COMPAQ

Software Product Description

Product Name: TruCluster Server Version 5.1 **SPD 70.79.06**

DESCRIPTION

Compaq TruCluster™ Server Version 5.1 for Compaq Tru64™ UNIX Version 5.1, the next generation in the TruCluster product line from Compaq, provides highly available and scalable solutions for mission-critical computing environments. TruCluster Server delivers powerful but easy-to-use UNIX clustering capabilities.

By combining the advantages of symmetric multiprocessing (SMP), distributed computing, and fault resilience, a cluster running TruCluster Server offers high availability while providing scalability beyond the limits of a single system. On a single-system server, a hardware or software failure can severely disrupt a client's access to critical services. In a TruCluster Server cluster, a hardware or software failure on one member system results in the other members providing these services to clients.

By extending single-system management capabilities to clusters, TruCluster Server reduces the effort and complexity of cluster administration. It provides a clusterwide namespace for files and directories, including a single root file system that all cluster members share. A common cluster address (cluster alias) for the Internet protocol suite (TCP/IP) makes the cluster appear as a single system to its network clients while load balancing client connections.

A single system image allows a cluster to be managed more easily than distributed systems. TruCluster Server cluster members share a single root file system and common system configuration files. Therefore, most management tasks need to be done only once for the entire cluster rather than repeatedly for each cluster member. The cluster can be managed either locally from any of its members or remotely using Tru64 UNIX Web-based management tools. Tru64 UNIX and TruCluster Server software, and applications, are installed only once. Most network applications, such as the Apache Web server, need to be configured only once in the cluster and can be managed more easily in a cluster than on 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.

TruCluster Server facilitates deployment of services that remain highly available while they have no embedded knowledge they are running in a cluster. Applications can access their disk data from any cluster member. TruCluster Server also provides the support for components of distributed applications to run in parallel, providing high availability while taking advantage of cluster-specific synchronization mechanisms and performance optimizations.

TruCluster Server allows the processing components of an application to concurrently access raw devices or files, regardless of where the storage is located in the cluster. Member-private storage and clusterwide shared storage is equally accessible to all cluster members. Using either standard UNIX file locks or the distributed lock manager (DLM), an application can synchronize clusterwide access to shared resources, maintaining data integrity.

TruCluster Server is an efficient and reliable platform for providing services to networked clients. To a client, the cluster appears to be a powerful single-server system; a client is impacted minimally, if at all, 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 of, and transparently monitors the state of, registered applications. 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, which maintains the availability of applications and data. Administrators can manually relocate applications for load balancing or hardware maintenance.

TCP-based and UDP-based applications can also take advantage of the cluster alias subsystem. These applications, depending on their specific characteristics, can run on a single cluster member or simultaneously on multiple members. 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 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, administrators can set up hardware configurations that allow the addition of a system or storage unit without shutting down the cluster.

TruCluster Server requires a PCI-based Memory Channel interconnect for fast and reliable communication between cluster members. Using multiple shared buses and redundant Memory Channel interconnects promotes no-single-point-of-failure (NSPOF) characteristics for mission-critical applications.

FEATURES

A TruCluster Server cluster acts as a single virtual system, even though it is made up of multiple systems. Cluster members can share resources, data, 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.

CFS supports the Advanced File System (AdvFS) along with NFS client and NFS server for both read and write access. The UNIX File System (UFS), CD-ROM File System (CDFS), and Digital Video Disk File System (DVDFS) are supported for read access only. For higher performance, applications can use direct I/O through the file system to bypass the buffer cache.

Device Request Dispatcher

The device request dispatcher supports clusterwide access to character and block disk devices, and to tape and tape changer devices. All local and remote cluster disk and tape I/O passes through the device request dispatcher. A member does not need a direct connection to a disk, or tape, or tape changer device to access data on that device. This permits great flexibility in selecting a hardware configuration that is both economical and useful.

Cluster Alias

A cluster alias is an IP address that makes the cluster look like a single system to clients and other hosts on the network. Cluster aliases free clients from having to connect to specific members for services. If the member providing the service goes down, a client reconnects to another member elected by the cluster alias 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 cluster members, each using a cluster alias to address the service.

The cluster alias subsystem provides an optional virtual MAC (vMAC) address that can be associated with each cluster alias IP address. When configured, the same MAC address is used in all ARP responses for the cluster alias address, independent of which cluster node is responding to cluster alias ARP requests. This permits faster failover when a new node assumes responsibility for responding to cluster alias ARP requests.

Cluster Application Availability Facility

The cluster application availability (CAA) facility delivers the ability to deploy highly available single instance applications in a cluster by providing resource monitoring and application relocation, failover, and restart capabilities. CAA is used to define which members can run a service, the criteria

under which to relocate a service, and the location of an application-specific action script. Monitored resources include network adapters, tape devices, media changers, and applications. CAA allows services to manage and monitor resources by using entry points within their action scripts. Applications do not need to be modified in any way to utilize CAA.

Rolling Upgrade

TruCluster Server allows rolling upgrade from the previous version of the base operating system and the TruCluster software to the next subsequent release of the base operating system and TruCluster software. It also allows the rolling of patches into the cluster. Updating the operating system and cluster software does not require a shutdown of the entire cluster. A utility is provided to roll the cluster in a controlled and orderly fashion. The upgrade procedure allows the monitoring of the status of the upgrade while it is in progress.

Cluster Management

The SysMan system management utilities provide a graphical view of the cluster configuration, and can 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 locally or remotely.

Performance Management

The Performance Manager for Tru64 UNIX is a management application that monitors UNIX system performance information. A single instance of Performance Manager can monitor cluster and member systems and alert the user when problems arise. It monitors the cluster using the common cluster management information base (MIB) and TruCluster Server MIB.

The `collect` utility is a lightweight, highly flexible performance data collector that can run continuously 7x24 and manage its log files. For more information, see the `collect`(8) reference page.

Cluster MIB

TruCluster Server supports the Compaq Common Cluster MIB. The Compaq Insight Manager™ uses this Cluster MIB to discover cluster member relationships, and to provide a coherent view of clustered systems across supported platforms.

Highly Available NFS Server

When configured as an NFS server, a TruCluster Server cluster can provide highly available access to the file systems it exports. There are no special cluster management operations required to configure the cluster as a highly available NFS server. In the event of a system failure, another cluster member will become the NFS server for the file system, transparent to external NFS clients. NFS file locking is supported, as are both NFS V2 and V3 with UDP and TCP.

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 protects file system integrity. TruCluster Server supports AdvFS for both read and write access.

An optional, separately licensed product, the Advanced File System Utilities, performs online file system management functions. 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 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 cluster 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. Mirroring of LSM is RAID Advisory Board (RAB) certified for RAID Levels 0 and 1.

LSM is supported for use in a TruCluster Server cluster and will support any volume in a cluster except for the following: clusterwide root domain, quorum disk, member disks, or boot and swap partitions.

LSM RAID 5 volumes are not supported in clusters. See the OPTIONAL SOFTWARE section of this SPD for more information on LSM.

Global Error Logger & Event Manager

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

Cluster Storage I/O Failover

TruCluster Server provides two levels of protection in the event of storage interconnect failure. When configured with redundant storage adapters, the storage interconnect will be highly available. Should one interconnect fail, traffic will transparently fail over to the surviving adapter. When a member system is connected to shared storage with a single storage interconnect and it fails, transactions are transparently performed via the cluster interconnect to another cluster member with a working storage interconnect.

Cluster Client Network Failover

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

Cluster Interconnect Failover

Memory Channel is a high-performance, PCI-based interconnect that cluster members use for passing low-overhead messages among themselves. TruCluster Server requires a PCI-based Memory Channel interconnect for fast and reliable communication between cluster members. When configured with redundant Memory Channel adapters, a cluster with no single point of failure can be configured to achieve high availability. The cluster can transparently fail over intercluster communication to the surviving adapter in the event that one fails.

Support for Parallelized Database Applications

TruCluster Server provides the software infrastructure to support parallelized database applications, such as Oracle Parallel Server (OPS) and Informix Extended Parallel Server (XPS) to achieve high performance and high availability. OPS and XPS are offered and supported separately by 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 with an expansive set of lock modes that applications use to implement complex resource-sharing policies. 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 efficiently coordinate the application's activities within the cluster.

Support for Memory Channel API

TruCluster Server provides a special application programming interface (API) library for high-performance data delivery over Memory Channel by giving access to Memory Channel data transfer and locking functions. This Memory Channel API library enables highly optimized applications that require high-performance data delivery over the Memory Channel interconnect.

High performance within the cluster is achieved by providing user applications with direct access to the capabilities of the Memory Channel interconnect. For example, a single store instruction on the sending host is sufficient for the data to become available for reading in the memory of another host.

The Memory Channel API library allows a programmer to create and control access to regions of the clusterwide address space by specifying UNIX style protections. Access to shared data can be synchronized using Memory Channel spinlocks for clusterwide locking. Clusterwide signaling allows applications to send UNIX signals to processes operating on other members.

The Memory Channel API library facilitates highly optimized implementations of Parallel Virtual Machine (PVM), Message Passing Interface (MPI), and High Performance Fortran (HPF), providing seamless scalability from SMP systems to clusters of SMP machines. This provides the programmer with comprehensive access to the current and emerging de facto standard software development tools for parallel applications while supporting portability of existing applications without source code changes.

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 whether members in a cluster are active and maintains a cluster membership list that is consistent on all cluster members.

Support for Fibre Channel Solutions

TruCluster Server supports the use of switched Fibre Channel storage and Fibre Channel Arbitrated Loop.

Fibre Channel provides the following benefits over parallel SCSI storage:

- Greater performance
- Greater scalability
- More reliability, serviceability, and availability

Fibre Channel can be used for clusterwide shared storage, cluster file systems, swap partitions, and boot disks. Compared to parallel SCSI storage, Fibre Channel is easier to configure and its long distance permits greater flexibility in configurations.

Compared with a switched Fibre Channel topology, Arbitrated Loop offers a lower cost solution by trading off bandwidth, and therefore some performance. It is supported for two-member configurations only.

For more information on supported TruCluster Server configurations and specific cabling restrictions using Fibre Channel, see the *Hardware Configuration Technical Update for Fibre Channel for TruCluster Server Version 5.1* at the following URL:
http://tru64unix.compaq.com/faqs/publications/pub_page/tcr_update.html

Enhanced Security with Distributed Authentication

TruCluster Server supports the ability to enable the Enhanced Security option on all cluster members. 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 cluster members.

SOFTWARE REQUIREMENTS

TruCluster Server Version 5.1 requires the Tru64 UNIX Version 5.1 operating system.

The Tru64 UNIX operating system is a separately licensed product. See SPD 70.70 for more information on the Tru64 UNIX operating system.

Additional Required Subsets

TruCluster Server Version 5.1 requires that additional software subsets be installed. See the TruCluster Server *Software Installation* manual for more information.

OPTIONAL SOFTWARE

Compaq Advanced Server for UNIX

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 highly available and highly scalable file shares, print shares, and even Primary Domain Controller resources to Windows clients. For more information on ASU, visit the Compaq Advanced Server for UNIX Web site at:
http://www.tru64unix.compaq.com/products/adv_server

Legato NetWorker

See the *NetWorker Read This First* letter for information on evaluating or purchasing a version of NetWorker that supports TruCluster Server Version 5.1.

Compaq SANworks™ Data Replication Manager

Compaq SANworks Data Replication Manager is controller-based data replication software for disaster tolerance and data movement solutions. It works with the new StorageWorks™ Fibre Channel

MA8000/EMA12000 Storage Solutions. The RAID Array 8000 (RA8000) and Enterprise Storage Array 12000 (ESA12000) are also supported.

Advanced File System Utilities

Advanced File System (AdvFS) is a log-based file system that provides flexibility, compatibility, high availability, and high performance for files and filesets, up to 16 TB. Administrators can add, remove, reconfigure, tune, and defragment files — and back up storage — without unmounting the file system or halting the operating system. By supporting multivolume file systems, AdvFS enables file-level striping to improve file transfer rates, and integrates with the functionality provided by the Logical Storage Manager (LSM).

A graphical user interface simplifies management tasks and utilities to dynamically resize file systems, load balance, undelete files, and clone files for hot backup.

The AdvFS Utilities is a separately licensed software product for Tru64 UNIX. See SPD 44.52 for more information.

Logical Storage Manager

The Tru64 UNIX Logical Storage Manager (LSM) is an integrated, host-based solution to data storage management. Concatenation, striping, mirroring, hot-sparing, and a graphical user interface allow 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. For more information, see SPD 51.24.

StorageWorks Software

The StorageWorks Software package includes the licenses for Tru64 UNIX Logical Storage Manager and the Advanced File System Utilities. The part number for the StorageWorks software package is QB-5RXA*-AA.

Web-Based Enterprise Service

Web-Based Enterprise Service (WEBES) is an extension of the Compaq industry-leading Web-Based Enterprise Management (WBEM) technology, and provides a core of common service tool functionality across the Compaq product platforms. The WEBES tools integrate a high availability system fault management architecture, Distributed Enterprise Service Tools Architecture (DESTA), with the Compaq architecture for distributed, Web-based system management.

Compaq Web-based Enterprise Service Suite Version 2.1 is shipped on the Tru64 UNIX Associated Products Volume 2 CD-ROM and includes the following services:

- Compaq Analyze (symptom-directed hardware diagnosis tool)
- Compaq Crash Analysis Tool (symptom-directed operating system software diagnosis tool)
- Revision and Configuration Management tool (also known as Unicensus) (collects system configuration and revision data)

DECevent

DECevent is a rules-based hardware fault management diagnostic utility that provides error event analysis, reporting, and Bit-To-Text (BTT) translation capabilities of the binary system event log. See the DECevent release notes for a list of the products that are supported.

SOFTWARE CONFIGURATION REQUIREMENTS

TruCluster Server Version 5.1 requires the following memory and disk space:

- At least 128 MB of memory is required on each member system.
- Additional disks are required for clusterwide root (/), `/usr`, and `/var` file systems, and member boot disks. Another disk is needed if the optional quorum disk is configured. See the TruCluster Server *Software Installation* manual for more information.
- 52 MB of permanent free disk space is required to load TruCluster Server software onto a Tru64 UNIX system disk.

These requirements refer to the disk space required on the system disk. The sizes are approximate; actual sizes may vary depending on the system environment, configuration, and software options.

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.

A rolling upgrade to the next version of the cluster software requires the following:

- At least 50 percent free space in root (/), `cluster_root#root`
- At least 50 percent free space in `/usr`, `cluster_usr#usr`
- At least 50 percent free space in `/var`, `cluster_var#var`, plus an additional 425 MB to hold the subsets for the new version of the Tru64 UNIX operating system
- At least 50 percent free space in /usr/i18n, `cluster_i18n#i18n` when used

ORDERING INFORMATION

TruCluster Server is for Tru64 UNIX Version 5.1 environments that require high availability for applications.
Software Documentation: QA-6BRAA-GZ

Systems	Software License	Migration License*
AlphaServer™ 800, 1000A, 1200, DS10, DS20, DS20E	QL-6BRAC-AA	QL-6J1AC-AA
AlphaServer ES40	QL-6BRAE-AA	QL-6J1AE-AA
AlphaServer 2000, 2100, 2100A, 4000, 4100, GS60E, GS80	QL-6BRAG-AA	QL-6J1AG-AA
AlphaServer 8200, 8400, GS60, GS140, GS160, GS320	QL-6BRAQ-AA	QL-6J1AQ-AA

* Customers may convert existing licenses for either TruCluster Available Server Software or TruCluster Production Server Software to TruCluster Server licenses by purchasing TruCluster Server Migration licenses.

SOFTWARE LICENSING

TruCluster Server is licensed as a standard Compaq software layered product and is provided only under a license. Each system in the TruCluster Server environment requires separate Tru64 UNIX and TruCluster Server licenses. For more information about the Compaq 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 Server product are allocated on an unlimited-system-use basis.

For more information on the License Management Facility, see the Tru64 UNIX Operating System Software Product Description (SPD 70.70) or the Tru64 UNIX operating system documentation.

DISTRIBUTION MEDIA

TruCluster Server Version 5.1 is a separately licensed product and is distributed on the Tru64 UNIX Version 5.1 Associated Products Volume 2 CD-ROM.

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 5.1 supports the KZPSA-BB, KZPBA-CB, KGPSA-BC, and KGPSA-CA as shared storage bus adapters. Subject to the current maximum number of adapters and any other restrictions for a given system, TruCluster Server supports a maximum of 32 shared buses in any combination.

See the TruCluster Server *Hardware Configuration* manual for information on configuring clusters. For platform-specific limits and constraints, see the appropriate *Supported Options List* at: http://www.compaq.com/alphaserver/products/options.html

For firmware requirements, select "AlphaServer" from the software & drivers download center at: http://www.compaq.com/support/files/index.shtml

TruCluster Server supports the following systems with up to eight members in a cluster:

Supported Systems

System	Shared Storage IO Adapter	Memory Channel
AlphaServer 800	KZPSA, KZPBA, KGPSA	MC 1, 1.5 & 2
AlphaServer 1000A	KZPSA	MC 1.5
AlphaServer 1200	KZPSA, KZPBA, KGPSA	MC 1, 1.5 & 2
AlphaServer 2000	KZPSA	MC 1, 1.5
AlphaServer 2100	KZPSA	MC 1, 1.5
AlphaServer 2100A	KZPSA	MC 1, 1.5

System	Shared Storage IO Adapter	Memory Channel
AlphaServer 4000, 4100	KZPSA, KZPBA, KGPSA	MC 1, 1.5 & 2
AlphaServer 8200	KZPSA, KZPBA, KGPSA	MC 1, 1.5 & 2
AlphaServer 8400	KZPSA, KZPBA, KGPSA	MC 1, 1.5 & 2
AlphaServer DS10	KZPBA, KGPSA	MC 2
AlphaServer DS20, DS20E	KZPBA, KGPSA	MC 2
AlphaServer ES40	KZPBA, KGPSA	MC 2
AlphaServer GS60, GS60E	KZPSA, KZPBA, KGPSA	MC 1, 1.5 & 2
AlphaServer GS80	KZPBA, KGPSA-CA	MC 2
AlphaServer GS140	KZPSA, KZPBA, KGPSA	MC 1, 1.5 & 2
AlphaServer GS160	KZPBA, KGPSA-CA	MC 2
AlphaServer GS320	KZPBA, KGPSA-CA	MC 2

NOTES:
Systems shown supporting the KGPSA support the KGPSA-BC and KGPSA-CA. Systems shown in the table with KGPSA-CA support KGPSA-CA only.

Hard partitions of GS80, GS160 and GS320 can be clustered together either across separate systems or within systems, but each hard partition must have a Memory Channel connection.

Supported Memory Channel Hardware

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

MC 1 & 1.5	MC 2	Description
CCMAA-AA or CCMAA-BA	CCMAB-AA	PCI Adapter
CCMHA-AA	CCMHB-AA	Hub
CCMLA-AA	CCMLB-AA	Linecard
N/A	BN39B-04	4 m copper cable
BC12N-10		10 foot copper cable
	BN39B-10	10 m copper cable
	BN39B-01 (1 meter)	Connects MC adapter to CCMFB optical converter
	CCMFB-AA	Fiber-optics converter
	BN34R-10 (10 meter)	Fiber-optics cable: Connect one optical converter to another
	BN34R-31 (31 meter)	Fiber-optics cable: Connect one optical converter to another

NOTES:
At least one Memory Channel adapter must be installed in a PCI slot in each member system. A link cable(s) is 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.

Memory Channel 1/1.5 and Memory Channel 2 cannot be mixed on the same rail.

There are special rules about circumstances where Memory Channel 1 and Memory Channel 2 can be used together in the same cluster. See the TruCluster Server *Hardware Configuration* manual for information on supported Memory Channel configurations.

SUPPORTED FIBRE CHANNEL HARDWARE

TruCluster Server supports the following Fibre Channel (FC) hardware. For more information on supported TruCluster Server configurations using Fibre Channel, see the *Hardware Configuration Technical Update for Fibre Channel for TruCluster Server Version 5.1* at the following URL: http://tru64unix.compaq.com/faqs/publications/pub_page/tcr_update.html

Device	Description
KGPSA-BC	PCI-to-FC host adapter
KGPSA-CA	PCI-to-FC host adapter
DS-DSGGA-AA/AB	8/16 port FC switch
DS-DSGGB-AA/AB	8/16 port FC switch
DS-DSGGC-AA	8 port FC switch
DS-SWXHB-07	7 port FC hub

NOTE:
The use of the 7-port Fibre Channel hub is restricted to use with DS10, DS20, DS20E and ES40 systems and these clusters are restricted to a maximum of two members.

Fibre Channel Arbitrated Loop Support

TruCluster Server supports Fibre Channel arbitrated loop for clusters with a maximum of two members only.

Supported Fibre Channel Array Controllers

TruCluster Server supports the following Fibre Channel array (RAID) controllers.

Device	Description
HSG60	Array Controller
HSG80	Array Controller
MA6000	RAID Array
Device	**Description**
RA8000/MA8000	RAID Array
ESA12000/EMA12000	RAID Array

SUPPORTED SCSI HARDWARE

TruCluster Server supports the following SCSI storage hardware. For more information on the supported SCSI solutions, see the TruCluster Server *Hardware Configuration* manual.

Supported SCSI Signal Converters

TruCluster Server supports the following SCSI signal converters. See the TruCluster Server *Hardware Configuration* manual for information on supported SCSI signal converters and configuration.

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

The following SCSI cables are supported:

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, D, or E	VHDCI to HD68 cable
BN37A	Ultra VHDCI Cable
BN37B	VHDCI to HD68 cable
BN21M	50-pin LD to HD68 cable

Supported SCSI Terminators and Connectors

TruCluster Server supports the following SCSI terminators and connectors:

Device	Description
H879-AA	HD68 terminator
H885-AA	HD68 trilink connector
H8861-AA	VHDCI trilink connector
H8863-AA	VHDCI terminator
H8574-A	50-pin LD terminator
H8860-AA	50-pin LD terminator

Supported SCSI Storage Boxes

TruCluster Server supports the following storage boxes for direct attachment on a shared SCSI bus:

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

Supported Parallel SCSI Array Controllers

TruCluster Server supports the following parallel SCSI RAID controllers on shared storage buses:

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

Supported Disk Devices for Shared Storage

Every SCSI storage disk currently sold by Compaq that appears in the supported options list for a supported AlphaServer is supported for use in a cluster on a shared bus.

Some legacy disk devices are not supported for use on a shared bus. TruCluster Server supports the following disk devices on shared storage. Any SCSI or Fibre Channel storage disk manufactured by Compaq later than the ones in the following list, and appearing in the supported options list for a supported AlphaServer, is supported.

- 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

Supported Tape Devices and Media Changers

TruCluster Server supports the configuration of specific tape devices on a shared SCSI bus and on Fibre Channel. These devices will function properly in a multi-initiator environment. On a SCSI bus, they will be disrupted by 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 MiniLibrary
- TZ887 DLT MiniLibrary
- TZ89
- TL881
- TL890 MiniLibrary Expansion Unit
- TL891 MiniLibrary
- TL892 MiniLibrary
- TL893 Automated Tape Library
- TL894 Automated Tape Library
- TL895 Automated Tape Library
- TL896 Automated Tape Library
- Compaq 20/40 GB DLT Tape Drive
- Compaq 40/80 GB DLT Tape Drive
- ESL9326D Enterprise Library
- 340654-001 Fibre Channel Tape Controller
- 152975-001 Fibre Channel Tape Controller II

NOTES:
The TL881, TL890, TL891, TL892, TL893, TL894, TL895, TL896, Compaq 20/40 GB DLT Tape Drive, Compaq 40/80 GB DLT Tape Drive, and ESL9326D Enterprise Library are supported with both the KZPSA and KZPBA-CB adapters. All other SCSI attached tape device and media changer support is provided with KZPSA adapters only.

The TL891 Mini Library, TL895 Automated Tape Library, and the ESL9326D Enterprise Library are also supported on a Fibre Channel storage bus with the KGPSA-BC and KGPSA-CA adapters.

Network Adapters

TruCluster Server supports any Ethernet, FDDI, ATM (LAN emulation mode only), or Gigabit Ethernet adapters that are supported by the version of Tru64 UNIX on which it is running.

HARDWARE RESTRICTIONS

The following are hardware restrictions for TruCluster Server. See the TruCluster Server *Hardware Configuration* manual for additional information on hardware restrictions.

Prestoserve NVRAM failover is not supported on shared disk devices.

TruCluster Server Version 5.1 supports up to eight-member cluster configurations as follows:

- Switched Fibre Channel: Eight-member systems may be connected to common storage over Fibre Channel in a fabric (switch) configuration.
- Parallel SCSI: Only four of the member systems may be connected to any one SCSI bus. Multiple SCSI buses may be connected to different sets of members and the sets of members may overlap. Use of a DS-DWZZH-05 UltraSCSI hub with fair arbitration enabled is recommended when connecting four member systems to a common SCSI bus.

HARDWARE CONFIGURATION EXAMPLES

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

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