



# Software Product Description

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**Product Name: TruCluster Server Version 5.0**

**SPD 70.79.01**

## DESCRIPTION

Compaq TruCluster Server Version 5.0 for Compaq Tru64 UNIX Version 5.0, the next generation in the UNIX cluster product line from Compaq, provides highly available and scalable solutions for users in mission-critical computing environments. It delivers easier to use, yet more sophisticated, UNIX clustering capabilities by adding a fully clustered shared file system to the rich functionality already found in the Compaq TruCluster products.

TruCluster Server Version 5.0 also significantly reduces the effort and complexity of managing a cluster. Since the cluster behaves as a single system, it is less work to manage a cluster than separate systems.

By combining the advantages of symmetric multiprocessing, distributed computing, and fault resilience, a cluster running TruCluster Server Version 5.0 offers its users high availability while providing scalability beyond the limits of a single system. TruCluster Server significantly reduces, but does not eliminate, the impact of hardware and software failures.

TruCluster Server Version 5.0 extends single-system management capabilities to clusters. It provides a clusterwide namespace for files and directories, including a single root file system that all cluster members share. It also includes a cluster alias feature for the Internet protocol suite (TCP/IP) so that a cluster appears as a single system to its network clients while load balancing client connections.

Because TruCluster Server cluster members share a single root file system and common system configuration files, most management tasks need to be performed only once for the entire cluster rather than repeatedly for each individual member. The cluster can be managed from any of its members as well as remotely using Tru64 UNIX Web-based management tools. Tru64 UNIX and TruCluster Server software are installed just once per cluster. Most network applications need to be configured only

once in the cluster. This allows a cluster to be managed easier than distributed systems.

A choice of graphical, Web-based, or command-line user interfaces makes management tasks easier for the administrator, flexible for those with large configurations, and streamlined for expert users.

Like the TruCluster Available Server and TruCluster Production Server products, TruCluster Server lets you deploy highly available services that have no embedded knowledge they are running in a cluster, and that can access their disk data from any cluster member. Like the TruCluster Production Server product, TruCluster Server lets you run components of distributed applications in parallel, providing high availability while taking advantage of cluster specific synchronization mechanisms and performance optimizations.

TruCluster Server Version 5.0 allows the processing components of an application to concurrently access raw devices or file system files, regardless of where they are located in the cluster. Member-private storage as well as clusterwide shared storage is equally accessible to all members. Using either standard UNIX file locks or the Distributed Lock Manager (DLM), an application can synchronize clusterwide access to shared resources, to maintain data integrity.

To a client, the cluster appears to be a powerful single-server system; a client is minimally, if at all, impacted by hardware and software failures in the cluster.

TruCluster Server simplifies the mechanisms of making applications highly available. A cluster application availability (CAA) facility records the dependencies and monitors the state of registered applications transparently. If a hardware or software failure prevents a system from running a service, the failover mechanism automatically relocates the service to a viable system in the cluster, thus maintaining the availability of applications and data. Administrators can use CAA commands to manually

relocate applications for load balancing or hardware maintenance.

TCP-based and UDP-based applications can take advantage of the features of the cluster alias subsystem. These applications, depending on their specific characteristics, can run simultaneously on multiple members of the cluster, or on a single cluster member. The cluster alias subsystem routes client requests to any member participating in that cluster alias. During normal operations, client connections are dynamically distributed among multiple service instances according to administrator-provided metrics.

TruCluster Server Version 5.0 supports a variety of hardware configurations that are cost-effective, and meet performance needs and availability requirements. Hardware configurations can include different types of systems and storage units, and can be set up to allow easy maintenance of systems and storage. In addition, it is possible to set up hardware configurations that allow the addition of a system or storage unit without shutting down the cluster.

TruCluster Server Version 5.0 requires a PCI-based Memory Channel interconnect for fast and reliable communication between cluster members. Using multiple shared buses and redundant Memory Channel interconnects contributes to a cluster with no single point of failure configured to achieve high availability.

## FEATURES

A TruCluster Server cluster acts as a single virtual system, even though it is made up of multiple systems. Members of the cluster can share resources, data storage, and clusterwide file systems under a single security and management domain, yet they can boot or shut down independently without disrupting the cluster.

### *Cluster File System*

The cluster file system (CFS) makes all files, including the root (*/*), */usr*, and */var* file systems, visible to and accessible by all cluster members. It does not matter whether a file is stored on a device connected to all cluster members or on one that is private to a single member. Each file system is served by a single cluster member; other members access that file system as CFS clients. CFS preserves full X/Open and POSIX semantics for file system access and maintains cache coherency across cluster members. For instance, an application can use standard UNIX file locks to synchronize access to shared files.

In the event of a failure of the path to a file system, CFS will use an alternate path if one is available. Should an entire system serving a file system fail, CFS will select a new server in the cluster.

CFS supports the AdvFS file system along with NFS client and NFS server for both read and write access. UFS and CDROM file system are supported for read access only.

### *Device Request Dispatcher*

The device request dispatcher - supports clusterwide access to both character and block disk devices. All local and remote cluster disk I/O passes through the device request dispatcher, which results in great flexibility in hardware configurations. A member does not need to be directly attached to the bus on which a disk resides to access storage on that disk.

### *Cluster Alias*

A cluster alias is an IP address that makes the cluster look like a single node to other hosts on the network; it provides a single-system view to network clients. Cluster aliases free clients from having to connect to specific nodes for services. If the member providing the service goes down, client requests are automatically directed to another member, which the cluster alias has elected to provide the service. With applications that run concurrently on multiple members, scaling is achieved by permitting multiple clients to connect to instances of the service on multiple nodes within the cluster, each using a cluster alias to address the service.

### *Cluster Application Availability Facility*

The cluster application availability (CAA) facility provides resource monitoring and application restart capabilities. The resources currently monitored are network adapters and cluster members. Using CAA, you can define failover and relocation policies for services and set up application specific action scripts. Applications do not need to be modified in any way to utilize CAA. An administrator defines and registers profiles for applications that are to remain highly available in the cluster. A profile specifies an application's dependencies and how that application should react to failure.

### *Support for Memory Channel Interconnect*

Memory Channel is a high-performance, PCI-based interconnect that cluster members use for passing low-overhead messages among themselves. TCP/IP is supported over Memory Channel. A software library provides a special set of application programming interfaces for high-performance data delivery over

Memory Channel. The following functions utilize Memory Channel in the cluster:

- High performance cluster communication
- High performance shared storage service
- High performance Distributed Lock Manager
- High performance, direct application to application memory serving

#### *Support for Parallelized Database Applications*

TruCluster Server Version 5.0 provides the software infrastructure to support parallelized database applications, such as Oracle Parallel Server (OPS) and the Extended Parallel Option for Informix Dynamic Server to achieve performance and high availability. OPS and the Extended Parallel Option for Informix Dynamic Server must be purchased separately from Oracle Corporation and Informix Software, Inc., respectively.

#### *Distributed Lock Manager*

The Distributed Lock Manager (DLM) synchronizes access to resources that are shared among cooperating processes throughout the cluster. DLM provides a software library that applications use to implement a resource sharing policy. DLM provides services to notify a process owning a resource that it is blocking another process requesting the resource. An application can also use DLM routines to coordinate the application's activities efficiently with the state of the cluster.

#### *Connection Manager*

The connection manager is a distributed kernel component that ensures that cluster members communicate with each other and enforces the rules of cluster membership. The connection manager forms a cluster, and adds and removes cluster members. It tracks which members in a cluster are active and which are not, and maintains a cluster membership list that is consistent on all cluster members.

#### *Transparent NFS ® Failover*

TruCluster Server Version 5.0 provides highly available access to exported NFS data. In the event of a system failure, file system failover and recovery is transparent to external NFS clients. NFS locking is supported. Both NFS V2 and V3 with UDP and TCP are supported.

#### *Fast File System Recovery*

The Advanced File System (AdvFS) is a log-based file system that provides higher availability and greater flexibility than traditional UNIX file systems.

AdvFS journaling provides increased file system integrity. AdvFS is supported by TruCluster Server Version 5.0 for both read and write access.

An optional, separately licensed product, the Advanced File System Utilities, perform management functions on-line while file systems are active. See the OPTIONAL SOFTWARE section of this SPD for more information on the AdvFS Utilities.

#### *Increased Data Integrity*

Tru64 UNIX Logical Storage Manager (LSM) is a cluster-integrated, host-based solution to data storage management. In a TruCluster Server Version 5.0 cluster, LSM operations continue despite the loss of cluster members, as long as the cluster itself continues operation and a physical path to the storage is available. LSM disk groups can be used simultaneously by all cluster members and the LSM configuration can be managed from any member.

Basic LSM functionality, including disk spanning and concatenation, is provided with the Tru64 UNIX operating system. Extended functions such as striping (RAID 0), mirroring (RAID 1), and online management are available with a separate license.

LSM is supported in a TruCluster Server V5.0 cluster with the following restrictions:

- LSM volumes cannot be used within the clusterwide root domain.
- LSM volumes cannot be used for the boot or swap partitions of individual members.
- LSM cannot be used to mirror a quorum disk or any partitions on that disk.
- LSM RAID 5 volumes are not supported in clusters.

Mirroring of LSM is RAID Advisory Board (RAB) certified for RAID Levels 0 and 1. See the OPTIONAL SOFTWARE section of this SPD for more information.

#### *Global Error Logger & Event Manager*

TruCluster Server Version 5.0 can log messages about events that occur in the TruCluster environment to one or more systems. TruCluster administrators can also receive notification through electronic mail of critical problems when they occur.

#### *Cluster Interconnect Failover*

When configured with redundant Memory Channel adapters, the TruCluster Server cluster provides the ability to transparently failover inter-cluster communication to the surviving adapter in the event that one fails.

*Cluster Client Network Failover*

TruCluster Server Version 5.0 supports highly available client network interfaces via the Tru64 UNIX Version 5.0 NetRAIN feature.

*Cluster Management*

The SysMan system management utility provides a graphical view of the cluster configuration, and may be used to determine the current state of availability and connectivity in the cluster. The administrator can invoke management tools from SysMan, allowing the cluster to be managed from a single location.

*Cluster MIB*

TruCluster Server Version 5.0 supports Compaq's Common Cluster management information block (MIB). This cluster MIB is implemented by each member of a cluster, and shows member views of the cluster. Each cluster member host name, IP addressing configuration, and status are maintained in the cluster. Compaq's Insight Manager™ uses this cluster MIB to discover cluster member relationships and provide a coherent view of clustered systems across supported platforms.

The Performance Manager for Tru64 UNIX is a management application that monitors UNIX system performance information. A single instance of Performance Manager can monitor resources of a system and alert the user when problems arise. It monitors the cluster using the Common Cluster MIB.

*Enhanced Security with Distributed Authentication*

TruCluster Server supports the ability to enable the Enhanced Security option on all members of the cluster. This includes support for features for enhanced login checks and password management. Audit and ACL support can also be enabled independently of the Enhanced Security option on members of the cluster.

**SOFTWARE REQUIREMENTS**

TruCluster Server Version 5.0 requires the Tru64 UNIX Operating System Version 5.0.

For more information on Tru64 UNIX Operating System, a separately licensed product, see SPD 70.70.01.

**Additional Required Subsets**

TruCluster Server Version 5.0 requires that additional software subsets be installed. Please see the TruCluster Server *Software Installation* manual for further details.

**OPTIONAL SOFTWARE**

Compaq Advanced Server for UNIX (ASU) provides Windows NT 4.0 networking services, such as file sharing, print sharing, and security, for Tru64 UNIX. In addition to basic file and print services, ASU provides full Windows domain controller support, support for enterprise-wide trust relationships, and support for Windows NT security -- including file permissions and Windows NT local and global groups.

Additionally, you can manage users, file shares, and printers using native Windows NT 4.0 administrative tools. When combined with TruCluster Server software, ASU provides available and highly scalable file shares, print shares — and Primary Domain Controller resources to your Windows clients.

For more information on ASU, you can visit the Compaq Advanced Server for UNIX (ASU) Web.site at [www.unix.digital.com/products/adv\\_server](http://www.unix.digital.com/products/adv_server).

Legato NetWorker™ is an integrated product offering that addresses the storage management needs of the heterogeneous enterprise environment. NetWorker delivers the manageability, availability, and performance necessary to protect multi-platform environments with one integrated solution. NetWorker Version 5.5 single server version is bundled with the Tru64 UNIX Version 5.0 operating system, enabling backup of directly attached storage. To obtain NetWorker V5.5 full product and service, please contact Legato via email at [compaqanswers@legato.com](mailto:compaqanswers@legato.com), or visit the Legato Web site at [www.legato.com/compaqanswers/](http://www.legato.com/compaqanswers/).

Advanced File System (AdvFS) is a log-based file system that provides flexibility, compatibility, availability, and high performance for files and filesets as large as almost 16 TB. Administrators can add, remove, reconfigure, tune, and back up storage without unmounting the file system or halting the operating system. AdvFS supports multi-volume file systems, which enables file-level striping to improve file transfer rates, and integrates with the Logical Storage Manager. AdvFS Utilities, which is a separately licensed software product for Tru64 UNIX (see SPD 44.52.xx), provides a graphical user interface to simplify management tasks and utilities to dynamically resize file systems, defragment files, load balance, undelete files, and clone files for hot backup.

The Tru64 UNIX Logical Storage Manager (LSM) is an integrated, host-based solution to data storage management, providing concatenation, striping, mirroring, hot-sparing, and a graphical user interface that allows data storage management functions to be done online, without disrupting users or applications. LSM manages storage as a single entity in both cluster and single node environments. LSM is a separately licensed software product for Tru64 UNIX. Please see SPD 51.24.xx for more information.

The StorageWorks™ Software package includes the above two key storage products: The Tru64 UNIX Logical Storage Manager and the AdvFS Utilities. StorageWorks delivers high availability, configuration flexibility online, optimal file system performance, and data protection. The product part number for StorageWorks is QB-5RXA\*-AA.

### SOFTWARE CONFIGURATION REQUIREMENTS

- At least 128 MB of memory is required on each member system.
- Additional disks are required for the clusterwide root, /usr, and /var file systems, member boot disks and an optional quorum disk. Please see the TruCluster Server *Hardware Configuration* manual for full details. Free disk space required to load TruCluster Server software onto a Tru64 UNIX system disk: 24 MB.

The sizes are approximate; actual sizes may vary depending on the system environment, configuration, and software options.

### ORDERING INFORMATION

TruCluster Server Version 5.0 is for environments which require high availability for applications, scalability, and the high-performance Memory Channel interconnect.

Software License: QL-6BRA\*-AA  
 Software License (30-day loan): QL-6BRA9-LB  
 Software License (60-day loan): QL-6BRA9-LD  
 Software Documentation: QA-6BRAA-GZ

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

### SOFTWARE LICENSING

TruCluster Server Version 5.0 is licensed as a standard Compaq software layered product and is provided only under a license. Each system in the TruCluster environment requires separate Tru64 UNIX and TruCluster Server licenses. For more information about Compaq's licensing terms and

policies, contact your local Compaq representative or reseller.

This product supports the Tru64 UNIX License Management Facility (LMF). License units for the TruCluster product are allocated on an unlimited system use basis.

For more information on the License Management Facility, please see the Tru64 UNIX Operating System Software Product Description (SPD 41.61.xx) or the Tru64 UNIX operating system documentation.

### GROWTH CONSIDERATIONS

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

### DISTRIBUTION MEDIA

TruCluster Server Version 5.0, a separately licensed product, is distributed on the TruCluster Server Version 5.0 CD-ROM, (QA-6BRAA-H8).

### SOFTWARE PRODUCT SERVICES

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

### SUPPORTED HARDWARE

TruCluster Server Version 5.0 supports the following systems with up to 8 systems in a configuration. TruCluster Server Version 5.0 supports up to 30 shared buses with KZPSA-BB adapters, subject to platform configurations. A maximum of 30 shared buses with the KZPBA-CB are also supported in a TruCluster Server configuration, subject to platform configurations. The TruCluster Server *Release Notes* and *Hardware Configuration* manual provide information regarding configuration and firmware requirements.

### Supported Systems

System	SCSI
AlphaServer 800 5/333, 5/400, 5/500	KZPSA, KZPBA-CB
AlphaServer 1000 4/200, 4/233, 4/266, 5/300	KZPSA
AlphaServer 1000A	KZPSA
AlphaServer 1200 5/400, 5/533	KZPSA, KZPBA-CB
AlphaServer 2000 4/200, 4/233, 4/275, 5/250, 5/300, 5/350	KZPSA
AlphaServer 2100	KZPSA

System	SCSI
AlphaServer 2100A 4/200, 4/233, 4/275, 5/250, 5/300, 5/350	KZPSA
AlphaServer 4000, 4000A , 4100 5/300, 5/400, 5/466, 5/466, 5/600	KZPSA, KZPBA-CB
AlphaServer 8200 5/300, 5/350, 5/440, 5/625	KZPSA, KZPBA-CB
AlphaServer 8400 5/300, 5/350, 5/440, 5/625	KZPSA, KZPBA-CB
AlphaServer DS20	KZPBA-CB
AlphaServer ES40	KZPBA-CB
AlphaServer GS60	KZPBA-CB
AlphaServer GS140	KZPBA-CB

**Supported Memory Channel Hardware**

TruCluster Server Version 5.0 requires Memory Channel hardware. Note that there are two variants of Memory Channel (MC):

MC 1 & 1.5	MC2	Description
CCMAA-AA or CCMAA-BA	CCMAB-AA	PCI Adapter
CCMHA-AA	CCMHB-AA	Hub
CCMLA-AA	CCMLB-AA	Line Card
N/A	BN39B-04	4-meter Cable
BC12N-10	BN39B-10	10-meter Cable

**NOTES:**

- At least one Memory Channel adapter must be installed in a PCI slot in each member system. One or more link cables are required to connect systems to each other or to a hub. A cluster environment with one or two members does not require a hub. A configuration of more than two members requires a Memory Channel hub.
- Any TruCluster Server configuration using AlphaServer DS20 and ES40 systems must use Memory Channel 2 interconnect adapters and cables (CCMAB-AA, BN39B-04, and BN39B-10) and, if the hub is used, a Memory Channel 2 hub (CCMHB-AA) and linecards (CCMLB-AA).
- There are special rules about circumstances where Memory Channel 1 and Memory Channel 2 can be used together in the same cluster. The TruCluster Server *Hardware Configuration* manual provides information regarding supported Memory Channel configurations.

**Supported SCSI Controllers**

The systems are connected to shared SCSI buses using an adapter from the following list. The TruCluster Server *Hardware Configuration* manual and *Release Notes* provide more information regarding SCSI controller configuration and firmware revisions, respectively:

- KZPSA - PCI to Fast Wide Differential SCSI-2 adapter
- KZPBA-CB – PCI to UltraSCSI wide differential adapter

**Supported SCSI Signal Converters**

TruCluster Server Version 5.0 supports the following SCSI signal converters. The TruCluster Server *Release Notes* and *Hardware Configuration* manual provide information regarding supported SCSI signal converters.

Signal Converter	Description
DWZZA-AA	Standalone unit, single-ended/narrow to differential/narrow
DWZZA-VA	SBB, single-ended/narrow to differential/narrow
DWZZB-AA	Standalone unit, single-ended/wide to differential/wide
DWZZB-VW	SBB, single-ended/wide to differential/wide
DS-DWZZH-03	UltraSCSI hub
DS-DWZZH-05	UltraSCSI hub

**Supported SCSI Cables**

TruCluster Server Version 5.0 supports the following SCSI cables:

Device	Description
BN21W-0B	SCSI-2 Cable "Y"
BN21R or BN23G	SCSI-2 Cable "A"
BN21K or BN21L	SCSI-3 Cable "P"
BN21M	50-pin LD to 68-pin HD
BC06P or BC19J	50 pin LD Cable
BN38C or BN38D	VHDCI to HD68 cable
BN37A	Ultra VHDCI Cable
BN21M	50pin LD to HD68 cable

**Supported Terminators and Connectors**

TruCluster Server Version 5.0 supports the following terminators and connectors:

Device	Description
H879-AA	HD68 terminator

H885-AA	HD68 tri-link connector
H8861-AA	VHDCI tri-link connector
H8863-AA	VHDCI terminator
H8574-A	50-pin LD terminator
H8860-AA	50-pin LD terminator

### Supported Disk Devices

TruCluster Server Version 5.0 supports the following disk devices on shared storage. The TruCluster Server *Release Notes* provide information regarding disk device firmware revisions.

- RZ26-VA Narrow
- RZ26L-VA Narrow
- RZ26L-VW Wide
- RZ26N-VA Narrow
- RZ26N-VW Wide
- RZ28-VA Narrow
- RZ28-VW Wide
- RZ28B-VA Narrow
- RZ28D-VA Narrow
- RZ28D-VW Wide
- RZ28L-VA Narrow
- RZ28L-VW Wide
- RZ28M-VA Narrow
- RZ28M-VW Wide
- RZ29-VA Narrow
- RZ29-VW Wide
- RZ29B-VA Narrow
- RZ29B-VW Wide
- RZ29L-VA Narrow
- RZ29L-VW Wide
- RZ40-VA Narrow
- RZ40-VW Wide
- RZ40L-VA Narrow
- RZ40L-VW Wide
- RZ1BB-VW Wide
- RZ1CB-VW Wide
- RZ1DB-VW Wide
- RZ1CD-VW Wide
- RZ1CF-VA Narrow
- RZ1CF-VW Wide
- RZ1DF-VA Narrow
- RZ1DF-VW Wide
- RZ1EF-VA Narrow
- RZ1EF-VW Wide
- RZ1EA-VW Wide
- RZ1FB-VW Wide
- RZ1CD-VW Wide
- RZ1DD-VW Wide
- RZ1ED-VW Wide
- RZ2CD-VW Wide
- RZ2DD-VW Wide
- RZ2ED-VW Wide

### Supported Tape Devices and Media Changers

TruCluster Server Version 5.0 supports the configuration of specific tape devices on a shared SCSI bus. These devices will function properly in a multi-initiator environment. They will, however, be disrupted by SCSI bus resets that occur during cluster membership change events. Backup software must be explicitly capable of handling and recovering from such events and must utilize the cluster application availability facility to facilitate highly available backup.

The following tape devices and media changers are supported on shared storage:

- TZ88
- TZ885 DLT Mini Library
- TZ887 DLT Mini Library
- TZ89
- TL890 Mini Library Expansion Unit
- TL891 Mini Library
- TL892 Mini Library
- TL893 Automated Tape Library
- TL894 Automated Tape Library
- TL895 Automated Tape Library
- TL896 Automated Tape Library

#### NOTES:

- The TL890, TL891, and TL892 are supported with both the KZPSA and KZPBA-CB adapters. All other tape device and media changer support is provided with KZPSA adapters only.

### Supported Storage Boxes

TruCluster Server Version 5.0 supports the following storage boxes:

Storage box	Description
BA350	Single ended, narrow
BA356	Single ended, wide
DS-BA356	Ultra SCSI, SBB shelf

### Supported Array (RAID) Controllers

TruCluster Server Version 5.0 supports the following RAID controllers on shared storage buses. The TruCluster Server *Release Notes* provide information regarding supported Array (RAID) controllers firmware revisions.

RAID Controller
▪ SWXRA-Z1 Array Controller (HSZ20)
▪ HSZ40-Bx Array Controller
▪ HSZ40-Cx Array Controller
▪ HSZ50-Ax Array Controller
▪ HSZ70 Array Controller
▪ HSZ80 Array Controller

Note:

The HSZ80 is supported currently only with AlphaServer 800, 1200, 4x00, 8200, and 8400 systems.

The previous information is valid at the time of release. Please contact your local Compaq office for the latest information.

### **Network Adapters**

TruCluster Server Version 5.0 supports monitoring for any Ethernet, FDDI, ATM (LAN emulation mode only), or Gigabit Ethernet adapters that are supported by Tru64 UNIX Version 5.0.

### **HARDWARE RESTRICTIONS**

The following are hardware restrictions for TruCluster Server Version 5.0. The TruCluster Server *Hardware Configuration* manual provides additional information regarding hardware restrictions.

- Prestoserve ® NVRAM failover is not supported on shared disk devices.

### **HARDWARE CONFIGURATION EXAMPLES**

The TruCluster Server *Hardware Configuration* manual provides hardware configuration examples.

### **Trademark Information**

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