

EMC Celerra and ClearCase Integration

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Introduction

This document describes the integration of Rational ClearCase™ software with EMC Celerra™ File Server (CFS) over the Network File System (NFS) and Common Internet File System (CIFS) protocols. Included in this document are the following sections:

- ◆ Overview of Celerra
- ◆ Overview of ClearCase
- ◆ Benefits of Integrating ClearCase and Celerra
- ◆ ClearCase Installation on Celerra
- ◆ Storing ClearCase VOBs and Views on Celerra
- ◆ Sharing ClearCase File and Directory Elements in a Mixed Environment
- ◆ Exporting a CFS File System to be used as VOB/View Repository
- ◆ Troubleshooting

You must be familiar with NFS, CIFS, and with the basic Celerra architecture before reading this document.

Overview of Celerra

Celerra is a dedicated network file server running software optimized for sharing information over networks. Celerra combines Symmetrix® enterprise storage technology with a unique software and hardware approach to bring unprecedented levels of availability, management, scalability, and performance to network file storage. This network-attached storage solution allows you to share information between heterogeneous networked servers and end-user clients.

Overview of ClearCase

ClearCase is a software configuration management system developed by Rational Software Corporation. ClearCase is a distributed client-server application that manages versions of files and directories by storing them in a database. ClearCase allows you to track changes to every file and directory, and maintains histories of source code, test suites, libraries, executables, and documentation.

ClearCase Terminology

ClearCase-specific terms and descriptions are contained in Table 1.

Table 1. ClearCase-specific Terms

Term	Description
Element	Files and directories that reside in ClearCase source control.
VOB (Versioned Object Base)	A repository that stores versions of file elements, directory elements, derived objects (an intermediate result of the build process under ClearCase control), and metadata.
VOB tag	An object that enables you to view information on a specific Versioned Object Base.

Table 1. ClearCase-specific Terms

View	An object that provides a work area for one or more users. Allows you to look at a specific version of elements, files, and directories within a database through a given set of rules.
View tag	An object that allows you to access the view network wide. The name with which users reference a view.
Storage Pools	A set of files and directories inside the VOB that can be a: <ul style="list-style-type: none"> • source pool or a cleartext pool that contains element data • derived object pool that contains derived objects

VOB Database

Each VOB is implemented as a directory tree whose top directory is called a *VOB storage directory*. A VOB holds an embedded database under the *db* subdirectory that stores all version control structures such as elements, branches, and versions. The actual data (all of the element's versions) are stored in the *s* subdirectory tree. The *s* and *db* directories are critical directories and need a reliable storage device.

The *c* subdirectory tree caches the recently accessed file elements and may experience high I/O.

The *d* directory tree stores the intermediate results of the building process and increases in size during the development process.

View Database

Each View is also implemented as a directory tree. The View holds an embedded database under the *db* subdirectory that is used to track correspondence between VOB and View. All the View private objects are stored in a private storage area (*s* subdirectory).

Host Roles in a ClearCase Environment

The role of each host in a ClearCase environment is described in Table 2.

Table 2. ClearCase Environment Hosts and Roles

Host	Role
Registry server	Stores access-path information related to all VOBs and views in the ClearCase environment. Note: You can have one Backup Registry server.
License server	Authorizes and limits the use of ClearCase according to your license agreement. Each user requires a license. Licensing limits the number of concurrent users.
VOB server	Runs the services to access the VOBs. Hosts the storage directory of the VOBs.
View server	Runs the services to access the Views. Hosts the storage directory of the Views.
ClearCase client	User workstation that runs ClearCase programs.
Non-ClearCase server	Does not run ClearCase, but shares its storage-space resources on the ClearCase network.

Benefits of Integrating ClearCase and Celerra

The benefits of integrating ClearCase and Celerra are:

- ◆ Concurrent access to a VOB for NFS and CFS users
- ◆ High availability of ClearCase on CFS
- ◆ VOB backup with minimal lock time required
- ◆ Dynamic file system extensions

Concurrent Access to a VOB for NFS and CIFS Users

Integrating Celerra and ClearCase allows concurrent access to VOBs and Views for the CIFS and NFS environments. If Celerra is not used, the only way to access a UNIX VOB through Windows views is by using a third-party file access product, such as NFS Maestro or Disk Access, or by using the CCFS (ClearCase File System), which provides snapshot views only.

In prior implementations, CFS supported the hosting of the VOB pools and the .s View subdirectory linked from the storage directory on the ClearCase server. Previous ClearCase versions required the top VOB and view storage directories to reside on the same host that runs the service processes.

With current ClearCase versions, you can create a Windows NT VOB tag for an existing UNIX VOB. You can share the same directories and files, check out the same elements (with the unreserved option) at the same time in both UNIX and Windows NT, make changes to files, and allow ClearCase to merge the changes.

High Availability of ClearCase on CFS

A Data Mover can be configured as the backup for one or more Data Movers. If a failover occurs, the backup Data Mover takes the identity (such as IP addresses, mounts, and exports) of the primary Data Mover. For ClearCase, this operation should be transparent for the NFS clients, but not for the CIFS clients. Typical symptoms of failure under Windows NT when you browse the VOB using Windows Explorer are as follows:

- ◆ Inconsistent status of the checkin/checkout operation.
- ◆ For some elements, the **ClearCase** option in the right-click menu of Windows NT Explorer disappears.
- ◆ **System process : Fatal application exit** window appears when attempting to open the file.

To resolve the situation, you must restart ClearCase Services on the ClearCase Windows NT VOB Server. You do this through the ClearCase Properties dialog box on the Control Panel. Figure 1 illustrates this service.

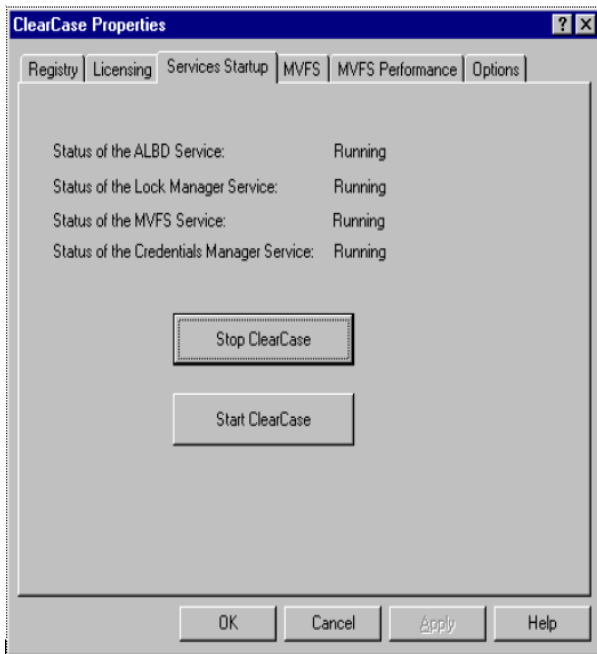


Figure 1. ClearCase Properties - Services Startup Dialog Box

VOB Backup with Minimal Lock Time Required

Rational Software strongly recommends that you back up your VOB(s) periodically.

You must lock the VOB before you back it up. The VOB must be locked during the entire backup operation. When the VOB is locked it cannot be used.

TimeFinder/FS

With the TimeFinder/FS feature on CFS, the VOB can be locked for a much shorter period of time than with a more traditional backup process. With EMC's Business Continuance Volumes (BCVs), a mirrored copy of the file system can be created. When the database is locked, the VOB metadata is flushed, and then the mirror can be turned off.

The following scenario assumes that the `nas_fs -S` command was already issued, and the snapshot (`ufsccl1_snap1`) exists.

To create the mirror:

1. On the Control station, turn the mirror on:

```
$ nas_fs -M on ufsccl1_snap1
```

Wait for the command to complete.

Monitor the output of the command `nas_fs -i ufsccl1_snap1` and verify that the remainder value is zero.

2. On the VOB server, lock the entire VOB:

```
cleartool lock vob:<vob-cfs-tag>
```

Wait for the command to complete. Note: The VOB is not accessible until it is unlocked.

3. C. On the Control Station, turn the mirror off:

```
$ nas_fs -M off ufsccl1_snap1
```

Wait for the command to complete.

4. On the VOB server, unlock the VOB:

```
cleartool unlock vob:<vob-cfs-tag>
```

Wait for the command to complete.

After the snapshot has completed, the file system `ufsccl1_snap1` can be mounted, potentially on a different Data Mover, and is available for traditional backup or other non-production purposes, for example, testing.

SnapSure

With the SnapSure feature on CFS, the VOB can also be locked for a much shorter period of time. A lock is requested prior to taking a checkpoint. The VOB is not accessible until it is unlocked.

You must lock the VOB(s) prior to taking a checkpoint.

To create a checkpoint for the `ufsccl1` file system where the VOB for `/usr/myvob` resides:

1. On the Control Station, create the metavolume to host the checkpoint:

```
$ nas_volume -n mtv3 -c d8
```

2. On the VOB server, lock the entire VOB:

```
cleartool lock vob:<vob-cfs-tag>
```

3. On the Control Station, create a SnapSure checkpoint:

```
$ nas_fs -C ufsccl1 -v mtv3
```

4. On the VOB server, unlock the VOB:

```
cleartool unlock vob:<vob-cfs-tag>
```

Wait for the command to complete.

After the checkpoint is created, the file system, `ufsccl1_ckpt1`, can be mounted on the same Data Mover and is available for traditional backup.

Dynamic File System Extension

The dynamic file system extension feature of Celerra allows you to extend a file system while the file system is in use. The file system extension takes place on the VOB where the file system resides. There is no need to relocate the VOB to a larger file system on this server or another server where stopping user activities may be required.

The example below shows the `ufsc2` file system that hosts the VOB and its expansion.

The storage path name includes the Data Mover name. For example, `dm102-ana0` is the name of the Data Mover and `ufsc2` is the name of the file system in which the VOB resides. When you set the environment, it is recommended that you do not include the Data Mover name or file system name in the storage path. By not including these two items in the storage path, the environment is more manageable in the event that the VOB is relocated.

To extend the file system:

1. On the VOB server, type the Cleartool `space` command to show the space used (94%):

```
cleartool> space -directory /net/dm102-ana0/ufsc2/vob_cfs_22.vbs
```

Use (MB)	%Use	Directory
1001.0	94%	/net/dm102-ana0/ufsc2/vob_cfs_22.vbs
1001.0	94%	Subtotal
1001.8	94%	File system dm102-ana0:/ufsc2 (capacity 1061.4 Mb)

2. On the Control Station, extend `ufsc2` by the size of the `mtv11` metavolume:

```
$ nas_fs -x ufsc2 mtv11
```

3. On the VOB server, check the space used (47%):

```
cleartool> space -directory /net/dm102-ana0/ufsc2/vob_cfs_22.vbs
```

Use (MB)	%Use	Directory
1001.0	47%	/net/dm102-ana0/ufsc2/vob_cfs_22.vbs
1001.0	47%	Subtotal
1001.8	47%	File system dm102-ana0:/ufsc2 (capacity 2122.8 Mb)

ClearCase Installation on Celerra

The following software and hardware are required to install ClearCase on Celerra:

- ◆ Celerra File Server, version 2.2.35.4 or higher
- ◆ ClearCase 4.1 with recommended patches
- ◆ Symmetrix Version 5266+ (the instant split feature is required for TimeFinder/FS)

Refer to the ClearCase documentation for installation instructions. Specific settings for Celerra are not required.

CFS can host the ClearCase release area as well. This facilitates future ClearCase software upgrades.

Storing ClearCase VOBs and Views on Celerra

This section describes how you can create ClearCase VOBs and views stored on Celerra in the UNIX and Windows NT environments.

UNIX Environment

Creating a VOB on UNIX

The UNIX environment illustrated in Figure 2 shows a VOB with the storage directory stored on Celerra.

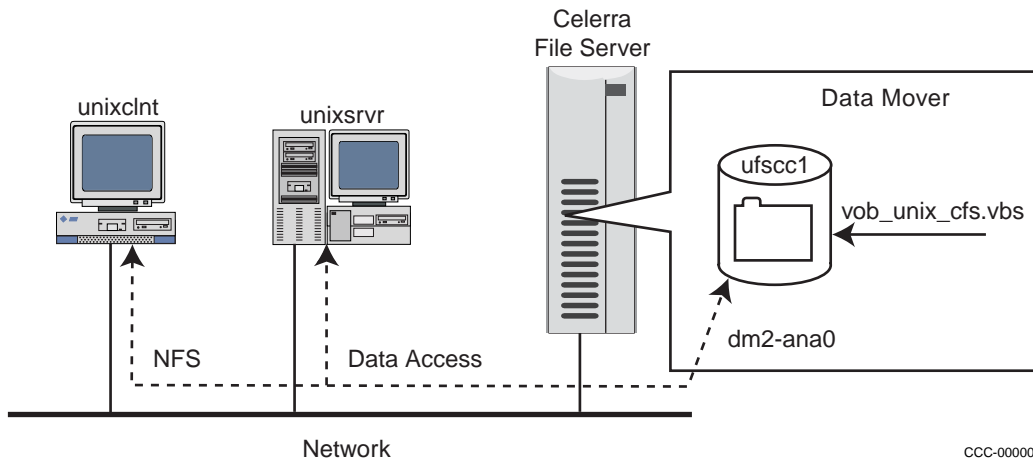


Figure 2. VOB Stored on CFS Being Accessed by an NFS Client

Table 3 describes the host names and ClearCase roles used in Figure 2.

Table 3. Host Name and ClearCase Roles

Host Name	ClearCase Role	Domain Name
unixsrvr	UNIX ClearCase VOB server	domain=nsdprod
unixclnt	UNIX ClearCase client	domain=nsdprod

You can use the ClearCase `mkvob` and `mkview` commands with the following options in Table 4.

Table 4. Options for the `mkvob` and `mkview` Commands

Option	Function
-host	Defines which host runs the ClearCase processes for the VOB.
-hpath	The pathname to the valid storage location on that host.
-gpath	The global pathname to the VOB storage directory that is valid for all the hosts in that region, including the one where the VOB physically resides.

To create a VOB with storage located on the Data Mover *dm2-ana0/ufsccl1*, type:

For better readability of the command, set the string variable *STGPATH* with the VOB storage pathname.

1. `ccadmin@unixsrvr> set STGPATH=/net/dm2-ana0/ufsccl1/vob_unix_cfs.vbs`
2. `ccadmin@unixsrvr> cleartool mkvob -c "test" -tag /vob_unix_cfs -public password clear -host unixsrvr -hpath $STGPATH -gpath $STGPATH $STGPATH`

Creating a View on UNIX

To create a view in UNIX, type:

1. `ccuser1@unixclnt> set STGPATH=/net/dm2-ana0/ufsccl1/view_unix_cfs.vws`
2. `ccuser1@unixclnt> cleartool mkview -tag view_unix_cfs -host unixclnt -hpath $STGPATH -gpath $STGPATH $STGPATH`

To create a snapshot view in UNIX, type:

1. `ccuser1@unixclnt> set STGPATH=/net/dm2-ana0/ufsccl1/snap_unix_cfs.vws`
2. `ccuser1@unixclnt> cleartool mkview -sna -tag snap1_unix_cfs -host unixclnt -hpath $STGPATH -gpath $STGPATH $STGPATH`

In this instance, the VOB must be loaded into the view before you can use it. Refer to the *ClearCase Reference Manual* for detailed instructions.

Windows NT Environment

Creating a VOB on Windows NT

The Windows NT environment, illustrated in Figure 3, shows how you can create a VOB with the storage directory stored on Celerra.

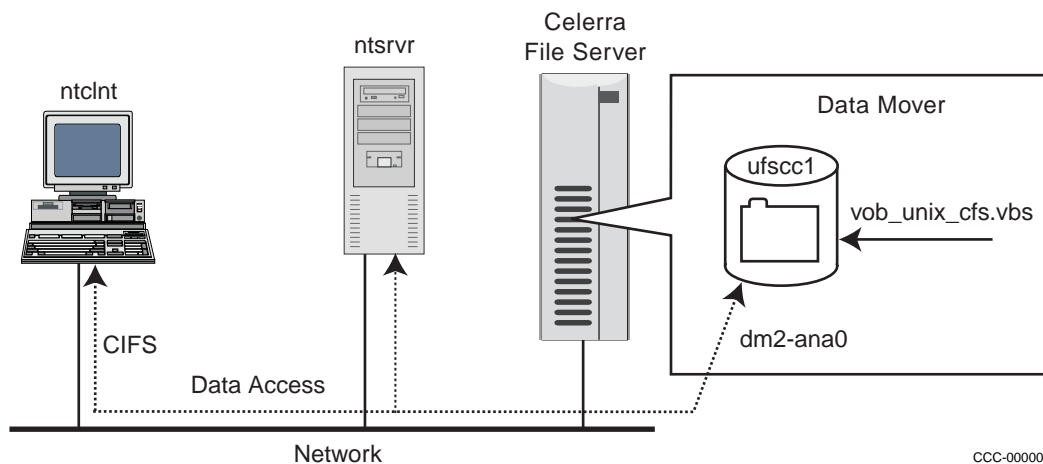


Figure 3. VOB Stored on CFS Being Accessed by a CIFS Client

Table 5 describes the host names and ClearCase roles used in Figure 3.

Table 5. Host names and ClearCase Roles

Host Name	ClearCase Role	Domain Name
ntsrvr	NT ClearCase VOB server	domain=milkyway
ntclnt	NT ClearCase client	domain=milkyway

You can use the ClearCase `mkvob` and `mkview` commands with the following options in Table 6.

Table 6. Options for the `mkvob` and `mkview` commands

Option	Function
-host	Defines which host runs the ClearCase processes for the VOB.
-hpath	The pathname to the valid storage location on that host.
-gpath	The global pathname to the VOB storage directory that is valid for all the hosts in that region, including the one where the VOB physically resides.

To create a VOB with the storage located on the Data Mover `\\dm2-ana0\ufsccl`, type:

For better readability of the command, set the string variable `STGPATH`.

1. `c:\> set STGPATH=\\dm2-ana0\ufsccl\vob_nt_cfs.vbs`
2. `c:\> cleartool mkvob -c "test" -tag /vob_nt_cfs -public
password clear -host ntsrvr -hpath %STGPATH% -gpath %STGPATH% %STGPATH%`

Creating a View on Windows NT

To create a view on Windows NT, type:

1. `c:\> set STGPATH=\\dm2-ana0\ufsccl\nt_view_cfs.vws`
2. `c:\> cleartool mkview -tmode msdos -tag nt_view_cfs -host ntclnt -hpath
%STGPATH% -gpath %STGPATH% %STGPATH%`

To create a snapshot view on Windows NT, type:

1. `c:\> set STGPATH=\\dm2-ana0\ufsccl\snap1_nt_cfs.vws`
2. `c:\> cleartool mkview -sna -tag snap1_nt_cfs -host ntclnt -hpath %STGPATH%
-gpath %STGPATH% %STGPATH%`

In this instance, the VOB must be loaded into the view before you can use it. Refer to the *ClearCase Reference Manual* for detailed instructions.

Sharing ClearCase File and Directory Elements in a Mixed Environment

With Celerra, you can create a Windows NT VOB tag for an existing UNIX VOB, which allows you to:

- ◆ Share the same directories and files across UNIX and Windows NT
- ◆ Work on the same elements in both UNIX and Windows NT
- ◆ Does not require NFS third-party software on Windows NT
- ◆ Does not require CIFS third-party software on UNIX

To create a Windows NT VOB tag for a UNIX VOB:

1. `c:\> set GPATH=\\dm2-ana0\ufsccl\vob_unix_cfs.vbs`
2. `c:\> set HPATH=/net/dm2-ana0/ufsccl/vob_unix_cfs.vbs`
3. `c:\> cleartool mktag -vob -tag /nt_vob_tag -host unixsrvr -hpath %HPATH%
-gpath %GPATH% %GPATH%`

Table 7 shows the host names, ClearCase roles, and domain names that are referenced in Figure 4.

Table 7. Host names and ClearCase Roles

Host Name	ClearCase Role	Domain Name
unixsrvr	UNIX ClearCase VOB server	domain=nsdprod
unixclnt	UNIX ClearCase client	domain=nsdprod
ntsrvr	NT ClearCase VOB server	domain=milkyway
ntclnt	NT ClearCase client	domain=milkyway

Figure 4 shows a ClearCase environment consisting of Windows NT and UNIX hosts.

dm2-ana0 is the NetBIOS name for CIFS and host name for NFS clients of Data Mover server_2 in the Celerra File Server. dm2-ana0 hosts the file system ufsccl that is used as the data repository for VOBs and views.

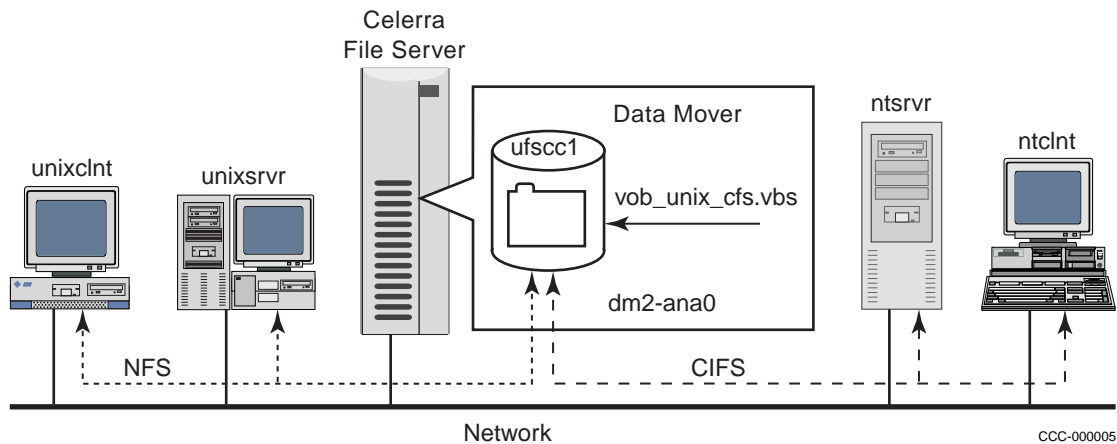


Figure 4. Access across the Windows NT and CIFS Platforms on the Same VOB

Exporting a CFS File System to be used as VOB/View Repository

To export the file system `ufsccl1` for use as VOB and view repository:

1. On the Control Station, type:

```
$ server_mountpoint server_2 -c /ufsccl1
$ server_mount server_2 -o accesspolicy=NATIVE,nolock ufsccl1 /ufsccl1
$ server_export server_2 -o access=unixsrvr:unixclnt,root=unixsrvr /ufsccl1
```

You must have root access to the host(s) designated to be the VOB or view server(s).

2. Create a Windows NT share to access the file system using CIFS (no ClearCase-specific settings are necessary). On the Control Station, type:

```
$ server_cifs server_2 -a security=NT
$ server_export server_2 -P cifs -n ufsccl1 /ufsccl1
```

The ClearCase Windows NT environment requests the creation of the special domain user `clearcase_albd` with administration privileges. The special domain user must belong to the `clearcase` global group used by the application process. Figure 5 shows the Group Memberships dialog box in the User Manager where you create the special domain user.

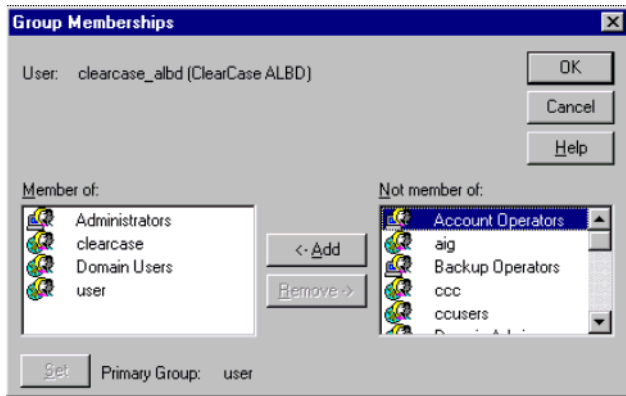


Figure 5. Group Memberships Dialog Box

3. In addition to the ClearCase users (for example, ccuser1), the *clearcase_albd* user must also be added to the *etc/password* file of the Data Mover. In the password file, type:

```
ccuser1.milkyway:*:32665:2000:::
clearcase_albd.milkyway:*:1405:2001:::
```

4. ClearCase is case-sensitive; therefore, the primary group names for UNIX and Windows NT must be in the same case. This is important for data sharing.

To assign a name in the Celerra *etc/group* file, refer to the *Celerra File Server Basic Administration Guide*.

The *clearcase_albd* user must belong to the *clearcase* global group. ClearCase issues an alert message when other users attempt to join that group.

Use the *credmap* and *creds* utilities to check the consistency of the credentials across the ClearCase network in a multi-protocol (CIFS/NFS) environment. These utilities are available on the Windows NT hosts.

Configuration Tips for a Mixed Environment

When you configure ClearCase in a mixed NFS and Windows NT environment:

1. Be consistent with user and group names across both platforms, including case.
2. Set the `CLEARCASE_PRIMARY_GROUP` Windows NT variable with the corresponding UNIX group at the start of your Windows NT ClearCase session. To do this, type:

```
C:>set CLEARCASE_PRIMARY_GROUP=user
```

Set the variable before you start any interop session on Windows NT.

3. In Windows NT, in the **ClearCase Properties - Options** tab, the **Use this domain to map UNIX user and group names** option must be set to the proper UNIX domain name.

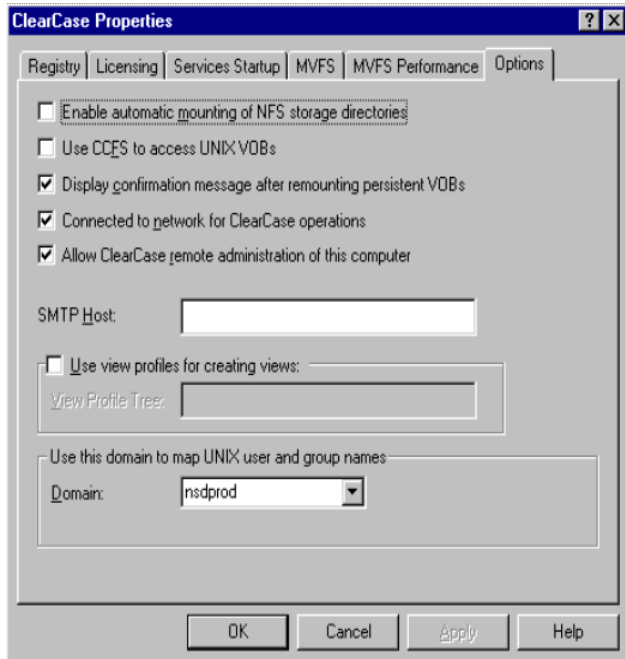


Figure 6. ClearCase Properties - Options Dialog Box

Troubleshooting

This section provides error messages with problems and solutions.

Example 1

The following error message displays when you attempt to create a VOB with the storage path on Data Mover *dm102-ana0* and the file system */ufsccl*:

```
ccadmin@unixsrvr> STGPATH=/net/dm102-ana0/ufsccl/vob_cfs.vbs
ccadmin@unixsrvr> cleartool mkvob -c "demo" -tag /tmp/vob_cfs -host unixsrvr -hpath
$STGPATH -gpah $STGPATH $STGPATH
cleartool: Error: Unable to determine absolute pathname for "/net/dm102-ana0/ufsccl"
- Permission denied
cleartool: Error: Unable to create directory /net/dm102-ana0/ufsccl/vob_cfs.vbs:
Permission denied
cleartool: Error: Unable to create versioned object base
"/net/dm102-ana0/ufsccl/vob_cfs.vbs
```

Problem

The file system, *ufsccl*, was not exported by the Data Mover or access permissions to the *ufsccl* directory were not granted.

Solution

Check the consistency of the permission attributes for the *ufsccl* directory with `ls -l`. Use the `chmod` command to change the permission attributes. On the Control Station, export the file system using the `access=` option, specifying the ClearCase host names. For example:

```
$ server_export server_2 -o access=unixsrvr /ufsccl
```

Example 2

To create a VOB, type:

```
ccadmin@unixsrvr> STGPATH=/net/dm102-ana0/ufsccl/vob_cfs.vbs
ccadmin@unixsrvr> cleartool mkvob -c "demo" -tag /tmp/vob_cfs -host unixsrvr
-hpath $STGPATH -gpath $STGPATH $STGPATH
```

The following error message appears when you attempt to create a VOB with the storage path on Data Mover *dm102-ana0* and file system */ufsccl*:

```
cleartool: Error: Failed to record hostname unixsrvr in storage directory
/net/dm102-ana0/ufsccl/vob_cfs.vbs
cleartool: Error: Problem starting vob_server for vob
unixsrvr:/net/dm102-ana0/ufsccl/vob_cfs.vbs
cleartool: Error: See albd or vob error logs on host unixsrvr
cleartool: Error: Unable to create versioned object base
/net/dm102-ana0/ufsccl/vob_cfs.vbs
```

To create a View, type:

```
ccadmin@unixsrvr> STGPATH=/net/dm102-ana0/ufsccl/view_cfs.vws
ccadmin@unixsrvr> cleartool mkview -c "demo" -tag view_cfs -host unixsrvr -hpath
$STGPATH -gpath $STGPATH $STGPATH
```

The following error message appears when you create a View with the storage path on Data Mover *dm102-ana0* and file system */ufsccl*:

```
cleartool: Error: Unable to create directory /net/dm102-ana0/ufsccl/view_cfs.vws: No
such file or directory
cleartool: Error: Unable to create directory /net/dm102-ana0/ufsccl/view_cfs.vws: No
such file or directory
cleartool: Error: Unable to create view /net/dm102-ana0/ufsccl/view_cfs.vws
```

Problem

The file system, *ufsccl*, that is exported by the Data Mover does not have root access given for the ClearCase server, *unixsrvr*, specified in the *-host* option.

Solution

On the Control Station, use the **server_export** command to give root access to host *unixsrvr*. For example:

```
$ server_export server_2 -o root=unixsrvr /ufsccl
```

Example 3

An error occurs when you attempt to check in a file:

```
cleartool> ci -nc file500M.txt
text_file_delta: Error: Trouble writing to file
/net/dm102-ana0/ufsccl/vob_cfs_22.vbs/s/sdft/12/9/tmp_12632.3: No space left on device
text_file_delta: Error: Trouble accessing file
/net/dm102-ana0/ufsccl/vob_cfs_22.vbs/s/sdft/12/9/tmp_12632.3: No space left on device
cleartool: Error: Type manager text_file_delta failed create_version operation.
cleartool: Error: Unable to check in file500M.txt.
```

Problem

The file system where the VOB storage directory resides has run out of space.

Solution

Use the **nas_fs** command to extend the file system.

On the Control Station, type:

```
$ nas_fs -x ufsccl mtv11
```