly to a Data General support center. See "AV/Alert" for a description of this service.

Major features of the H.A.D.A. II include:

- High performance commercial application-oriented storage subsystem
 - Winchester disk storage featuring RAID 0 (Redundant Array of Inexpensive Disks), RAID 1, RAID 3 (see Note), RAID 5, and independent drive modes of operation
 - Supports both 500MB and 1GB (see Note) Winchester disk drives
 - Intelligent IOP (I/O processor) supports reliable multi-RAID configurations concurrently

- Data striping approach provides increased I/O performance; automatically distributes data across multiple actuators (heads)
- Improved high availability features
 - Customer replace-under-power disk drives, IOPs, fans, and power supply
 - Continued operation during single disk failure within a RAID 3 or RAID 5 group or RAID 1 mirrored pair
 - Redundant IOPs allow system recovery on single point failure either at the host bus adapter or the IOP level
- Scalable storage subsystem
 - Supports up to 20 drives in rackmount or deskside configurations
 - Maximum disk storage capacity of 20GB (see Note) in a single rackmount chassis or deskside package
 - Up to 2 array subsystems can be configured on a single host SCSI system bus
 - Single cable host connection; differential SCSI connection allows total bus length of 25 meters (81 feet)
- Small footprint
 - Supports up to 80GB of storage capacity in a standard 72-inch 11000 series cabinet
- Low cost of ownership

Note: Available during the last three months of 1992

See **sd(7)** and **dgsc(7)** for device specification syntax, and the manual *The High-Availability Disk-Array Subsystem II (H.A.D.A. II): Configuring and Managing the Rackmount Model and Installing, Configuring, and Managing the Deskside Model* (014-002168-00) for installation, setup, and maintenance of the H.A.D.A. system. For notes about potential H.A.D.A. II installation and management problems, see "Problems to Avoid: System Administration."

4.1.4.2 Model 7430 SCSI-2 Controller

The Model 7430 is a Fast SCSI-2 host bus adapter for VME-based AViiON host systems. It has two SCSI-2 channels and can support data transfer rates up to 10MB/second per channel. Each SCSI channel on the Model 7430 can be configured as either differential or single-ended by reorienting the bus interface on the host adapter. The Model 7430 can support up to 14 SCSI devices, or seven per channel. No more than two H.A.D.A. IIs are recommended per bus to maximize subsystem performance. In addition, in high availability environments only one of the Model 7430's two SCSI channels should be used for disk arrays to minimize single points of failure. The remaining SCSI channel can be used to support other SCSI disk and/or tape drives as necessary.

A new device driver, **dgsc**, supports the model 7430 controller. See **dgsc(7)** for device specification syntax, and the manual *Installing the Model 7430 VME SCSI-2 Adapter (VSA) in AViiON Systems* (014-002163-00) for installation and setup of the hardware.

An AViiON server equipped with this new controller plus a H.A.D.A. II or SCSI-2 disk (described below) can support "Dual-Initiator Configuration" and "Operator-Initiated Failover." See these sections for descriptions of these expanded features.

4.1.4.3 Model 6796/6799 520MB 3-1/2 Inch 4400 RPM SCSI-2 Disk

The 520MB 3-1/2 inch SCSI-2 drive is a half-height device based on a 609 (unformatted) HDA (Hard Disk Assembly). This product offers high performance capabilities including 12ms average seek time, 4400 RPMs, and 6.82 second average rotational latency time. The product's SCSI interface has a 240KB on-board buffer and a maximum data transfer rate of 3.0MB/second asynchronous and 5.0MB/second synchronous.

This new disk is available in two models: a single-ended SCSI version (Model 6796) and a differential version (Model 6799). See the man page **sd(7)** for device specification syntax. For installation and setup see the manual *Installing the 3-1/2 Inch Disk Drive: Models 6662, 6796, and 6799* (014-002139-02).

4.1.4.4 Optical Disk System

The OpStar optical storage family of fully-integrated optical products comprises disk subsystems, add-on drives, and jukeboxes. Subsystems based on 5-1/4 inch media are multifunction: they accept permanent WORM (Write Once Read Many) media and Rewritable media, with both media using the MO (Magneto-Optical) technology. 12-inch subsystems incorporate WORM media, using the alloy method technology.

You can obtain specific model numbers for these products from Data General's product brief, *OpStar Optical Storage Systems* (Order Number 012- 004084), which your Data General representative can supply.

OpStar products provide the following features and benefits:

- Standard UNIX system-based file access for optically-stored data
- Family of fully-integrated software, drives, jukeboxes, and media
- Provides platform for Document Image Processing (DIP)
- Supports all AViiON processors
- 5-1/4 inch multifunction (permanent/Rewritable) data storage from 650MB to 36.4GB on an OpStar subsystem, with a data life of up to 30 years
- 12 inch permanent data storage from 6.55GB to 327.5GB on an OpStar subsystem, with a data life of up to 100 years

- Allows the use of WORM or Rewritable media in a single drive or jukebox
- Allows users to move from changeable to archival storage (or the reverse) without changing subsystems; maximizes investment in optical storage
- Fully-supported DG/UX file system
- Virtual File Manager allows each disk side in the jukebox to be concurrently mounted as a file system within the DG/UX system
- Provides network file availability on AViiON system-supported communications packages such as NFS and Novell NetWare®
- Software Subscription Service and Support Plus are available for OpStar software

For more information, see the manuals *Installing and Configuring OpStar Optical Disk Subsystems Series 6613 and 6614* (014-510346-00), *Using OpStar Optical Storage Software* (093-510347-00), and the following OpStar optical storage software release notes:

- OpStar Virtual File Manager (VFM): 085-000648-01
- OpStar Optical File Manager (OFM): 085-000649-01
- OpStar Jukebox Control Library (JB): 085-000447-01
- OpStar Optical Drive (OD): 085-000647-01

4.1.4.5 NVRAM Devices

DG/UX Release 5.4.2 supports non-volatile RAM devices. These are 2MB memory modules backed up by battery, which may be used as very fast file systems, or as disk cache. For NVRAM reference and setup information, see *nvrnd(7)*, *Setting Up and Installing VME Cache Memory with Battery Backup Modules in AViiON Systems* (014-510511-00) *Managing the DG/UX System* (093-701088-02), and *Customizing the DG/UX System* (093-701101-02).

For notes about potential installation and management problems with NVRAM devices, see "Problems to Avoid: System Administration."

4.1.5 Tape Drives

4.1.5.1 Model 6762 2GB 3-1/2 Inch 4mm Digital Audio Tape (DAT) Drive

The 4mm DAT (Digital Audio Tape) unit delivers very high data storage capacity on compact media in an easily configured 3-1/2 inch half-height drive. It uses standard 60 or 90 meter 4mm DAT cassettes recorded in DDS2 or DDS2-DC industry standard formats. Digital data storage and compression in combination with the inherent advantages of DAT technology provide outstanding reliability and cost performance.

Major features of the 4mm DAT drive include:

- Up to 8.0 GB (compressed) of storage
- High data transfer rates (up to 732KB/second)
- 3-1/2 inch half-height form factor
- SCSI-2 single-ended interface
- Industry standard formats
 - DDS (Digital Data Storage)
 - DDS-DC (DDS-Data Compression)
- 1MB RAM buffer for improved streaming performance
- High-speed ECC (error correction code)
- High-speed direct block access capabilities
- Low power requirements
- Read after write ability
- High reliability and simple serviceability
- FCC-compliant, UL-listed, and CSA-certified

See **st(7)** for the data compression selection syntax. See the manual *Installing and Operating the Model 6762 Digital Audio Tape (DAT) Drive* (014-0002138-00) for installation and operation information.

4.1.5.2 Model 6760/6761 5GB 5-1/4 Inch 8mm Tape Drive

The 8mm cartridge tape drive is a high-performance, high-capacity 8mm tape subsystem that meets the data storage needs of many types of computer systems. This new tape drive, compatible with the Model 6590, supports hardware data compression, multiple densities, and SCSI-2 protocol. Its ability to store up to 10GB of data on a single, standard 8mm cartridge makes it ideally suited for high-end applications that require unsurpassed data capacity and transfer rates.

Major features of this tape drive include:

- Up to 10GB storage capacity using industry standard IDRC (Improved Data Recording Capability) compression algorithm
- 5-1/4 inch full-height form factor
- Single-ended or differential SCSI-2 interface options

- Industry standard formats
- 1MB RAM buffer for improved streaming performance
- High-speed ECC (error correction code)
- High-speed direct block access
- Low power requirements
- Read after write ability
- High reliability and simple serviceability
- High data transfer rates up to 1MB/second
- FCC-compliant, UL-listed, and CSA-certified

See **st(7)** for access syntax and the manual *Installing and Operating Model 6760 and 6761 Cartridge Tape Drives* (014-002169-00) for installation and operation information.

Data General expects to release the Model 6760/6761 tape drive during the last three months of 1992.

4.1.5.3 Model 6691 525MB 5-1/4 Inch Tape Drive

This new standalone unit expands the QIC series and complements the 6690 CD-ROM drive. The specifications for Model 6691 525MB 5-1/4 inch QIC tape drive are identical to those of the Model G6677-G 525MB QIC cartridge tape drive, except that the Model 6691 drive is a standalone device. This drive also reads and writes 150MB tapes. It provides the following features:

- Tape speed of 120 ips
- Data density of 16,000 bpi
- Nominal data access time of 100 seconds
- Rewind speed of 120 ips
- Rewind time of 100 seconds
- SCSI (single-ended) interface

See **st(7)** for access syntax and the manual *Installing and Operating the Model 6691 Stand-alone Cartridge Tape Drive* (014-002158-00) for installation and operation information.

4.1.6 CD-ROM

4.1.6.1 Model 6690 CD-ROM Drive

Data General's Model 6690 5-1/4 inch, read-only standalone CD-ROM disk drive provides cost-effective storage for large-scale reference and distribution of non-alterable data. It provides 600MB of read-only, removable disk space, and can read prerecorded data from high-capacity, industry standard CD-ROM cartridges.

The Model 6690 CD-ROM drive provides the following features and benefits:

- Its 350ms average access time provides fast random data access
- Because it accepts industry-standard cartridge and media formats, it can read off-the-shelf published CD titles
- Up to 600MB of low-cost, read-only data storage provides high capacity, online data storage
- Its compact 5-1/4 inch, half-height form factor offers cost-effective data storage in a convenient package

Note that new PROMs may be required to use the Model 6690 CD-ROM drive as a boot device for CD-ROM installation media. See `sd(7)` for access syntax and the manual *Installing and Operating the Model 6690 Standalone CD-ROM Drive* (014-002162-00) for installation and operation information.

4.2 Kernel

4.2.1 SCSI Devices

The Small Computer System Interface (SCSI) drivers have changed. So that a SCSI device may be accessed via multiple ports, the SCSI device specification accepts an additional, optional parameter. This change is reflected in the SCSI device driver manual pages: `sd(7)`, `st(7)`, `dgsc(7)`, `ncsc(7)`.

4.2.2 Device Drivers

The device driver interface has changed. The manuals *Writing a Standard Device Driver for the DG/UX System* (093-701085-00) and *Programming in the DG/UX Kernel Environment* (093-701083-01) have been revised to reflect the changes. If you write standard or Streams device drivers, you should obtain these revised manuals.

4.2.3 File Buffering Performance

To allow for greater control of physical memory resource usage, DG/UX Release 5.4.2 introduces three new kernel configuration parameters. These parameters are described below. See `/usr/etc/master.d/dgux` for additional information.

PERCENTBUF limits the percentage of physical memory that can be used to cache data files. Use this parameter to prevent data file I/O from causing undesirable paging of program text and data. The default value is 100, which results in behavior equivalent to DG/UX Release 5.4 Update 1. A minimum value of 5 is silently enforced. If you suspect a buffer limit may improve performance, experiment.

MAXPAGEOUTS limits the number of concurrent pageout I/O operations. Use this parameter to tune pageout activity according your system's response time and throughput requirements, and its paging throughput capacity. Setting a lower value tends to improve response times for interactive applications while limiting paging throughput. Setting a higher value has the opposite effect. The default value for DG/UX Release 5.4.2 is either 32 or a system's physical memory (MB) divided by 2.6, whichever is lower. For comparison, the equivalent **MAXPAGEOUTS** value for DG/UX Release 5.4 Update 1 is a system's physical memory (MB) multiplied by 2.5. Thus, DG/UX Release 5.4.2 significantly reduces concurrent pageout activity by default.

HOGFILESIZE defines the maximum amount of physical memory (in bytes) that a data file can occupy before being treated less favorably for physical memory resource allocation. When physical memory resources are scarce, the system will tend to reduce memory consumption for data files occupying more than **HOGFILESIZE** bytes. The default **HOGFILESIZE** value for DG/UX Release 5.4.2 is 262,144. For comparison, the equivalent value for DG/UX Release 5.4 Update 1 is infinity, indicating no correlation between memory allocation behavior and memory usage.

In addition to these three new tuning parameters, DG/UX Release 5.4.2 includes the following changes in file buffering to improve performance:

- Limits the number of concurrent asynchronous I/O operations to each file. This change prevents a system's I/O resources (for example, bards and disks) from being monopolized by I/O to a small group of files.
- Imposes flow control on sequential writes to large files on NFS-mounted file systems, and on file systems using the `fsync_on_close` option of `mount`. This change prevents such writes from filling up physical memory with dirty data that will be slow to page out.
- Increases the maximum file paging unit size from 16KB to 64KB. This change allows file data elements of up to 64KB to be paged in a single I/O operation.
- Fixes the DG/UX Medium Term Scheduler's (MTS's) detection of memory thrashing behavior. High levels of data file paging will no longer cause the MTS to artificially constrain the number of bound processes, i.e. processes which can be scheduled to run.

4.2.4 Dual-Initiator Configuration

This release extends support for *dual-initiator configuration*: allowing two AViiON servers to configure a single disk or tape device. The following disk and tape devices can be used in dual-initiator configurations:

Model 6796 single-ended and Model 6799 differential 520MB half-height SCSI-2 disk drive

Model 6716 single-ended and Model 6718 differential 1.4 Gbyte full-height SCSI-2 disk drive

H.A.D.A. II disk-array subsystem, differential models

Model 6588/6589 1/2" reel-to-reel tape drive, single-ended

Model 6760 8mm 5GB 5 1/4" helical scan tape drive

Model 6762 4mm 2GB 3 1/2" DAT tape drive

Model 6677 QIC-320 1/4" cartridge tape drive, single-ended

Only AViiON systems equipped with **dgsc** or **ncsc** adapters support dual-initiator configurations. For dual configuration with the **dgsc** adapter, the differential disk models are strongly recommended.

For notes about potential installation and management problems with devices that are configured with two hosts, see "Problems to Avoid: System Administration."

4.2.5 Operator-Initiated Failover

To set up and manage dual-initiator configurations, see Chapter 7 of *Managing the DG/UX System* (093-701088-02). For a tutorial introduction to dual-initiator configurations and operator-initiated failover, see *Physical Disk Failover in DG/UX 5.4.2* (012-004186-00). To administer dual-initiator configurations, use the **sysadm Device -> Disk -> Failover** selection. For the shell interface to failover, see these manual pages: **admfailoverdisk(1M)**, **admfailoverhosts(1M)**, **admfailovergiveaway(1M)**, **admfailovertakeaway(1M)**, **failoverd(1M)**.

4.2.5.1 IOP Replacement

If your H.A.D.A. II system includes two input output processors (IOPs), the failover feature allows you to continue using all disk units in your H.A.D.A. II unit while one of the IOPs is being repaired.

If a H.A.D.A. II input output processor (IOP) fails, IO requests to all disk units accessed through that IOP will fail. If the host has a physical connection to the other IOP in the chassis, and remains able to use its system disk so that it can access the failover database and critical system data, then it can switch ownership of the disk units to the remaining IOP. This allows the host to quickly get back into operation until an off-peak time is available for repair.

If the system disk resides in the H.A.D.A. II chassis, you can build a software mirror of the system disk, such that each image is accessed through a different IOP. This will provide for continuous access to the system disk and failover database in the event that one IOP fails. To set up a software mirror on the system disk, see the file **093701088_02**. This file amends the instructions in Chapter 7 of *Managing the DG/UX System* (093-701088-02).

When the IOP is repaired, you can put it in a running system and bring it to a ready state. Then you can reboot the host, and use the **sysadm** failover menu to switch ownership of the affected disks back to the repaired IOP, thus restoring the system to its original configuration.

4.2.6 H.A.D.A. II and SCSI-2 Message Logging

The H.A.D.A. II system and SCSI-2 disks log messages (events) to the host computer. For example, when a Field Replaceable Unit (FRU), such as a disk module, is inserted or removed from a H.A.D.A. II system, or when some status or error condition occurs, the event is recorded.

If the AV/ALERT error reporting facility is operating, it processes the messages, which are also recorded in the host's **/usr/adm/messages** log file. Most H.A.D.A. II errors are saved as well in the event log maintained by GridMgr, and may be viewed at the H.A.D.A. II console.

If the AV/ALERT facility is not operating, the DG/UX host displays messages on the system console. The messages are documented in your H.A.D.A. II or SCSI-2 manual. The messages are briefly illustrated below.

4.2.6.1 H.A.D.A. II Message Example

Each message includes the name of the device that reported the event, a status/error code, and a FRU number. The DG/UX driver reporting these events cannot map the FRU number to a position indicator such as row/column, but in most cases it will be apparent which FRU is affected.

For example, the message:

```
Disk-array FRU (a disk module) was inserted or was powered on.
Reported by unit sd(dgsc@30(FFFFC000,6),5,0), status code 0x608,
FRU number 0xA.
```

indicates that the IO processor at SCSI-ID five reported that a disk (FRU number 0xA) was inserted into disk unit zero (SCSI LUN zero). The status code is 608 (hexadecimal).

Refer to your H.A.D.A. II reference manual for full documentation of error codes.

4.2.6.2 SCSI-2 Message Examples

The message:

```
SCSI adapter dgsc@30(FFFFC000,6) was reset and reinitialized after
a timeout error.
```

indicates that a timeout occurred, and that the **dgsc** SCSI adapter was re-initialized. This message

follows a successful recovery from some transient condition.

The message:

```
Device at SCSI ID 2, LUN 0 on SCSI adapter dgsc@31(FFFFC080,6) has
failed following a recovery attempt. Check SCSI cabling and con-
figuration.
```

indicates a persistent problem with a particular device, which cannot recover from the problem. Each subsequent attempt to use the device results in an I/O error.

The system administrator may be able to correct the problem, without stopping the system, by deconfiguring and reconfiguring the device. See `sysadm(1M)` or *Managing the DG/UX System* (093-701088-02) for explanations of the deconfigure and configure operations.

The message:

```
SCSI adapter dgsc@31(FFFFC080,6) was reset after a device timeout,
and is no longer functional. Check SCSI cabling and configura-
tion.
```

indicates a persistent problem within the SCSI adapter, and that the adapter has been flagged as failed. Any further attempt to use a device on the adapter results in an I/O error. This is potentially a hardware problem.

4.2.7 Panic Dumps

After a system panic, you now have the option of dumping memory to a logical disk unit rather than to tape. As dumps to disk are much faster than dumps to tape, this option allows you to reboot almost immediately after a panic; and to prepare an STR tape, using the memory image saved on disk, at a more convenient time.

This new feature, reflected in the section "Preparing STR Tapes" at the end of this release notice, is explained in *Managing the DG/UX System* (093-701088-02). For specific instructions about transferring a system dump to tape from a logical disk, see `lsd(1M)`.

Note: the `ldm_dump` command line syntax does not permit spaces between the parameters. The following example from Chapter 3 of the Managing manual:

```
ldm_dump(sd(cisc(),0),sys_dump
```

shows an erroneous space before the last parameter. This problem will be fixed in the next manual revision.

4.2.8 STREAMS

4.2.8.1 Specifying Multiple Demons

To increase performance, the STREAMS implementation in DG/UX 5.4.2 supports multiple STREAMS demons on multi-processor systems. If the tunable parameter `NSTRDEMONS` in the system file is set to 0 (the default), the system starts one demon for every two CPUs (for example, one demon for one or two CPUs, two demons for three and four CPUs, and so on). Otherwise, the system starts `n` demons, where `n` is the smaller of `NSTRDEMONS` and the number of CPUs. See Chapter 4 of *Managing the DG/UX System* for additional information about the setting of tunable parameters.

4.2.8.2 Problems to Avoid: STREAMS

Passing 32-Bit Values. The min/max packet and high/low water mark fields (defined in the `module_info` structure in `sys/stream.h`) are of type short, thus limited to 65535. Streams modules that need to pass 32-bit packet or high/low water mark values must set the values explicitly in their open routines by calling `strqset()`. (See *Programmer's Guide: STREAMS* for `strqset` documentation; STREAMS routines are not included in the online manual pages.)

Detaching Modules. A program containing the `connld` STREAMS module that tries to `fdetach` an attached pipe while the pipe is being opened may block indefinitely. If this occurs, you must kill the blocking process. To avoid this problem, take the following precautions: (1) do not explicitly `fdetach` the end of a pipe containing `connld`; (2) do not push `connld` onto both ends of the same pipe; (3) do not attach both ends of a pipe containing `connld`. If you follow these guidelines, the kernel detaches pipes whenever they are closed.

Pushing Modules on a Pipe. The following combination of events can cause a system panic:

- An application pushes a STREAMS module containing a service routine onto a pipe
- The pipe at the opposite end is closed first

This problem will be fixed in a future release. Meanwhile, to avoid the problem, do one of the following:

- In applications that push modules on only one end of a pipe, close the pipe end first.
- Pop all modules from a pipe before closing it.

Note that, when an application is interrupted or killed, normal exit processing is performed. Thus, these work-arounds may be ineffective in cases where a process is interrupted or killed.

4.2.9 Other Kernel Changes

The `NCARGS` parameter in `/usr/include/sys/param.h` has been increased from 20480 to 524288. This value specifies the maximum size in bytes of the arguments and environments given to `exec`.

4.3 TCP/IP

For this release, the TCP/IP software has been redesigned to improve performance:

- The latency, or per process overhead, has been reduced. This leads to much better performance for applications that use small packets.
- The scalability, or ability to support multiple LAN controllers efficiently, has been improved. This increases throughput on multi-LAN, multi-CPU servers.

An additional performance boost comes from hardware (see "New Hardware" below). For instance, the DMA-capable LAN controller, VLCi, significantly reduces the CPU workload for data transfers.

As a result of these changes, performance will be improved on all networked configurations of AViiON systems running DG/UX Release 5.4.2, and especially in networks that include multi-processor AViiON servers equipped with the new VLCi controllers.

4.4 AV/Alert

The AV/Alert remote error reporting system is supported in this revision of DG/UX. The DG/UX device drivers log errors. The **dgsvcd** demon, started during system initialization, reports logged errors, by modem, to Data General support centers.

If you subscribe to AV/Alert, your system will automatically dial the Data General support center when DG/UX Release 5.4.2 enters init level 3. This default behavior is controlled by the `true` setting of the `dgsvcd_START` parameter in the `/etc/dgux.params` file. For additional information about AV/Alert, see **dgsvcd(1M)**, *Connecting Your Modem and Enabling AV/Alert* (015-000361-00), *AViiON Series Computer Systems Automatic Reporting and Remote Assistance* (015-000356-00), and *User Guide for the Service Manager Interface Used on AViiON Systems* (015-000362-00).

4.5 Compiler and Language Support

4.5.1 Support for Version 3.00 Assembler

The GNU C compiler now generates version 03.00 assembly syntax under the *m88kdguxelf* software development environment (see **sde(5)**). This means that you must rewrite asm statements in any C application that uses them so that they conform to the new syntax. You do not, however, have to change assembler source code. The following example illustrates the syntax differences:

Version 03.00 syntax:

```
or.u    #r13,#r0,#hi16(n)
or.u    #r12,#r0,#hi16(m)
ld      #r11,#r12,#lo16(m)
cmp     #r10,#r11,0
ext     #r12,#r10,1<#eq>
```

```

subu    #r12, #r0, #r12
st      #r12, #r13, #l016(n)

```

Version 02.01 syntax:

```

or.u    r13, r0, hil6(_n)
or.u    r12, r0, hil6(_m)
ld      r11, r12, l016(_m)
cmp     r10, r11, 0
ext     r12, r10, l<eq>
subu    r12, r0, r12
st      r12, r13, l016(_n)

```

These examples show that for version 03.00, you must use the # sign to distinguish registers and assembly constructs. Also, you must spell the names of symbols without a prepending underscore.

GNU C supports an extended asm that allows the construct "%#". This construct yields either nothing or a # character depending on the target assembler. You can write some asm code to work with both assemblers. For example,

```

asm ("xmem %#r10, %#r10, %#r0"
    : /* no outputs */
    : /* no inputs */
    : /* clobbers r10 */ "r10");

```

will yield the string "xmem r10,r10,r0" when you use the version 02.01 assembler and the string "xmem #r10,#r10,#r0" when you use the version 03.00 assembler.

Note that asm statements cannot accommodate differences in the spelling of external names and local names. However, judicious use of the extended asm features will typically preclude the need to provide an explicit spelling. For example, to perform an xmem on the global variable "lock", you could write:

```

asm ("or.u %#r10, %#r0, %#hil6(_lock)" ::: "r10");
asm ("or %#r10, %#r10, %#l016(_lock)" ::: "r10");
asm ("xmem %#r10, %#r10, %#r0" ::: "r10");

```

By necessity, this gives the spelling of "lock". An improvement would of this would be:

```

asm ("or.u %#r10, %#r0, %#hil6(%0)" :: "" (&lock) : "r10");
asm ("or %#r10, %#r10, %#l016(%0)" :: "" (&lock) : "r10");
asm ("xmem %#r10, %#r10, %#r0" ::: "r10");

```

The xmem instruction is unusual. Its first operand is read and written and so it is both an input and an output. Also, since xmem is typically used as the basis of a spin lock and the output varies in ways not apparent to the compiler, a volatile asm instruction should be used. The suggested asm instruction for xmem is:

```

asm volatile ("xmem %0, %1, %#r0"
    : "=r" (value)
    : "r" (&lock), "0" (LOCK_VALUE));

```

This stores the value of "LOCK_VALUE" in "lock" and places the previous value of "lock" in "value". The volatile form is used so the compiler will not regard the instruction as loop invariant.

You can use extended asm as statements in the body of a function. For more information on extended asm, browse the on-line documentation using the **info(1)** command.

Details of version 03.00 syntax can be found in the *System V Application Binary Interface: Motorola 88000 Processor Supplement*.

4.5.2 Problems to Avoid: Compiler and Language Support

4.5.2.1 Software Development Environments

Note these important points about DG/UX support for multiple software development environments (SDEs).

4.5.2.1.1 ELF

Programs you develop in the DG/UX Release 5.4.2 ELF environment may run under an earlier DG/UX revision, but are not guaranteed to do so.

4.5.2.1.2 88open

Programs developed in the 88open BCS or OCS environments will run under earlier DG/UX revisions. However, because the 88open standards predate the release of UNIX System V Release 4 and DG/UX Release 5.4, many enhancements available in the DG/UX ELF environment are not available in the 88open environment.

4.5.2.1.3 COFF

Existing COFF executables will continue to run unchanged, but the COFF development environment (**sde-target** name *m88kdguxcoff*) will not be supported in the next full release. If you develop COFF programs, convert to a supported environment before the next release. If you require COFF, you can convert to the 88open BCS or OCS environment.

4.5.2.2 Loading mxdb

DG/UX Release 5.4.2 includes versions of two programs, **/usr/bin/ctl** and **/usr/bin/dtl**, that are more recent than the versions included with **mxdb** release 2.10 or earlier. If you plan to install release 2.10 or earlier of **mxdb** after upgrading your system to DG/UX Release 5.4.2, move these two programs to a temporary location before you start loading **mxdb**. Then, after loading **mxdb**, move the DG/UX Release 5.4.2 versions of **ctl** and **dtl** back to directory **/usr/bin**. Following these steps will insure that your system includes the most recent versions of these programs. (Loading **mxdb** over DG/UX Release 5.4.2 overwrites as well the manual pages **ctl(1)** and **dtl(1)**, but because these manual pages have not changed, this will cause no problem.)

4.5.2.3 Debugging

Core files are not exclusively opened while being written. As a result, if two or more processes dump core to the same directory at the same time, the resulting core file will be unusable for debugging purposes.

If a debugger sets watchpoints (data store breakpoints) in a target process that executes a **vfork(2)** system call, the watchpoints are erroneously removed. When the target process next stops and is permitted by the debugger to resume execution, the watchpoints are reinstated.

4.6 Libraries

4.6.1 libc

In all environments:

- The **perror()** routine now provides error messages for: EDOTDOT, EOVERFLOW, EILSEQ, ENOSYS, ERESTART, EPOWERFAIL, and ECLNRACE.
- The precision of functions **atof()**, **ecvt()**, and **scalb()** is improved.
- A program which includes `<getwidth.h>` no longer requires the option **-traditional** to compile. On DG/UX Release 5.4 Update 1, unless `'-traditional'` was used, compiles would fail.

In the ELF environment (*m88kdguxelf*):

- The **ptsname()** function has been enhanced with a mode that allows it to return slave-side Pseudo-terminal names that will be visible to old versions of the **ttyname()** function. Old versions of **ttyname()** did not look under `/dev/pts`. See **ptsname(3c)** for details.
- The speed of the **frexp()** routine, supporting denormalized numbers, has been improved.
- The **mincore()** function no longer generates undefined reference errors during linking.
- The **getwd()** and **getcwd()** functions no longer write to previously freed memory.
- The **getgrent()** function no longer returns pointers to previously freed memory.

In COFF environments (*m88kdguxcoff*, *m88kbcs*, and *m88kocs*):

- Profiling, which produced link errors in DG/UX Release 5.4 Update 1, now works.
- The **monitor()** function, missing in DG/UX Release 5.4 Update 1, is now present.
- The **ttyname()** function has been enhanced to use the **ttysrch()** capability (previously available only in the *m88kdguxelf* environment). This allows greater flexibility in tailoring applications to behave correctly for all platforms.

In the 88open environments (*m88kbcs* and *m88kocs*):

- The **gettimeofday()** system call now reliably returns 0 upon successful completion. Previously, the results were unpredictable.
- The **gethostname()** system call, which always returned -1 in DG/UX Release 5.4 Update 1, now returns the correct host name.

4.6.2 libdgc

In the ELF (*m88kdguxelf*) environment, support for messages in languages other than English is now available. So that error messages can be displayed in a standard format, or passed to the monitor and the logger, these routines have been added: **pfmt()**, **lfmt()**, **vpfmt()**, and **vlfmt()**. See the man pages for details.

4.6.3 libw32

Leading hexadecimal notation **0x** or **0X** is now correctly interpreted with **scanf("%x")**. Previously, if the input string was **0x10**, the result was incorrectly 0 because the **x** was being treated as an invalid character. Now **0x10** is correctly interpreted as decimal 16 or hex 10.

4.6.4 Problems to Avoid: Libraries

4.6.4.1 libm

The functions **sin()** and **cos()** no longer check for loss of accuracy; with large arguments, these routines will no longer set **errno** to **ERANGE**. This change was made for compatibility with USL System V Release 4: see the "Future Directions" stated for **trig(BA_LIB)** in the **SVID**.

4.6.4.2 libnsl

Support for the library **libnsl.a** will be removed in the next release of DG/UX. Start using **libnsl.so** instead.

4.6.4.3 Using sigsetjmp and siglongjmp

The **sigsetjmp** and **siglongjmp** routines are incorrectly implemented in the ELF environments in DG/UX Release 5.4 and Release 5.4 Update 1. In particular, they fail to save and restore the stack definition and previous context pointer (**uc_stack** and **uc_link** fields of a **ucontext_t** structure). An application that uses **sigaltstack** or manipulates the **uc_link** field explicitly may not operate correctly.

For the DG/UX Release 5.4.2 ELF environment, there is a special compilation option to correct this problem: see **sigsetjmp(3C)** for details. However, an application built with this option will *not* execute in DG/UX Release 5.4 or DG/UX Release 5.4 Update 1.

4.6.4.4 Compiling with `__STDC__`

During compilation with `cc` or `gcc`, when `__STDC__` is not defined, the return types of `fread`, `fwrite`, `strlen`, `strspn` and `strcspn` are now `int`, not `size_t` as they were in previous releases. This change was made to comply with the **traditional/transitional** compilation mode. See `cc(1)` for details.

4.7 System Administration

4.7.1 Using `sysadm`

The `sysadm` program has been enhanced and its disk management functions expanded. The new functions are explained in the manual *Managing the DG/UX System* (093-701088-02). For details about the shell interface to the new disk functions, see the manual pages `admdisk(1M)`, `adm-mdisk(1M)`, and `admpdisk(1M)`.

4.7.2 Changes in Initialization and Runtime Defaults

The system initialization scripts have been changed as noted below:

- Prototype `crontab` files (`lp.proto`, `root.proto`, and `uucp.proto`) have been moved from `/var/spool/cron/crontabs` to `/admin/crontabs`.
- The `rwhod` agent does not run by default on network hosts as in previous releases. To reinstate the old default, remove the comment character from the `rwhod` startup line in `/etc/tcpip.params`. This change is reflected in `runtime(1C)`, `rwhod(1C)`, and `rwhod(1M)`.
- The `ftpd` agent runs in secure mode by default: only files with public access that are located in `/ftpliboot` can be accessed through the Trivial File Transfer Protocol. Secure mode is new with this revision. To reinstate the old default, remove the `-s` option from the `ftpd` startup line in `/etc/inetd.conf`.
- The `telnetd` and `rlogind` agents now create pseudo-terminal line names of the form `/dev/pts/N`, where previously they created names of the form `/dev/ttypN`. The new naming form follows the System V Release 4 convention. Thus, if you type `tty` on a remote system, to which you logged in via `telnet` or `rlogin`, your line name will appear as `/dev/pts/0`, where it used to appear as `/dev/ttyp0`. Since BCS applications may require names residing directly in `/dev`, a compatibility mode giving `/dev/ptsN` is available using the `System->Parameters->Set` menu in `sysadm`. (Changing the compatibility mode requires a reboot.) See `ptsname(3C)` for additional information about pseudo-terminal changes in DG/UX Release 5.4.2.
- If you are upgrading to DG/UX Release 5.4.2 from DG/UX Release 5.4 or DG/UX Release 5.4 Update 1, your system's `/etc/ttydefs` file will be replaced with a new version, and the previous version saved as `/etc/ttydefs.YYMMDD`. If you have customized this file for your system, you will need to incorporate the changes from the saved file into the new `/etc/ttydefs` file. See `ttydefs(4)` for assistance.

4.7.3 Uninterruptible Power Supply

Uninterruptible Power Supplies (UPS) are supported. If your system includes a UPS, use the devices menu in `sysadm` to set it up. For information about the shell interface, and about selecting a serial port for communicating with the UPS device, see the manual pages `admups(1M)` and `upsd(1M)`.

4.7.4 Problems to Avoid: System Administration

4.7.4.1 Using `ps` During H.A.D.A. I Bind Operations

Do not use `ps` with the `-f` option while a H.A.D.A. I bind operation is in progress. The bind operation holds a resource which `ps -f` needs, and cannot get until the bind completes. The `ps` operation similarly holds a resource that all other processes need to fork or exit. Thus, the `ps` process will hang, and other processes will hang behind `ps`, until the bind operation completes.

4.7.4.2 H.A.D.A. II

If your H.A.D.A. II system is configured with two hosts, see as well the potential problems described in the section "Setting Up Dual-Initiator Configurations."

4.7.4.2.1 Configuring Failover on a H.A.D.A. II Subsystem

In the manual *Managing the DG/UX System*, Chapter 7, the section "Managing Failover Disks" shows how to configure SCSI-2 disks for failover between two computer systems. The section is correct for stand-alone SCSI-2 disks, but not for SCSI-2 disks in a H.A.D.A. II subsystem. The examples omit, from the disk unit names, the physical unit number parameter. When you configure a H.A.D.A. II disk for failover, you must specify its physical unit number (also known as LUN). For example, in the unit name `sd(dgsc(0),0,3)`, the number 3 identifies physical unit number (LUN) 3.

For a correct failover example for H.A.D.A. II disks, consult your H.A.D.A. II manual, *The High-Availability Disk-Array Subsystem II (H.A.D.A. II): Configuring and Managing the Rack-Mount Model, and Installing, Configuring, and Managing the Deskside Model* (014-002168-00)

The next revision of *Managing the DG/UX System* will correctly illustrate how to configure H.A.D.A. II disks for failover.

4.7.4.3 Using Failover

You can set up failover such that a disk can be transferred to the host that currently owns it. This is beneficial with SCSI-2 disks connected to multiple controllers, and with a H.A.D.A. II system equipped with two I/O Processors. For same-host failover, the `give` operation is unavailable. Use the `take` operation to transfer the disk to its alternate path.

The failover software currently cannot fail over disks with nested file systems. If your disk has file systems of the form `/a`, `/a/b`, `/a/b/c`, etc., the failover software will not unmount and mount the file systems in the proper order. This problem will be corrected in a future release.

The **admfailoverdisk** command uses **fuser** to terminate processes that would prevent the deregistration of a physical disk. The **fuser** command terminates a process by sending a SIGKILL signal to it. Certain processes may not be prepared to handle this signal without problems. You should terminate such processes, following whatever procedures they require, *before* transferring a disk between two working systems. Similarly, you should terminate applications, such as NetWare®, that restart terminated processes before transferring a disk between two working systems.

Currently, **sysadm** provides no access to the failover application, hosts, and takeaway databases. To maintain these files, use the failover commands **admfailoverapplication**, **admfailoverhosts**, and **admfailovertakeaway**. These functions will be added to **sysadm** in a future release.

When cross-mounting file systems between hosts in a failover configuration, the **admfailoverdisk** command attempts to unmount an NFS file system and mount it locally if it resides on a disk that is being failed over. This is not guaranteed to succeed. After failing over a physical disk, you should check to make sure the appropriate file systems are mounted.

The failover feature allows you to switch ownership of a system disk (a boot disk) from a primary host to a secondary host, which can then use the unit. However, before rebooting the primary host, you must halt the secondary host, turn off the H.A.D.A. II system, and turn it back on.

4.7.4.4 Setting Up Dual-Initiator Configurations

The devices that may be used in dual configurations are listed in the "Dual-Initiator Configuration" section. Do not attempt to use unsupported devices in a dual configuration.

When setting up a dual-initiator configuration including a system equipped with a **dgsc** adapter, configure at least one device on each **dgsc** adapter. If you do not, booting one of the hosts can cause the other to panic.

4.7.4.4.1 Configuring AV4600 Series and AV530 Systems

Do not configure an **ncsc** adapter, or any other device that shares a SCSI controller with an **ncsc** adapter, to use SCSI-ID 7. Instead, configure one initiator's **ncsc()** adapter to use SCSI-ID 6, and configure the other initiator's **ncsc()** adapter to use SCSI-ID 5. The SCSI-IDs for other devices sharing the SCSI controllers with the **ncsc()** adapters can then be set as appropriate, but should not use SCSI-ID 7. Note that this is contrary to the SCSI-ID settings recommended in your manual set.

Using SCSI-ID 7 in a dual-initiator configuration that includes the **ncsc** adapter may cause one of the systems to panic when the other is powered on. This problem, which exists only with the **ncsc** adapter, will be fixed in a future PROM release.

4.7.4.4.2 Tape Drives

With tape drives, dual configuration allows two hosts to share a tape device through a direct connection, in a mutually-exclusive fashion: when one host is using the drive, the other host may not use it. There is no failover support for tape devices.

If a host fails while using a shared tape device, it is possible that the device will remain "busy", and that the other host will not be able to access it. To clear this condition, turn the tape drive off and back on.

4.7.4.4.3 SCSI-2 Disks

When setting up a dual-initiator configuration of SCSI-2 disks, take care not to exceed the cable length limit. The limit for single-ended SCSI-2 disks is 6 meters (19 feet). This limit is cumulative, and must include the cables internal to the host and peripheral housing. Exceeding the limit can cause erratic behavior, and possibly a system panic.

To avoid this problem, we recommend a differential SCSI interface with the **dgsc(7)** adapter, for SCSI-2 disks that are configured with two hosts. The cumulative cable length limit for the differential interface is 25 meters (81 feet).

4.7.4.4.4 Combined Storage Subsystem 2 (CSS2)

To use the CSS2 peripheral housing unit in a single-ended dual-initiator configuration, you must remove the signal conditioner if one is present.

4.7.4.4.5 Use of Stand-alone Diagnostics or **diskman**

Do not use the DG/UX installer kernel or stand-alone **diskman** on one host in a dual-initiator configuration while the other host is powered on. Similarly, do not use stand-alone diagnostic tools unless they are specifically designed for dual-initiator configurations. These utilities assume the default adapter SCSI-ID of 7, which may conflict with SCSI-IDs in use on the bus. Or the utilities may otherwise use the SCSI bus in a way that causes the the other host to behave erratically, hang, or panic.

4.7.4.5 Creating Software Mirrors for System Disks

If you plan to create mirrors for system disks, such as **/root**, **/usr/** or **swap**, see the online file **/usr/release/093701088_02**. The instructions in Chapter 7 of *Managing the DG/UX System*, section "Managing Software-Mirrored Disks" are correct for file systems that can be unmounted, but will not work for files systems that are always in use.

4.7.4.6 Using NVRAM

Do not use an NVRAM device as swap space. Doing so will cause your system to hang. Use ordinary volatile RAM for swap space.

If you plan to set up disk cache on an NVRAM device, see the online file `/usr/release/093701088_02`. The instructions in Chapter 7 of *Managing the DG/UX System*, section "Managing Cached Disks" are incomplete. The online file gives two examples to supplement the manual.

4.7.4.7 Running Out of Space in /tmp and /var

Many commands and applications use the system directories `/tmp` and `/var` for storing data temporarily, or for purposes of recovery. As system administrator, you should ensure that these directories do not fill up. System users may experience serious problems, including loss of data, if they do. For examples of such preventable problems, and workarounds, see the sections "Using vi: Recovery Files," "Printing on Remote Printers," and "Using Electronic Mail" in this release notice.

4.7.4.8 Removing a Piece of a Logical Disk

The usual procedure for removing a logical disk that contains multiple pieces is to delete the entire logical disk. However, if the logical disk is damaged (i.e., one or more pieces are no longer accessible), you must remove each of the remaining pieces individually. This is the only case in which an individual logical disk piece should be removed. These procedures are explained in *Managing the DG/UX System*, Chapter 7, "Removing a Logical Disk" and "Removing a Piece of a Damaged Logical Disk."

There are several points to keep in mind when removing a logical disk piece:

- When removing more than one piece of a logical disk, remove the last piece first and remove the pieces in order. For example, to remove pieces 1, 3 and 4 of a logical disk that used to contain four pieces, remove piece 4, then piece 3, then piece 1.
- Do not deregister the physical disk containing the damaged logical disk piece until all pieces of the logical disk have been removed.
- Do not attempt to resize a logical disk by removing a logical disk piece. Instead, use `sysadm` or the commands `admfilesystem` (if a file system exists on the logical disk) or `admdisk` (if no file system exists on the logical disk) to shrink the file system or logical disk.

4.7.4.9 Registering Disks

The `sysadm Device->Disk->Physical->Register` selection will not allow you to perform a "forced" registration of a disk belonging to another AViiON system. To perform this operation, use this command:

```
admpdisk -o register -f "diskname"
```

where `diskname` is the device specification of the physical disk. For example:

```
admpdisk -o register -f "sd(ncsc(1,6),3,0)"
```

4.7.4.10 Copying Disks

When you copy a physical disk, with **admpdisk** or the **sysadm** Device->Disk->Physical->Copy selection, the logical disks (and logical disk pieces) on the source physical disk are copied to the available free space on the destination physical disk. Any existing logical disks on the destination physical disk are not overwritten. To duplicate a physical disk (make a copy containing only those logical disks that are on the source physical disk), first clean off the destination physical disk, either by removing any logical disks on it, or by formatting it. To format, you can use **admpdisk -o initialize** or the **sysadm** selection Device->Disk->Physical->Soft_Format.

4.7.4.11 Expanding a Logical Disk or File System

If you expand a logical disk which already has 32 pieces, the next access of that logical disk will result in a system panic.

To find out the current number of pieces in a logical disk, use the **sysadm** Device->Disk->Logical->List selection. To expand a logical disk, you can use the **sysadm** Device->Disk->Logical->Expand selection, the File System->Local Filesys->Expand selection, or the **diskman** Grow a File System selection. These functions are explained in *Managing the DG/UX System* (093-701088-02), sections "Displaying Information About A Logical Disk" and "Expanding a File System."

4.7.4.12 Using Old or Obsolete Programs

dg_telnetd. This is an old version of the telnet service demon, **telnetd**. The old version will be removed in a future release. You should stop using **dg_telnetd** and start using **telnetd** instead. (The default **/etc/inetd.conf** file starts the new version.) Should **telnetd** fail to meet any of your application needs, please let Data General know immediately by filing an STR.

osysadm. Data General no longer supports this version of the system administration program. While this program is present on the 5.4.2 release tape, you should stop using it and start using **sysadm**.

4.7.4.13 Mounting NFS File Systems

We recommend that you mount NFS file systems with the "hard,intr" options. The "hard" option prevents possible loss of data but can cause a process to hang; the "intr" option allows a user or system administrator to override the protection provided by "hard" in order to kill a hung process. These recommended options are the **sysadm** defaults. With **mount**, or if you edit **/etc/fstab** manually, "hard" is the default but "intr" must be specified.

The "hard" option specifies that NFS operations will be retried until the NFS server responds. This ensures that all data destined for the server's disks will eventually be written, even if the server is rebooted while the write operation is in progress. It also insures that a user application attempting to read data (possibly including the application itself, if it resides on the server's disks)

will eventually complete the read operation, despite any intervening server crashes.

The "intr" option specifies that SIGKILL can always be used to terminate a hung process, and that almost all NFS operations can be interrupted by normal process termination signals (SIGHUP, SIGQUIT, SIGINT, SIGTERM) if the application accepts delivery of the signals. The "intr" option thus allows a user or system administrator to interrupt and kill a process that is hung waiting for a response from an NFS server. Killing a hung process, however, causes the loss of any data that has been written by the process but not yet delivered to the server. Two circumstances where killing a hung process may become necessary are:

- To regain control of a login session
- To free critical system (DG/UX kernel) resources needed in order to allow other processes that are not accessing the down server to continue their execution

The "soft" mount option specifies that the operating system should abort NFS operations after they have been retried a set number of times. Although this option prevents processes from hanging indefinitely, it does so at the risk of data loss (with NFS write operations) or sudden process termination (with NFS read operations).

With NFS read-only file systems (those mounted with the "ro" option), the "soft" option can result in unexpected process termination, but cannot cause data loss. Thus, with a file system that is mounted read-only (for example, the DG/UX manual pages), the "soft" option might be preferable.

4.7.4.14 Shrinking an NFS File System

Do not shrink a file system with **diskman** while that file system is in use. If you do, any client that has the file system mounted through NFS with modify access may lose buffered data from that file system. (An ENODEV error message from an asynchronous write operation indicates that this problem has occurred.) To prevent this problem, prior to beginning the shrink operation, caution NFS users to **umount(1M)** the file system. The command **showmount -a** show you NFS mounts alphabetically by host.

Enlarging a file system while it is in use causes no problem, and so requires no special measures.

4.7.4.15 Loading A Software Package Onto a Server

When loading a software package onto a client server, use the **sysadm Software -> Package -> Load** operation rather than **diskman**. While **diskman** can load any software package conforming to Data General package guidelines, it does not propagate new software to diskless clients.

If you are instructed to load non-operating system software with **diskman**, refer to the release notice accompanying that software for details on completing the installation for diskless clients.

4.7.4.16 Using Modems

Users are sometimes unable to connect with AViiON systems by modem. If your system includes a dial-in modem, and if users have reported being unable to connect with your system, read this section.

A symptom of this problem is that a user attempting to connect with the system through the modem line gets a NO CARRIER message, or a CONNECT message but no login prompt. To prevent the problem, or reduce its likelihood, inspect the modem line settings as indicated below in the section "Inspect Modem Line Settings."

The recommended workaround for the problem depends on whether the modem line is used for originating as well as for receiving calls, and on your modem's features.

If the problem has already occurred, stop the port monitor (**ttymon** process) for the modem line. Then, after you have changed the line and/or modem settings, restart the port monitor.

If the modem line is for incoming calls only, turn off result codes. This procedure is described below in the section "Turn Off Result Codes."

If you use your modem for calling out as well as for receiving calls, check your modem manual to find out whether it supports one of these options:

Result codes on originate: receive result codes for calls that you originate (outgoing), but turn them off for calls that you receive (incoming). If your modem supports the option, select it instead of turning off result codes.

Reset on DTR drop: the modem resets after dropping the Data Terminal Ready (DTR) state. If your modem doesn't support result codes on originate, but does support this option, select it and also turn off result codes. This will allow you to modify the uucp files such that, for calls that you originate, result codes are turned on, then have the modem reset (turn result codes back off) at the conclusion of the call.

If your modem line is bidirectional and if your modem supports neither option, turn off result codes. Then, each time you call out, turn result codes on before the call and off again after completing the call.

For instructions about how to modify uucp behavior, see "UUCP Management" in Chapter 12 of *Managing the DG/UX System (093-701088-02)*.

4.7.4.16.1 Inspect Modem Line Settings

See the section "Creating a Port Service for a Modem" in Chapter 5 of *Customizing the DG/UX System*. Inspect these settings:

- **Hangup:** force a hangup before initializing the line. Set this value to no (the default).
- **Bidirectional?:** specify whether the line is used for calling out as well as for receiving incoming calls. No (the default) indicates that the line is for incoming calls only.

- **wait-read value:** wait for this number of New Line characters before displaying the login prompt. Enter 2 or more (the default is none), then tell users who may try to log in through the modem that they must press New Line this number of times in order to get the login prompt.
- **Timeout:** wait this number of seconds between typed characters, then restart the login sequence. Enter 30 (the default), then tell users that they have this much time to complete login.

4.7.4.16.2 Turn Off Result Codes

The steps for disabling response codes are given below: for `ttyXX`, enter the port used by the modem.

- Make `uucp` the owner of the port:

```
# chown uucp /dev/ttyXX
```

- Define the device, by adding a line like the following to the `/etc/uucp/Devices` file:

```
Direct ttyXX,M - 2400 direct
```

Set a baud rate, 2400 in the example, that is correct for your modem.

- Call the line. Type this command:

```
# cu -d -l ttyXX
```

- At this point, a number of message lines appears. After you get the message `_receive started`, enter these three modem commands:

```
atq1
at&w
~.
```

The command to turn result codes on is `atq0`.

Note: it is possible that the commands are different for your modem. Consult the owner's manual for your modem if you have problems.

4.8 Commands

4.8.1 Internationalization

In DG/UX Release 5.4.2, 119 commands (listed below) can now produce messages in languages other than English. Also, the format of error messages from these 119 commands has changed. Now, labels (such as "UX:ls:") and severities (such as "ERROR:") are prepended to messages. These changes may affect software which is dependent on specific English content or on pre-DG/UX 5.4.2 message formats.

To illustrate the format change, in DG/UX Release 5.4 and DG/UX Release 5.4 Update 1, typing `ls foo` when file `foo` does not exist results in this message:

```
foo: No such file or directory
```

In DG/UX Release 5.4.2, this message appears:

```
UX:ls: ERROR: Cannot access foo: No such file or directory
```

By default, messages are displayed in English. If foreign language message catalogs are present on your system, and if the environment variables `LC_MESSAGES` or `LANG` are set to an appropriate value, messages appear in the selected language.

The commands that support multi-language messages are:

accept	cron	grep	lpsystem	ps	tee
alpq	crontab	iconv	lpusers	pwd	test
at	csplit	join	ls	red	touch
atq	cut	jsh	mail	reject	tr
atrm	date	kbdcomp	mailx	rm	tty
awk	dd	kbdload	mesg	rmail	ttyadm
banner	diff	kbdpipe	mkdir	rmdir	ttydefs
basename	dirname	kbdset	mv	rsh	ttymon
batch	disable	kill	newgrp	sed	uname
cancel	ed	lfmt	news	sh	uniq
cat	egrep	ln	nl	shl	unpack
cd	enable	login	nohup	sleep	vedit
chgrp	expr	lp	od	sort	vi
chmod	fgrep	lpadmin	pack	split	view
chown	file	lpfilter	passwd	stty	wait
cmp	find	lpforms	paste	su	wall
col	gencat	lpmore	pcat	sum	wc
comm	getopt	lpsched	pfmt	tabs	who
cp	getopts	lpshut	pg	tail	write
cpio	gettxt	lpstat	pr	tar	

In addition to error message format changes, note these enhancements for support of multiple languages:

- A new option, `-d`, has been added to the `mkmsgs` command. With this option, `mkmsgs` writes to standard output the original text strings that were used to create the existing `msgfile`.

- The following commands, in some cases, prompt the user for yes/no responses before continuing: **cp**, **find**, **ln**, **mv**, **rm**, **tar**. Multi-language support has been added for these commands. Depending on the setting of the LANG environment variable, the commands will prompt in, and accept responses in, languages other than English.

4.8.2 Printer Services

The LP subsystem has been modified and enhanced as indicated below.

4.8.2.1 New LP Filters

Three new printer filters are included in this release: **pageprint**, **epsonfx** and **proprinter**.

The **pageprint** filter allows you to print pages selectively with line printers. To do so, use the **lp** page selection option (**-Ppage-list**), where *page-list* can be individual pages or a range. Thus, you can reprint misprinted or missing pages, or restart a print request at a specified page. This option can be used with **lp** forms.

To configure **pageprint**, specify a printer's input content type as **simple**, or some content type based on **simple**, such as **epsonfx**. You can set input content types through **sysadm**, or with **lpadmin**. The **pageprint** filter adjusts to the page length and width as well as the line (lpi) and character (cpi) pitch given with **lp**.

The **epsonfx** filter enhances support for printers that include an **epsonfx** emulation. This filter allows you to select many standard **epsonfx** features such as print quality, tab settings, and margin settings. Printer-specific features, such as alternate paper tray selection and color selection, are also available for printers that support the features.

To configure **epsonfx**, specify a printer's input content type as **epsonfx**. To access **epsonfx** features from **lp**, use the option **-y mode**, where *mode* is the desired feature.

Provided with the **epsonfx** filter are these new **terminfo** entries for generic **epsonfx** printers, as well as for Data General printers that offer **epsonfx** emulation:

epsonfx	dg6617-epsonfx-80	dg6515-epson
epsonfx-80	dg6618-epsonfx	dg6515-epson-80
oki320-epsonfx	dg6618-epsonfx-80	epson800
oki321-epsonfx	dg6594-epsonfx	epson1000
oki321-epsonfx-80	dg6594-epsonfx-80	epson1000-80
dg6617-epsonfx	dg6514-epson	

The printer's type should be set to one of these entries. You can set the printer type and input content type through **sysadm**, or with **lpadmin**.

The **proprinter** filter provides advanced support for printers that include an IBM **proprinter** emulation. This filter allows you to select many standard **proprinter** features such as print quality, tab settings, and margin settings, and includes support for printer-specific features such as alternate paper tray selection.

To configure **proprinter**, specify a printer's input content type as **proprinter**. To access **proprinter** features from **lp**, use the option **-y mode**, where *mode* is the desired feature.

Provided with the **proprinter** filter are these new **terminfo** entries for generic **proprinter** printers, as well as for Data General printers that offer **proprinter** emulation:

```
proprinter          dg6594-proprinter
proprinter-80      dg6594-proprinter-80
proprinterXL       dg6618-proprinter
proprinterII       dg6618-proprinter-80
oki320-proprinter  dg6617-proprinter
oki321-proprinter  dg6617-proprinter-80
oki321-proprinter-80
```

The printer's type should be set to one of these entries. You can set the printer type or input content type through **sysadm**, or with **lpadmin**.

4.8.2.2 LP Enhancements

The LP subsystem now provides tty emulation support for the parallel printer device **/dev/lp**. This means that when you add a new **/dev/lp** printer with **sysadm**, you can specify **stty** options. You can set up multiple logical printers to use **/dev/lp**, each with unique **stty** options.

For example, you can set up one **/dev/lp** printer for graphics by specifying the **-raw** option, and another for text processing by including the newline expansion option **-onlcr**.

If no options are specified, **/dev/lp** defaults to newline expansion (**-onlcr**) and tab expansion (**-tab3**).

4.8.2.3 LP Bug Fixes

Problems associated with Parallel PostScript printing in DG/UX Release 5.4 Update 1 are now corrected. Use these settings when adding a PostScript printer.

Parallel PostScript Settings

```
Input content type: PS
Printer type:       PS-b (normal stacking)
Printer type:       PS-br (reverse stacking)
Interface:          standard
```

Serial PostScript Settings

```
Input content type: PS
Printer type:       PS (normal stacking)
Printer type:       PS-r (reverse stacking)
Interface:          standard
```

Termprinter PostScript Settings

```
Input content type: PS
Printer type:       PS-b (normal stacking)
Printer type:       PS-br (reverse stacking)
```

Interface: standard

4.8.3 Backing Up /root and /usr

A new script is provided that allows you to back up **/root** and **/usr** of an installed system to a bootable tape. See **systemtape(1M)**.

4.8.4 Using dump2 and restore

A new switch, **-V**, has been added to **restore**: display the files that would be restored, but do nothing. Use this option to verify a backup. See the manual page for additional information.

So that **dump2** and **restore** can be used with tape drives that support hardware data compression, the **/etc/dumptab** file has been modified.

4.8.5 Using who

Previously, **who** with the **-l** option listed the lines available for login. Now, the **-l** option lists the utmp entries for:

- Active port monitors, and
- Any ports monitored by **ttymon** processes running in express mode where no login session has been started.

The previous behavior is no longer supported. For port monitoring, DG/UX Release 5.4.2 uses **ttymon**, which does not put initial entries into **/etc/utmp**, but only adds entries as tty lines come into use.

The **-l** option is not recommended. Its behavior depends on USL decisions about the direction of System V Release 4. The option could change again, or be eliminated.

4.8.6 Using cu

The **cu** command has been enhanced. Previously, diversions to files had to be enabled explicitly with the commands **~%old** (enable silent diversions) or **~%divert** (enable unsolicited diversions). Now, these options can be enabled by setting environment variables **CU_OLD_STYLE** (= **~old**) and **CU_DIVERT** (= **~divert**). See **cu(1)**.

The **cu** command now sets modes CS7, CS8, ISTRIP, and -ISTRIP exactly as assigned by **stty**. The **-b7** switch forces CS7 ISTRIP; the **-b8** switch forces CS8 -ISTRIP.

4.8.7 Problems to Avoid: Commands

4.8.7.1 Loading /usr with restore

If you invoke **restore** to reload a backup of the **/usr** file system that was made with **dump2**, the operation will fail when **/usr/sbin/restore** attempts to overwrite itself. In revisions of DG/UX later than 5.4, a memory-mapped program cannot overwrite itself during execution. There are two simple workarounds for this problem:

- If you are using **sysadm**, invoke **restore** interactively and select for restoration all files in **/usr** except **/usr/sbin/restore**.
- To be able to use **restore** directly on **usr**, copy the program from **/usr/sbin** to **/tmp**, then invoke **/tmp/restore**.

4.8.7.2 Using Wildcards Inside Backquotes with csh

In the C shell (**csh**), there is a small problem with backquote expansion. If, within a backquote, you use a wildcard that matches a large number of files (more than 3000), your **csh** process may lock up. If this happens, kill the locked process and start a new **csh** process.

4.8.7.3 Using vi: Recovery Files

If your **vi** editing session is aborted, the system normally does the following:

- From a copy of your edit file (in **/tmp** by default), copies a recovery file to **/var/preserve/your-login-name**
- Notifies you, by email, of the recovery file's existence, and tells you how to recover the file: type **vi -r file**, where *file* is the name of the file you were editing at the time of the abort.

If there is insufficient space in **/var/preserve**, the recovery file will not be created and you will not be notified. If you suspect that this has happened (for example, your editing session was aborted and, after a reasonable wait, you have not received an email notification), you can do the following to make certain that you do not lose any recovery data:

- Type **vi -L** to find out whether recovery data is present. You will see a display like the following:

```
/usr/preserve/your-login-name:
No files saved.
/tmp:
On Fri Dec 24 and 9:13 saved 2502 lines of file "merry.christmas"
```

- Make sure that there is sufficient space in **/tmp** (or whatever directory contains the recovery file) to contain an additional copy of your recovery file. If there is not, you will lose your recovery data.

- Type `vi -r /tmp/merry.christmas`

If the directory `/tmp` is full when you type the command above, the message `No space left on device` appears. This indicates that your recovery information is lost.

4.8.7.4 Specifying Printer Classes

Printer classes are not supported in DG/UX Release 5.4.2. If you set up a printer class named *class* and enter it with `lp`:

```
lp -d class file_to_print
```

this error message appears:

```
UX:lp: ERROR: There is no filter to convert the file content.
UX:lp: TO FIX: Use the lpstat -p -l command to find a
           printer that can handle the file type
           directly, or consult with your system
           administrator.
```

Data General will release a patch to correct this problem. If your printer configuration requires the use of printer classes, you should consider postponing the installation of DG/UX Release 5.4.2 until the patch is available.

4.8.7.5 Printing on Remote Printers

In earlier DG/UX revisions, the request to print multiple copies of a file (`lp -n`) did not work with postscript files. This problem is fixed in DG/UX Release 5.4.2, but the fix does not extend to remote systems running earlier revisions. For example, the command `lp -n2 -dps file.ps` will work correctly where printer `ps` is installed on an AViiON system running DG/UX Release 5.4.2. But if the destination printer is installed on a system running an earlier DG/UX revision, only one copy of the file `file.ps` will be printed.

When you print to a remote printer, the file to be printed is copied to `/var/spool` of the printer's host. If, at the time you submit a print request to a remote printer, there is insufficient space in `/var/spool` to contain the file, it may be printed only partially or not at all. This problem will be fixed in a future release.

There is a bug in `lpsched` that causes remote lpNet jobs to be hung in a print queue on the client side when multiple `lp` requests are submitted close together. The workaround is to issue the following command:

```
lp -i request-id
```

where *request-id* is the identifier of any of the hung print requests. Another workaround is to stop and restart the scheduler on the client host. Note that this problem is on the client side and does not affect the `lp` scheduler on server side.

Periodically, a print request submitted to a BSD UNIX system may get stuck in the local DG/UX queue. To find out whether this problem may have occurred, type `lpstat -t1`. This will tell you if a job is queued remotely.

To work around this problem, try logging in as root and typing these commands:

```
lpshut
/usr/lib/lpsched
```

If this does not work, check the `/etc/hosts.equiv` file on the BSD system, to make sure the file contains an entry for your host.

If you get a mail message stating that your job could not print due to access problems, retry your job by either "`cat <file> | lp ...`", or add "`-c`" to the `lp` line to make a copy of the file you are printing. This copy made by the `lp` subsystem will not have access problems. If you are printing from a software package, such as a spreadsheet or a word processor, make sure that the `-c` flag is added to the `lp` command line generated by your software.

4.8.7.6 Printing on Serial PostScript Printers

A print job submitted to a serial PostScript printer on an AViiON 5000 series system may be truncated. The problem may occur with Data General model 6646T, 6779T, 6772, and 6773 printers that are connected by cable 15340E, through a VDA cluster box (VDC/8p/16) or a VAC 16. The problem will be fixed in a future release. Meanwhile, to work around the problem, add `clocal` to the `Stty options:` field on the `sysadm Device->Printer->Devices->Modify` menu.

4.8.7.7 Using Electronic Mail

Do not save a `mail` or `mailx` folder containing 8-bit characters (binary files) that was created on a pre-5.4 DG/UX system, or on a non-DG/UX system. Doing so will corrupt the mailbox. Setting the locale so that the ISO 8859-1 character set is used may solve this problem, by changing the type of the message from binary to text.

The `mailx` program uses the `/tmp` directory of the local host. If this directory is full at the time you quit `mailx` with `save`, some messages may be truncated. This problem will be fixed in a future revision. Meanwhile, if you get this message:

```
mailx: Your mailfile was found to be corrupted.
      (Unexpected end-of-file).
      Message #nn may be truncated.
```

exit from `mailx` without saving. Then, before restarting `mailx`, delete some unneeded files in `/tmp`.

4.8.7.8 Using oawk

The `oawk` program is no longer supported. Use `awk` instead. Change any scripts using `oawk` so that they use `awk`.

5 Notes and Warnings

For readability and ease of reference, this release notice discusses any notes or warnings along with enhancements and changes. See, in the previous section, the subsections "Problems to Avoid."

6 Documentation

For a current list of DG/UX and AViiON manuals, see *Guide to AViiON and DG/UX System Documentation* (069-701084-02). (Note: this release does not include an online version of the *Guide*, as previous releases did.)

6.1 New Manuals

<i>Programmer's Supplement for Release 5</i>	(069-100474-00)
<i>VLCi Ethernet LAN Controller (CMC-130) Reference Guide</i>	(014-002152-00)
<i>Technical Notice: Setting Up and Installing VLCi Controllers in AViiON Systems</i>	(014-002153-00)
<i>VFDDI (4211 Peregrine) User's Guide</i>	(014-002154-00)
<i>Technical Notice: Setting Up and Installing VFDDI Controllers in AViiON Systems</i>	(014-002155-00)
<i>Configuring and Installing VSC3i Controllers in AViiON Systems</i>	(014-002151-00)
<i>The High-Availability Disk-Array Subsystem II (H.A.D.A. II): Configuring and Managing the Rackmount Model and Installing, Configuring, and Managing the Deskside Model</i>	(014-002168-00)
<i>Installing, Configuring and Programming the Model 7430 VME SCSI-2 Adapter (VSA) in AViiON Systems</i>	(014-002163-00)
<i>Installing and Operating the Model 6762 Digital Audio Tape (DAT) Drive</i>	(014-002138-00)
<i>Installing and Operating Model 6760 and 6761 Cartridge Tape Drives</i>	(014-002169-00)
<i>Installing and Operating the Model 6691 Stand-Alone Cartridge Tape Drive</i>	(014-002158-00)
<i>Installing and Operating the Model 6690 Stand-Alone CD-ROM Drive</i>	(014-002162-00)
<i>Installing and Configuring OpStar Optical Disk Subsystems Series 6613 and 6614</i>	(014-510346-00)
<i>Using OpStar Optical Storage Software</i>	(093-510347-00)
<i>Setting Up and Installing VME Cache Memory with Battery Backup Modules in AViiON Systems</i>	(014-510511-00)
<i>Connecting Your Modem and Enabling AV/Alert</i>	(015-000361-00)
<i>AViiON Series Computer Systems Automatic Reporting and Remote Assistance</i>	(015-000356-00)
<i>User Guide for the Service Manager Interface Used on AViiON Systems</i>	(015-000362-00)

6.2 Revised Manuals

<i>Guide to AViiON and DG/UX System Documentation</i>	(069-701085-02)
<i>Installation Roadmap to DG/UX for AViiON Systems</i>	(069-701084-02)
<i>Installing the DG/UX System</i>	(093-701087-02)
<i>Customizing the DG/UX System</i>	(093-701101-02)
<i>Managing the DG/UX System</i>	(093-701088-02)
<i>Using the DG/UX System</i>	(069-701035-02)
<i>Using TCP/IP on the DG/UX System</i>	(093-701023-03)
<i>Managing TCP/IP on the DG/UX System</i>	(093-701051-05)
<i>Porting and Developing Applications on the DG/UX System</i>	(069-701059-04)
<i>Programming in the DG/UX Kernel Environment</i>	(093-701083-01)
<i>Using the DG/UX Kernel Debugger</i>	(093-701075-02)
<i>Writing a Standard Device Driver for the DG/UX System</i>	(093-701085-00)
<i>Installing and Operating the Cartridge Tape Drive Models 6675, 6676, 6677, and 6756</i>	(014-001953-02)
<i>Installing the 3-1/2 Inch Disk Drive: Models 6662, 6796 and 6799</i>	(014-002139-02)
<i>Installing Model 6811-B and Model 6660 Series Disk Drives</i>	(014-001940-01)

6.3 Obsolete Manuals

Effective with this release, the AView library is a category C product. The manual *Programmer's Reference for the AView Graphics Library* (093-000717-00) is no longer available.

Beginning with this release, Data General no longer publishes the DG/UX reference manuals. However, the documents on which the manuals were based -- the manual pages -- are still updated and provided online with each DG/UX release. Type **man man** for instructions about how to view and print manual pages.

<i>Programmer's Reference for the DG/UX System, Vol 1</i>	(093-701055-03)
<i>Programmer's Reference for the DG/UX System, Vol 2</i>	(093-701056-03)
<i>Programmer's Reference for the DG/UX System, Vol 3</i>	(093-701102-01)
<i>System Manager's Reference for the DG/UX System</i>	(093-701050-03)
<i>User's Reference for the DG/UX System</i>	(093-701054-03)

6.4 New or Revised Manual Pages

The following manual pages are new in DG/UX 5.4.2:

addsev(3C)	admfailoverapplication(1M)	admfailoverdisk(1M)
admfailovergiveaway(1M)	admfailoverhosts(1M)	admfailovertakeaway(1M)
admdisk(1M)	admmdisk(1M)	admpdisk(1M)
admreleasemedium(1M)	admups(1M)	binarsys(4M)
cien(7)	dgsc(7)	dtl(1)
epsonfx(1)	failover(4M)	failoverd(1M)
filesystem(2)	gen_toc(1M)	iso-88591(5)
iso-88592(5)	iso-88597(5)	lfmt(1)

lfmt(3C)	mkmsgs(1M)	nvrld(7)
pageprint(1)	pefn(7)	pfmt(1)
pfmt(3C)	proprinter(1)	ps_isolatin1encoding(5)
ps_standardencoding(5)	ps_symbol(5)	setcat(3C)
setlabel(3C)	stty(3C)	syncadm(1M)
synccheck(1M)	systemtape(1M)	upsd(1M)
vlfmt(3C)	vpfmt(3C)	vsxb(7)
wanadm(1M)		

The following manual pages have been renamed in DG/UX 5.4.2:

Old Name	New Name
dg_allow_shared_descriptor_attach(2)	dg_allow_shd_attach(2)
dg_attach_to_shared_descriptors(2)	dg_attach_to_shds(2)
directory(3X)	directory(3C)
lptermprinter(1)	lp.termprinter(1)
sde-chooser(4)	sde-chooser(1)

The following manual pages have been revised for DG/UX 5.4.2:

abort(3C)	admtcpipparams(1M)	alarm(2)
arp(6P)	berk_sigpause(2)	chmod(2)
cisc(7)	connect(2)	cu(1)
dbm(1M)	dg_sysctl(2)	dg_telnetd(1M)
exec(2)	fread(3S)	ftp(1C)
ftpd.deny(4M)	ftpd(1M)	gcc(1)
getuid(2)	hada(7)	hken(7)
hosts.equiv(4M)	ifconfig(1M)	insc(7)
intro(6)	iscd(7)	lsd(1M)
lseek(2)	man(1)	msgrcv(2)
ncsc(7)	ptsname(3C)	rarp(6P)
remsh/rsh(1C)	restore(1M)	rexecd(1M)
rlogin(1C)	ruptime(1C)	rwho(1C)
rwhod(1M)	sar(1)	sd(7)
sendmail(1M)	sigaction(2)	snmpd_files(4M)
ssid(7)	st(7)	stat(2)
string(3C)	tcpip.params(4M)	tftpd(1M)
unlink(2)	who(1)	write(2)

6.5 Documentation Changes Files

The manual *Managing ONC/NFS and Its Facilities on the DG/UX System* (093-701049-03) includes instructions for creating a new master server, customizing an NIS server, and setting up automount. The file `/usr/release/093701049_03` amends these instructions and corrects some erroneous references in the ONC/NFS manual.

The manual *Managing the DG/UX System* (093-701088-02), Chapter 7, includes instructions for setting up and managing disk caches and disk mirrors. The file `/usr/release/093701088_02` amends these instructions. The file also corrects a typographical error in an `ldm_dump` example.

7 Software Distribution

7.1 Media

The DG/UX System is available in these models:

- Model Number P001A, the **DG/UX Operating System with the X Window System** package:

068-600004-00 (CD-ROM) or
079-600243-00 (QIC-150 cartridge tape).

- Model Number Q001A, the **DG/UX Operating System** package:

068-600003-00 (CD-ROM) or
079-600242-00 (QIC-150 cartridge tape).

7.2 Files

The following online files, in directory `/usr/release`, list the contents of the DG/UX Release 5.4.2, base model:

dgux_5.4.2.fl
tcpip_5.4.2.fl
onc_5.4.2.fl
nfs_5.4.2.fl
gcc_2.2.3.fl

If you are installing the workstation model (P001A), see the DG/UX™ X Release Notice for the names of other online files listing the contents of that model.

8 Installation Instructions

The primary instructions for installing DG/UX Release 5.4.2 from the release media (tape or CD-ROM) are contained in the manual *Installing the DG/UX System* (093-701087-02). Additional setup information is provided in *Customizing the DG/UX System* (093-701101-02). For full explanations of the **sysadm** installation and management program and other management topics, see *Managing the DG/UX System* (093-701088-02).

Before beginning installation, see section 3, "Environment," for changes in memory, swap, and disk space requirements or defaults, and for required PROM revisions.

The release tape or CD-ROM includes a patch for two problems in the **dev.a** kernel library. If you have a H.A.D.A. II device and/or a dual-initiator configuration, it is especially important that you install this patch. For more information about these problems and loading instructions for the patch, see the `dgux_5.4.2.p01` patch notice, part number 017-600018-00.

This section notes points about installation that may not be fully covered in the latest documentation.

8.1 Disk and File System Space Requirements

If you are upgrading from a previous release and installing from tape, make sure you have enough free disk space before beginning installation: in **/root** and **/usr** for the base model (Q001A), and in these plus **/usr/opt/X11** for the workstation model (P001A). (If you are installing from CD-ROM, the installation scripts will check the free disk space, and will not begin if the available space is inadequate.) Starting installation without adequate disk space will result in needless downtime.

Space requirements in **/root** and **/usr** are unchanged since DG/UX Release 5.4 Update 1. Assuming you plan to load all packages on a system currently running DG/UX Release 5.4 Update 1, the space requirements in these file systems are as follows:

- If you have more than 24,000 free blocks in **/root** and more than 175,500 free blocks in **/usr**, installation will succeed.
- If you have fewer than 17,000 free blocks in **/root** or fewer than 27,500 free blocks in **/usr**, installation will fail.
- If the free space in **/root** or **/usr** falls between these ranges, installation may succeed or fail, depending on the location and size of existing files.

The space requirement (in **/usr/opt/X11**) for the workstation model of DG/UX (P001A), assuming you load all X Window System images, has increased since DG/UX Release 5.4 Update 1, from 105,000 blocks to 150,000 blocks. If you are installing the workstation model, read the DG/UX X Window System release notice. Some important points about upgrading the X Window System software are noted below.

One of the installation prompts asks you which software packages you wish to install. You can accept the default (all), or indicate the packages by name. In the following two situations, you should indicate that you do *not* wish to load the X Window System software package:

- Your system lacks the additional 45,000 blocks of free disk space that the X software for DG/UX Release 5.4.2 requires. See the DG/UX X Window System release notice for options to work around this problem.
- You do not want to install the X software into a logical disk mounted as **/usr/opt/X11**.

In these two cases, you can load and install the X Window System software at a later time, using the **sysadm Software -> Package -> Load** operation.

If you are upgrading to DG/UX Release 5.4.2 and installing the X Window System software, the installation script detects that the **/usr/opt/X11** file system is too small, and asks you to confirm its expansion. Reply yes (the default). If you indicate that you do *not* want the **/usr/opt/X11** file system expanded, the script loads the X Window System software into the **/usr** file system instead. This may not be what you want. Loading the X Window System software into **/usr** is likely to cause other parts of the installation to fail: for example, the loading of the manual pages, which normally go in **/usr**, might fail due to insufficient file space.

To prevent disk space problems with the current and future releases or updates, we recommend that you remove, from **/root**, **/usr**, and **/usr/opt/X11**, any files that are not part of DG/UX releases.

9 Preparing a Software Trouble Report (STR)

If you believe you have found an error in the DG/UX system or its documentation, or if you have a suggestion for enhancing or improving the product, tell Data General about it. Here's how:

- Describe the problem or request using a Data General Software Trouble Report (STR) form. See "Describing Problems" below.
- For software problems, prepare a tape containing diagnostic information and problem illustrations. See "Preparing STR Tapes" below.

A copy of the standard STR form suitable for printing on a line printer is in the file **/usr/release/STR_form**. STR forms are also available from the nearest Data General office, from your representative, or from the Customer Support Center. Depending on your support contract, you submit STR reports to the Customer Support Center or directly to your Data General representative.

9.1 Describing Problems

For each problem you report, fill in the 3-page STR form completely. Where asked for the release, enter Release 5.4.2. For the name and model number, enter:

- TCP/IP and C001A for TCP/IP problems

For assistance in diagnosing, describing, and solving TCP/IP problems, see *Managing TCP/IP on the DG/UX System* (093-701023-03).

- NFS and C002A for NFS problems

- DG/UX and P001A for other DG/UX problems

Also, indicate the type of STR you are writing:

- An enhancement request: Describe it clearly and explain why you want it.
- A documentation error: Identify the document – the manual page name, the document title, ordering number, the page number(s) and section(s) containing the error. Explain the error if necessary.
- A software problem: Clearly describe the problem, indicating how to reproduce it.

If you are reporting a problem that involves or results in a system panic or hang, your STR form **must** be accompanied by a tape containing:

- In file 0, a system memory dump
- In file 1, a **cpio** copy of your tailored system file (usually named **/dgux**)
- Optionally, in file 2, a **cpio** copy of other files (logs, program source and executable files, shell scripts, and so on) that cause, illustrate, or document the problem.

An accompanying tape is also essential for problems caused by programs not supplied by Data General. Include a copy of the executable program file **and** of the source file.

If your STR includes a tape, indicate in the problem description the tape's organization and contents.

9.1.1 System Halts or Hangs

If the system hangs:

- Try the "hot key" sequence: while holding down **Ctrl**, alternately and rapidly press [and] until the SCM prompt appears.
- If the hot key does not shut the system down, reset your machine using the reset key or button. Once in the SCM, enter "**reset**" followed by "**start 1000**". This invokes the dump dialog, illustrated in "Preparing STR Tapes," below.

9.1.2 Incorrect Behavior By a System Call or Device Driver

Write the **shortest possible** program that demonstrates the problem. This can be a shortened version of your actual program, without unnecessary variables and logic. Supply both source and executable copies of this program and a copy of the system image (**/dgux**), along with a detailed description of how to reproduce the problem.

9.1.3 Incorrect Behavior of a Command

Write the **shortest possible** shell script that demonstrates the problem. Supply a copy of this script with a detailed description of how to reproduce the problem. Before submitting the problem, be sure that it can be duplicated under “sterile” conditions; for example, with a standard path, standard permissions on files, and so on. In other words, try to ensure that your environment is not the cause of the problem.

9.1.4 Fast-Recovery File System

If you are filing an STR about the fast-recovery file system, include `/etc/log/fast_fsck.log` on the STR tape. Include also on the tape all output produced by the fast-recovery or normal run of `fsck` that reported problems. When `fsck` is run as part of an `init` script, that output is placed in `/etc/log/fsck.log`. If you run `fsck` manually, get this information for the STR tape by redirecting output to a file or piping it through `tee`.

9.2 Preparing STR Tapes

In most cases, a software error report should include both a filled-in STR form and an STR tape. While Data General wants to know of any problems you may encounter, those reported without accompanying diagnostic information are very difficult to solve.

There are two types of system error: those associated with system panics or hangs (type 1), and those having to do with failure of specific programs or components only (type 2). A type 1 STR tape **must** include a system memory dump (tape file 0) and a copy of the system image (tape file 1); it may also contain other requested files (tape file 2). A type 2 STR tape includes only the latter: program source, executable, and output files that demonstrate the problem, in tape file 0.

There is a place on the problem description form for you to indicate whether a tape is provided, and if so, how the tape is organized. There is also a place for recording the panic code. Be sure to provide this information.

The behavior of your system after a panic depends on two configurable system parameters:

- The default dump device, which may be the name of a tape drive, a logical disk, or a network controller.
- The default behavior, which may be:
 1. Prompt the operator to confirm whether memory should be dumped, and to which device. (This, the default, is the usual choice when the default dump device is a tape drive.)
 2. Dump memory to the default dump device without asking. (This is a good choice when the dump device is a logical disk.)
 3. Do not dump memory.

Option 3 – skip the memory dump – is not recommended. To force a memory dump after a panic when this option is set, you can press the reset button, then boot with the `-d` option to initiate the system dump dialog.

9.2.1 The System Dump Dialog

When option 1 (prompt) is set, a dialog ensues after a panic at the system console. The dialog differs slightly depending on whether the dump device is a tape drive, a logical disk, or a network device. At each prompt, you can accept the displayed default or enter an overriding value.

To the prompt that asks whether to limit the dump to kernel memory, take the default (yes) unless you are told otherwise by a Data General representative. A full memory dump is seldom required.

9.2.1.1 Dump to Tape

If the default dump device is the local tape drive `st(inc(),4)`, a dialog like the following ensues:

```
Do you want to take a system dump? [Y] ↵
Limit the main memory dump to kernel memory only (no user memory)? [Y] ↵
Dump destination device? st(inc(),4) ↵
Mount tape. Type newline when tape is ready. ↵
```

If the system memory image is too large to fit on one tape, these prompts appear:

```
Tape volume 1 completed.
Mount tape. Type newline when tape is ready. ↵
```

If any tape volume write fails, you can restart the dump at the beginning of that volume:

```
Hard error on tape volume 1. Restarting volume from checkpoint.
Mount tape. Type newline when tape is ready. ↵
```

By default (you can change the default with `dg_sysctl(1M)`) the final volume rewinds upon completion of the dump:

```
System dump completed successfully.
```

Before submitting this tape with an STR, append a copy of your system file and other relevant material. See "STR Tape Examples," below, for illustrations.

9.2.1.2 Dump to Logical Disk

If the default dump device is a logical disk named `/dev/rdisk/sys_dump` on the physical disk `sd(inc(),0)`, this dialog occurs:

```
Do you want to take a system dump? [Y] ↵
Limit the main memory dump to kernel memory only (no user memory)? [Y] ↵
Dump destination device? ldm_dump(sd(inc(),0),sys_dump) ↵
```

To submit an STR, transfer the memory dump to tape, append a copy of your system file, and append other relevant material. See "STR Tape Examples" below for illustrations.

9.2.1.3 Dump to a Network Device

If you are at a diskless workstation, a dialog like the following occurs after a panic:

```
Do you want to take a system dump? [Y] ↵
Limit the main memory dump to kernel memory only (no user memory)? [Y] ↵
Dump destination device? inen() ↵
```

Only the workstation's communications controller name—**inen()** or **dgen()**—will work as the dump device. If any other value appears, override it.

The memory dump is written to a file on the server's disk specified in the server's **/etc/bootparams** file. Then the workstation boots from the boot path specified in **/etc/bootparams**.

If you encounter a problem, such as insufficient file space or incorrect permissions on the server, go to the server and fix the problem. Then come back to the workstation and boot, specifying the option that first initiates the dump dialog:

```
SCM> b inen() -d ↵
```

To submit an STR, transfer the memory dump to tape and append a copy of the system file. (Sample commands are given in the next section.)

9.3 STR Tape Examples

9.3.1 Copy a Panic Dump to Tape

Effective with this revision of DG/UX, you can specify a logical disk unit as the default system dump device. If you have selected this option, the first step in preparing an STR tape (for a problem connected with a system panic) is to transfer, from the logical disk to tape, the system memory image that was dumped after the panic. The command below transfers a memory dump from a logical disk named **/dev/rdisk/sys_dump** to the tape in drive **/dev/rmt/0n**:

```
# lsd /dev/rdisk/sys_dump /dev/rmt/0n ↵
```

The memory image is copied to file 0 of the tape. Note that the no-rewind option (**n**) is specified for the drive. This is so the tape will be ready for writing file 1. You can skip the next section and go to "Copy Your Tailored System File."

9.3.2 Position to the End of a Dump Tape

Your system may be set up so that, in the event of a panic, it copies a memory dump to file 0 of a tape in a specified drive. If so, you prepare an STR tape by appending the system image to the tape containing the panic dump. But first, to prevent overwriting file 0 on the tape, make sure the write head is located at the end of file 0 and ready to write file 1 (next step). Assuming the tape drive is named `/dev/rmt/0n`, the command is:

```
# mt -f /dev/rmt/0n fsf ␣
```

This step may not be necessary, but it will do no harm. (By placing a semicolon after the command above, you can combine this step with the next step.)

9.3.3 Copy Your Tailored System File

In all cases, an STR tape that includes a memory dump image must also include a copy of your tailored system file. Without an image of the operating system that was running when the panic occurred, a memory dump is useless for diagnosis. The following command transfers the system file named `dgux` to tape drive `/dev/rmt/0n`:

```
# cd /; echo dgux | cpio -oBcv > /dev/rmt/0n ␣
```

The system file is copied to file 1. The tape, because it was not rewound, is ready for writing any additional files to file 2.

9.3.4 Copy Additional Diagnostic Files

For copying any additional files to the STR tape, use a command line like this:

```
# ls filenames | cpio -oBcv > /dev/rmt/0 ␣
```

This example assumes `filenames` is a template for files in the current directory that you wish to copy. The tape rewinds after this command line. It is now ready for forwarding to Data General with the STR and problem description forms.

9.3.5 Preparing an STR Tape for a Diskless Workstation

The following sample commands make an STR tape for a diskless workstation:

```
# cd /srv/dump ␣
# ls diskless_client_name | cpio -oBcv >/dev/rmt/0n ␣
# cd /srv/release/PRIMARY/root/_kernels ␣
# ls dgux.diskless | cpio -ocvB >/dev/rmt/0n ␣
```

These commands: (1) change to the server directory containing the memory dump; (2) transfer the memory dump to file 0, without rewind; (3) change to the server directory containing the tailored system file; (4) transfer the system file to file 1. The tape is set for copying additional files to tape file 2.

The actual pathname of the memory dump file for a workstation—**/srv/dump/diskless_client_name** in this example— is specified in the file **/etc/bootparams** on the workstation's server. Also, the name of the custom kernel may be something other than **dgux.diskless**.

The commands above assume you are logged into the server. If you are instead logged into the workstation, make sure **/srv/dump** is mounted, issue commands (1) and (2), and substitute these commands for (3) and (4):

```
# cd / ↵
# ls dgux | cpio -ocvB >/dev/rmt/0 ↵
```

9.3.6 Preparing an STR Tape Without a Memory Dump

For problems that do not involve a system dump, put all files associated with the problem in tape file 0, in **cpio** format, using a command like the following:

```
# ls filenames | cpio -oBcv > /dev/rmt/0 ↵
```

Do not use absolute pathnames (for example, starting with /).

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Note: Boldfaced page numbers (e.g., **1-5**) indicate definitions of terms or other key information.

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