Introduction

The Tru64 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. Tru64 UNIX is an implementation of OSF/1 R1.0, R1.1, and R1.2 technology, and the Motif® graphical user interface and programming environment.

Tru64 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 6.5 (X11R6.5) from The Open Group are supported.

Tru64 UNIX complies with other standards and industry specifications, including major standards sponsored by The Open Group, POSIX, FIPS, and the System V Interface Definition (SVID). By providing support for SVID, Tru64 UNIX supports System V applications. The Tru64 UNIX Operating System is compatible with Berkeley 4.3 programming interfaces.

System Management

Tru64 UNIX System Management (SysMan) includes an easy-to-use suite of tools for installing, configuring, and managing a Tru64 UNIX system. SysMan provides centralized administration (the sysman command) for system management tasks. Tru64 UNIX system management provides a set of features for the automation of system installations and configurations.
The SysMan tools and applications provide several user interfaces that allow administrators to manage a Tru64 UNIX system from anywhere:

- A Java™ Technology-based interface for managing over the Web or from a PC
- A graphical interface based on X Windows
- A Curses interface for character-cell environments
- A command-line interface for scripting, automation, and for auditing system configurations

SysMan's Division of Privileges (DoP) utility allows users to perform privileged actions without the need to know the root password. SysMan also includes a comprehensive event management mechanism for posting, subscribing, and viewing all system events, including hardware and software.

Installation

Tru64 UNIX can be installed from either a CD-ROM or a remote installation server. Administrators have a choice of full, update, and cloned installations. Installation Services are available for those customers who would like an experienced HP Software Specialist to install the software.

Full Installation

The full installation procedure installs the Tru64 UNIX operating system onto any supported Alpha system hardware configuration. The application uses a "wizard-like" interface to walk administrators through all the required steps to perform an installation, providing default responses to ease the process. In addition to English, the Full Installation application can also be run using a Japanese or Chinese locale. The default file system type during installation is the Advanced File System (AdvFS), an HP journaling file system. Alternatively, administrators can choose the UNIX file system (UFS). The Tru64 UNIX system disks can also be configured for Logical Storage Manager (LSM) during the initial system installation, allowing the use of volume management functions. Administrators can also select and install Worldwide Language Support software during the initial installation.

Update Installation

The update installation procedure updates the operating system from Tru64 UNIX Version 5.1 or Version 5.1A to Version 5.1B, while preserving appropriate system files and existing user-customized files. The Installation Guide shows the successive update paths to reach if a system is running a version of the operating system other than Version 5.1. Version 5.1B-3 does not use the update install mechanism see the documentation that ships with Version 5.1B-3.

During an update installation of the base operating system, Worldwide Language Support (WLS) software is automatically updated as well. It is not necessary to remove WLS software before updating the operating system or to update WLS software as a separate task.

At the beginning of the update installation process, an analysis of a Tru64 UNIX system is done to identify:

- Layered products that prevent the update from continuing
- Layered products that should be reinstalled after the update
- Fatal and nonfatal file system type conflicts
- Available disk space
- Unsupported hardware platforms

System Management

System Cloning

Cloning allows administrators to take a snapshot of a fully installed and configured system. Later, administrators can automatically install and configure other systems without the need to go through the set of installation and configuration steps. After a system's configuration has been saved, administrators can apply it manually or automatically to other systems at any time.

System cloning combined with user-defined scripts, which allow for customized scripts to be executed during different phases of the installation process, allow administrators to perform an unattended installation and configuration of a system. Administrators can use cloning for repetitive installations and configurations on multiple systems.

Remote Installation Service (RIS)

The Tru64 UNIX Server Extensions includes the Remote Installation Service (RIS). RIS sets up a framework on a Tru64 UNIX server system that enables other Tru64 UNIX client systems to do a full, update, or cloned installation (except New Hardware Delivery) of the operating system software and the Worldwide Language Support software over the network from the server system. Additional software (part of option software) can be loaded onto the client system from the RIS server system after the client has been installed. BOOTP is the boot protocol used to initiate the installations. Because of the high bandwidth requirements, RIS is supported only in local area network environments that use Ethernet, Gigabit Ethernet, and FDDI network addresses.

A RIS client can be booted from the following interfaces:

- Internal Ethernet
- The DE422 and DE425 EISA Ethernet option cards
- The DE203, DE204, and DE205 ISA Ethernet option cards
- The DE434, DE435, DE436, DE500, DE504, DE600, and DE602 PCI Ethernet option cards
- The DEFEA EISA family of FDDI option cards
- The DEFPA PCI family of FDDI option cards

Firmware Requirements for RIS Option Cards

Console firmware and all option firmware in the DMS or RIS server and in every client system must be compatible with the version of Tru64 UNIX system software that will be running on that system.

See the Release Notes Overview included with the Console Firmware CD-ROM, which is packaged along with the Tru64 UNIX Operating System software kit (QA-6ADAA-H8), to determine firmware version compatibility.

Dataless Configurations

The Tru64 UNIX Server Extensions include support to install and operate systems in a dataless configuration. A server system maintains the root, /usr, and /var file systems for all client systems. The server maintains one copy of root for each client. The /usr file system is exported read-only and is shared by all clients registered in the environment. Each client has its own /var file system. Dataless clients access the file systems maintained on the server using NFS. A minimum of one disk drive is required on each client for dumping and swapping.

The Dataless Management Utility (dmu) enables the server to register and manage the software areas used by Tru64 UNIX dataless clients. BOOTP is the protocol used to boot the clients and mount the remote file systems.

Configurations

To configure a system initially after a full installation, SysMan automatically runs Quick Setup the first time administrators log in. Quick Setup determines the configuration utilities that are right for a system, and then uses a wizard-like interface to help administrators set up client systems. Administrators can use the resulting system "as is" or customize it using settings from the full-featured configuration applications. Quick Setup is also available from the System Setup menu.

System Management

Xmesh

Support for the Xmesh utility was added with Tru64 UNIX Version 5.1B. Xmesh is used solely on the new HP AlphaServers ES47, ES80, and GS1280 systems. It enables end users to view the CPU Mesh together with its components. Xmesh displays the utilization of each of the components, which make up the CPU Mesh, for example CPU, I/O hoses, and R/Z boxes. It is a read-only application that does not allow the user to modify the system in any way.

Online Addition and Removal (OLAR)

Online addition and remove of CPUs (OLAR) is supported on AlphaServer GS160 and GS320 systems. This capability can be used to expand capacity, upgrade existing components, and replace failed components while the operating system services and applications continue to run. This functionality provides the benefits of increased system uptime and availability by avoiding scheduled and unscheduled downtime for maintenance and capacity upgrades. Customers can also indict faulty CPU and PCI components within GS160/320 systems for improved serviceability, such as physical removal, including the boot and interrupt-handling CPUs.

OLAR management is integrated with the SysMan suite of system management applications, which provides the ability to manage all aspects of the system from a centralized location.

Component Indictment and Automatic Deallocation (CI/AD)

Component indictment and automatic deallocation (CI/AD) represent proactive fault avoidance capabilities, that is, the ability to detect and respond to identified errors prior to the system being impacted. CI/AD is currently supported on GS80, GS160, GS320, ES45, ES47, ES80, and GS1280 AlphaServer systems. This functionality allows individual CPUs and/or memory pages to be automatically shut down in the event of a proactive notification of failure, due to past error analysis. For systems that do not support physical CPU removal, the user will have the ability to shut down or stop using a failing CPU until a replacement operation can occur. Systems that do support physical CPU removal, such as the GS160 and GS320, can replace the failing CPU on line. Component indictment capability requires that System Event Analyzer (SEA), formerly Compaq Analyze, Version 4.0 be installed. As of Tru64 UNIX Version 5.1B, one can indict the KGPSA PCI Adapter card on the GS80, GS160, GS320, ES45, ES47, ES80, GS1280, and DS25 systems.

Bootable Tape

Tru64 UNIX supports the Bootable Tape application to create and recover a disk image from a system, so that administrators can restore a system from a directly attached tape device.

System Management Menu (SysMan)

The SysMan Menu provides a framework to easily execute system management tasks. Administrators have a choice of interfaces, including:

- X11-capable display
- Personal computer running Windows® 95, Windows 98, Windows NT®, Windows 2000, and Windows XP
- Character-cell terminal

System Management Station (SMS)

The SysMan Station provides a graphical representation of the system and enables administrators to manage the system from a personal computer. The SysMan Station is a Java technology tool that is fully integrated with HP TruCluster Server Version 5.1A and later. SMS allows administrators to remotely manage systems from anywhere - PCs clients, UNIX workstations, or any Alpha system. Administrators can access the Tru64 UNIX System Management Home Page, System Management Menu, SysMan Station, and the UniCensus Configuration reports easily from any browser using the dedicated Insight Management 2301 HTTP port.

System Management

Event Manager

Event Manager provides a centralized means of gathering, distributing, storing, and reviewing event information, regardless of how the events are posted. Event Manager makes event information more accessible and provides a flexible and adaptable event infrastructure. Event Manager's Application Programming Interface enables any third-party or customer-developed applications to be customized to take advantage of this system data.

Monitoring and Tuning

Tru64 UNIX provides the following monitoring and tuning capabilities:

- Kernel Tuner displays and changes parameters of the kernel subsystem.
- Class Scheduler allows the administrator to prioritize jobs and tasks.
- Process Tuner displays, monitors, and manages system processes. A number of sort and filter options are provided to format the information display.
- Environmental Monitoring monitors the thermal, fan, and redundant power supply of Alpha systems that have prerequisite hardware sensor support. The functionality sets user-defined scripts, temperature levels, collection rate, and shutdown grace period, and can start or stop the environmental monitoring state.
- Collect is a lightweight, highly flexible performance collector. Collect can run continuously 7x24 and manage its own logs. For more information, see the Collect reference page.

Insight Manager Agents

Tru64 UNIX provides web-based management capabilities by integrating the Insight Manager™ Agents with, insight_manager(5). Insight Manager enables Web-based device monitoring and fault management of local and remote system hardware and software resources. Administrators can access features from any browser using the HP dedicated 2301 HTTP port.
Insight Manager for Tru64 UNIX includes SNMP-based subagents for presenting SNMP data through any web browser. The SNMP subagents supply a rich set of HP Enterprise MIBs, which provide hardware information, status, and statistics of CPU and memory boards, I/O devices, SCSI-based storage devices, Network Interface Cards, and Environmental devices, such as temperature sensors, fans, and power supplies.

Resource Management

Tru64 UNIX supports a variety of tools to manage CPU resources. Processor sets and class scheduling have been provided with the Tru64 UNIX operating system since 1997. With processor sets, individual CPUs can be grouped and dedicated to specific applications or users. CPUs can then be moved between processor sets administratively or, if one set requires additional resources during peak load periods, through the resource usage monitoring capabilities provided within the Tru64 UNIX operating system. Class scheduling adds further definition to how CPU resources can be managed by assigning users and applications to a class, which is allotted a percentage of the CPU time available on the system as a whole or within processor sets. Up to 100 different classes may be defined for a given system or system partition, enabling an administrator to apportion the necessary CPU cycles among all the jobs running on the system. As a result, the risk that a highly compute-intensive job will dominate the system and degrade services for other users can be effectively mitigated.

System Management

Storage Management

Storage Management products and features provide an integral extension to Tru64 UNIX system management functionality. The following products include valuable storage management features that ship with the Tru64 UNIX base product and related information on storage features available through the purchase of layered products.

Tru64 UNIX Logical Storage Manager (LSM) is an integrated host-based solution for data storage management. Basic LSM functionality, including disk spanning and concatenation, is provided with the base operating system and is free of charge. Additional features, such as 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, 1, 0 +1, and 5. See the LAYERED PRODUCTS section of these QuickSpecs and the LSM QuickSpecs for more information.

NetWorker provides automated backup and recovery of files on a local system. The SingleServer version is supplied free of charge with Tru64 UNIX and provides automated backup and recovery of the direct attached storage devices. Users can purchase upgrade licenses to access the benefits of the full NetWorker product from Legato Systems, Inc. See the LAYERED PRODUCTS section of these QuickSpecs for more information.

Collgui Utility Version 3.0

Collgui is a highly integrated graphical front-end tool for Collect. It allows the user to automatically extract and quickly analyze Collect data.

Service Tools

Tru64 UNIX provides graphical presentation of the following commands:

- The iostat command (I/O statistics)
- The netstat command (network statistics)
- The vmstat command (virtual memory statistics)
- The who command

Tru64 UNIX provides the following service tools:
The sys_check data gathering and reporting tool gives the current state of a system, including configuration information, microcode information, and Tru64 UNIX parameter settings.

Revision and Configuration Management (RCM)

The RCM tool collects system configuration and revision data information. The data is stored in the RCM Server at HP Services and the server is then used to create detailed revision and configuration reports. Please note that on DSxx (e.g. DS20), ESxx (e.g. ES40) and GSxx (e.g. GS160) AlphaServers, RCM requires WEBES to be installed for it to collect FRU data.

WEB-Based Enterprise Service (WEBES) Version 4.4.1 is an extension of the HP industry-leading Web-Based Enterprise Management (WBEM) technology and provides a core of common service tool functionality across some HP product platforms. RCM while using some of the WEBES functionality is no longer packaged with WEBES as of WEBES V4.2. The tool functionality contained in the WEBES kit includes the following:

- System Event Analyzer (symptom directed hardware diagnosis tool)
- Compaq Crash Analysis Tool (symptom directed operating system software diagnosis tool)

- System Event Analyzer (formerly known as "Compaq Analyze")
  System Event Analyzer is a hardware diagnosis software tool that provides analysis for single errors or fault events at a rudimentary level, as well as multiple event and complex analysis. System Event Analyzer is the enabling technology for indictment of failing CPUs in support of the CPU OLAR (online addition and removal of CPUs) functionality. See the *System Event Analyzer User Guide* for details.
- Compaq Crash Analysis Tool (CCAT)
  CCAT is a software application tool that helps service engineers and system managers to analyze operating system crashes on site.

The Tru64 UNIX file system architecture is based on the OSF/1 Virtual File System (VFS), which is based on the Berkeley 4.3 Reno Virtual File System. VFS provides a standard interface for file access regardless of the physical file system in which the files reside.

Tru64 UNIX supports the file system types described in this section.

Advanced File System (AdvFS)

The Advanced File System is a journaled, self-tuning, local file system that provides higher availability and greater flexibility than traditional UNIX file systems. Using transaction journaling, AdvFS provides increased file system integrity and recovers file domains in seconds rather than hours after an unexpected restart.

Administrators can resize file domains dynamically to allocate or deallocate storage while the system is running, and to set quotas for users, groups, and filesets. Quotas can have hard and soft limits, which specify a period of time that a quota can be exceeded.

AdvFS file storage is defined by extents, which are contiguous areas of disk storage. The AdvFS defragment utility can reduce the number of file extents needed by each file in a domain by making file's data blocks contiguous on disk. Files with fewer, larger extents have less metadata overhead and will show better performance because less I/O operations are required to access a file. AdvFS also supports direct I/O. This feature supplies applications that do their own cache and I/O management - for instance a database - with the ability to bypass the AdvFS cache and I/O management algorithms and deliver near raw disk performance while still providing all of the system management benefits of a file system.

The AdvFS /, /usr, and /var filesets are configured during installation. The system has generous configuration capabilities. Administrators can mount 232-1 filesets and file domains.

Users can select Atomic Data Logging of a file, which guarantees user data integrity in the event of a system failure.
A single AdvFS file domain may contain up to 256 physical or logical volumes/LUNs with an AdvFS Utilities license installed. See the System Configuration and Tuning guide for volumes per domain, file domain, and fileset recommendations.

- The maximum physical volume size is 1 TB-512 K.
- The maximum number of files in a fileset is 2^{31}. (This number is limited by the length of the tag that is used to uniquely identify a file in a fileset.)
- The maximum size of an AdvFS file and fileset is 16 TB - 512 K ($2^{13} * 2^{32}$), with an 8 K page size and a 31-bit page number.

AdvFS supports backups of mounted filesets. These backups are done with the vdump or rvdump utilities, which back up files and any associated extended attributes (including ACLs) from a single mounted fileset or clone of the fileset to a local or remote storage device. For more information, see the *AdvFS Administration* guide. The vrestore and rvrestore commands restore any associated extended attributes, including ACLs, in the archive data.AdvFS includes the fixfdmn file system repair utility. This utility performs in-place repair of AdvFS file system metadata. This is a first-generation, offline, in place, AdvFS metadata repair tool. The goal of this tool is to mount an unmountable damaged file system after it has been repaired for mounting and I/O operations.

An AdvFS API exists for applications needing access to AdvFS-specific file attributes.

The disk-structure analysis commands allow the system administrator to examine the low-level structures of files, filesets, and file domains. The verify and slavage utilities may also be useful if a file system has become unmountable by the system disk due to hardware or software problems.

The right to use the Advanced File System is granted by the Tru64 UNIX Operating System license.

AdvFS Utilities is a separately licensed layered product that expands the capabilities of AdvFS as follows:

- Permits adding more than one volume to a file domain.
- Enables cloning - enables the application to remain on line during backup by creating a read-only copy (clone) of an active fileset.
- Enables performance tuning, such as striping files across multiple volumes to improve read/write performance, balancing the domain to even out the percentage of free space among the volumes of a multivolume file domain, and migration to optimize

disk usage.

- Enables creating a trashcan directory to store files that are deleted.
- Provides full support for hardware-initiated cloning and snapshot based third-party backup solutions.
- Takes advantage of physical storage volume growth.
- See the LAYERED PRODUCTS section of these QuickSpecs for more information on the AdvFS Utilities.

UNIX File System (UFS)

UFS is based on the UNIX Fast File System (FFS) and is compatible with the Berkeley 4.3 Tahoe release.

Network File System (NFS)

Tru64 UNIX NFS V2 allows transparent file access over TCP/IP networks. The Network Information System (NIS) is provided for centralized system management of files. The automount service automatically mounts and unmounts NFS file systems. AutoFS provides the same services as the automount daemon but provides greater scalability and improved performance. The NFS locking service allows advisory and record locks to be used with remotely mounted files. Automount will be retired in a future release of the operating system. Instructions for migrating from automount to autofs have been provided in the *Network Administration Services* guide. Additional instructions for migrating from automount to autofs in a cluster can be found in the *TruCluster Server Release Notes*.

Tru64 UNIX provides an NFS V3 server and client protocol implementation 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 to enable connectivity from PC-NFS V5.1B-3, V5.1B-2, V5.1B-1, V5.1B, V5.1A, 5.1, 4.0, and 3.5 clients.

Memory File System (MFS)

The Tru64 UNIX MFS is a memory-based UFS. The MFS has the same file system structure 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 as the result of a reboot, an unmount, or a power failure. MFS is useful for temporary files or for read-only files that are copied in after the MFS has been created.

ISO 9660 Compact Disk File System (CDFS)

File Systems

The Tru64 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. Tru64 UNIX CDFS is based on the following levels of ISO 9660:

- Level 2 of Interchange
- Level 1 of Implementation, which enables the user to mount single-volume CD-ROMs that are formatted in compliance with ISO 9660 as a local file system
- Listing and examination of files using standard UNIX utilities and programs
- Reading of files and directories using the standard POSIX system interface
- NFS export mounted ISO 9660 file systems
- Support for the High Sierra Group extensions that 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)
- The 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 eight levels)
- File time stamps

Open Group Preliminary Specification (1991) CD-ROM Support Component (XCDR)

XCDR extensions allow users to examine selected ISO 9660 attributes through defined utilities and shared libraries. A system administrator can substitute different file protections, owners, and file names for CD-ROM files.

CDFS supports the organization of multiple sessions on one CD-ROM volume. The maximum number of CDFS mounts is 512. The contents of all sessions are available as one file system and are not separately available. Users can access DVD disks using the CDFS file system.

DVD File System (DVDFS)

The Tru64 UNIX implementation of DVDFS is based on the ECMA 167 Universal Disk Format (UDF) specification Version 2.00. DVDFS gives the administrator the ability to mount and read UDF formatted Digital Versatile Disks on a single node as well as in a cluster.

File-on-File Mounting File System (FFM)

The File-on-File Mounting File System 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 pipe implementation for improved performance.

/proc File System

The SVR4-compatible /proc file system for Tru64 UNIX allows running processes to be accessed and manipulated as files by ordinary system calls: open, close, read, write, seek, and ioctl.

IPv6

Tru64 UNIX extends support of IPv6 with additional application enablers (latest industry-standard APIs for application portability and improved user support with additional IPv6 tools to help with the transition to IPv6), additional interoperability/coexistence enablers between IPv4 and IPv6 (including tunneling and transition mechanisms), and improved Performance/Scalability/Quality. The Tru64 UNIX implementation of IPv6 conforms with RFC 3542 specifications.

IP Security (IPsec)

Tru64 UNIX provides comprehensive protection for IPv4 and IPv6 network traffic through support of the IPsec protocol suite. Encryption, data-origin authentication, data integrity protection, and compression of encrypted data is available through the AH, ESP, and IPCOMP protocols, supported in both tunnel and transport modes. Encryption can be performed using the Advanced Encryption Standard (AES) and Data Encryption Standard (DES and 3DES). Authentication can be performed using the SHA-1 and MD5 algorithms.

The Internet Key Exchange (IKE) protocol is fully supported for authentication and key exchange. Authentication can be via pre-shared keys, or through RSA or DSA certificates.

IPsec security policy is managed through the SysMan graphical user interface. IPsec protection cannot be applied to traffic that uses the cluster alias feature of the TruCluster product.

Mobile IP

Tru64 UNIX provides Mobile IPv6 Correspondent Node functionality based on the Internet draft Mobility Support in IPv6, draft-ietf-mobileip-ipv6-15.txt. See: http://www.ietf.org/proceedings/01dec/I-D/draft-ietf-mobileip-ipv6-15.txt

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TCP/IP

Tru64 UNIX allows for TCP/IP network communications over supported network devices. The TCP/IP protocol suite is implemented in the socket framework.

Sockets

Tru64 UNIX provides sockets that are based on the Berkeley UNIX Operating System structure, which provides a framework for I/O over a network.

STREAMS

Tru64 UNIX provides SVR4-compatible STREAMS. Like sockets, STREAMS provides a framework for character I/O between user space and kernel networking protocols.

X/Open Transport Interface (XTI)

The 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)

Tru64 UNIX provides a 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.

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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 part of a comprehensive network security plan. Tru64 UNIX also provides interface access filtering to reinforce the system security against IP spoofing attacks.

Packetfilter

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

The Tru64 UNIX Packetfilter supports two filtering models: the CMU/Stanford model 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. The Packetfilter pseudo-driver can support up to 255 simultaneous open filters (each filter is usually mapped to one instance of an application program).

Several public domain applications that use the Packetfilter are integrated in Tru64 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 extensible, allowing software developers to add MIBs to the agent and to participate in the SNMP.

The SNMP agent contains full SNMP V2.c agents, fully compatible with V1.0 MIB implementations, for managing Internet MIB-2 objects, and FDDI objects. Support for AgentX is provided in V5.0A.

Dynamic Host Configuration Protocol (DHCP)

Tru64 UNIX includes a complete DHCP client/server solution for centralizing and automating IP address administration using a graphical interface.

Point-to-Point Connections

The Tru64 UNIX system supports point-to-point connections using Serial Line Internet Protocol (SLIP) and Point-to-Point Protocol (PPP). The PPP subsystem implements PPP V2.3.1, which supports asynchronous point-to-point connections and IP. It provides authentication with Password Authentication Protocol (PAP) and Cryptographic Authentication Protocol (CHAP).

Open Network Computing (ONC)

Tru64 UNIX supports Open Network Computing V4.2, including Network File System V2 and V3, PCNFSd, Lock Manager, Status Monitor, NFSportmon, Network Information Service (NIS), automount, and user-level RPC.

Networking

Asynchronous Transfer Mode (ATM)

The Tru64 UNIX Asynchronous Transfer Mode 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 registration 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.

The ATM subsystem supports Classical IP (RFC 1577), including support for multiple IP subnets, per-VC MTU negotiation, and packetfilter access to data into and out of the host.

LAN Emulation over ATM is supported (Ethernet and IEEE 802.3 frames only), for carrying IP and LAT protocols. Support is based on the ATM Forum V1.0 specification. Packetfilter access is provided to emulate LAN data into and out of the host.

Tru64 UNIX provides limited support for IP switching over ATM, based on the Ipsilon Networks Inc. reference model (RFC 1953 and 1954). Only one IP switching network device is supported per host, and an ATM adapter used for IP switching cannot simultaneously support ATM Forum UNI or ILMI protocols.

The ATM subsystem (except IP switching and PVCs) can be configured with the atmsetup utility to start automatically at boot time. Tru64 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.

Slow Ethernet

Tru64 UNIX supports Slow Ethernet (10Base).

Fast Ethernet

Tru64 UNIX supports Fast Ethernet (IEEE 802.3 100Base-TX) in full and half duplex.

Gigabit Ethernet

Tru64 UNIX supports Gigabit Ethernet IEEE 802.3z Gigabit Ethernet Standard, IEEE 802.3x Pause Frame Flow control (X-on/X-off), both symmetric and asymmetric, and is Jumbo frame capable.

Fiber Distributed Data Interface (FDDI)

Tru64 UNIX provides FDDI fiber optic support based on all relevant ANSI and IEEE standards, including SMT revision 7.2.

NetRAIN

Tru64 UNIX provides NetRAIN support for Ethernet, Gigabit Ethernet, FDDI, and ATM controllers (LANE only). NetRAIN allows for failover of communications from one controller to another in the event a fault is detected in the communications path. A maximum of 10 ports are supported in a NetRAIN set.

Networking

Link Aggregation

Tru64 UNIX incorporates support for link aggregation (also known as "trunking"). This support allows customers to combine two or more Gigabit Ethernet ports, or two or more 10/100 Ethernet ports, into a link aggregation group (LAG). A LAG provides an Ethernet interface capable of carrying higher aggregated data rates than any single Gigabit or 10/100 Ethernet link. A LAG also provides high availability, with automatic failover to the remaining links in the LAG in the event of a link failure. The link aggregation software imposes no limits on the number of Ethernet ports that may be aggregated, or on the number of aggregations that may be created. This is limited only by the number of Ethernet ports supported by a particular hardware platform. The software has been tested with the following switches, but should interoperate with any trunking-capable switch:

Name	Model
Cisco	6509, 6513, 352XL
3COM	4900 SX
Foundry	FastIron II
Extreme Networks	Summit 7i
Alteon	ACE180

IP Multicast

Tru64 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 multi-protocol environments.

The Tru64 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 Stanford University), which provides the Distance Vector Multicast Routing Protocol (DVMRP).

Name Services

Tru64 UNIX supports the Domain Name System (DNS) as described in RFC 1034 and RFC 1035, providing a host name and address lookup service for the Internet network. The Tru64 UNIX implementation of the Domain Name System is based on BIND Version 8.2.2p5 . The user can use BIND to supplement the host's database.

Tru64 UNIX also supports the Sun™ 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)

Tru64 UNIX provides the Network Time Protocol V4.98a to synchronize and distribute the time for all machines in a network environment.

Time Synchronization Protocol (TSP)

Tru64 UNIX provides Berkeley's Time Synchronization Protocol to synchronize the time of all machines in a network without ensuring the accuracy of the time that is provided.

Local Area Transport (LAT)

Tru64 UNIX provides a STREAMS-based implementation of the Local Area Transport 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.

Networking

LAT/Telnet Gateway

The LAT/Telnet gateway service supported in Tru64 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 number of logins have been tested:

- RLOGIN: 7,043*
- Telnet: 12,395*
- LAT: 4,575*

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

Secure Web Server

Secure Web Server (based on Apache) is included with this release of Tru64 UNIX. Secure Web Server has been updated to Version 6.4.0. Secure Web Server is based on the industry standard Apache Software Foundation (ASF) code base. HP has improved the base ASF product by including Secure Sockets Layer (SSL) capability allowing for encryption up to and including 156 bits; it also includes support for Java Servlets, Java Server Pages, and Hypertext Preprocessor (PHP).

RFC Standards

The Tru64 UNIX Operating System implements a complete range of Internet RFC (Request for Comment) and Non-RFC standards. These RFCs and Non-RFC standards are outlined in the Tru64 UNIX *Technical Overview* book. This book can be found on the Tru64 UNIX Documentation CD-ROM.

The Tru64 UNIX Operating System, running Enhanced Security, is designed to meet, and in some cases exceed, the requirements of the C2 evaluation class of DoD 5200.28-STD "Trusted Computer System Evaluation Criteria," also known as the Orange Book. Tru64 UNIX supports various configurations and setup scripts, which allow selection of such desired Enhanced Security features as extended passwords, audit, and access control lists (ACLs).

System administrators can choose between command-line interfaces or GUIs.

Network Information Service (NIS) Compatibility

Tru64 UNIX provides support for accessing NIS distributed databases while running Enhanced Security. NIS can also be used to distribute the Enhanced Security protected password database. The number of simultaneous logins allowed depends on the configuration. Tru64 UNIX provides support for accessing NIS distributed databases while running Enhanced Security. NIS can also be used to distribute the Enhanced Security protected password database. The number of simultaneous logins allowed depends on the configuration.

Security Integration Architecture

All security mechanisms on Tru64 UNIX are part of the Security Integration Architecture (SIA), which isolates security-sensitive commands from the specific security mechanisms. This eliminates the need to modify the security-sensitive commands for each new security mechanism.

- Secure Shell Software - SSH is bundled with the operating system and is based on Secure Shell Version 3.2.0 software. The Secure Shell software is a client/server software application that provides a suite of secure network commands that can be used in addition to or in place of traditional network commands (such as telnet, ftp and the r* commands). The Tru64 UNIX Secure Shell software implementation is cluster aware and includes one of a kind support for securing the srcmd libc function. When enabled, it transparently secures any application that uses the libc rcmd function, including the r* commands (rsh, rcp, and rlogin).
- Common Data Security Architecture (CDSA) - CDSA has been integrated into the base operating system.

Tru64 UNIX includes the following C2 security features:

- Discretionary Access Controls (DAC) - Allows users to define how the resources they create can be shared. Optional 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.1e draft 13 with some draft 15 enhancements.
- Auditing - Allows users to monitor normal and 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). Features include 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 - Ensures that the physical storage that is assigned to shared objects or that is released prior to reassignment to another user does not contain data from previous users.
- Integrity - Allows users 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.

Advanced Printing Software

Advanced Printing Software is a printing system for Tru64 UNIX, developed in collaboration with Xerox and based on PrintXchange technology from Xerox. It is a distributed client/server printing system intended for use in workgroup and enterprise environments. Advanced Printing Software is based on a printing model defined by ISO 10175 and a command set defined by POSIX 1387.4. To provide inter-operation with the default BSD based printing system on Tru64 UNIX, Advanced Printing Software uses inbound and outbound gateways to move print jobs to or from the lpr/lpd print subsystems.

LPD Printing

Tru64 UNIX includes printing software based on the Berkeley Software Distribution (BSD) lpr/lpd printing model. It uses extended Line Printer Daemon (LPD) protocol (RFC 1179) to transfer print jobs to and from remote hosts. Print filters are supplied for a wide variety of printer models, both networked and directly connected. See the Supported Hardware Section for information about supported printer models.

Big Memory Pages

Big Pages memory allocation supports mapping a page of virtual memory to 8, 64, or 512 pages of physical memory. Given physical memory's current 8-KB page size, this means that a single page of virtual memory can map to 64, 512, or 4096 KB. Using Big Pages can minimize the performance penalties that are associated with misses in the translation look aside buffer. The result can be improved performance for applications that need to map large amounts of data. Big Pages memory allocation has the following characteristics:

- Enables a virtual page in the process address space to be mapped to the most appropriate multiple-page granularity option supported by the system's physical memory.
- Uses threshold values set on a per memory-type basis to determine whether a memory allocation request is eligible for use of the extended page sizes.
- Enables users to configure the Big Page size utilized by any individual application running on their system.

Data Access – Object Database Connection and Java Database Connection (ODBC and JDBC)

- Tru64 UNIX provides DataDirect Technologies, Inc., software products to enable ODBC and JDBC connectivity for applications. This is optional software for use in developing and deploying applications and is licensed as part of the Tru64 UNIX operating system license.
- Tru64 UNIX Version 5.1B-3 ships with DataDirect Connect Version 5.0 for ODBC and DataDirect SequeLink Version 5.4.
- SequeLink ODBC Edition is a universal ODBC client component. DataDirect SequeLink ODBC provides transparent connectivity to almost any type of client, network, server, or database.
- For developers working with Java, JDBC provides Java applications to access data sources and databases across platforms. The SequeLink Java Edition is a universal standards-based implementation of JDBC. It is also flexible in design, providing scaleable connectivity from multivendor client, server, and Web environments to industry-leading relational databases. It is optimized and tuned for the Java environment, extending the functionality and performance of existing systems and easily incorporating new technologies.

Windows 2000 Single Sign-On

Tru64 UNIX allows Windows users to authenticate to Tru64 UNIX using their Active Directory user name and password. Secure authentication between the Tru64 UNIX system and Active Directory occurs by using Kerberos technology. UNIX user account information can be stored in the LDAP-enabled Active Directory, to give administrators a single user account directory spanning Tru64 UNIX and Windows 2000. Administrators can also manage the additional Tru64 UNIX attributes using the Microsoft® Management Console (MMC) snap-in extensions provided with this kit.

User Interfaces

The following sections describe Tru64 UNIX user interface environments.

Web Browsers

Tru64 UNIX bundles several browsers with the operating system, namely two variants of the Netscape together and the Mozilla browser. The licenses for these Web browsers are included in the Tru64 UNIX base license. These browsers support several language fonts, such as Japanese, Korean, Unicode, and Simplified Chinese.

- Netscape Communicator 4.76 - The Netscape Communicator Internet Client Worldwide Web browser.
- Netscape Browser 6.2.3 - Tru64 UNIX Version 5.1B includes the Netscape 6.2.3 Web Client, an XML enabled browser by which users can access the Platform Management Utility for the ES80 and the GS1280.
- Mozilla Version 1.7.5 Application Suite for Tru64 UNIX - The Mozilla Application Suite's Web client is the next-generation Web, mail, and news application. Mozilla is an open source Web application created by the Mozilla Foundation. It is designed for standards compliance, performance, and portability.

Common Desktop Environment (CDE)

CDE is the default user interface for Tru64 UNIX.

CDE Version 1.0 includes Motif and is dependent on the underlying Open Group X Window System, Version 11, Release 6 as described in this document.

CDE Version 1.0 provides a common user interface that is available across multiple vendor platforms. CDE offers a range of integrated desktop services, including the following:

- The Front Panel
- Session management
- Window management
- File Manager
- Procedural and object-oriented application integration
- Online information
- Productivity and collaborative tools
- Data interchange
- Environment
- Visuals
- Network services

Mail User Agents

The graphical mail user agent supplied with CDE, dtmail provides Multipurpose Internet Mail Extensions (MIME).

Netscape Communicator provides a mail user agent that supports both POP3 and IMAP servers.

Tru64 UNIX 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 Tru64 UNIX releases, the MH 6.7.1 user agent is provided. The RAND Corporation developed the MH mail agent as an interface to the mail system.

User Interfaces

Motif

Tru64 UNIX includes the CDE V1.0/Motif V1.2 graphical user interface. Motif 2.1 also ships with Tru64 UNIX on the Associated Products CD-ROM Volume 2.

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)
- User Interface Language (UIL)
- User Interface Language Compiler (UILC)
- Widget Meta-Language Compiler (wml) and description files
- X Toolkit Intrinsics Library (Xt)
- X Library (Xlib)

X Window System

The X Window System, Version 11, Release 6 (X11R6.5) is fully supported in Tru64 UNIX, and supports the following Open Group standards:

- X Image Extensions (V5)
- Inter-Client Communications Conventions Manual Update — Tru64 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

Under The Open Group's UNIX branding program, HP has received the UNIX 98 brand for the Tru64 UNIX Operating System, the UNIX 98 Workstation brand, and the Common Desktop Environment brand. Tru64 UNIX is licensed to use the UNIX trademark in conjunction with the Tru64 UNIX product.

Tru64 UNIX conforms to the Single UNIX Specification, Version 2 required for the UNIX 98 brand. It consists of three BASE specifications:

- Commands and Utilities, Issue 5
- System Interface Definitions, Issue 5
- System Interfaces and Headers, Issue 5

In addition, the Single UNIX Specification includes:

- Network Services, Issue 5
- X/Open Curses, Issue 4, Version 2

UNIX 98

The UNIX 98 Product Standard is a significantly enhanced version of the UNIX 95 Product Standard. The mandatory enhancements include (1) Threads interfaces, (2) Multibyte Support Extension (MSE), (3) Large File Support, (4) Dynamic Linking, (5) changes to remove hardware data-length dependencies or restrictions, and (6) Year 2000 changes.

UNIX 98 is made up of the following Product Standards:

- Internationalized System Calls and Libraries Extended V2
- Commands and Utilities V3
- C Language
- Sockets V2
- Transport Service (XTI) V2
- Internationalized Terminal Interfaces (XCurses)

UNIX 98 Workstation

The UNIX 98 Workstation Product Standard is the same as the UNIX 98 Product Standard, with the addition of the requirement to conform to the Common Desktop Environment Product Standard.

UNIX 98 Workstation is made up of the following Product Standards:

- Internationalized System Calls and Libraries Extended V2
- Commands and Utilities V3
- C Language
- Transport Service (XTI) V2
- Sockets V2
- Intermationalized Terminal Interfaces
- X Window System Application Interface V2
- Motif Toolkit
- Calendaring and Scheduling

Standards

Common Desktop Environment (CDE)

This Product Standard defines the X/Open Common Desktop Environment, a common graphical user interface environment for use on systems supporting the X Window System. Although the X/Open's Common Desktop Environment brand specifies only X11R5 components, Tru64 UNIX fully implements X11R6, while maintaining the CDE Standard brand.

The Common Desktop Environment is made up of the following Product Standards:

- X Window System Application Interface V2
- Motif Toolkit
- Calendaring and Scheduling

UNIX 95

Tru64 UNIX conforms to the Single UNIX Specification. Under The Open Group's UNIX branding program. HP has received and maintains the UNIX 95 brand for the Tru64 UNIX Operating System.

All Conformance Statement Questionnaires for Tru64 UNIX are provided on The Open Group Web site at the following URL: http://www.opengroup.org/csq/.

Motif

Tru64 UNIX provides the OSF/Motif Application Environment, which is based on CDE 1.0 (OSF/Motif R1.2.4) and conforms to the IEEE POSIX 1295 specification.

POSIX.1 and FIPS 151-2

Tru64 UNIX conforms to the IEEE Std 1003.1- 1990, POSIX Part 1: System Application Program Interface (API) [C Language], also referred to internationally as ISO/IEC 9945-1:1990, and to the Federal Information Processing Standard, FIPS 151-2.

IEEE Std 1003.1b-1993

Tru64 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].

IEEE Std 1003.1c-1995

Tru64 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].

IEEE Std 1003.1g/D6-1997 (March)

Tru64 UNIX includes support for the POSIX 1003.1g Sockets, as defined in POSIX 1003.1g, March 1997, Part XX: Protocol Independent Interfaces (PII) Section 5: Detailed Network Interface – Socket.

Standards

IEEE Std 1003.2-1992

Tru64 UNIX conforms to the IEEE Std 1003.2 1992 - Shell and Utilities, referred to internationally as ISO/IEC 9945-2, and provides the following implementation options:

- [POSIX2_C_BIND]
- [POSIX2_C_DEV]
- [POSIX2_CHAR_TERM]
- [POSIX2_LOCALEDEF]
- [POSIX2_SW_DEV]
- [POSIX2_UPE]

SVID

Tru64 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). Tru64 UNIX provides more than 400 commands and interfaces that comply with SVID3/SVR4.

System V Release 3.2 (SVR3)

SVID, Issue 2

Tru64 UNIX conforms to the Base System as specified in Issue 2.

A license to use Tru64 UNIX binaries includes the right to use the included System V Release 3.2 derivatives.

System V Release 4.0 (SVR4)

SVID, Issue 3

Tru64 UNIX includes a significant number of commands and interfaces compatible with SVID3.

The Tru64 UNIX shared library scheme is patterned on and compatible with the SVR4 shared library scheme. Tru64 UNIX implements the SVR4 /proc file system, which provides the capability of accessing processes using file semantics. Tru64 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.

Extended System V Functionality

System V functionality in the operating system has been extended in some existing commands and library functions to include System V formatted output, and support for System V options. A number of new utilities are also supported, most notably the sar and truss utilities.

Standards

Real-Time

Tru64 UNIX provides a real-time user and programming environment. The real-time programming environment conforms to the POSIX 1003.1b-1993 standard.

The Tru64 UNIX real-time programming environment provides a fully preemptive kernel (optionally enabled), and 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

The compile-time constant (POSIX_4D11) previously provided to preserve compatibility with earlier drafts has been retired.

Symmetric Multiprocessing (SMP)

Tru64 UNIX supports symmetric multiprocessing (SMP), which enables systems with two or more processors to execute the same copy of the operating system, access common memory, and execute instructions simultaneously. SMP functionality fully exploits the additional compute capabilities of multiple processors.

Threads

Tru64 UNIX provides software developers the ability to write multithreaded programs that take full advantage of SMP using POSIX Threads. POSIX Threads provide a pthreads interface that complies with the POSIX 1003.1c semantics. The POSIX Threads implementation provides user space threads that are supported by and cooperate with the threaded kernel of Tru64 UNIX in a comprehensive two-level scheduling model that transparently maintains full concurrency when a thread blocks. In addition, for building libraries whose routines can be called in either a single-threaded or multi-threaded context, POSIX Threads provide a thread-independent services (TIS) interface.

The Visual Threads tool is available to help programmers analyze and debug multi threaded applications for common problems such as deadlock, protection of shared data, and thread usage errors. It can also be used to monitor the thread-related performance of the application.

Shared Libraries

Tru64 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. Tru64 UNIX also provides static versions of most of these libraries.

HP Fortran Run-Time Libraries

The HP Fortran run-time support libraries (libfor, libfutil, libUfor) enable users to run previously compiled programs that require these libraries. The libraries support Fortran program function areas including input and output, intrinsic functions, data formatting, data conversion, miscellaneous math functions, Fortran bindings to common operating system services, and more.

C++ Run-Time Libraries

The C++ run-time support libraries (libcxx, libcomplex, libtask) enable users to run previously compiled applications containing C++ code, without having C++ installed on the target system. These libraries support C++ functionality in areas including input and output, complex arithmetic, multitasking, and more. The shared versions of the libcomplex and libtask libraries will be retired in a future version of Tru64 UNIX. Instead, they will be available with the C++ compiler as archive libraries.

HP COBOL Run-Time Libraries

HP recommends the use of Micro Focus COBOL, as resold by HP, for Tru64 UNIX based COBOL application development. For customers developing HP COBOL applications on HP OpenVMS who also want to deliver HP COBOL based applications on Tru64 UNIX, HP COBOL run-time libraries are licensed with Tru64 UNIX. The HP COBOL compilers are available as a separately licensed layered product.

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

HP Pascal Run-Time Libraries

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

Portable Mathematics Library

The Portable Mathematics Library (PML) 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 that, when executed, collects analysis data for a wide variety of purposes. ATOM includes all of the run-time libraries necessary to execute ATOM-based analysis utilities and tools. The ATOM Run-Time Libraries are licensed with Tru64 UNIX. Several useful ATOM based analysis tools developed by HP to facilitate program development are licensed with the Tru64 UNIX Developers' Toolkit.

Development Environment

Software Development Kit for the Java™ Platform

Tru64 UNIX provides the Software Development Kit (SDK) v 1.4.1-2 for the Java™ Platform. The SDK implements Sun Microsystems' Java 2 SDK, Standard Edition (J2SDK), v 1.4.1-2.

The SDK includes the basic set of command-line tools, the Class Libraries, and virtual machine implementation needed to develop and run Java applets and applications. The SDK also includes the Fast Virtual Machine (Fast VM) as the default SDK VM. The Fast VM provides optimal runtime performance on Tru64 UNIX systems.

The SDK passes 100 percent of the tests provided in Sun's Java Compatibility Kit. The SDK is included as part of the Tru64 UNIX Operating System kit and is subject to the terms of the Base license for Tru64 UNIX, as well as the additional SDK license. For additional information, see: www.hp.com/software/java/alpha .

Memory-Mapped File Support

Tru64 UNIX supports the Berkeley mmap function and, therefore, allows an application to access data files with memory operations rather than with file input and output operations.

Shells

Tru64 UNIX provides the following shells:

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

All shells are programmable and allow users to customize their environment.

Dynamic Loader

Tru64 UNIX uses an SVR4-compatible loader to dynamically load shared libraries. This loader provides SVR4 symbol resolution semantics, including symbol preemption.

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

Data Link Interface (DLI)

Tru64 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

Tru64 UNIX includes the configuration manager framework, which allows dynamic loading (and configuring) of kernel subsystems. The framework, composed of a configuration manager daemon (cfgmgr), a kernel loader daemon (kloadsrv), a system configuration database (sysconfigtab), and its management utility (sysconfigdb), allows kernel modules (such as device drivers) to be loaded after the system is booted.

Foreign Device Boot Support

Tru64 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.

Development Environment

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 buses:
  - EISA
  - ISA
  - PCI
  - SCSI peripheral devices
  - VMEbus

Common Access Method (CAM)

Common Access Method is an ANSI standard for the software drivers that provide the interface between an operating system and a SCSI device. The Tru64 UNIX CAM implementation provides drivers and tools for robotic medium changers found in tape libraries. Tru64 UNIX CAM is highly compatible with ANSI X3.131-1986, Level 2 and supports SCSI-2/SCSI-3 based CAM. These features were formerly provided in the CAM Layered Components (CLC) and have now been incorporated into the base operating system.

Internationalization

The Tru64 UNIX internationalization environment, tools, and localization features enable the development and execution of internationalized software without re-engineering the user application. Supported Character Sets, Unicode support, Euro support, a complete listing of I18N features, as well as memory and disk space requirements by language variant, can be found at the following URL: http://h30097.www3.hp.com/unix/i18n.htm

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Unicode Support

Tru64 UNIX supports Unicode Version 3.1 and ISO 10646 standards through a set of UCS-4 and UTF-8 based locales. Codeset conversion capability to and from UCS-4 (UTF-32), UCS-2 (UTF-16) and UTF-8 formats is provided for all supported codesets. Conversion support from Unicode to a full range of codesets, including the ISO 8859 series (Latin-1, Latin-2, ISO-Greek, etc.), PC codepages, and a wide variety of Asian encodings, is also provided.

Euro Currency Support

Tru64 UNIX supports the processing of the new euro currency symbol through the use of ISO Latin-9, and Unicode V3.0. Applications running in the Unicode UTF-8 or the ISO 8859-15 locales can display, process, and print the euro currency symbol, provided that the applications have been modified to recognize the euro character, and the UTF-8 and ISO 8859-15 character sets.

Chinese Character Set Standard GB18030

Tru64 UNIX conforms to the People's Republic of China National Standard GB18030-2000. This is a mandatory standard and supports the Chinese Character Set Standard for Information Interchange.

Developers' Toolkit Version 5.1B

The Developers' Toolkit for Tru64 UNIX provides a robust set of tools that help developers write effective applications to improve quality, optimize the power of Alpha systems, and streamline development time. The Developers' Toolkit includes:

- An ANSI-compliant C compiler with advanced optimization capabilities
- A state-of-the-art debugger that supports threads services to optimize SMP systems
- In-depth profiling and post-link optimizers that analyze CPU usage, heap memory, and streamline applications
- Porting tools that reduce the time and cost of moving applications from 32-bit UNIX and OpenVMS systems to 64-bit Tru64 UNIX
- GUI-based development and traditional command-line interfaces
- An extensive library of routines that simplify the process of creating custom development tools

The Developers' Toolkit for Tru64 UNIX is a prerequisite for all Tru64 UNIX development tools. This product is licensed separately from theTru64 UNIX Operating System. A description of the product and be found in the Developers' Toolkit QuickSpec.

Application Transition Tools

Tru64 UNIX to HP-UX 11i application transition tools have been added to the Associated Products CD-ROMS:

- Tru64 UNIX to HP-UX 11i Software Transition Kit Version 2.2 - This kit includes file scanning utilities, developer's documentation, and porting documentation to help resolve compatibility issues between Tru64 UNIX and HP-UX 11i v2. The file scanning utilities use a clear methodology for code analysis, providing sound advice for each Application Programming Interface (API) encountered in scanned Tru64 UNIX C, C++ and Fortran source code files as well as makefiles.
- binaryScan The binaryScan utility for Tru64 UNIX has been updated to Version v2.1. This update which includes reporting capabilities for TruCluster and AdvFS related APIs and an updated database. More information about binaryScan is available at the following Web site: http://devresource.hp.com/drc/resources/binaryScan/download.jsp
- The hpuxman utility has been updated to Version 1.1. This update includes HP-UX 11i v2 reference pages. More information about hpuxman is available at the following Web site: http://devresource.hp.com/drc/resources/Tru64_UNIX_to_HPUX_hpuxman_v11.jsp

These tools are updated on a frequent basis and are available on HP web site at: http://www.hp.com/go/tru64appmigration/.

TruCluster Plus Software Package

The TruCluster Plus Software package includes TruCluster Server Software plus two key storage management products: Logical Storage Manager and AdvFS Utilities. TruCluster Plus Software delivers all of the features of TruCluster Server Software plus online configuration, optimal file system performance, and data protection. The part number for TruCluster Plus Software is QP-6R9A*-AA.

Advanced File System Utilities (AdvFS) Version 5.1B-3

The AdvFS Utilities extend the high availability and flexibility of AdvFS. The AdvFS Utilities provide a graphical user interface to ease management tasks and online utilities to dynamically resize file systems, balance the percentage of space used on volumes, undelete files using trashcans, stripe files, and clone files for hot backup. The product is described in the AdvFS Utilities QuickSpecs.

Logical Storage Manager (LSM) Version 5.1B-3

The Tru64 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. The product is described in the Logical Storage Manager QuickSpec.

Layered Products

Legato NetWorker® 7.2

Legato NetWorker® provides automated backup and recovery of files on a local system. Legato NetWorker® SingleServer and the 30-day evaluation are included with Tru64 UNIX. A SingleServer license is provided free of charge with Tru64 UNIX and provides automated backup and recovery of the directly attached storage device. After 30 days, contact Legato for an authorization code at licensing@legato.com. To purchase the full Legato NetWorker® product, contact Legato at hpanswers@legato.com, phone 408-530-3296, or visit their Web site at: http://portal2.legato.com/partners/strategic/hp/

Advanced Server for Tru64 UNIX (ASU) Version 5.1B-3

Advanced Server for Tru64 UNIX provides seamless interoperability between Tru64 UNIX servers, Windows NT servers, and Microsoft Windows clients. Through the ASU software, Tru64 UNIX resources are available to Microsoft users without modification to their software, even allowing administration from Windows PC management utilities.

The ASU provides a highly scalable, highly available, reliable, and supported SMB/CIFS file and print server that leverages all of the advantages of Tru64 UNIX in a Microsoft client environment. As a multi-instance TruCluster application, it runs on multiple cluster members but appears as a single server to clients. This allows the connection load to be distributed among the cluster members, and provides high availability by tolerating failures. It provides full Windows NT4 Domain Controller functionality that is interoperable with Windows 2000 / Windows XP environments. Recent features include support for UTF-8 codesets, support for notification of file changes, and a pccheck utility to collect the system configuration of Windows clients.

Graphic Drivers

Graphic driver kits provide support for particular graphics cards and provide development and run-time environments for 2D or 3D applications. The driver kits are located on the Associated Products CD, or can be downloaded from: http://www.support.compaq.com/open3d

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Multimedia Services

Multimedia Services for Tru64 UNIX brings audio and video capabilities to HP Alpha workstations, and provides a full programming library for use by developers of new applications. The Multimedia Services run-time license is included with the Tru64 UNIX base operating system.

Server Extensions for Tru64 UNIX

HP Tru64 UNIX Server Extensions is an integrated layered product for the Tru64 UNIX Operating System that provides server services bundled with all Alpha Servers. The Server Extensions include remote installation and dataless configuration support. It requires a separate license, which is packaged with Tru64 UNIX AlphaServer systems.

OpenLDAP

OpenLDAP Directory Server Version 2.2.15 is bundled with Tru64 UNIX V5.1B-3 and can be found on the Associated Products CD-ROMs. The Lightweight Directory Access Protocol (LDAP) is an Internet standard directory service protocol that runs over TCP/IP. LDAP is designed to provide access to directories, which support the X.500 model. It is designed to provide either a standalone directory service or lightweight access to an X.500 directory, unlike DAP, which incurs a heavier resource footprint.
The LDAP Client Utilities have been updated to Version 2.2.15 with Tru64 UNIX 5.1B-3. This update includes support for an additional configuration parameter, nisnetgrpbranch, added for LDAP netgroups support.

Hardware Requirements

The Tru64 UNIX Operating System can execute on valid Alpha systems and must include the following minimum system configuration:

- Tru64 UNIX requires the minimum component of main memory to be 128 MB.
- The minimum disk space requirement for installing the Tru64 UNIX Operating System is 1 GB. The 1 GB disk space requirement does not include the additional space required to update the Worldwide Language Support component of Tru64 UNIX.
- However, HP recommends that systems have at least two 2 GB disk space available to ensure sufficient disk space for swap, patches, and storage.
- The supported load devices include CD-ROM readers (such as RRD44) or a variety of network interfaces.
- Tru64 UNIX minimally requires one console terminal connection with ASCII capabilities or one HP graphics display console for Alpha systems.
- Recommended minimum root partition should be 128 MB (single system only).
- Recommended minimum usr partition should be 700 MB (single system only).

Hardware Partitioning

Tru64 UNIX provides the enabling technology to support static hardware partitions on the AlphaServer GS series systems. The partition guide is now available at the following Web page:
http://h18002.www1.hp.com/alphaserver/products/options.html or
http://h18002.www1.hp.com/alphaserver/technology/index.html

QuickSpecs describes how to configure and order Intel®, Alpha, and VAX workstations and servers. QuickSpecs are located at: www.hp.com/go/productbulletin.

Use of Tru64 UNIX in hardware partitions no longer requires a Tru64 UNIX Hardware Partitioning License for each additional partition. For more information, see the Software Licensing section in this document.

Optional Hardware

Additional memory and secondary storage may be required depending upon the usage of the Tru64 UNIX Operating System software and optional software products.

Combinations of hardware options are subject to such limitations as bandwidth, physical configuration restraints, thermal dissipation, electrical loads, and power supply. See the following URL:
http://h18002.www1.hp.com/alphaserver/products/options.html

Supported Hardware

Combinations of hardware options are subject to limitations, such as bandwidth, physical configuration constraints, and electrical load and power supply.

HP reserves the right to change the number and type of devices supported by Tru64 UNIX. The minimum hardware requirements for future versions and updates of Tru64 UNIX may be different from current requirements. See the following URL:
http://h18002.www1.hp.com/alphaserver/products/options.html

Supported AlphaServer Systems AlphaServer Models

AlphaServer 300
AlphaServer 400
AlphaServer 800
AlphaServer l000
AlphaServer l000A
AlphaServer 1200
AlphaServer 2000
AlphaServer 2l00
AlphaServer 2100A
AlphaServer 4000
AlphaServer 4100
AlphaServer 8200
AlphaServer 8400
AlphaServer DS10, DS10L, DS15
AlphaServer DS20, DS20E, DS20L, DS25
AlphaServer ES40, ES45, ES47, ES80
AlphaServer GS60, GS60E, GS140
AlphaServer GS80, GS160, GS320, GS1280

Supported Alpha Workstation Systems Alpha Workstation Models

AlphaStation 200
AlphaStation 250
AlphaStation 400
AlphaStation 255
Ultimate Workstation 533au
AlphaStation 500
AlphaStation 600
AlphaStation 600A
AlphaStation DS20E
AlphaStation ES40
Professional Workstation XP1000, XP900
Personal Workstation 433au, 500au, 600au

Retired Hardware

The following hardware platforms were retired in Version 5.1 of Tru64 UNIX and are not supported with this release:
DEC 2000, DEC 3000, DEC 4000, DEC 7000, DEC 10000

XMI Bus support was retired in Version 5.1 of Tru64 UNIX and is not supported with this release.

Supported Hardware

SCSI Device Support

The Tru64 UNIX Operating System supports the ANSI SCSI-2/SCSI-3 standards. Tru64 UNIX supports Fibre Channel Switched Fabric Protocol and Arbitrated Loop Protocol. Tru64 UNIX does not support Point-to-Point Protocol. HP certifies Tru64 UNIX with HP storage devices. The list of certified HP devices is provided in the QuickSpecs for specific platforms.

Printer Support

Printer models supported on Tru64 UNIX can be found on the following Web page:
http://h30097.www3.hp.com/printing/printers.html

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. You can view specific information about Tru64 UNIX and Alpha systems at: http://www.hp.com.

Distribution Media

Tru64 UNIX is distributed on CD-ROM and is ISO 9660 Level 1 compliant.

Source Materials Options

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, HP does not warranty the ability to build a binary kit. Limited documentation is also provided. HP does not warranty the results of using the source kit to change selected portions of the system.

Customers who are appropriately licensed by the Santa Cruz Operations (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 distribution (initial distribution or revision) of source materials:

- Customers must be currently licensed by the Santa Cruz Operations (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 HP that the customer's UNIX source license is valid.
- Customers must have signed the HP Software Program Sources License Agreement for the facility or site where the CPU is located.

Source kits provided by HP do not necessarily contain all source files used by HP to build object code kits. HP provides these source kits on a reference-only basis. HP does not provide support for source code as part of the standard Software Product Services (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 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 HP) that has a Single-Use License for the object code.

The source code distribution update 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 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 HP) that has a Single-Use License for the object code and is also listed on the Source License for this product.

Ordering Information

Tru64 UNIX Software Media Kit

Tru64 UNIX Operating System: QA-6ADAA-H8

The Software Media kit includes CD-ROMs containing the operating system binaries and complete Tru64 UNIX online documentation. Hardcopy startup documentation is also included in the Media kit, including the Installation Guide, Release Notes, and Technical Overview.

Software Documentation

Documentation for Tru64 UNIX is provided on the Documentation CD-ROM. It is also available on the Worldwide Web and in printed form.

The software Media Kit (QA-6ADAA-H8) includes the Documentation CD-ROM and printed versions of the books in the Startup Kit. The Documentation CD-ROM is also separately orderable (QA-6ADAA-G8).

The structure of the printed Tru64 UNIX Documentation kit and its subkits follows. Each kit contains the following subkits:

- Tru64 UNIX Documentation Kit (QA-6ADAA-GZ)
  - End User Documentation Kit (QA-6ADAB-GZ)
    - Startup Kit (QA-6ADAC-GZ)
    - System and Network Management Kit (QA-6ADAE-GZ)
    - General User Kit (QA-6ADAD-GZ)
  - Developer's Kit (QA-6ADAF-GZ)

Included the Developer's Kit is a book published by company other than HP. Thus book is available only in printed form. All of the other books in these kits are provided on line on the Documentation CD-ROM.

Reference pages for Tru64 UNIX are provided on the operating system CD-ROM, the Documentation CD-ROM, and the Worldwide Web. They can also be purchased in printed form in a separately orderable kit (QA-6ADAG-GZ).
Users can view the Tru64 UNIX documentation at: http://www.hp.com/go/Tru64unix

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Source Distribution

Source License/Distribution: QB-6ADAA-E8
Update Source License/Distribution: QB-6ADAE-E8
Education Source License/Distribution: QB-6ADBA-E8
Education Update Source License/Distribution: QB-6ADBE-E8

For more information, see the Source Materials Options section of these QuickSpecs.

The version of the Tru64 UNIX Operating System described in these QuickSpecs qualifies as a Minor Functional version release.

The Tru64 UNIX Operating System license provides the right to use the software as described in these QuickSpecs, and is furnished under the licensing of the Hewlett-Packard Company's Standard Terms and Conditions. Licenses (including all Base, SMP,and User Licenses) for prior versions must be updated to this version either through the purchase of a Service Agreement that includes the rights-to-use new versions, or through the purchase of Update Licenses.

There are five different types of Tru64 UNIX Operating System licenses:

- Operating System Base License (QL-MT4A*-6*) Update License (QL-MT4A*-7*)
- Symmetric Multiprocessing (SMP) Extension to Base License (QL-MT4A9-6*) Update (QL-MT4A9-7*)
- Tru64 UNIX Hardware Partitioning License (QM-MT4AA-AA) Update License not required.
- Concurrent Use Licenses (QL-MT7AM-3*) Update (QL-MT7AM-5*)
- Unlimited User Licenses (QL-MT7A*-AA) Update (QL-MT7A*-RA)

The following sections describe each type of license.

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 Tru64 UNIX Operating System on a single processor.

This license also authorizes up to two concurrent interactive users of the system. An interactive user, either a person or device, is one that is logged in to a Tru64 UNIX processor or is interactively using the operating system software by means other than a login. The two interactive users authorized as part of the Operating System Base License are additive with Concurrent Use License quantities, but may not be separated from the Operating System Base License.

In addition to the two interactive users, login as root is authorized for system management purposes only. If a Tru64 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 Concurrent Use Licenses, Unlimited Interactive User Licenses, Hardware Partitioning 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 capability on those Tru64 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 added 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.

Tru64 UNIX Hardware Partitioning License

QM-MT4AA-AA has been retired.

The Tru64 UNIX Base License provides the right to enable Tru64 UNIX in a single hardware partition. The Tru64 UNIX Hardware Partition License is no longer required for each additional Tru64 UNIX hardware partition within the same system. For example, a system divided into two (2) Tru64 UNIX partitions requires one (1) Tru64 UNIX Base License loaded on to each partition.

Software Licensing

Concurrent Use Licenses
(QL-MT7AM-3* LMF Product Name: OSF-USR)
An Operating System Base License is a prerequisite for Concurrent Use Licenses on the same system.

These licenses grant the right to interactive use of the Tru64 UNIX Operating System. The Concurrent Use Licenses 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.

Concurrent Use Licenses can be redesignated and can be installed and used only on a single Tru64 UNIX system at a time.

An interactive user, either a person or device, is one that is logged in to a Tru64 UNIX processor or is interactively using the operating system software by means other than a login.

Unlimited User Licenses
(QL-MT7A*-AA LMF Product Name: OSF-USR)
An Operating System Base License is a prerequisite for an Unlimited User License for use on the same system.

This license grants the right to use the Tru64 UNIX Operating System by an unlimited number of interactive users on a system.

An Unlimited Interactive User License 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 User License.

For more information on licensing, see: http://licensing.hp.com/swl/view.slm?page=index

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Software Product Services

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

Software Warranty

This software is provided by HP with a 90-day conformance warranty in accordance with the HP warranty terms applicable to the license purchase.
