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**IBM® Rational® ClearCase MultiSite®**

Creating a replicated environment

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This module covers creating a replicated environment for IBM Rational ClearCase MultiSite version 7.0 or higher.

## Introduction

- This module covers:
  - ▶ Designating hosts in a replicated environment
  - ▶ Creating a replicated environment
  - ▶ Keeping a VOB family in sync
  - ▶ Working in an environment where a firewall is present
- Prerequisites:
  - ▶ Completion of the Introduction to IBM Rational ClearCase MultiSite module
  - ▶ An understanding of general ClearCase concepts



This module explains designating hosts in a replicated environment, creating a replicated environment, keeping a VOB family in sync, and working in an environment where a firewall is present.

Before beginning this module, the user should be familiar with the concepts discussed in the Introduction to IBM Rational ClearCase Multisite module, and have an understanding of general ClearCase concepts.

## Module objectives

- Upon completion of this module, a user will know:
  - ▶ How to create a replicated environment in an organization
  - ▶ Know what permission and identity preserving replicas are
  - ▶ How to set up sync jobs to keep the family in sync
  - ▶ What to do when a firewall device is present in a replicated environment



Upon completion of this module, a user will know how to create a replicated environment in an organization, know what permission and identity preserving replicas are, know how to set up sync jobs to keep the family in sync, and what to do when a firewall device is present in a replicated environment.

## Designating host systems

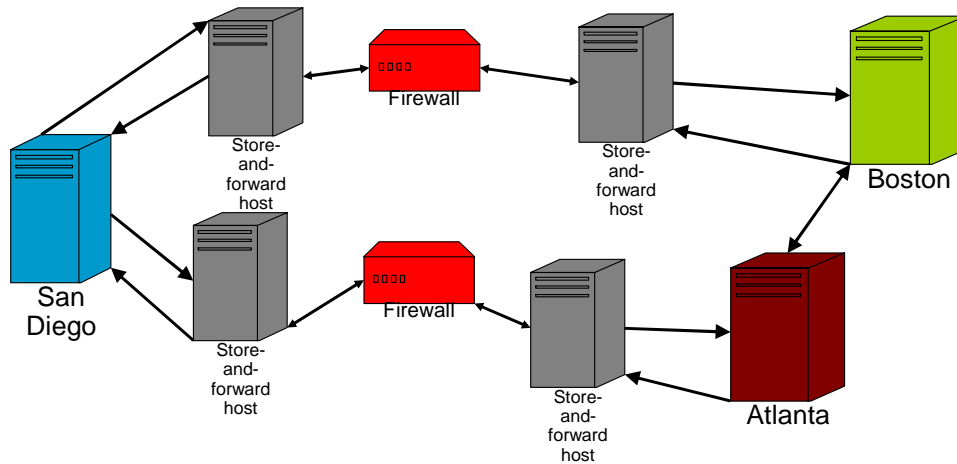
- Examine the current environment
  - ▶ Determine if the network has enough bandwidth to support multisite
- Determine how many sites and replicas are necessary for development
- Determine if need store-and-forward hosts are needed
- Verify if there is a firewall in the environment
  - ▶ Firewalls in a multisite environment require special considerations in implementation
  - ▶ Specific settings must be made to allow multisite packets to pass through the firewall



This section of the module discusses designating host systems. When creating a new multisite environment, examine the current environment. Decide how many sites and replicas are necessary for development. Also, determine if store-and-forward hosts are needed. Store-and-forward hosts are primarily used in environments where firewalls are present, but might also be used in environments without firewalls to load balance shipping of packets. Finally, verify if there is a firewall in the environment. Firewalls in a multisite environment require special considerations in their implementation. Specific settings must be made to allow multisite packets to pass through the firewall.

## Designating host systems

### Examining your current environment



When examining the environment, map out all offices and locations in the organization that require a replicated VOB for development to occur. Determine if there are firewall devices between any of the sites. If there are firewalls in the environment, a shipping server is necessary to transmit the packets through the designated ports. Also, consider the sync pattern in which the replicas are updated in, whether the pattern is one way, a star, or circular. This pattern will depend on how quickly development teams require updates at each site. The sync patterns can be highly complex depending on how many physical sites are involved, how frequently update packets need to be sent, and to which site they are being sent.

## Creating a replicated environment

- Creating replicas
  - ▶ Use the mkreplica command
  - ▶ Mkreplca dumps the VOB database
  - ▶ Mkreplca generates a single replica creation packet unless the `–maxsize` option is used
- `–ship` and `–fship`
  - ▶ `–fship` attempts to forward the packets to the remote site immediately
  - ▶ `–ship` does not ship the packets immediately
  - ▶ `–ship` places the packets in the outgoing shipping bay for future processing by the shipping server



To create a replica of an existing VOB, use the `mkreplica` command. `Mkreplca` first dumps the VOB database and generates a single replica creation packet, unless the `–maxsize` option is specified. When creating new replicas, note which versions of ClearCase are used at each site. When major version levels are present, create the replica from the lower version site and send it to the higher version site. For example, if Site A is running ClearCase 2003.06.16, and Site B is running 7.0.1.1, Site A must create the replica and ship it to Site B. If Site B were to create the replica, the import would fail at site A due to the lower version not recognizing the formatting of the creation packet.

A command specified with `–fship` will attempt to forward the packets to the remote site immediately. `–ship` will not ship the packets immediately; it places the packets in the outgoing shipping bay for future processing by the shipping server.

## Creating a replicated environment

- Permission preserving replicas:
  - ▶ Maintain the same permissions on elements
  - ▶ Synchronize changes to permissions to other replicas in the family that preserve permissions
  - ▶ Preserve read, write and execute permissions for user, group, and others
  - ▶ Do not preserve the SID (Windows®), set-UID bit, set-GID bit, and sticky bit (UNIX®)



Permissions preserving replicas maintain the same permissions on elements between all replicated sites. When changes to permissions are made, they are synchronized to other replicas in the family that preserves permissions.

Read, write and execute permissions for the user, group, and others are preserved. The Security Identifier on Microsoft Windows (SID), set-UID bit, set-GID bit, and sticky bit (UNIX) are not preserved. The reason these are not preserved is because these values are site specific, and are different at each site. This is a primary reason for only using the permission preserving mode.

## Creating a replicated environment

- Permission preserving replicas (continued):
  - ▶ When changing a replica to be permissions-preserving, or to create a new permissions-preserving replica, the VOB family feature level of the replica must be at least 4
  - ▶ Run `mkreplica -export` at an identities- and permissions-preserving replica or a permissions-preserving replica to create a replica that preserves permissions
  - ▶ Ignore changes to identities made at other replicas



To change a replica to be permissions preserving, or to create a new permissions preserving replica, the VOB family feature level of the replica must be at least four.

To create a replica that preserves permissions, run `mkreplica -export` at an identities and permissions preserving replica or at a permissions preserving replica.

Permissions preserving replicas ignore changes to identities made at other replicas, and maintain their own identity information for elements.



## Creating a replicated environment

- Permission preserving replicas (continued):
  - ▶ Make the user who enters the `mkreplica -import` command the owner of the new VOB and all of the elements in it
  - ▶ Make the VOB owner the owner of the new elements when an update packet containing oplogs for new elements is imported
  - ▶ Make the primary group of the user who runs the `mkreplica -import` command the VOB's primary group and the group for all elements



The user who enters the `mkreplica -import` command becomes the owner of the new VOB and all of the elements in it.

When an update packet containing oplogs for new elements is imported, the VOB owner becomes the owner of the new elements.

The primary group of the user who runs the `mkreplica -import` command becomes the VOB's primary group and the group for all elements. When an update packet containing oplogs for new elements is imported, the VOB's primary group is the group for the new elements.

Changes to identities made at a non-identities-preserving replica are not recorded in oplogs.

## Creating a replicated environment

- Identities and permissions preserving replicas:
  - ▶ Maintain the same user and group identities and permissions on elements
  - ▶ Synchronize changes to identities or permissions to sibling replicas
  - ▶ Do not preserve the owner and group of the original VOB



Identities and permissions preserving replicas maintain the same user and group identities and permissions on elements.

Changes to identities or permissions are synchronized to sibling replicas. In identities and permissions preserving replicas, the SIDs, UIDs and GIDs are maintained between the sites. This requires that the two sites belong to the same domain in a Microsoft Windows Active Directory environment or in the same Unix Network Information Service (NIS) network.

The owner and group of the original VOB are not preserved; the user who enters the `mkreplica -import` command becomes the owner of the new VOB.

## Creating a replicated environment

- Identities and permissions preserving replicas (continued):
  - ▶ Make the user's group the primary group of the VOB, and the user's group list becomes the VOB's group list
  - ▶ Create a replica that preserves identities and permissions by running the `mkreplica -export` command at an identities- and permissions-preserving replica
  - ▶ Cannot preserve permissions and identities across different operating system types



When an identities and permissions preserving replica is imported, the user's group that entered the `mkreplica` command becomes the primary group of the VOB, and the user's group list becomes the VOB's group list. The user must be a member of all the groups that are used for elements in the replica.

To create a replica that preserves identities and permissions, the `mkreplica -export` command should be run at an identities and permissions preserving replica.

Permissions and identities cannot be preserved across different operating system types. For example, a user at a host running Microsoft Windows 2003 Server cannot create an identities and permissions preserving replica to a host running Red Hat Linux.

## Creating a replicated environment

- Importing replicas
  - ▶ After the replicas are generated and shipped, an administrator at a remote site can import the creation packets.
  - ▶ The administrator can use the `–preserve` and `–perms_preserve` switches to preserve identities and permissions.



After the replicas generate and ship, an administrator at a remote site can import the creation packets. If the replica creation packets are lost between the sites, new creation packets must be generated at the sending site. To do this, remove the old replica using `rmreplica`, and create a new one.

The administrator can choose to use the `–preserve` and `–perms_preserve` switches to preserve identities and permissions. If the administrator does not want to preserve identities or permissions, they must specify the `–npreserve` switch.

## Creating a replicated environment

- Mkreplca examples
  - ▶ Create a replica, and ship it immediately
    - `multitool mkreplca -export -fship hostname:my_new_replica`
  - ▶ Create a replica, but do not ship it immediately; use the `-workdir` switch for temporary files
    - `multitool mkreplca -export -workdir -ship hostname:my_new_replica`
  - ▶ Import a replica that preserves identities and permissions
    - `multitool mkreplca -import -tag \myvob -vob \\host\ccstorage\vobs\myvob.vbs -perms_preserve`



The following `mkreplca` command examples run from a command prompt while in a `view\VOB` context.

To create a replica and ship it immediately, use:

```
multitool mkreplca -export -fship hostname:my_new_replica
```

To create a replica but not ship it immediately, using the `-workdir` switch for temporary files, use:

```
multitool mkreplca -export -workdir -ship hostname:my_new_replica
```

To import a replica that preserves identities and permissions, use:

```
multitool mkreplca -import -tag \myvob -vob \\host\ccstorage\vobs\myvob.vbs -perms_preserve
```

When a replica is imported, the path to the new `.vbs` directory for the VOB must be specified in a UNC style format on Microsoft Windows systems, or `/net/hostname` on UNIX operating systems.

## Keeping the family in sync

- Determining synchronization patterns
  - ▶ Determine the pattern that the replicas of a VOB are synced in
    - Determined by the site that needs the updates the quickest for development to move along
    - Depends on how many replicas are present in an environment
  - ▶ Determine if there are any one way synchronizations
    - One way syncs are useful for a backup replica
    - One way syncs are also used in secure environments to protect sensitive data



The next section of this module details keeping the family in sync.

First, determine the pattern the replicas of a VOB are synced in. The pattern is typically determined by the site that needs the updates the quickest for development to continue. The pattern also depends on how many replicas are present in an environment.

Next, determine if there are any one-way synchronizations. One-way syncs are often used for a backup replica, as the backup is only used in a disaster recovery scenario. One-way syncs are also used in secure environments to protect sensitive data.

## Keeping the family in sync

- Setting up synchronization jobs
  - ▶ In Windows, the ClearCase Administration Console can be used to set up the sync jobs or cleartool schedule.
  - ▶ In UNIX, the cleartool schedule command is used.
  - ▶ The administrator determines how often the replicas are synced according to demand for updates at each site.
  - ▶ Other factors should be considered, such as network bandwidth.



In Windows, the ClearCase Administration Console can be used to set up the sync jobs, or the cleartool schedule command can be used from a command prompt. On systems running UNIX operating systems, use the cleartool schedule command.

The administrator must determine how often the replicas are synced according to the demand for updates at each site. Other factors must be considered as well, such as network bandwidth. Shipping packets too frequently will cause excessive network traffic, and increases the chance of packets being lost.

## Keeping the family in sync

### Setting up synchronization jobs

The screenshot shows the 'ccadminconsole' interface with a list of scheduled jobs. The 'Job Properties' dialog box is open for the 'Daily MultiSite Export' job. The 'Advanced Schedule Options' dialog box is also open, showing the 'Repeat task' section where the frequency is set to 'Every: 1 hour(s)'. A yellow callout bubble contains the text: 'The Advanced Schedule option is where to set the frequency the sync job is run at'.

Job ID	Name	Schedule	Next Run Time
1	Daily VOB Pool Scrubbing	At 4:30 AM every day, starting 3/17/2008	4:30 AM 6/3/2008
2	Daily VOB Snapshots	After Daily VOB Pool Scrubbing	After Daily VOB Pool ...
3	Daily Registry Backup	After Daily VOB Snapshots	After Daily VOB Snap...
4	Daily Local Tasks	After Daily Registry Backup	After Daily Registry ...
5	Daily View Space	After Daily Local Tasks	After Daily Local Tasks
6	Daily VOB Space	After Daily View Space	After Daily View Space
7	Daily Base CC/CQ	After Daily VOB Space	After Daily VOB Space
8	Weekly Log Scrub	Weekly Log Scrub	Weekly Log Scrub
9	Weekly VOB Data	Weekly VOB Data	Weekly VOB Data
10	Weekly Local Task	Weekly Local Task	Weekly Local Task
11	Weekly VOB Sync	Weekly VOB Sync	Weekly VOB Sync
12	Daily MultiSite Exp	Daily MultiSite Exp	Daily MultiSite Exp
13	Daily MultiSite Sync	Daily MultiSite Sync	Daily MultiSite Sync
14	Daily MultiSite Rec	Daily MultiSite Rec	Daily MultiSite Rec
15	Daily CC MultiSite	Daily CC MultiSite	Daily CC MultiSite
16	Daily MultiSite Syn	Daily MultiSite Syn	Daily MultiSite Syn
17	Daily MultiSite Syn	Daily MultiSite Syn	Daily MultiSite Syn
18	Daily MultiSite Syn	Daily MultiSite Syn	Daily MultiSite Syn



In the screen capture example on this slide, the default Daily MultiSite Export job is being modified. The job is being set to run every day, starting at 8pm. When the Advanced button is clicked, another dialog box appears, Advanced Schedule Options. This is where the frequency of the job is set. Here, the job is set to run every hour.



## Keeping the family in sync

- Creating custom sync scripts
  - ▶ By default, the sync\_export\_list.bat file synchronizes all replicated VOBs it finds on a host to all of its sibling replicas.
  - ▶ Custom scripts allow a user to specify which replicas to update. This reduces network traffic, and allows the user to control the sync pattern.
  - ▶ Custom sync scripts are specified in the scheduled job in the parameters section.



By default, the sync\_export\_list.bat file synchronizes all replicated VOBs it finds on a host to all of its sibling replicas.

A custom sync script allows an administrator to specify which replicas will update at each site. The custom sync scripts allow the administrator to manage a specified sync pattern by directing sites to send update packets to specific replicas.

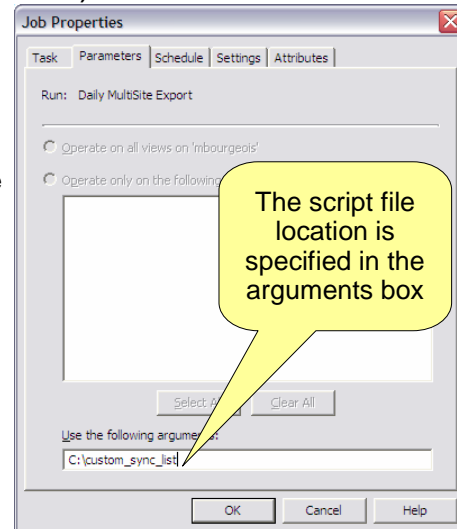
Sync scripts reduce network traffic, as each site will not send update packets for every replicated VOB found on a system. Custom sync scripts are specified in the scheduled job in the parameters section.

## Keeping the family in sync

### Custom sync script example (Windows)

```
replicas:Boston_code@\code_VOB,San_Diego_code
replicas:Boston_dev@\dev_VOB,Atlanta_dev
```

The script file must contain a line for each VOB that is replicated, or a sync packet will not generate for it



This screen details an example of a custom sync script using Windows. On a Microsoft Windows system, create a file on the system. In it, use the syntax of `replicas:replica_name@\vob_tag`. List additional replicas by inserting a comma and listing the replica names. The script file must contain a line for each replicated VOB on the host to be synced. In the scheduled Job properties in the Administration console, the arguments box is located in the Parameters tab. The `-all` default argument is removed, and the path to the sync script is inserted.

## Keeping the family in sync

### Custom sync script example (UNIX)

```
replicas:Boston_code@/vobs/code_VOB,San_Diego_code  
replicas:Boston_dev@/vobs/dev_VOB,Atlanta_dev
```

The syntax is the same in the file for UNIX except for the UNIX style VOB tags

To set the script location in the scheduled job, use the following commands:

- cleartool schedule -edit -schedule
- Change the line that says  
Job.Args: -quiet 1 -all  
to  
Job.Args: -quiet 1 <path to your script>
- Save the changes



For UNIX operating systems, the script is set up in the same way as Windows. A file generates with the syntax of replicas, and the replicas list with Unix style VOB tags. Use the cleartool schedule -edit -schedule command to edit the schedule. Replace the -all parameter with the path to the script file in the Job.Args section. Save the changes to the file and set the schedule.

## Working in a firewall environment

- When there is a firewall present in a multisite environment, use the CLEARCASE\_MAX\_PORT and CLEARCASE\_MIN\_PORT environment variables.
- The variables specify a port range opened on a firewall allowing multisite update packets to pass.
- Without these variables set, the packets are blocked, and updates do not send.



Finally, this section explains what to do when in a firewall environment. When there is a firewall present in a multisite environment, use the CLEARCASE\_MAX\_PORT and CLEARCASE\_MIN\_PORT environment variables. When using these variables on a host running Microsoft Windows, note that no other ClearCase processes can run on this system. This is due to the way the albd\_server dynamically assigns ports to the child processes. If a process tries to create outside of the range specified in the variables, the process will die, and ClearCase will not function correctly.

The variables specify a port range that is opened on a firewall allowing multisite update packets to pass. Without these variables set, the packets are blocked, and updates are not sent.

## Working in a firewall environment

- The variables are set in the shipping.conf file on UNIX, or as system environment variables on Windows.
- Requests for mastership are not designed to work through a firewall.



The variables are set in the shipping.conf file on UNIX systems, or as system environment variables on Windows systems.

Note that requests for mastership are not designed to work through a firewall. When mastership needs to be transferred in an environment with a firewall, the mastering site needs to transfer the mastership of the object.

## Summary

- Designating host systems
  - ▶ The network bandwidth and available hosts
  - ▶ The physical locations involved, what firewalls are present
  - ▶ Diagram the implementation to clarify the design and sync patterns
- Creating a replicated environment
  - ▶ Use of the mkreplica command
  - ▶ Switches used when creating the replica
  - ▶ Similarities exist between identity and permission preserving replicas on elements
  - ▶ Changes are synchronized to sibling replicas



This module discussed the aspects of creating a replicated environment.

It first described how to examine the environment to allow for an implementation of a replicated VOB environment. Network bandwidth and the number of hosts you have available should be considered. Also, determine how many physical locations are involved and what firewalls are present. The best way to visualize the environment is to create a diagram of the implementation to clarify the design and sync patterns.

Next, when creating the replicated environment, use the mkreplica command to create replicas. Note that a variety of switches exist that can be used to create the replica. Identity and permission preserving replicas maintain the same user and group identities and permissions on elements. Changes to identities or permissions are synchronized to sibling replicas.

## Summary

- Keeping the family in sync
  - ▶ Determine which sites need updates the quickest
  - ▶ Set the scheduled jobs
  - ▶ Awareness of custom sync scripts
- Working in a firewall environment
  - ▶ CLEARCASE\_MIN\_PORT and CLEARCASE\_MAX\_PORT variables are used to communicate through a firewall device on designated ports
  - ▶ Requests for mastership will not work through a firewall



To keep the family in sync, determine which sites need updates the quickest, as this is a major factor in determining the sync pattern. To create the sync jobs, set the scheduled jobs in the Administration console on Windows, or the cleartool schedule command on UNIX. The intervals the jobs run at can be set in the job properties. Custom sync scripts are used to design sync patterns and designate which replicas will receive updates from which sites.

When working in a firewall environment, note that the CLEARCASE\_MIN\_PORT and CLEARCASE\_MAX\_PORT environment variables must be used to communicate through a firewall device on designated ports. Without these variables set, update packets will not pass through the firewall device. Also, ensure that no other ClearCase processes are running on a host where these variables are enabled. Finally, remember that requests for mastership will not work through a firewall.

## Additional resources

- Practice creating new replicas
  - ▶ Create new replicas between different operating systems
  - ▶ Set up customized sync scripts to keep the environment up to date
- Review additional documentation
  - ▶ Multisite Administrators Guide
  - ▶ Technotes
    - Requesting mastership in a firewall environment
      - <http://www-1.ibm.com/support/docview.wss?uid=swg21220843>
    - Setting the ClearCase MultiSite scheduled job to send packets to a group of replicas
      - <http://www-1.ibm.com/support/docview.wss?uid=swg21119733>



Upon completing this module, it is recommended to practice replicating an existing VOB. Review the information contained in this module, attempt to create a replica, make changes in it, and keep it in sync with the remote site.

When finished with the practice exercise, a replica of an existing VOB should exist on a remote host. The two sites should be in sync with each other.

Also, review additional documentation regarding ClearCase Multisite. The administrators guide goes into greater detail on the topics discussed in this module. The technotes listed provide additional details to a few of the topics discussed in this course.



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