Software Product Description

DESCRIPTION

The ULTRIX Operating System is Digital Equipment Corporation's native implementation of the UNIX® Operating System for all currently supported VAX, MicroVAX, VAXstation and Digital RISC systems. The ULTRIX Operating System is an interactive, demand-paged, virtual memory, multiple processor, time-sharing operating system that has a hierarchical file system with dismountable volumes, compatible device and interprocess I/O, asynchronous processes, system command language selectable on a per-user basis, disk quotas, job quotas, over 200 subsystems, and a high degree of portability among processors running ULTRIX application programs.

In addition to the Berkeley 4BSD functionality, Digital has added the following enhancements to ULTRIX:

System Administration Enhancements:

- Integral bad block replacement for DSA/MSCP and SCSI disks

- System diagnostics

- Error logging

- Streaming tape

- Remote backup

- Network installation for MicroVAX, VAXstation and RISC-based systems

- Magnetic tape facilities including labeled tape facility for single-volume ANSI tape interchange with ULTRIX and non-ULTRIX systems

- Line printer setup automation

- Documented error messages

- Support for up to 256 simultaneous users available through the use of user capacity upgrades

Multiprocessor Support

ULTRIX kernel has been enhanced to support multiple processors executing kernel code. Support has been added for both RISC and VAX multiprocessor systems. Semaphores and spin locks were added to synchronize access to kernel data structures. Each processor shares a common kernel image of text and data. The commands startcpu and stopcpu control attached processors. The cpustat utility views various cpu statistics.

Data Management

ULTRIX/SQL is an implementation of an industry standard SQL relational database management system. ULTRIX/SQL is highly compliant with ANSI/ISO 9075:1989 SQL standard. ULTRIX/SQL V1.0 is highly compliant with the ANSI level II SQL standard, Rdb/VMS VAX SQL and IBM®'s DB2 for maximum portability. SQL also provides the key to distributed databases and gateways to other database systems.

ULTRIX/SQL includes:

- Runtime SQL RDBMS engine with multi-server architecture and an intelligent query optimizer to enhance performance. The multi-server architecture allows system administrators to set up any number of database servers on any number of CPUs in a network for total control of system load balancing. It provides greater flexibility for system and database administrators to tune their environments for optimum performance.

ULTRIX/SQL uses the query optimization technology to allow end-users and programmers to access databases without having to be experts in how to state queries to achieve the best performance. It incorporates sophisticated artificial intelligence techniques to ensure that every query is solved in an efficient manner. The most significant benefit of query optimization is the ability to tune performance of applications without having to change or recompile them.

- DECnet and TCP/IP network access within the ULTRIX environment.

- An interactive SQL terminal monitor to allow on-line interactive queries to the database.

- DBA tools for the creation and maintenance of the database system.

- Optimization tools for the tuning of ULTRIX/SQL to achieve maximum performance.

- Automated recovery. ULTRIX/SQL automatically backs out all pending transactions and returns the database to a consistent state without operator intervention if a system crash occurs.

- Full documentation for users, DBAs and system administrators including on-line man-pages and a cross reference table for standards compliancy.

To install ULTRIX/SQL, the default shared memory values must be raised in the kernel config file and a special user must be added to the kmem group (can be removed once ULTRIX/SQL is installed). A minimum configuration of 16 megabytes swap space is needed and the disk space requirements are: 20 megabytes for VAX and 34 megabytes for RISC, with an optional embedded SQL development library requiring an additional 2 megabytes for VAX and 6 megabytes for RISC.

Optional products for SQL preprocessing and Rdb/VMS remote access are detailed in their own Software Product Description (SPD).

Communication Enhancements

Asynchronous Lines

Dynamic reassignment of asynchronous lines allows use of the same modems for dialing in and out of a system without user intervention. Terminal drivers support 7-bit and 8-bit characters.

ULTRIX includes a set of intersystem facilities for communication and networking of multiple systems:

Ethernet support - Allows for Ethernet communication using the TCP/IP network protocols, ThinWire, baseband, and, optionally, the Digital DNA network protocol if DECnet-ULTRIX is present (refer to DECnet-ULTRIX SPD 26.83.xx). All protocols can operate concurrently on a single physical Ethernet link.

CI network support - Allows for Computer Interconnect (CI) host to host communication using the network support port TCP/IP network protocols. The CI network is well suited for NFS traffic and can be used to offload the Ethernet of NFS traffic.

Security Enhancements

ULTRIX offers security features which have been designed to be compliant with the C2 security level as specified by the *Trusted Computing Security Evaluation Criteria* (Orange Book) and the *Password Management Guidelines* (Green Book).

- Protection of the memory interface and terminals via pre-assigned group identifiers.

- New Trusted Path facility which allows users logging into a system via either LAT or a terminal multiplexor to ensure that no other process is running on that line.

- Administrator option to configure enhanced login and password functionality which includes a shadow authentication database, configurable minimum password length (up to 16 characters), password aging and expiration.

- Security auditing subsystem and audit trail reduction facility which tracks and records all the security relevant actions occurring on the system along with who performed the action.

ULTRIX supports the BIND V4.8 and HESIOD name services. The BIND service provides a host name and address lookup service for the Internet network. HESIOD is layered on top of BIND and provides a more generic name service. The user can use HESIOD/BIND to replace or supplement the hosts, aliases, auth, group, networks, passwd, protocols, rpc, and services databases.

The IBM 2780/3780 Terminal Emulator is an ULTRIX software package that allows your system to emulate a 2780 or 3780 IBM terminal. The 2780/3780 Terminal Emulator uses the Binary Synchronous Communications (BSC) protocol to send and receive files across a communication line connected to an IBM system that supports 2780/3780 devices. The Digital devices that must be used on the VAX- and MicroVAX-based systems for the ULTRIX 2780/3780 Terminal Emulator are noted in the *OPTIONAL HARDWARE* section of this Software Product Description. This package is not available on RISC platforms.

The Local Area Transport (LAT) supports communication with service nodes on the same Ethernet. Software that runs on local area terminal servers is downloaded over the Ethernet network from either a Phase IV load host or any valid ULTRIX load host. A single ULTRIX host may support up to 256 simultaneous LAT sessions.

The host-initiated connection feature of LAT allows the manager of an ULTRIX system to associate a named port on a named terminal server with a specific tty device

special file. As a result, users can code applications that connect to the port through LAT.

The LAT/TELNET Gateway feature allows an ULTRIX system to be configured so users on a LAT terminal can connect to remote hosts via Telnet without first having to log in to the local ULTRIX system.

The ULTRIX Operating System provides a file system hierarchy of named directories and sub-directories. With the ULTRIX Operating System, the Digital Generic File System Interface (GFSI) provides the ability to mount multiple local and remote file systems. The currently supported file system types include the local ULTRIX File System (UFS) and Sun MicroSystems, Inc. Network File System (NFS™). NFS allows transparent file access over an Ethernet or CI network. POSIX-compatible file and record locking is supported by the NFS lock manager over an Ethernet or CI network. In addition, Sun MicroSystems, Inc. Yellow Pages service (YP) provides support for centralized system management of files over an Ethernet or CI network. The automounter service automatically mounts and unmounts NFS file system.

ULTRIX supports synchronous file system writes on a per-file basis. In addition, an option to the "mount" command permits an entire file system to be designated as synchronous, in which case, all writes issued to files in that file system are performed synchronously. These synchronous options provide deterministic file system operations and are useful in database applications. The file system buffer cache size is configurable.

Remote Procedure Call

The Digital Remote Procedure Call (DECrpc) facility is based on Apollo®'s Network Computing System™ (NCS) Remote Procedure Call (RPC) facility. DECrpc allows application developers to partition their applications along subroutine interfaces and to have those subroutines execute on remote hosts. It provides a transport independent interface to applications using the Internet UDP/IP protocols. DECrpc includes the following set of components:

• Remote Procedure Call (RPC) runtime library

• Network Interface Definition Language (NIDL) compiler

• Local and Global Location Brokers

DECrpc does not include other components of Apollo's Network Computing Architecture such as the Concurrent Programming Support or the replicated Global Location Broker.

RPC Applications are written in a high-level language, NIDL, which in turn generates calls to the RPC runtime procedures. The stub files generated by the NIDL compiler are C source files.

DECrpc has been tested and found compatible with the NCS V1.5 product from Apollo.

Kerberos is a third-party authentication service. The authentication of an application X to another application Y depends upon the trust both X and Y have in Kerberos. The BIND/HESIOD daemon named has been enhanced to optionally use Kerberos. ULTRIX also provides the Kerberos V4 programming interface so that application developers can use this service. ULTRIX does not provide the routines to send encrypted (safe) messages.

ULTRIX provides the ability to synchronize and distribute time for all machines in a network environment. The Network Time Protocol (NTP) is used to synchronize time. The University of Maryland developed the NTP daemon. The University of California at Berkeley time synchronization daemon, timed, is used to distribute time to all machines in a network.

Program Development Enhancements

A variety of tools for program development are provided with ULTRIX. These tools include VAX C/ULTRIX, portable C compiler, Pascal compilers and Source Code Control System. VAX C is only available on the VAX platforms. Pascal for RISC and FORTRAN for RISC are available as a layered product.

CDA Toolkit

The CDA Toolkit is an object library that provides the data structures and routines used to create, store, and interchange the revisable file formats supported by CDA (Compound Document Architecture). The CDA Toolkit is used to create CDA-compliant applications or to write converters that will interchange existing file formats using CDA data structures as the intermediate format.

Migration to and from the CDA environment includes portability across the RISC/ULTRIX, VAX/ULTRIX, and VMS Operating Systems. Electronic mailing and copying of revisable CDA documents provides support for hardware- and system-independent display and printing.

CDA data structures are predefined aggregate types that store in memory all the items needed to encode DDIF and DTIF documents. DDIF (Digital Data Interchange Format) aggregates are used to create CDA-compliant compound documents, graphics and image

documents, or converters. DTIF (Digital Table Interchange Format) aggregates are used to create CDA-compliant table data documents or converters for use by spreadsheet and database applications.

CDA data structures are used by supplying the appropriate information for all the items stored in each aggregate. The way in which the data structures are linked using the CDA routines determines the structure of the documents created by supporting applications.

CDA routines perform multiple operations including file, stream, and aggregate management; item storage and access; and reading, writing, and conversion of CDA data structures. Calls to the CDA routines are encoded within an application source file.

Converters bundled with the CDA Toolkit are: the DDIF, DTIF, and Text input and output converters; a PostScript® output converter; and an Analysis output converter which is a debugging tool that produces text output of CDA in-memory data structures.

Digital encourages independent software vendors to use the CDA Toolkit and its converter architecture to write new converters. The CDA Converter Architecture provides the advantage of a standard hub of interchange so that all CDA-compliant converters, whether developed by Digital or independent software vendors, can participate in data exchange.

The CDA Viewer, also bundled with the CDA Toolkit, displays the contents of all CDA-supported documents on a UWS workstation or character-cell terminal.

Callable DECwindows and character-cell viewer routines are used to write portable viewer widgets.

VAX C/ULTRIX is an implementation of the C programming language as described by Kernighan and Ritchie in *The C Programming Language.* Included are extensions as defined by the proposed ANSI Standard for C. Many compute-bound C applications compiled with VAX C/ULTRIX will run significantly faster than when compiled with the Portable C Compiler (pcc) on ULTRIX. VAX C/ULTRIX cannot be used for system level programs requiring the ASM pseudo function or where undocumented or nonstandard C features of pcc are used. If necessary, an application can be linked using some object modules compiled with both VAX C/ULTRIX and pcc. VAX C/ULTRIX uses the native run-time and system libraries on ULTRIX. It also uses the native header files. It supports the pcc command line with the exception of the following options: -go,-p,-t,-R,-S,-B. VAX C/ULTRIX is compatible with VAX C, Version 2.3 for VMS systems, except for VMS specific options. VAX C is not supported or shipped on RISC platforms.

Virtual Memory

The virtual memory subsystem is derived from 4.2BSD and has been enhanced with 4.3BSD performance enhancements and System V memory extensions. It provides full demand paging for both files resident on a local file system and files remotely resident and accessible via NFS. The backing store for paging/swapping can reside on a local disk partition or in the case of diskless support, in an NFS remote system file. System V features include demand paged shared memory support and page locking.

The ULTRIX virtual memory programmer's interface provides full source level compliance to existing standards. New interfaces of SVID issue 3 are not currently supported.

User Interfaces

Digital provides the following shells with ULTRIX:

— C Shell

— BSD Bourne Shell

— System V Bourne Shell

— Korn Shell

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

Data Encryption/Decryption Facilities

The object code distribution for The ULTRIX Operating System includes no forms of encryption or decryption other than one-way password encryption and Kerberos encryption algorithm. The encryption software is available as an option under a separate order number. (Refer to the *SOFTWARE OPTIONS* section.)

Compatibility with Other UNIX Offerings

The ULTRIX Operating System is compatible with other software system implementations which include:

4th Berkeley Software Distribution (4BSD), Version 4.2 and Version 4.3:

— File system formats are interchangeable provided disk partitions are compatible.

— The Bourne Version 7 and C Shell script syntaxes are highly compatible.

— Source code programs written for the Portable C Compiler (pcc) and object file formats are highly compatible.

— 4.2 BSD C Run-time and Math libraries are compatible.

SVID

SVID support is based on SVID Issue 2, Volume 1.

— Bourne System V Shell (Issue 1) script syntax is highly compatible.

— Source programs written for the Portable C Compiler (pcc) language that follow programming guidelines contained in Issue 2, Volume 1, Parts II and III of System V Interface Definition are highly compatible.

— System V Interprocess Communication (IPC)-Shared Memory, Semaphores, Message Queues, and Named Pipes.

— System V C Run-time and Math libraries are compatible.   .

Note: Under ULTRIX, source programs which conform to the SVID, Issue 1, may require recompilation.

Sun Network File System (NFS), Version 2.0:

— ULTRIX supports the Sun network services NFS, Mount, Yellow Pages, Automount and Lock manager/Status monitor. These services have been tested and found compatible with the corresponding SunOS services of the following Sun Operating Releases: V3.0, V3.2, V3.4, V3.5 and V4.0. The Automounter has been tested and found compatible with the automount service provided in SunOS Release V4.0.

— Named pipes accessed using NFS are not compatible between ULTRIX-32 V3.2 and ULTRIX V4.0 systems. A patch is available for ULTRIX-32 V3.1 systems.

Commands

The following commands meet specifications for POSIX 1003.2, Draft8:

diff	id	ln
tr	env	find
getopts	date	mkdir
mkfifo	mktemp	bc
chgrp	chmod	chown
tee	cp	join
ar	awk	cmp
make	basename	dirname
fold	sort	uniq

POSIX awk( )

In anticipation of POSIX 1003.2 final acceptance, a POSIX convergent awk utility is available. The new awk includes a change in the order of operator precedence. This may affect some existing awk programs that do not explicitly define precedence with the use of parenthesis. Therefore, this new awk will not be replacing the current awk, but will be introduced as the current awk is retired. ULTRIX 4.0 will be the first release for planning the retirement of current awk.

The migration towards full compliancy with POSIX 1003.2 will result in the retirement of the current awk( ) utility when the next major release of ULTRIX becomes available. That release will continue to deliver a version of nawk( ) modified to reflect a POSIX 1003.2 compatible utility.

The new awk in ULTRIX 4.0 introduces a number of new features:

1. New keywords: delete, do, function, return.

2. New built-in functions: atan2, cos, sin, rand, srand, gsub, sub, match, close, system.

3. New predefined variables: FNR, ARGC, ARGV, RSTART, RLENGTH, SUBSEP.

4. New expression operators: ?:,^

5. The FS variable and the third argument to split are now treated as extended regular expressions.

6. The operator precedence has changed to more closely match C.

7. The escape characters have been added to the extended regular expression.

New awk does not support Internationalized capabilities.

man Macros and Reference Page Support

The "man" macros, reference pages tools, and the reference pages which document the "man" macros and tools are now identical on all ULTRIX platforms.

The default page size has been changed to 8.5"x11" when formatted by troff-type roff formatters, based on Digital's documentation standard.

The generation of crop marks has been disabled because they do not fit on 8.5"x11" output media.

The use of Triumvirate fonts has been discontinued. They are replaced by PostScript Helvetica fonts. Macros which are intended specifically to call Triumvirate fonts, or whose names imply the use of Triumvirate fonts, have been changed to call Helvetica fonts.

Industry Standards

POSIX

This product provides all the interfaces required by the IEEE 1003.1-1988 standards. Source programs written in the C language that follow the programming guidelines contained in this standard are highly compatible. This product also meets the NIST (National Institute of Standards and Technology) FIPS (Federal Information Processing Standards) 151-1, which references draft 12 of the IEEE Std. 100-1988.

ULTRIX uses the Berkeley operating environment as the default operating environment. Future releases will use POSIX as the default operating environment.

X/OPEN

With the installation of the separately orderable XPG3 conformance upgrade, ULTRIX, Version 4.1 is XPG3 branded at the BASE level. The BASE level brand includes support areas of the X/OPEN Portability Guide 3: System call interfaces, Header Files, C libraries, Commands, and C compiler.

Internationalization

ULTRIX system includes a comprehensive set of library routines, commands and utilities to support the development of internationalized application software.

- Native Language System (NLS)

  The internationalized environment is based on the definition of the NLS interface in XPG3. This includes language support databases, an announcement mechanism (setlocale), and a message catalog system.

  The base system includes language support databases for French, English, and German for each of three codesets: Digital's MCS, ISO 8859/1, and ISO 646. A compiler, ic, is provided for users to define new language support databases.

  The default locale is called the C locale and is American English/ASCII.

  The message catalog system includes the "gencat" utility and related library functions that are used to access a message catalog from a C language application at run time.

- I18N Tools

  A set of tools is provided to assist engineers with the process of extracting message text from C programs and generating message catalogs. Message text source files can be translated using the utility "trans" or with any eight bit transparent text editor. These tools (extract, strextract, strmerge) are designed to work with the XPG3 message catalog system and are Digital enhancements to the NLS environment.

- Commands and Utilities

  There are 71 eight bit transparent commands as specified in XPG3. Several other commands are also eight bit transparent including editors (vi, ex, ed, sed) and networking commands (rlogin, ftp, tip, uucp).

  All NLS commands are provided and conform to the XPG3 specification. Refer to *I18N Tools*.

  The utility iconv provides a mechanism for codeset conversion that may be necessary in a heterogeneous network.

- Libraries

  A library of internationalization routines that conform to XPG3 is provided (libi) as well as modifications to the standard C library. These changes meet both the XPG3 and POSIX specifications.

  ctype library routines have been modified to make use of locale/culture specific information.

  Standard C library functions handle eight bit characters properly in accordance with XPG3.

  The routines setlocale, strxfrm, strcoll, strftime are in libc. The setlocale routine allows users to select a specific instance of localization such as dictionary or telephone ordering instead of character ordering (@modifier syntax).

- Kernel

  The kernel provides support for the use of Digital's MCS character set as well as ISO 8859/1 (e.g. 8 bit coded character sets).

- Networking

  Networking commands provide full eight bit charac-
  ter support. Mail is not eight bit transparent since the
  U.S. government RFC 822 specifically states that the
  high order bit is to be stripped. X/Open has recog-
  nized this as a problem and will likely withdraw the
  requirement for eight bit transparent Mail.

  DECnet is eight bit transparent.

- Filesystem

  The ULTRIX filesystem provides full eight bit trans-
  parency.

  Data interchange routines, such as tar and cpio, sup-
  port eight bit filenames. This can potentially cause
  an interoperability problem with UNIX systems that
  only provide 7 bit ASCII support.

- System Administration

  Usernames with eight bit characters are fully sup-
  ported and tools, such as adduser, have been up-
  dated to reflect this.

ULTRIX Supported Subsets

The definition of mandatory and optional subsets can be
found in the *Advanced Installation Guide*. The master
inventory file /sys/dist/ULTRIX.mi contained within the
unsupported UDXBASE400 for RISC and ULXBASE400
for VAX subset, contains a list of software components.
Subsets with names that begin with UDT for RISC and
ULT for VAX contain supported components.

Unsupported Subsets

In addition to the supported components of ULTRIX,
Digital provides components provided by 4.2BSD on an
"AS-IS" basis. This software is not warranted by Dig-
ital and no Software Performance Reports will be ac-
knowledged or answered on any component of these
subset. Support service cannot be purchased for this
software. The unsupported component software is pro-
vided on a separate distribution media, with the excep-
tion of the RA60 distribution and CDROM distribution,
in which case, the unsupported subset is contained in
a separate partition on the disk. These commands as-
signed to subsets with names that begin with UDX for
RISC and ULX for VAX are unsupported components.

RISC Systems

FORTRAN and Pascal are sold separately as layered
products. Certain portions of the unsupported code
which are architecture dependent on VAX will not ship.
VAX C will not be shipped. The R2000/R3000 hardware
uses the COFF format (Common Object File Format) in
its object files and load modules.

Architectural Differences

The following differences exist between ULTRIX (VAX)
cc and ULTRIX (RISC) cc:

- Hardware architectural differences.

- ULTRIX (RISC) does not support the const keyword.

- ULTRIX (RISC) pointers are unsigned, VAX are
  signed.

- Cannot dereference NULL ptrs on ULTRIX (RISC);
  includes arg to strlen.

- asm( ) is not supported with ULTRIX (RISC) in any
  form.

- The ULTRIX (RISC) compiler does not allow "old-
  fashioned initialization". An example of this, which
  worked on VAX but gave a warning and does not
  work on ULTRIX (RISC), is: "int i 0";.

- varargs is different. Any program that tries to walk
  the argument list by taking the address of an argu-
  ment and incrementing it will not be successful, es-
  pecially for double precision arguments. Programs
  using the macros in varargs.h will work. Compiling
  with the "-varargs" option on ULTRIX (RISC) will at-
  tempt to detect non-portable code.

- The setjmp/longjmp buffer is larger on ULTRIX
  (RISC). Programs with a hard coded ten-word buffer
  will fail; programs that correctly include <setjmp.h>
  and declare a 'jmp_buf' will work correctly.

- ULTRIX (RISC) has boundary alignment rules. User
  programs should only see this as a performance is-
  sue (the kernel does fix-ups). It is better, however, to
  align double-words, words and half-words on natural
  boundaries. (The setsysinfo system call or uac com-
  mand can be used to turn off the fixup messages.)

- ULTRIX (RISC) pointers cannot be used as the var
  on switch statements.

- ULTRIX (RISC) will not allow the same .c or .o file to
  be listed twice. ULTRIX (RISC) will generate doubly
  defined symbol errors. VAX pcc allowed this.

- -L flag: on VAX pcc -L flags on the line collectively
  affect "-l" flags. On ULTRIX (RISC) -L flags are seen
  strictly left to right, so that a -l must come first.

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- ULTRIX (RISC) global symbols do not have an extra leading underscore added to them. This difference affects assembler programmers and users of nlist(3).

- The -R (read-only text) option is not yet supported with ULTRIX (RISC).

- -Md/-Mg options: not needed on ULTRIX (RISC); the hardware has only one double precision format.

- ULTRIX (RISC) defines a macro (LANGUAGE_C, for instance) for the preprocessor that makes it possible to write multilingual include files.

- cpp predefined symbols: Both VAX & ULTRIX (RISC) define: 'ultrix', 'unix', 'bsd4_2'. On ULTRIX (RISC) the equivalent predefined symbol of 'vax' is 'mips'. On ULTRIX (RISC) 'MIPSEL' and 'host_mips' are also defined.

- ULTRIX supports communication over full- and half-duplex point-to-point DDCMP synchronous lines. DMC mode is provided for backward compatibility. This feature is only available on VAX platforms.

- Uucp and tip operations over an X.25 public packet switching network are supported using a MICOM Micro 800/X.25 Concentrator PAD™ device attached to one of the supported asynchronous communications multiplexers. This feature is only available on VAX platforms.

- Some ULTRIX options on the RISC R2000/R3000 hardware are not available on the VAX hardware.

- -I (no dirname).

- -P (preprocess, produce .i).

- -W (phase, opt).

- -v (print commands).

- ULTRIX (RISC) recognizes the environ variables ROOTDIR and TMPDIR.

- -cpp/-nocpp: most useful for languages other than C.

- -G: relevant only to MIPS architecture.

- -j, -k, -ko: relevant only to ULTRIX (RISC) compiler design.

- -std (warn nonstd usage): vcc has -V standard=portable.

- -volatile, -varargs: modify compiler behavior in certain areas.

- -V (print versions).

- ULTRIX (RISC) has big/little endian options: -EB and -EL.

- -unsigned indicates that variables of type "char" are to be treated as unsigned quantities. The default is to treat chars as signed.

Profiling:	On VAX, there are two levels selected with -p & -pg. On ULTRIX (RISC), there are also two levels, selected with the -p option or by running the post-processor program pixie(1). The ULTRIX (RISC) compiler is not affected by either option; all work is done in the assembler or loader (or postprocessor)
Optimization:	On VAX, there is one level of optimization, off by default and enabled with -O. On ULTRIX (RISC), there are five levels. By default, the second level is used; the -O0 option disables this, -O or -O2 invokes global optimization and there are rather more complex processes that can be used with -O3 and -O4. ULTRIX (RISC) also has the -Olimit switch that allows optimization to be bypassed with overly complicated code sections.
Selecting alternate compilers:	On both architectures, the -t & -B options specify passes and paths; however, the pass names for -t differ (there are more on ULTRIX (RISC)), and the semantics of -B belong to the -h option; -B is used to specify a command suffix instead. ULTRIX (RISC) also has -H, -K, and -# arguments designed for compiler development work.
Debugging information:	ULTRIX (RISC) offers four levels, where VAX has only two (on and off).

VAX ONLY	DIFFERENT	RISC ONLY
– arff	– config	– btou/utob
– rxformat	– csh	– cord
– symorder	– sh5	– uld
– 2780/3780	– prof	– dis
– adb	– ranlib	– odump
– makespt	– lint	– pixie
– /usr/mdec	– make	– ppu
– vcc	– ps	– showsnf
– lk	– disktab	– stdump
– libg	– makedev	– uac
	– brk	

LICENSE MANAGEMENT FACILITY SUPPORT

ULTRIX supports Digital's License Management Facility (LMF), which is a component of the overall Digital Distributed Software Licensing Architecture (DDSLA). The LMF provides on-line checking of software licenses and enables easier software management. The facility incorporates support for two types of licenses, availability and activity. The first version of LMF in ULTRIX V4.0 is limited to single node capability.

PrintServer Software

ULTRIX incorporates client software providing support for the PrintServer range of printers. The software includes ANSI to PostScript, ReGIS to PostScript and TEK to PostScript filters. The ReGIS to PostScript and TEK to PostScript filters are only available on VAX systems.

XTI is a UNIX version independent (BSD or SystemV) network application programming interface. Most networking applications are written to sockets since it is available on most UNIX systems. Over time, this trend would shift to the System V interface. With XTI, customers can write to a standard interface which will use either streams or sockets.

The packet filter is a software-driven network traffic monitor which provides demultiplexing of networking packet headers, as well as reception and transmission of packets containing user defined network protocols on an Ethernet LAN. The packet filter functions as an Ethernet Monitor and can be used to filter specific network protocols. The packet filter can also be used to send and receive packets using protocols not currently supported in the ULTRIX kernel.

Simple Network Management (SNMP) protocol manages TCP/IP networks. ULTRIX supports the SNMP Agent on both the VAX and the DECstation (MIPS) platform.

HARDWARE REQUIREMENTS

The ULTRIX Operating System can execute on valid VAX, MicroVAX or Digital RISC based systems and must include the following minimum system configuration. 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. (Refer to ULTRIX Worksystem Software Product Description (SPD 28.22.xx) for minimum hardware and device hardware requirements for all worksystems.)

- Supported ULTRIX processor at appropriate hardware revision level.

- Minimum component of main memory (Refer to the *OPTIONAL HARDWARE* section).

- Supported ULTRIX system device capable of holding the supported subsets (Refer to the *OPTIONAL HARDWARE* section).

- For local (non-network) distribution, supported ULTRIX software load and backup device.

- A valid load device for diagnostics.

- One console terminal with ASCII capability.

- The minimum memory configuration is 6MB for VAX and 8MB for RISC.

- Amount of memory supported is maximum support by hardware configurations or 512MB whichever is less.

- No more than ten terminal multiplexers per ULTRIX driver type may be configured. The actual number of terminal lines supported at one time with good performance depends on the types of processing performed as well as on the physical memory and CPU type.

- No more than two Ethernet controllers can be configured on any processor.

LAT and DECnet traffic is restricted to one Ethernet interface/controller. Each Ethernet interface/controller must be connected to a separate network or subnetwork in a routing configuration. Diskless activity requires the ability to communicate via mop. Therefore, diskless clients are also restricted to one Ethernet.

- TK50 media can be read but not written on a TK70 drive.

- A maximum of one CI interface per system is supported.

- To support a RL02 disk subsystem along with a UDA50 DSA disk subsystem under ULTRIX, the RL02 controller should be placed on a second UNIBUS. When both controllers are on a single UNIBUS the system will experience Data Lates, Hard disk errors and sometimes file corruption.

ULTRIX/CI Support

ULTRIX supports configurations that utilize the Computer Interconnect (CI) hardware. A configuration can consist of a single node or up to a maximum of 16 nodes, where a node is defined as being either an ULTRIX supported processor or a mass storage server. A maximum of four mass storage servers are permitted in a CI environment. Support is provided for homogeneous CI (ULTRIX) environment only.

The mass storage server is a free-standing, high speed, intelligent service designed to the specifications of the Digital Storage Architecture and known as the Hierarchical Storage Controller (HSC).

Network Remote Installation

RIS (Remote Installation Service) performs a remote installation through a local area network. The RIS is structured to install remotely both VAX and RISC workstations from a VAX or RISC server. To manage a large number of workstation installations, the RIS is capable of installing through a database file.

Diskless Workstations

ULTRIX supports a local area network of diskless workstations (clients) managed from a central host equipped with the necessary mass storage (the server). Centralizing the workstation's disk resources reduces the overall system cost and simplifies the administration of the network.

DMS (Diskless Management Service) performs diskless workstations setup. The DMS is structured to setup both VAX and RISC workstations from a VAX or RISC server. To manage a large number of diskless workstations, the DMS is capable of installing through a database file.

The following configuration guidelines apply to diskless workstations and servers:

- All the ULTRIX supported VAXstation and Digital RISC worksystems are supported diskless clients.

- The minimum memory configuration is 6MB for a VAX diskless client or 8MB for a RISC diskless client.

- The minimum memory is 16MB for a VAX diskless server or 16MB for a RISC diskless server.

- The MicroVAX 2000, VAXstation 2000 and any MicroVAX or VAXstation server with an RQDX1, RQDX2 or RQDX3 disk controller is limited to the support of three diskless clients.

GROWTH CONSIDERATIONS

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

OPTIONAL HARDWARE

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

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

(System configuration details are described in the *VAX Systems and Options Catalog.*)

The following tables list those hardware options that are supported by the ULTRIX Operating System. All device drivers for these hardware units contained in The ULTRIX Operating System are warranted by Digital.

PROCESSOR	MicroVAX II VAXserver 100	MicroVAX 2000 VAXserver 2000	MicroVAX 3100 VAXserver 3100	MicroVAX 3300/3400 VAXserver 3300/3400
Disk Drives	7 Maximum	3 Maximum	8 Maximum	3 Maximum
Controller	1 RQDX2			
	1 RQDX3			
	1 KDA50 [3]		N/A	
				DSSI [16]
	1 KFQSA			KFQSA
	1 KRQ40			
	1 KRQ50			
Drives	RA60			
	RA80			
	RA81			
	RA82			
	RA90			
	RA92			
	RX33 D	RX33 D	RX33 D	
	RX50 D		RX33 D	
		RD32 D		
	RD51 D			
	RD52 D			
	RD53 $D,5$	RD53 $D,17$		
	RD54 [6]	RD54 [6]		
	RRD40 $D,11$		RRD40 $D,$	
	RRD50 $D,11$			
			RZ24	
			RZ23 $L,18$	
			RZ55	
			RZ56	
			RZ57	
	RF30			RF30
	RF31			RF31
	RF71			RF71
	RF72			RF72
Magnetic Tapes	4 Maximum	1 Maximum	2 Maximum	4 Maximum
Controller	TQK50		N/A	TQK70
	TQK70			KRQ50
	KLESI-Q			KLESI-Q
	TSV05			TSV05

PROCESSOR	MicroVAX II VAXserver 100	MicroVAX 2000 VAXserver 2000	MicroVAX 3100 VAXserver 3100	MicroVAX 3300/3400 VAXserver 3300/3400
Drives	RV20 TK70 L TU81E TS05	TK50Z L	TZK10 TZ30 L TSZ05 TK50Z L TLZ04 TKZ08 RX33 D RX23 D	RV20 RRD40 TK70 L TS05
Communication Devices [2,13]	DEQNA [7] DMV11 [13] DPV11 [10] DHQ11 DHV11 DZQ11 [2] DZV11 [2] DELQA	DESVA [9] DHT32 DSH32	DSH32	CXA16 CXY08 DELQA/DESQA [15] DMV11 [13] DPV11 [10] DRV1W CXF32 CXB16
Modem/Pad Devices	DFA01 DF02 DF03 DF112 DF126 [10] DF212 DF224 DF242 Micom Micro 800/X.25™ DF296	DF02 DF03 DF112 DF212 DF224 DF242 Micom Micro 800/X.25 DF296	DF02 DF03 DF112 DF212 DF224 DF242 Micom Micro 800/X.25 DF296	DFA01 DF02 DF03 DF112 DF126 [10] DF212 DF224 DF242 Micom Micro 800/X.25 DF296
Line Printers	1 Maximum	1 Maximum	1 Maximum	1 Maximum
Controller	LPV11 LPV16			LPV11 LPV16
Printers	LG01 LG02 LP27			LG01 LG02 LP27

PROCESSOR	MicroVAX II VAXserver 100	MicroVAX 2000 VAXserver 2000	MicroVAX 3100 VAXserver 3100	MicroVAX 3300/3400 VAXserver 3300/3400
Serial Printers [4]	LA36	LA36	LA36	LA36
	LA50	LA50	LA50	LA50
	LA75	LA75	LA75	LA75
	LA100	LA100	LA100	LA100
	LA120	LA120	LA120	LA120
	LA210	LA210	LA210	LA210
	LCG01	LCG01	LCG01	LCG01
	LG02	LG02	LG02	LG02
	LG31	LG31	LG31	LG31
	LJ250	LJ250	LJ250	LJ250
	LN03	LN03	LN03	LN03
	LN03R	LN03R	LN03R	LN03R
	LN03S	LN03S	LN03S	LN03S
	LQP02	LQP02	LQP02	LQP02
	LQP03	LQP03	LQP03	LQP03
	LVP16	LVP16	LVP16	LVP16
Asynchronous Terminals [4]	VT100 Series	VT100 Series	VT100 Series	VT100 Series
	VT200 Series	VT200 Series	VT200 Series	VT200 Series
	VT300 Series	VT300 Series	VT300 Series	VT300 Series
	DECmate II/III	DECmate II/III	DECmate II/III	DECmate II/III
	Rainbow 100B	Rainbow 100B	Rainbow 100B	Rainbow 100B
	Rainbow 100+	Rainbow 100+	Rainbow 100+	Rainbow 100+
	Rainbow 190	Rainbow 190	Rainbow 190	Rainbow 190
	PRO 350	PRO 350	PRO 350	PRO 350
	PRO 380	PRO 380	PRO 380	PRO 380
	VAXmate	VAXmate	VAXmate	VAXmate

Notes:

[1]   Letter D = Data device only.
      Letter L = Valid ULTRIX load device.

[2]   DZV11 and DZQ11 are supported only up to 9600 baud. This also applies to the MicroVAX 2000 serial asynchronous lines.

[3]   KDA50 for the MicroVAX II must be at least at Rev Level C5.

[4]   For the MicroVAX 2000, only one modem/pad device can be connected because there is only a single EIA port.

[5]   The RD53 requires an RQDX2 or RQDX3 controller.

[6]   The RD54 requires an RQDX3 controller at least at Rev Level 2.8.

[7]   The DEQNA must be at least at Revision E1.

[8]   The DF126 can only be used with the DPV11 (IBM 2780/3780 Emulator); maximum baud rate 2400.

[9]   The DESVA is the ThinWire Ethernet controller for the MicroVAX 2000.

[10]　The DPV11 can only be used in conjunction with the 2780/3780 Emulator.

[11]　The RRD50/40 is available with controller and drive, and two drives are supported per controller. The RRD50/40 is supported as a read only device.

[12]　KDA50 for the MicroVAX 3000 systems must be at Rev Level E1 or greater.

[13]　The DMV11 is supported using TCP/IP and DECnet over full and half duplex point-to-point DDCMP sync lines. DMC mode is provided for backwards compatibility.

[14]　The MicroVAX 3500 with RD54s is supported as a timesharing system only.

[15]　Two controllers are allowed with an expansion cabinet.

[16]　The MicroVAX 3300/3400 provides by default a DSSI Bus Interface for RF disk support or by the KFQSA controller and Ethernet interface DELQA/DESQA by default which are supported by ULTRIX device drivers.

[17]　The RD53 can be used as a system disk only if a second disk of equal or greater size is available on the system.

[18]　Two drives (RZ23L) are required for system disks for a standalone system.

PROCESSOR	MicroVAX 3500 VAXserver 3500	MicroVAX 3600 VAXserver 3600/3602
Disk Drives	7 Maximum	7 Maximum
Controller	1 RQDX3	1 RQDX3
	1 KDA50 [12]	1 KDA50 [12]
	1 KFQSA	1 KFQSA
		1 KRQ40
	1 KRQ50	1 KRQ50
Drives		RA60
	RA70	RA70
		RA80
		RA81
		RA82
		RA90
		RA92
	RD51 D	RD51 D
	RD52 D	RD52 D
	RD53 D	RD53 D
	RD54 [6,14]	RD54 [6]
	RRD40 D,[11]	RRD40 D,[11]
	RRD50 D,[11]	RRD50 D,[11]
	RF30	RF30
	RF31	RF31
	RF71	RF71
	RF72	RF72
Magnetic Tapes	4 Maximum	4 Maximum
Controller	TQK50	TQK50
	TQK70	TQK70

PROCESSOR	MicroVAX 3500 VAXserver 3500	MicroVAX 3600 VAXserver 3600/3602
Drives	KLESI-Q	KLESI-Q
	TSV05	TSV05
	RV20	RV20
	TK50 ^{L}	TK50 ^{L}
	TK70 ^{L}	TK70 ^{L}
	TU81E	TU81E
	TS05	TS05
Communication Devices [2,13]	CXA16	CXA16
	CXB16	CXB16
	CXY08	CXY08
	DZQ11 [2]	DZQ11 [2]
	DELQA/DESQA	DELQA/DESQA
	DPV11 [10]	DPV11 [10]
	CXF32	
Modem/Pad Devices	DFA01	DFA01
	DF02	DF02
	DF03	DF03
	DF112	DF112
	DF126 [10]	DF126 [10]
	DF212	DF212
	DF224	DF224
	DF242	DF242
	Micom Micro	Micom Micro
	800/X.25	800/X.25
	DF296	DF296
Line Printers	1 Maximum	1 Maximum
Controller	LPV11	LPV11
	LPV16	LPV16
Printers	LG01	LG01
	LG02	LG02
	LP27	LP27
Serial Printers [4]	LA36	LA36
	LA50	LA50
	LA75	LA75

PROCESSOR	MicroVAX 3500 VAXserver 3500	MicroVAX 3600 VAXserver 3600/3602
	LA100	LA100
	LA120	LA120
	LA210	LA210
	LCG01	LCG01
	LG02	LG02
	LG31	LG31
	LJ250	LJ250
	LN03	LN03
	LN03R	LN03R
	LN03S	LN03S
	LQP02	LQP02
	LQP03	LQP03
	LVP16	LVP16
Asynchronous Terminals [4]	VT100 Series	VT100 Series
	VT200 Series	VT200 Series
	VT300 Series	VT300 Series
	DECmate II/III	DECmate II/III
	Rainbow 100B	Rainbow 100B
	Rainbow 100+	Rainbow 100+
	Rainbow 190	Rainbow 190
	PRO 350	PRO 350
	PRO 380	PRO 380
	VAXmate	VAXmate

Notes:

[1] Letter D = Data device only.
Letter L = Valid ULTRIX load device.

[2] DZV11 and DZQ11 are supported only up to 9600 baud. This also applies to the MicroVAX 2000 serial asynchronous lines.

[3] KDA50 for the MicroVAX II must be at least at Rev Level C5.

[4] For the MicroVAX 2000, only one modem/pad device can be connected because there is only a single EIA port.

[5] The RD53 requires an RQDX2 or RQDX3 controller.

[6] The RD54 requires an RQDX3 controller at least at Rev Level 2.8.

[7] The DEQNA must be at least at Revision E1.

[8] The DF126 can only be used with the DPV11 (IBM 2780/3780 Emulator); maximum baud rate 2400.

[9] The DESVA is the ThinWire Ethernet controller for the MicroVAX 2000.

[10] The DPV11 can only be used in conjunction with the 2780/3780 Emulator.

[11] The RRD50/40 is available with controller and drive, and two drives are supported per controller. The RRD50/40 is supported as a read only device.

[12] KDA50 for the MicroVAX 3000 systems must be at Rev Level E1 or greater.

13   The DMV11 is supported using TCP/IP and DECnet over full and half duplex point-to-point DDCMP sync lines. DMC mode is provided for backwards compatibility.

14   The MicroVAX 3500 with RD54s is supported as a timesharing system only.

15   Two controllers are allowed with an expansion cabinet.

16   The MicroVAX 3300/3400 provides by default a DSSI Bus Interface for RF disk support or by the KFQSA controller and Ethernet interface DELQA/DESQA by default which are supported by ULTRIX device drivers.

17   The RD53 can be used as a system disk only if a second disk of equal or greater size is available on the system.

18   Two drives (RZ23) are required for system disks for a standalone system.

PROCESSOR	MicroVAX 3800 VAXserver 3800	MicroVAX 3900 VAXserver 3900	DECsystem 5400	DECsystem 5500
Disk Drives	7 Maximum	7 Maximum	32 Maximum	
Controller	1 KDA50 [7]	1 KDA50 [9]	DSSI	SCSI
	KRQ40	KRQ40		
	KRQ50	KRQ50 [9]	KRQ50	KRQ50
	1 KDA50	1 RQDX3 [9]	KDA50	KRDA50
	1 KFQSA		KFQSA	KFQSA
Drives			ESE20 [D]	ESE20 [D]
	RA60	RA60	RA60	RA60
	RA70	RA70	RA70	RA70
	RA80	RA80		
	RA81	RA81	RA81	RA81
	RA82	RA82	RA82	RA82
	RA90	RA90	RA90	RA90
	RA92	RA92	RA92	RA92
	RRD40	RRD40	RRD40 [L]	RRD40 [L]
	RRD50	RRD50		
	RD51 [D]	RD51 [D]		
	RD52 [D]	RD52 [D]		
	RD53 [D]	RD53 [D]		
	RD54 [4]	RD54		
	RF30		RF30	RF30
	RF31		RD31	RF31
	RF71		RF71	RF71
	RF72		RF72	RF72
				RZ23 [D]
				RZ24
				RZ55
				RZ56
				RZ57
				RX23 [D]
				RX33 [D]
Magnetic Tapes	4 Maximum	4 Maximum	4 Maximum	4 Maximum
Controller	TQK50	TQK50		SCSI
	TQK70	TQK70	TQK70	TQK70
	KLESI-Q	KLESI-Q	KLESI-SA	KLESI-SA
	TSV05	TSV05	TSV05	TSV05
Drives	RV20	RV20	RV20	RV20
	TK50 [L]	TK50 [L]		
	TK70 [L]	TK70 [L]	TK70 [L]	TK70 [L]

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PROCESSOR	MicroVAX 3800 VAXserver 3800	MicroVAX 3900 VAXserver 3900	DECsystem 5400	DECsystem 5500
	TU81E	TU81E	TU81E	TU81E
	TS05	TS05	TS05	TS05
				TZ30 [L]
				TZK10
				TK50Z [L]
				TSZ05
				TLZ04
Communication Devices [2,8]	CXA16	CXA16	CXA16	CXA16
	CXB16	CXB16	CXB16	CXB16
	CXY08	CXY08	CXY08	CXY08
	DZQ11 [2]	DZQ11 [2]		
	DELQA/DESQA	DELQA/DESQA	DELQA/DESQA	DESQA/DESQA
	DPV11 [6]	DPV11 [6]		
			DESTA	DESTA
Modem/Pad Devices	DFA01	DFA01	DFA01	DFA01
	DF02	DF02	DF02	DF02
	DF03	DF03	DF03	DF03
	DF112	DF112	DF112	DF112
	DF126 [5]	DF126 [5]	DF126	DF126
	DF212	DF212	DF212	DF212
	DF224	DF224	DF224	DF224
	DF242	DF242	DF242	DF242
	Micom Micro 800/X.25	Micom Micro 800/X.25	Micom Micro 800/X.25	Micom Micro 800/x.25
	DF296	DF296	DF296	DF296
Line Printers	1 Maximum	1 Maximum	1 Maximum	1 Maximum
Controller	LPV11	LPV11	LPV11	LPV11
	LPV16	LPV16	LPV16	LPV16
	LG01	LG01		
	LG02	LG02		
	LP27	LP27		
Serial Printers [3]	LA36	LA36	LA36	LA36
	LA50	LA50	LA50	LA50
	LA75	LA75	LA75	LA75
	LA100	LA100	LA100	LA100

PROCESSOR	MicroVAX 3800 VAXserver 3800	MicroVAX 3900 VAXserver 3900	DECsystem 5400	DECsystem 5500
	LA120	LA120	LA120	LA120
	LA210	LA210	LA210	LA210
	LCG01	LCG01	LCG01	LCG01
	LG02	LG02	LG02	LG02
	LG31	LG31	LG31	LG31
	LJ250	LJ250	LJ250	LJ250
	LN03	LN03	LN03	LN03
	LN03R	LN03R	LN03R	LN03R
	LN03S	LN03S	LN03S	LN03S
	LQP02	LQP02	LQP02	LQP02
	LQP03	LQP03	LQP03	LPQ03
	LVP16	LVP16	LVP16	LVP16
Asynchronous Terminals [3]	VT100 Series	VT100 Series	VT100 Series	VT100 Series
	VT200 Series	VT200 Series	VT200 Series	VT200 Series
	VT300 Series	VT300 Series	VT300 Series	VT300 Series
	DECmate II/III	DECmate II/III	DECmate II/III	DECmate II/III
	Rainbow 100B	Rainbow 100B	Rainbow 100B	Rainbow 100B
	Rainbow 100+	Rainbow 100+	Rainbow 100+	Rainbow 100+
	Rainbow 190	Rainbow 190	Rainbow 190	Rainbow 190
	Pro 350	Pro 350	Pro 350	Pro 350
	Pro 380	Pro 380	Pro 380	Pro 380
	VAXmate	VAXmate	VAXmate	VAXmate

Notes:

[1]   Letter D = Data device only.
    Letter L = Valid ULTRIX load device.

[2]   DZV11 and DZQ11 are supported only up to 9600 baud. This also applies to the MicroVAX 2000 serial asynchronous lines.

[3]   For the MicroVAX 2000, only one modem/pad device can be connected because there is only a single EIA port.

[4]   The RD54 requires an RQDX3 controller at least at Rev Level 2.8.

[5]   The DF126 can only be used with the DPV11 (IBM 2780/3780 Emulator); maximum baud rate 2400.

[6]   The DPV11 can only be used in conjunction with the 2780/3780 Emulator.

[7]   KDA50 for the MicroVAX 3000 systems must be at Rev Level E1 or greater.

[8]   The DMV11 is supported using TCP/IP and DECnet over full and half duplex point-to-point DDCMP sync lines. DMC mode is provided for backwards compatibility.

[9]   Two controllers are allowed with an expansion cabinet.

PROCESSOR	DECstation 3100S	DECsystem 3100	DECsystem 5100	DECsystem 5000 Model 200
Disk Drives [4]	7 Maximum [5]	7 Maximum [5]	7 Maximum [5]	28 Maximum [5]
Controllers				
Drives	RZ23 ^{D}	RZ23 ^{D}	RZ23 ^{D,L}	
	RZ24	RZ24	RZ24	
	RZ55	RZ55	RZ55	RZ55
	RZ56	RZ56	RZ56	RZ56
	RZ57	RZ57	RZ57	RZ57
	RX23 ^{D}	RX23 ^{D}	RX23 ^{D}	RX23 ^{D}
	RX33 ^{D}	RX33 ^{D}	RX33 ^{D}	RX33 ^{D}
	RRD40 ^{L}	RRD40 ^{L}	RRD40 ^{L}	RRD40 ^{L}
Magnetic Tapes [4]	2 Maximum	2 Maximum	2 Maximum	Maximum [5]
Controller				
	TZK10	TZK10	TZK10	TZK10
	TZ30 ^{L}	TZ30 ^{L}	TZ30 ^{L}	TZ30 ^{L}
	TK50Z ^{L}	TK50Z ^{L}	TK50Z ^{L}	TK50Z ^{L}
	TSZ05	TSZ05	TSZ05	TSZ05
	TLZ04	TLZ04	TLZ04	TLZ04
	TKZ08	TKZ08		TKZ08
Communication Devices	1 Line Async [2]	1 Line Async [2]	11 Line Async	1 Line Async
Modem/Pad Devices			2 Maximum	
	DF03 [3]	DF03 [3]	DF03	DF03
	DF112 [3]	DF112 [3]	DF112	DF112
	DF212 [3]	DF212 [3]	DF212	DF212
	DF224 [3]	DF224 [3]	DF224	DF224
	DF242 [3]	DF242 [3]	DF242	DF242
Line Printers	1 Maximum	1 Maximum	11 Maximum	2 Maximum
Serial Printers	LA36	LA36	LA36	LA36
	LA50	LA50	LA50	LA50
	LA75	LA75	LA75	LA75
	LA100	LA100	LA100	LA100
	LA120	LA120	LA120	LA120
	LA210	LA210	LA210	LA210
	LCG01	LCG01	LCG01	LCG01
	LG02	LG02	LG02	LG02

PROCESSOR	DECstation 3100S	DECsystem 3100	DECsystem 5100	DECsystem 5000 Model 200
	LG31	LG31	LG31	LG31
	LJ250	LJ250	LJ250	LJ250
	LN03	LN03	LN03	LN03
	LN03R	LN03R	LN03R	LN03R
	LN03S	LN03S	LN03S	LN03S
	LQP02	LQP02	LQP02	LQP02
	LQP03	LQP03	LQP03	LQP03
	LVP16	LVP16	LVP16	LVP16
Asynchronous Terminals				2 Maximum
	VT100 Series	VT100 Series	VT100 Series	VT100 Series
	VT200 Series	VT200 Series	VT200 Series	VT200 Series
	VT300 Series	VT300 Series	VT300 Series	VT300 Series
	DECmate II/III	DECmate II/III	DECmate II/III	DECmate II/III
	Rainbow 100B	Rainbow 100B	Rainbow 100B	Rainbow 100B
	Rainbow 100+	Rainbow 100+	Rainbow 100+	Rainbow 100+
	Rainbow 190	Rainbow 190	Rainbow 190	Rainbow 190
	PRO 350	PRO 350	PRO 350	PRO 350
	PRO 380	PRO 380	PRO 380	PRO 380
	VAXmate	VAXmate	VAXmate	VAXmate

Notes:

[1]   Letter D = Data device only.
      Letter L = Valid ULTRIX load device.

[2]   Although 4 are available, ports 1 and 2 are not available. Port 3 is system console. Port 4 is available for printer or modem.

[3]   The modems must be configured such that the "Forced DSR" attribute is NOT set on the modem. If the "Forced DSR" attribute is set, the modem will be unable to recognize loss of connection, and may incorrectly assume that a connection has been established. Consult the modem's corresponding Owner's Manual for specific information on clearing the "Forced DSR" option.

[4]   The SCSI (Small Computer System Interface) cable length is limited to six meters, thereby limiting the number of external devices (tapes and disk) that can actually be attached to the system per bus.

[5]   Disk and tape devices are connected to the DECsystem and DECstation via SCSI (Small Computer System Interface). There is one integral SCSI controller and, optionally, up to three more SCSI controllers may be added. Each SCSI controller will support up to seven devices in any combination. Each controller has an identifier which may be set via the DS5000 Console Interface (the factory default is id6). Each device which is added must have its own unique identifier which must not conflict with any other device, including the SCSI controller. The SCSI controller should always have the highest id.

PROCESSOR	VAX-11/750	VAX-11/780 VAX-11/785
Floating Point	FP750	FP780/785
I/O Adapters		
SBI		1
UNIBUS	2 DW750	4 DW780
MASSBUS	2 RH750	4 RH780
MEMORY	1 MS750 Controller	2 MS780 Controllers
CI Adapters	1 CI750	1 CI780
Disk Drives	48 Maximum	64 Maximum
UNIBUS Disks	20 Maximum	28 Maximum
Controller	2 UDA50 [5,6]	4 UDA50 [5,6]
	HSC [12]	HSC [12]
	RL11	RL11
Drives	RA90	RA90
	RA92	RA92
	RA82	RA82
	RA81	RA81
	RA80	RA80
	RA60 L	RA60 L
	RA70	RA70
	RL02 D	RL02 D
MASSBUS Disks	32 Maximum	32 Maximum
	RM05	RM05
	RP07 D	RP07 D
Magnetic Tapes	4 Maximum	4 Maximum
CI Tapes	TA78	TA78
	TA79	TA79
	TA81	TA81
Console Tapes	TU58 [4,8]	

PROCESSOR	VAX-11/750	VAX-11/780 VAX-11/785
UNIBUS Tapes [7]		
Controller	KLESI-U	KLESI-U
	TS11	TS11
	TSU05	TSU05
Tapes	RV20	RV20
	TU80 [L]	TU80 [L]
	TU81 [L]	TU81 [L]
	TU81E [L]	TU81E [L]
	TS05	TS05
	TUK50	TUK50
MASSBUS Tapes		
Controller	TM03	TM03
	TM78	TM78
Tapes	TE16 [L]	TE16 [L]
	TU77 [L]	TU77 [L]
	TU78 [L]	TU78 [L]
	TU79 [L]	TU79 [L]
Communication Devices		
UNIBUS Communication Devices	DELUA [11]	DELUA [11]
	DEUNA [11]	DEUNA [11]
	DMR11 [3]	DMR11 [3]
	DHU11	DHU11
	DMF32 [2]	DMF32 [2]
	DMZ32	DMZ32
	DZ11	DZ11
	DZ32	DZ32
	DUP11 [10]	DUP11 [10]
Modem/Pad Devices	DF02	DF02
	DF03	DF03
	DF112	DF112
	DF126 [9]	DF126 [9]
	DF212	DF212
	DF224	DF224
	DF242	DF242
	Micom Micro	Micom Micro

PROCESSOR	VAX-11/750	VAX-11/780 VAX-11/785
	800/X.25	800/X.25
	DF296	DF296
Line Printers	5 Maximum	5 Maximum
Controller	LP11	LP11
	LP32	LP32
Printer	LG01	LG01
	LG02	LG02
	LN01	LN01
	LN01S	LN01S
	LP27	LP27
	LP29	LP29
Serial Printers	LA36	LA36
	LA50	LA50
	LA75	LA75
	LA100	LA100
	LA120	LA120
	LA210	LA210
	LCG01	LCG01
	LG02	LG02
	LG31	LG31
	LJ250	LJ250
	LN03	LN03
	LN03R	LN03R
	LN03S	LN03S
	LQP02	LQP02
	LQP03	LQP03
	LVP16	LVP16
Asynchronous Terminals [8]	VT100 Series	VT100 Series
	VT200 Series	VT200 Series
	VT300 Series	VT300 Series
	DECmate IV/III	DECmate IV/III
	Rainbow 100B	Rainbow 100B
	Rainbow 100+	Rainbow 100+
	Rainbow 190	Rainbow 190
	PRO 350	PRO 350
	PRO 380	PRO 380

PROCESSOR	VAX-11/750	VAX-11/780 VAX-11/785
	VAXmate	VAXmate

Notes:

[1] Letter D = Data device only.
Letter L = Valid ULTRIX load device.

[2] The asynchronous and the general purpose parallel interface as a printer port in DMA mode of the DMF32 are supported.

[3] The DMR11 is supported using TCP/IP and DECnet over full- and half- duplex point-to-point DDCMP sync lines. DMC mode is used for backward compatibility.

[4] The TU58 console tape on the VAX-11/750 is supported in single-user mode only.

[5] The UDA50 must be at microcode Revision Level 4 or higher.

[6] Each UDA50 must be configured on a separate UNIBUS adapter.

[7] Maximum of one UNIBUS tape controller per UDA.

[8] The TU58-XB must be at minimum Rev K or F2 for the VAX-11/750.

[9] The DF126 can only be used with the DUP11 device (IBM 2780/3780 emulation); maximum baud rate 2400.

[10] The DUP11 can only be used in conjunction with 2780/3780 terminal emulation.

[11] Either one DELUA or one DEUNA controller can be configured on any UNIBUS adapter. LAT and DECnet traffic is restricted to one Ethernet. Each Ethernet must be connected to a separate network or subnetwork in a routing configuration.

[12] The HSC must be running V370 microcode or higher. A maximum of four are supported.

PROCESSOR	DECsystem 5810 DECsystem 5820 DECsystem 5830 DECsystem 5840	VAX 6000-210 VAX 6000-220 VAX 6000-230 VAX 6000-240 VAXserver 6000-210 VAXserver 6000-220	VAX 6000-310 VAX 6000-320 VAX 6000-330 VAX 6000-340 VAX 6000-350 VAX 6000-360 VAXserver 6000-310 VAXserver 6000-320	VAX 6000-410 VAX 6000-420 VAX 6000-430 VAX 6000-440 VAX 6000-450 VAX 6000-460 VAXserver 6000-410 VAXserver 6000-420
Floating Point Unit	Integral	Integral	Integral	Integral
I/O Adapters				
VAXCI	1	1	1	1
VAXBI	4	6	6	6
SBI				
UNIBUS				
MASSBUS				
CI Adapters	CIBCA-BA	CIBCA-AA, BA	CIBCA-AA, BA	CIBCA-AA, BA
Disk Drives	96 Maximum	96 Maximum	96 Maximum	96 Maximum
Controller	KDB50 HSC KDM70	12 KDB50 [5] HSC KDM70	12 KDB50 [5] HSC KDM70	12 KDB50 [5] HSC KDM70

PROCESSOR	DECsystem 5810 DECsystem 5820 DECsystem 5830 DECsystem 5840	VAX 6000-210 VAX 6000-220 VAX 6000-230 VAX 6000-240 VAXserver 6000-210 VAXserver 6000-220	VAX 6000-310 VAX 6000-320 VAX 6000-330 VAX 6000-340 VAX 6000-350 VAX 6000-360 VAXserver 6000-310 VAXserver 6000-320	VAX 6000-410 VAX 6000-420 VAX 6000-430 VAX 6000-440 VAX 6000-450 VAX 6000-460 VAXserver 6000-410 VAXserver 6000-420
Drives	ESE20 ^{D}	ESE20 ^{D}	ESE20 ^{D}	ESE20 ^{D}
	RA90	RA90	RA90	RA90
	RA92	RA92	RA92	RA92
	RA82	RA82	RA82	RA82
	RA81	RA81	RA81	RA81
		RA80	RA80	RA80
	RA70	RA70	RA70	RA70
	RA60	RA60	RA60	RA60
UNIBUS Disks				
Controller				
Drives				
Magnetic Tapes	6 Maximum	6 Maximum	6 Maximum	6 Maximum
CI Tapes	TA78	TA78	TA78	TA78
	TA79	TA79	TA79	TA79
	TA81	TA81	TA81	TA81
	TA90 [14]	TA90 [14]	TA90 [14]	TA90 [14]
	TA90E [15]	TA90E [15]	TA90E [15]	TA90E [15]
VAXBI Tapes	RV20 ^{D}	RV20 ^{D}	RV20 ^{D}	RV20 ^{D}
	TU81E	TU81E	TU81E	TU81E
	TK70 ^{L}	TK70 ^{L}	TK70 ^{L}	TK70 ^{L}
UNIBUS Tapes [7]				
Tapes				
Communication Devices	Maximum	4 Maximum	4 Maximum	3 Maximum
		DEMNA [11]	DEMNA [11]	DEMNA [11]
	DEBNI [11,13]	DEBNI [11,13]	DEBNI [11,13]	DEBNI [11,13]
VAXBI		DEBNA [11]	DEBNA [11]	DEBNA [11]
Communication Devices	DMB32 [3]	DMB32 [3]	DMB32 [3]	DMB32 [3]
	DHB32	DHB32	DHB32	DHB32
UNIBUS				

PROCESSOR	DECsystem 5810 DECsystem 5820 DECsystem 5830 DECsystem 5840	VAX 6000-210 VAX 6000-220 VAX 6000-230 VAX 6000-240 VAXserver 6000-210 VAXserver 6000-220	VAX 6000-310 VAX 6000-320 VAX 6000-330 VAX 6000-340 VAX 6000-350 VAX 6000-360 VAXserver 6000-310 VAXserver 6000-320	VAX 6000-410 VAX 6000-420 VAX 6000-430 VAX 6000-440 VAX 6000-450 VAX 6000-460 VAXserver 6000-410 VAXserver 6000-420

Communication Devices

Modem/Pad Devices	DF02	DF02	DF02	DF02
	DF03	DF03	DF03	DF03
	DF112	DF112	DF112	DF112
	DF126 [9]	DF126 [9]	DF126 [9]	DF126 [9]
	DF212	DF212	DF212	DF212
	DF224	DF224	DF224	DF224
	DF242	DF242	DF242	DF242
		Micom Micro	Micom Micro	Micom Micro
		800/X.25	800/X.25	800/X.25
	DF296	DF296	DF296	DF296

Line Printers	1 Maximum	5 Maximum	5 Maximum	5 Maximum
Controller	DMB32	DMB32	DMB32	DMB32
				LP11
				LP32
Printer	LG01	LG01	LG01	LG01
	LG02	LG02	LG02	LG02
	LN01	LN01	LN01	LN01
	LN01S	LN01S	LN01S	LN01S
	LP27	LP27	LP27	LP27
	LP29	LP29	LP29	LP29

Serial Printers [8]	LA36	LA36	LA36	LA36
	LA50	LA50	LA50	LA50
	LA75	LA75	LA75	LA75
	LA100	LA100	LA100	LA100
	LA120	LA120	LA120	LA120
	LA210	LA210	LA210	LA210
	LCG01	LCG01	LCG01	LCG01
	LG02	LG02	LG02	LG02
	LG31	LG31	LG31	LG31
	LJ250	LJ250	LJ250	LJ250
	LN03	LN03	LN03	LN03

PROCESSOR	DECsystem 5810 DECsystem 5820 DECsystem 5830 DECsystem 5840	VAX 6000-210 VAX 6000-220 VAX 6000-230 VAX 6000-240 VAXserver 6000-210 VAXserver 6000-220	VAX 6000-310 VAX 6000-320 VAX 6000-330 VAX 6000-340 VAX 6000-350 VAX 6000-360 VAXserver 6000-310 VAXserver 6000-320	VAX 6000-410 VAX 6000-420 VAX 6000-430 VAX 6000-440 VAX 6000-450 VAX 6000-460 VAXserver 6000-410 VAXserver 6000-420
	LN03R	LN03R	LN03R	LN03R
	LN03S	LN03S	LN03S	LN03S
	LQP02	LQP02	LQP02	LQP02
	LQP03	LQP03	LQP03	LQP03
	LVP16	LVP16	LVP16	LVP16
Asynchronous Terminals [8]	VT100 Series	VT100 Series	VT100 Series	VT100 Series
	VT200 Series	VT200 Series	VT200 Series	VT200 Series
	VT300 Series	VT300 Series	VT300 Series	VT300 Series
	DECmate II/III	DECmate II/III	DECmate II/III	DECmate II/III
	Rainbow 100B	Rainbow 100B	Rainbow 100B	Rainbow 100B
	Rainbow 100+	Rainbow 100+	Rainbow 100+	Rainbow 100+
	Rainbow 190	Rainbow 190	Rainbow 190	Rainbow 190
	PRO 350	PRO 350	PRO 350	PRO 350
	PRO 380	PRO 380	PRO 380	PRO 380
	VAXmate	VAXmate	VAXmate	VAXmate

Notes:

[1]　　Letter D = Data device only.
　　　Letter L = Valid ULTRIX load device.

[2]　　The asynchronous and the general purpose parallel interface as a printer port in DMA mode of the DMF32 are supported.

[3]　　The asynchronous and the general purpose parallel interface as a printer port in DMA mode of the DMB32 are supported.

[4]　　The DMR11 is supported using TCP/IP and DECnet over full- and half-duplex point-to-point DDCMP sync lines. DMC mode is used for backwards compatibility.

[5]　　The KDB50 must be at microcode Revision Level K or greater.

[6]　　UDA50 must be at microcode Revision Level 4 or greater.

[7]　　Maximum of one UNIBUS tape controller per UDA.

[8]　　Console software for the VAX 8600/8650 must be at Version 2.0 or greater.

[9]　　The DF126 can only be used with the DUP11 device (IBM 2780/3780 emulation); maximum baud rate 2400.

[10]　The DUP11 can only be used for 2780/3780 emulation.

[11]　Either one DELUA or one DEUNA controller can be configured on any UNIBUS adapter. VAX 8700 and 8800 systems can have two UNIBUS adapters. All other systems are limited to one UNIBUS adapter. The maximum number of Ethernet adapters includes both BI and UNIBUS devices. LAT and DECnet traffic is restricted to one Ethernet. Each Ethernet must be connected to a separate network or subnetwork in a routing configuration.

[12]　A maximum of one CI interface per system is supported.

[13]　The DEBNI is a high-speed BI-to-Ethernet adapter intended as a replacement for the existing DEBNA. The DEBNI is available as either a new module or firmware upgrade option to an existing DEBNA.

[14]　The TA90 must be connected to an HSC running V3.90A or later.

[15]　　The TA90E must be connected to an HSC running V5.0 or later.

[16]　　Console software for the VAX 8530, 8550, 8700 and 8800 must be at Version 4.0 or greater.

PROCESSOR	VAX 8200 VAX 8250	VAX 8300 VAX 8350	VAX 8500 [16] VAX 8530 [16]
Floating Point Unit	Integral	Integral	Integral
I/O Adapters			
VAXCI	1	1	1
VAXBI	1	1	2
SBI			
UNIBUS	1 DWBUA	1 DWBUA	1 DWBUA
MASSBUS			
CI Adapters	CIBCI [12]	CIBCI [12] CIBCA-AA, BA [12]	CIBCI [12] CIBCA-AA, BA [12]
Disk Drives	96 Maximum	96 Maximum	96 Maximum
Controller	4 KDB50 [5]	4 KDB50 [5]	4 KDB50 [5]
	HSC	HSC	HSC
Drives	ESE20 [D]	ESE20 [D]	ESE20 [D]
	RA90	RA90	RA90
	RA92	RA92	RA92
	RA82	RA82	RA82
	RA81	RA81	RA81
	RA80	RA80	RA80
	RA70	RA70	RA70
	RA60	RA60	RA60
UNIBUS Disks	4 Maximum	4 Maximum	4 Maximum
Controller	1 UDA50 [6]	1 UDA50 [6]	1 UDA50 [D,6]
Drives	RA90	RA90	RA90
	RA90	RA90	RA90
	RA92	RA92	RA92
	RA82	RA82	RA82
	RA81	RA81	RA81
	RA80	RA80	RA80
	RA70	RA70	RA70
	RA60	RA60	RA60
Magnetic Tapes	6 Maximum	6 Maximum	6 Maximum
CI Tapes	TA78	TA78	TA78

PROCESSOR	VAX 8200 VAX 8250	VAX 8300 VAX 8350	VAX 8500 [16] VAX 8530 [16]
	TA79	TA79	TA79
	TA81	TA81	TA81
			TA90 [14]
			TA90E [15]
VAXBI Tapes	RV20 *D*	RV20 *D*	RV20 *D*
	TU81E *L*	TU81E *D*	TU81E *L*
UNIBUS Tapes [7]			
Tapes	TS11 *L*	TS11 *L*	
	TU80 *L*	TU80 *L*	
	TU81 *L*	TU81 *L*	
	TU81E *L*	TU81E *L*	
	TS05	TS05	
	TUK50	TUK50	
Communication Devices	3 Maximum	4 Maximum	4 Maximum
	DEBNI [11,13]	DEBNI [11,13]	DEBNI [11,13]
VAXBI	DEBNA [11]	DEBNA [11]	DEBNA [11]
Communication Devices	DMB32 [3]	DMB32 [3]	DMB32 [3]
	DHB32	DHB32	DHB32
UNIBUS	DELUA [11]	DELUA [11]	DELUA [11]
Communication Devices	DEUNA [11]	DEUNA [11]	DEUNA [11]
	DMR11 [4]	DMR11 [4]	DMR11 [4]
	DHU11	DHU11	DHU11
	DMF32 [2]	DMF32 [2]	DMF32 [2]
	DMZ32	DMZ32	DMZ32
	DZ11	DZ11	DZ11
	DUP11 [10]	DUP11 [10]	DUP11 [10]
Modem/Pad Devices	DF02	DF02	DF02
	DF03	DF03	DF03
	DF112	DF112	DF112
	DF126 [9]	DF126 [9]	DF126 [9]
	DF212	DF212	DF212
	DF224	DF224	DF224
	DF242	DF242	DF242
	Micom Micro	Micom Micro	Micom Micro

PROCESSOR	VAX 8200 VAX 8250	VAX 8300 VAX 8350	VAX 8500 [16] VAX 8530 [16]
	800/X.25	800/X.25	800/X.25
	DF296	DF296	DF296
Line Printers	5 Maximum	5 Maximum	5 Maximum
Controller	DMB32	DMB32	DMB32
	LP11	LP11	LP11
	LP32	LP32	LP32
Printer	LG01	LG01	LG01
	LG02	LG02	LG02
	LN01	LN01	LN01
	LN01S	LN01S	LN01S
	LP27	LP27	LP27
	LP29	LP29	LP29
Serial Printers [8]	LA36	LA36	LA36
	LA50	LA50	LA50
	LA75	LA75	LA75
	LA100	LA100	LA100
	LA120	LA120	LA120
	LA210	LA210	LA210
	LCG01	LCG01	LCG01
	LG02	LG02	LG02
	LG31	LG31	LG31
	LJ250	LJ250	LJ250
	LN03	LN03	LN03
	LN03R	LN03R	LN03R
	LN03S	LN03S	LN03S
	LQP02	LQP02	LQP02
	LQP03	LQP03	LQP03
	LVP16	LVP16	LVP16
Asynchronous Terminals [8]	VT100 Series	VT100 Series	VT100 Series
	VT200 Series	VT200 Series	VT200 Series
	VT300 Series	VT300 Series	VT300 Series
	DECmate II/III	DECmate II/III	DECmate II/III
	Rainbow 100B	Rainbow 100B	Rainbow 100B
	Rainbow 100+	Rainbow 100+	Rainbow 100+
	Rainbow 190	Rainbow 190	Rainbow 190

PROCESSOR	VAX 8200 VAX 8250	VAX 8300 VAX 8350	VAX 8500 [16] VAX 8530 [16]
	PRO 350	PRO 350	PRO 350
	PRO 380	PRO 380	PRO 380
	VAXmate	VAXmate	VAXmate

Notes:

[1]　Letter D = Data device only.
　　Letter L = Valid ULTRIX load device.

[2]　The asynchronous and the general purpose parallel interface as a printer port in DMA mode of the DMF32 are supported.

[3]　The asynchronous and the general purpose parallel interface as a printer port in DMA mode of the DMB32 are supported.

[4]　The DMR11 is supported using TCP/IP and DECnet over full- and half-duplex point-to-point DDCMP sync lines. DMC mode is used for backwards compatibility.

[5]　The KDB50 must be at microcode Revision Level K or greater.

[6]　UDA50 must be at microcode Revision Level 4 or greater.

[7]　Maximum of one UNIBUS tape controller per UDA.

[8]　Console software for the VAX 8600/8650 must be at Version 2.0 or greater.

[9]　The DF126 can only be used with the DUP11 device (IBM 2780/3780 emulation); maximum baud rate 2400.

[10]　The DUP11 can only be used for 2780/3780 emulation.

[11]　Either one DELUA or one DEUNA controller can be configured on any UNIBUS adapter. VAX 8700 and 8800 systems can have two UNIBUS adapters. All other systems are limited to one UNIBUS adapter. The maximum number of Ethernet adapters includes both BI and UNIBUS devices. LAT and DECnet traffic is restricted to one Ethernet. Each Ethernet must be connected to a separate network or subnetwork in a routing configuration.

[12]　A maximum of one CI interface per system is supported.

[13]　The DEBNI is a high-speed BI-to-Ethernet adapter intended as a replacement for the existing DEBNA. The DEBNI is available as either a new module or firmware upgrade option to an existing DEBNA.

[14]　The TA90 must be connected to an HSC running V3.90A or later.

[15]　The TA90E must be connected to an HSC running V5.0 or later.

[16]　Console software for the VAX 8530, 8550, 8700 and 8800 must be at Version 4.0 or greater.

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PROCESSOR	VAX 8550 [11]	VAX 8800 [5,12] VAX 8650	VAX 8700	VAX 8800 VAX 8810	VAX 8820 VAX 8830/40
Floating Point Unit	Integral	FP86	Integral	Integral	Integral
I/O Adapters					
VAXCI	1	1	1	1	1
VAXBI	2		4	4	6
SBI		1 DB86			
UNIBUS	1 DWBUA	6 DW780	2 DWBUA [9]	2 DWBUA [9]	
MASSBUS		4 RH780			
Disk Drives	96 Maximum	96 Maximum	96 Maximum	96 Maximum	96 Maximum
VAXBI Disks					
Controller	4 KDB50 [7]	6 UDA50	8 KDB50 [7]	9 KDB50 [7]	12 KDB50 [7]
	HSC	HSC	HSC	HSC	HSC
Drives	ESE20 [D]	ESE20 [D]	ESE20 [D]	ESE20 [D]	ESE20 [D]
	RA90	RA90	RA90	RA90	RA90
	RA92	RA92	RA92	RA92	RA92
	RA82	RA82	RA82	RA82	RA82
	RA81	RA81	RA81	RA81	RA81
	RA80	RA80	RA80	RA80	RA80
	RA70	RA70	RA70	RA70	RA70
	RA60	RA60	RA60	RA60	RA60
UNIBUS Disks					
Controller Drives	1 UDA50 [D,8]	8 UDA50 [8,9,10]	2 UDA50 [D,8,9]	2 UDA50 [D,8,9]	
	RA90	RA90	RA90	RA90	
	RA92	RA92	RA92	RA92	
	RA82	RA82	RA82	RA82	
	RA81	RA81	RA81	RA81	
	RA80	RA80	RA80	RA80	
	RA70	RA70	RA70	RA70	
	RA60	RA60	RA60	RA60	
MASSBUS Disks		32 Maximum			
		RM05			
		RP07 [D]			

PROCESSOR	VAX 8550 [11]	VAX 8600 [5,12] VAX 8650	VAX 8700	VAX 8800 VAX 8810	VAX 8820 VAX 8830/40
Magnetic Tapes	6 Maximum	6 Maximum	6 Maximum	6 Maximum	6 Maximum
CI Adapters	CIBCA-AA, BA	CI780	CIBCI CIBCA-AA, BA	CIBCI CIBCA-AA, BA	CIBCA-AA, BA
CI Tapes	TA78	TA78	TA78	TA78	TA78
	TA79	TA79	TA79	TA79	TA79
	TA81	TA81	TA81	TA81	TA81
	TA90 [18]	TA90 [18]	TA90 [18]	TA90 [18]	TA90 [18]
	TA90E [19]	TA90E [19]	TA90E [19]	TA90E [19]	TA90E [19]
VAXBI Tapes	TU81E ^{L}		TU81E ^{L}	TU81E ^{L}	TU81E ^{L}
	RV20		RV20	RV20	RV20
UNIBUS Tapes					
Controller		TSU05			
Tapes		TS11 ^{L}			
		TU80 ^{L}			
		TU81 ^{L}			
		TU81E ^{L}			
		TS05			
		TUK50			
MASSBUS Tapes					
Controller		TM03			
		TM78			
Tapes		TE16 ^{L}			
		TU77 ^{L}			
		TU78 ^{L}			
		TU79 ^{L}			
Communication Devices [13]	4 Maximum	4 Maximum	4 Maximum	3 Maximum	
VAXBI	DEBNI [15,17]		DEBNI [15,17]	DEBNI [15,17]	DEBNI [15,17]
Communication Devices	DEBNA [15]		DEBNA [15]	DEBNA [15]	DEBNA [15]
	DMB32 [13]	DMB32 [3]	DMB32 [3]	DMB32 [3]	DMB32 [3]
	DHB32		DHB32	DHB32	DHB32

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PROCESSOR	VAX 8550 [11]	VAX 8600 [5,12] VAX 8650	VAX 8700	VAX 8800 VAX 8810	VAX 8820 VAX 8830/40
UNIBUS	DELUA [15]	DELUA [15]	DELUA [15]	DELUA [15]	
Communication Devices	DEUNA [15]	DEUNA [15]	DEUNA [15]	DEUNA [15]	
	DMR11 [4]	DMR11 [4]	DMR11 [4]	DMR11 [4]	
	DHU11	DHU11	DHU11	DHU11	
	DMF32 [2]	DMF32 [2]	DMF32 [2]	DMF32 [2]	
	DMZ32	DMZ32	DMZ32	DMZ32	
	DZ11	DZ11	DZ11	DZ11	
	DUP11 [14]	DUP11 [14]	DUP11 [14]	DUP11 [14]	
Modem/Pad Devices	DF02	DF02	DF02	DF02	DF02
	DF03	DF03	DF03	DF03	DF03
	DF112	DF112	DF112	DF112	DF112
	DF126 [13]	DF126 [13]	DF126 [13]	DF126 [13]	DF126 [13]
	DF212	DF212	DF212	DF212	DF212
	DF224	DF224	DF224	DF224	DF224
	DF242	DF242	DF242	DF242	DF242
	Micom Micro	Micom Micro	Micom Micro	Micom Micro	Micom Micro
	800/X.25	800/X.25	800/X.25	800/X.25	800/X.25
	DF296	DF296	DF296	DF296	DF296
Line Printers	5 Maximum	5 Maximum	5 Maximum	5 Maximum	5 Maximum
Controller	DMB32		DMB32	DMB32	DMB32
	LP11	LP11	LP11	LP11	
	LP32	LP32	LP32	LP32	
Printer	LG01	LG01	LG01	LG01	LG01
	LG02	LG02	LG02	LG02	LG02
	LN01	LN01	LN01	LN01	LN01
	LN01S	LN01S	LN01S	LN01S	LN01S
	LP27	LP27	LP27	LP27	LP27
	LP29	LP29	LP29	LP29	LP29
Serial Printers	LA36	LA36	LA36	LA36	LA36
	LA50	LA50	LA50	LA50	LA50
	LA75	LA75	LA75	LA75	LA75
	LA100	LA100	LA100	LA100	LA100
	LA120	LA120	LA120	LA120	LA120
	LA210	LA210	LA210	LA210	LA210

PROCESSOR	VAX 8550 [11]	VAX 8600 [5,12] VAX 8650	VAX 8700	VAX 8800 VAX 8810	VAX 8820 VAX 8830/40
	LCG01	LCG01	LCG01	LCG01	LCG01
	LG02	LG02	LG02	LG02	LG02
	LG31	LG31	LG31	LG31	LG31
	LJ250	LJ250	LJ250	LJ250	LJ250
	LN03	LN03	LN03	LN03	LN03
	LN03R	LN03R	LN03R	LN03R	LN03R
	LN03S	LN03S	LN03S	LN03S	LN03S
	LVP16	LVP16	LVP16	LVP16	LVP16
	LQP02	LQP02	LQP02	LQP02	LQP02
	LQP03	LQP03	LQP03	LQP03	LQP03
Asynchronous Terminals	VT100 Series	VT100 Series	VT100 Series	VT100 Series	VT100 Series
	VT200 Series	VT200 Series	VT200 Series	VT200 Series	VT200 Series
	VT300 Series	VT300 Series	VT300 Series	VT300 Series	VT300 Series
	DECmate II/III	DECmate II/III	DECmate II/III	DECmate II/III	DECmate II/III
	Rainbow 100B	Rainbow 100B	Rainbow 100B	Rainbow 100B	Rainbow 100B
	Rainbow 100+	Rainbow 100+	Rainbow 100+	Rainbow 100+	Rainbow 100+
	Rainbow 190	Rainbow 190	Rainbow 190	Rainbow 190	Rainbow 190
	PRO 350	PRO 350	PRO 350	PRO 350	PRO 350
	PRO 380	PRO 380	PRO 380	PRO 380	PRO 380
	VAXmate	VAXmate	VAXmate	VAXmate	VAXmate

Notes:

[1]   Letter D = Data device only.
      Letter L = Valid ULTRIX load device.

[2]   The asynchronous and the general purpose parallel interface as a printer port in DMA mode of the DMF32 are supported.

[3]   The asynchronous and the general purpose parallel interface as a printer port in DMA mode of the DMB32 are supported.

[4]   The DMR11 is supported using TCP/IP and DECnet over full- and half-duplex point-to-point DDCMP sync lines. DMC mode is used for backwards compatibility.

[5]   The VAX 8600 CPU must be at hardware Revision Level K or greater.

[6]   The VAX 8650 CPU must be at hardware Revision Level A1 or greater.

[7]   The KDB50 must be at microcode Revision Level K or greater.

[8]   UDA50 must be at microcode Revision Level 4 or greater.

[9]   Each UDA50 must be configured on a different UNIBUS adapter.

[10] On the VAX 8600/8650 the eighth UDA50 can only be configured on the last UNIBUS adapter.

[11] Console software for the VAX 8530, 8550, 8700 and 8800 must be at Version 4.0 or greater.

[12] Console software for the VAX 8600/8650 must be at Version 2.0 or greater.

[13] The DF126 can only be used with the DUP11 device (IBM 2780/3780 emulation); maximum baud rate 2400.

[14] The DUP11 can only be used for 2780/3780 emulation.

[15] Either one DELUA or one DEUNA controller can be configured on any UNIBUS adapter. VAX 8700 and 8800 systems can have two UNIBUS adapters. All other systems are limited to one UNIBUS adapter. The maximum number of Ethernet adapters includes both BI and UNIBUS devices. LAT and DECnet traffic is restricted to one Ethernet. Each Ethernet must be connected to a separate network or subnetwork in a routing configuration.

[16] For systems configured in the 24-slot box, the maximum memory supported is 128MB.

[17] The DEBNI is a high-speed BI-to-Ethernet adapter intended as a replacement for the existing DEBNA. The DEBNI is available as either a new module or firmware upgrade option to an existing DEBNA.

[18] The TA90 must be connected to an HSC running V3.90A or later.

[19] The TA90E must be connected to an HSC running V5.0 or later.

Optional Encryption Software

The option to include cryptographic software for the UL-TRIX product is provided in binary format. This code permits the encryption and decryption of the contents of user files.

Note: This software is not included in the base operating system because of U.S. State Department regulations regarding the shipment of cryptographic code outside the United States and Canada. Refer to the *Software Options* section for ordering information.

Option to Extend User Login Limitation

This option is available for all ULTRIX processors to extend the operating system login limit beyond the two-user level initially provided. The option to upgrade this user login limit is provided through LMF Product Authorization Keys (PAKS). The ability of a system to support the licensed number of users will depend in part upon the hardware configuration of the system and the user application. (Refer to the *Software Options* section for ordering information.)

PREREQUISITE SOFTWARE

None

OPTIONAL SOFTWARE

Refer to the ULTRIX Optional Software Cross Reference Table (SPD 26.99.xx).

INSTALLATION

ULTRIX is classified as Customer Installed; however, Installation Services are available for those customers who desire installation of the software product by an experienced Digital Software Specialist.

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In addition to the right to use, the license gives you the one-time right to copy the software from your original CPU installation to the additional CPU. Therefore, the Distribution and Documentation Option is not required, but optional.

Note: The ULTRIX license also licenses "executable only" images created with the System Building Utility in VAX/LISP ULTRIX.

For academic use only in educational accounts, Single-Use ULTRIX Licenses are offered in a special, discounted educational form.

User License Key Option

To increase the login user limit beyond the base system initial limit of two users, you must purchase the appropriate capacity license. The capacity limits as depicted by the various options do not necessarily reflect system perfc.mance. The capacity licenses are a legal requirement.

Encryption License Option

To use the DES cryptographic software, you must purchase the appropriate encryption license. This license provides the legal ability to run the encryption and decryption algorithms on the system. U.S. State Department regulations govern the shipment of the cryptographic code outside the United States and Canada.

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