

HP StorageWorks

Cluster Extension EVA user guide

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Cluster Extension EVA user guide

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About this guide

This guide provides information about:

- Installing HP StorageWorks Cluster Extension (CLX) EVA
- Configuring HP CLX EVA
- Integrating HP CLX EVA with Microsoft Cluster Service
- Troubleshooting HP CLX EVA

Intended audience

This guide is intended for system administrators responsible for maintaining the cluster environment and the management of storage subsystems and who already possess the following skills and knowledge:

- Data processing
- Direct-access storage device subsystems and their basic functions
- Storage systems
- Cluster software, its configuration, and its concepts
- Expertise with the operating system, including commands and utilities
- Experience with related software programs

Related documentation

In addition to this guide, please refer to other documents for this product:


- *HP StorageWorks Continuous Access EVA design reference guide*
- *HP StorageWorks Enterprise Virtual Array updating product software*
- *HP StorageWorks Command View EVA installation and configuration guide for Windows Server 2003*
- *HP StorageWorks Command View EVA user guide*
- *HP StorageWorks Continuous Access EVA UI operation guide*
- *HP StorageWorks SAN design guide*
- *HP StorageWorks Storage System Scripting Utility reference guide*

These and other HP documents can be found on the HP documents web site: <http://www.hp.com/support/>.


Document conventions and symbols


Table 1 Document conventions

Convention	Element
Medium blue text: Figure 1	Cross-reference links and e-mail addresses
Medium blue, underlined text (http://www.hp.com)	Web site addresses
Bold font	<ul style="list-style-type: none">• Key names• Text typed into a GUI element, such as into a box• GUI elements that are clicked or selected, such as menu and list items, buttons, and check boxes
<i>Italics font</i>	Text emphasis
Monospace font	<ul style="list-style-type: none">• File and directory names• System output• Code• Text typed at the command-line
<i>Monospace, italic font</i>	<ul style="list-style-type: none">• Code variables• Command-line variables
Monospace, bold font	Emphasis of file and directory names, system output, code, and text typed at the command line

 **WARNING!** Indicates that failure to follow directions could result in bodily harm or death.

 **CAUTION:** Indicates that failure to follow directions could result in damage to equipment or data.

 **IMPORTANT:** Provides clarifying information or specific instructions.

 **NOTE:** Provides additional information.

 **TIP:** Provides helpful hints and shortcuts.

HP technical support

Telephone numbers for worldwide technical support are listed on the HP support web site:
<http://www.hp.com/support/>.

Collect the following information before calling:

- Technical support registration number (if applicable)
- Product serial numbers
- Product model names and numbers
- Applicable error messages

- Operating system type and revision level
- Detailed, specific questions

For continuous quality improvement, calls may be recorded or monitored.

HP strongly recommends that customers sign up online using the Subscriber's choice web site:

<http://www.hp.com/go/e-updates>.

- Subscribing to this service provides you with e-mail updates on the latest product enhancements, newest versions of drivers, and firmware documentation updates as well as instant access to numerous other product resources.
- After signing up, you can quickly locate your products by selecting **Business support** and then **Storage** under Product Category.

HP-authorized reseller

For the name of your nearest HP-authorized reseller:

- In the United States, call 1-800-282-6672.
- Elsewhere, visit the HP web site: <http://www.hp.com>. Then click **Contact HP** to find locations and telephone numbers.

Helpful web sites

For other product information, see the following HP web sites:

- <http://www.hp.com>
- <http://www.hp.com/go/storage>
- <http://www.hp.com/support/>
- <http://www.docs.hp.com>

1 HP Cluster Extension EVA features

The quest to extend high availability over geographically dispersed locations has driven today's information technology personnel to demand cluster solutions capable of recovering from even the most extensive disasters.

HP Cluster Extension (CLX) EVA monitors HP Continuous Access EVA-mirrored disk pairs and allows access to the remote data copy if the application becomes unavailable on the local site. If the application service is restarted on the remote site after the local (primary) application service shutdown, HP CLX EVA uses its internal database to check whether the current disk states allow automatic access to your data based on consistency and concurrency considerations. Integrated in the cluster software or available as command-line interface for your own integration, HP CLX EVA ensures that the data can be accessed if necessary.

HP CLX EVA software provides these key features:

- Integration into cluster software
- Disaster tolerance through geographic dispersion
- Automated redirection of HP Continuous Access EVA data replication groups
- Command-line interface for easy integration

Integration into cluster software

HP CLX EVA provides tight integration into cluster software where possible and is a resource to the clustered application service (disk or IP address) and must be managed as such. The architecture of HP CLX EVA could be integrated into many cluster software products. It currently supports Microsoft Cluster service.

NOTE: For a list of supported cluster software, please refer to the HP CLX EVA installation `readme` file.

Disaster tolerance through geographic dispersion

Using two or more storage systems with HP Continuous Access EVA, you can copy data to a remote data center. HP CLX EVA provides the cluster software with a mechanism to check and allow data access to transfer the local application service to a remote cluster service. The distance to your remote location is limited only by the technology your cluster software uses to communicate with each system in the cluster, the technology you use for physical data replication, and the degree of failover automation.

Disaster tolerance considerations

The capability of restoring the application service quickly after a failure of the server, storage, or the entire data center is essential *disaster tolerance*.

To protect against such disasters, a single data center is not sufficient. Systems (storage as well as servers) must be geographically distributed in order to build a disaster-tolerant architecture that protects against planned and unplanned downtime.

Of course, redundant network cards and host bus adapters are a basic requirement. The same applies for the power supplies of both the storage and the server. With this hardware in place, the external power service and the network must also be designed to allow no single point of failure (SPOF).

Today, data is the most valuable asset in your enterprise. The HP EVA family of storage systems provides a fully-redundant architecture; and the flexibility to upgrade firmware online reduces the risk of unplanned and planned downtime. The storage system also provides the feature of remotely mirroring your data to a second storage system.

The cost of maintaining this expensive hardware in place must be compared to the risk of a true disaster. The cost pays off in a real disaster because the business-critical applications are still accessible from another location.

Guidelines

The following considerations, applied to the cluster environment, can ensure that an application service survives a disaster with minimal downtime.

- Geographic dispersion of hardware and applications
- Redundant paths to access the network and storage
- Redundant storage management agents
- Alternative power sources
- Redundant networks
- Data replication

Several methods of implementing such disaster-tolerant architectures are possible. All of these methods are covered by a clustered solution using the HP EVA family of storage systems and HP Continuous Access EVA.

Disaster-tolerant architectures overview

With HP CLX EVA, you can extend your cluster solution beyond the limitations of existing data center and campus-wide distances. HP CLX EVA enables metropolitan-wide (and beyond) failover capabilities.

Having a local storage system in each data center also means that the server does not have to write twice. HP Continuous Access EVA mirrors each write-I/O to the remote site. This relieves the server of the burden, thereby preventing performance bottlenecks.

Disaster-tolerant architectures using data replication over the network

Data replication over the network is a way to achieve disaster tolerance and is considered *logical replication*. [Figure 1](#) shows an example of logical replication.

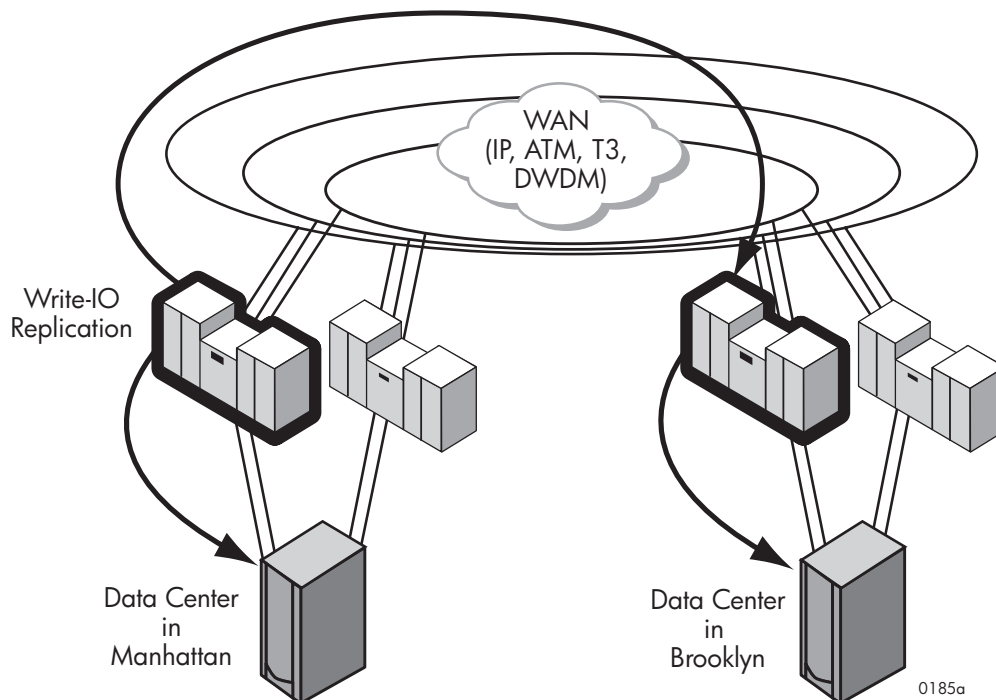


Figure 1 Logical replication over networks

Logical replication uses specific host-based software to write data to local disks and replicate that data to a remote system connected to an attached storage device. Because data is replicated over the network, there is no distance limitation for such solutions.

Logical replication techniques imply that the failover process is primarily manual. This means each site belongs to a different cluster, or only the primary site is clustered, while the secondary site acts as a

standby system. It is possible that no cluster software is involved and that only one system is available at each site.

Data replicated over the network can be at the granularity of a single disk, a file system, or a transaction. In this category, HP offers products like HP Continentalcluster in conjunction with database replication on HP-UX and HP OpenView Storage Mirroring for Windows.

All logical replication techniques have some significant disadvantages. The remote system is a standby system. As such, it must perform the same task as the primary system and cannot be used for any other purpose. If the standby system is activated, it must replay redo logs first and cannot automatically serve as a replication source.

Another significant disadvantage of such architectures is that the server must write every I/O twice, once to the attached storage device and once to the remote system over the network. These replication techniques can be implemented only asynchronously; otherwise, the application experiences noticeable performance degradation.

Because of the nature of replication products, additional CPU power is necessary to mirror write requests. Most logical replication products are available or work best only on some operating systems, which means that many different products must be deployed in a heterogeneous environment.

Logical replication implies that all logs that have not been shipped (or are in transit) are lost in case of a disaster.

Disaster-tolerant architectures using Fibre Channel networks

Disaster-tolerant architectures using Fibre Channel (FC) networks can be achieved by *physical replication*. Figure 2 shows an example of physical replication using FC.

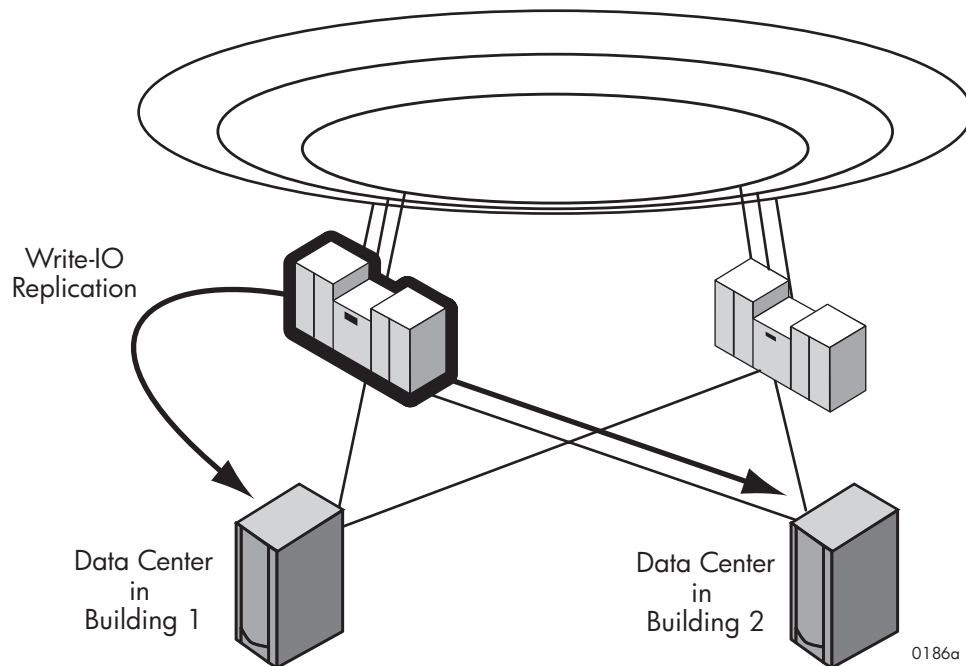


Figure 2 Physical replication using FC

As with logical replication, physical replication often uses host-based software to replicate data. Here, data is written to server-attached storage devices twice.

Using FC, you could use dual-attached storage devices, where one port is connected to the local server and one is connected to the remote server. To access your data at the remote location in case of a disaster, each server must have a local and a remote storage device. The volume management software must be set up to mirror each write request to both the local and the remote storage device. With HP EVA storage systems, several servers can be connected to each storage system using FC switches. Data replicated via volume mirroring is based on the granularity of a single volume.

This solution is called *campus cluster*. You can use a single cluster and an automated failover process. With campus clusters, servers in both sites can be active. In this category, HP offers HP Serviceguard in conjunction with LVM mirroring for HP-UX for several disk systems.

Campus cluster solutions are limited to the distance FC supports today. Because storage systems must be in a range of 300-500 meters (direct connect) or up to 10 kilometers (connected via FC switches or FC hubs), campus cluster solutions can only offer limited protection against natural disasters.

Another limiting factor is the cluster heartbeat protocol or the communications protocol used for cluster reformation processes. These protocols are vendor-specific implementations and require private networks. This means that these protocols are not routable. The distance limitations of a private network depend on the supplied network infrastructure and latency specification of the heartbeat or cluster reformation protocol.

Another significant disadvantage of such architectures is that the server must write every I/O twice—once to the locally-attached storage device and once to the remote-attached storage device. These replication techniques are implemented as software running on the server, which reduces the available compute power and degrades server performance.

Because of the nature of volume mirroring products, additional CPU power is necessary to mirror write requests across two disks.

Most of these products have another significant disadvantage. In case of a path failure, the whole volume must be copied to resynchronize the second volume with the current state of the first volume. If you need to replace the storage device, all volumes must be copied. This significantly affects server performance.

Disaster-tolerant architectures using storage-system-based mirroring

Using HP Continuous Access EVA-based mirroring is also considered *physical replication*. As with campus clusters, such solutions require two or more storage systems.

In storage-system-based mirroring, the storage system keeps track of the data integrity of the mirrored disks. HP EVA storage systems offer VRaid1 or VRaid5 protection as a standard feature and allow online addition and replacement of disks and the array controller. Internal and external mirroring features are available to provide copies of data.

The FC protocol is used to transfer data between two storage systems. Using converters or gateways, FC can be routed over IP networks and T3 to allow very long distance separation between the storage systems. To replicate data over more than 10 km, you must purchase special extenders or switches.

The cluster solutions using HP Continuous Access EVA-based disk mirroring are called *metropolitan clusters* or *geographically dispersed clusters*. Servers are members of the same cluster dispersed over two or more sites. Because the storage system controls the replication process, the server is relieved from writing any I/O request to the disk more than once.

HP Continuous Access EVA-mirrored disks typically have a read/write-enabled source (primary) disk and a read-only destination (secondary) disk. This leads to problems because current cluster software products cannot distinguish between write-protected and write-enabled disks, and are not able to enable disk access if the disk is not writable during the server boot process.

Cluster software assumes that the application service has access to read/write-enabled data disks on any system on which the application service has been configured. Because the secondary volume of a disk pair is not normally accessible, the failover process typically involves manual intervention.

HP CLX EVA provides the software to enable automated failover and failback procedures integrated as a resource of the application service. HP CLX EVA uses an internal database to decide whether or not the data on the failover site is safe to be accessed. Manual intervention is required if the current storage system states and the user settings conflict with rules stored in the internal database.

As with campus clusters, the limiting factor of metropolitan or geographically dispersed clusters is the cluster heartbeat or the communications protocol used for the cluster reformation processes. These protocols are vendor-specific implementations and typically require private networks. This means these protocols are not routable. The distance limitations of networks supporting a private network are dependent on the supplied network infrastructure and latency issues of the heartbeat or cluster reformation protocol.

Cluster management software can help address these issues. This software offers disaster tolerance by managing two or more clusters from a single console or server. Such a configuration is considered a *continental cluster*. Depending on the implementation, *automated* or *semiautomated* failover processes between clusters are possible.

Metropolitan or geographically dispersed clusters, as well as continental clusters, require metropolitan or wide area networks. In most cases, those network connections involve common carriers and special network equipment, which can be very expensive. The reliability of a direct connection or a campus network can be degraded; more planning is needed to deploy and maintain a disaster-tolerant environment.

Using HP Continuous Access EVA, you can access data consistently in every failover case, and you can resynchronize a completely failed storage system while the application is running with almost no impact on server performance. This means you can re-establish disaster tolerance without application downtime. [Figure 3](#) shows an example of physical replication using HP Continuous Access EVA.

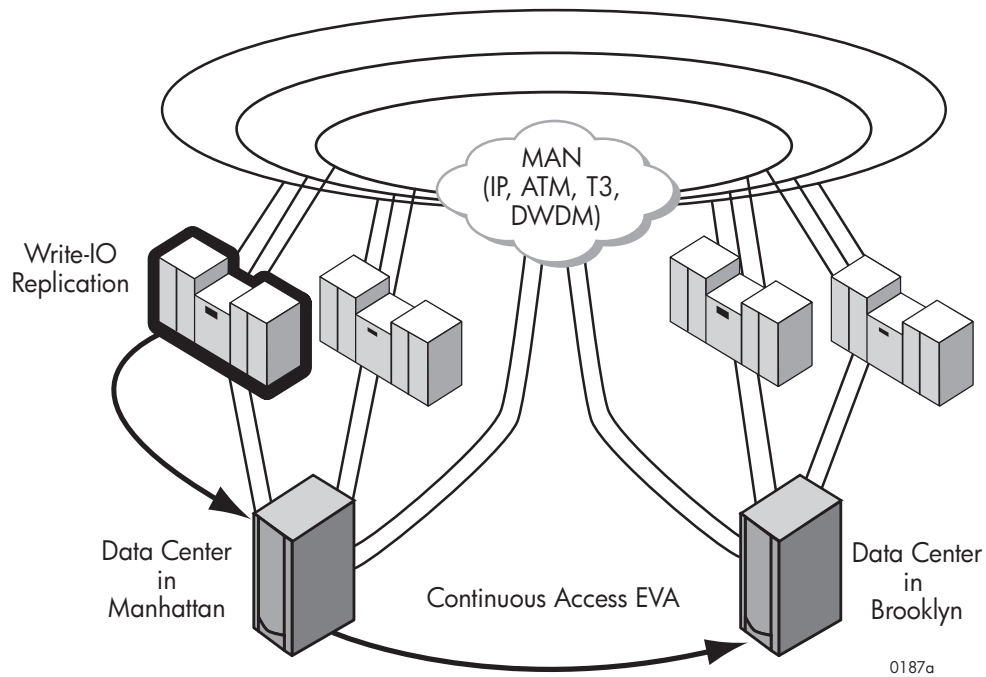


Figure 3 Physical replication using HP Continuous Access EVA

Automated redirection of mirrored HP Continuous Access EVA DR group members

Storage systems with HP Continuous Access EVA provide a unique feature that allows the automated redirection of the mirroring destination. This means HP Continuous Access EVA almost instantaneously swaps the source/destination relationship of data replication (DR) group members if the application must access the destination vdisk. This feature ensures that the disk pairs are always synchronized so that the failback process is as fast as the failover process.

NOTE: *Vdisks* are virtual disks used in an HP EVA storage system for the storage of application data. A **DR group** (data replication group) is a construct comprising one or more vdisks in an HP EVA storage system. The DR group is the unit in which HP CLX EVA failover/failback operations are performed. For detailed information, see [“Continuous Access EVA DR groups” on page 33](#) and [“Create DR groups” on page 57](#).

If the links between your storage systems are broken, the source HP EVA starts logging all write I/O of a DR group member to a write history log to replay the changes later once the links become available. In a

failover case, HP CLX EVA takes the appropriate action for each link/array status and makes sure your application service has the latest data.

Command-line interface for easy integration

HP CLX EVA provides a command-line interface to enable disaster-tolerant environments even if no cluster software is available for your operating system or if you would like to integrate HP Continuous Access EVA with your choice of cluster software.

This feature is convenient if you use custom software to migrate application services from one system to another or if you want HP CLX EVA to check the DR group member states to ensure you can automatically start your application service on the local storage system.

Graphical user interface

HP CLX EVA for Windows can be configured with the MS Cluster Administrator graphical user interface (GUI). The cluster software provides a GUI to set and change resource values. HP CLX EVA offers full integration into the GUI so that you can utilize the capacity of your cluster software.

Several options are available to configure the HP CLX EVA during and after installation. For more information, see [Chapter 3](#).

Majority node set quorum support

Microsoft Cluster service depends on a quorum resource to maintain a persistent log of cluster configuration changes and status, as well as a single point to resolve any possible events that could result in a *split-brain* situation.

With the introduction of Windows Server 2003, Microsoft supports a new form of quorum resource called Majority Node Set (MNS). HP CLX EVA configurations use this quorum resource to support geographically dispersed clusters.

A quorum disk is not needed and not supported in HP CLX EVA environments.

HP CLX EVA has been certified to fulfill all requirements for geographically dispersed Microsoft clusters. For certified configurations, see the Microsoft website:

www.microsoft.com/windows/catalog/server/

To navigate to the list of certified configurations:

1. Click on the **Hardware** tab in the upper center of the web page.
2. Mouse over **Cluster Solutions** on the left side of the tab.
3. Select **Geographically Dispersed Cluster Solution**.
4. Enter Hewlett-Packard Company in the **Search within Category field**.
5. Press **Enter**.

HP CLX EVA storage system configurations

This section provides an overview of HP CLX EVA storage system configurations. Please see [Chapter 2](#) for more details.

Cluster configurations typically consist of two or more server systems connected to a shared storage subsystem.

HP CLX EVA allows dispersion of data center resources by enabling cluster systems to take advantage of HP EVA storage systems configured for HP Continuous Access EVA mode of operations. HP CLX EVA connects the HP EVA management software to control HP EVA storage systems (and HP Continuous Access EVA) with the cluster software and uses the ability of cluster software to react to system hardware and application failures.

HP CLX EVA behavior is based on four major considerations:

- Cluster software failover behaviors
- HP CLX EVA user settings
- The replication mode setting (for HP Continuous Access EVA)

- DR group member status information

Therefore, and because of consistency and concurrency considerations, HP CLX EVA supports the configurations described in this section. The replication mode of HP Continuous Access EVA is used to configure the remote replication feature of an HP EVA storage system environment based on your needs for application service availability, data concurrency, and replication performance.

One-to-one configuration

Cluster host nodes are split between two or more geographically dispersed data center sites and use redundant, diversely routed network connections for intra-cluster communications. Those links must be as reliable as possible to prevent false failover operations or split-brain situations.

Each cluster host node connected to an HP EVA storage system should have redundant I/O paths to the HP EVA storage system. Connections to both the source (primary) and the destination (secondary) copy of the application disk set are not allowed from the same host. You need to configure your servers only in the zone that allows access to the local HP EVA storage system.

HP recommends a minimum of two cluster host nodes per site. This allows for preferred local failover in case of system failure. Local failover operations are faster than remote failover between HP EVA storage systems because you do not need to change the mirroring direction of the DR group members.

You can deploy HP CLX EVA in environments where several clusters use the same HP EVA storage system pair.

You can use HP Continuous Access EVA in synchronous replication mode with HP Continuous Access EVA between two HP EVA storage systems connected using FC switches and extender hardware.

Currently, HP CLX EVA supports Continuous Access EVA in synchronous replication mode in the following configurations:

- Switched FC connection (dual fabric ISLs)
- FC to DWDM networks, via FC switches
- FC over IP networks, via FC switches as shown in the *HP StorageWorks Continuous Access EVA Design Reference Guide*

The HP Continuous Access EVA links must have redundant, separately routed links for each fabric. The cluster network must have redundant, separately routed links.

Cluster networks and HP Continuous Access EVA can share the same links if the link technology is protocol-independent (for example, WDM) or if the FC protocol is transformed into an IP. [Figure 4](#) shows an example of one-to-one configuration.

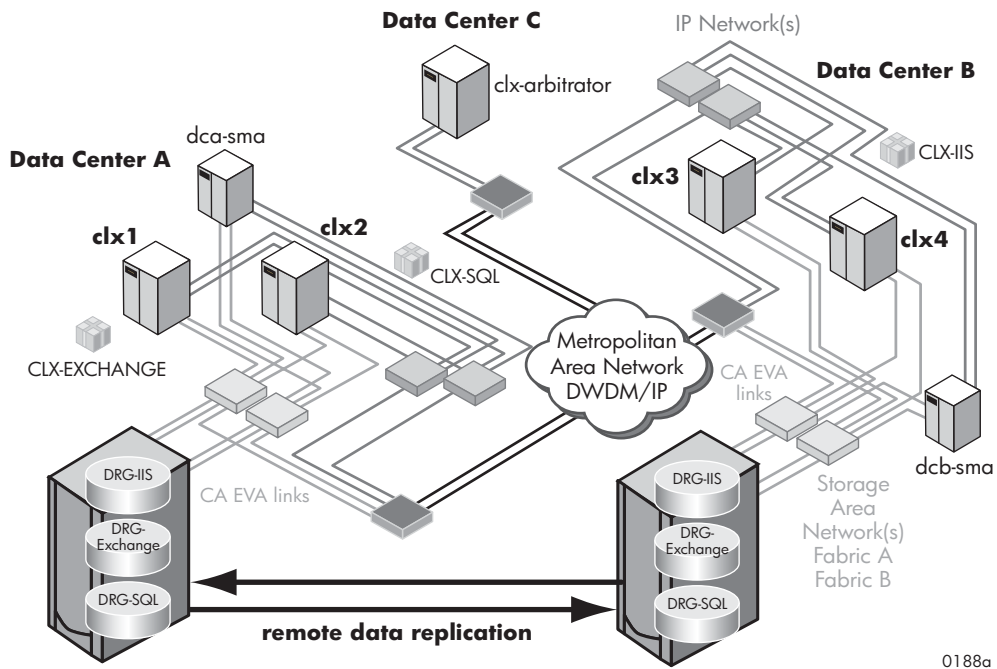


Figure 4 One-to-one configuration

Consolidated DR site configuration

HP CLX EVA supports configurations that have a single HP EVA storage system in the disaster recovery data center and up to two source HP EVA storage systems (the logical configuration must be a one-to-one configuration). The restrictions outlined earlier also apply to consolidated configurations.

HP CLX EVA does not support NxM configurations, where the application service's data disk set is spread over two or more HP EVA storage systems.

HP CLX EVA uses the unit of DR groups as the failover unit. This means all vdisks or members of a DR group will be failed over if the cluster software moves disk access from one cluster node to another.

HP CLX EVA does not directly support *managed sets*. Applications that consist of more than one DR group in one or more HP EVA storage systems can be managed by HP Continuous Access EVA as managed sets.

If necessary, you can configure managed sets by creating HP CLX EVA resources that include the DR groups included in the managed set and configuring them in the same application service group (cluster group). [Figure 5](#) illustrates consolidated DR site configuration.

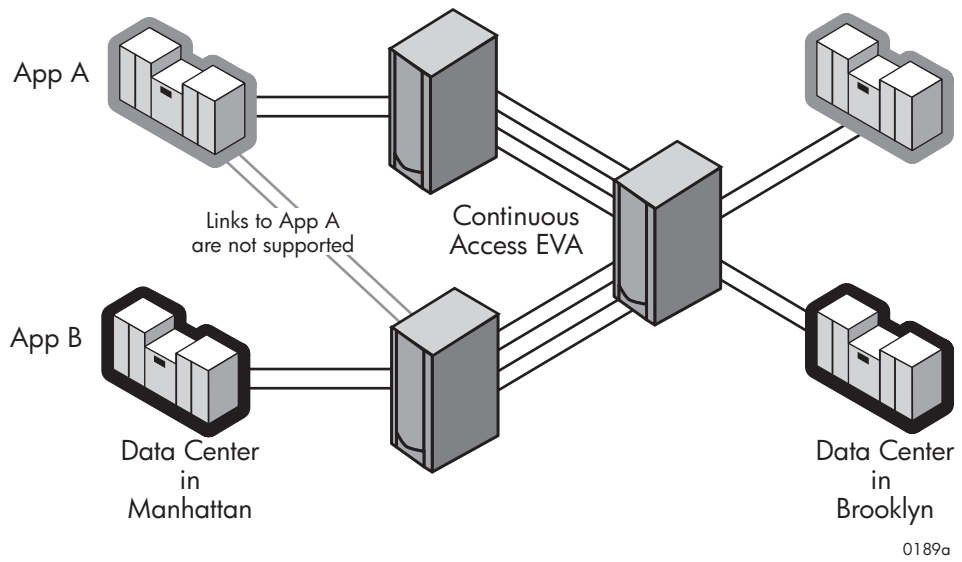


Figure 5 Consolidated DR site configuration

2 HP CLX EVA processes and components

HP CLX EVA is shipped as a resource Dynamic Link Library (DLL) for Microsoft Cluster service and a command-line program for custom integrations. Customized solutions for failover application services must implement HP CLX EVA through the command-line interface prior to the disk activation procedure.

HP CLX EVA environments

The ideal environment for a HP CLX EVA configuration consists of at least five servers (two at each data center site and one as an arbitrator at a third site) and separated redundant communications links for cluster heartbeats, client access and HP Continuous Access EVA. All communications interfaces must be installed in pairs, to serve as failover components, preventing single points of failure (SPOFs).

Alternative pathing software for host-to-storage connections such as HP StorageWorks Secure Path for Windows operating systems must be used.

Network communications links between the dispersed data centers must be redundant and physically routed differently. This prevents the *backhoe issue* where all links between data centers are cut together. This is especially important because the cluster is more vulnerable to *split-brain* syndromes. Split-brain syndrome is where both data centers' systems form new clusters, which could allow access to both copies of the data. This can be prevented with physically separated network links and redundant network components. HP CLX EVA allows you to configure the failover behavior so that the application service startup procedure is stopped if none of the remote cluster members can be reached. The default configuration of HP CLX EVA expects the cluster software to deal with the split-brain syndrome.

Because the storage system stores the most valuable data, this data must get across to the remote storage system. At least two HP Continuous Access EVA links (ISLs) must be available when the storage systems are connected. For extended distances, extender components must be purchased. These components are able to bundle HP Continuous Access EVA links. At least two links are necessary to provide redundancy and protection against single points of failure. Although communications links can cover considerable distances, each network segment must be extended to the dispersed data center in order to maintain a heartbeat among all servers.

Recommendation

Use two systems at each site to give local application service failover among local cluster systems priority over remote, more time-consuming failover procedures. When failing over, HP CLX EVA must reconfigure the storage systems to change the mirroring direction. This takes more time than just checking for the correct DR group member states. At the remote site, two systems should be available in case the failover system experiences a hardware or power failure.

The use of an MNS quorum requires an odd number of cluster nodes, with at least one system in a third location. [Figure 4 on page 24](#) depicts a preferred HP CLX EVA configuration.

CAUTION: HP CLX EVA works with only one system at each location, with a single I/O path between the server and the storage system and a single link between storage systems. However, those configurations are not considered highly available, nor are they disaster tolerant. Therefore, HP CLX EVA configurations with single points of failure are not supported by HP.

HP CLX EVA execution

HP CLX EVA requires cluster software to automatically fail over and fail back among systems on a local site or between sites. HP CLX EVA must manipulate the application startup process before storage system vdisks are accessed. HP CLX EVA, therefore, must be integrated as the first resource (in the order of resources).

To write to HP Continuous Access EVA paired vdisks, you must make sure the paired vdisks are in read/write mode. DR group members (paired vdisks) are usually in read/write mode on the source (primary) vdisk only; the destination (secondary) vdisk is in read-only mode.

- In case of a failover, HP CLX EVA automatically changes the direction of the mirrored pair. A reboot of the server is not necessary.
- In case of a disaster, the storage system can have several different states for DR group members. HP CLX EVA decides whether those vdisks can be accessed and made available to the application service.

HP CLX EVA must be installed on all servers in the cluster that can run the application service in the cluster.

HP CLX EVA stores information about the application environment in an internal object database and uses HP Storage Management Initiative Specification (SMI-S) EVA to gather information about the state of the associated DR group members. Information about the configured storage system environment and failover behavior is transferred either directly by the cluster software or by gathering it from the user configuration file.

An internal object database provides HP CLX EVA with the format and default value of supported parameters.

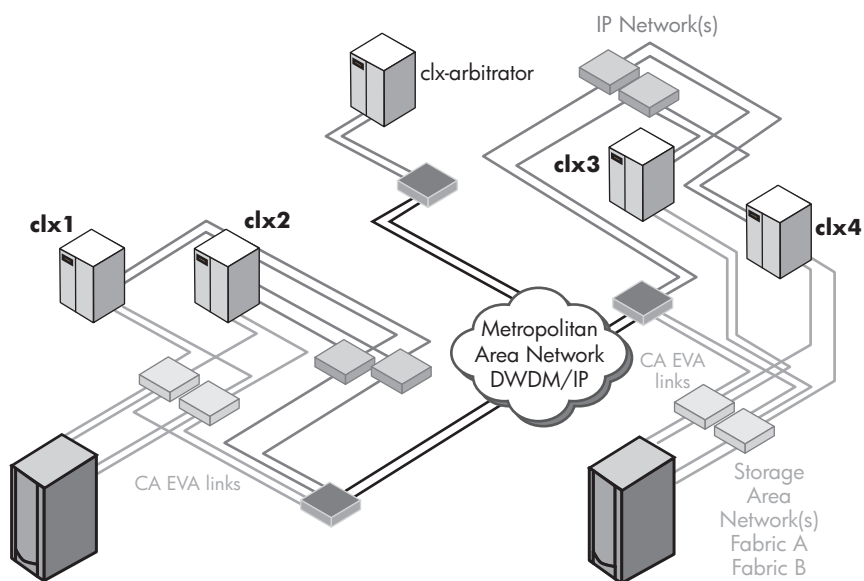
Vdisk states are stored in the internal object database, and a rule engine is used to process those DR group member states. The rule engine matches current DR group member states and configuration parameters with a defined rule, stores it in the database, and invokes predefined actions. Those actions prepare the DR group member vdisks to be enabled for access or stop the application service startup process if the matching rule requires a stop.

HP Continuous Access EVA and HP SMI-S

HP Continuous Access EVA provides remote copy functionality for the storage systems. Storage systems can be mirrored to two different remote storage systems.

HP CLX EVA does not support configurations where data disks are spread over two storage systems in either source (primary) or destination (secondary) storage systems. HP CLX EVA supports configurations where two (or more) storage systems use one remote storage system as the failover site. In those cases, the storage system configuration can be considered a logical one-to-one configuration.

Figure 6 depicts an example of a supported configuration.



0190a

Figure 6 Supported HP CLX EVA storage system configuration

Synchronous replication

Using synchronous mode, all write requests from the server are first transferred to the remote storage system. After each I/O has been mirrored in the cache area of the remote array, it is acknowledged to the local storage system. The write request is then acknowledged to the server.

You can configure synchronous replication by setting the failsafe mode:

- **Enable** - Prohibits write requests immediately if a link failure or disk failure occurs that prevents HP Continuous Access EVA from receiving write acknowledgement from the remote storage system. This means the local storage system cannot replicate data to the remote storage system. Setting the Failsafe mode to **Enable** provides data concurrency at any time. This mode does not write to the write history log.
- **Disable** - Allows write requests even if the request cannot be replicated to the remote storage system. If a write request cannot be replicated to the remote storage system, the write is stored in the write history log. Write I/Os in the write history log are transferred automatically once the failure has been recovered. This is the default.

In order to disable automatic merging (resynchronization) when the failure has been recovered, you must suspend the DR group manually. The suspend status of the DR group does not persist through a failover. This means that when the DR group is failed over to the remote storage system, the replication operation is automatically resumed if possible.

Asynchronous replication

HP Continuous Access EVA also allows data to be replicated asynchronously. The write request is acknowledged to the server after it has been mirrored in the local controller cache. This provides the fastest response time for remote mirroring. Each write request is transferred to the remote storage system asynchronously. The remote array applies all received write requests in the order they were sent, keeping data consistent.

NOTE: Asynchronous replication is currently not supported with HP CLX EVA.

HP Continuous Access EVA DR groups

A DR group is a construct that comprises one to eight Vdisks in an HP EVA storage system so that they:

- Replicate data to the same specified destination storage array
- Fail over together
- Preserve write order within the data replication groups
- Share a log disk

All virtual disks used for replication must belong to a DR group, and a DR group must contain at least one vdisk. A DR group can be thought of as a collection of copy sets or vdisk members.

The replicating direction of a DR group is always from a source to a destination. By default, the storage system on which the source vdisk is created is called the home storage system. The home designation denotes the preferred storage system for the source; this designation can be changed to another storage system.

A DR group contains pointers to another DR group for replication. A DR group replicating from a home storage system to a destination system is in the original state. When replication occurs from a storage system (for example, after a failover), it is in a reversed state.

You must configure a single DR group for a cluster group in Microsoft Cluster service. This DR group must include all Vdisks being used for the application service.

The DR group is the unit in which HP CLX EVA failover/failback operations are carried out.

Rolling disaster protection and snapshots/snapclones

To implement rolling disaster protection, you can create HP Business Copy EVA disk pairs for DR groups locally. The HP Business Copy EVA snapshots or snapclones must not be presented to the local cluster node. Microsoft Cluster service uses the disk's Signature to identify a cluster disk. The cluster software cannot differentiate between the original disk and the clone if both are presented to the same server.

SMI-S Server configuration

To control HP Continuous Access EVA-mirrored Vdisks from a server, HP CLX EVA uses the HP SMI-S interface. The HP SMI-S client implemented in the HP CLX EVA resource DLL, or in the command-line

interface, communicates with the HP SMI-S server running on the Storage Management appliance or with the Storage Management agent.

NOTE: The term **storage management agent** refers to the off-appliance, customer-provided Windows server installation of HP Command View EVA. The term **storage management appliance (SMA)** refers to the HP Command View EVA installation on the HP-supplied management appliance. In this document, both are referred to as SMA.

The HP SMI-S server implements the programmatic interface and functionality of HP Command View EVA and HP Continuous Access EVA user interfaces.

SMI-S uses the Common Information Model (CIM) and Web-based Enterprise Management (WBEM) specifications to define common models for storage hardware and storage functions. CIM is a computer industry standard for defining device and application characteristics so that system administrators and management programs can control devices and applications from different manufacturers or sources in the same way.

CIM takes advantage of Extensible Markup Language (XML). CIM was developed by an industry group, the Distributed (formerly Desktop) Management Task Force (DMTF), as part of WBEM. CIM is intended to be more comprehensive than earlier models now in use—Simple Network Management Protocol (SNMP) and Desktop Management Interface (DMI). With CIM, relationship information (what's connected to what) can be used to help trace the source and status of problems.

For HP CLX EVA, an HP SMI-S server is necessary to control HP Continuous Access EVA operations and to gather storage system status information. The HP SMI-S server names (storage management agents—SMAs) are stored as objects and an encrypted configuration file stores access information for each application service. You can configure several SMAs to provide additional redundancy. HP CLX EVA switches to the next available SMA when an SMA becomes unavailable.

The HP SMI-S server must be installed on each SMA and should be running at all times to provide failover capability.

User configuration file

HP CLX EVA provides a user configuration file to customize its failover/failback behavior. You can specify all customizable objects of HP CLX EVA in this file.

For more information, see [“User configuration file” on page <blue>102](#).

Force flag

The force flag forces HP CLX EVA to skip the internal logic and enables write access to the local vdisks regardless of the DR group member state. You can set this flag when you are sure that the current site contains the latest data, even though a previous application service startup process failed because HP CLX EVA discovered a DR group member state that could not be handled automatically.

To use the force flag feature, you must create a file called `application_name.forceflag` in the directory specified by the `ApplicationDir` object, prior to starting the application service that uses HP CLX EVA. `application_name` is the name of the HP CLX EVA resource. Before you create this file, ensure that the application service is not running elsewhere.

This file is removed after HP CLX EVA detects the file.

You cannot use the force flag if the local vdisk state is a combination of destination and copying, which indicates that a copy operation is in progress. A disk cannot be put in read/write access mode when a write operation is in progress to that Vdisk; in this case, HP CLX EVA returns a global error.

Pre-execution and post-execution programs

HP CLX EVA can invoke pre-execution and post-execution programs prior to or after a HP CLX EVA failover/failback function. These programs can be any executable, and must be able to provide return codes to HP CLX EVA. If the programs add significant execution time to the application service startup process, the timeout values for the startup process must be adjusted in the cluster software.

HP CLX EVA transfers information as command-line arguments to the pre-execution and post-execution programs. You must not specify command-line arguments. Pre-executables and post-executables must be specified by full path in the `PreExecScript` and `PostExecScript` objects. If no executable is specified (there is an empty value for the object), no preprocessing or postprocessing is performed. If the object is not defined, then the argument value is empty.

The following arguments are transferred to the scripts in this order:

1. Name (resource name)
2. Reserved
3. DR group name (`DeviceGroup` object)
4. Link state
5. DR mode (source/destination)
6. Log state
7. Failsafe mode
8. Failsafe lock state
9. Suspend mode state
10. Storage system WWN (local)
11. Storage system WWN (remote)
12. VCS firmware version
13. Application directory path (`ApplicationDir` object)
14. Log file location (`LogDir` object)
15. `DC_A_Hosts` node names
16. `DC_B_Hosts` node names

Pre-executables and post-executables must supply a return code. The return code is used to determine whether a failover function is called.

Pre-execution return codes

Table 2 Pre-execution return codes and descriptions

Pre-execution return codes	Descriptions
0	<code>PRE_OK_TAKEOVER</code> Pre-executable ok and failover action allowed.
1	<code>PRE_ERROR_GLOBAL</code> Pre-executable failed; no failover; stop application service cluster wide. Microsoft Cluster service does not allow cluster wide or data center wide disabling of resources. This is local error behavior.
2	<code>PRE_ERROR_DC</code> Pre-executable failed; no failover; stop application service in this data center. Microsoft Cluster service does not allow cluster wide or data center wide disabling of resources. This is local error behavior.
3	<code>PRE_ERROR_LOCAL</code> Pre-executable failed; no failover; stop application service on this system.

Table 2 Pre-execution return codes and descriptions

Pre-execution return codes	Descriptions
4	PRE_ERROR_TAKEOVER Pre-executable failed; failover action allowed.
5	PRE_OK_NOTKVR_NOPST Pre-executable ok; no failover; no post-exec.

CAUTION: If the pre-execution program returns 1, 2, 3 or 5, a properly configured post-executable is not executed. If a failover function fails, the post-executable is not executed.

Post-execution return codes

Table 3 Post-execution return codes

Post-execution return codes	Descriptions
0	POST_OK Post-executable ok; continue.
1	POST_ERROR_GLOBAL Post-executable failed; stop application service cluster wide. Microsoft Cluster service does not allow cluster wide or data center wide disabling of resources. This is local error behavior.
2	POST_ERROR_DC Post-executable failed; stop application service in this data center. Microsoft Cluster service does not allow cluster wide or data center wide disabling of resources. This is local error behavior.
3	POST_ERROR_LOCAL Post-executable failed; stop application service on this system.
4	POST_ERROR_CONTINUE Post-executable failed; continue without error.

CAUTION: Windows script and batch files return 0 if the program was successfully executed. To return a different value, use the following line as the last statement in your pre- or post-executable:
`exit /b <exitcode>`

HP CLX EVA log facility

The logging module of HP CLX EVA provides log messages to the cluster software as well as to the HP CLX EVA log file. The HP CLX EVA log file includes disk status information and is located by default in this directory:

```
%ProgramFiles%\Hewlett-Packard\Cluster Extension EVA\log\
```

If you need to clear and reset the log file, for example to reduce disk space usage, archive the log file and then delete it. A new log file is automatically generated.

Error return codes

HP CLX EVA provides the following error return codes for failover operations:

Table 4 Error return codes and descriptions

Error return codes	Descriptions
local error	Prohibits an application service startup on the local system. This can be caused by the inability of HP CLX EVA to enable disk access, or the misconfiguration of the storage system environment.
data center error	Prohibits an application service startup on any system in the local data center. This error is returned if the disk state indicates that it makes no sense to allow any other system connected to the same storage system to access the disks. Microsoft Cluster service does not allow cluster wide or data center wide disabling of resources. This is local error behavior.
global error	Returned if the configuration or the disk state do not allow an automatic application service startup process. Manual intervention is required in such cases. Microsoft Cluster service does not allow cluster wide or data center wide disabling of resources. This is local error behavior.

When HP CLX EVA is integrated into the cluster software, an error message string and integer value are displayed. For the command-line interface, a return code is displayed. For more information, see "[Command-line interface commands](#)" on page 88.

MNS quorum in Microsoft Cluster service

Microsoft Cluster service uses a quorum disk resource to eliminate the potential split-brain syndrome in case of network failures and to coordinate administrative actions performed by cluster nodes.

The traditional quorum disk represents a possible single point of failure (SPOF); when it fails or communication to it is lost, the whole cluster shuts down. If the SPOF is not eliminated, the cluster is at risk even when geographically dispersed.

Because the quorum disk is a shared disk connected to all nodes, it would still reside in a single location. It is possible to stretch the connection from all nodes to the disk system where the quorum disk resides; however, this does not eliminate the risk of an entire storage system failure.

Mirroring the quorum disk using HP Continuous Access EVA allows failover access of the quorum disk. However, an automated failover is not possible because the Vdisk presentation and fabric zoning must be adjusted and the cluster must be restarted.

As an alternative to the use of a quorum disk resource, Microsoft introduced a new quorum-capable resource with Windows Server 2003 called *majority node set quorum* (MNS).

An MNS is a single quorum resource that allows you to build clusters with nodes which are geographically separated. In an MNS cluster, unlike in a quorum disk cluster, data is stored on multiple disks across the cluster. The MNS resource ensures that the cluster's configuration data is stored locally on the nodes and that it is kept consistent across the different disks. This allows cluster topologies where the nodes do not need shared access to a quorum disk.

Data disks used for your application in the majority node set could, in principle, be local disks physically attached to the nodes themselves or disks on a shared storage fabric. With HP CLX EVA, your data disks are shared in the same data center and mirrored to the remote data center.

In the MNS implementation that is provided as part of MSCS in Windows Server 2003, each server in the cluster uses a directory on its own local system disk to store the quorum data. If the configuration of the cluster changes, that change is reflected across the different local disks. A change to the configuration can be made only if the change can be committed to:

$(\langle \text{Number of nodes in the cluster} \rangle / 2) + 1$

This ensures that more than 50 percent of the nodes have an up-to-date copy of the configuration information.

The cluster service does not start (and bring resources online) if there are 50 percent or less of the configured nodes up and running. The cluster service waits (trying to restart) until a quorum is established by more nodes joining. This guarantees that the cluster has the latest and most up-to-date configuration.

In the case of a failure or split-brain, all resources running on the part that has contact to 50 percent or less of all the nodes in the cluster are terminated because those nodes have lost the quorum.

This preserves the cluster guarantee of bringing a resource online on only one node. If a cluster becomes partitioned (that is, there is a communication failure between two sets of nodes in the cluster), then any partitions that do not have a majority of the configured nodes have lost the quorum.

This ensures that, if there is a part of the cluster alive that contains a majority of nodes, it can safely start up any resources that are not running on that partition.

This also means that, in a geographically dispersed cluster, you must distribute the nodes evenly between two data centers and have an arbitrator node in a third site or separate protected area to be able to survive a single data center failure.

Using the MNS quorum mechanism, geographically dispersed HP CLX EVA clusters do not require a shared disk to span the sites. Data disks are replicated using HP Continuous Access EVA, and HP CLX EVA is there to fail over the write access when a site failover is necessary.

HP Command View EVA and HP SMI-S EVA dependencies

HP CLX EVA depends on HP Command View EVA and HP SMI-S EVA, as well as the cluster software it is integrated with.

Before you configure HP CLX EVA, verify that the host and storage systems are properly configured. Ensure that:

- The storage system and its remote peer have been properly configured.
- The host system recognizes the storage systems.
- The HP Continuous Access EVA links (ISLs) are working properly in both directions.
- You are familiar with the disk configuration of the operating system.

HP SMI-S configuration

To function properly, HP CLX EVA requires at least one instance of HP SMI-S EVA running on an SMA.

You must set up at least one SMA with HP SMI-S in each data center.

In a HP Continuous Access EVA environment, both HP EVA storage systems should be managed by the same active SMA at all times. If you switch active/passive management appliances for one HP EVA, you should also switch the peer HP EVA to the same SMA. Passive SMAs allow HP CLX EVA to gather only limited information in case of a DR group failover.

HP CLX EVA can switch to any of the configured HP SMI-S EVA instances on the alternate SMAs if it cannot connect to the first SMA in the list. To interface with the local array, HP CLX EVA will try all local SMAs first before resorting to use the remote SMAs. To interface with the remote array, HP CLX EVA will also try the local SMAs first, unless the intersite links (ISLs) are down. When the ISLs are down, HP CLX EVA will immediately try to use the remote SMAs to interface with the remote array.

Configuration file (clxsmiscfg)

HP CLX EVA uses the encrypted `clxsmiscfg` file to store configuration and access information for each configured SMA. It uses this file to look up which SMAs (and HP SMI-S servers) are available to be contacted. You can add, delete and edit entries in the `clxsmiscfg` file using the `clxpmu` password management command described on [page 153](#).

This file is created locally. You must copy the file to each node in the `%HPCLX_EVA_PATH%\bin` directory or create it on each node. You can also use the `CLXPMU` button in the Properties tab of each HP CLX EVA resource to edit the file locally on each node.

Secure Socket Layer (SSL) protocol

You can configure HP CLX EVA to use Secure Socket Layer (SSL) protocol to communicate with the HP SMI-S server. The SSL setting depends on whether or not SSL has been enabled at the HP SMI-S server side.

You can check the `EnableSSL` setting by viewing the `cim.properties` file on the SMA. See *HP StorageWorks SMI-S EVA Installation Instructions and Release Notes* for details.

Some HP products might not yet support SSL communication with the HP SMI-S server. Make sure that all products that you use with the HP EVA storage system and that are relying on the HP SMI-S server support SSL. If you use one product that uses the HP SMI-S server and does not support SSL communication, you must disable SSL on the HP SMI-S server side and change all clients (for example, HP CLX EVA) to disable SSL communication.

HP Command View EVA dependencies

HP Command View EVA is used to create vdisks and configure the HP EVA storage system. Using HP Command View EVA, you can:

- Create HP Continuous Access EVA DR groups
- Use the HP Continuous Access User Interface (UI) to view a graphical representation of a DR group setup
- Use the HP Continuous Access UI to manually switch source and destination roles of DR group members

Storage System Scripting Utility (SSSU)

You must use the Storage System Scripting Utility (SSSU) to set the access mode of the destination vdisk to read-only. You can also use SSSU to:

- Create vdisks and DR groups in a convenient automated fashion via custom scripts
- Capture your HP EVA storage system configuration setup

IP network considerations

Because HP Command View EVA and HP SMI-S are essential resources to HP CLX EVA, HP recommends that you provide reliable network connections for cluster-node-to-SMA communications. HP also recommends that you use the redundant network connections of the SMA for alternative access.

SAN fabric considerations

The SMAs use the SAN to communicate with the HP EVA storage system. Make sure that the SMAs are configured to access both fabrics and HP EVAs in the HP Continuous Access EVA configuration.

3 Installation

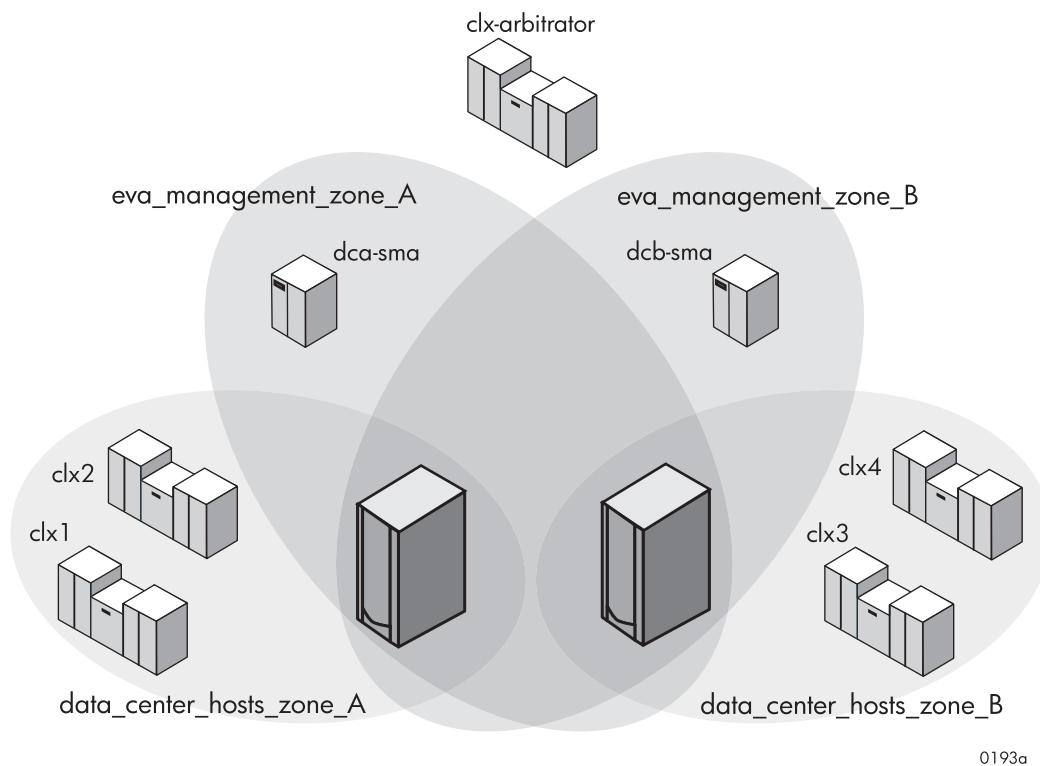
This chapter describes the installation of HP CLX EVA in Microsoft Cluster service environments with the HP EVA family of storage systems.

Prerequisites

Before HP CLX EVA can be used with your cluster software, ensure that:

- You have installed and configured Microsoft Cluster service on the first node.
- You have installed Microsoft hot fix 823147, a fix for MNSs to prevent overwriting pending changes that could lead to cluster database corruption.
- You have the latest supported software and firmware versions, fixes, FC adapter firmware, and driver versions.
- HP Continuous Access EVA links (including all extender hardware) are set up in a redundant, bidirectional configuration.
- Alternative I/O paths between server system and the EVA storage system are set up.
- The cluster and client network is set up in a redundant configuration.
- Your zoning configuration is such that the servers recognize their respective (local) HP EVA, but not the remote HP EVA, each SMA recognizes both HP EVAs can recognize each other.

Figure 7 Zoning requirement



Minimum disk space

The following minimum disk space is necessary for installing HP CLX EVA:

- 50 megabytes (MB) in %ProgramFiles%\Hewlett-Packard\Cluster Extension EVA
- 25 MB of system memory

Supported versions

HP CLX EVA supports the following HP array platforms and associated software as shown in [Table 5](#).

Table 5 Supported arrays and software

	HP CLX EVA 1.00.00	HP CLX EVA 1.01.00
Windows Server	Windows Server 2003 Enterprise Edition 32-bit and 64-bit Datacenter Edition 64-bit	Windows Server 2003 Enterprise Edition 32-bit and 64-bit Datacenter Edition 64-bit
HP EVA Type	HP EVA 3000/5000	HP EVA3000/5000 HP EVA 4000/6000/8000
Firmware	Minimum: VCS 3.025	Minimum: VCS 3.025 for HP EVA 3000/5000 Minimum: XCS 5.020 for HP EVA 4000/6000/8000
HP Continuous Access EVA	1.2	2.1
HP Command View EVA	Minimum: 3.3	Minimum: 4.0.1
HP SMI-S EVA	Minimum: 3.3.3	Minimum: 4.0.1
SSSU	Build 7	Build 18
HP Secure Path	Minimum: 4.0C-SP2	Minimum: 4.0C-SP2 (For HP EVA 3000/5000)
MPIO DSM for HP EVA	N/A	HP MPIO full-featured failover 1.0 for HP EVA 4000/6000/8000

For more information, please see the documentation and release notes for each of the above products.

Please check the HP CLX EVA `readme` file for the most up-to-date supported versions of the above-mentioned products.

Installation roadmap

This list shows the steps for installing HP CLX EVA in a Microsoft Cluster service environment.

1. Prepare the data center for HP CLX EVA installation:
 - Check the IP network setup and the SAN configuration ([page 35](#)).
 - Install and configure HP StorageWorks Secure Path for EVA3000/5000 and MPIO for EVA4000/6000/8000 to enable alternative pathing for Windows ([page 35](#)).
 - Install and configure HP SMI-S EVA on the SMA ([page 36](#)).
 - Install and configure Java Runtime Environment ([page 36](#)).
 - Configure the HP EVA storage system ([page 36](#)).
 - Create hosts ([page 36](#)).
 - Create vdisks and add LUN presentation ([page 37](#)).
 - Create DR groups ([page 39](#)).
 - Add a LUN presentation to a destination vdisk and set the access mode ([page 41](#)).
 - Install Microsoft Cluster service on all nodes ([page 43](#)).
2. Install HP CLX EVA:
 - Install HP CLX EVA resource type DLL ([page 44](#)).
 - Install HP CLX EVA ([page 44](#)).
 - Install HP CLX EVA command-line interface ([page 46](#)).
 - License HP CLX EVA software ([page 46](#)).
3. Solve installation problems:

- Register the HP CLX EVA resource manually ([page 62](#)).
- Reconfigure HP CLX EVA ([page 62](#)).

Preparing data centers for HP CLX EVA installation

The following are configuration procedures for the local primary site and the remote secondary site prior to installation of HP CLX EVA for environments with HP EVA family of storage systems.

Consult your HP service representative for assistance in configuring the storage system. HP consulting and integration services are available to help you create a HP CLX EVA geographically-dispersed cluster environment.

Check IP network setup and SAN configuration

Microsoft Cluster service requires a single IP subnet to be dispersed over all sites of your disaster-tolerant cluster setup. This is necessary for the cluster to exchange *heartbeats* (alive) messages between all cluster nodes.

Several VLAN technologies are available that can stretch single subnets over long distance connections. For example, Wave Division Multiplexer (WDM) and its variations can be used to extend several different protocols (including IP and Fibre Channel) over large distances (100 km and more).

Please ask your network equipment provider and your HP sales representative for detailed information.

In an MNS quorum cluster, all nodes must be distributed so that an equal number of nodes is located in the local and remote data center and an additional node in a third location functions as a tie-breaker or arbitrator.

This third location can be a separate room in a separate fire protection zone with separate power connections. The arbitrator node can act as a regular cluster node and can be connected to one of the storage systems. However, a connection to either storage system is not necessary for the node to act as a tie-breaker.

[Table 6](#) shows the number of supported nodes.

Table 6 Number of supported cluster nodes

Location A	Location B	Location C	# of cluster nodes if a single location fails/total # of nodes in the cluster
1	1	1	2/3
2	2	1	3/5
2	2	2	4/6
3	3	1	4/7
3	3	2	5/8

Any other combination would represent a majority of nodes in a single data center, and a failure of that data center would cause the entire cluster to shut down.

SAN fabrics can be extended to allow for array based data replication. Please consult the *HP StorageWorks Continuous Access EVA Design Reference Guide* and the *SAN Design Guide* for supported SAN extension configuration and instructions on setting up your HP Continuous Access EVA environment.

HP CLX EVA is tested to work in dispersed data center environments with a separation distance of up to 500 km or a round-trip latency of up to 20 milliseconds.

Install HP Secure Path and MPIO DSM

HP Secure Path is available for Windows 2000 and Windows 2003 with Microsoft Cluster service. HP Secure Path uses a filter driver to access physical disks through redundant hardware paths. You must use HP Secure Path to take advantage of I/O path failover, a feature not available with Windows operating systems.

You must install HP Secure Path on the cluster system prior to connecting the system to the second I/O path. HP Secure Path must be used with HP EVA 3000/5000 disk arrays.

HP MPIO Full Featured DSM (Device Specific Module) for Windows for HP EVA disk arrays provides multipathing support for HP EVA disk arrays on Windows 2000 and higher platforms. MPIO must be used with the HP EVA 4000/6000/8000 disk arrays.

Install and configure HP SMI-S EVA server on all management servers

The HP SMI-S EVA server is an integral part of the HP CLX EVA solution.

Install the HP SMI-S EVA server component on the system that runs the HP Command View EVA software.

Review the *HP StorageWorks SMI-S EVA Installation Guide* and *SMI-S EVA Release Notes* to set the access properties. When you later configure HP CLX EVA, you will need the following HP SMI-S information:

- HP SMI-S server name and IP address
- Port number (default is 5989 with SSL enabled)
- User name
- Password
- SSL use (yes or no)

Install and configure JRE on all clustered systems

To install your permanent HP CLX EVA license through the HP OpenView AutoPass GUI, you must install JRE 1.3.1 or later.

For 64-bit Windows systems, you must install Java SDK 1.4.2._04 or later.

Please visit the Java website www.java.com – or download the latest JRE directly:
http://www.java.com/en/download/windows_automatic.jsp

Configure HP EVA storage system

You can configure the HP EVA storage system using the HP Command View EVA SMA or the SSSU. Both require a user name and password for access.

Please refer to the *HP StorageWorks Command View EVA User Guide* and the *HP StorageWorks Storage System Scripting Utility reference guide* for detailed information.

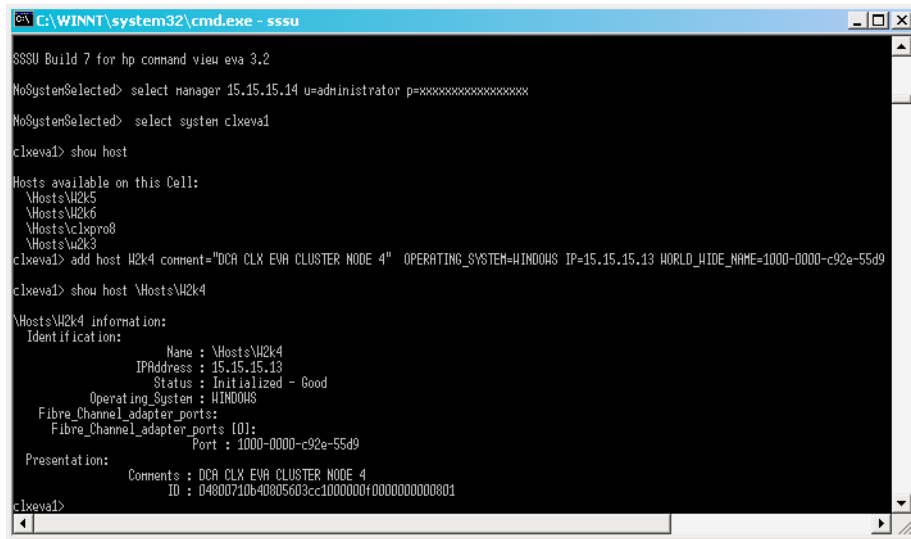
In order to manage DR groups, you can also use the HP Continuous Access EVA GUI. Please refer to the *HP StorageWorks Continuous Access EVA UI Operations Guide* for detailed information on how to use the HP Continuous Access EVA GUI.

Create hosts

Before you can assign disk storage to the cluster system and use it in the HP CLX EVA environment, you must create a host entry for the locally connected server on each HP EVA storage system.

Add a host to local HP EVA using SSSU

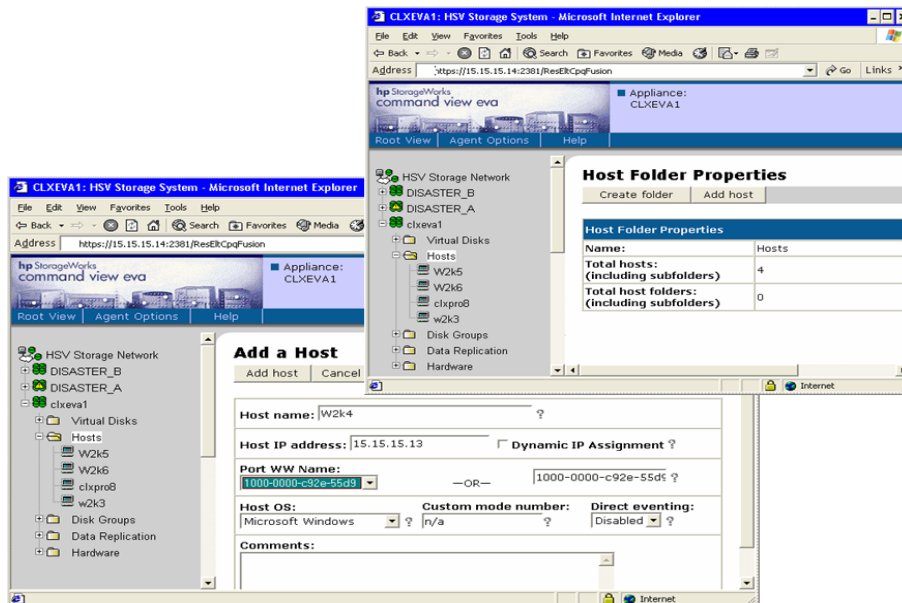
You can do this using the SSSU commands `add host` and `show host` after you select an SMA and a storage system. Do not create host entries on the local HP EVA storage system for cluster nodes that are located in the remote data center.



```
C:\WINNT\system32\cmd.exe - sssu
SSSU Build 7 for hp command view eva 3.2
NoSystemSelected> select manager 15.15.15.14 u=administrator p=xxxxxxxxxxxxxxxx
NoSystemSelected> select system clxeva1
clxeval> show host
Hosts available on this Cell:
  \Hosts\W2k5
  \Hosts\W2k6
  \Hosts\clxpro8
  \Hosts\w2k3
clxeval> add host W2k4 comment="DCA CLX EVA CLUSTER NODE 4" OPERATING_SYSTEM=WINDOWS IP=15.15.13 WORLD_WIDE_NAME=1000-0000-c92e-55d9
clxeval> show host \Hosts\W2k4
\Hosts\W2k4 information:
  Identification:
    Name : \Hosts\W2k4
    IPAddress : 15.15.13
    Status : Initialized - Good
    Operating System : WINDOWS
  Fibre_Channel_adapter_ports:
    Fibre_Channel_adapter_ports [0]:
      Port : 1000-0000-c92e-55d9
  Presentation:
    Comments : DCA CLX EVA CLUSTER NODE 4
    ID : 04800710b40805603cc1000000f0000000000801
clxeval>
```

Figure 8 Add a host to local HP EVA using the HP Command View EVA GUI

1. From the HP Command View EVA GUI, select your local HP EVA storage system and click the **hosts** folder.
2. Add local cluster nodes in the main hosts folder or create a new folder for cluster nodes and add them there.



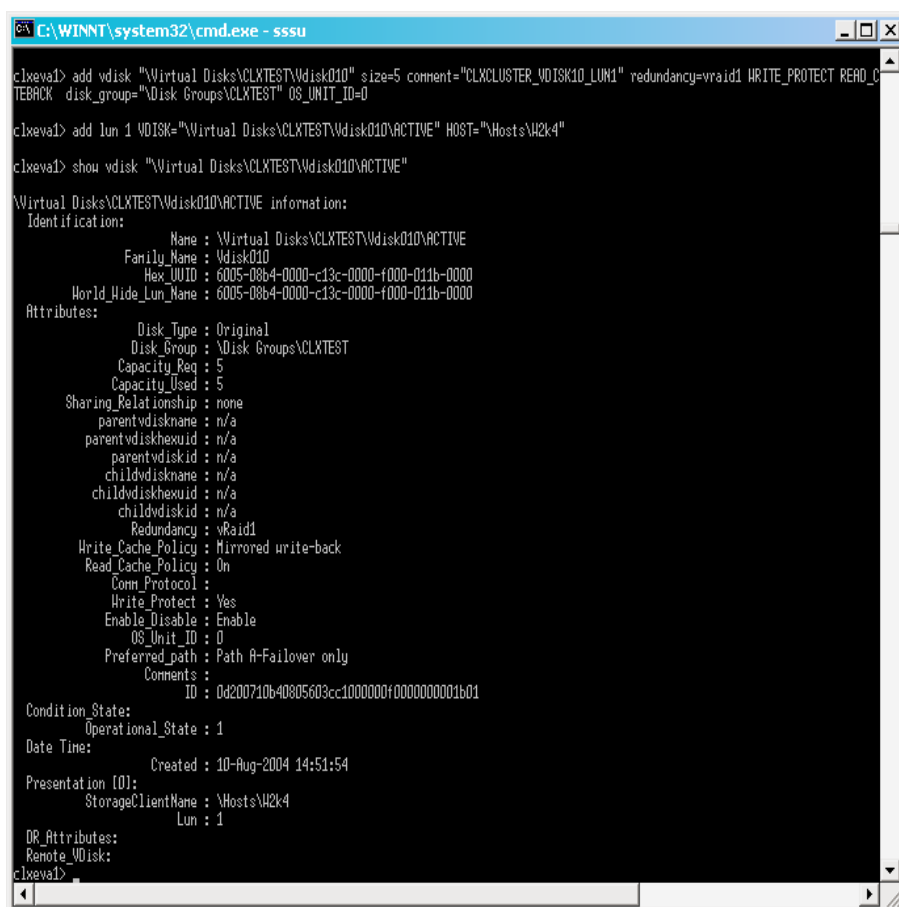
Create vdisks and add a LUN presentation

You can create the storage for your application data using SSSU or the HP Command View EVA GUI.

NOTE: Later, you will have to create a LUN presentation for your remote destination vdisk and set the access mode property for the destination vdisk to read-only. You can set this property only using SSSU. See “Add a LUN presentation to the destination vdisk and set read-only mode through HP Command View EVA or SSSU” on page 41.

Create vdisks and add a LUN presentation using SSSU

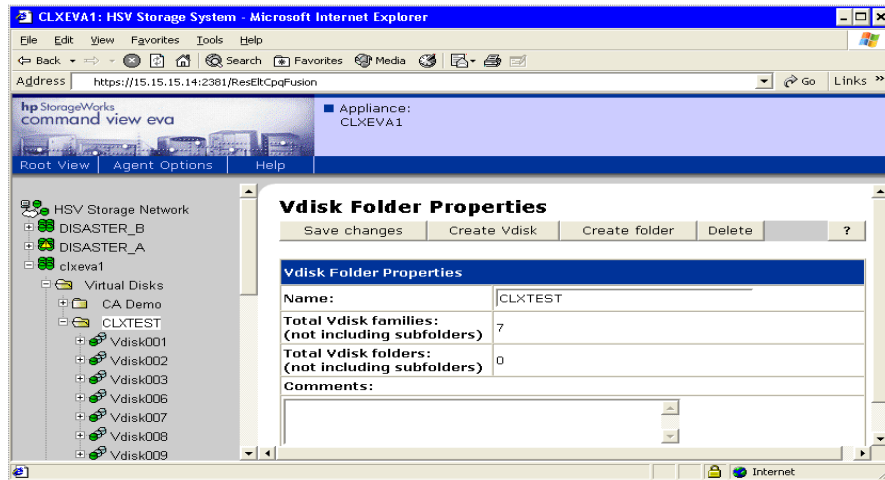
Create vdisks and add a LUN presentation with the SSSU commands `add vdisk` and `add lun` after you select an SMA and a storage system. You can use the respective `show` commands to gather further information.



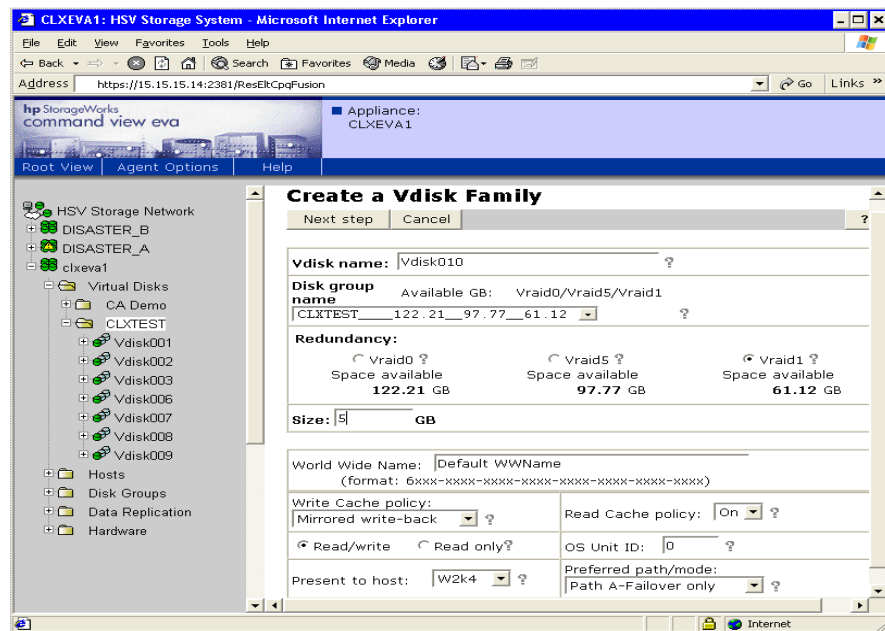
```
C:\WINNT\system32\cmd.exe - sssu
c:\eva1> add vdisk "\Virtual Disks\CLXTEST\Wdisk010" size=5 comment="CLXCLUSTER_WDISK10_LUN1" redundancy=vraid1 WRITE_PROTECT_READ_C
TEBACK disk_group="\Disk Groups\CLXTEST" OS_UNIT_ID=0
c:\eva1> add lun 1 VDISK="\Virtual Disks\CLXTEST\Wdisk010\ACTIVE" HOST="\Hosts\W2k4"
c:\eva1> show vdisk "\Virtual Disks\CLXTEST\Wdisk010\ACTIVE"
Virtual Disks\CLXTEST\Wdisk010\ACTIVE information:
  Identification:
    Name       : \Virtual Disks\CLXTEST\Wdisk010\ACTIVE
    Family Name : Wdisk010
    Hex_UUID   : 6005-D8b4-0000-c13c-0000-f000-011b-0000
    World_Wide_Lun_Name : 6005-D8b4-0000-c13c-0000-f000-011b-0000
  Attributes:
    Disk_Type       : Original
    Disk_Group      : \Disk Groups\CLXTEST
    Capacity_Req    : 5
    Capacity_Used   : 5
    Sharing_Relationship : none
    parentvdiskname : n/a
    parentvdiskhexuid : n/a
    parentvdiskid   : n/a
    childvdiskname  : n/a
    childvdiskhexuid : n/a
    childvdiskid    : n/a
    Redundancy      : vRaid1
    Write_Cache_Policy : Mirrored write-back
    Read_Cache_Policy : On
    Comm_Protocol   :
    Write_Protect   : Yes
    Enable_Disable  : Enable
    OS_Unit_ID     : 0
    Preferred_path  : Path A-Failover only
    Comments        :
    ID              : 0d200710b40805603cc1000000f0000000001b01
  Condition State:
    Operational_State : 1
  Date Time:
    Created           : 10-Aug-2004 14:51:54
  Presentation [0]:
    StorageClientName : \Hosts\W2k4
    Lun               : 1
  DR_Attributes:
  Remote_VDisk:
c:\eva1>
```

Create vdisks and add a LUN presentation using the HP Command View EVA GUI

1. From the HP Command View EVA GUI, select your local HP EVA storage system and click on the **Virtual Disks** folder. Here you can add vdisks in the main **Virtual Disks** folder or create a new folder and add them there.



2. Click **Create Vdisk**.



Enter the vdisk name, click the button for the desired vraid level, enter the size in GB, accept the default WWN or enter a new WWN, and confirm or change the defaults for **Write Cache policy** and **Read Cache policy**.

3. Click **Next Step**. The Operation succeeded confirmation displays. You can click **Create More Vdisks** to create another vdisk as needed.

Create DR groups

Before you can use HP CLX EVA, you must:

- Create a DR group that includes your previously created vdisk(s)
- Set access mode to read-only for destination vdisk
- Add a LUN presentation to your remote cluster node

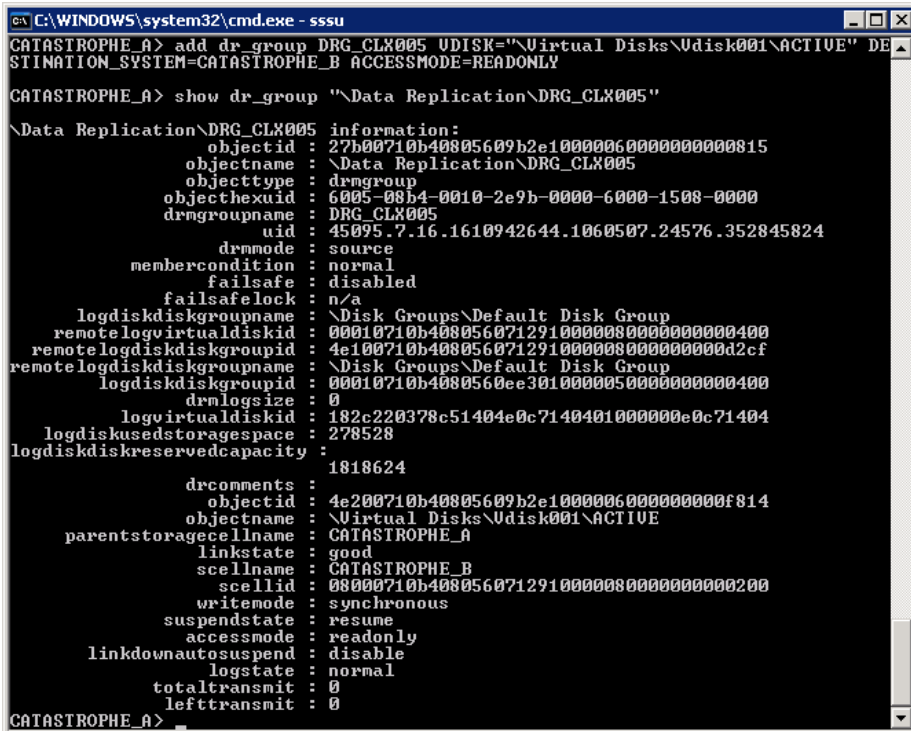
When you create the DR group with your local vdisk(s), a replica of the vdisk(s) on the remote destination storage system is created automatically. The disk pair is called a DR group member or copy set.

NOTE: For HP CLX EVA environments, you must set the access mode for the destination vdisk to read-only.

Add a DR group using SSSU

Use the SSSU commands `add dr_group` and `show dr_group` after you select an SMA and a storage system. The `show dr_group` command allows you to verify that the DR group was created with read-only access mode. If access mode is not set to read-only, use the `set dr_group` command to set read-only access mode. For example:

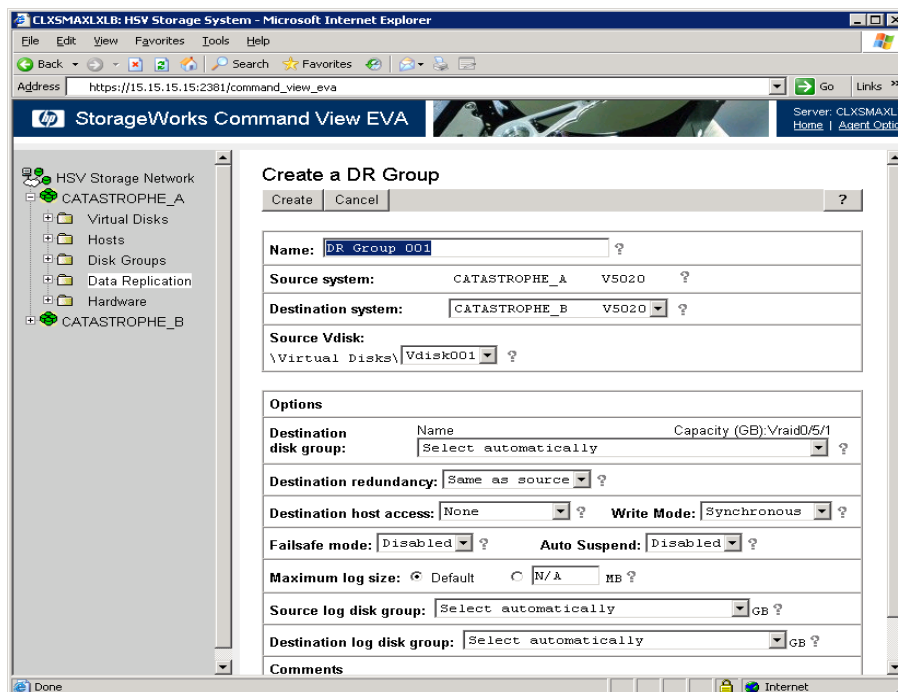
```
set dr_group "\\Data Replication\DRG_CLX005" accessmode=readonly
```



```
C:\WINDOWS\system32\cmd.exe - sssu
CATASTROPHE_A> add dr_group DRG_CLX005 UDISK="\Virtual Disks\Udisk001\ACTIVE" DESTINATION_SYSTEM=CATASTROPHE_B ACCESSMODE=READONLY
CATASTROPHE_A> show dr_group "\\Data Replication\DRG_CLX005"
\Data Replication\DRG_CLX005 information:
    objectid : 27b00710b40805609b2e10000060000000000815
    objectname : \Data Replication\DRG_CLX005
    objecttype : drmggroup
    objecthexuid : 6005-08b4-0010-2e9b-0000-6000-1508-0000
    drmggroupname : DRG_CLX005
    uid : 45095.7.16.1610942644.1060507.24576.352845824
    drmmode : source
    membercondition : normal
    failsafe : disabled
    failsafelock : n/a
    logdiskdiskgroupname : \Disk Groups\Default Disk Group
    remotelogvirtualdiskid : 00010710b408056071291000008000000000400
    remotelogdiskdiskgroupid : 4e100710b408056071291000008000000000d2cf
    remotelogdiskdiskgroupname : \Disk Groups\Default Disk Group
    logdiskdiskgroupid : 00010710b4080560e301000005000000000400
    drmlogsiz : 0
    logvirtualdiskid : 182c220378c51404e0c7140401000000e0c71404
    logdiskusedstoragespace : 278528
    logdiskdiskreservedcapacity : 1818624
    drcomments :
        objectid : 4e200710b40805609b2e1000006000000000f814
        objectname : \Virtual Disks\Udisk001\ACTIVE
    parentstoragecellname : CATASTROPHE_A
        linkstate : good
        scellname : CATASTROPHE_B
        scellid : 08000710b408056071291000008000000000200
        writemode : synchronous
        suspendstate : resume
        accessmode : readonly
    linkdownautosuspend : disable
        logstate : normal
    totaltransmit : 0
    lefttransmit : 0
CATASTROPHE_A>
```


Add a DR group using HP Command View EVA GUI

1. From the HP Command View EVA GUI, select the local HP EVA storage system and click on the **Data Replication** folder to add DR groups.



2. Enter the DR group name in the **Name** text box.
3. Select the **Destination system** from the list. This is the system you wish to failover to for remote data replication. To keep it simple, ensure both HP EVA configurations are identical.
4. Select the **Source Vdisk** from the list.
5. Select the **Destination disk group** from the list. You can accept the default already displayed or select one of the available disk groups.
6. Select **Disabled** or **Enabled** for the **Failsafe mode**.
HP CLX EVA supports enabled or disabled Failsafe mode. However, there are failover scenarios that HP CLX EVA will not be able to successfully fail over if the Failsafe mode is enabled. HP CLX EVA will log messages to indicate that it has encountered such a scenario when it happens. For more information, see [“HP Continuous Access EVA and HP SMI-S”](#) on page 24.
7. Set the **Write mode** to **Synchronous**.
8. Select the desired choices for the remaining DR group properties.

NOTE: When you add a DR group through HP Command View EVA or the HP Continuous Access EVA GUI, you must later set the access mode for your destination disk using SSSU.

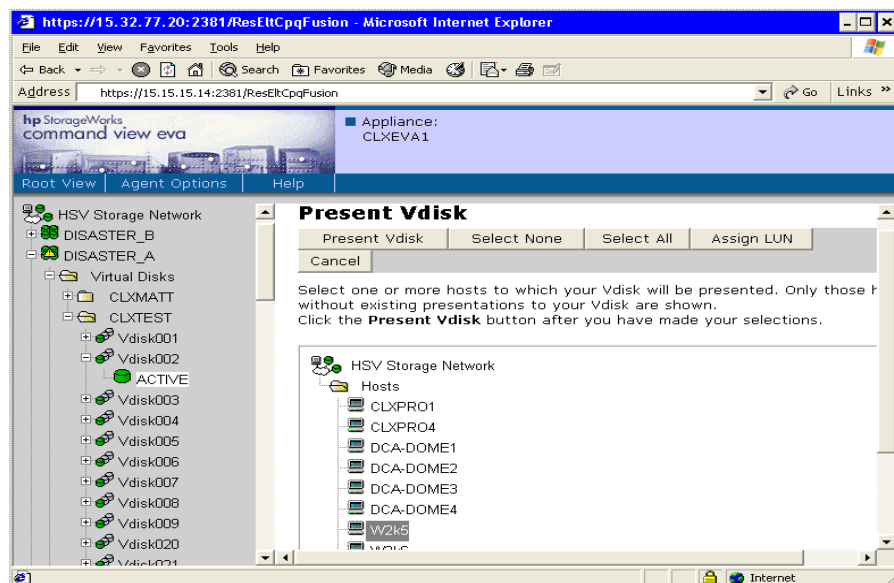
Add a LUN presentation to the destination vdisk and set read-only mode through HP Command View EVA or SSSU

The final step of HP Continuous Access EVA setup for HP CLX EVA is to present the destination vdisk(s) to your remote cluster server and set the disk access mode to read-only or verify that you set the access mode in a previous step.

NOTE: It is recommended that you use the same LUN number for all servers in the cluster. This step assumes that you have created your remote host entry on the destination storage system as described previously.

Add a LUN presentation and set access mode using HP Command View EVA GUI

1. Select the remote destination HP EVA storage system and click on the **Virtual Disks** folder. Locate the vdisk here or in a subfolder.



2. When you have found the vdisk belonging to the DR group you just created, click the vdisk icon. This will display the **ACTIVE** disk icon.
3. On the right pane, select **PRESENTATION** or click **Present Vdisk**.
4. Select **Present Vdisk** or **Assign LUN**.
 - **Present Vdisk** assigns the next available LUN.
 - **Assign LUN** lets you choose a LUN to assign.

NOTE: Now you must set the access mode for the destination Vdisk using SSSU.

Install Microsoft Cluster service on all nodes

Before installing Microsoft Cluster service, you should create your disk configuration through the Disk Manager. Rescan your disks from the Disk Manager if the disks are not visible.

NOTE: You may need to shut down all but one server on the source storage system to successfully configure your disks in the Disk Manager. Errors may occur during partitioning and formatting because all servers that you presented the same disk to on the local storage compete for access to the disk. This will not happen after the cluster software is installed and after you have formatted or partitioned the disk(s).

In rare cases, certain FC drivers will show disk access errors (event ID 51) in the event log when the disk access is set to read-only. This can be ignored for read-only destination disks and should not occur once HP CLX EVA is installed.

You must reboot the server(s) on the destination storage system or rescan the disks through the Disk Manager prior to and after installing the cluster software and at any later time that you add storage in read-only mode on the destination side.

1. Open the Cluster Administrator GUI by selecting **Start > Programs > Administrative Programs > Cluster Administrator**.
2. Install Microsoft Cluster service by adding all cluster nodes to the cluster. Use the **Advanced Settings** option when specifying the cluster nodes.
3. Select **Majority Node Set quorum** as the cluster's quorum resource. Quorum disks as a quorum resource are not supported with HP CLX EVA.

4. Specify network setup and login information.

Once the cluster software is installed, you can continue installing HP CLX EVA on all cluster nodes that have a FC connection to the local or remote HP EVA and are used to access storage resources on the HP EVA.

If the system that acts as an arbitrator or tie-breaker is not connected to either HP EVA, you do not need to install HP CLX EVA on that cluster node.

Installing HP CLX EVA

HP CLX EVA provides a standard InstallShield wizard for Windows. The setup program includes the HP CLX EVA integration with Microsoft Cluster service and the generic interface of HP CLX EVA.

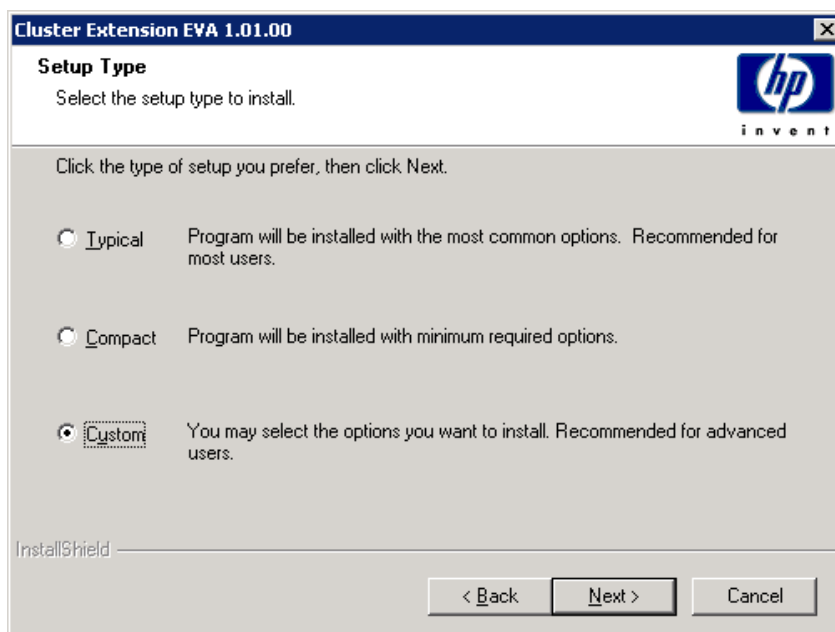
Install HP CLX EVA resource type DLL

This procedure installs the following HP CLX EVA components:

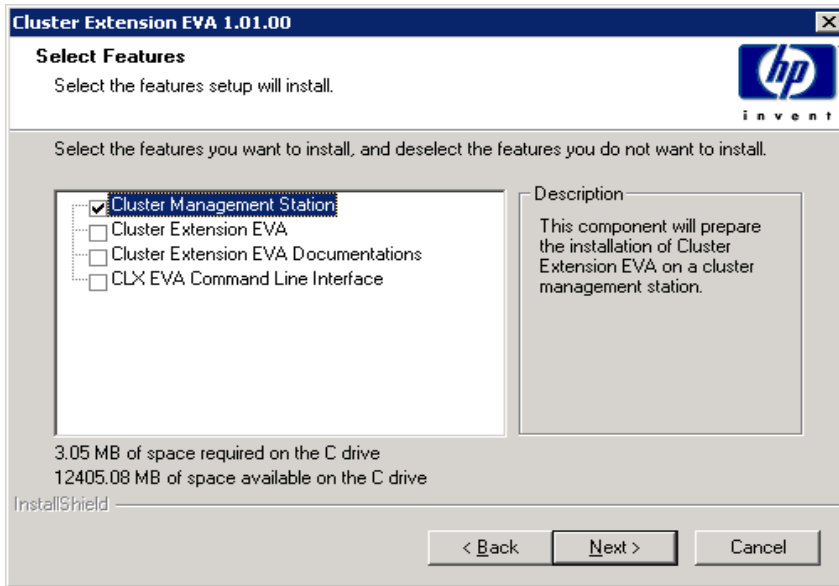
- Resource DLL `clxevamscs.dll`
- Cluster administrator extension DLL `clxevamscsex.dll`
- `clxevarun.exe` command-line interface
- Additional components

CAUTION: HP CLX EVA adds a resource type DLL to the Microsoft Cluster service. The associations with this resource type DLL are lost if the cluster software is removed. Every new installation, removal, or reinstallation of the Microsoft Cluster service requires running Repair for the HP CLX EVA "Cluster resource type" setup program. See ["Repair function" on page 62](#).

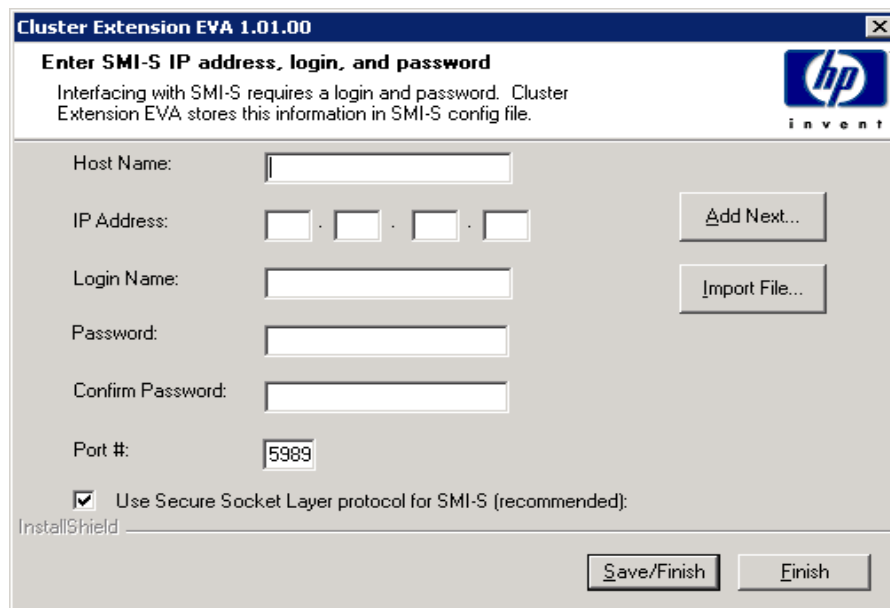
1. Download the self-extracting install image to a local directory on the cluster node. Double-click on the install package to start the installation.
2. Follow the onscreen instructions to enter your identification and select the program installation location.
3. In the Setup Type dialog box select **Typical** to install the HP CLX EVA resource DLL, cluster administrator extension DLL and HP CLX EVA documentation. Select **Compact** to install only the HP CLX EVA resource DLL and cluster administrator extension DLL without documentation. Select **Custom** to select specific components to install.



The Custom setup allows the option of installing only the CLX cluster administrator DLL on a management server. This enables you to run the Cluster Administrator GUI and manage the HP CLX EVA resources from a management host and not require a separate HP CLX EVA LTU for this node.



4. Enter the login name and password for HP SMI-S, which may be different from the actual host login name and password.



For Port #, accept the default at this point; do not overwrite. This is the number of the HP SMI-S connection port. Whether or not SSL is checked determines the default port number.

Configure HP CLX EVA resources

You can modify the default configuration to fit your Microsoft Cluster service and HP EVA storage system environment.

Before configuring the HP CLX EVA resource, review the Microsoft Cluster service resource properties of the HP CLX EVA resource type.

For information about resources and how to change the default settings, see ["Integration with Microsoft Cluster service" on page 75](#).

Install HP CLX EVA command-line interface

You can use the HP CLX EVA command-line interface for custom cluster software integration. For example, you can write your own online and offline scripts using the advanced DR group status checking options of HP CLX EVA.

NOTE: It is not necessary to install this component if you are using HP CLX EVA with Microsoft Cluster service.

License HP CLX EVA software

When you first install a HP CLX EVA product, you receive a 60-day instant-on license that allows you to use the product for 60 days without entering a permanent license key. The product logs messages to the product log file and the system log every 24 hours to notify you of how many days remain on the 60-day license.

HP CLX EVA requires a permanent license key to use the product for more than 60 days. Sometime during the initial 60-day period, you must obtain a license key from HP and enter the key. This section gives you instructions for getting and entering a license key.

About your entitlement certificate

When you purchase an HP CLX EVA product, you receive an entitlement certificate that includes the following information:

- Product name: HP Cluster Extension EVA for Windows 2003 LTU
- Product Number: T3667A
- Quantity: 1

You will need this information to retrieve and enter your license keys.

The entitlement certificate also includes instructions for using AutoPass in HP CLX EVA to retrieve and enter license keys, and explains how to contact the HP Password Center in your region for help. If you need more licenses than the license to use (LTU) quantity you have purchased, please contact your HP sales representative.

Overview of retrieving license keys

There are two types of license keys:

- Permanent license keys
- One time 60-day trial (evaluation) license key extension

Getting an evaluation license extension

Only one 60-day trial license extension will be issued for a total of 120 days of evaluation use. If you want to request an extension to your 60-day trial license key, contact the HP Password Center. When you receive your license key, use AutoPass to import it. See [“Importing a license key into AutoPass” on page 55](#).

Using AutoPass to retrieve permanent license keys

Have the information from your entitlement certificate available to retrieve permanent license keys.

1. Start the AutoPass licensing GUI (`clxautopass`) located in the HP CLX EVA product `bin` directory:

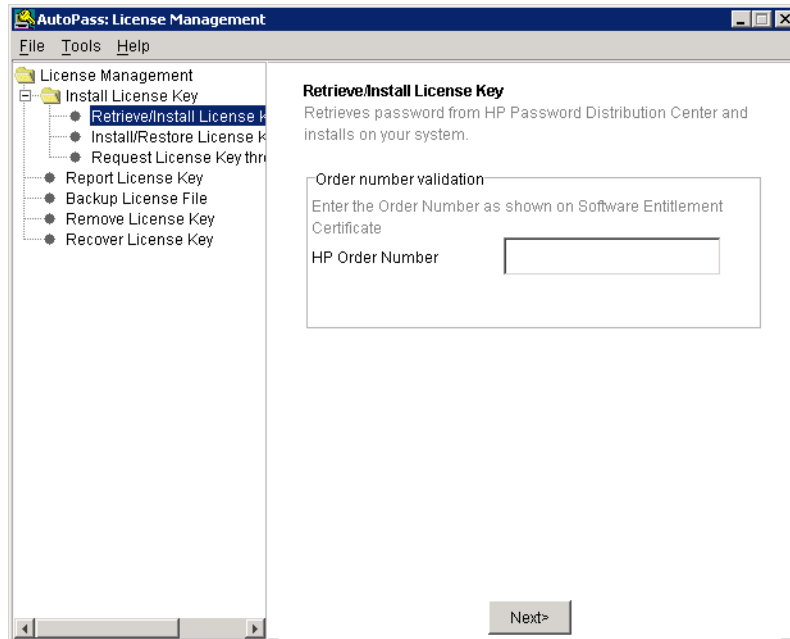
```
clxautopass -ovlicensemgr
```

AutoPass requires JRE version 1.3 or later.
2. If you have a connection to the Internet from this system, refer to [“Retrieving license keys over the Internet” on page 68](#).
3. If you do not have a connection to the Internet from this system, refer to [“Requesting license keys by e-mail or fax” on page 77](#).
4. After installing the permanent license keys, restart HP CLX EVA so that the system will recognize the license. You can restart HP CLX EVA by restarting Microsoft Cluster service.

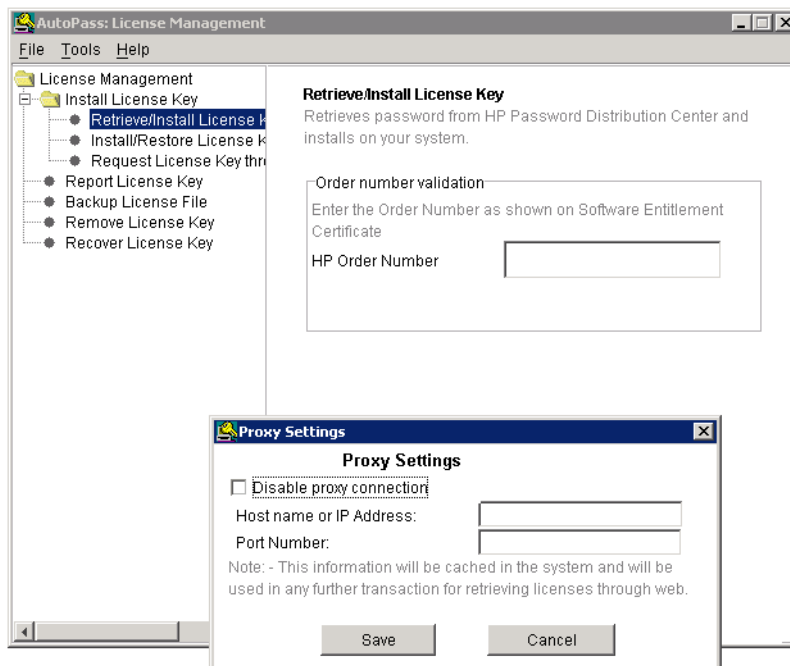
Retrieving license keys over the Internet

After starting `clxautopass` in the HP CLX EVA product `bin` directory, use AutoPass to retrieve a permanent license key through the Internet.

1. The AutoPass Retrieve/Install License Key window displays when the application starts.

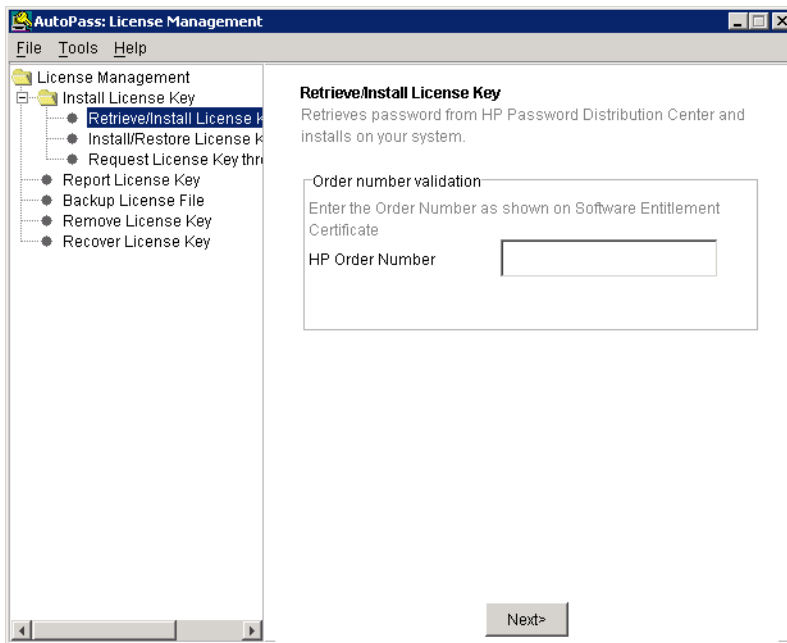


2. If you require a web proxy to access the Internet, click the **Tools** menu and click **Configure Proxy**. The Proxy Settings window opens.

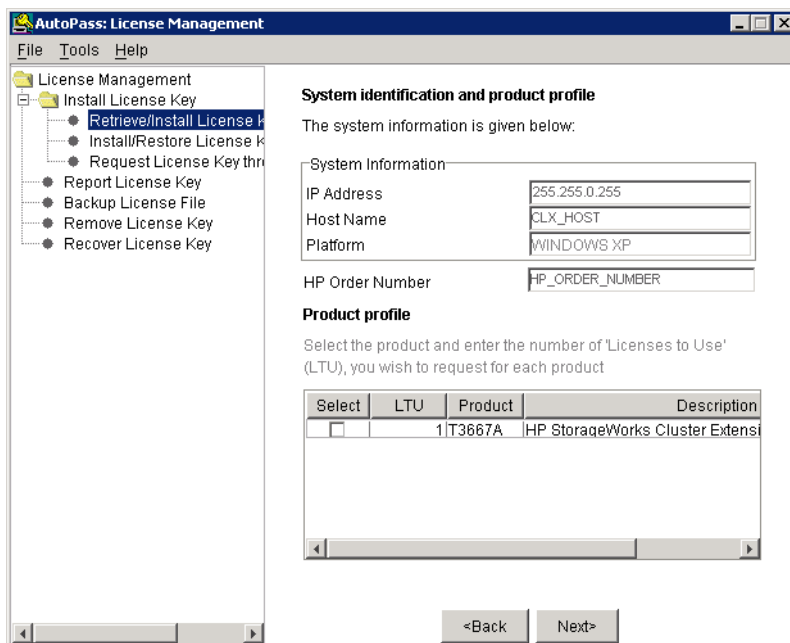


3. In the Proxy Settings window, click the **Disable proxy connection** or enter the host name (or IP address) and the port number for your proxy server, and then click **Save**.

4. Enter the HP order number from your entitlement certificate, and then click **Next** to continue.



5. The System Identification and Product Profile window opens. Confirm the information that you supplied or that the system captured automatically.



The information in the right pane is divided into three areas:

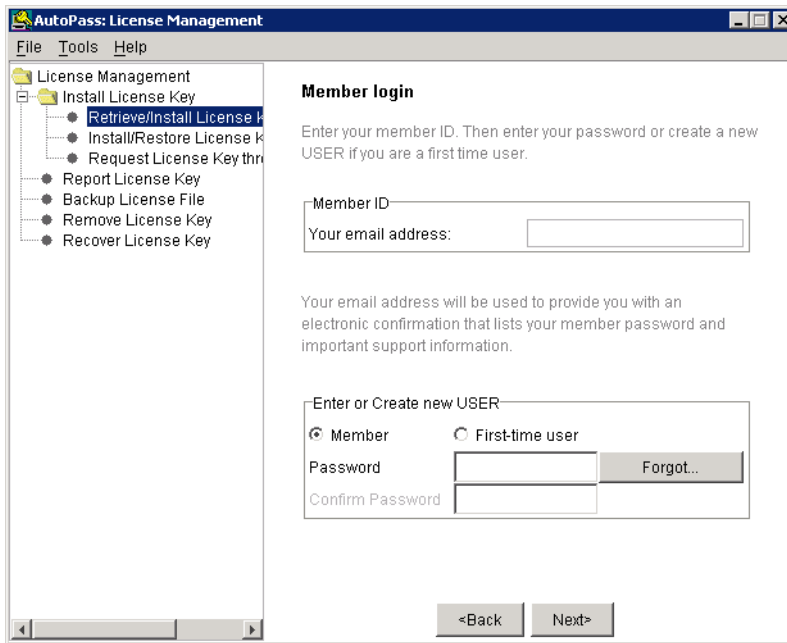
System information: Displays information about the computer system on which you are installing the product.

HP Order Number: Determines what information displays in the Product profile area.

Product profile: Lists the products you are installing and the number of LTUs you purchased. The scrollbars allow you to scroll to see all products and their complete descriptions.

6. Click the boxes for the product LTUs you purchased, as shown on your entitlement certificate.
7. For each selected product, enter the number of LTUs you are installing. This must be a number greater than 0. Fixed LTU products have a default value of 1; you cannot change the number.
8. Click **Next**. AutoPass uses an online database to verify the number of LTUs requested. If you have not purchased enough LTUs to fulfill your request, AutoPass lists the products with insufficient LTUs. Change the number of LTUs requested and continue.

The Member Login window opens.



9. Enter your e-mail address. This will be your member ID for AutoPass licensing.
10. Click **Member** or **First-time user**.
11. Enter your AutoPass password.

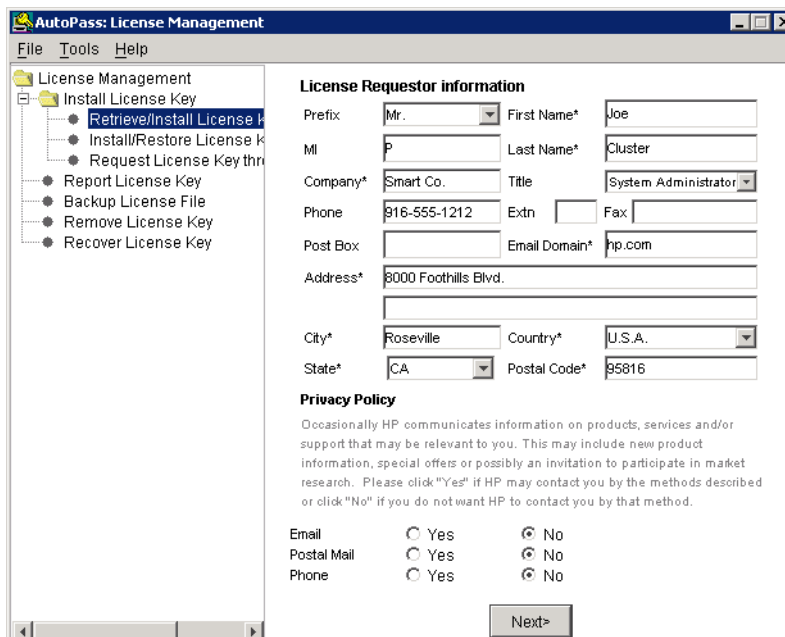
If you don't have a password, create one: Verify that you clicked **First-time user** and then enter a new password in the **Password** and **Confirm Password** fields. The two entries must match and must contain between 4 and 15 characters.

If you are an existing AutoPass user, verify that you clicked **Member** and then enter your existing password. If you can't remember your password, click **Forgot**. HP will e-mail you your password.

If you are an existing AutoPass user, but clicked **First-time user**, AutoPass will check to see if the password you entered is already valid for your member ID (e-mail address). If so, a message displays telling you that you are already registered and you should click **Member** or create a new password.

12. Click **Next**.

The License Requestor Information window opens. If you are an existing user and you have an active Internet connection, the window displays your current information. If you are a first-time user or there is no Internet connection, the fields are blank.



13. Enter any new or changed information.

Required fields are marked with an asterisk (*).

If you selected U.S.A. as the country, select your state from the dropdown list. For other countries, enter the state.

14. Under **Privacy Policy**, select how HP may contact you.

15. Click **Next**. The License Owner window displays.

License Owner

Is License Requestor same as License Owner?
Provide following details if the license requester and owner are not same.

Email Address* john_doe@hp.com

Prefix Mr. First Name* John

MI J Last Name* Doe

Company* Hewlett-Packard Title Software Contact

Phone 916-333-4444 Extn Fax

Post Box Email Domain* hp.com

Address* 4444 Foothills Blvd.

City* Roseville Country* U.S.A.

State* CA Postal Code* 95661-5785

If you would like to add this product to an existing HP support contract, please input your existing System Handle:

Support ID

<Back Next>

16. Click or clear **Is License Requestor same as License Owner?**

When you click this box, the information entered for the license requester populates the fields in the License Owner window.

If the license owner is not the same as the license requester, enter the requested information for the license owner.

17. Click **Next**. The Information Summary window opens.

Information summary

Check the following summary and use the 'Back button' to make any changes.

Installation Target

IP Address 255.255.0.255

Host Name CLX_HOST

Platform WINDOWS XP

Product	LTU	Description
T3667A	1	HP StorageWorks Cluster Extension EVA

Customer Profile

Requestor Information

First Name Joe

Middle Initial P

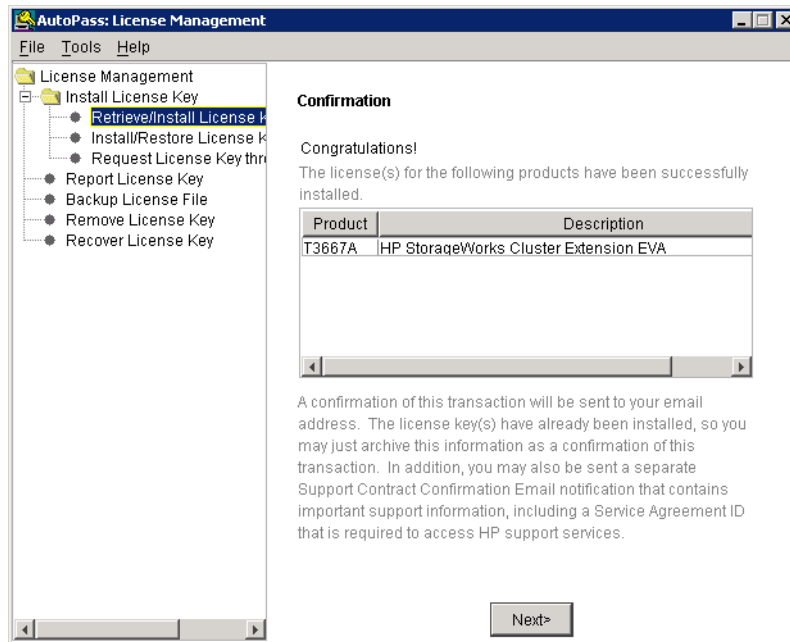
Last Name Cluster

<Back Next>

18. Check the information summary carefully, and click **Back** to go to the previous window to change incorrect details. AutoPass displays a message for each product for which there is an insufficient

number of LTUs. If an insufficient LTU message displays, you must go back to the System Identification and Product Profile window and change the number of LTUs requested.

19. Click **Next**. AutoPass generates passwords for the selected products. If the passwords are successfully installed, the Password Delivery System updates your member profile and machine information.
20. The Confirmation window displays a table showing the products that have had license keys/passwords successfully installed.



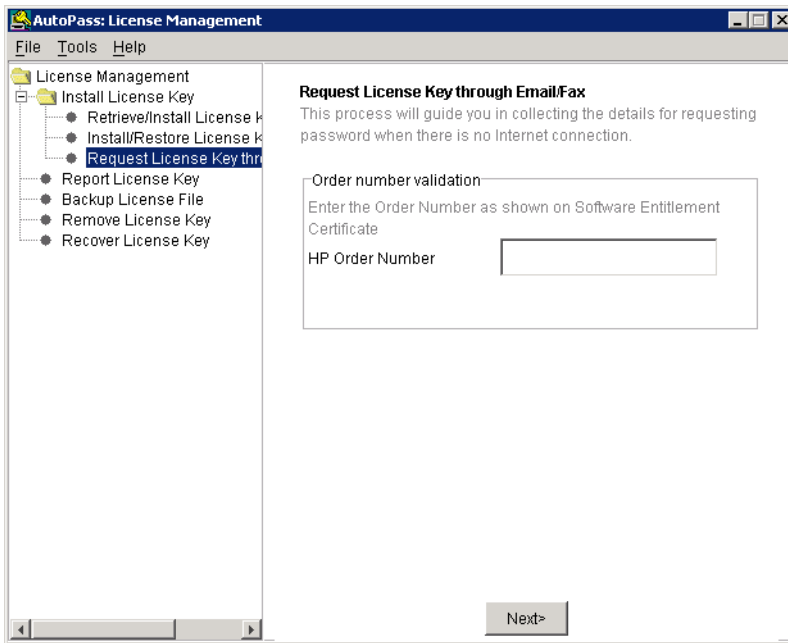
21. Click **Next** if you want to retrieve and install the license key for another order number, or select **Close** in the **File** menu to close the application.

Requesting license keys by e-mail or fax

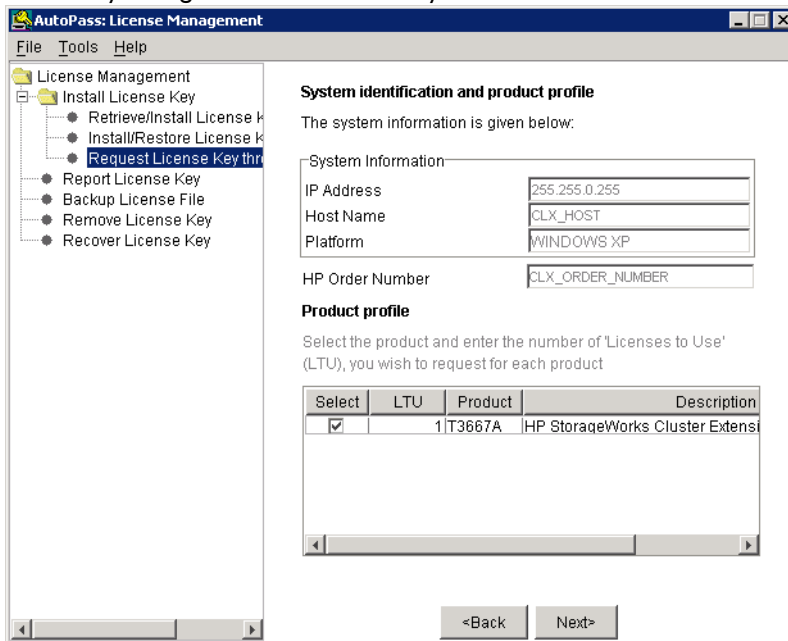
If you install Cluster Extension EVA on a system that does not have an Internet connection, you can request a license key by e-mail or fax. Use AutoPass as explained below to send your request to the HP Password Center. When you receive the license key in your e-mail, use AutoPass to import it. See [“Importing a license key into AutoPass” on page 55](#).

1. Open AutoPass by running the `clxautopass` utility:

```
clxautopass -ovlicensemgr
```
2. Select **Request License Key through Email/Fax** in the left pane.



3. Enter the HP order number for your product.
4. Click **Next**.
5. The System Identification and Product Profile window displays. Confirm the information you supplied or that the system gathered automatically.



The information is divided into three areas:

System information: Displays information about the computer system on which you are installing the product.

HP Order Number: Determines what information displays in the product profile area.

Product profile: Lists the products you are installing and the number of LTUs you purchased. The scroll bars allow you to scroll to see all products and their complete descriptions.

6. Enter the product and description for each product you are installing.
7. Click the boxes for your product and description entries.
8. Enter the number of LTUs for each product, as shown on your entitlement certificate.

9. Click **Next**. The License Requestor Information window opens.

License Requestor information

Prefix: Mr. First Name*: Joe
MI: P Last Name*: Cluster
Company*: Smart Co. Title: System Manager
Phone: 916-555-1212 Extn: Fax:
Post Box: Email Domain*: domain.com
Address*: 8000 Foothills Blvd.
City*: Roseville Country*: U.S.A.
State*: CA Postal Code*: 95747

Privacy Policy
Occasionally HP communicates information on products, services and/or support that may be relevant to you. This may include new product information, special offers or possibly an invitation to participate in market research. Please click "Yes" if HP may contact you by the methods described or click "No" if you do not want HP to contact you by that method.

Email: Yes No
Postal Mail: Yes No
Phone: Yes No

<Back Next>

10. Enter the requested information in the blanks.

Required fields are marked with an asterisk (*).

You must enter a state only if you select USA as the country. Select a state from the dropdown list. For other countries, enter the state.

11. Under **Privacy Policy**, select how HP may contact you.

12. Click **Next**.

The License Owner window opens.

License Owner

Is License Requestor same as License Owner?
Provide following details if the license requester and owner are not same.

Email Address*: joe.cluster@domain.com
Prefix: Mr. First Name*: Joe
MI: P Last Name*: Cluster
Company*: Smart Co. Title: System Manager
Phone: 916-555-1212 Extn: Fax:
Post Box: Email Domain*: domain.com
Address*: 8000 Foothills Blvd.
City*: Roseville Country*: U.S.A.
State*: CA Postal Code*: 95747

If you would like to add this product to an existing HP support contract, please input your existing System Handle:
Support ID:

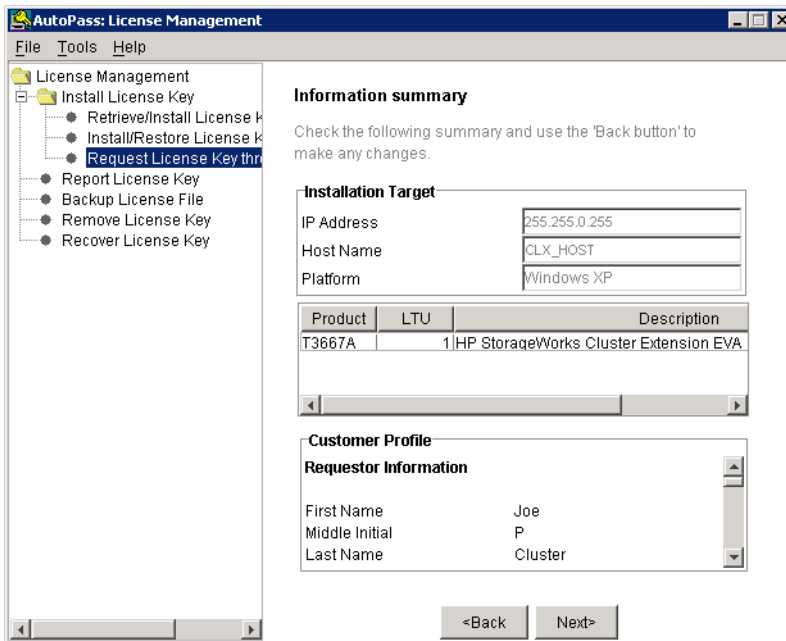
<Back Next>

13. Click or clear **Is License Requestor same as License Owner?**

When you click this box, the information entered for the license requestor populates the fields in the License Owner window.

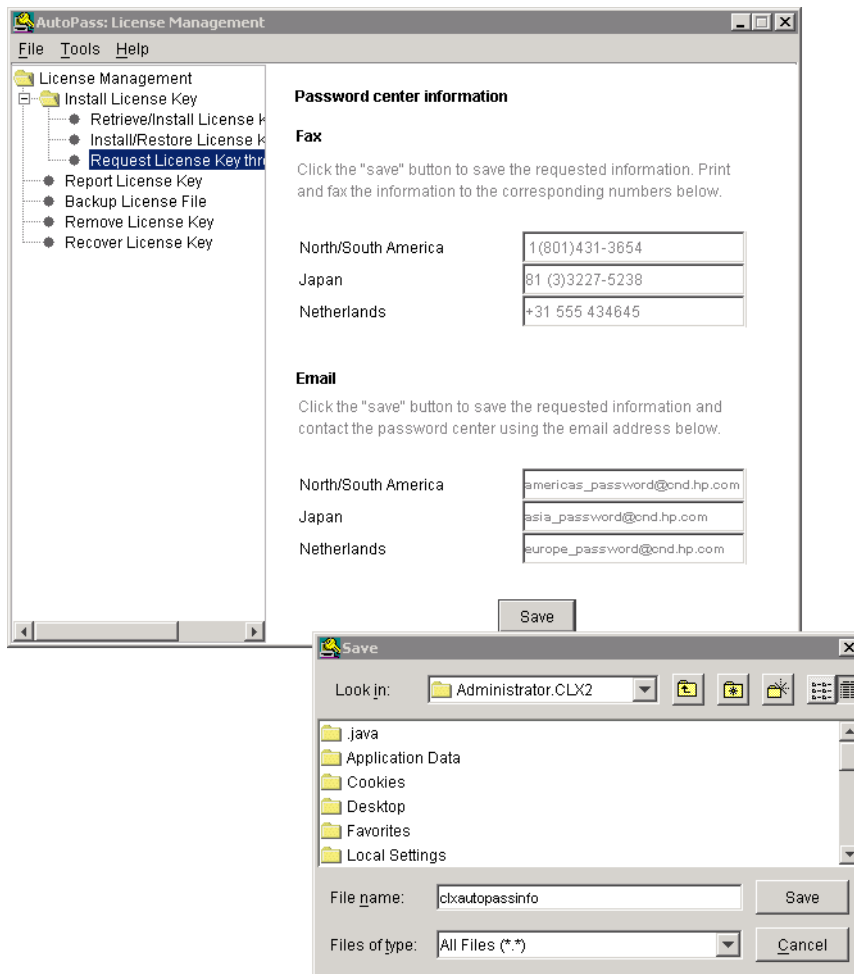
14. If the license owner is not the same as the license requestor, enter the requested information for the license owner.

15. Click **Next**. The Information Summary window opens.



16. Check the information summary carefully, and click **Back** to go to the previous window to change incorrect details.

17. Click **Next**. The Password center information window displays.



- Follow the instructions in the Password center information window for faxing or e-mailing your license key request to the HP Password Center. Click **Save** and choose your preferred location to save your information.

Importing a license key into AutoPass

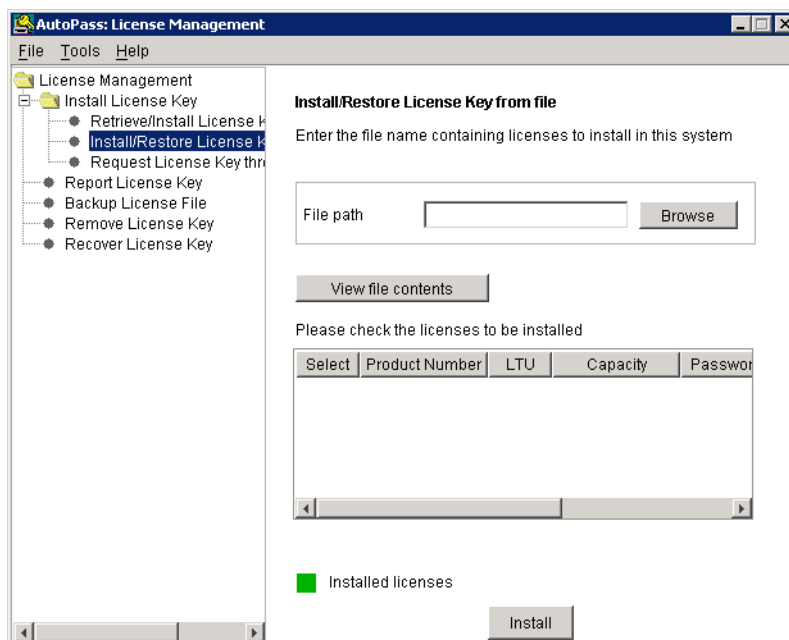
You may request license keys by contacting the HP Password Center by phone, e-mail, or fax, or from the web at: www.webware.hp.com. When you receive a license key by e-mail, use the AutoPass program as described in this section to import the license key from a saved file into HP CLX EVA.

- To request a license key by phone, fax, or email, contact the nearest HP Password Center using the contact information in [Table 7](#). You will need your entitlement certificate information, such as HP order number, product LTUs, and quantities you purchased.

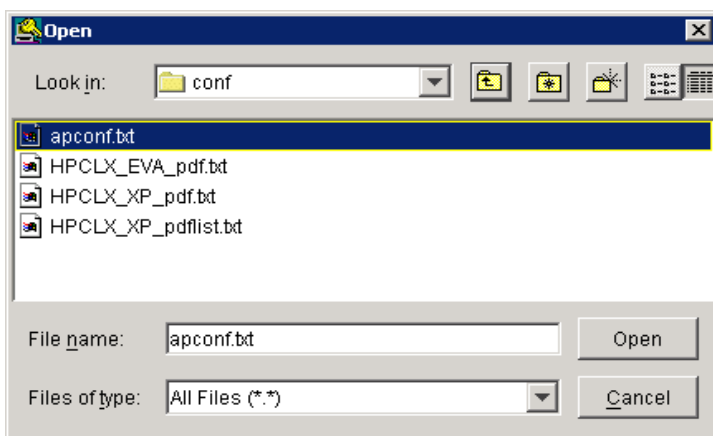
Table 7 HP Password Center contact information

Location	Phone Number	Fax Number	Email
North/South America	(801) 431-1597 or (800) 326-0411	(801) 431-3654	americas_password@cnd.hp.com
Europe/Africa	(+31-55-543-4642)	(+31-55-543-4645)	europa_password@cnd.hp.com
Asia Pacific	Outside Japan (+81-3-3227-5672) In Japan (+81-03-3227-5264)	(+81-3-3227-5238)	asia_password@cnd.hp.com

- The HP Password Center e-mails a license key password certificate to you as an attachment.
- Save the attachment file in a location accessible by the system where you run AutoPass. When saving the file, do not use the file name `LicFile.txt` because that name is used by AutoPass as the destination file name for installed license keys.
- Open the saved license key file using a text editor. Follow the instructions in the license key file to perform required editing of the license password.
- Open AutoPass by running the `clxautopass` utility:
`clxautopass -ovlicensemgr`
- Click **Install/Restore License Key** in the left pane.

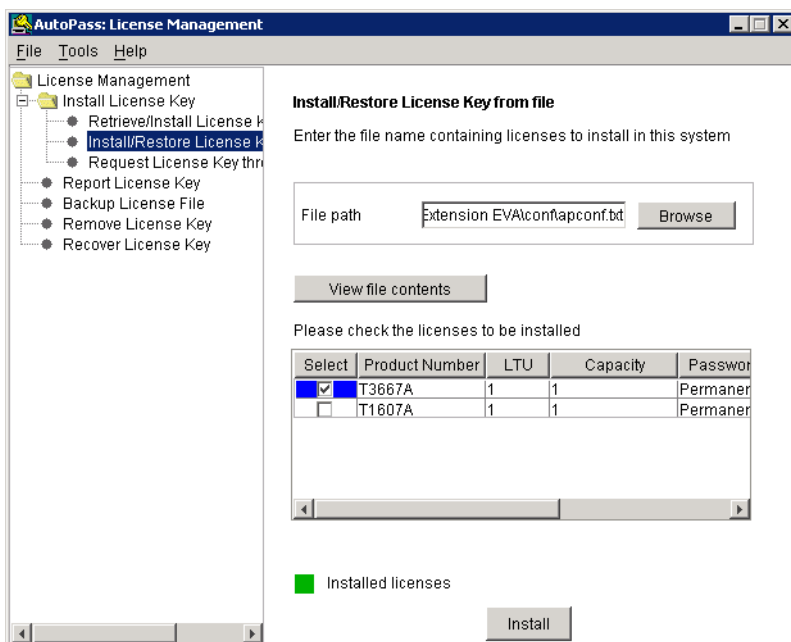


7. Click **Browse**.

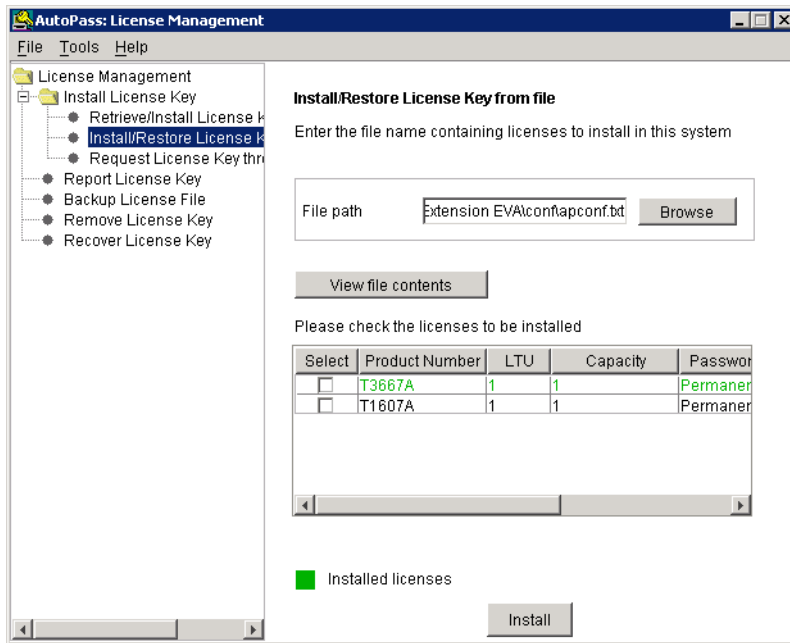


8. Browse to the license key file. Find the file, highlight it, and click **Open**. You return to the Install/Restore License Key from file window.

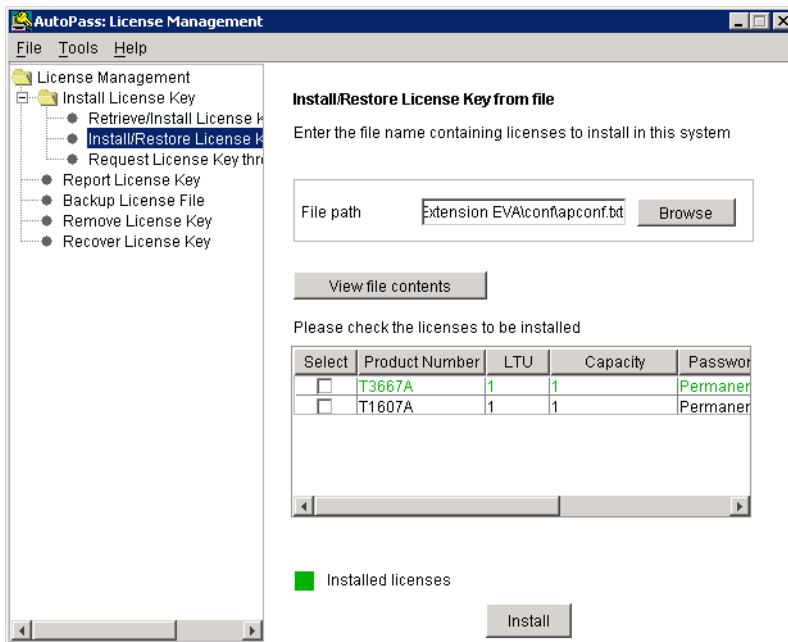
9. Click **View file contents** to display the details for the selected license key file.



10. Click the boxes for passwords (license keys) you want to import into AutoPass, and then click **Install**. Passwords for the selected products are imported into the AutoPass License file (LicFile.txt) on your local system.



Products that had licenses successfully installed are indicated by a different color font, as designated by the Installed licenses legend at the bottom of the screen.



Requesting a 60-day trial extension

If you want to request a 60-day trial (evaluation) license key extension, you can do so directly at the HP Password Center. Go to the web site: www.webware.hp.com. The trial license code for your HP CLX EVA product trial software is TRIAL-CLX_EVA. The trial license extension will give you a one-time 60-day extension.

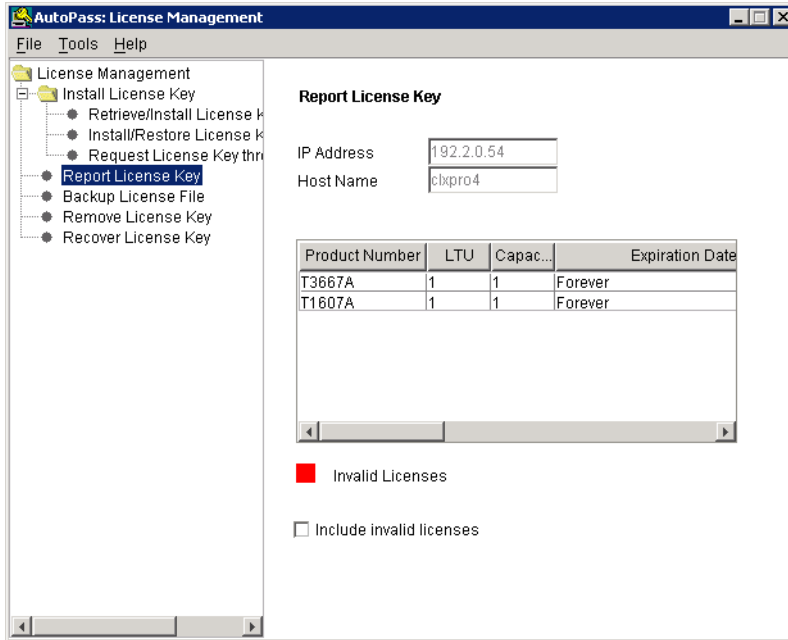
You will receive your trial license key by email. Import the license key using the process described in "Importing a license key into AutoPass" on page 55.

License options

Report license key

To view a report of the license keys installed on the system:

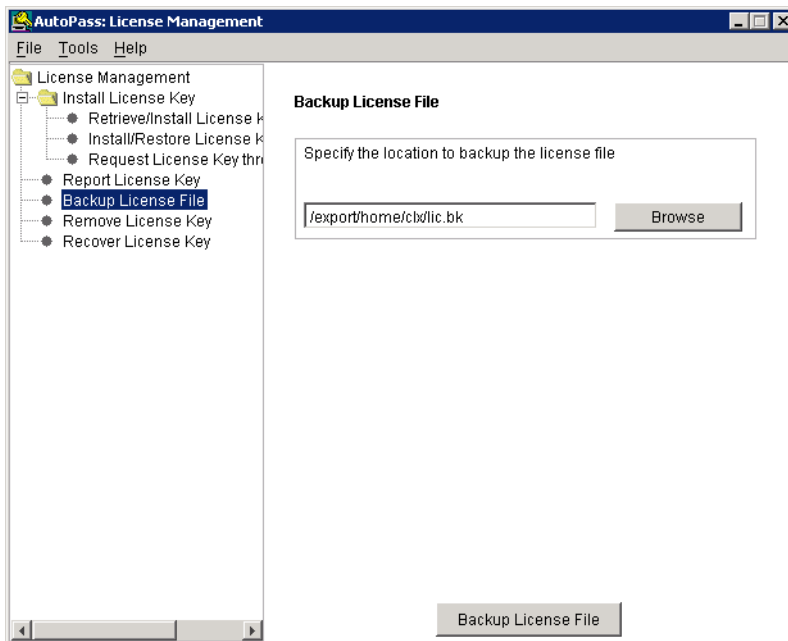
1. Run `clxautopass -ovlicensemgr`
2. When AutoPass opens, select **Report License Key** in the left pane.



Backup license file

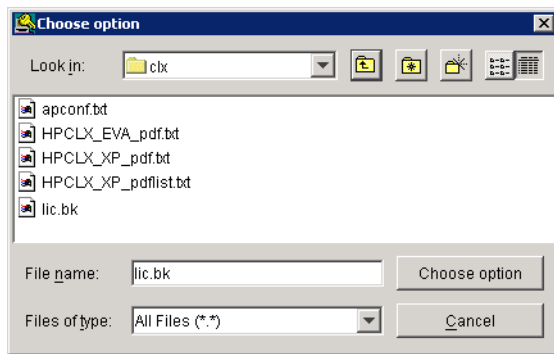
To back up the AutoPass license file `LicFile.txt`:

1. Run `clxautopass -ovlicensemgr`.
2. When AutoPass opens, select **Backup License File** in the left pane.



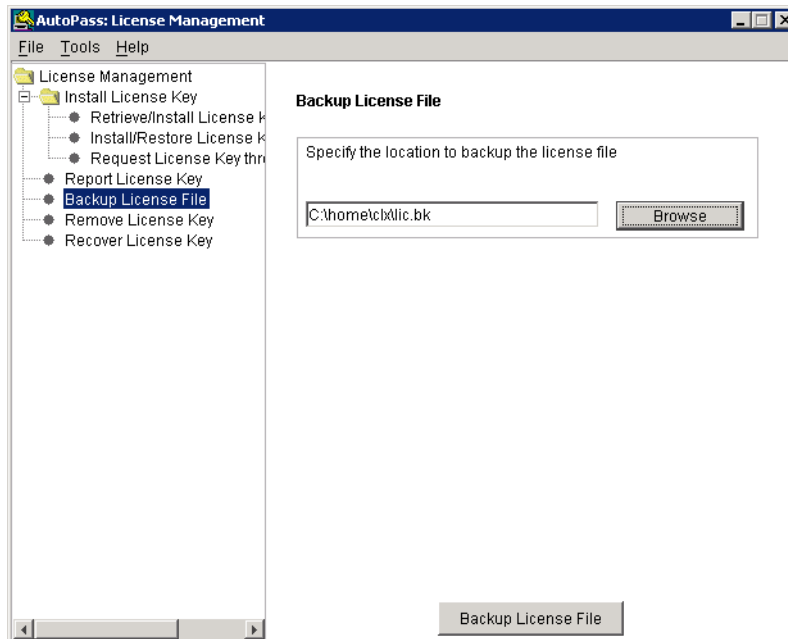
3. In the Backup License File window, click **Browse** to specify the location and file name where you want to save the backup copy of the AutoPass license file.

The Choose option window displays.



4. Browse to the directory you want to use. Enter a file name in the **File name** field.
5. Click **Choose option** to return to the Backup License File window.

The Backup License File window displays.

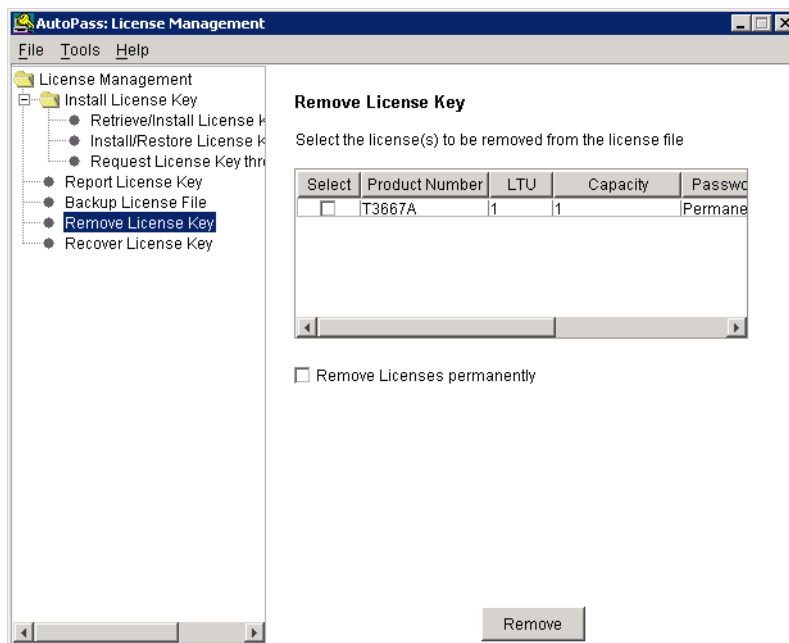


6. Click **Backup License File** to save the AutoPass license file to the specified backup file location.

Remove license key

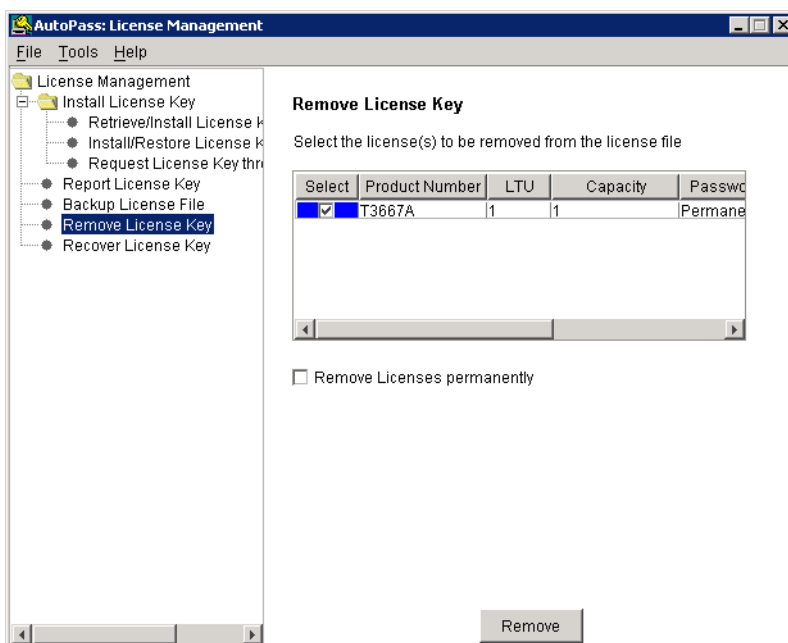
To remove license keys from your system for products that are no longer being used or have been removed:

1. Run `clxautopass -ovlicensemgr`.
2. When AutoPass opens, click **Remove License Key** in the left pane.



- In the Remove License Key window, select the license keys you want to remove. You can permanently remove licenses by clicking the **Remove Licenses permanently** box.

NOTE: Licenses that are permanently removed cannot be recovered using the Recover License Key option. They must be reinstalled.

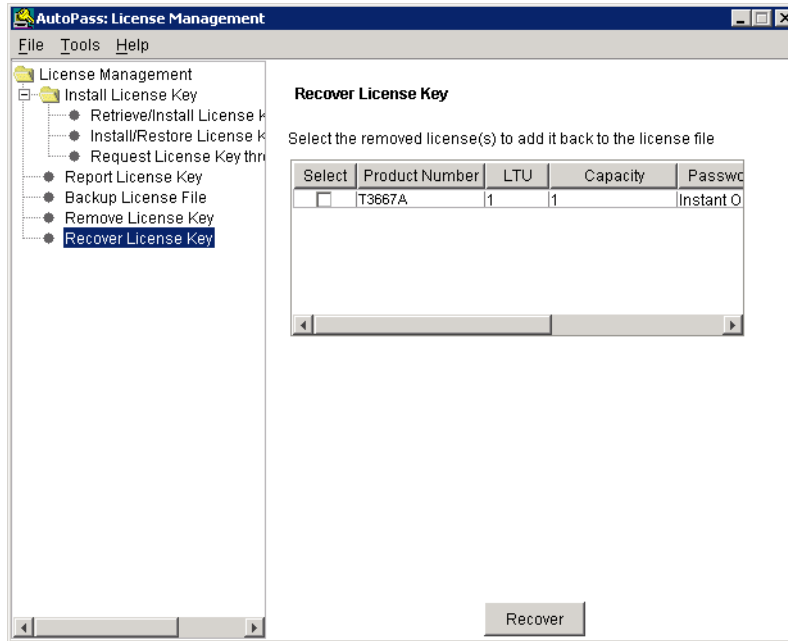


- Click **Remove** to remove the license from the AutoPass license file. The list of installed licenses updates after you click Remove.

Recover license key

To recover a license key that was previously removed:

1. Run `clxautopass -ovlicensemgr`.
2. When AutoPass opens, select **Recover License Key** in the left pane.



3. Select the licenses you want to add back to the AutoPass license file and click **Recover**. The list of removed licenses updates after you click Recover.

clxautopass command-line utility

In addition to using `clxautopass` to start the AutoPass GUI, you can use `clxautopass` to install the instant-on license and import a password from the license key file.

Installing the instant-on license

In cases where the HP CLX EVA installation process failed to install the 60-day instant-on license, use `clxautopass` to install it. Repair any conditions that may have caused the instant-on license installation to fail. Then run the following command to install the instant-on license:

```
clxautopass -installinstanton
```

Importing a license key from a file

Once you receive the license key file by e-mail, you can import the license key using the command-line instead of using the AutoPass GUI. To import the license key, run the following command:

```
clxautopass -addpasswords <license file path>
```

where *<license file path>* is the full (absolute) path name to the license key file.

The `clxautopass -addpasswords` command is equivalent to selecting the **Install/Restore License Key** from file option in the AutoPass GUI.

Upgrading HP CLX EVA

Procedure

You cannot upgrade to the current version of HP CLX EVA. You must first remove the previous version and then install the current version. See [“Removing HP CLX EVA” on page 61](#).

Removing HP CLX EVA

Procedure

To remove HP CLX EVA, follow this procedure using InstallShield:

1. Click **Start > Control Panel > Add or Remove Programs**.
2. Click **Cluster Extension EVA 1.01.00** and click **Change/Remove**.

3. Select **Remove** on the Welcome window and click **Next**.
4. Click **Yes** on the confirmation window to remove HP CLX EVA.
5. Choose **Yes** to unregister the HP CLX EVA resource type from the Microsoft Cluster Administrator. HP CLX EVA resource type will not be available to the other nodes in the cluster.
Choose **No** to not unregister the HP CLX EVA resource type from the Microsoft Cluster Administrator. HP CLX EVA resource type will still be available to the other nodes in the cluster.

NOTE: If you choose to unregister the HP CLX EVA resource, but the Microsoft Cluster Service is not installed and running, a window will display indicating that setup was not able to determine if Microsoft Cluster Service is running. Microsoft Cluster Service must be installed and running for setup to unregister the HP CLX EVA resource.

6. If you have a `clxsmiscfg` file on your system under the HP CLX EVA installation path `bin` directory, setup will ask you to save this file.

If you choose yes to save this file, then you will be prompted to select a location to save this file.

Export/Save HP SMI-S configuration file option

When removing HP CLX EVA, you will be prompted to export/save the existing `clxsmiscfg` file to a local directory. You can import this file when you perform an update installation of HP CLX EVA.

Troubleshooting Installation Problems

Register HP CLX EVA resource manually

Execute the following commands from the Microsoft Cluster service command-line to register the HP CLX EVA resource manually when a problem has occurred during installation.

1. Check whether the HP CLX EVA resource type is registered with Microsoft Cluster service:

```
\cd %SystemRoot%\system32
cluster resourcetype
```

2. Register the HP CLX EVA resource type with Microsoft Cluster service:

```
cluster resourcetype "Cluster Extension EVA" /CREATE /DLLNAME:clxevamscs.dll
/TYPE:"Cluster Extension EVA"
```

3. Check whether the HP CLX EVA cluster extension DLL is registered with Microsoft Cluster service to provide the Microsoft Cluster service Cluster Administrator GUI functionality:

```
cluster resourcetype "Cluster Extension EVA" /PROPERTIES
```

4. Register the HP CLX EVA cluster extension DLL with Microsoft Cluster service:

```
cluster /REGADMINEXT:clxevamscsex.dll
```

Reconfigure HP CLX EVA

You can run the HP CLX EVA installation program after you have installed one or more product components. Now the installation begins in maintenance mode, from which you can optionally add or remove individual components, repair or update installed components, or remove all components.

Use the Setup Maintenance screen to make installation changes.

Modify function

Select **Modify** from the Maintenance dialog box to add or remove HP CLX EVA components by clicking or clearing the box associated with each component. Only those components that are checked are installed; all other components are removed.

Repair function

Select **Repair** from the Maintenance dialog box to search for installed components and reinstall them (without having to first remove the components). This enables easy changes to component configurations without, in most instances, disrupting the cluster service.

Remove function

Before using the Remove function to remove all HP CLX EVA components, you must remove the HP CLX EVA resource type.

Remove resource type

To remove the HP CLX EVA resource type from the system, you must first remove the individual HP CLX EVA resources. Refer to the Microsoft Cluster documentation for instructions about how to remove resources.

1. Before you can remove the HP CLX EVA resource type from the server, first either offline the resource groups or move the resource groups that contain a HP CLX EVA resource to another cluster node.
2. Remove the node from the list of possible owners and from the node name list of the HP CLX EVA resource.
3. Open the **Add/Remove Programs** utility from the Control Panel. Select **HP StorageWorks Cluster Extension EVA** in the Change or Remove Programs pane. In the setup maintenance Welcome dialog box, select **Modify** to remove only the resource type while leaving other components installed.
4. Ensure that Cluster Resource Type is not checked, then click **Next**. Select **Remove** to remove all HP CLX EVA components.

Disable the HP CLX EVA resource DLL

Before you can disable the resource DLL, you must first offline the resource group or switch the resource group to another system.

To remove the HP CLX EVA resource from the cluster group:

1. Determine whether the resource group is online or offline.
2. If the resource group is offline, you can remove the Cluster Extension EVA resource from the resource group.

If the resource group is online, take the resource group offline or move the resource group with the following command from the Microsoft Cluster service command line:

```
cluster group resource_group  
cluster group resource_group /moveto: system_name  
cluster group resource_group
```

or:

```
cluster group resource_group /offline  
cluster group resource_group
```

Related Information

For information about how to remove a resource, see [“Deleting a Cluster Extension EVA resource” on page 132](#).

4 User configuration file and HP CLX EVA objects

Objects define the storage system environment and failover/failback behavior. You can customize objects in the user configuration file or directly in the cluster software.

User configuration file

HP CLX EVA gathers application service-specific information from the user configuration file `UCF.cfg`. This file describes the dependencies between application services and HP Continuous Access EVA DR groups in one file for all application services in the cluster.

A sample of `UCF.cfg` is located in the `/sample` directory.

You must copy the user configuration file to the configuration directory of all nodes that use HP CLX EVA.

By default, this location is defined as:

```
%ProgramFiles%\Hewlett-Packard\Cluster Extension EVA\conf
```

Related information

For related information, refer to [“Basic configuration example” on page 73](#) and [“Creating and configuring the user configuration file” on page 143](#).

NOTE: HP CLX EVA integration with Microsoft Cluster service does not require a user configuration file when the standard environment for HP CLX EVA is used. The HP CLX EVA objects that are integrated with Microsoft Cluster service are configurable as resource private properties in the cluster software. For more information, see [“Configure Cluster Extension EVA resources” on page 66](#).

File structure

The user configuration file includes a common section and an application section, distinguished by `COMMON` and `APPLICATION` control tags, respectively. Objects in both sections have one of the following formats:

Table 8 Object formats and descriptions

Format	Descriptions
tag	A definition of an object, for example, <code>COMMON</code> or <code>APPLICATION</code> .
integer	A number (for example, a timeout value).
string	A name, which can include alphabetic and numeric characters and underscores (for example, an application startup value).
list	A list of space-separated strings (for example, a list of host names). Lists of numbers are stored as lists of strings.

Specifying object values

When using the default configuration, you must provide values for the following objects:

- `CSObjectPathA` ([page 70](#))

- CSObjectPathB (page 70)
- DC_A_Hosts (page 71)
- DC_B_Hosts (page 71)
- DC_A_ManagementHosts (page 71)
- DC_B_ManagementHosts (page 71)
- DC_A_StorageCellWWN (page 72)
- DC_B_StorageCellWWN (page 72)
- DeviceGroup (page 72)

You do not need to change the default settings unless you want to change the degree of protection for your DR group members. If you change an object, you may also need to change additional objects. For example, if you change the `FailsafeMode` object to **enable**, you might also need to change the `FailsafeModeOverride` object.

Objects are supported according to the requirements or capabilities of the cluster software, as listed in Table 9.

Table 9 Object support

Name	CLI	MS Cluster Service
COMMON	•	•
LogDir	•	•
LogLevel	•	•
SmisRequestRetries	•	•
SmisRequestTimeout	•	•
APPLICATION	•	•
ApplicationDir	•	•
ApplicationStartup	•	•
* CSObjectPathA	•	•
* CSObjectPathB	•	•
* DC_A_Hosts	•	•
* DC_B_Hosts	•	•
* DC_A_ManagementHosts	•	•
* DC_B_ManagementHosts	•	•
* DC_A_StorageCellWWN	•	•
* DC_B_StorageCellWWN	•	•
* DeviceGroup	•	•
FailsafeMode	•	•
FailsafeModeOverride	•	•
Filesystems	•	
PostExecScript	•	•
PreExecScript	•	•
ResyncWaitTimeout	•	•
UseNonCurrentDataOk	•	•
Vgs	•	

Legend

* Required

• Supported

COMMON objects

The common section of the configuration file sets the environment of HP CLX EVA.

The `COMMON` tag is a single tag that appears only once in the configuration file, and does not require any value.

Objects of the type common can only appear once, and must be placed after the `COMMON` tag.

If the default values fit your environment, there is no need to specify them in the file.

COMMON

Format	tag
Description	Distinguishes between general (common) and application-specific objects.

LogDir

Format	string
Description	<i>(Optional)</i> Defines the path to the HP CLX EVA log file.
Default value	%ProgramFiles%\Hewlett-Packard\Cluster Extension EVA\log

LogLevel

Format	string
Description	<i>(Optional)</i> Defines the logging level used by HP CLX EVA.
	<code>error (default)</code> Logs <code>error</code> messages only for events that are nonrecoverable.
	<code>warning</code> Logs <code>error</code> messages and <code>warning</code> messages for events that are recoverable.
	<code>info</code> Logs <code>error</code> messages, <code>warning</code> messages, and additional information, such as disk status.
	<code>debug</code> Logs <code>error</code> messages, <code>warning</code> messages, <code>info</code> messages, and messages that report on execution status. Useful for troubleshooting.

SmisRequestRetries

Format	string
Description	<i>(Optional)</i> Specifies the number of retries HP CLX EVA will attempt for an HP SMI-S Continuous Access EVA management command on each SMA.
Default value	0

SmisRequestTimeout

Format	string
--------	--------

Description	(Optional) Defines the maximum amount of time (in milliseconds) an HP SMI-S Continuous Access EVA management command can run before the command is timed out. This object is used by all components within HP CLX EVA that interfaces with HP SMI-S including the <code>clxconf</code> utility, the Connection Test function in the administrator GUI and the HP CLX EVA resource DLL. You must consider this when setting the <code>SmisRequestTimeout</code> to a value other than the default. Setting the <code>SmisRequestTimeout</code> to a value less than the default will increase the chance that the HP CLX EVA resource DLL will timeout and not complete the online of the HP CLX EVA resource. Setting the <code>SmisRequestTimeout</code> to a value greater than the default will increase the time in which you will get a response from user interface functions such as the Connection Test function and the <code>clxconf</code> utility if HP SMI-S does in fact have a longer response time than the <code>SmisRequestTimeout</code> value.
Default value	180000

APPLICATION objects

The application section of the configuration file defines failover and failback behavior of HP CLX EVA for each application service. `APPLICATION` is a multitag that can appear in the configuration file for each application service using HP CLX EVA.

The `APPLICATION` object requires the name of the application service as its value. The objects specified after an `APPLICATION` tag must appear only once per application. Like common objects, application objects have predefined default values.

HP CLX EVA uses the following rules to define objects:

- If you use the default value, you do not need to specify the object.
- The processing of object settings may depend on the setting of other objects. For example, if you set `FailsafeMode` to **enable**, HP CLX EVA uses the values specified for `FailsafeModeOverride`. However, this object is ignored if you set `FailsafeMode` to **disable**.
- The pre-execution and post-execution functions in HP CLX EVA will not be processed if the associated object values are empty. (This is the default setting.)

To set `APPLICATION` object values for the command-line interface, modify the user configuration file.

To set `APPLICATION` object values for Microsoft Cluster service, use the Microsoft Cluster Service Cluster Administrator GUI.

APPLICATION

<i>Format</i>	tag
<i>Description</i>	Distinguishes between general and application-specific objects. Specify the name of the application service. The format of its value is equivalent to a string value.

ApplicationDir

<i>Format</i>	string
---------------	--------

<i>Description</i>	<p>Specifies the directory where HP CLX EVA searches for application-specific files, such as the force flag or online file.</p> <p>If you set <code>ApplicationDir</code> to a nonexistent drive, HP CLX EVA is unable to create the online file and cannot bring the resource online.</p> <p>If you do not set <code>ApplicationDir</code>, HP CLX EVA uses the local <code>%HPCLX_EVA_PATH%</code> values as defined in the registry during initial installation.</p>
<i>Default value</i>	<code>%HPCLX_EVA_PATH%</code>
<i>Files</i>	<p><code>resource_name.forceflag</code> <code>resource_name.online</code></p> <p>If specified in a user configuration file, <code>resource_name</code> is the value of the <code>APPLICATION</code> tag; otherwise, <code>resource_name</code> is the value of the HP CLX EVA resource name.</p>

ApplicationStartup

<i>Format</i>	string
<i>Description</i>	<p>(Optional) Specifies where a cluster group should be brought online.</p> <p>You can customize the <code>ApplicationStartup</code> object to determine whether an application service starts locally or is transferred back to the remote data center (if possible) to start directly without waiting for resynchronization. This object is used only if an application service has already been transferred to the secondary site and no recovery procedure has been applied to the DR group (the DR group has not been recovered and is not in a normal state). This process is considered a failback attempt without prior DR group recovery.</p> <p>HP CLX EVA can detect the most current copy of your data based on the DR group state information. If HP CLX EVA detects that the remote HP EVA storage system has the most current data, it will either wait for the resynchronization of the local vdisk to complete before proceeding with the failover, or stop the startup process to enable the cluster software to fail back to the remote HP EVA storage system.</p> <p>If a resynchronization is in progress, HP CLX EVA monitors the progress of the copy process. If the application service was running on a destination (secondary) HP EVA storage system without a replication link, a large number of records may need to be copied. If the copy process takes more time than the configured application startup timeout, the application startup will fail.</p>

Microsoft Cluster service-specific behavior

If the `ApplicationStartup` resource property is set to `FASTFAILBACK` and the `FailoverThreshold` value of the resource group is set to a number higher than the current number of clustered systems for the resource group, the resource group will restart on configured nodes until one of the following conditions is met:

- The resource is brought online in the remote data center.
- The resource failed because the `FailoverThreshold` value has been reached.
- The resource failed because the `FailoverPeriod` timeout value has been reached.

CAUTION: Disable subsequent automated failover operations for recovery failback operations. This means that if you want to use HP CLX EVA's capabilities to recover a suspended DR group state during a failover, make sure that follow-on failover operations are disabled in case the recovery attempt fails. To disable subsequent failover attempts, set the `FailoverThreshold` to zero (0) until the recover operation has finished successfully.

<i>Valid values</i>	<p><code>FASTFAILBACK</code> (<i>default</i>) The cluster group is brought online in the remote data center (if possible) without waiting for resynchronization. The application startup process is stopped locally, and HP CLX EVA reports a data center error. Depending on the cluster software, the application service cannot start on any system in the local data center and the cluster software transfers the application service back to the remote data center.</p> <p>Use this value to provide the highest application service uptime.</p> <p>In a two-node cluster, this process does not work because the target failback system is not available. In this case, you must start the application service manually, or set the <code>ApplicationStartup</code> object to <code>RESYNCWAIT</code>.</p> <p><code>RESYNCWAIT</code></p> <p>Online local. The resource group must wait until the DR group status is no longer merging or copying. HP Continuous Access EVA initiates a resynchronization of the local vdisk based on the remote vdisk. HP CLX EVA monitors the copy process. If no copy progress is made after a monitoring interval expires, the copy process is considered failed, and HP CLX EVA returns a global error. If you specified <code>RESYNCWAIT</code> for the <code>ApplicationStartup</code> object, you must specify the <code>ResyncWaitTimeout</code> object, in case HP CLX EVA should wait for resynchronization changes for more or less than 90 seconds, which is the default.</p>
---------------------	--

CSObjectPathA

<i>Format</i>	string
<i>Description</i>	(Required) Specifies the <code>HPEVA_ConsistencySet</code> object path for the DR group in data center A. This object path is used in sending management commands directed at the HP Continuous Access EVA DR group.

Microsoft Cluster service-specific behavior

This is a private property for the HP CLX EVA resource type within Microsoft Cluster service. HP CLX EVA automatically runs the Connection Test and updates the consistency set object paths as necessary when the **OK** or **Apply** buttons are selected on the **Parameters** tab.

Command-line interface-specific behavior

You must enter this object in the user configuration file (`UCF.cfg`) when you use HP CLX EVA's command-line interface. To obtain the value of this object, run the `clxconf.exe` utility (see "[clxconf](#)" on [page 147](#)).

CSObjectPathB

<i>Format</i>	string
<i>Description</i>	<p>(Required) Specifies the HPEVA_ConsistencySet object path for the DR group in data center B. This object path is used in sending management commands directed at the HP Continuous Access EVA DR group.</p> <p>Microsoft Cluster service-specific behavior</p> <p>This is a private property for the HP CLX EVA resource type within Microsoft Cluster service. HP CLX EVA automatically runs the Connection Test and updates the consistency set object paths as necessary when the OK or Apply buttons are selected on the Parameters tab.</p> <p>Command-line interface-specific behavior</p> <p>You must enter this object in the user configuration file (UCF.cfg) when you use Cluster Extension EVA's command-line interface. To obtain the value of this object, run the clxconf.exe utility (see "clxconf" on page 147).</p>

DC_A_Hosts

<i>Format</i>	list
<i>Description</i>	(Required) Space-separated list of the cluster nodes in data center A.

DC_B_Hosts

<i>Format</i>	list
<i>Description</i>	(Required) Space-separated list of the cluster nodes in data center B.

DC_A_ManagementHosts

<i>Format</i>	list
<i>Description</i>	<p>(Required) Space-separated list of management agent servers or SMAs for data center A. HP CLX EVA attempts to establish a management path (SMI-S) connection with one of the management servers on the hosts in the list. The first host in the list that establishes a successful connection with HP CLX EVA is used as the management path for the failover operation. HP CLX EVA attempts to connect to the management hosts in the local data center first, before using management hosts in the remote data center. The hosts listed for data center A are associated with data center A and do not necessarily need to be physically located in data center A. You can specify the hosts using either the system host name or the IP address.</p>

DC_B_ManagementHosts

<i>Format</i>	list
---------------	------

<i>Description</i>	<i>(Required)</i> Space-separated list of management agent servers or SMAs for data center B. HP CLX EVA attempts to establish a management path (SMI-S) connection with one of the management servers on the hosts in the list. The first host in the list that establishes a successful connection with HP CLX EVA is used as the management path for the failover operation. HP CLX EVA attempts to connect to the management hosts in the local data center first, before using management hosts in the remote data center. The hosts listed for data center B are associated with data center B and do not necessarily need to be physically located in data center B. You can specify the hosts using either the system host name or IP address.
<hr/>	
DC_A_StorageCellWWN	
<i>Format</i>	string
<i>Description</i>	<i>(Required)</i> The WWN of the HP EVA storage system located in data center A. This is the node WWN value indicated in the Storage System Properties page in HP Command View EVA.
<hr/>	
DC_B_StorageCellWWN	
<i>Format</i>	string
<i>Description</i>	<i>(Required)</i> The WWN of the HP EVA storage system located in data center B. This is the node WWN value indicated in the Storage System Properties page in HP Command View EVA.
<hr/>	
DeviceGroup	
<i>Format</i>	string
<i>Description</i>	<i>(Required)</i> HP Continuous Access EVA DR group, containing the application service disk set.
<hr/>	
FailsafeMode	
<i>Format</i>	string
<i>Description</i>	<i>(Optional)</i> Specifies the failsafe mode configured for the DR group. This object is used to make sure your configurations are supported based on consistency considerations. Different failover and recovery procedures are used for different failsafe modes. If you change the <code>FailsafeMode</code> object value, also review the value of the <code>FailsafeModeOverride</code> object.
<i>Valid values</i>	disable <i>(default)</i> enable
<hr/>	
FailsafeModeOverride	
<i>Format</i>	string
<i>Description</i>	<i>(Optional)</i> Specifies whether HP CLX EVA can disable the failsafe mode configured for the DR group during a failover, if necessary. This object is only used if <code>FailsafeMode</code> is enabled for the DR group. Disabling <code>FailsafeMode</code> may leave the data at the destination site in a non-current state. Setting <code>FailsafeModeOverride</code> to <code>yes</code> allows for highest data availability with the compromise of data currency at the destination site.
<i>Valid values</i>	NO <i>(default)</i> YES

PostExecScript

Format string

Description (Optional) Specifies an executable with its full path name to be invoked after the failover action or failover procedure. You may include environment variables in path names. You must not specify arguments to be passed to the executable.

PreExecScript

Format string

Description (Optional) Specifies an executable with its full path name to be invoked before the failover action or failover procedure. You may include environment variables in path names. You must not specify arguments to be passed to the executable.

ResyncWaitTimeout

Format integer

Description (Optional) Specifies the timeout value, in seconds, for a DR group member resynchronization. It may take some time to resynchronize member vdisks. The timer times out if there is no change in the percentage value of the copy status for the DR group in the specified time interval. The timeout value is used if the `ApplicationStartup` object is set to `RESYNCWAIT`.

Default value 90

UseNonCurrentDataOk

Format string

Description (Optional) Specifies whether HP CLX EVA can fail over to the destination site in cases where the data at the destination site may not be current. When this is set to `yes`, HP CLX EVA proceeds with the failover even in cases where the destination data may not be current. When this is set to `no`, HP CLX EVA does not allow the failover to occur on any nodes in the local data center, hence forcing the cluster software to move the application resource back to a node in the remote data center at the source site.

Valid values NO (default)
YES

Basic configuration example

This is an example of a basic `UCF.cfg` file.

NOTE: The values of any object must be on the same line as the object name. The example below shows the values for `CSObjectPathA` and `CSObjectPathB` on multiple lines but this would be incorrect if specified in the configuration file.

```
#\Program Files\Hewlett-Packard\Cluster Extension EVA\conf\UCF.cfg
#This is the Cluster Extension EVA User Configuration File (UCF.cfg).
#The COMMON tag specifies the configuration for the
#Cluster Extension EVA core environment
\n
COMMON
LogLevel info #default (not necessary)
\n
APPLICATION sap #the application service
DeviceGroup \Data Replication\DRG004 #DrGroup
DC_A_StorageCellWWN 50001fe15002B5A0
DC_B_StorageCellWWN 50001fe15002B570
```

5 Integration with Microsoft Cluster service

HP CLX EVA for Windows integrates with Microsoft Cluster service as a resource DLL. This allows cluster administrators to configure the storage system-specific failover behavior as easily as any other resource DLL in the cluster service.

Configuring HP CLX EVA resources

HP CLX EVA objects are configurable as properties of the specific HP CLX EVA resource. The value of a HP CLX EVA object can be compared with the value of a Microsoft Cluster service resource private property.

If you use the default values for HP CLX EVA `COMMON` objects, no user configuration file is required. The HP CLX EVA resource gathers all necessary information about the resource group and the storage systems while the HP CLX EVA resource is brought online.

HP CLX EVA creates a `resource_name.online` file to indicate that the HP EVA resource is online on the local node. This file is created in the directory specified by the `ApplicationDir` resource property. If the resource is taken offline, this file is deleted.

The HP CLX EVA resource can be configured using either the Microsoft Cluster service command-line interface or the Cluster Administrator GUI.

Two required property values can be set automatically only through the Cluster Administrator GUI. The values of the HP CLX EVA objects `CSObjectPathA` and `CSObjectPathB` are gathered and set by running the Connection Test. This test checks if the provided HP EVA WWNs and DR Group names are valid and accessible through the provided SMAs. To set these private properties using the command-line interface, use the `clxconf` command and configure a `UCF.cfg` file.

After installing HP CLX EVA for Windows, you create a new HP CLX EVA resource by adding a resource of the type HP CLX EVA to your desired resource group. The HP CLX EVA resource type definition is preconfigured to fit most HP Continuous Access EVA configurations.

Resource names and resource group names

HP CLX EVA resource names and resource group names must be single words. You may use the underscore or hyphen character to join different words.

Example

`CLX_resource`

HP CLX EVA resource-specific parameters

Prior to configuring the resource properties, review the HP CLX EVA objects described in [“User configuration file and Cluster Extension EVA objects”](#) on page 101.

Setting non-CLX EVA resource-specific parameters

Microsoft allows specific failover parameter and threshold values to be set by the user for a resource group as well as for a resource.

You must change these values in a HP CLX EVA environment to be able to take certain manual recovery actions in case of a disaster.

Resource properties

HP CLX EVA requires that you change the values of some of the following resource properties provided by Microsoft Cluster service. The resource properties listed below that have a “Required value” field must be changed for each HP CLX EVA resource to match the specified required value.

<hr/>	
IsAlivePollInterval	
Format	integer
Description	Used to poll the Alive state for the resource (in milliseconds). Decreasing this value allows for faster resource failure detection but consumes more system resources.
Default value	60000
<hr/>	
LooksAlivePollInterval	
Format	integer
Description	Used to poll the Alive state for the resource (in milliseconds). HP CLX EVA calls the <code>IsAlive</code> routine with each <code>LookAlive</code> routine, automatically. Therefore, it does not make sense to set both interval values to different values. Decreasing this value allows for faster resource failure detection but consumes more system resources.
Default value	60000
<hr/>	
PendingTimeout	
Format	integer
Description	Used to specify the timeout for status resolution (in seconds). This value is the Microsoft default value. See “Timing considerations for Microsoft Cluster service” <blue>(page 83)</blue>.
Default value	180
<hr/>	
RestartAction	
Format	integer
Description	Defines whether a resource can be automatically restarted after it has failed. The value must affect the group. This ensures that the resource group fails over to another system in case a resource is reported FAILED.
Valid values	0 (do not restart) 1 (restart) 2 (restart and affect the group) (default)
<hr/>	
RestartPeriod	
Format	integer
Description	Determines amount of time for restart (in seconds). This value is the Microsoft default value. It is not used if <code>RestartThreshold</code> is 0.
Default value	900
<hr/>	
RestartThreshold	
Format	integer
Description	Determines number of restart attempts. This value must be 0. It does not make sense to restart the HP CLX EVA resource on the same system several times without fixing the problem encountered by HP CLX EVA.
Required value	0
<hr/>	

Resource group properties

HP CLX EVA requires that you change the values of the following group properties provided by Microsoft Cluster service.

AutoFailbackType	
Format	integer
Description	Prevents automatic fail back of a resource group to its primary system. The resource group should be transferred back manually after the failure has been recovered. This allows for recovery of all possible failure sources and pair resynchronization (if necessary) while the application service is still running.
Required value	0

FailoverPeriod	
Format	string
Description	Determines time (in hours) the cluster service attempts to failover a resource group. This value is the Microsoft default value. See “Timing considerations for Microsoft Cluster service” on page 83 .
Default value	6

FailoverThreshold	
Format	integer
Description	Determines number of failover attempts. The recommended setting allows the Cluster service to transfer the resource group to each system once in case of subsequent system failure. Because of the nature of this parameter, it is possible that the resource group automatically restarts on a system several times if not all cluster nodes are active members of the cluster at that time. If this value is a number higher than the current number of clustered systems for the resource group, the resource group restarts until either the <code>FailoverThreshold</code> value or the <code>FailoverPeriod</code> timeout value is reached.
Valid values	Number of systems in the resource group node list minus 1.
Default value	10

There are several other property values you may set to change the cluster failover behavior, for example, to change the arbitration timing. These values do not need to be changed in HP CLX EVA environments.

Adding a HP CLX EVA resource

To use the Microsoft Cluster service command-line to add a HP CLX EVA resource:

Syntax

```
cluster resource resource_name /create /group: resource_group_name /type:"Cluster Extension EVA"
```

Example

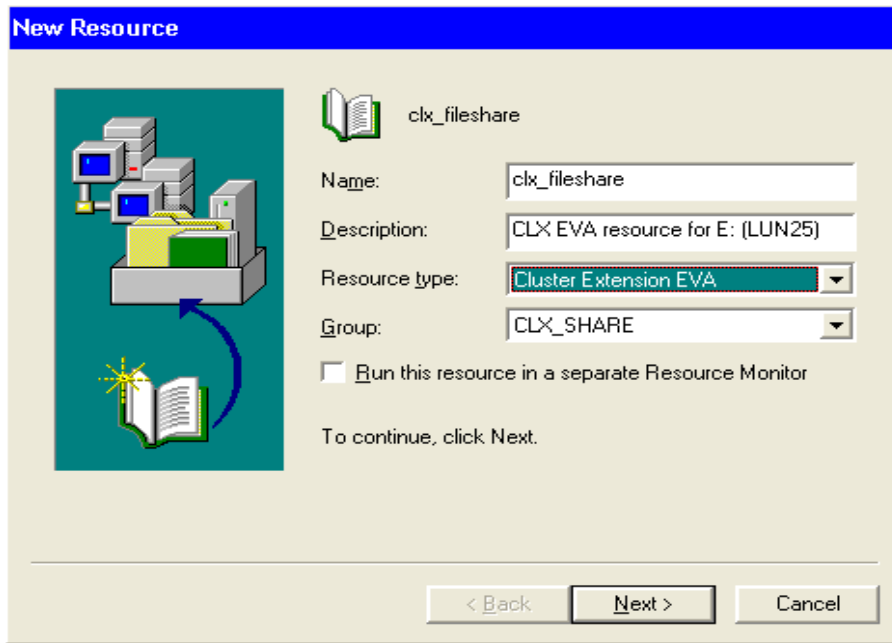
This example adds a HP CLX EVA resource called `clx_fileshare` to the `CLX_SHARE` resource group.

```
C:\>cluster resource clx_fileshare /create /group:CLX_SHARE /type:"Cluster Extension EVA"
```

For information about naming restrictions, see [“Resource names and resource group names” \(page 75\)](#).

To use the Microsoft Cluster service Cluster Administrator GUI to add an HP CLX EVA resource:

1. Open Cluster Administrator.
2. From the **File** menu, choose **New > Resource**.
3. Enter values in the following fields:
 Name: clx_fileshare
 Description: As appropriate for the resource.
 Resource type: Select **Cluster Extension EVA** from the list.
 Group: Select CLX_SHARE from the list.



4. Click **Next**.
5. Add or remove resource owners.
6. Click **Next**. Do not add any dependencies.
7. Click **Next**.
8. Modify resource property values of the new Cluster Extension EVA resource clx_fileshare as needed.
9. Click **Finish**.

Changing HP CLX EVA resource properties

HP CLX EVA resource properties can be changed any time. However, changes take effect only when the resource is brought online the next time.

To change HP CLX EVA resource properties, you must take the resource offline.

CAUTION: Do not change any property of the HP CLX EVA resource while the resource is running.

Syntax

```
cluster resource resource_name /privprop object_name={value | "value1 value2 . . ."}
.
```

You can display all attributes of the HP CLX EVA resource clx_fileshare with the following command:

```
cluster resource clx_fileshare /privprop
```

Example

This example affects a HP CLX EVA resource called `clx_fileshare` to change the default `FailsafeMode` property:

```
C:\>cluster resource clx_fileshare /privprop FailsafeMode=enable
```

Example

This example changes the node list for data center A used for the HP CLX EVA resource `clx_fileshare` from `W2k1` to `W2k2` and adds an additional node `W2k3`.

```
C:\>cluster resource clx_fileshare /privprop DC_A_Hosts=W2k2 W2k3
```

Example

This example affects a HP CLX EVA resource called `clx_fileshare` to change the `CSObjectPathA` property.

```
C:\>cluster resource clx_fileshare /privprop CSObjectPathA=
HPEVA_ConsistencySet.InstanceID=50001FE15002B5A0.6005-08b4-0001-2b69-0000-6
000-86a0-000
```

In order to get the values for `CSObjectPathA` and `CSObjectPathB`, you must create and configure a `UCF.cfg` file for this DR group and run the `clxconf -smis` command. The values for both HP CLX EVA objects are stored in the `clxobjpaths.cfg` file. This step is not necessary when using the Cluster Administrator GUI.

To change property values of the HP CLX EVA resource from the Microsoft Cluster service Cluster Administrator GUI:

1. Open Cluster Administrator.
2. Double-click the **Resources** folder in the console tree.
3. Double-click the `clx_fileshare` resource in the details pane.
4. Click each tab and set the properties for the `clx_fileshare` resource.
5. Modify resource property values of the new HP CLX EVA resource `clx_fileshare` as needed.
6. Click **APPLY** to finish your modifications.
7. Click **Finish**.

Advanced properties

The **Parameters** tab of the HP CLX EVA resource offers basic settings. Use this tab to enter environment data, such as the storage system WWNs and DR group name. You can access more advanced settings using additional buttons in the **Parameters** tab.

Changing failsafe mode-specific values

You can change the failsafe mode-specific values of HP CLX EVA by changing the failsafe mode from `disable` to `enable`. This allows you to change the HP CLX EVA object `FailsafeModeOverride` (page 113).

Changing failover and failback behavior

You can change the failover/failback behavior of HP CLX EVA by clicking the **Failover/Failback** button. The window allows changing the following HP CLX EVA objects:

- `ApplicationStartup` (page 108)
- `ResyncWaitTimeout` (page 114)

Configuring failover actions

You can define pre-executables and post-executables to be executed before or after HP CLX EVA invokes its failover functions. The window allows changing the following objects:

- `PostExecScript` (page 114)
- `PreExecScript` (page 114)

You can specify path names, and they may include space characters and environment variables.

Changing a resource name

CAUTION: Do not change the name of a HP CLX EVA resource at any time. Changing a resource name does not change or update the internal HP CLX EVA database. HP CLX EVA continues to use the old resource name. If you change a HP CLX EVA resource name and then attempt to reuse the old name for a new HP CLX EVA resource, the resources impact each other. This could cause resources to go offline unexpectedly.

To change a resource name, first delete the HP CLX EVA resource, and then create a new resource with a new name. Make sure to note the original setting and object values before deleting the HP CLX EVA resource.

Adding dependencies on a HP CLX EVA resource

HP CLX EVA must be the first resource in the resource chain of a Microsoft Cluster service resource group.

All resources that depend on the disk resource, such as a file share, including all disk resources (physical disks) must be configured for dependency on the HP CLX EVA resource.

Syntax

```
cluster resource physical_disk_resource /adddependency: ClusterExtensionEVA_resource
```

Example

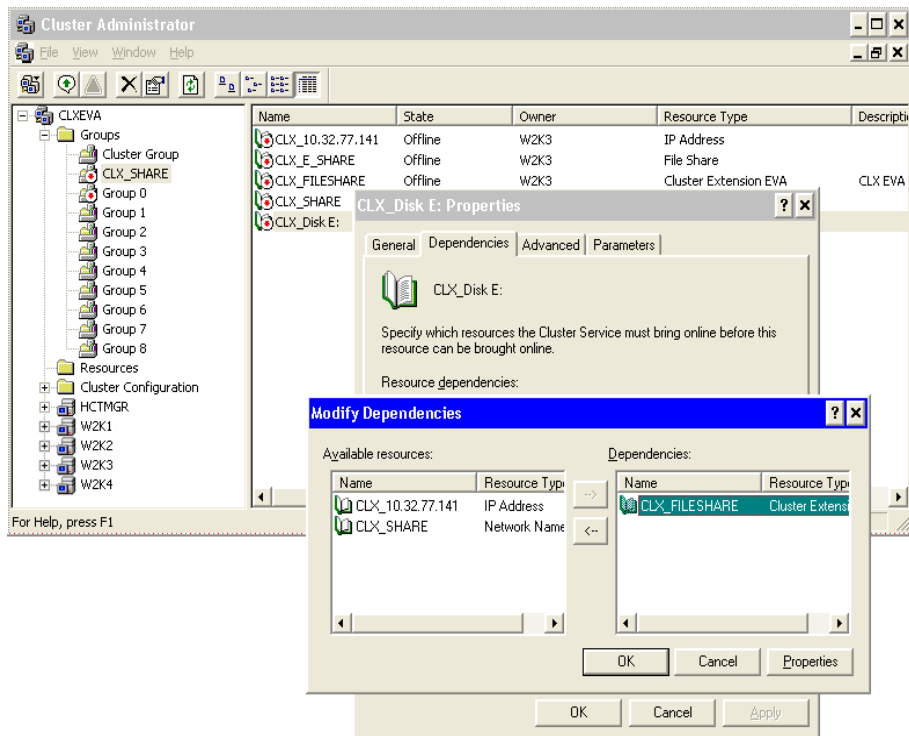
This command example adds a dependency on the Cluster Extension EVA `clx_fileshare` resource to the physical disk resource `Disk_EVA_LUN25`.

```
C:\>cluster resource Disk_EVA_LUN25 /adddependency:clx_fileshare
```

To add a dependency on a HP CLX EVA resource:

1. Open Cluster Administrator.
2. Double-click the **Resources** folder in the console tree.
3. Double-click the `Disk_EVA_LUN25` resource in the details pane.
4. Click the **Dependencies** tab, and then click **Modify**.

5. Add the `clx_fileshare` resource to the dependencies of the `Disk_EVA_LUN25` resource.



6. Click **OK** to finish your modifications.

Bringing an HP CLX EVA resource online

Resources are usually brought online automatically when the resource group is brought online. You might need to move the resource group to the node where you want to bring the resource online, first. Bringing a resource in the resource group online causes resources on which the resource depends to go online also.

Syntax

```
cluster resource ClusterExtensionEVA_resource /online: system_name
```

Example

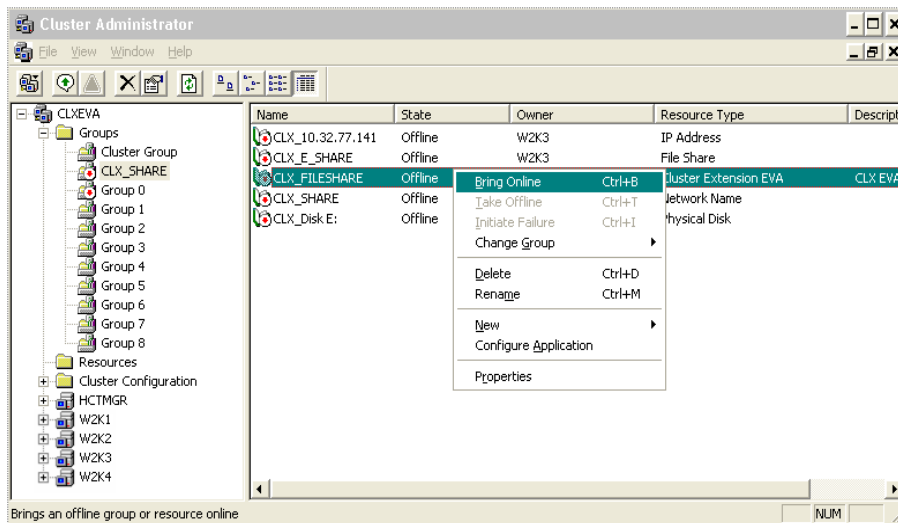
You can bring the HP CLX EVA resource `clx_fileshare` in the resource group `CLX_SHARE` online with the following command:

```
C:\>cluster resource clx_fileshare /online:w2k1
```

To bring a HP CLX EVA resource online from the Microsoft Cluster service Cluster Administrator GUI:

1. Open Cluster Administrator.

2. Double-click the **Resources** folder in the console tree, and then click the resource `clx_fileshare` in the details pane.



3. In the **File** menu, select **Bring Online**.

Taking an HP CLX EVA resource offline

Resources are usually taken offline automatically when the resource group is taken offline. Taking a resource offline causes resources that depend on that resource to go offline also.

Syntax

```
cluster resource ClusterExtensionEVA_resource /offline
```

Example

To take the HP CLX EVA resource `clx_fileshare` offline, use this syntax:

```
c:\>cluster resource clx_fileshare /offline
```

To take a HP CLX EVA resource offline from the Microsoft Cluster service Cluster Administrator GUI:

1. Open Cluster Administrator.
2. Double-click the **Resources** folder in the console tree.
3. Select the resource in the details pane.
4. From the **File** menu, choose **Take Offline**.

Deleting an HP CLX EVA resource

Deleting a running HP CLX EVA resource causes the resource and its dependents to go offline.

Syntax

```
cluster resource ClusterExtensionEVA_resource /delete
```

Example

```
C:\>cluster resource clx_fileshare /delete
```

CAUTION: Deleting a running HP CLX EVA resource does not remove the `resource_name.online` file.

To delete a HP CLX EVA resource from the Microsoft Cluster service Cluster Administrator GUI:

1. Open Cluster Administrator.
2. Double-click the **Resources** folder in the console tree.
3. Select the resource `clx_fileshare` in the details pane.

4. From the **File** menu, choose **Delete**.

Timing considerations for Microsoft Cluster service

HP CLX EVA gives priority to storage system operations over cluster software operations. If HP CLX EVA is invoked during a disk pair resynchronization operation (merging) or is gathering information about the remote storage system, HP CLX EVA waits until the requested status information is reported. This ensures the priority of data integrity over cluster software failover behavior. However, this behavior can cause a failure of HP CLX EVA resources in some cases:

- When HP CLX EVA uses HP SMI-S to communicate with the HP EVA storage systems. Depending on the settings of the HP SMI-S request timeout parameter and the number of retries, the online operation could time out. This can occur if the SMAs configured in the list of to-be-contacted SMAs is populated with many SMAs and if the HP EVA storage system is busy processing other management commands.
- When a disk pair resynchronization (merge) is in progress, HP CLX EVA waits until the DR group is in a normal state if the `ApplicationStartup` resource property is set to `RESYNCWAIT`. In case of merge/resynchronization, the delta data (stored in the history log) between the source and destination vdisks could be big enough for the copy process to exceed the resource `PendingTimeout` value.
- When the `ResyncWaitTimeout` object is set above the resource `PendingTimeout` value.

In general, because the failover environment is dispersed into two (or more) data centers, the failover time cannot be expected to be the same as that in a single data center with a single shared disk device. Therefore, the resource group's `FailoverPeriod` value and the resource's values `RestartPeriod`, `PendingTimeout`, `LookAlive`, and `IsAlive` of the HP CLX EVA resource and the resource group using the HP CLX EVA resource must be adjusted based on failover tests performed to verify the proper configuration setup.

The resource group's `FailoverPeriod` value must be higher than the resource's `RestartPeriod` value, and both must be higher than the resource's `PendingTimeout` value.

Microsoft Cluster Server provides two parameters to adjust state change recognition/resolution: `IsAlive` and `LookAlive`. HP CLX EVA automatically calls the `IsAlive` function whenever the Cluster service calls the `LookAlive` function. Therefore, both functions must be set to the same value.

Failure behavior with Microsoft Cluster service

Bouncing resource groups

HP CLX EVA alternates (start and fail) between local nodes if the `ApplicationStartup` object is set to `FASTFAILBACK` and no remote system is available until the resource group restart limit has been reached. See "ApplicationStartup" on page 108.

Restrictions for Microsoft Cluster service with HP CLX EVA

When HP CLX EVA is used to enable failover between storage systems, observe the following requirements for Microsoft Cluster service configuration:

- The HP CLX EVA resource must be the first resource for all other disk resources in the resource group.
- Only one HP CLX EVA resource is allowed to be configured per resource group.
- The resource's `PendingTimeout` value must be greater than the value specified for the `ResyncWaitTimeout` attribute.
- The resource's `PendingTimeout` value must be equal to or greater than the wait time specified for the `SmisRequestTimeout` value.

Disaster-tolerant configuration example using a file share

This example assumes the following configuration:

- Four nodes (`w2k1`, `w2k2`, `w2k3`, and `w2k4`).
- Two HP EVA storage systems with WWNs `50001fe15002B5A0` and `50001fe15002B570`.
- DR group configured as `\Data Replication\DRG_LUN25`.
- Two SMAs `SMAM019FK351K` and `SMAM019FK001A`.

- An MNS arbitrator node in a third site or separate protected area.
- A pre-executable `clxpre.exe` to be invoked by HP CLX EVA.
- Default failover behavior is used for the cluster group.
- The resource `CLX_FILESHARE` is part of the service group `CLX_SHARE` and must be brought online before the physical disk resources `Disk_EVA_LUN25`.

Figure 9 illustrates failover options and shows a second cluster group `CLX_IIS`.

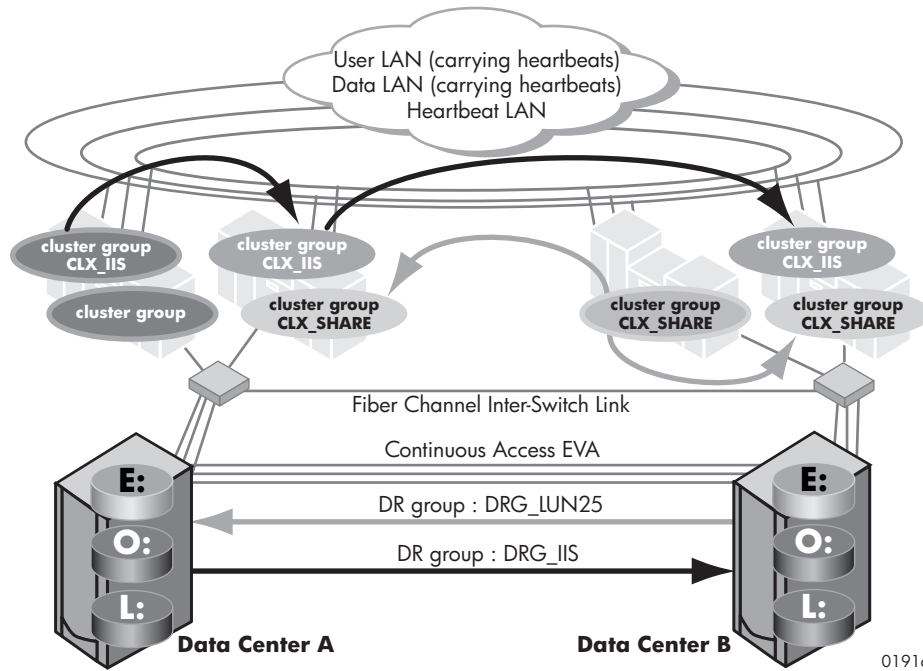


Figure 9 Disaster-tolerant HP CLX EVA configuration example

Figure 10 shows a `CLX_SHARE` resource group example.

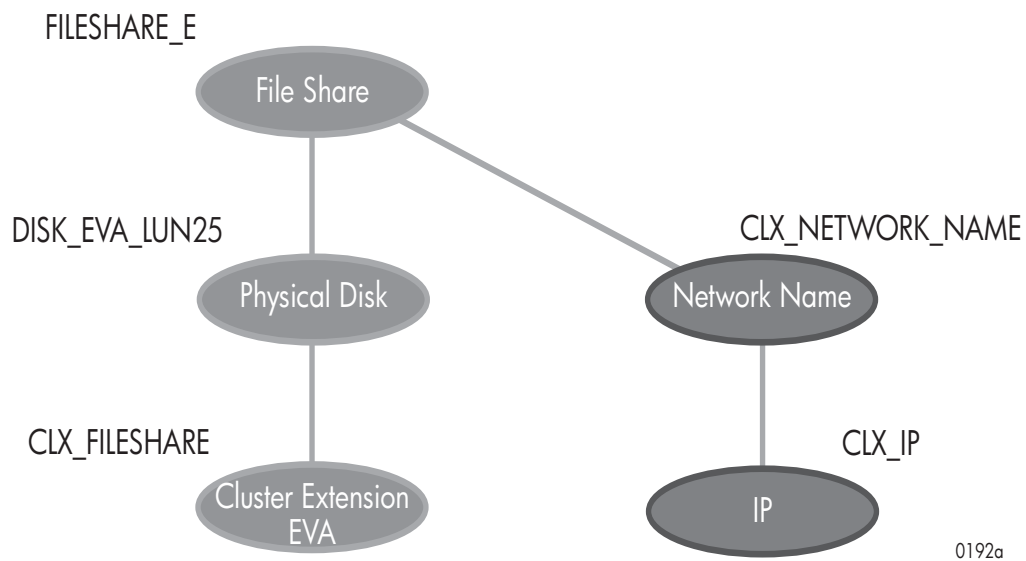


Figure 10 Resource tree for resource group `CLX_SHARE`

HP CLX EVA is configured as a single resource to enable read/write access to the physical disk resource used for the `CLX_SHARE` resource group. The physical disk resource depends on the HP CLX EVA resource and can be brought online only when the HP CLX EVA resource is already online. Independent on this resource tree, the network card is configured with the `CLX_SHARE` resource group's IP address and network name.

If all those resources have been brought online, the file share can be started.

To configure the HP CLX EVA resource according to the configuration shown above, you would do the following:

1. Log in to the `w2k3` system with the Administrator account.
2. Create the file share resource with all above-mentioned resources and dependencies, except the HP CLX EVA resource on `w2k3`.
3. Create a new resource of type HP CLX EVA and add nodes `w2k2`, `w2k3`, and `w2k4` to its possible owners.
4. Change the restart behavior of the HP CLX EVA resource so that the resource can be restarted and that the restart affects the group. Set the number of restarts (Restart Threshold) to `0`.
5. Edit the properties in the **Parameters** tab (or last window) to configure your HP CLX EVA resource. Enter the SMAs, the full DR group name, the HP EVA storage system WWNs, the `DC_A_Hosts`, and the `DC_B_Hosts`.
6. Click the **Pre/Post Exec** button and add `clxpre.exe` with its full path. (The `clxpre.exe` program is an example. It is not included in the HP CLX EVA product.)
7. Add a dependency on the HP CLX EVA resource `CLX_FILESHARE` to the physical disk resource `Disk_EVA_LUN25`.
8. Check the cluster service group and resource settings.

```
C:\>cluster group CLX_SHARE /prop
C:\>cluster resource CLX_FILESHARE /prop
```

9. Set the HP CLX EVA resource property `RestartAction` to `0` or click the **Do not restart** box in the resource's Advanced tab and check if the value has changed.

```
C:\>cluster resource CLX_FILESHARE /prop RestartAction=0
C:\>cluster resource CLX_FILESHARE /prop
```

10. Bring the resource group online on `w2k3` using the Cluster Administrator GUI or command-line interface:

```
C:\>cluster group CLX_SHARE /online:w2k3
```

Verify that the HP CLX EVA resource and all other `CLX_SHARE` resource group resources are brought online.

```
C:\>cluster group CLX_SHARE
```

11. Take the resource group offline and verify that all resources are stopped.

```
C:\>cluster group CLX_SHARE /offline
C:\>cluster group CLX_SHARE
```

12. Bring the resource group online again and verify that all resources are available.

```
C:\>cluster group CLX_SHARE /online:w2k3
C:\>cluster group CLX_SHARE
```

13. Check the cluster service settings of nodes `w2k4`, the group and resource settings.

14. Move the resource group to node `w2k4` and verify that all resources are available.

```
C:\>cluster group CLX_SHARE /moveto:w2k4
C:\>cluster group CLX_SHARE
```

15. Check the cluster service settings of systems `w2k2`, the group and resource settings.

16. Move the resource group to node `w2k2` and verify that all resources are available.

```
C:\>cluster group CLX_SHARE /moveto:w2k2
C:\>cluster group CLX_SHARE
```

17. Check the cluster service settings of node `w2k1`, the group and resource settings.

18. Take the resource group offline and verify that all resources are stopped.

```
C:\>cluster group CLX_SHARE /offline
C:\>cluster group CLX_SHARE
```

19. Change the Cluster Extension EVA resource to be able to restart on another system.

```
C:\>cluster resource CLX_FILESHARE /prop RestartAction=2
C:\>cluster resource CLX_FILESHARE /prop
```

Administration

If the HP CLX EVA log files need to be cleared and reset (for example, due to disk space issues), first locate the log files. If the default directory is used when HP CLX EVA was first installed, the log files can be found at the following location:

```
C:\Program Files\Hewlett-Packard\Cluster Extension EVA\log
```

Either delete, or first archive then delete the files. HP CLX EVA automatically creates new log files.

Recommendation

Archive the log files before deleting them.

The system resources should be monitored on a regular basis as part of Windows 2003 system administration. If any system resource usage by the cluster service is reaching maximum levels, stop and then restart the cluster service. This action automatically fails over the resources and resets system resources.

An alternative method is to manually move all resources to another node in the cluster before stopping the cluster service. After all resources are successfully moved to another node, you can stop and then restart the cluster service. Then manually move back all resources.

Related information

Refer to Microsoft Cluster service documentation for information about how to stop a Cluster service.

6 Command-line interface

HP CLX EVA allows integration into almost any cluster software for Windows operating systems. The command-line interface allows integration of HP Continuous Access EVA configurations for Windows Server 2003.

You can use the HP CLX EVA `clxevarun` command to check proper functionality of HP CLX EVA prior to integration with the cluster software.

Configuring the command-line interface

Using the HP CLX EVA command-line interface requires the following configuration steps:

1. Create the HP Continuous Access EVA environment.
2. Set up HP SMI-S EVA and create the DR group configuration.
3. Create and configure the user configuration file (see [page 88](#)).

Creating the HP Continuous Access EVA environment and configuring HP CLX EVA command-line interface integration

HP support personnel are trained and authorized to set up HP Continuous Access EVA. You can, however, configure and change DR groups and HP SMI-S EVA server instances using HP Command View EVA and the HP Continuous Access EVA UI. For more information, refer to the documentation listed in [HP technical support](#) in the [About this guide](#) section of this manual.

Timing considerations

HP CLX EVA is designed to prioritize HP EVA storage system operations over application service startup operations. If HP CLX EVA is invoked during a disk pair resynchronization (merging) operations or is gathering information about the remote HP EVA storage system, HP CLX EVA will wait until the requested status information is reported. This prioritizes data integrity over application service startup and failover behavior.

Because the failover timing depends on the configuration of your HP SMI-S EVA server and HP Command View EVA environment and the settings in the `UCF.cfg` file, you must evaluate the following considerations:

- HP CLX EVA uses HP SMI-S EVA server instances to communicate with the HP EVA storage systems. Depending on the settings of the HP SMI-S EVA server and HP Command View EVA environment timeout parameters and the number of HP EVAs managed by those components, the online operation could time out. This can also happen if `clxevarun` is used in a script or called by another program and the HP SMI-S EVA server instance(s) cannot be reached.
- If the `ApplicationStartup` attribute is set to `RESYNCWAIT`, HP CLX EVA tries to resynchronize disk pairs and waits until the DR group is in a normal state. Depending on the amount of data to be transferred, it could take hours to resynchronize. If this is the case, `clxevarun` may take some time to return. Do not stop `clxevarun`; use the SSSU command `show DR_GROUP <full-path/dr-group-name>` or the HP Command View EVA or HP Continuous Access EVA UI name to check the status of the DR groups.
- Depending on the amount of data that is out of sync between the source and destination vdisk, a merge/resynchronization or a full copy operation is initiated. The amount of delta data to be transferred between the source and destination vdisk could be large enough for the copy process to take some time.
- To prevent failover commands from being terminated by the failover timeout trigger before it is finished, the time to copy an average amount of daily processed (write) data should be measured and the resource online timeout interval should be adjusted according to the measured copy time. Use only one (the slowest) link used for HP Continuous Access EVA to measure the copy time. This ensures that the average daily generated data can be transferred fast enough from the remote HP EVA storage system, even in the event of a single surviving replication link between the HP EVA storage systems.

In general, because the failover environment is dispersed into two (or more) data centers, the failover time cannot be expected to be the same as it would be in a single data center with a single shared disk device.

Restrictions for customized HP CLX EVA implementations

Following are some restrictions that apply when using the HP CLX EVA command-line interface.

- The HP CLX EVA command-line interface call `clxevarun` must be invoked before the associated disk resources are activated.
- Associated disk resources must not be activated on any other server. If other disk resources are activated, HP CLX EVA may remove write-access rights for those disk devices (putting them in read-only mode).

Creating and configuring the user configuration file

The command-line interface expects as an argument the name configured as the `APPLICATION` tag value.

Example

The following is an example of a customized user configuration file when using `clxevarun`. Note that the values of any object must be on the same line as the object name. This example shows the values for `CSObjectPathA` and `CSObjectPathB` on multiple lines but this would be incorrect if specified in the configuration file.

```
---- Sample UCF.cfg begin
APPLICATION                CLX030
DeviceGroup                 \Data Replication\DRG030 #DR group
DC_A_StorageCellWWN        50001FE15002B5A0
DC_B_StorageCellWWN        50001FE15002B570
DC_A_ManagementHosts       smam019fk351k # active sma
DC_B_ManagementHosts       clxeval      # passive sma
FailsafeMode               disable
DC_A_Hosts                  w2k7 w2k6
DC_B_Hosts                  w2k5 w2k8
CSObjectPathA HPEVA_ConsistencySet.InstanceID="50001FE15002B5A0.6005-08b4-
0001-2b74-0000-6000-021a-0000"
CSObjectPathB HPEVA_ConsistencySet.InstanceID="50001FE15002B570.6005-08b4-
0001-27b1-0000-7000-03fe-0000"
\n
APPLICATION                CLX031
DeviceGroup                 \Data Replication\DRG031 #DR group
DC_A_StorageCellWWN        50001FE15002B5A0
DC_B_StorageCellWWN        50001FE15002B570
DC_A_ManagementHosts       smam019fk351k # active sma
DC_B_ManagementHosts       clxeval      # passive sma
FailsafeMode               disable
DC_A_Hosts                  w2k7 w2k6
DC_B_Hosts                  w2k5 w2k8
CSObjectPathA HPEVA_ConsistencySet.InstanceID="50001FE15002B5A0.6005-08b4-
0001-4cf1-0000-6000-061f-0000"
CSObjectPathB HPEVA_ConsistencySet.InstanceID="50001FE15002B570.6005-08b4-
0001-6e12-0000-7000-031a-0000"
---- Sample UCF.cfg end
```

Command-line interface commands

Details of the following command-line interface commands appear on the referenced pages:

- `clxevarun`
- `clxconf`
- `clxgetobjpath`
- `clxresconf`
- `clxpmu`

- clxautopass

clxevarun

Check the DR group status of application disk set.

Syntax

```
clxevarun [ -forceflag ] parameter
```

Arguments

clxevarun expects only one parameter as the default setting. This parameter is used to uniquely identify the application service in the APPLICATION section of the user configuration file.

clxevarun first checks for the `-forceflag` option. When using clxevarun, you do not need to create an `application_name.forceflag` file. This option, however, must be specified first if used.

CAUTION: The `forceflag` option is implemented as an emergency switch to manually activate your vdisk. If the `forceflag` option has been specified, Cluster Extension EVA will not check any consistency or concurrency rules before activating the vdisk in the associated DR group.

Description

You can use clxevarun to manually prepare the application service's disk set before an existing application service start procedure is invoked. You can also integrate clxevarun in your own application startup scripts. When using clxevarun, the status of the associated DR group is checked to ensure that access to the vdisk(s) will occur under data consistency and concurrency situations only.

clxevarun must be invoked before the application service disk set can be activated; it is considered an online-only program. However, the command-line interface features provide the same disaster recovery features as the integrated versions of HP CLX EVA.

Return codes

clxevarun exits with one of the following return codes:

- 0 OK – Application service can be started.
- 1 ERROR_GLOBAL – Application service should not start on any node in either site on either HP EVA storage system.
- 2 ERROR_DC – Application service should not start on any node in the local site on the local HP EVA storage system.
- 3 ERROR_LOCAL – Application service should not start on this node.

Example 1

```
# clxevarun my-exchange
```

In example 1, clxevarun assumes that you have defined an APPLICATION tag named `my-exchange` in the `UCF.cfg` file and you have specified all necessary objects, including the `DeviceGroup` object, to map the DR group to the application service `my-exchange`. HP CLX EVA will check the vdisk set mapped to the application service `my-exchange`, run the necessary failover procedure, and return one of its return codes.

Example 2

```
# clxevarun -forceflag my-exchange
```

In example 2, clxevarun assumes that you have defined an APPLICATION tag named `my-exchange` in the `UCF.cfg` file and you have specified all necessary objects, including the `DeviceGroup` object, to map the DR group to the application service `my-exchange`. HP CLX EVA will check the vdisk set mapped to the application service `my-exchange`, and run the necessary failover procedure to enable read/write access to the vdisks.

Retrieve object paths.

Syntax

```
clxconf -smis
```

Arguments

clxconf expects one required parameter: -smis.

Description

You can use clxconf to manually retrieve the consistency set object paths for a given DR group and place them in a file called clxobjpaths.cfg. These object paths are required for clxevarun to work properly.

clxconf will attempt to get the consistency set object paths for each application in the UCF.cfg file. Once retrieved, the consistency set object paths CSObjectPathA and CSObjectPathB must be placed in the UCF.cfg file under their respective APPLICATION tag.

Return codes

clxconf exits with one of the following return codes:

- 0 OK – clxconf successfully obtained both consistency set object paths for all of the applications.
- 3 FAILURE – clxconf failed to obtain both consistency set object paths for one or more of the applications.

Example 1

```
#clxconf -smis
```

In example 1, clxconf assumes that you have defined one or more APPLICATION tags in the UCF.cfg file and you have specified all necessary objects, including the DeviceGroup object, to map the DR group to the application service. The following is content from a sample UCF.cfg file:

```
---- Sample UCF.cfg begin
APPLICATION          CLX030
DeviceGroup          \Data Replication\DRG030 #DR group
DC_A_StorageCellWWN 50001FE15002B5A0
DC_B_StorageCellWWN 50001FE15002B570
DC_A_ManagementHosts smam019fk351k # active sma
DC_B_ManagementHosts clxeval        # passive sma
FailsafeMode         disable
DC_A_Hosts           w2k7 w2k6
DC_B_Hosts           w2k5 w2k8

APPLICATION          CLX031
DeviceGroup          \Data Replication\DRG031 #DR group
DC_A_StorageCellWWN 50001FE15002B5A0
DC_B_StorageCellWWN 50001FE15002B570
DC_A_ManagementHosts smam019fk351k # active sma
DC_B_ManagementHosts clxeval        # passive sma
FailsafeMode         disable
DC_A_Hosts           w2k7 w2k6
DC_B_Hosts           w2k5 w2k8
---- Sample UCF.cfg end
```

clxconf will get the consistency set object paths and place them in clxobjpaths.cfg. For example:

```
---- Sample clxobjpaths.cfg begin
APPLICATION CLX030
CSObjectPathA HPEVA_ConsistencySet.InstanceID="50001FE15002B5A0.6005-08b4-
0001-2b74-0000-6000-021a-0000"
CSObjectPathB HPEVA_ConsistencySet.InstanceID="50001FE15002B570.6005-08b4-
0001-27b1-0000-7000-03fe-0000"

APPLICATION CLX031
CSObjectPathA HPEVA_ConsistencySet.InstanceID="50001FE15002B5A0.6005-08b4-
0001-4cf1-0000-6000-061f-0000"
CSObjectPathB HPEVA_ConsistencySet.InstanceID="50001FE15002B570.6005-08b4-
0001-6e12-0000-7000-031a-0000"
---- Sample clxobjpaths.cfg end
```

At this time, you need to copy and paste the consistency set object paths from clxobjpaths.cfg to the appropriate application in UCF.cfg in order for clxevarun to work properly. In this case, the new UCF.cfg file would be:

```
---- Sample UCF.cfg begin
APPLICATION          CLX030
DeviceGroup          \Data Replication\DRG030 #DR group
DC_A_StorageCellWWN 50001FE15002B5A0
DC_B_StorageCellWWN 50001FE15002B570
DC_A_ManagementHosts smam019fk351k # active sma
DC_B_ManagementHosts clxeval        # passive sma
FailsafeMode         disable
DC_A_Hosts            w2k7 w2k6
DC_B_Hosts            w2k5 w2k8
CSObjectPathA HPEVA_ConsistencySet.InstanceID="50001FE15002B5A0.6005-08b4-
0001-2b74-0000-6000-021a-0000"
CSObjectPathB HPEVA_ConsistencySet.InstanceID="50001FE15002B570.6005-08b4-
0001-27b1-0000-7000-03fe-0000"

APPLICATION          CLX031
DeviceGroup          \Data Replication\DRG031 #DR group
DC_A_StorageCellWWN 50001FE15002B5A0
DC_B_StorageCellWWN 50001FE15002B570
DC_A_ManagementHosts smam019fk351k # active sma
DC_B_ManagementHosts clxeval        # passive sma
FailsafeMode         disable
DC_A_Hosts            w2k7 w2k6
DC_B_Hosts            w2k5 w2k8
CSObjectPathA HPEVA_ConsistencySet.InstanceID="50001FE15002B5A0.6005-08b4-
0001-4cf1-0000-6000-061f-0000"
CSObjectPathB HPEVA_ConsistencySet.InstanceID="50001FE15002B570.6005-08b4-
0001-6e12-0000-7000-031a-0000"
---- Sample UCF.cfg end
```

Note that the values of any object must be on the same line as the object name. This example shows the values for CSObjectPathA and CSObjectPathB on multiple lines but this would be incorrect if specified in the configuration file.

clxgetobjpath

Print Consistency Set object path for a DR group (64-bit version only)

Syntax

```
clxgetobjpath SMA_hostname [DC_A_EVA_WWN DC_B_EVA_WWN DR_Group]
```

Arguments

If you only provide the SMA's hostname, it will test the connection to this host. There will be no output if the connection is OK.

If you provide HP EVA WWNs and a DR group name, the output will show the HP SMI-S CSObjectPath(s) values.

Return codes

Table 10 Return codes and descriptions

Return codes	Descriptions
0	Successful, returns CSObjectPath_A and CSObjectPath_B values.
1	Found CSObjectPath for HP EVA in data center A only.
2	Found CSObjectPath for HP EVA in data center B only.
3	Connected to HP SMI-S server but cannot find matching CSObjectPaths for DR group.
-1	Input error, prints usage.
-2	Cannot find username/password in bin\clxsmiscfg file.
-3	Cannot connect to HP SMI-S server.
-4	The size of return package from HP SMI-S is less than or equal to 0.
-5	HP SMI-S exception caught.
-11	Open registry key SOFTWARE\Hewlett-Packard\Cluster Extension EVA failed.
-12	Get value for HPCLX_EVA_PATH from registry key failed.

Description

clxgetobjpath is used by the Cluster Administrator GUI Extension for HP CLX EVA (64-bit version only). Invoke the program by clicking the **Connection Test** button.

Do this test after making changes to the HP Continuous Access EVA/SMI-S configuration of an HP CLX EVA resource (after clicking the **Parameters** tab of your HP CLX EVA resource in the Cluster Administrator GUI and changing any of the HP EVA or HP SMI-S related objects such as the DR group name).

clxgetobjpath uses the clxsmiscfg file to get access to the HP SMI-S server to retrieve the CSObjectPath value from both HP EVA storage systems. This value is needed for failover actions on passive SMAs.

Example 1

```
C:\>cd %HPCLX_EVA_PATH%
C:\Program Files\Hewlett-Packard\Cluster Extension EVA>cd bin
C:\Program Files\Hewlett-Packard\Cluster Extension EVA\bin>clxgetobjpath CLXEVA1
50001FE15002B5A0 50001FE15002B570 "\Data Replication\DRG031"
HPEVA_ConsistencySet.InstanceID="50001FE15002B5A0.6005-08b4-0001-2b74-0000-6000-021f-
HPEVA_ConsistencySet.InstanceID="50001FE15002B570.6005-08b4-0001-27b1-0000-7000-0408-
```

Example 2

```
C:\Program Files\Hewlett-Packard\Cluster Extension EVA\bin>clxgetobjpath CLXEVA1
C:\Program Files\Hewlett-Packard\Cluster Extension EVA\bin>echo %ERRORLEVEL%
0
```

Example 1 shows the consistency set values for the DR group DRG031 on both HP EVA storage systems.

Example 2 shows that an attempt to connect to the HP SMI-S server on the server CLXEVA1 was successful.

clxresconf

Verify the HP EVA/SMI-S configuration of your MSCS resources.

Syntax

```
clxresconf -mcs|-ucf
```

Arguments

You must specify the `-mcs` option in order to check all HP CLX EVA resources in the MSCS cluster.

If you use the `clxevarun` command-line interface integration and created a user config file (`UCF.cfg`), you can verify the file using the `-ucf` option.

Description

Use `clxresconf` to verify the correctness of your HP CLX EVA resource configuration in regards to the HP EVA storage system and HP SMI-S parameters. `clxresconf` verifies the HP CLX EVA resources of your MS cluster or the defined applications (`APPLICATION` tag) in the `UCF.cfg`. File output shows the resource name/application tag name and the status of the configuration.

Example

```
C:\>cd %HPCLX_EVA_PATH%\bin
C:\Program Files\Hewlett-Packard\Cluster Extension EVA\bin>clxresconf -mcs
Application Name..... Status
-----
my-exchange.....Configuration OK
clx-sql1.....Error: Can not get management host's username/password.
Please check it with PMU tool.
clx-iis1.....Error: Connection to SMA Failed.
clx-share.....Error: Only find passive SMA.
clx-test.....Error: SMI-S exception.
C:\Program Files\Hewlett-Packard\Cluster Extension EVA\bin>
```

clxpmu

Manage HP CLX EVA passwords

Syntax

```
clxpmu
```

CAUTION: The changes made using the HP CLX EVA password management utility (`clxpmu`) are saved on the local node on which it is run only. To make the changes global, you must manually run `clxpmu` on each node or copy the file `clxsmiscfg` (located in `%HPCLX_EVA_PATH%\bin`) to each node in the cluster after you save the changes in `clxpmu`. HP recommends that you create a backup copy of the `clxsmiscfg` file before running `clxpmu`.

Description

`clxpmu` is a menu-driven application you can use to manually create, delete, modify, view, and save a list of HP SMI-S servers/SMAs and the information needed by HP CLX EVA in order to make a connection from a cluster node to the HP SMI-S server instance. The information is saved to the `clxsmiscfg` file. This file is originally created during HP CLX EVA installation.

clxpmu Main Menu

Menu choice	Description
1) View existing entries	View a list of SMAs already configured in the following format: <i><hostname> <host IP:SMI-S port number> login:<login> SSL:[SSLyes/SSLno]</i>
2) Delete existing entry	Select SMA to delete from list. This function requires you to enter the password for the HP SMI-S server selected and specified earlier for deletion before the operation can be performed.
3) Add new entry	Add the following information to the list of host managers: Host name: Host name for SMA. Host IP: IP address for SMA. Port: Port to connect to SMA (default is 5988 if no SSL or 5989 if SSL). Login name: Login to connect to HP SMI-S server. Password: Password connect to HP SMI-S server. Use SSL: Specify if you will be connecting using SSL.
4) Modify existing entry	Select a host from a list of configured SMA(s) and modify the following properties: Host name Host IP Port Login name Password Use SSL This function requires you to enter the password for the HP SMI-S server selected for modification before changes can be performed.
5) Save changes and quit	Save changes to the configuration file (clxsmiscfg) and exit clxpmu.
6) Quit without saving changes	Exit clxpmu.

Return codes

0 OK

clxautopass

Obtain a HP CLX EVA license

Syntax

clxautopass.exe <action> <options>

Actions

```
-addpasswords <license file path> [<log level>] [-clxrun]
-ovlicensemgr [<log level>] [-clxrun]
-installinstanton [<log level>] [-clxrun]
```

Options

```
log level: -error | -info | -warn
-clxrun: if wish to log to clxrun log
```

Actions/Options	Description
-addpasswords	Manually imports a license file into HP CLX EVA. <i><license file path></i> is the absolute path name to the license key file you wish to import. Use this option if you cannot or do not wish to use the HP CLX EVA AutoPass GUI.
-ovlicensemgr	Invokes the HP CLX EVA AutoPass GUI. Refer to “License Cluster Extension EVA software” on page 67 for a more detailed description of AutoPass. If you are having trouble invoking the AutoPass GUI, please make sure you have JRE 1.3 or higher and that java.exe is in the working path. If all this is in order, try typing java in the command line to make sure Java works correctly. Some Java-specific issues are beyond HP CLX EVA's control. For example: C:>java Registry key Software\JavaSoft\Java Runtime Environment\CurrentVersion has value 1.4, but 1.2 is required. This is a common issue. Sometimes it happens when there are several versions of the JRE on the system. Try removing all the older versions of JRE before upgrading to a new version.
-installinstanton	Installs a 60-day instant-on license for HP CLX EVA. Because the installation of HP CLX EVA automatically installs a 60-day temporary license, using this manually is for rare cases where the HP CLX EVA installation process may have failed to install the 60-day instant-on license.
log level	Optional parameter that specifies the level of logging HP CLX EVA will use for this program. If unspecified, clxautopass uses log level -info.
-clxrun	Optional parameter for cases when you wish to log to the clxrun.log log file.

Return codes

clxautopass exits with one of the following return codes:

Table 11 clxautopass return codes and descriptions

Return code	Description
1	Successful operation

Table 11 clxautopass return codes and descriptions

Return code	Description
-1	Usage or environment failure
3	Autopass failure

Example 1

```
#clxautopass -addpasswords C:\licenses\permanent_license.txt
```

This example imports the license file C:\licenses\permanent_license.txt to HP CLX EVA. The log level is -info.

Example 2

```
#clxautopass -addpasswords C:\licenses\permanent_license.txt -warn -clxrun
```

This example imports the license file C:\licenses\permanent_license.txt to HP CLX EVA. The log level is -warn and is logged to the clxrun.log file.

7 Troubleshooting

To troubleshoot problems with HP CLX EVA, you must understand HP Continuous Access EVA environments. Refer to the HP Continuous Access EVA and HP SMI-S EVA documentation before assuming that a problem has been caused by HP CLX EVA.

Log files

Log files assist you in locating and identifying problems. Timestamps, component IDs, and message IDs are included.

- HP CLX EVA related messages are logged by Microsoft Cluster service to the file `%ClusterLog%\cluster.log`.
- HP CLX EVA keeps its own log file `clxmssc.log` in its default log location. HP CLX EVA messages can also be found in the Microsoft Cluster service cluster log file if the HP CLX EVA `LogLevel` object is set to `info` (`info` is default `LogLevel`).

CAUTION: HP CLX EVA is not able to handle DR group states automatically and correctly when they result from manual intervention or modifications to the DR group states done by the user.

Always disable automatic resource group failover when merging or resynchronizing DR groups. A failure of the resynchronization source while resynchronizing can lead to non-current data on the resynchronization target.

The resynchronization process copies data in transactional order, which means that you could start your application with this data but it might be older than the source.

Start errors

- Generic startup or initialization logic errors can occur when the path to the HP CLX EVA binaries has not been set in the `PATH` environment variable and the processes (for example the cluster service) have not recognized the `%HPCLX_EVA_PATH%` variable. To fix this problem, restart the cluster service.
- If an error occurs because needed components of HP CLX EVA are not available, a file is generated that could help with troubleshooting. The file is `clxlog.log`. It may be in any directory, but is usually in the working directory of the operating system (`%SYSTEMROOT%`).
- If HP CLX EVA does not find the user configuration file in the correct directory location, or if an error occurs after initialization, HP CLX EVA returns a local error.

Failover error handling

HP CLX EVA automatically fails over resource groups if the system the resource group is running on becomes unavailable. This is done as part of the cluster functionality. This also means that if a problem with the HP EVA DR group state or the HP SMI-S EVA server occurs, any resource group online process is stopped.

HP CLX EVA is highly configurable. Depending on the customer setting, HP CLX EVA is used to prevent resource groups from going online automatically under the wrong conditions.

Therefore, HP CLX EVA returns local, data-center-wide, or even cluster-wide errors to prevent accidental access to the resource group's `vdisk(s)`.

HP CLX EVA resources return a data center error and fail the resource if the DR group status indicates that the problem experienced locally would not be solved on another system connected to the same HP EVA storage system. This means all systems specified in the `DC_A_Hosts` resource property or the `DC_B_Hosts` resource property would fail to bring the resource group online.

Depending on the resource group and resource property values, the resource tries to start on different nodes several times. If the remote data center is down, this would look like the resource group alternates (bounces) between the surviving systems. This happens until the above-mentioned resource and resource group property values are reached or until restart of the resource is disabled by the user.

This could be also the case if the `ApplicationStartup` resource property has been set to `FASTFAILBACK`.

If a DR group state is discovered that does not allow bringing the resource group online on any system in the cluster, a cluster error is reported and the resource fails on all systems. This could lead to the same behavior as described for a HP CLX EVA data center error.

In any case, HP does not recommend restarting a failed resource group without investigating the problem. A failed HP CLX EVA resource indicates the need to check the status of the DR group and its member vdisks and decide whether it is safe to continue or not.

MNS needs its own resource monitor

The MNS quorum is a regular cluster resource which is monitored by the cluster resource monitor (`ResrcMon.exe`). In order to avoid cluster failures because of other hanging resources, HP recommends that the MNS resource run in its own resource monitor process. This can be changed by selecting the MNS quorum resource in the Cluster Administrator GUI. Right-click and select **Properties** from the menu or double-click on the MNS resource and click the box next to **Run this resource in a separate Resource Monitor**, and then click **OK**.

SMA needs to be able to communicate with all cluster nodes

The SMA that hosts the HP SMI-S EVA server must be able to communicate with all cluster nodes.

If there a communication error message during the initialization phase in the HP CLX EVA log file, check to see if the HP SMI-S EVA server can look up the cluster node names correctly and if it can connect to the cluster nodes. Use `nslookup` and `ping` to do this. You can also use the `hosts` file to add cluster host names for name resolution to make sure that the SMI-S server can resolve names.

If there is a communication error message during the initialization phase in the HP CLX EVA log file, use `nslookup` and `ping` to see if the HP SMI-S EVA server can recognize the cluster node names correctly and if it can connect to the cluster nodes. Changing the network priority of the server in the Advance Settings of the Network Connections window might be necessary. You can also use the `hosts` file to add cluster host names for name resolution to ensure that the HP SMI-S EVA server is able to resolve names.

This applies to all cluster nodes.

Failing physical disk resources during online attempt of the resource group

Physical disk resources fail when onlining resource groups that use HP CLX EVA for DR group failover for two reasons:

- The physical disk resource does not have a dependency on its HP CLX EVA resources configured. Review the setup steps for HP CLX EVA resources and [“Adding dependencies on a Cluster Extension EVA resource” on page 128](#).
- The DR group is created with access mode disabled and has not been set to read-only access for the destination vdisk(s). The disk resource fails initially. After rescanning the disks in the Device Manager (disk management), the physical disk resource goes online as expected. However, the physical disk resource might fail again after a later server reboot. To resolve this issue, review [“Create DR groups” on page 57](#) and [“Add a LUN presentation to the destination Vdisk and set read-only mode through Command View EVA or SSSU” on page 60](#). Setting the destination vdisk access mode to read-only solves this issue.

Cluster failure because hotfix 823147 is missing

If your MNS quorum cluster failed and does not start, please review the description of knowledge base article 823147 at:

<http://support.microsoft.com/default.aspx?scid=kb;en-us;823147&Product=winsvr2003>

Physical disks cannot be added to the cluster because physical disk number or drive letter is not shown in pulldown menu when creating physical disk resources

If you cannot see the drive letter or disk when trying to add a new resource:

- Ensure that the cluster group is online on the current host in which you are configuring the disk. If having the cluster group online on the current host does not solve the problem, then proceed with the solution described in the next bullet item.
- Failback the DR group to the HP EVA where you originally created the disk partition and the drive letter.

Use the Cluster Administrator GUI on the node where you originally created the disk partition and drive letter. Create the physical disk resource there.

If you have HP Secure Path installed and you still cannot see the drive letter when adding the physical disk resource, you can use the HP Secure Path command `spprutil device` to find the mapping between the Windows physical disk number and the shown partition numbers.

You can add the disk based on this mapping and failover/failback the disk. The correct drive letter will show up once the disk is brought online on the node where you originally created the disk partition and drive letter.

Please also review Microsoft Knowledge Base article 834911 if you have problems adding new disk devices to your cluster configuration. A detailed description can be found at: <http://support.microsoft.com/default.aspx?scid=kb;en-us;834911>. This problem may also be caused by a contention issue. See the note in "Install Microsoft Cluster service on all nodes" on page 43.

Obtaining DR group status after failover

Obtaining DR group status incurs a performance cost to HP Command View EVA and the HP SMI-S EVA server. HP CLX EVA avoids this performance impact by not retrieving the DR group status after failover unless necessitated by the use of a `post-exec` script. HP CLX EVA uses the `PostExecScript` object parameter to determine if it is required to retrieve the DR group status after a failover. HP CLX EVA will only get the DR group status after a failover if the `PostExecScript` object parameter is set to a valid script file name, and the `PostExecCheck` object parameter is set to `yes`.

HP SMI-S upgrade issues

Values defined in the `cim.properties` and `EVAProvider.properties` files will reset to default values after the HP SMI-S server component is upgraded. Save a copy of the `cim.properties` and `EVAProvider.properties` files before performing the upgrade. Use the saved copies as a reference after the upgrade to set the property values back to your desired settings.

Note that the `EVAProvider.properties` file contains version numbers that reflect the currently installed version of HP SMI-S. It is important that you do not simply overwrite the new copy of the `EVAProvider.properties` file with the saved copy.

In particular, verify that the value of the `enableSSL` property matches your desired setting after the HP SMI-S server component is upgraded. If you have chosen to use SSL in your HP CLX EVA environment, set the `enableSSL` property to `true`.

After upgrading the HP SMI-S server component on your storage management agent, restart the HP SMI-S server component using the Services window in the following procedure.

1. Select **HP StorageWorks SMI-S CIMOM**.
2. Right-click and select **Restart**.

Failure to restart the HP SMI-S server can lead to failover errors due to HP CLX EVA command timeouts. Run the connection test to ensure that the HP CLX EVA resources can communicate with the HP SMI-S server by clicking **Connection Test** on the Parameter tab in any of the HP CLX EVA resources in the Cluster Administrator GUI.

Glossary

allocation policy	Storage system rules that govern how virtual disks are created. There are two rules: Allocate completely – The space a virtual disk requires on the physical disks is reserved, even if the virtual disk is not currently using the space. Allocate on demand – The space a virtual disk requires on the physical disks is not reserved until needed.
alternate site	Controller pair or storage system containing a copy of the data stored at a primary site. A storage system may be considered a primary site for some LUNs and an alternate site for other LUNs. An alternate site could be in the same room or building as the primary site, but generally it is not.
array	All the physical disk drives in a storage system that are known to and under the control of a controller pair. Multiple arrays can exist in the same cabinet, or one array can include more than one cabinet (as in the case of an expansion cabinet).
asynchronous replication mode	The mode of operation of a DR group whereby the HP EVA controller firmware provides I/O completion acknowledgement to the host after data is delivered in cache at the source, and before the data delivery to cache on the destination. This mode is not available at this time. See also DR Group write mode.
bandwidth	The transmission capacity of a link or system, usually measured in bits per second.
bidirectional	The circumstance when a storage system is configured so that it contains both source and destination vdisks. This configuration allows for multidirectional I/O flow among several storage systems.
HP Continuous Access EVA	The HP StorageWorks Continuous Access EVA software that lets you create and maintain duplicate copies of local logical volumes on a remote storage system.
CLI	Command-line interface
HP Command View EVA	HP StorageWorks Command View EVA consists of: The graphical user interface (GUI) that displays the usage of the storage system. The software behind the GUI, which controls and monitors the functions. The HP Command View EVA software can be installed on more than one HP OpenView Storage Management Appliance (SMA) in a fabric. Each installation of the HP Command View EVA software is a management agent. The client for the agent is a standard browser.
HP Continuous Access user interface	A tool for managing the replication of storage objects in a SAN. It provides a graphical user interface for the management of disk I/O, failover, and maintenance operations. The Continuous Access user interface is installed in the HP OpenView Storage Management Appliance (SMA) and appears as a software service.
copy set	A generic term for a disk pair; a logical disk in one storage array that is replicated to another logical disk in another storage array. There are two states: normal and copying. The term is commonly used to represent the pair of Vdisks, one on the source array and one on the destination array.
data distribution	Pushing copies of data to geographic locations to make it more easily accessible to many customers.
data migration	Moving data to a new location or to one with a larger capacity.

data movement	HP Continuous Access EVA provides for data movement services, such as data backup, data migration, data distribution, and data mining.
data replication mode	See DR mode.
default disk group	The first disk group created when the storage system is initialized. The default disk group can contain up to the entire set of physical disks in the array. The minimum number of physical disks the default disk group can contain is eight. The maximum is the number of installed disks and is limited to 14 drives per attached drive enclosure.
destination vdisk	A vdisk that is the recipient of replicated data from a source vdisk.
destination vdisk access	A storage system's ability to allow host access to a destination vdisk. There are two options: Disabled Read-only (write-protected)
Device Manager or Element Manager	A Web-based storage environment manager that enables users to configure and monitor StorageWorks controllers. The device manager or element manager resides on the SMA.
disaster tolerance	The capability for rapid recovery of user data from a remote location when a significant event or disaster occurs at the local computing site. It is a special combination of high-availability technology and services that can continue the operation of critical applications in the event of a site disaster. Disaster-tolerant systems are designed to allow applications to continue operating during the disaster recovery period.
disk failure protection	The three levels of disk failure protection are: None—No protection is present. Single—The capacity of one physical disk is reserved. Double—The capacity of two physical disks is reserved. Disk failure protection occurs when the storage system sets aside reserved capacity to take over the functionality of a failed or failing physical disk drive. In groups with mixed capacity drives, the reserved capacity is based on the largest disk in the disk group. The system must cover a failure in any drive, so it reserves enough capacity to cover the largest failure that could happen.
disk group	A named group of physical disks selected from all the available physical disks in the storage system where one or more vdisks can be created. A physical disk can belong to only one disk group.
DR group	A Virtual Controller Software (VCS) construct organizing one or more vdisks in an HSV storage system so that they replicate to the same specified destination, fail over together if a single vdisk in the collection fails, and preserve write-ordering within the collection. This is the HSV implementation of an association set, and its member vdisks are the HSV implementation of copy sets.
DR group direction	The replication direction of a DR group. There are two states: Original (from Home) Reversed (failed over, or toward Home)
DR group log state	The current behavior of the log associated with a DR group. In the state options, references to multiple destinations are for future use. There are three possible states: Normal – No destination is logging or merging. Logging – At least one destination is logging; none are merging. Merging – At least one destination is merging.

DR group write mode	Characterizes how a write from a host is replicated. A DR group has two modes of replication writes from the source vdisk to the destination vdisk: Synchronous replication – I/O requests to both source and destination must be complete before the storage system processes the next I/O request from the host. Asynchronous replication – The storage system processes the next I/O request on the source even if there are outstanding I/O requests on the destination. This mode is not available at this time.
DR mode	The operational mode of a DR group that indicates the capability of I/O to be written to its source and/or its destination.
dual fabric	Two independent fabrics providing multipath connections between FC end devices.
DWDM	Dense wavelength division multiplexing
HP Enterprise Virtual Array (EVA)	An HP StorageWorks product that consists of one or more storage systems. Each storage system consists of a pair of HSV controllers and the disk drives they manage. A storage system within the Enterprise Virtual Array (EVA) can be formally referred to as an Enterprise Storage system, or generically referred to as a storage system.
fabric	A network of FC switches or hubs and other devices.
failover	This term is context specific. DR group failover – An operation to reverse the direction of a DR group. Managed set failover – An operation to reverse the direction of all the DR groups in the managed set. Fabric or path failover – The act of transferring I/O operations from one fabric or path to another. Controller failover – The assumption by one controller of the workload of its partner. Application failover – An operation to transfer an application from one host or node to another.
failsafe locked	A mode set to cause a condition in which a failsafe-enabled DR group is unable to complete a write to its destination, or when a member vdisk fails. This condition prohibits any further host I/O to any of the vdisks in the DR group, and requires immediate intervention.
failsafe mode	A DR group mode in which all source vdisks in the group become both unreadable and unwritable if any of their corresponding destination vdisks is unreachable. No logging takes place for the vdisks. There are two states: Enabled Disabled
FC	See Fibre Channel.
FC connection	A FC path between two storage systems or between a host and its storage. A connection is made up of multiple FC links.
Fibre Channel (FC)	An ANSI standard name given to a low-level protocol for a type of serial transmission. The FC specifications define the physical link, the low-level protocol, and all other pertinent characteristics.
Fibre Channel adapter	See HBA.
Fibre Channel connection	See FC connection.
full copy	A copy operation in which all 1 MB blocks written on a source vdisk since it was created are replicated to a destination vdisk.

GB	Gigabytes
GUI	Graphical user interface. A software interface that uses a computer's graphic systems to make a program more user friendly.
HBA	Host Bus Adapter
heartbeat	A periodic synchronization signal issued by cluster software or hardware to indicate that a node is an active member of the cluster.
high availability (HA)	Redundant systems, software, and information technology processes to reduce the risk of downtime. No single point of failure.
Home	The preferred storage system for the source vdisks of a DR group. By default, this is the storage system on which a source Vdisk is created, although this designation is user defined.
host	A computer that runs user applications and uses (or can potentially use) one or more virtual disks created and presented by the controller pair.
HSV	Hierarchical Storage Virtualization. The name given to the virtualization controller architecture.
in-band communication	Communication that uses the same communications pipe as the operational data. See also out-of-band communication.
ISL	Intersite link or interswitch link. The abbreviation is context-sensitive.
leveling	Distribution of all user data within the virtual disks across all physical disks within the disk group.
local site	See primary site.
log	Storage that is used for logging.
logging	Usually context-sensitive. In HP Continuous Access EVA, logging refers to the history of host write commands (and data) when the destination array is not accessible. If failsafe mode is enabled, logging does not occur.
LUN	Logical unit number. An identifier through which a vdisk is presented to a host.
managed set	Any collection of DR groups selected by the user for the purpose of managing them. For example, a managed set can be created to manage all DR groups whose sources reside in the same cabinet or all DR groups that deal with a particular set of applications.
MB	Megabytes
merge or merging	Transferring the contents of the log to the destination vdisk in order to synchronize the source and destination vdisks. Also known as resynchronization.
MMC	Microsoft Management Console
MNS	Majority node set quorum. A quorum-capable resource introduced by Microsoft with Windows Server 2003. A single quorum resource that allows you to build clusters with nodes which are geographically separated.
normalization	The initial full copy that occurs between a source vdisk to the destination vdisk.
OpenView	An HP line of software products that provides storage management solutions, data protection and recovery, automatic performance tuning, storage virtualization, and other features for multivendor storage environments.
out-of-band communication	Communication that uses a different communications pipe than that used by operational data. See also in-band communication.

preferred path	A preference for which controller of the controller pair manages the virtual disk. This preference is set by the user through HP Command View EVA when creating the virtual disk. A host can change the preferred path of a virtual disk at any time. The primary purpose of preferring a path is load balancing.
presentation	The process whereby a controller presents a virtual disk only to the host computer that has authorized access.
primary site	Controller pair residing at the data center that contains the source data. A storage system may be considered a primary site for some Vdisks and an alternate site for other vdisks.
relationship	The arrangement created when two storage systems are partnered for the purpose of replicating data between them.
remote site	See alternate site.
resume	Command issued to a DR group or managed set that causes replication to resume after being suspended. This command may initiate a merging of the DR group log or a full copy.
quorum	In Microsoft Cluster service, a cluster resource that has been configured to maintain essential cluster data and recovery information. If a node fails, the quorum acts as a tie-breaker and is transferred to a surviving node to ensure that data remains consistent within the cluster.
SCSI	Small Computer System Interface
selective presentation	The process whereby a controller presents a virtual disk only to the host computer that is authorized access.
single path	A single connection or path between storage systems containing source and replicated data, or between a host and the storage assigned to that host.
site failover	Command to change a destination role to a source role at the designated site. See also failover.
SMA	The term storage management agent refers to the off-appliance, customer-provided Windows server installation of HP Command View EVA. The term storage management appliance refers to the HP Command View EVA installation on the HP-supplied management appliance. In this guide, both are referred to as SMA. See also Storage Management Appliance.
snapclone	A virtual disk that can be manipulated while the data is being copied. Only an active member of a virtual disk family can be Snapcloned. The Snapclone, like a snapshot, reflects the contents of another virtual disk at a particular point-in-time. Unlike a snapshot, the Snapclone is an actual clone of the source virtual disk and immediately becomes an independent active member of its own virtual disk family.
snapshot	A temporary virtual disk that reflects the contents of another logical disk at the particular point-in-time. A snapshot operation is performed only on an active virtual disk. The active disk and its snapshot constitute a virtual family.
source vdisk	A vdisk that contains original data that is replicated to its destination vdisk.
“split-brain” syndrome	A state of data corruption can occur if a cluster is reformed as subclusters of nodes at each site, and each subcluster assumes authority, starting the same set of applications and modifying the same data.
Storage Management Appliance	The HP OpenView Storage Management Appliance is a specialized server on which the HP Command View EVA, HP Continuous Access EVA user interface, and other SAN applications run.

Storage Management Appliance Software	SMA software installed on SMA hardware that provides a GUI for accessing the monitored SAN environment. This software also provides a launch site for a variety of value-added applications and provides navigation links to directly manage storage components on the SAN.
Storage Management server	Any HP supported hardware-software platform that is not connected to the SAN fabric and that does not serve as a storage host. SMS software installed on a platform provides a GUI interface for accessing the monitored SAN environment.
storage pool	The aggregated blocks of available storage in the total physical disk array.
storage system	A pair of HSV controllers and the array of physical disks they control. A storage system may contain Vdisks that are sources as well as vdisks that are destinations. Sometimes used in context as follows: Source storage system – Used in the context of a particular DR group, this is the storage system at which the source vdisk resides. Destination storage system – Used in the context of a particular DR group, this is the storage system at which the destination vdisk resides.
storage virtualization	The transparent abstraction of storage at the block level. It separates out logical data access from physical per disk, or per array, data access.
suspend	Command issued to a DR group or managed set that temporarily halts replication of I/O from source vdisks to destination Vdisks in that DR group. Source vdisks continue to run I/O locally, and the I/O is also copied to the DR group log. The command cannot be issued if the DR group is failsafe enabled.
synchronous mode	The mode of operation of a DR group where the data is written to the source and destination caches, after which a completion acknowledgement is sent to the host. See also DR group write mode.
TB	Terabytes
TCP/IP	Transmission Control Protocol/Internet Protocol. A suite of communications protocols used to connect host computers to the Internet.
UUID	Universal Unique Identifier. A unique 128-bit identifier associated with HSV objects.
VCS	Virtual Controller Software. The firmware that runs the EVA 3000 and EVA 5000 storage systems.
vdisk	A simulated disk drive accessible from hosts attached to the SAN. When it is a member of a DR group, a vdisk is the HSV implementation of a copy set, and it can have two states: normal and copying.
Virtual Controller Software	See VCS.
virtual disk	See vdisk.
virtual disk family	A virtual disk and its snapshot, if a snapshot exists, constitute a family. The original virtual disk is called the active disk. When you first create a virtual disk family, the only member is the active disk.
volume	A generic term for a storage unit, such as a hard disk, floppy disk, disk cartridge, CD-ROM, or tape cartridge.

Vraid0	A virtualization technique that provides no data protection. The data host is broken down into chunks and distributed on the disks that make up the disk group from which the virtual disk was created. Reading and writing to a Vraid0 virtual disk is very fast and makes the fullest use of the available storage, but provides no data protection (redundancy) unless there is parity.
Vraid1	A virtualization technique that provides the highest level of data protection. All data blocks are mirrored, or written twice, on separate physical disks. For read requests, the block can be read from either disk, which can increase performance. Mirroring takes the most storage space because twice the storage capacity must be allocated for a given amount of data.
Vraid5	A virtualization technique that uses parity striping to provide moderate data protection. Parity is a data protection mechanism for a striped virtual disk, on which the data to and from the host is broken down into chunks and distributed to the physical disks that make up the disk group in which the virtual disk was created. If the striped virtual disk has parity, another chunk (a parity chunk) is calculated from the set of data chunks and written to the physical disks. If one of the data chunks becomes corrupted, the data can be reconstructed from the parity chunk and the remaining data chunks.
World Wide LUN Name	A 128-bit identifier associated with a vdisk (64 bits come from the controller WWN).
World Wide Name (WWN)	A 64- or 128-bit identifier that uniquely identifies the address of a component on the fabric.
WWLN	See World Wide LUN Name.
WWN	See World Wide Name.
XCS	The firmware that runs the EVA 4000/6000/8000 storage systems.

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