digital™

# Software Product Description

**PRODUCT NAME: DIGITAL UNIX® Operating System, Version 4.0C** **SPD 41.61.19**

## DESCRIPTION

The DIGITAL UNIX Operating System is a 64-bit advanced kernel architecture based on Carnegie-Mellon University's Mach V2.5 kernel design with components from Berkeley Software Distribution (BSD) 4.3 and 4.4, UNIX® System V, and other sources. DIGITAL UNIX is Digital Equipment Corporation's implementation of the Open Software Foundation™ (OSF®) OSF/1 R1.0, R1.1, and R1.2 technology, and the Motif® graphical user interface and programming environment.

Under the X/Open UNIX branding program, DIGITAL has received the UNIX 95 brand for the DIGITAL UNIX operating system, and is licensed to use the UNIX trademark in conjunction with the DIGITAL UNIX product.

DIGITAL UNIX provides symmetric multiprocessing (SMP), real-time support, and numerous features to assist application programmers in developing applications that use shared libraries, multithread support, and memory mapped files. The full features of the X Window System™, Version 11, Release 6 (X11R6) from the X Consortium Inc. are fully supported. Selected features of Release 6.1 (X11R6.1) are also supported.

DIGITAL UNIX complies with numerous other standards and industry specifications, including X/Open™'s XPG4 and XTI, POSIX®, FIPS, and System V Interface Definition (SVID). By providing support for the SVID, DIGITAL UNIX supports System V applications. To ensure a high level of compatibility with DIGITAL's ULTRIX Operating System, the DIGITAL UNIX Operating System is compatible with Berkeley 4.3 and System V programming interfaces. DIGITAL UNIX conforms with the OSF Application Environment Specification (AES) that specifies an interface for developing portable applications that will run on a variety of hardware platforms.

## STANDARDS

*XPG4 UNIX*

DIGITAL UNIX conforms to XPG4 UNIX, also known as the Single UNIX Specification, previously known as Spec1170. XPG4 UNIX covers the following specifications of the X/Open Common Application Environment (CAE): System Interface Definitions, Issue 4, Version 2; System Interfaces and Headers, Issue 4, Version 2; Commands and Utilities, Issue 4, Version 2; Networking Services, Issue 4; and X/Open Curses, Issue 4.

DIGITAL UNIX has been branded with the XPG4 UNIX Profile brand, also known as the UNIX 95 Brand. UNIX 95 includes the following component brands: XPG4 Internationalized System Calls and Libraries Extended, XPG4 Commands and Utilities V2, XPG4 C Language, XPG4 Sockets, XPG4 Transport Interfaces (XTI), and XPG4 Internationalized Terminal Interfaces (XCurses). The UNIX 95 Conformance Statement Questionnaire for DIGITAL UNIX is provided in DIGITAL document order number AA-QAKPB-TE.

*XPG4 Common Desktop Environment (CDE)*

DIGITAL UNIX conforms to the XPG4 Common Desktop Environment which covers the following specifications of the X/Open CAE; Window Management (X11R5): Xlib - C Language Binding, Window Management (X11R5): X Toolkit Intrinsics, Window Management (X11R5): X Window System File Formats and Application Conventions, Interclient Communications Conventions Manual (ICCCM), and X Logical Font Description (XFLD), X /Open Motif Toolkit API, Calendaring and Scheduling API, X/Open Common Desktop Environment - Definitions and Infrastructure, and the X/Open Common Desktop Environment - Services and Applications. Although the XPG4 Common Desktop Environment specifies only X11R5 components, DIGITAL UNIX has fully implemented X11R6, while maintaining compliance with the XPG4 CDE Standard.

DIGITAL UNIX has been branded with the XPG4 CDE Profile which includes the following component brands: XPG4 X Window System Application Interface V2, and XPG4 X Window System Display Component.

The CDE Conformance Statement Questionnaire for DIGITAL UNIX is provided in DIGITAL document order number AA-QAKPB-TE.

*Motif*

DIGITAL UNIX provides the OSF/Motif Application Environment. This environment is based on CDE 1.0 (OSF/Motif R1.2.5). This environment conforms to the IEEE POSIX 1295.

*POSIX.1 and FIPS 151-2* DIGITAL UNIX conforms to the IEEE Std 1003.1-1990, POSIX Part 1 - System Application Program Interface (API) [C Language], also referred internationally as ISO/IEC 9945-1:1990, and to the Federal Information Processing Standard, FIPS 151-2. DIGITAL UNIX has been certified with the National Institute of Standards and Technology (NIST). A POSIX.1 conformance document is provided in DIGITAL document order Number AA-PS35D-TE.

*IEEE Std 1003.1b-1993*

DIGITAL UNIX conforms to the IEEE Std 1003.1b-1993 (formally known as IEEE P1003.4), Part 1: System Application Program Interface (API) and Amendment 1: real-time Extension [C Language]. A POSIX.1b conformance document is provided in DIGITAL document order Number AA-PS35D-TE.

*IEEE Std 1003.1c-1995*

DIGITAL UNIX conforms to the IEEE Std 1003.1c-1995, "IEEE Standard for Information Technology—Portable Operating System Interface (POSIX) – Part 1: System Application Program Interface (API)—Amendment 2: Threads Extension [C Language]". A POSIX.1c conformance document is provided in DIGITAL document order Number AA-QWY2A-TE.

*IEEE Std 1003.2-1992*

DIGITAL UNIX conforms to the IEEE Std 1003.2-1992 - Shell and Utilities and providing the following Implementation options: [POSIX2_C_BIND], [POSIX2_C_DEV], [POSIX2_CHAR_TERM], [POSIX2_LOCALEDEF], [POSIX2_SW_DEV], and POSIX2_UPE]. A POSIX.2 conformance document is provided in DIGITAL document order Number AA-QWQQA-TE.

*SVID*

DIGITAL UNIX conforms to the base operating system Section of the System V Interface Definition Issue 2 (SVID2), and to the base operating system and kernel Extension Sections of the SVID Issue 3 (SVID3). DIGITAL UNIX provides more than 400 commands and interfaces that comply with SVID3/SVR4.

*System V Compatibility*

DIGITAL UNIX enhances System V compatibility by means of a habitat mechanism. In those few cases where a given command or interface may behave differently under OSF/1, SVID 2, or SVID 3, the habitat mechanism permits the user to specify which behavior is preferred.

*System V Release 3.2 (SVR3)*

SVID, Issue 2:

DIGITAL UNIX has been tested using the System V Verification Suite 3 (SVVS3) and conforms to the Base System as specified in Issue 2.

A license to use DIGITAL UNIX binaries includes the right to use the included System V Release 3.2 derivatives.

Additional commonly used SVID 2 base commands have been added by the SVID 2 habitat.

*System V Release 4.0 (SVR4)*

SVID, Issue 3:

A significant number of commands and interfaces compatible with SVID3 have been added to DIGITAL UNIX.

The DIGITAL UNIX shared library scheme is patterned on and compatible with the SVR4 shared library scheme.

The SVR4 /proc file system that provides the capability of accessing processes using file semantics is implemented in DIGITAL UNIX.

SVR4 style terminal devices are supported in DIGITAL UNIX. This allows for increased number of terminal connections. Support for BSD tty name will be retired (removed from the DIGITAL UNIX distribution) in a future release, no sooner than March, 1998.

DIGITAL UNIX includes STREAMS compatible with System V Release 4.0. Like sockets, STREAMS provides a framework for character I/O between user space and kernel networking protocols.

Additional features defined as part of the SVID 3 standard are included in DIGITAL UNIX, such as RPC (SVID 3) and sockets.

*Real-time*

DIGITAL UNIX provides a real-time user and programming environment shipped as an optional real-time subset. The DIGITAL UNIX real-time programming environment conforms to the POSIX 1003.1b-1993 standard for real-time which allows portable real-time applications to be developed and to run in a POSIX environment.

In addition to providing a fully preemptive kernel (optionally enabled), the DIGITAL UNIX real-time programming environment supports the following POSIX 1003.1b features:

- Real-time clocks and timers
- Real-time queued signals
- Fixed-priority scheduling policies
- Real-time scheduler priorities
- Counting semaphores
- Shared memory
- Process memory locking
- Asynchronous I/O
- Synchronized I/O
- Process communications facilities
- Message passing interfaces
- Thread safe implementation of real-time libraries

Obsolete functionality from earlier drafts of the 1003.4 specification has been retired. The compile-time constant (POSIX_4D11) previously provided to preserve compatibility with earlier drafts, has also been retired.

*Threads*

DIGITAL UNIX provides software developers the ability to write multithreaded programs using DECthreads. DECthreads provides a pthreads interface that complies with the POSIX 1003.1c semantics and DCE semantics.

*Shared Libraries*

DIGITAL UNIX provides a full complement of dynamic shared libraries, based on System V semantics, which increase system performance, reduce minimum hardware requirements, and ease system management. DIGITAL UNIX provides the following shared libraries:

| Library | Description |
|---|---|
| libDXm | Digital Motif Extensions library |
| libMrm | Motif Resource Manager library |
| libots | Digital Compiled Code Support library |
| libX11 | Xlib library |
| libXaw | X Athena Widgets run-time library |
| libXext | X Client-side Extension library |
| libXie | X Imaging extension client side run-time library |
| libXm | Motif Widgets library |
| libXmu | X Miscellaneous utilities run-time library |
| libXt | X Intrinsics library |
| libXTrap | Client side run-time library for Xtrap |
| libXv | X Video extension client side run-time library |
| libaud | C2 security auditing library |
| libbkr | Motif help system library |
| libc | C library |
| libc_r | Threads version of libc |
| libcdrom | Rock Ridge extensions to CDFS library |
| libcmalib | DECthreads library - CMA interface |
| libcurses | Curses screen control library |
| libdnet_stub | DECnet library |
| libdps | Adobe® Display PostScript™ client-side run-time libraries |
| libdpstk | Adobe Display PostScript toolkit |
| libesnmp | Extensible SNMP library |
| libiconv | Development environment routines |
| libm | Digital Portable Math library |
| libmach | Mach library |
| libmxr | Library used by mxr, the ULTRIX binary interpreter for OSF/1 |
| libpsres | Adobe Display PostScript resources utilities |
| libpthreads | DECthreads library POSIX 1003.1c threaded interface |
| librt | Real-time library (POSIX 1003.1b interface) |
| libsecurity | C2 security library |
| libsys5 | System V Compatibility library |
| libdxterm | DECterm widget library |
| libtli | TLI library |
| libxti | XTI library |
| libICE | Inter-Client Exchange protocol library |
| libSM | Session Management protocol library |
| libUil | Callable UIL compiler |
| libXIE | X Imaging extension V5 client side run-time library |
| libXi | X input extension |
| libXtst | X test extension |

DIGITAL UNIX also provides static versions of these libraries.

## INSTALLATION

Systems with graphic adapters and a minimum of 32MB of memory are presented a MOTIF compliant graphical interface for installation. Other system configurations are presented with a simple text based interface.

DIGITAL UNIX is customer installable. Installation Services are available for those customers who would like an experienced Digital Software Specialist to install the software.

*Update Installation*

An update installation procedure will update the operating system from DIGITAL UNIX Version 4.0 and 4.0A to DIGITAL UNIX Version 4.0B. This procedure preserves appropriate system files and the existing user customized files.

*Full Installation*

A full installation procedure will install DIGITAL UNIX onto the system. Full installations may repartition the system drives removing all existing information. Two options are available with a full installation:

- The default installation process configures the disk with the default UFS file system, and loads the mandatory DIGITAL UNIX software subsets.
- The custom installation provides the ability to customize file system layout and select optional software for installation. Mandatory and dependent subsets are automatically loaded.

*System Cloning*

DIGITAL UNIX includes the ability to duplicate the file system layout, file system type, and software subset selections from identical systems already installed. Performing a cloned installation alleviates the need to answer most questions during the installation procedure.

*License Management Facility (LMF)*

Digital's License Management Facility (LMF) provides on-line checking of software licenses and enables easier software management. LMF incorporates support for two types of licenses, availability and activity. LMF is limited to single node capability.

## USER INTERFACES

*Internet Interface*

DIGITAL UNIX includes the Netscape Navigator® Internet Client World-Wide-Web browser. The software license for this bundled version of the Netscape Navigator Internet client is included with the DIGITAL UNIX base license. Users of earlier versions of DIGITAL UNIX are licensed to use the Netscape Navigator Internet client when they update to V4.0 or V4.0A with an update license or with update services. The Netscape Navigator Internet client includes support for Latin and Japanese fonts.

*User Environment*

The Common Desktop Environment (CDE) is the default user interface for DIGITAL UNIX. CDE 1.0 includes Motif and is dependent on the underlying X Consortium X Window System, Version 11, Release 6 (X11R6) as described in this document.

The Common Desktop Environment functionality replaces the DECWindows Motif Environment as the default user interface. The DECWindows Motif environment, as described in this document, is available as an optional interface accessible through the CDE login manager. The DECwindows Motif applications also continue to be available.

The DIGITAL UNIX user interface environment consists of the following:

- CDE V1.0
- Motif programming libraries and headers
- X11R6 application programming libraries and headers
- Base set of workstation fonts
- X Server

*Common Desktop Environment*

The Common Desktop Environment (CDE 1.0), jointly developed by the CDE 1.0 developers, provides a common user interface that is now available across multiple vendor platforms. CDE includes a range of integrated desktop services including the following:

- The front panel, for controlling access to work spaces, applications, devices, and frequently used objects, tools and functions.
- Session management (including Login Manager, Session Manager, and security features such as session start-up, login password, & screen lock and screen savers)
- Window management via the Window Manager and Workspace Manager
- File Manager for managing objects, files and directories

- Procedural and object-oriented application integration (including drag-and-drop and data interchange capabilities)
- On-line information which includes context-sensitive application help with hyperlink and hypergraphics with access to man pages
- Productivity and collaborative tools including a text editor, icon editor, multimedia-enabled mailer, group calendar, application builder, and terminal emulator
- Data interchange support for multiple formats (including compound formats)
- Environment customization with the style manager and tools to integrate applications into the desktop.
- Visuals (such as icons, color palettes, and backdrops)
- Network services which includes message server and policy and execution and management.

CDE 1.0 contains the following components and libraries:

- Components: dtsession and dtscreeen, dtlogin, dtfile, dticon, dtprintinfo, dtstyle, dtappintegrate, dtcreate, dtwm, dthelpgen/view/print, Dtksh, dtpad, dtaction/dtexec/dtspcd, dtappgather/dtsearchpath, dttypes/actions & filetypes, dtcalc, dtlp, dtcm + utilities, dtmail/dtmime, dtterm
- Development Environment: dtappbuilder
- Libraries: libtt
- Utilities: libXm, libDtHelp, libDtWidget, libDtSvc

CDE is supported on a minimum configuration of 32MB of memory.

CDE, as described above, is comprised of the March 14, 1995 CDE 1.0 Sample Implementation.

DIGITAL UNIX provide enhancements to CDE which include support for the ImageViewer, and Multimedia Services.

*Mail User Agents*

The graphical mail user agent supplied with the Common Desktop Environment, dtmail, provides Multipurpose Internet Mail Extensions (MIME).

DIGITAL UNIX also supplies mail and mailx for character cell systems. The mailx/Mail system is compatible with SVID 2, XPG4, and the Berkeley Enhanced mailer (/usr /bin/ucbmail).

For compatibility with previous DIGITAL UNIX releases, the MH 6.7.1 user agent and the dxmail graphical user agent to MH are provided. The MH mail agent was developed by the RAND Corporation, as an interface to the mail system.

*Motif*

DIGITAL UNIX includes the CDE/Motif V1.0 graphical user interface as previously described.

The Motif programming environment provides an extensive set of Window System libraries and tools for use by developers of new applications. Provided in both shareable and static versions, these libraries include:

- Motif Toolkit (Xm)
- Motif Resource Manager (Mrm)
- Digital extensions to the OSF/Motif Toolkit (DXm)
- User Interface Language (UIL)
- User Interface Language Compiler (UIL)
- Widget Meta-Language Compiler (wml) and description files
- X Toolkit Intrinsics Library (Xt)
- X Library (Xlib)

In addition, DIGITAL UNIX provides the OSF/Motif and X11 programming examples, which are intended as illustrations of various Motif and X11 programming techniques. Note that many of the examples are not fully implemented by the Open Software Foundation but do provide valuable programming information. A README file is included with each example and outlines the features and limitations of the particular application.

*X Window System*

*X11R6*

The X Window System, Version 11, Release 6 (X11R6) is fully supported in DIGITAL UNIX.

The following are new X Consortium standards in Release 6. DIGITAL UNIX provides support for all of these:

- X Image Extensions (V5) - This is a complete implementation of full XIE 5.0 protocol, except for the following techniques that are excluded from the SI: ColorAlloc: Match, Requantize Convolve: Replicate Decode: JPEG lossless Encode: JPEG lossless Geometry:AntialiasByArea, AntialiasByLowpass.
- Inter-Client Communications Conventions Manual Update: - DIGITAL UNIX supports version 2.0 of the ICCCM.
- Inter-Client Exchange Protocol and Library
- X Session Management Protocol and Library
- Input Method Protocol
- X Logical Font Descriptions (update)
- SYNC extension
- XTEST extension

- BIG-REQUESTS extension
- XC-MISC extension

*X11R6.1*

In addition, DIGITAL UNIX supports selected Release 6.1 (X11R6.1) features, including the X Keyboard extension (XKB) (version 0.65) and the double buffering extension (DBE).

*Adobe Display Postscript System*

In addition, DIGITAL UNIX supports the Adobe Display PostScript System X server extension and client library.

- Display PostScript X server extension
- Display PostScript client library

The license to use the Adobe Display PostScript X server extension and client library is included with Digital UNIX.

The Licensee agrees to only execute Display PostScript on those DIGITAL computer systems listed in Tables 1 and 2 in this Software Product Description (SPD), and that in any event licensee agrees not to make use of the Display PostScript software, directly or indirectly, to print bitmap images with print resolutions greater than 150 dots/per/inch (DPI), or to generate fonts or typefaces for use other than with the DIGITAL computer systems identified in this SPD. However, the foregoing limitation shall not be deemed to prohibit the printing of images of greater than 150 DPI resolution when such images are used solely for incidental or illustrative purposes.

*DECwindows Motif user environment*

The DECwindows Motif user environment is optionally available. This environment was the default Motif based environment in previous DIGITAL UNIX releases. This environment can be accessed though the CDE login manager or can be configured to be the default environment. This environment consists of:

| | |
|---|---|
| Login manager: | The XDM login manager can optionally be configured to manage logins on the X server. |
| Session manager: | The session manager provides for application launching and customization of the X session. |
| Terminal emulation: | XTerm and DXTerm provide users with traditional character cell interfaces. |
| Additional applications: | Calculator, Calendar, Cardfiler, Clock, Mail. |

**SYSTEM MANAGEMENT**

System Management (SysMan) consists of a suite of graphical configuration and administrative applications for managing DIGITAL UNIX systems. SysMan applications are launchable from the Application Manager icon on the CDE front panel, or may be executed from a command line interface. SysMan is organized into the following components: Configuration, Daily Administrative, Monitoring and Tuning, Storage Management, and Tools.

*Configuration*

BIND Configuration - An application to configure the system as a BIND client or BIND server. BIND configuration is used to initialize and maintain the BIND data files on the master nameservers, the BIND boot files, and the BIND resolver configuration files.

Disk Configuration - An application to display the disks attached to the system, display disk attributes including the partition information, repartition the disk, and define a disk alias.

Latsetup - An application to administer Local Area Transport (LAT).

Mail Configuration - An application to set up the routing and delivery of mail for the system. It configures Sendmail, and simplifies the configuration of the system as a Mail client or Mail server.

Network Configuration - An application to configure network interfaces, routed or gated routing daemons, configure the system as an IP router, configure rwhod, and configure static routing.

NFS Configuration - An application to configure the system as an NFS client and/or an NFS server, start and stop the NFS daemons, configure automounter, mount and unmount, and export NFS file systems.

NIS Configuration - An application to configure and execute Network Information Service on the system.

Printer Configuration - An application to define and modify printer configurations for local and remote printers that are accessible to the system.

*Daily Administration*

Account Manager - An application to manage user and group accounts. The account manager will operate under either base or enhanced security. This application is used to create and modify user accounts, create and modify group accounts, lock and unlock accounts, and change passwords for users. It manages both local and NIS accounts.

Archiver - An application to manage archiving on the system. Supporting tar, cpio and pax format, this application stores and retrieves selected files from/to a locally attached output device including a tape drive or floppy disk drive.

Audit Manager - An application to set up the audit environment on the system.

DHCP server configuration - An application to configure and monitor the Dynamic Host Configuration Protocol on servers and clients.

Display Window - A generic application that provides an interface for executing and displaying the output of any UNIX command at user defined intervals.

File Sharing - An application to mount filesystems accessible via NFS, and exports local files systems.

Host Manager - An application to display and manage user specified remote hosts.

License Manager - An application to manage software product licenses. Software Product Authorization Keys (PAKs) can be listed, added and deleted with this application.

Power Manager - An application to manage the power reduction features of a system monitor, disks and CPU. This application is only available on systems with power management features.

Shutdown - An application to facilitate the shutdown process of a system. This application provides an interface to determine the amount of time prior to system shutdown, the display of messages, and the execution of user shutdown scripts.

System Information - An application to display and monitor information about the system, including the operating system and version, the amount of RAM on the system, the number of CPUs, CPU activity, available free memory, available swap space, file system utilization and locally attached disk and tape drive device names.

*Monitoring and Tuning*

Kernel Tuner - An application to display and change parameters of the kernel subsystem.

Process Tuner - An application to display, monitor and manage the processes on the system. A number of sort and filter options are provided to manage the process information displayed.

Performance Manager - A real-time performance manager that provides tools for detection and correction of performance problems. A Graphical User Interface running locally can display data from every node in the DIGITAL UNIX network that runs the Performance Manager daemon, SNMP daemon, or cluster daemon.

*Storage Management*

Bootable Tape - An application to create and recover a disk image from a system. Supported processor platforms are:

— DEC 3000-300, 300X, 400, 500, 600, and 900

— AlphaServer 1000A

— AlphaServer 2100

— AlphaServer 4100

— AlphaStation 200

— AlphaStation 600

Supported tape devices are:

— TZK10, QIC tape, 320-525MB

— TZK11, QIC tape, 2.0GB

— TLZ06, 4mm, 2-4GB

— TLZ07, 4mm, 4-8GB

— TZ86, 5.25 inch cartridge

Networker - An application that provides automated backup and recovery of files on a single local system to a local tape or loader. A subset of the optional POLYCENTER NetWorker Save and Restore (NSR) layered product, the SingleServer is licensed free of charge with the DIGITAL UNIX Operating System, and provides functionality similar to NSR, except that SingleServer supports only a single, local client.

Features of the SingleServer include:

- Support for unattended backups
- Easy to use preconfigured settings
- Five preconfigured policies for managing backups
- Five preconfigured backup schedules
- Label templates for electronically labeling tapes
- Easy file recovery

*Tools*

A graphical presentation of the iostat (I/O statistics), netstat (network statistics), systemmessages (system messages), vmstat (virtual memory statistics) and the who command are provided.

DIGITAL UNIX includes DECevent that provides error reporting and binary-to-text translation capabilitites. This tool ships as part of the Associated Products CD-ROM.

DIGITAL UNIX also provides a Verifier and Exerciser Tool (VET) that contains a set of system exercisers and an online diagnostic monitor. This tool ships as part of the firmware CD-ROM.

## FILE SYSTEMS

The DIGITAL UNIX file system architecture is based on OSF/1 Virtual File System (VFS) which is based on the Berkeley 4.3 Reno Virtual File System. VFS provides an abstract layer interface into files regardless of the file systems in which the file resides.

DIGITAL UNIX supports the following file system types:

- POLYCENTER Advanced File System (AdvFS)
- UNIX File System (UFS) - based on the Berkeley Fast File system
- Network File System (NFS)
- Memory File System (MFS)
- ISO 9660 Compact Disk File System (CDFS)
- File-on-File Mounting File System (FFM)
- /proc File System

File system limits are documented in the Digital UNIX Release Notes.

*POLYCENTER Advanced File System (AdvFS)*

The POLYCENTER Advanced File System (AdvFS) is a journaled, local file system that provides higher availability and greater flexibility than traditional UNIX file systems. Using transaction journaling, AdvFS recovers file domains in seconds rather than hours after an unexpected restart such as a power failure. AdvFS journaling also provides increased file system integrity. AdvFS provides greater flexibility by allowing filesets (file systems) to share a single storage pool, and enabling hard and soft fileset quotas in addition to user and group quotas. The root/boot device can be optionally configured to use AdvFS during installation.

The right to use the POLYCENTER Advanced File System is granted by the DIGITAL UNIX Operating System license. In addition, a separately licensed, optional layered product, the POLYCENTER Advanced File System Utilities, can be ordered. Refer to the *OPTIONAL SOFTWARE* section of this SPD for more information.

*UNIX File System (UFS)*

UFS is compatible with the Berkeley 4.3 Tahoe release.

*Network File System (NFS)*

DIGITAL UNIX NFS V2 allows transparent file access over TCP/IP networks. In addition, the Network Information System (NIS), formerly Yellow Pages (YP), is provided for centralized system management of files. The automounter service automatically mounts and unmounts NFS file systems. The NFS locking service allows advisory and record locks to be used with remotely mounted files.

An NFS V3 server and client protocol implementation is provided in addition to V2. NFS V3 includes 64-bit support for file access, exclusive create semantics, negotiable transfer sizes, safe asynchronous writes, added support for access checking and other changes designed to increase efficiency and performance. NFS file systems can use either the UDP or TCP transport protocols.

Network Lock Manager (NLM) V4 includes support for files larger than 2 GB. Support for additional over-the-wire error code is also provided. NLM V3 is supported for NFS V2 compatibility.

V2 PC-NFS server support is provided, enabling connectivity from PC-NFS V5.1a, 5.1, 4.0 and 3.5 clients.

*Memory File System (MFS)*

The DIGITAL UNIX MFS is a memory-based UFS. The MFS has the same file system structure characteristics as the UFS, but resides in virtual memory. No permanent file structures or data are written to disk, so the contents of an MFS file system are lost on reboot, unmount, or power failure. An MFS is useful for temporary files or for read-only files that are loaded into it after it is created.

*ISO 9660 Compact Disk File System (CDFS)*

The DIGITAL UNIX implementation of CDFS is based on ISO 9660, a standard for a volume and file structure for the interchange of information using CD-ROM. DIGITAL UNIX CDFS is based on the following levels of ISO 9660:

- Level 2 of Interchange
- Level 1 of Implementation, which enables the user to do the following:
  - — Mount single volume CD-ROMs which are formatted in compliance with ISO 9660, as a local file system
  - — List and examine files using standard UNIX utilities and programs
  - — Read files and directories using the standard POSIX system interface
  - — NFS export mounted ISO 9660 file systems
  - — Support the High Sierra Group extensions which provide compatibility with older format CD-ROMs

CDFS also supports CD-ROMs recorded using the Rock Ridge Interchange Protocol, Revision 1.09, August 1991. Rock Ridge specifies the use of the extension fields that are defined by ISO 9660:1988, and it uses those extensions to provide the following information:

- File owner, file group, file permissions

- Additional file types (symbolic links, device special files, named pipes)
- setuid, setgid, and sticky bits
- Hard link counts
- POSIX file names (mixed case names, unstructured names, and longer names than ISO-9660:1988 allows)
- Deep directory hierarchies (greater than 8 levels)
- File time stamps

XCDR extensions - X/OPEN Preliminary Specification (1991) CD-ROM Support Component (XCDR). XCDR extensions allow the user to examine selected ISO 9660 attributes through defined utilities and shared libraries. In addition, functionality is provided to allow a system administrator to substitute different file protections, owners, and file names for CD-ROM files.

*File-on-File Mounting File System (FFM)*

The File-on-File Mounting File System (FFM) allows regular, character, or block-special files to be mounted over regular files, and is primarily used by the SVR4-compatible system calls 'fattach' and 'fdetach' of a STREAMS-based pipe (or FIFO).

*File-Based Pipes*

A file-based pipe implementation replaces the socket-based pipes implementation for improved performance.

*/proc File System*

The SVR4-compatible /proc file system for DIGITAL UNIX allows running processes to be accessed and manipulated as files by ordinary system calls, open, close, read, write, seek and ioctl. *Logical Storage Manager (LSM)*

DIGITAL UNIX Logical Storage Manager (LSM) is an integrated host-based solution to data storage management. Basic LSM functionality, including disk spanning and concatenation, is provided with the base operating system. Additional features, including disk striping, mirroring, and a graphical user interface, are available with a separate license. LSM is RAID Advisory Board (RAB) certified for RAID Levels 0 and 1. Refer to the *OPTIONAL SOFTWARE* section of this SPD and the LSM SPD for more information.

A migration utility is provided to allow LVM users to migrate their LVM volumes to LSM. This utility will be retired in a future release of the operating system, no sooner than October, 1997.

**NETWORKING**

*TCP/IP*

DIGITAL UNIX allows for TCP/IP network communications over supported network devices. The TCP/IP protocol suite is implemented in the socket framework.

*Sockets*

DIGITAL UNIX provides sockets that are based on the Berkeley UNIX Operating System structure, which provides a framework for I/O over a network.

*STREAMS*

DIGITAL UNIX provides SVR4-compatible STREAMS. Like sockets, STREAMS provides a framework for character I/O to and from user space to kernel networking protocols.

*X/Open Transport Interface (XTI)*

X/Open Transport Interface (XTI) is an extension to the System V STREAMS user space interface called Transport Level Interface (TLI). This interface is thread-safe.

*Data Link Bridge (DLB)*

DIGITAL UNIX provides an DLPI-compatible interface into the non-STREAMS (BSD) driver environment. This interface does not support complete DLPI semantics. The DLB interface is the preferred interface for STREAMS modules to access the BSD-based datalink services.

*Screend*

When the system is operating as an IP router, screend provides flexible per-packet access controls for forwarded packets. This can be used as one part of a comprehensive network security plan. DIGITAL UNIX also provides an interface access filtering to reinforce the system security against IP spoofing attacks.

*Packetfilter*

The Packetfilter is a software interface that allows an application to send and receive packets directly to or from a LAN (Ethernet or FDDI). The Packetfilter provides flexible demultiplexing (filtering) of incoming packets, so that many such applications can run simultaneously.

The DIGITAL UNIX Packetfilter supports two filtering models: the original CMU/Stanford model, as supported in ULTRIX, and the BSD Packet Filter (BPF), which provides more flexible and efficient filtering. (BPF was developed by the University of California, Lawrence Berkeley Laboratory.)

Several public domain applications that use the Packetfilter are integrated in DIGITAL UNIX including rarpd, tcpdump, tcpslice, nfswatch, and nfslogsum.

*Simple Network Management Protocol (SNMP)*

The SNMP Agent allows management of the Internet, FDDI, system resources, and network resources using the SNMP. The agent is also extensible, allowing software developers to add MIBs to the agent, and participate in the SNMP.

The SNMP agent contains the following base system functionality:

- Full SNMP V1.0 agent capabilities
- MIB implementations for managing Internet MIB-2 objects, FDDI objects, and Token Ring objects

*Dynamic Host Configuration Protocol (DHCP)*

DIGITAL UNIX includes a complete DHCP server/client solution for centralizing and automating IP address administration. A graphical interface enables server system managers to easily configure IP configurations with various DHCP clients.

*Point to Point Connections*

The DIGITAL UNIX system supports point-to-point connections using SLIP (Serial Line Internet Protocol) and PPP (Point to Point Protocol). The PPP subsystem is asynchronous and supports only IP. It provides authentification with PAP (Password Authentification Protocol) and CHAP (Cryptographic Authentification Protocol).

*Distributed Computing Environment (DCE)*

DIGITAL UNIX provides the framework to support the Distributed Computing Environment (DCE). DCE is a separate layered product but the run-time service license is bundled with the operating system. DCE provides users with access to resources, regardless of their location on the network. It extends system level services to allow applications to interoperate with one another, port to other platforms, and be distributed over the network.

*Open Network Computing (ONC)*

DIGITAL UNIX supports Open Network Computing (ONC) V4.2 including: Network File System V2 and V3, PCNFSd, Lock Manager, Status Monitor, NFSportmon, Network Information Service (NIS), automount, and user level RPC.

*Asynchronous Transfer Mode (ATM)*

The DIGITAL UNIX Asynchronous Transfer Mode (ATM) subsystem supports the ATM Forum's User-Network Interface (UNI) V3.0 and V3.1 specifications, including the Interim Local Management Interface (ILMI) protocol for reg- istration of up to 32 addresses per interface, UNI signaling for point- to-point connections, and best effort and CBR VCs for AAL5 PDUs. Also, per- VC cell pacing (to limit the rate at which an end-system transmits) is supported. In addition, DIGITAL UNIX supports Multiple IP subnets, per-VC MTU negotiation, and packetfilter access (for filtering incom- ing packets only) for Classical IP (RFC 1577). Lastly DIGITAL UNIX supports the ATM Forum's LAN Emulation specification.

DIGITAL UNIX does not support the UNI V3.0 and V3.1 specifications for full ATM Simple Network Management Protocol (SNMP) Management Information Bases (MIBs), point-to-multipoint connections, Operations and Maintenance (OAM) flows, VBR VCs, AAL1, AAL3/4, or "raw" AAL.

*Fast Ethernet*

DIGITAL UNIX supports Fast Ethernet (IEEE 802.3 100Base-TX). Refer to the OPTIONAL HARDWARE section for specific hardware supported.

*FDDI*

DIGITAL UNIX provides FDDI fiber optic support. Refer to the *OPTIONAL HARDWARE* section for specific hardware supported.

*Token Ring*

DIGITAL UNIX supports Token Ring with source routing support for multi-ring networks. Refer to the *OPTIONAL HARDWARE* section for specific hardware supported.

*IP Multicast*

DIGITAL UNIX supports the Level 2 end-system IP Multicast functionality, specified in RFC 1112, on Ethernet and FDDI. The implementation provides integrated multicast address management for multiprotocol environments.

The DIGITAL UNIX implementation also provides kernel routines for encapsulating IP tunnels to enable wide area IP Multicast routing.

These routines include kernel code from public domain Multicast support version 3.5 and mrouted (version 3 Copyright 1989 by the Board of Trustees of Leland Standford University) which provides the Distance Vector Multicast Routing Protocol (DVMRP).

*Name Services*

DIGITAL UNIX supports the Domain Name System as described in RFC 1034 and RFC 1035, providing a host name and address lookup service for the Internet network. The DIGITAL UNIX implementation of the Domain Name System is based on BIND version 4.9.3. The user can use BIND to replace or supplement the host's database. DIGITAL UNIX also supports Sun's Network Information Service (NIS), formerly known as Yellow Pages (YP). NIS can be used to replace or supplement hosts, aliases, group, networks, password, protocols, rpc, and services databases.

*Network Time Protocol (NTP)*

DIGITAL UNIX provides the Network Time Protocol (NTP) V3 to synchronize and distribute the time for all machines in a network environment. The time synchronization daemon, xntpd, is used to distribute time to all machines in a network.

*Time Synchronization Protocol (TSP)*

DIGITAL UNIX provides Berkeley's Time Synchronization Protocol (TSP). TSP synchronizes the time of all machines in a network without ensuring the accuracy of the time that is provided.

*Local Area Transport (LAT)*

DIGITAL UNIX provides a STREAMS-based implementation of the Local Area Transport (LAT) that serves terminals to one or more service nodes on a local area network (LAN). LAT allows a host to function as both a service node and a server node. It also enables host applications to initiate connections to server ports (designated as application ports) to access remote devices such as printers.

*LAT/Telnet Gateway*

The LAT/Telnet gateway service supported in DIGITAL UNIX provides a gateway from a LAT terminal server to allow connections to TCP/IP nodes using intermediate LAT hosts.

*Number of Logins*

The following maximum number of logins are supported:

| | |
|---|---|
| RLOGIN: | 2,048* |
| Telnet: | 2,048* |
| LAT: | 4,000* |

Note: *These numbers can vary depending on hardware configurations and user workloads.

*USER INTERFACES*

*Internet Interface*

DIGITAL UNIX includes the Netscape Navigator Gold V3.0 ® Internet Client World- Wide-Web browser. The software license for this bundled version of the Netscape Navigator Internet client is included with the DIGITAL UNIX base license. Users of earlier versions of DIGITAL UNIX are licensed to use the Netscape Navigator Internet client when they update to V3.2C or V4.0 with an update license or with update services. The Netscape Navigator Internet client includes support for Latin and Japanese fonts.

*Internet*

DIGITAL UNIX includes the Netscape Navigator Fastrack V2.0 ® Internet World-Wide-Web server. The software license for this bundled version of the Netscape Fastrack V2.0 is included with the DIGITAL UNIX base license. Users of earlier versions of DIGITAL UNIX are licensed to use the Netscape Fastrack server when they update to V3.2c or V4.0 with an update license or with update services.

DIGITAL UNIX provides the Java® Development Kit V1.0.2, which is a port of the Java Development Kit under license from Sun Microsystems, Inc.

The Java Development Kit (JDK) includes the Java compiler (javac), Java debugger(jdb), the Code Generator for interfacing Java programs and C (javah), and the Java Virtual Machine (JVM). The javac, jdb, and javah components make up the basic set of command line tools needed to develop Java applets and applications. The JVM consists of the Interpreter, the Class Libraries, and Native Methods. The JDK will be physically included as part of the DIGITAL UNIX operating system kit in a future release. Until such time as it is physically delivered bundled with DIGITAL UNIX, it is available via download at no charge from a web page located at: http://www.unix.digital.com/products/internet/java.html.

*Internet*

The DIGITAL UNIX Operating System implements the following Internet RFC (Request for Comment) and Non-RFC standards:

| RFC | Protocol | Name |
|---|---|---|
| 678 | — | Standard File Formats |
| 768 | UDP | User Datagram Protocol |
| 791 | IP | Internet Protocol as amended by RFC's 922 and 950 |
| 792 | ICMP | Internet Control Message Protocol |
| 793 | TCP | Transmission Control Protocol |
| 821 | SMTP | Simple Mail Transfer Protocol |
| 822 | MAIL | Format of Electronic Mail Messages |
| 826 | ARP | Address Resolution Protocol |
| 854 | TELNET | Telnet Protocol |
| 855 | — | Telnet option specifications |
| 856 | — | Telnet binary transmission |
| 857 | — | Telnet echo option |
| 858 | — | Telnet Suppress Go Ahead option |
| 859 | — | Telnet status option |
| 868 | TIME | Time Protocol |
| 893 | — | Trailer Encapsulations |

| RFC | Protocol | Name |
|---|---|---|
| 894 | IP-E | Internet Protocol on Ethernet Networks |
| 903 | RARP | Reverse Address Resolution Protocol |
| 904 | EGP | Exterior Gateway Protocol |
| 919 | —— | Broadcast Datagram over IP |
| 922 | —— | IP Broadcast Datagrams with Subnets |
| 950 | —— | IP Subnet Extension |
| 951 | BOOTP | The Bootstrap Protocol |
| 954 | RPC | NICNAME/WHOIS (Obsoletes RFC 812) |
| 959 | FTP | File Transfer Protocol |
| 1014 | XDR | External Data Representation |
| 1034, 1035 | DOMAIN | Domain Name System |
| 1042 | IP-IEEE | Internet Protocol on IEEE 802 |
| 1049 | —— | Content-Type Field for Internet Messages |
| 1050 | RPC | Sun® Remote Procedure Calls |
| 1055 | SLIP | Serial Line Internet Protocol |
| 1057 | —— | Portmapper |
| 1058 | RIP | Routing Information Protocol |
| 1094 | NFS | Network File System Protocol |
| 1112 | —— | Host Extensions for IP Multicast |
| 1116 | —— | Telnet Line Mode Option |
| 1119 | NTP | Network Time Protocol minus authentication |
| 1122 | —— | Requirements for Internet Hosts Communication Layers (Must Level) |
| 1123 | —— | Requirements for Internet Hosts Applications and Support (Must Level) |
| 1144 | CSLIP | Compressing TCP/IP Headers for Low-Speed Serial Links |
| 1155 | SMI | Structure of Management Information |
| 1156 | MIB | Management Information Base |
| 1157 | SNMP | Simple Network Management Protocol |
| 1188 | IP-FDDI | Transmision of IP over FDDI (Obsoletes RFC 1103) |
| 1191 | — | Path MTU Discovery (router specification, host specification (TCP only)) |
| 1212 | — | Concise MIB definitions |
| 1213 | MIB-II | Management Information Base II (supercedes RFC 1158 and 1156) |
| 1225 | POP3 | Post Office Protocol, Rev. 3 |
| 1231 | —— | IEEE 802.5 Token Ring MIB (Set operations are not supported) |
| 1253 | —— | OSPF Version 2 Management Information Base |
| 1256 | ICMP | Router Discovery Messages |
| 1282 | —— | BSD rlogin |
| 1285 | —— | FDDI Management Information Base (Set operations are not supported) |
| 1288 | FINGER | Finger Protocol (Obsoletes RFC 1196) |
| 1305 | NTP | Network Time Protocol V3.0 |
| 1321 | MD5 | The MD5 Message Digest Algorithm |
| 1323 | TCP-HIPER | TCP Extensions for High Performance (Window Scale option only) |
| 1332 | IPCP | The PPP Internet Protocol Control Protocol (Obsoletes RFC 1172) |
| 1334 | PAP /CHAP | PPP Authentication Protocols |
| 1350 | TFTP | Trivial File Transfer Protocol (Obsoletes RFC 783) |
| 1483 | —— | Multiprotocol Encapsulation over ATM AAL5 (routed protocol encapsulation only) |
| 1497 | BOOTP | BOOTP Vendor Information Extensions (obsoletes RFC1048, 1084, 1395); Updates RFC 951 |
| 1514 | – | Host Resources MIB (Set operations are not supported) |
| 1521 | – | MIME support as stated in Appendix A of this RFC |
| 1533 | DHCP | DHCP options and BOOTP Vendor Extensions |
| 1534 | — | Interoperation between DHCP and BOOTP |
| 1541 | DHCP | Dynamic Host Configuration Protocol |
| 1542 | — | Clarifications and Extensions for the Bootstrap Protocol (Obsoletes RFC 1532), Updates RFC 951 |
| 1547 | IS-PPP | Requirements for an Internet Standard Point-to-Point Protocol |
| 1571 | | Telnet Environment Option Interoperability Issues |
| 1572 | | Telnet Environment Option |
| 1577 | —— | Classical IP over ATM |

| RFC | Protocol | Name |
|---|---|---|
| 1583 | OSPF | OSPF V2 (obsoletes RFC 1247) |
| 1589 | — | A Kernel Model for Precision Timekeeping (the support to discipline the system clock to an external precision timing source is not supported) |
| 1626 | — | Default MTU for IP over ATM |
| 1661 | PPP | The Point-to-Point Protocol PPP (obsoletes RFCs 1548, 1331, and 1171) (asynchronous IP only) |
| 1700 | — | Assigned Numbers (Obsoletes RFC 1340, etc) |
| 1755 | — | Signaling for IP over ATM |
| 1813 | NFS | Network File System Version 3 Protocol |

### Non-RFC Standards

- 4.3BSD and 4.4BSD Socket Interface
- 4.3BSD inetd
- 4.3BSD lpd
- 4.3BSD netstat
- 4.3BSD ping
- 4.3BSD rcp
- 4.3BSD rexecd
- 4.3BSD rlogin
- 4.3BSD rmt
- 4.3BSD rsh
- 4.3BSD sendmail V5.65 with IDA enhancements
- 4.3BSD syslog
- uucp Basic Networking Utilities (HoneyDanBer)
- X/Open Transport Interface (XTI)
- Sun Open Network Computing (ONC) 4.2
- New rdist command packaged as optional nrdisk
- BSD Packet Data Compression (for PPP)

## SECURITY

The DIGITAL UNIX Operating System, running Enhanced Security, is designed to exceed the requirements of the C2 evaluation class of DoD 5200.28-STD "Trusted Computer System Evaluation Criteria", also known as the Orange Book.

DIGITAL UNIX supports various configurations and setup scripts which allow selection of desired Enhanced Security features such as extended passwords, audit and Access Control Lists (ACLs).

System Administrators have a choice of command line interfaces or GUIs. The GUI tools improve the ease of use of administering the system's Enhanced Security.

*Network Information Service (NIS) Compatibility*

Support is provided for accessing NIS distributed databases while running Enhanced Security. NIS can also be used to distribute the Enhanced Security protected password database. When using NIS, no more than 4000 user accounts are supported by the Enhanced Security subset. The number of simultaneous logins allowed is dependent on the configuration.

*Security Integration Architecture*

All security mechanisms on DIGITAL UNIX are part of the Security Integration Architecture (SIA). The SIA isolates the security-sensitive commands from the specific security mechanisms, thus eliminating the need to modify the security-sensitive commands for each new security mechanism.

The following C2 security functionality is included in DIGITAL UNIX:

*Discretionary Access Controls*

Provides the capability for users to define how the resources they create can be shared. Optional access control lists (ACLs) provide greater granularity of file system object protection at the individual user level than the default DAC protection. The ACL mechanism is designed to POSIX draft 13, with some draft 15 enhancements.

*Auditing*

A tool is provided to monitor normal, as well as unauthorized usage of a system with a choice of a GUI or command line interface.

*Identification and Authentication*

— Password length and lifetime are based on the Department of Defense Password Management Guideline (Green Book).

— Extensive login controls, such as automatic account lockout, account vacationing, per terminal settings for delays and maximum consecutive failed logins, password usage history and system generated password.

*Object Reuse*

This ensures that the physical storage assigned to shared objects or physical storage that is released prior to reassignment to another user, does not contain data from previous users.

*Integrity*

Provides the capability to validate the correct operation of hardware, firmware, and software components of the Trusted Computing Base (TCB).

*System Architecture*

A separate execution domain is maintained for the Trusted Computing Base (TCB) components using hardware memory management to protect the TCB while it is executing.

Note: DIGITAL UNIX, with Enhanced Security, provides tools and mechanisms that help the system maintain the level of trust for which the system was designed. No system can provide complete security and DIGITAL cannot guarantee system security. However, DIGITAL continually strives to enhance the security capabilities of its products. Customers are strongly advised to follow industry recognized security practices.

## DEVELOPMENT ENVIRONMENT

*DEC Ada Run-time Libraries*

The DEC Ada run-time support libraries (libada.a and libada.so) are provided to enable users to run previously compiled programs which require the DEC Ada libraries at run-time. These libraries support Ada program functions in areas including Tasking, Exceptions, Timer Services, and Miscellaneous Computations.

*DEC FORTRAN Run-time Libraries*

The DEC FORTRAN run-time support libraries (libfor, libfutil, libUfor) are provided to enable users to run previously compiled programs that require the DIGITAL FORTRAN libraries at run-time. These libraries support FORTRAN program functions in the areas of input and output, intrinsic functions, data formatting, data conversion, miscellaneous math functions, FORTRAN bindings to common operating system services, and more.

*DEC C++ Run-time Libraries*

The DEC C++ run-time support libraries (libcxx, libcomplex, libtask) are provided to enable users to run previously compiled applications containing DEC C++ code, without requiring that DEC C++ be installed on the target system. These libraries support DEC C++ program functions in the areas of input and output, complex arithmetic, multitasking, and more.

*DEC COBOL*

It is DIGITAL Equipment Corporation's strategy to recommend the use of Micro Focus COBOL as resold by DIGITAL for DIGITAL UNIX based COBOL application development. For customers developing DEC COBOL applications on VMS who also want to deliver DEC COBOL-based applications on DIGITAL UNIX, DEC COBOL run-time libraries are licensed with DIGITAL UNIX. The DIGITAL COBOL compilers are available as a separately licensed layered product.

The DEC COBOL run-time support libraries (libcob, libots2, libisamstub) are provided to enable users to run previously compiled programs that require the DIGITAL DEC COBOL libraries at run-time. These libraries support COBOL program functions in the areas of file input and output, decimal arithmetic, COBOL ACCEPT /DISPLAY statements, STRING/UNSTRING operations, CALL and CANCEL, and more.

*DEC Pascal Run-time Libraries*

The DEC Pascal run-time support libraries (libpas.a, libpas.so, and libpas_msg.cat) are provided to enable users to run previously compiled programs which require the DEC Pascal libraries at run-time. These libraries support DEC Pascal program functions in the areas including input and output, miscellaneous math functions, time and date services, and miscellaneous file services, and more.

*DIGITAL Portable Math Library*

The DIGITAL Portable Math Library (DPML) is a common math library for FORTRAN, C, and Pascal. It provides IEEE single and double floating point support.

*ATOM Run-time Libraries*

Analysis Tool with Object Modification (ATOM) enables software developers to build customized analysis tools. It uses the target application program, an instrumentation file, and an analysis file to create a new executable file which, when executed, collects analysis data for a wide variety of purposes. ATOM includes all of the runtime libraries necessary for executing ATOM based analysis utilities and tools. The ATOM Run-time Libraries are licensed with DIGITAL UNIX. Several useful DIGITAL-developed ATOM based analysis tools that facilitate program development are licensed with the DIGITAL UNIX Developers' Toolkit.

*Memory Mapped File Support*

DIGITAL UNIX supports the Berkeley mmap function and, therefore, allows an application to access data files with memory operations rather than file input and output operations.

*Shells*

DIGITAL UNIX provides the following shells:

- POSIX Shell
- C Shell
- Bourne Shell from System V
- Korn Shell

All shells are programmable and allow for a tailorable user environment.

*Dynamic Loader*

DIGITAL UNIX uses a SVR4 compatible loader to load shared libraries dynamically. This loader provides the following enhanced features:

- SVR4 symbol resolution semantics, including symbol preemption

The COFF object file format is supported for all forms of object files.

*Device Driver Kit (DDK)*

The DIGITAL UNIX Device Driver Kit (DDK) enables OEMs, Value-Added Resellers, Independent Hardware Vendors and System Integrators to quickly develop support for devices used in DIGITAL UNIX systems. Developers at companies that manufacture disk drives, printers, graphics devices, network devices, real-time devices, etc., can use this kit to create the drivers that make it possible to sell into the growing base of DIGITAL UNIX servers and workstations.

The DIGITAL UNIX Device Driver Kit (DDK) provides documentation and templates for device driver developers. Also included is the X Developers' kit, which makes it possible to develop device-specific X Windows support for graphics options.

To obtain the DIGITAL UNIX Device Driver Kit, refer to the "Ordering Information" section of this SPD.

DDK Customers must be licensed users of DIGITAL UNIX and the Developers' Toolkit for DIGITAL UNIX.

*Data Link Interface (DLI)*

DIGITAL UNIX provides a Data Link Interface to allow applications to directly use the data link layer services in order to interact directly with the network device drivers.

*Loadable Subsystems Framework*

DIGITAL UNIX includes configuration manager framework which allows dynamic loading (and configuring) of kernel subsystems. The framework is composed of a configuration manager daemon (cfgmgr), a kernel loader daemon (kloadsrv), a system configuration database (sysconfigtab) and its management utility (sysconfigdb). This framework allows kernel modules (such as device drivers) to be loaded after the system is booted.

*Foreign Device Boot Support*

DIGITAL UNIX provides the ability for device driver developers to build and deliver single binary drivers that work at installation time. This allows the device to be used during the installation process. This ability is supported for graphics device drivers.

*Loadable Drivers Framework*

Device driver suppliers may now dynamically load their drivers into the kernel using the configuration manager framework. Functions provided to facilitate integration of third party device support include:

- Autoconfiguration support
- Interrupt registration support
- Installation support
- Loadable driver support for the following busses:
  - — TURBOchannel
  - — EISA
  - — ISA
  - — PCI
  - — SCSI peripheral devices
  - — VMEbus

*Common Access Method (CAM)*

Common Access Method (CAM) is an ANSI standard for the software drivers that provide the interface between an operating system and a SCSI device. The DIGITAL UNIX CAM implementation is highly compatible with ANSI X3.131-1986, Level 2 and supports SCSI-2 based CAM.

*Supported Hardware Options*

Hardware options supported by DIGITAL UNIX are listed in tables in the SUPPORTED HARDWARE section of this SPD. All device drivers contained in DIGITAL UNIX for these hardware units are warranted by DIGITAL.

## HARDWARE

*Symmetric Multiprocessing (SMP)*

Symmetric multiprocessing (SMP) enables systems containing two or more processors to execute the same copy of the operating system, access common memory, and execute instructions simultaneously. The SMP functionality fully exploits the additional compute capabilities of multiple processors. Capabilities include:

- Multiple threads from the same or different tasks can run concurrently on different processors.
- Process Affinity - Allows binding a process to a specific processor.
- Unattended Reboot - On a hard failure of a nonboot processor, the operating system will tag the failing CPU and automatically reboot the system, without enabling the defective CPU.
- Stop/Start CPU - Ability to stop/start a specified nonboot processor.
- Processor Sets - Ability to dedicate a process, or set of processes, to a specific processor or set of processors. Can also be used to partition the available processors among a set of users.

*PCMCIA (PC Card) Support*

DIGITAL UNIX provides PCMCIA (PC Card) support.

The support is limited to the following capabilities:

- Support of a selected ISA to PCMCIA adapter
- The selected ISA to PCMCIA adapter is from the SCM Microsystems:
- SWAPBOX CLASSIC X2 ... Model MMCD-D2
  - — 3.5" Front Access
  - — 2 slots (type II + type III) PC Card socket.
  - — Standard PC-AT 16-bit ISA bus interface
  - — PCMCIA Revision 2.X and ExCA compliant
- SWAPBOX PREMIUM COMBO ... Model MMCD-FC2
  - — 3.5" 1.44 Mbyte Floppy Drive Support.
  - — One Type I, II or III front-access PC Card socket.
  - — One Type I, II or III rear-access PC Card socket.
  - — Standard PC-AT 16-bit ISA bus interface
  - — PCMCIA Revision 2.X and ExCA compliant
- Support on the following platforms:
  - — AlphaStation 200, 255, 400, 600
  - — AlphaServer 1000
  - — DIGITAL Personal Workstation 433au
- Support of fax/modem PC Cards
  - — The Megahertz XJ2288 is the only modem card fully qualified on DIGITAL UNIX. Other modem cards of similar type may work. The following is the list of modem cards that are known to work:
    - card manufacturer: MEGAHERTZ
    - product name: XJ2288
    - card manufacturer: MEGAHERTZ
    - product name: XJ1144
    - card manufacturer: AT&T Paradyne
    - product name: KeepInTouch Card
    - card manufacturer: Digital
    - product name: PCMCIA V.32bis 14,400 Fax
- hot swap capability of PC Cards

## INTERNATIONALIZATION

DIGITAL UNIX provides an internationalization environment and tools as well as the localization features to enable the development and execution of internationalized software, without the need to re-engineer the user application.

The following single byte and multibyte character sets are supported:

*Single Byte Character Sets - Languages (Locales):*

| | | |
|---|---|---|
| Catalan (1) | | |
| Czech (1) | Danish (1) | Dutch (2) |
| English (3) | Finnish (1) | French (4) |
| German (2) | Greek (1) | Hebrew (1) |
| Hungarian (1) | Icelandic (1) | Italian (1) |
| Catalan (1) | Lithuanian(1) | Slovene (1) |
| Norwegian (1) | Polish (1) | Portuguese (1) |
| Russian (1) | Slovak (1) | Spanish (1) |
| Swedish (1) | Thai (1) | Turkish (1) |

*Multibyte Character Sets - Languages (Locales):*

| | | |
|---|---|---|
| Chinese/Simplified (4) | Chinese/Traditional (12) | Japanese (4) |
| Hong Kong (4) | Korean (2) | |

DIGITAL UNIX base operating system functionality includes:

- 32-bit wide character support
- XPG4 Worldwide Portability Interfaces (WPI)
- Internationalized commands
- Internationalized Curses library (libcurses)
- iconv library (libiconv, an International Codeset Conversion Library)
- Locale utilities

- Date and time formats in the native languages
- Local currency symbols
- Local numeric formatting
- Character Classification - isupper, islower, iscntrl, is * functions
- Collation - Character sort order of the codeset
- Yes and No response in the native language
- Fonts for supported character sets
- TTY Drivers - Support for various input functionalities for the native languages
- Translated CDE User Interface
- Keymaps for local keyboards
- Translated Motif User Interface
- Support for all Language Variants using the North American keyboard
- Input method support for Hebrew and Asian Languages
- 8-bit mail support when one or more of the language variants is installed
- Printing in the native languages

*Unicode Support*

Support for the Unicode and ISO 10646 standards is provided through a set of UCS-4 based locales. Codeset conversion capability to/from UCS-4 and UTF-8 formats is provided for all supported codesets. Unicode character transformation support is also provided.

*Memory Requirements for Asian Language Variants*

Applications running under a single Asian language variant can operate within the memory requirements of the base operating system. Running multiple Asian language variants in a single session will require additional memory for satisfactory performance.

## HARDWARE REQUIREMENTS

The DIGITAL UNIX Operating System can execute on valid DIGITAL Alpha systems and must include the minimum system configuration as described in the *SUPPORTED HARDWARE* section of this SPD. The actual amount of work supported at one time, with good performance, depends on the types of processing performed as well as on the physical memory and secondary storage available.

- DIGITAL UNIX requires the minimum component of main memory to be 32 MB.
- Based on testing, system configurations are limited to 256 physical volumes (disks). The maximum logical volume size supported is 512 GB.
- DIGITAL UNIX requires a system disk capable of holding the supported software subsets. For a Default Installation (mandatory subsets only), a minimum of 425 MB disk (such as RZ25) is required. For a Custom Installation selecting all BASE software subsets, a 680 MB disk (such as RZ56) is required.

Note: Due to additional functionality being planned, a future functional release (no sooner than March, 1997), will require a larger disk space capacity for the custom type of installation with all base subsets.

- The following numbers have been compiled from typical update installations from V4.0 or V4.0A to V4.0B. The Additional Space Needed values represent the typical amount of space needed per file system by the update installation procedure during the course of an update. These values take into account the additional processing space for temporary files that the update installation requires and will vary depending on your specific hardware configuration and file system type. These values have been determined before the use of the Update Administration Utility.

| File System | File System Type | V4.0 Mandatory Subsets ONLY | V4.0B Mandatory Subsets ONLY | Additional Space Needed |
|---|---|---|---|---|
| / | ufs | 39.59 | 41.42 | 4.77 |
| /usr | ufs | 164.02 | 171.57 | 10.42 |

| File System | File System Type | V4.0 All Subsets | V4.0B All Subsets | Additional Space Needed |
|---|---|---|---|---|
| / | ufs | 48.11 | 49.93 | 5.12 |
| /usr | ufs | 326.46 | 332.19 | 10.66 |
| /var | ufs | 5.84 | 5.62 | 1.38 |
| / | AdvFs | 49.58 | 51.35 | 6.54 |
| /usr | AdvF | 326.26 | 331.91 | 22.35 |
| /var | AdvFs | 6.09 | 6.41 | 2.23 |

| File System | File System Type | V4.0A Mandatory Subsets ONLY | V4.0B Mandatory Subsets ONLY | Additional Space Needed |
|---|---|---|---|---|
| / | ufs | 40.32 | 41.43 | 4.05 |
| /usr | ufs | 164.58 | 171.58 | 9.84 |

| File System | File System Type | V4.0A All Subsets | V4.0B All Subsets | Additional Space Needed |
|---|---|---|---|---|
| / | ufs | 48.81 | 49.95 | 4.40 |
| /usr | ufs | 324.89 | 331.88 | 10.70 |
| /var | ufs | 5.84 | 5.62 | 1.38 |
| / | AdvFs | 50.25 | 51.35 | 5.86 |
| /usr | AdvFs | 324.66 | 331.60 | 23.69 |
| /var | AdvFs | 6.10 | 6.41 | 2.23 |

- Systems which have more subsets installed than the Default Installation, but fewer subsets than the Custom Installation selecting all BASE software subsets will require varying minimum disk space for an update installation. Refer to the Installation Guide for a list of subset sizes to help determine the disk space requirements for an update installation on such systems.
- DIGITAL UNIX supports the backup devices listed in the *OPTIONAL HARDWARE* section of this SPD.
- The supported load devices include CD-ROM readers (such as RRD44) or a variety of network interfaces.
- DIGITAL UNIX requires one console terminal with ASCII capability or one DIGITAL graphics display console for Alpha systems.

*Disk Space Requirements*

In addition to base DIGITAL UNIX disk space requirements, the following amount of disk space is required for language variants.

The language variant components are structured in such a way that there is a common part as well as individual part for each language variant. The common part is a prerequisite for any individual language component listed below.

*Common Part:*

| | |
|---|---|
| Mandatory for base O/S | 0.58MB |
| Optional for base O/S | 2.76MB |
| Mandatory for workstations* | 2.46MB |
| Optional for workstations | 80.86MB |

* Mandatory for Workstations is required for enabling the workstation/windowing functionality.

*Individual Part:*

| Language | Mandatory Base Subsets | Optional Base Subsets | Mandatory Wrk-stn. Subsets | Optional Wrkstn. Subsets | Total |
|---|---|---|---|---|---|
| Catalan | 0.77MB | 0.00MB | 4.02MB | 12.83MB | 17.63MB |
| Chinese/PRC | 1.43MB | 18.19MB | 7.37MB | 26.18MB | 53.17MB |
| Czech | 0.00 | 2.51 | 4.48 | 5.83 | 12.81 |
| Danish | 0.77 | 0.00 | 0.00 | 0.00 | 0.77 |
| Dutch | 0.77 | 0.00 | 0.00 | 0.00 | 0.77 |
| Finnish | 0.77 | 0.00 | 0.00 | 0.00 | 0.77 |
| German | 0.77 | 0.00 | 4.01 | 11.11 | 15.89 |
| Spain | 0.77 | 0.00 | 4.02 | 12.83 | 17.63 |
| French | 0.77 | 0.00 | 4.00 | 11.27 | 16.04 |
| Greek | 0.77 | 1.39 | 0.98 | 1.12 | 4.26 |
| Hong Kong | 3.00 | 31.35 | 17.83 | 48.06 | 100.24 |
| Hungarian | 0.00 | 2.50 | 4.40 | 5.83 | 12.74 |
| Icelandic | 0.77 | 0.00 | 0.00 | 0.00 | 0.77 |
| Hebrew | 0.05 | 1.35 | 1.26 | 1.94 | 4.61 |
| Italian | 0.77 | 0.00 | 4.5 | 9.12 | 13.94 |
| Japanese | 6.68 | 42.59 | 22.87 | 26.57 | 98.72 |
| Korean | 1.53 | 6.25 | 5.53 | 8.94 | 22.24 |
| Lithuania | 0.00 | 0.00 | 0.91 | 3.43 | 4.34 |
| Norwegian | 0.77 | 0.00 | 0.00 | 0.00 | 0.77 |
| Polish | 0.00 | 2.51 | 4.52 | 5.83 | 12.87 |
| Portuguese | 0.77 | 0.00 | 0.00 | 0.00 | 0.77 |
| Russian | 0.00 | 1.67 | 4.45 | 4.36 | 10.48 |
| Slovene | 0.00 | 2.46 | 0.92 | 3.40 | 6.78 |
| Slovak | 0.00 | 2.51 | 4.74 | 5.92 | 13.17 |
| Swedish | 0.77 | 0.00 | 3.77 | 2.44 | 6.98 |
| Taiwan | 2.13 | 29.96 | 14.02 | 24.65 | 70.76 |
| Thai | 0.58 | 3.40 | 2.53 | 1.21 | 7.72 |
| Turkish | 0.77 | 2.45 | 1.01 | 3.27 | 7.49 |

## OPTIONAL HARDWARE

Additional memory and/or secondary storage may be required depending upon the usage of the DIGITAL UNIX Operating System software and/or optional software products.

Combinations of hardware options are subject to limitations such as bandwidth, physical configuration restraints, thermal dissipation, electrical loads and power supply.

System configuration details are described in the *DIGITAL Systems and Options Catalog*.

Hardware options supported by DIGITAL UNIX are listed in tables in the *SUPPORTED HARDWARE* section of this SPD. All device drivers contained in DIGITAL UNIX for these hardware units are warranted by DIGITAL.

DIGITAL UNIX supports the following third party printers on platforms that have parallel ports:

- Epson FX-80 and FX-1050
- HP® LaserJet® (Models IIP, IIIP, IIID, 4)
- IBM® Proprinter®
- NEC SilentWriter® Model 290

## OPTIONAL SOFTWARE

The DIGITAL UNIX Developers' Toolkit includes the DEC C compiler and provides developers with a number of development tools that speed and simplify application development. The Developers' Toolkit includes the

ATOM analysis utilities and tools which enable software developers to build custom analysis tools. The Developers' Toolkit includes tools for debugging, memory leak detection and analysis, linking and link management, profiling and performance monitoring, source code control, and other development tools traditionally associated with UNIX. This product is licensed separately from the DIGITAL UNIX Operating System. (SPD 44.36.xx)

The DIGITAL UNIX Server Extensions provides system managers with the ability to set up and perform network installations using DIGITAL's Remote Installation Service (RIS), and includes support for dataless configurations. (SPD 44.35.xx)

The DIGITAL UNIX Logical Storage Manager is an integrated, host-based solution to data storage management, providing concatenation, striping, mirroring, and a graphical user interface that allows data storage management functions to be performed online, without disrupting users or applications. (SPD 51.24.xx)

DECsafe Available Server significantly reduces downtime due to system hardware or software failures. It provides multihost access to SCSI disks and a generic failover mechanism for network-based services and applications. (SPD 44.17.xx)

The POLYCENTER Advanced File System Utilities extend the high availability and flexibility of AdvFS. The AdvFS Utilities provide a Graphical User Interface (GUI) to ease management tasks, and online utilities to dynamically resize file systems, defragment files, balance percentage of space used on volumes, undelete files using trashcans, stripe files, and clone files for hot backup. (SPD 44.52.xx)

NetWorker Client Support provides the ability to save and restore file systems. NetWorker is a separately licensed software product for DIGITAL UNIX. (SPD 50.98.xx)

The System V Environment for DIGITAL UNIX provides System V Release 4 (SVR4) system administration utilities, developer tools, and general user commands that extend the SVR4 functionality inherent in the DIGITAL UNIX operating system. The System V Environment for DIGITAL UNIX is compliant with the System V Interface Definition, Issue 3 (SVID3) Volumes 1-3. (SPD 46.16.xx)

DIGITAL Open3D for DIGITAL UNIX provides support for the following graphics accelerators on Alpha workstations running the DIGITAL UNIX operating system:

- ZLX-E family: ZLX-E1, ZLX-E2, ZLX-E3
- ZLX-M family: ZLX-M1 and ZLX-M2
- ZLX-L family: ZLX-L1 and ZLX-L2
- ZLXp-E family: ZLXp-E1, ZLXp-E2, ZLXp-E3
- ZLXp-L family: ZLXp-L1 and ZLXp-L2
- PowerStorm family: PowerStorm 3D10, PowerStorm 3D30, PowerStorm 4D20, PowerStorm 4D40T, PowerStorm 4D50T, PowerStorm 4D60T
- Freedom Series family: Freedom Series 3150, Freedom Series 3250, Freedom Series 3400.

In addition, DIGITAL Open3D provides a complete development and run-time environment for 2D and 3D applications. (SPD 45.07.xx)

Prestoserve for DIGITAL UNIX is a disk write accelerator for disk block device write operations. This product is available on most Alpha systems. (SPD 35.11.xx)

Multimedia Services for DIGITAL UNIX brings audio and video capabilities to DIGITAL's workstations, and provides a full programming library for use by developers of new applications. (SPD 48.92)

DECtalk Software for DIGITAL UNIX is an application and application programming interface based on Digital Equipment Corporation's industry-leading text-to-speech synthesis technology. This version of DECtalk has been enhanced to work under the Common Desktop Environment (CDE) for UNIX. (SPD 48.98.01)

## GROWTH CONSIDERATIONS

The minimum hardware and software requirements for any future version of this product may be different from the requirements for the current version.

## DISTRIBUTION MEDIA

DIGITAL UNIX is distributed on CD-ROM.

## ORDERING INFORMATION

The DIGITAL UNIX Operating System license provides a licensed user the right to use the software as described within this Software Product Description. Separate licenses are available for the right to use development tools and the C compiler, and separate licenses are available for the right to use the Remote Installation Service. Refer to the SPD's for the DIGITAL UNIX Developers' Extensions (SPD 44.36.xx) and the DIGITAL UNIX Server Extensions (SPD 44.35.xx) for details.

The Software Media kit includes CD-ROMs containing the operating system binaries and complete DIGITAL UNIX online documentation. Hardcopy start-up documentation is also included in the Media kit, including the *Installation Guide*, *Release Notes* and *Technical Overview*.

The Software Documentation Kit is a complete hardcopy documentation set for DIGITAL UNIX, excluding the reference pages. The hardcopy reference pages can be ordered separately. The Software Documentation Kit contains versions of the documentation found online via the CD-ROM, as well as additional documentation published by companies other than DIGITAL. Most documentation provided with DIGITAL UNIX that is published by companies other than DIGITAL is available in hardcopy only.

The *DIGITAL UNIX Technical Overview* provides a detailed description of the DIGITAL UNIX Operating System, and is available both online and in hardcopy with the End User Documentation.

**DIGITAL UNIX Operating System**

Software 2-User Base Licenses: QL-MT4A*-**

Software Interactive User Licenses: QL-MT7A*-**

Software Product Services: QT-MT4A*-**/ QT-MT7A*-**

Software Media Kit: DIGITAL UNIX Operating System: QA-MT4AA-H8

Device Driver Kit: QA-MT4AV-G8

Software Documentation:

Full Documentation Kit (excluding Reference Pages):

QA-MT4AA-GZ

Reference Pages Documentation Kit:

QA-MT4AG-GZ

The full documentation kit contains the following:

End User Documentation: QA-MT4AR-GZ

DIGITAL UNIX Developer's Toolkit: QA-MT5AE-GZ

DIGITAL UNIX Server Extensions: QA-MT4AU-GZ

DIGITAL UNIX documentation, including the DIGITAL UNIX Device Driver (DDK) documentation, is also available on the World Wide Web at:

http://www.UNIX.digital.com/faqs/publications/pub_page/pubs_page.html

Language variant documentation in English (AA-Q4F9B-TE) includes the DECwindows/Hebrew Motif Programmer's Supplementary Guide, as well as Supplemental guides for Japanese, Korean, Thai, Simplified Chinese, and Traditional Chinese support.

*Source Distribution:*

Source License/Distribution: QB-MT4AA-E8

Update Source License/Distribution: QB-MT4AE-E8

Education Source License/Distribution: QB-MT4BA-E8

Education Update Source License/Distribution: QB-MT4BE-E8

* Denotes variant fields. For additional information on available licenses, services, and media, refer to the appropriate price book.

**SOFTWARE LICENSING**

The DIGITAL UNIX Operating System software is furnished under the licensing of Digital Equipment Corporation's Standard Terms and Conditions.

There are four types of DIGITAL UNIX Operating System licenses available on Alpha processors:

**Operating System Base License (QL-MT4A*-6*)**

LMF Product Name: OSF-BASE

This license grants the right to noninteractive use of the file, application, batch, print, and compute services of the DIGITAL UNIX Operating System on a single processor.

This license also authorizes up to two concurrent interactive users of the system (see Interactive User below). The two interactive users authorized as part of the Operating System Base License are additive with Interactive User License quantities, but may not be separated from the Operating System Base License.

In addition to the two interactive users, login as root is also authorized for system management purposes only. If a DIGITAL UNIX Base License is not registered and activated using the LMF, then login by root only is permitted for system management purposes.

The Operating System Base License is a prerequisite for Interactive User Licenses, Unlimited Interactive User Licenses, and SMP Extensions to Base Licenses.

**Symmetric Multiprocessing (SMP) Extension to Base License (QL-MT4A9-6*)**

LMF Product Name: OSF-BASE

SMP Extensions extend the Operating System Base License to enable symmetric multiprocessing (SMP) capability on those DIGITAL UNIX systems supporting SMP. SMP Extensions to Base are permanently tied to the Operating System Base License and may not be separated from the Operating System Base License if an SMP board is removed from the system.

One SMP Extension License is needed for each active processor in the SMP system that is additional to the initial processor authorized by the Operating System Base License.

SMP Extensions grant the right to use the same version of the Operating System software as permitted by the corresponding Operating System Base License at the time when the SMP Extension is installed.

**Interactive User License (QL-MT7A*-B*) or Concurrent Use Licenses (QL-MT7AM-3*)**

LMF Product Name: OSF-USR

An Operating System Base License is a prerequisite for Interactive User and/or Concurrent Use Licenses on the same system.

These licenses grant the right to interactive use of the DIGITAL UNIX Operating System. The Interactive User and Concurrent Use Licenses are are available in various quantities which can be combined to match any total desired.

Multiple user licenses of the same or different quantities may be installed and used together on a given system to authorize system use by the sum of their quantities. These user licenses authorize users in addition to the two users authorized as part of the Operating System Base License.

Interactive User and Concurrent Use Licenses are redesignatable and can be installed and used only on a single DIGITAL UNIX system at a time.

An interactive user, either a person or device, is one that is logged in to a DIGITAL UNIX processor or is interactively using the operating system software by means other than a login.

**Unlimited Interactive User Licenses (QL-MT7A*-AA)**

LMF Product Name: OSF-USR

An Operating System Base License is a prerequisite for an Unlimited License for interactive users on the same system.

This license grants the right to use of the DIGITAL UNIX Operating System by an unlimited number of interactive users on a system.

An Unlimited License for interactive users grants the right to use Software versions authorized under the Operating System Base License in effect at the time of the grant of the Unlimited Interactive User License.

## SOURCE MATERIALS OPTIONS

*Source Code Distribution*

A source kit is available for users who need to retrieve and modify selected source modules. Although every attempt is made to include accurate source modules, Digital does not warrant the ability to build a binary kit. Limited supporting documentation is also provided. DIGITAL does not warrant the results of using the source kit to change selected portions of the system.

Customers who are appropriately licensed by the Open Software Foundation (OSF) and by Santa Cruz Operation (SCO) may obtain optional source material for this software product.

Most users do not require source materials. Sources are used primarily by those with an in-depth knowledge of operating system internals to make highly specialized modifications to the software product.

The following minimum conditions must be satisfied prior to each and every distribution (initial distribution or revision) of source materials:

- Customers must be currently licensed by the Open Software Foundation (OSF) to use OSF/1 R1.2 source code on a designated CPU for which source materials are to be ordered. OSF must verify to Digital that the customer's OSF/1 source license is valid.
- Customers must be currently licensed by the Open Software Foundation (OSF) to use Motif R1.2.3 source code on a designated CPU for which source materials are to be ordered. OSF must verify to DIGITAL that the customer's Motif source license is valid.
- Customers must be currently licensed by UNIX System Laboratories (SCO) for the 3B2 implementation of UNIX System V Release 3.2 (or later) source code on a designated CPU for which source materials are to be ordered. SCO must verify to DIGITAL that the customer's UNIX source license is valid.

- Customers must have signed DIGITAL's Software Program Sources License Agreement for the facility or site where the CPU is located.

Source kits provided by DIGITAL do not necessarily contain all source files used by DIGITAL to build object code kits. DIGITAL provides these source kits on a reference-only basis. DIGITAL does not provide support for source code as part of the standard SPS offerings. These sources are distributed on an "AS IS" basis.

The source code distribution provides users with a source license and the machine-readable source code for this software product. Subject to the terms and conditions of the OSF/1 source license from the OSF and the UNIX source license from SCO, this option gives customers the right to use this source code on any CPU at the facility/location (as specified in the above mentioned agreements with DIGITAL) which has a Single-Use License for the object code.

The source code distribution option provides users with the machine-readable source code for a revised version of this software product. Subject to the terms and conditions of the OSF/1 source license from the OSF and the UNIX source license from SCO, this option gives users the right to use this revised source code on any CPU at the facility/location (as specified in the above mentioned agreements with DIGITAL) which has a Single-Use License for the object code and is also listed on the Source License for this product.

## SOFTWARE PRODUCT SERVICES

A variety of service options are available from DIGITAL. For more information, contact your local DIGITAL office.

All licenses bundled with the DIGITAL UNIX operating system are covered for services and support under the DIGITAL UNIX operating system support contract.

## SOFTWARE WARRANTY

Warranty for this software product is provided by DIGITAL with the purchase of a license for the product as defined in the applicable DIGITAL Standard Terms and Conditions.

## SUPPORTED HARDWARE

The following tables list supported hardware for DIGITAL UNIX. Combinations of hardware options are subject to limitations such as bandwidth, physical configuration constraints, and electrical load and power supply.

The content of this hardware configuration section is intended to specify the device limitations and provide a general guide. It does not describe all possible hardware configurations or circumstances. Any particular configuration should be discussed with DIGITAL. Contact DIGITAL for the most up-to-date information on possible hardware configurations.

DIGITAL reserves the right to change the number and type of devices supported by DIGITAL UNIX. The minimum hardware requirements for future versions and updates of DIGITAL UNIX may be different from current hardware requirements. For configuration details about Alpha systems, refer to the *DIGITAL Systems and Options Catalog* and the *Networks and Communications Buyer's Guide.*

*Embedded and Real-time Boards*

An Embedded and Real-time OEM is a hard goods /capital equipment manufacturer that utilizes DIGITAL's products embedded in the OEM's own products. The DIGITAL products act as a specialized controller of specific functions in the OEM's product, not as a general purpose computer.

DIGITAL products may be physically embedded within the OEM's product (e.g. a CPU board and software inside a Telephone Switch) or may be functionally integrated into the solution (e.g. a system box and software controlling a flight simulator). The DIGITAL product is perceived by the end customer to be an integral and dedicated component of the Embedded and Real-time OEM's product, NOT a general purpose computer.

*SCSI Device Support Table*

The DIGITAL UNIX operating system supports the ANSI SCSI-2 standard. The following SCSI devices have been certified for use with the DIGITAL UNIX operating system. Refer to appropriate platform Systems and Options Catalog for system specific restrictions.

**Table 1**
**SCSI Device Support Table**

| | | | |
|---|---|---|---|
| **CD-ROM Drives:** | **RRD42** | **RRD44** | **RRD46** |
| | **RRD43** | **RRD45** | |
| **Disks:** | **RZ24L**[1] | **RZ26L** | **RZ55**[1] |
| | **RZ25** | **RZ26N** | **RZ56** |
| | **RZ25F** | **RZ28** | **RZ57**[2] |
| | **RZ25L** | **RZ28B** | **RZ58** |
| | **RZ25M** | **RZ28D** | **RZ73** |
| | **RZ26** | **RZ28M** | **RZ74** |
| | **RZ26F** | **RZ29B** | **RZ1DB** |
| | **RZ1BB** | **RZ1CB** | |

[1] Data Device only.

[2] Revision 6000 required (ECO EQ-01695-01).

**Table 1 (Cont.)**
**SCSI Device Support Table**

| | | | |
|---|---|---|---|
| **Solid State Disks:** | **EZ31[1]**<br>**EZ32[1]** | **EZ51[1]**<br>**EZ54** | **EZ58**<br>**EZ64**<br>**EZ69** |
| **Floppy Diskettes[1]:** | **RX23** | **RX26** | **RX33** |
| **Tapes:** | **TLZ04**<br>**TLZ06**<br>**TLZ07**<br>**TLZ09**<br>**TKZ08**<br>**TKZ63** | **TKZ09**<br>**TKZ60**<br>**TSZ07**<br>**TZ30**<br>**TZ85** | **TZ86**<br>**TZ87**<br>**TZ88**<br>**TZK10**<br>**TZK11** |
| **RAID Controllers:** | **HSZ10[3]** | **HSZ40[4]** | **HSZ50[4]** |

[1] Data Device only.

[3] HSZ10 support requires the StorageWorks RAID Array 110 utility for Digital UNIX.

[4] Dual redundant HSZ controllers are supported when both controllers are connected to the same host bus.

**Table 2**
**DEC 2000 Model 300 and Model 500**

| | | | |
|---|---|---|---|
| Diskettes: | RX26 | | |
| SCSI Adapters: | PB2HA-SA[1] | | |
| Network Adapters: | DW300 (EISA Token Ring)<br>DEFEA (EISA FDDI) | DE422 (EISA Lance Ethernet)<br>DE425 (EISA Tulip Ethernet) | |
| Communications: | PC4XD-AA (Par/Ser)[2] | PC4XD-AB (Dual/Ser) | |
| Keyboards: | PCXAL-XX | LK471, 411 | |
| Graphics Subsystems: | PB2GA-AA | PBXWT-A (CALCOMP DB III) | |
| Mouse: | PCXAS-AA | | |
| Serial Printers: | LA36<br>LA50<br>LA70<br>LA75<br>LA75 TURBO<br>LA100<br>LA120<br>LA210 | LA324<br>LCG01<br>LF01R<br>LG02<br>LG06<br>LG12<br>LJ250<br>LJ252 | LN03<br>LN03R<br>DEClaser 1100/1500[3]<br>DEClaser 2100/2150[3]<br>DEClaser 2200/2250[3]<br>DEClaser 3200/3250[3]<br>DEClaser 5100[3] |
| Monitors: | VRC16-HA<br>VRC16-H4<br>VRC16-HX<br>VRC21-HA/HB | PC7XV-DE<br>PC7XV-DG | PCXBV-DE/DF<br>PCXAV-F* |
| Modems: | PCXBF-AA (2400/9600)[4] | PCXCF-AA (9600/9600)[4] | PCXDF-AA (14400 /9600)[4] |

[1] G2 minimum firmware requirement.

[2] Only the serial port is supported.

[3] Support for these printers is at DEC ANSI level 1.

[4] Modem support only - no FAX available.

**Table 3**

**DEC 3000 Models 300, 300L, 300X, 300LX, 400, 400S, 500, 500S, 500X, 600, 600S, 700, 800, 800S, 900**

| | | | |
|---|---|---|---|
| TURBOchannel Adapters:[1] | DEFTA (FDDI)<br>DEFZA (FDDI)<br>DETRA (Token Ring)<br>DGLTA (ATM) | PMAD (Thickwire Ethernet)<br>PMAZB (Dual Slow SCSI)<br>PMAZC (Dual Fast SCSI)<br>KZTSA (FWD SCSI) | |
| Keyboards: | LK401 | LK421 | LK443<br>LK444 |
| Graphics Subsystems: | PMAGC-XX<br>PMAGD-XX | PMAGB-BX | PMAGB-JX |
| Tablet/Mouse: | VSXXX-AA<br>VSXXX-AB | VSXXX-FA | VSXXX-GA |
| Asynchronous Terminals: | VT100<br>VT102<br>VT200<br>VT220 | VT240<br>VT300<br>VT320 | VT340<br>VT420<br>VT510 |
| Serial Printers: | LA36<br>LA50<br>LA70<br>LA75<br>LA75 TURBO<br>LA100<br>LA120<br>LA210 | LA324<br>LCG01<br>LF01R<br>LG02<br>LG06<br>LG12<br>LJ250<br>LJ252 | LN03<br>LN03R<br>DEClaser 1100/1500[2]<br>DEClaser 2100/2150[2]<br>DEClaser 2200/2250[2]<br>DEClaser 3200/3250[2]<br>DEClaser 5100[2] |
| Monitors: | VRM17<br>VRT19<br>VR319 | VR320<br>VRT16<br>VRT17 | VRC16<br>VRC21 |
| Modems[3]: | DF02 | DF03 | DF296 |

[1]The DEC 3000 Models 300L and 300LX have no available TURBOchannel slots. Each supports the same options as the DEC 3000 Model 300 except those requiring a TURBOchannel to be configured.

[2]Support for these printers is at DEC ANSI level 1.

[3]DIGITAL UNIX will support any DIGITAL modem that understands DIGITAL Modem Command Language (DMCL).

**Table 4**
**DEC 4000 Models 6xx and 7xx**

| | | |
|---|---|---|
| Network Adapters: | DEFAA (FBUS+ FDDI) | |
| Asynchronous Terminals: | VT100 | VT300 |
| | VT102 | VT320 |
| | VT200 | VT340 |
| | VT220 | VT420 |
| | VT240 | VT510 |
| Serial Printers: | LA36 | LG02 |
| | LA50 | LG06 |
| | LA70 | LG12 |
| | LA75 | LJ250 |
| | LA75 TURBO | LJ252 |
| | LA100 | LN03 |
| | LA120 | LN03R |
| | LA210 | DEClaser 1100/1500[1] |
| | LA324 | DEClaser 2100/2150[1] |
| | LCG01 | DEClaser 2200/2250[1] |
| | LF01R | DEClaser 3200/3250[1] |
| | | DEClaser 5100[1] |
| Modems[2]: | DF02 | DF296 |
| | DF03 | |

[1] Support for these printers is at DEC ANSI level 1.

[2] DIGITAL UNIX will support any DIGITAL modem that understands DIGITAL Modem Command Language (DMCL).

**Table 5**
**DEC 7000 Models 6xx and 7xx; DEC 10000 Models 6xx and 7xx**

| | | | |
|---|---|---|---|
| Memory: | 1 GB [1] | 14 GB[1] | |
| Controller: | KDM70, CIXCD-AC[2] | | |
| I/O Servers: | HSC40[3]<br>HSC50[3] | HSC65[3]<br>HSC70[3] | HSC90[3]<br>HSC95[3] |
| Disks: | RA60[4]<br>RA71<br>RA72 | RA73<br>RA81<br>RA82 | RA90<br>RA92 |
| Tapes: | TA78<br>TA79 | TA90 | TA91 |
| Controller: | KZMSA[5] | | |
| Network Adapters: | DEMFA (XMI FDDI) | DEMNA (XMI Ethernet) | DEFAA (FBUS+ FDDI)<br>DGLPB (PCI ATM) |
| Asynchronous Terminals: | VT100<br>VT102<br>VT200<br>VT220 | VT240<br>VT300<br>VT320<br>VT340 | VT420<br>VT510 |
| Serial Printers: | LA36<br>LA50<br>LA70<br>LA75<br>LA75 TURBO<br>LA100<br>LA120 | LA210<br>LA324<br>LCG01<br>LF01R<br>LG02<br>LG06<br>LG12 | LJ250<br>LJ252<br>LN03<br>LN03R<br>DEClaser 1100/1500[6]<br>DEClaser 2100/2150[6]<br>DEClaser 2200/2250[6]<br>DEClaser 3200/3250[6] |
| Modems[7]: | DF02 | DF03 | DF296 |

[1] If a KDM70 is configured with either a DEC 7000 or a DEC 10000 machine, the maximum amount of main memory supported is 1 GB. When a KDM70 is not configured, the maximum amount of main memory supported is 14 GB.

[2] One CIXCD controller per system.

[3] The k.scsi requestor is not supported.

[4] Data device only.

[5] Up to 16 controllers supported.

[6] Support for these printers is at DEC ANSI level 1.

[7] DIGITAL UNIX will support any DIGITAL modem that understands DIGITAL Modem Command Language (DMCL).

**Table 6**
**AlphaServer 300 4/266**

| | | | |
|---|---|---|---|
| Storage Adaptors & Controllers: | KZPAA (PCI SCSI 2) | KZPSA | KZPSC |
| Diskettes: | RX23 | | |
| Network Adapters: | DEFPA (PCI FDDI)<br>DE434, 435, 450 (PCI Ethernet) | DE500 (PCI Fast Ethernet)<br>PBXNP (PCI Token Ring) | DE205 (ISA Ethernet)<br>DW110 (ISA Token Ring)<br>DGLPB (PCI ATM) |
| Keyboards: | PCXAL-XX | LK471 | LK411 |
| Tablet: | PBXWT-A (CalComp DB III) | | |
| Mouse: | PBXWS-AA (3 button) | | |
| Graphics Subsystems: | PBXGA-Ax/Bx/Cx<br>PB2GA-JA[2] | PB2GA-JB[2]<br>PB2GA-FB | PB2GA-FA (ATI Mach 64 CX)[1]<br>PBXGC-Ax/Bx |
| Serial Printers: | LA36<br>LA50<br>LA70<br>LA75<br>LA75 TURBO<br>LA100<br>LA120<br>LA210 | LA324<br>LCG01<br>LF01R<br>LG02<br>LG06<br>LG12<br>LJ250<br>LJ252 | LN03<br>LN03R<br>DEClaser 1100/1500[3]<br>DEClaser 2100/2150[3]<br>DEClaser 2200/2250[3]<br>DEClaser 3200/3250[3]<br>DEClaser 5100[3] |
| Monitors: | VRC21-LA/L4 | VRT17-PA/P4 | VRC15-KA/K4 |
| Modems[4]: | PCXDF-AA | PCXDF-BA | PBXDF-AA/BA (FAX/Modem) |

[1] Supported on 100 Model only.

[2] Cannot be used in a multiscreen configuration.

[3] Support for these printers is at DEC ANSI level 1.

[4] Modem support only - no FAX available.

**Table 7**
**AlphaServer 400 4/166, 4/233**

| | | | |
|---|---|---|---|
| Storage Adaptors & Controllers: | KZPAA (PCI SCSI 2)<br>KZPSA | KZPSC<br>KZPDA | KZPSM |
| Diskettes: | RX23L | | |
| Network Adapters: | DEFPA (PCI FDDI)<br>DE500 (PCI Fast Ethernet)<br>DE434, 435, 450 (PCI Ethernet) | DE205 (ISA Ethernet)<br>DW110 (ISA Token Ring)<br>PBXNP (PCI Token Ring) | DGLPB (PCI ATM)<br>PBXDI |
| Keyboards: | PCXAL-XX | LK411 | LK471<br>LK450 |
| Mouse: | PBXAS-AA/AB(3 button) | PBXWS-AA(3 button) | PC7XS-AA (2 button) |
| Tablet: | PBXWT-A (CalComp DB III) | | |
| Graphics Subsystems: | PBXGA-Ax,Bx,Cx | PB2GA-FB | PB2GA-FA |
| Serial Printers: | LA36<br>LA50<br>LA70<br>LA75<br>LA75 TURBO<br>LA100<br>LA120<br>LA210 | LA324<br>LCG01<br>LF01R<br>LG02<br>LG06<br>LG12<br>LJ250<br>LJ252 | LN03<br>LN03R<br>DEClaser 1100/1500[1]<br>DEClaser 2100/2150[1]<br>DEClaser 2200/2250[1]<br>DEClaser 3200/3250[1]<br>DEClaser 5100[1] |
| Monitors: | VRC15-KA/K4<br>VRC15-PA/P4 | VRC21-PA/P4<br>VRC16-PA/P4 | VRT17-PA/P4 |
| Modems[2]: | PCXDF | PBXDF-AA (FAX /modem) | PBXDF-BA (FAX/modem) |

[1]Support for these printers is at DEC ANSI level 1.

[2]Modem support only - no FAX available.

**Table 8**

**AlphaServer 1000 4/200, 4/266, 5/300; AlphaServer 1000A 4/233, 4/266, 5/300, 5/333, 5/400**

| | | | |
|---|---|---|---|
| Diskettes: | RX23L | | |
| Storage Adapters & Controllers: | KZPAA (PCI SCSI)<br>KZPSA (PCI FWD SCSI) | KZESC (EISA RAID)<br>KZPSC (PCI RAID)[1] | KZPDA<br>KZPSM |
| Network Adapters: | DEFEA (EISA FDDI)<br>DW300 (EISA Token Ring)<br>DE422 (EISA Lance Ethernet) | DE425 (EISA Tulip Ethernet)<br>DEFPA (PCI FDDI)<br>PBXNP (PCI Token Ring) | DGLPB (PCI ATM)<br>DE434, 435, 450 (PCI Ethernet)<br>DE500 (PCI Fast Ethernet) |
| Keyboards: | LK471 | LK411 | PCXAL-XX<br>PBXGB-AA/CA[2] |
| Graphics Subsystems: | PB2GA-AA<br>PB2GA-JA | PB2GA-FB | PBXGA-AX/BX |
| Mouse/Tablet: | PC7XS-CA (3 button)<br>PCX7S-AA (2 button) | PBXWT-A (CalComp DB III) | PBXWS-AA (3 button) |
| Serial Printers: | LA36<br>LA50<br>LA70<br>LA75<br>LA75 TURBO<br>LA100<br>LA120<br>LA210 | LA324<br>LCG01<br>LF01R<br>LG02<br>LG06<br>LG12<br>LJ250<br>LJ252 | LN03<br>LN03R<br>DEClaser 1100/1500[3]<br>DEClaser 2100/2150[3]<br>DEClaser 2200/2250[3]<br>DEClaser 3200/3250[3]<br>DEClaser 5100[3] |
| Monitors: | VRC14-PA/P4<br>VRC15-PA/P4<br>VRC15-KA/K4 | VRC16-PA/P4<br>VRC16-H4/HA<br>VRT17-PA/P4 | VRC21-PA/P4<br>VRC21-H4/HA<br>VRC-21-K4/KA<br>VRC21-L4/LA |
| Modems: | PBXDF-AA/BA | PCXBF-AA[4] | PCXCF-AA [4] |

[1] Only one KZPSC can be used at a time.

[2] CA is only supported on the 1000 5/300.

[3] Support for these printers is at DEC ANSI level 1.

[4] Modem support only - no FAX available.

**Table 9**

**AlphaServer 2000 4/200, 4/233, 4/275, 5/250, 5/300, 5/350, 5/375; AlphaServer 2100 4/200, 4/233, 4/275, 5/250, 5/300, 5/350, 5/375; AlphaServer 2100A 4/275, 5/250, 5/300, 5/350**

| | | | |
|---|---|---|---|
| Memory: | Limited to 2 GB | | |
| Diskettes: | RX26 | | |
| Storage Adapters & Controllers: | PB2HA-SA: Adaptec 1742A (EISA)[1]<br>KZESC (EISA RAID) | KZPAA (PCI SCSI)<br>KZPSA (PCI FWD SCSI) | KZPSC (PCI RAID)<br>KZPDA[2] |
| Network Adapters: | DEFEA (EISA FDDI)<br>DW300 (EISA Token Ring)<br>DE422 (EISA Lance Ethernet)[3] | DE425 (EISA Tulip Ethernet)<br>DEFPA (PCI FDDI)<br>DGLPB (PCI ATM) | DE434, 435, 450 (PCI Ethernet)<br>DE500 (PCI Fast Ethernet)<br>PBXNP (PCI Token Ring) |
| Keyboards: | PCXAL-XX | LK411 | LK471 |
| Mouse/Tablet: | PC7XS-CA | PBXWT-A (CalComp DB III) | PBXWS-AA (3 button) |
| Graphics Subsystems: | PB2GA-AA<br>PB2GA-JB[4] | PB2GA-FB<br>PB2GA-JA[4] | PBXGA-AA[5]<br>PBXGA-BA[5]<br>PBXGA-CA[5] |
| Serial Printers: | LA36<br>LA50<br>LA70<br>LA75<br>LA75 TURBO<br>LA100<br>LA120<br>LA210 | LA324<br>LCG01<br>LF01R<br>LG02<br>LG06<br>LG12<br>LJ250<br>LJ252 | LN03<br>LN03R<br>DEClaser 1100/1500[6]<br>DEClaser 2100/2150[6]<br>DEClaser 2200/2250[6]<br>DEClaser 3200/3250[6]<br>DEClaser 5100[6] |
| Monitors: | VRC15<br>VRC16 | VRT17 | VRC21 |
| Modems[7]: | DF02 | DF03 | DF296 |

[1] G2 minimum firmware requirement; maximum of one. Not supported on AlphaServer 2100A.

[2] KZPDA only supported 4/275, 5/250, and 5/300.

[3] Not supported on AlphaServer 2100A.

[4] Cannot be used in multiscreen configuration.

[5] Not supported on AlphaServer 2100A.

[6] Support for these printers is at DEC ANSI level 1.

[7] DIGITAL UNIX will support any DIGITAL modem that understands DIGITAL Modem Command Language (DMCL).

**Table 10**

**AlphaServer 4000 5/300, 5/300E, 5/400, 5/466; AlphaServer 4100 5/300, 5/300E, 5/400, 5/466**

| | | |
|---|---|---|
| Memory: | Limited to 4 GB | |
| Diskettes: | RX26 | |
| Storage Adapters & Controllers: | KZESC (EISA RAID)<br>KZPAA (PCI SCSI)<br>KZPDA | KZPSA (PCI FWD SCSI)<br>KZPSC (PCI RAID) |
| Network Adapters: | DW300 (EISA Token Ring)<br>DEFPA (PCI FDDI)<br>DGLPB (PCI ATM) | DE434, 435, 450 (PCI Ethernet)<br>DE500 (PCI Fast Ethernet)<br>PBXNP-AA (PCI Token Ring) |
| Keyboards: | PCXAL-XX | LK47W |
| Mouse: | PBXWS-WA (3 button) | |
| Graphics Subsystems: | PB2GA-JB | |
| Serial Printers: | LA36<br>LA50<br>LA70<br>LA75<br>LA75 TURBO<br>LA100<br>LA120<br>LA210<br>LA324<br>LCG01<br>LF01R | LG02<br>LG06<br>LG12<br>LJ250<br>LJ252<br>LN03<br>LN03R<br>DEClaser 1100/1500[1]<br>DEClaser 2100/2150[1]<br>DEClaser 2200/2250[1]<br>DEClaser 3200/3250[1]<br>DEClaser 5100[1] |
| Monitors: | VRC15 | VRT17<br>VRC21 |
| Modems[2]: | DF02<br>DF03 | DF296 |

[1] Support for these printers is at DEC ANSI level 1.

[2] DIGITAL UNIX will support any DIGITAL modem that understands DIGITAL Modem Command Language (DMCL).

**Table 11**

**AlphaServer 8200 5/300, 5/350, 5/440; AlphaServer 8400 5/300,5/350, 5/440**

| | | | |
|---|---|---|---|
| Memory: | 1 GB [1] | 14 GB[1] | |
| Storage Adapters & Controllers: | KDM70, CIXCD-AC[2]<br>KZPSA-BB (PCI FWD)<br>KZPSC-AA (PCI RAID)[5] | KZPSC-BA (PCI RAID)<br>KZPAA (PCI SCSI) | KZMSA[6]<br>KFE70-AA (EISA Bridge) |
| I/O Servers: | HSC40[3]<br>HSC50[3] | HSC65[3]<br>HSC70[3] | HSC90[3]<br>HSC95[3] |
| Disks: | RA60[4]<br>RA71<br>RA72 | RA73<br>RA81<br>RA82 | RA90<br>RA92 |
| Tapes: | TA78 | TA79 | TA90<br>TA91 |
| Network Adapters: | DEMFA (XMI FDDI)<br>DEMNA (XMI Ethernet)<br>DEFAA (FBUS+ FDDI) | DE425 (EISA Ethernet)<br>DW300 (EISA Token Ring)<br>DEFPA (PCI FDDI)<br>DGLPB (PCI ATM) | PBXNP (PCI Token Ring)<br>DE434, 435, 450 (PCI Ethernet)<br>DE500 (PCI Fast Ethernet) |
| Multifunctional Adapter: | KFTIA (ITIOP) | | |
| Asynchronous Terminals: | VT100<br>VT102<br>VT200<br>VT220 | VT240<br>VT300<br>VT320 | VT340<br>VT420<br>VT510 |
| Serial Printers: | LA36<br>LA50<br>LA70<br>LA75<br>LA75 TURBO<br>LA100<br>LA120<br>LA210 | LA324<br>LCG01<br>LF01R<br>LG02<br>LG06<br>LG12<br>LJ250<br>LJ252 | LN03<br>LN03R<br>DEClaser 1100/1500[7]<br>DEClaser 2100/2150[7]<br>DEClaser 2200/2250[7]<br>DEClaser 3200/3250[7] |
| Modems[8]: | DF02 | DF03 | DF296 |

[1] If a KDM70 is configured with either a AlphaServer 8200/8400 machine, the maximum amount of main memory supported is 1 GB. When a KDM70 is not configured, the maximum amount of main memory supported is 14 GB.

[2] One CIXCD controller per system.

[3] The k.scsi requestor is not supported.

[4] Data device only.

[5] Check KZPSC documentation for device limitations.

[6] Up to 16 controllers supported.

[7] Support for these printers is at DEC ANSI level 1.

[8] DIGITAL UNIX will support any DIGITAL modem that understands DIGITAL Modem Command Language (DMCL).

**Table 12**

**AlphaStation 200 4/100, 4/166, 4/233; AlphaStation 250 4/266; AlphaStation 400 4/233, 4/266**

| | | | |
|---|---|---|---|
| Storage Adapters and Controllers: | KZPAA-AA (PCI SCSI 2) | KZPSA-BB | KZPSC-AA/BA |
| Diskettes: | RX23 | RX23L | |
| Network Adapters: | DEFPA (PCI FDDI)<br>DE434, 435, 450 (PCI Ethernet) | DE500 (PCI Fast Ethernet)<br>PBXNP (PCI Token Ring) | DE205 (ISA Ethernet)<br>DW110 (ISA Token Ring)<br>DGLPB (PCI ATM) |
| Keyboards: | PCXAL-XX<br>LK47W-XX | LK471-XX<br>LK461-XX | LK411-XX<br>LK46W-XX |
| Tablet: | PBXWT-A (CalComp DB III) | | |
| Mouse: | PBXWS-AA/WA | | |
| Graphics Subsystems: | PBXGA-Ax/Bx/Cx<br>PB2GA-JA/JB[2] | PBXGB-XX<br>PBXGE-XX[5] | PB2GA-FA (ATI Mach 64 CX)[1]<br>PBXGC-XX |
| Serial Printers: | LA36<br>LA50<br>LA70<br>LA75<br>LA75 TURBO<br>LA100<br>LA120<br>LA210 | LA324<br>LCG01<br>LF01R<br>LG02<br>LG06<br>LG12<br>LJ250<br>LJ252 | LN03<br>LN03R<br>DEClaser 1100/1500[3]<br>DEClaser 2100/2150[3]<br>DEClaser 2200/2250[3]<br>DEClaser 3200/3250[3]<br>DEClaser 5100[3] |
| Monitors: | VRC21-LA/L4 | VRT17-PA/P4 | VRC15-KA/K4 |
| Modems[4]: | PCXDF-AA | PCXDF-BA | |

[1] Supported on 100 Model only.

[2] Cannot be used in a multiscreen configuration.

[3] Support for these printers is at DEC ANSI level 1.

[4] Modem support only - no FAX available.

[5] Supported on 250 system only.

**Table 13**
**AlphaStation 255 4/233, 4/300**

| | | |
|---|---|---|
| Storage Adaptors and Controllers: | KZPAA (PCI SCSI 2) | KZPSC-AA/BA |
| Diskettes: | RX23L | |
| Network Adapters: | DEFPA (PCI FDDI)<br>DE450 (PCI Ethernet)<br>DE500 (PCI Fast Ethernet) | DE205-AC (ISA Ethernet)<br>DGLPB (PCI ATM)<br>PBXNP-AA (PCI TR) |
| Keyboards: | LK47W-XX<br>LK461-XX<br>LK471-XX | LK46W-XX<br>LK411-XX<br>PCXAL-XX |
| Tablet: | PBXWT-A (CalComp DB III) | |
| Mouse: | PBXWS-WA | |
| Graphics Subsystems: | PB2GA-JA[1]<br>PB2GA-JB[1] | PBXGB-AA/CA<br>PBXGI-AA/G[2]<br>PBXGC-AA[2] |
| Serial Printers: | LA36<br>LA50<br>LA70<br>LA75<br>LA75 TURBO<br>LA100<br>LA120<br>LA210<br>LA324<br>LCG01<br>LF01R | LG02<br>LG06<br>LG12<br>LJ250<br>LJ252<br>LN03<br>LN03R<br>DEClaser 1100/1500[3]<br>DEClaser 2100/2150[3]<br>DEClaser 2200/2250[3]<br>DEClaser 3200/3250[3]<br>DEClaser 5100[3] |
| Monitors: | VRC15-WA/W3/W4<br>VRT17-WA/W3/W4 | VRC21-WA/W3/W4 |
| Modems[4]: | PBXDF-AA<br>PBXDF-BA | PCXCF-AA<br>PCXBF-AA |

[1]Cannot be used in multiscreen configuration.

[2]Requires OPEN3D for 2D/3D operation.

[3]Support for these printers is at DEC ANSI level 1.

[4]Modem support only - no FAX available.

**Table 14**
**DIGITAL Personal Workstation 433au, 500au**

| | | | |
|---|---|---|---|
| ATAPI/IDE: | PCXRN-AF | PCXRN-AH | |
| Storage Adaptors and Controllers: | KZPBA-CA | KZPAA-AA | |
| Diskettes: | RX23L | | |
| Network Adapters: | DEFPA-AA<br>DE500-AA | DGLPB-AB | DE450-CA |
| Keyboards: | LK97W-XX | | |
| Mouse: | PCXLN-AD | | |
| Graphics Subsystems: | PB2GA-JD[1] | PBXGB-AA/CA | PBXGI-AX[2] |
| Serial Printers: | | | |
| Monitors: | VRT17-WA/W4<br>VRTX7-W3 | VRC21-WA/W4<br>VRCX1-W3 | |

[1] Cannot be used in multiscreen configuration.

[2] Requires Open 3D for 2D/3D operation.

**Table 15**

**AlphaStation 500 5/266, 5/333, 5/400, 5/500; AlphaStation 600 5/266, 5/300, 5/333: AlphaStation 600A 5/500**

| | | | |
|---|---|---|---|
| Storage Adaptors and Controllers: | KZPAA (PCI SCSI 2)<br>KZPSA-BB | KZPSC-AA/BA<br>KZPDA-AA[6] | P2SE (2 Qlogic 1 Tulip)[2] |
| Diskettes: | RX23L | | |
| Network Adapters: | DEFEA (EISA FDDI)[1]<br>DW300 (EISA Token Ring)[1]<br>DE425 (EISA Ethernet)[1]<br>DE434, 435[1], 450 (PCI Ethernet) | DEFPA (PCI FDDI)<br>DGLPB (PCI ATM) | PBXNP (PCI Token Ring)<br>DE500 (PCI Fast Ethernet) |
| Keyboards: | PCXAL-XX<br>LK411-XX | LK461-XX<br>LK471-XX | LK46W-XX<br>LK47W-XX[4] |
| Mouse: | PBXWS-AA[2] | PBXWS-WA[4] | |
| Tablet: | PBXWT-A (CalComp DB III) | | |
| Graphics Subsystems: | PBXGA-Ax/Bx/Cx[2]<br>PBXGB-Ax/Cx | PBXGC-AX/BX[8]<br>PBXGI-AX[8] | PBXGE-XX[1] |
| Monitors: | VRC21-Lx[2]/Wx[4] | VRT17-Px[2]/Wx[4] | VRC15-KX/WX |
| Serial Printers: | LA36<br>LA50<br>LA70<br>LA75<br>LA75 TURBO<br>LA100<br>LA120<br>LA210 | LA324<br>LCG01<br>LF01R<br>LG02<br>LG06<br>LG12<br>LJ250<br>LJ252 | LN03<br>LN03R<br>DEClaser 1100/1500[3]<br>DEClaser 2100/2150[3]<br>DEClaser 2200/2250[3]<br>DEClaser 3200/3250[3]<br>DEClaser 5100[3] |
| Modems[5]: | PBXDF-BA[5] | | |

[1] 0014 is the minimum firmware required.

[2] Only supported on AlphaStation 600/600A.

[3] Support for these printers is at DEC ANSI level 1.

[4] Support on AlphaStation 500.

[5] Modem support only - no FAX available.

[6] Not supported on AlphaStation 600/600A.

[8] Requires Open3D for 2D/3D.

**Table 16**

**Embedded & Realtime Boards: AXPpci 33; AXPpci 33S, DIGITAL Modular Computing Components EBM43-AZ, EBM44-AZ, EBM21-AZ, EBM23-AZ**

| | | |
|---|---|---|
| Controller: | KZPAA (PCI SCSI 2) | |
| Diskettes: | RX23 | RX26 |
| Network Adapters: | DEFPA (PCI FDDI)<br>DE434 (PCI Tulip Ethernet)<br>DE435, 450 (PCI Tulip Ethernet) | DE203, 204, 205 (ISA Ethernet)<br>DW110 (ISA Token Ring)<br>PBXNP (PCI Token Ring) |
| Keyboards: | PCXAL-XX | |
| Mouse: | PCXAS-AA | |
| Graphics Subsystems: | PBXGA (ZLXp-E)<br>PBXGB (TGA2) | PB2GA-FA (ATI PCI mach 64 CX)[1]<br>PB2GA-JA (TRIO 64 PCI Card) |
| Serial Printers: | LA36<br>LA50<br>LA70<br>LA75<br>LA75 TURBO<br>LA100<br>LA120<br>LA210<br>LA324<br>LCG01<br>LF01R | LG02<br>LG06<br>LG12<br>LJ250<br>LJ252<br>LN03<br>LN03R<br>DEClaser 1100/1500[2]<br>DEClaser 2100/2150[2]<br>DEClaser 2200/2250[2]<br>DEClaser 3200/3250[2]<br>DEClaser 5100[2] |
| Monitors: | VRC16-HA<br>VRC16-H4 | PCXBV-PC |
| Modems[3]: | DF02<br>DF03 | DF296<br>PCXDF[4] |

[1] Supported only in the primary PCI slots on DIGITAL Modular Computing Components EBM21-AZ, EBM23-AZ, EBM43-AZ, and EBM44-AZ.

[2] Support for these printers is at DEC ANSI level 1.

[3] DIGITAL UNIX will support any DIGITAL modem that understands DIGITAL Modem Command Language (DMCL).

[4] Modem support only - no FAX available.

**Table 17**
**Embedded & Realtime Boards: AXPvme 64, 100, 160, and 230; Alpha VME 4/224, 4/288**

| | | | |
|---|---|---|---|
| Diskettes: | RX23 | RX26 | RX33 |
| Network Adapters: | DEFPZ (PMC FDDI) | DE520 (PMC Fast Ethernet) | |
| Graphics Subsystems: | TGA8M[1] | | |
| Asynchronous Terminals: | VT100<br>VT102<br>VT200 | VT220<br>VT240<br>VT300 | VT320<br>VT340<br>VT420<br>VT510 |
| Serial Printers: | LA36<br>LA50<br>LA70<br>LA75<br>LA75 TURBO<br>LA100<br>LA120<br>LA210 | LA324<br>LCG01<br>LF01R<br>LG02<br>LG06<br>LG12<br>LJ250<br>LJ252 | LN03<br>LN03R<br>DEClaser 1100/1500[2]<br>DEClaser 2100/2150[2]<br>DEClaser 2200/2250[2]<br>DEClaser 3200/3250[2]<br>DEClaser 5100[2] |
| Modems[3]: | DF02 | DF03 | DF296 |

[1] Alpha VME 4/224 and 4/288 only.

[2] Support for these printers is at DEC ANSI level 1.

[3] Digital UNIX will support any Digital modem that understands Digital Modem Command Language (DMCL).

**Table 18**
**Alpha VME 2100 (190 MHz, 275 MHz)**

| | | | |
|---|---|---|---|
| Memory: | Limited to 1 GB | | |
| Diskettes: | RX26 | | |
| Adapters: | KZPAA (PCI SCSI) | KZPSA (PCI FWD SCSI) | |
| Network Adapters: | DEFPA (PCI FDDI) | DGLPB (PCI ATM) | DE434, 435, 450 (PCI Tulip Ethernet) |
| Keyboards: | PCXAL-XX | | |
| Graphics Subsystems: | | | |
| Serial Printers: | LA36<br>LA50<br>LA70<br>LA75<br>LA75 TURBO<br>LA100<br>LA120<br>LA210 | LA324<br>LCG01<br>LF01R<br>LG02<br>LG06<br>LG12<br>LJ250<br>LJ252 | LN03<br>LN03R<br>DEClaser 1100/1500[1]<br>DEClaser 2100/2150[1]<br>DEClaser 2200/2250[1]<br>DEClaser 3200/3250[1]<br>DEClaser 5100[1] |
| Monitors: | VRC15 | VRC16 | VRT17<br>VRC21 |
| Modems[2]: | DF02 | DF03 | DF296 |

[1]Support for these printers is at DEC ANSI level 1.

[2]DIGITAL UNIX will support any DIGITAL modem that understands DIGITAL Modem Command Language (DMCL).

**Table 19**
**EB66+, EB64+, EB164, AlphaPC 64, AlphaPC 164**

| | | | |
|---|---|---|---|
| SCSI Adapter: | KZPAA (PCI SCSI 2) | | |
| Diskettes: | RX23 | RX26 | |
| Network Adapters: | DE434, 435, 450 (PCI Tulip Ethernet) | DE500 (PCI Fast Ethernet) | DE203, 205, 205 (ISA Ethernet) |
| Keyboards: | PCXAL-XX | LK411-xx | LK461-xx<br>LK471-xx |
| Graphics Subsystems: | PBXGA (ZLXp-E) | PB2GA-JA/JB | |
| Mouse: | PCXAS-AA | PCXWS-AA | |
| Serial Printers: | LA36<br>LA50<br>LA70<br>LA75<br>LA75 TURBO<br>LA100<br>LA120<br>LA210 | LA324<br>LCG01<br>LF01R<br>LG02<br>LG06<br>LG12<br>LJ250<br>LJ252 | LN03<br>LN03R<br>DEClaser 1100/1500[1]<br>DEClaser 2100/2150[1]<br>DEClaser 2200/2250[1]<br>DEClaser 3200/3250[1]<br>DEClaser 5100[1] |
| Monitors: | VRC16-HA<br>VRC21-H4 | PCXBV-PC<br>VRC15-W | VRC17-W<br>VRC21-W |
| Modems[1]: | DF02<br>DF03 | DF296<br>PCXDF[1] | PBXDF-AA<br>PCXCF-AA<br>PCXBF-AA |

[1] Support for these printers is at DEC ANSI level 1.

## Table 20
## Local Language Variant Optional Hardware

The following devices support input and output of local language data.

| Language | Terminals | Keyboards | Printers | Printers, Cont. |
|---|---|---|---|---|
| Czech (C)/ Slovak (S): | VT42D-PV (C)<br>VT42D-PZ (S)<br>VT510-DX<br>VT510-EX<br>VT510-FX<br>VT510-KX | LK401-BV<br>LK401-CZ<br>LK411-BV (C)<br>PCXAL-HV (C)<br>LK411-CZ (S)<br>PCXAL-JZ (S) | LA70-CC<br>LA65-CC<br>LA75S-CB + LA75Y-CF<br>LA310-CB + LA31X-CA<br>LA424-CC + LA24X-CL<br>and LA24X-CS | LA600-CB<br>LG06-DB<br>LG12-DA<br>LN06 + LNXX-FE<br>LN07 + LNXX-FE |
| Traditional Chinese: | VT382-D* | LK401-D* | CP382-D* | |
| Simplified Chinese: | VT382-C* | LK401-C* | LA88-C* | LA380-C* |
| Greek: | VT420-NH/PH<br>VT510-*X | LK401-BH<br>LK411-BH | LA70-CC<br>LA310-CB<br>LA75S-CB | LA424-** + LA24X-CJ<br>LA600-CB |
| Hebrew: | VT420-AT | LK401-AT | LA70-AT | LA424-AT<br>LA600-AT |
| Hungarian: | VT42D-PQ<br>VT510-*X | LK401-BQ<br>LK411-BQ<br>PCXAL-HQ | LA70-CC<br>LA75S-CB<br>LA310-CB<br>LA424-CC + LA24X-CL | LG01-**<br>LG02-**<br>LG06-** |
| Japanese: | VT282-F*<br>VT286-F*<br>VT382-F*<br>VT383-F* | LK401-*J<br>LK421-*J | LA84-B*<br>LA86-A*<br>LA88-A*<br>LA90-A*<br>LN10 (DEClaser 2400) | LA280-A*<br>LA380<br>LN03S-JA<br>LN05S-AJ<br>LN82R |
| Korean: | VT382-K* | LA401-K* | LA380-K* | DLP5100 |
| Polish: | VT42D-PP<br>VT42D-QP<br>VT42D-RP<br>VT510-*X | LK401-BQ<br>LK411-BP<br>PCXAL-HP | LA70-CC<br>LA75S-CB + LA75Y-CF<br>LA310-CB + LA31X-CA<br>LA424-CB + LA24X-CL<br>LPS20<br>LPS32 | LG06-CB<br>LN07<br>LN08<br>DECLaser 1152<br>DECLaser 3250 |
| Russian: | VT42D-PT<br>VT510-*X | LK401-BT<br>LK411-BT<br>PCXAL-HT | LA70-CC<br>LG01-**<br>LG02-**<br>LG06-** | LA424-CC + LA24X-CL<br>LA75S-CB + LA75Y-CF<br>LA310-CB + LA31X-CA |
| Thai: | VT382-T* | LA401-T* | As recommended by local office | |
| Turkish: | VT420-UU/XU<br>VT420-PU/YU<br>VT420-WU/VU<br>VT420-QU/ZU<br>VT510-*X | LK401-BU<br>LK401-BW<br>LK402-BW<br>LK411-BU<br>LK411-BW<br>LK412-BW | LA70-CC<br>LA310-CB<br>LA75S-CB<br>LA424-** + LA24X-CK<br>LA424-** + LA24X-CM | |

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