

CA XOsoft™ High Availability for Windows

Microsoft SQL Server Operation Guide
r12.5



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Chapter 1: Introduction

CA XOsoft High Availability (HA) is a high availability solution based on asynchronous real-time replication and automated application switchover and switchback to provide cost-effective business continuity for file servers and other application servers on both 32- and 64-bit Windows servers.

CA XOsoft HA offers push-button or fully automatic switchover of mission-critical servers over a LAN or WAN, server status monitoring, and integrated continuous data protection as a guard against data corruption, all in a system that sets the standard for ease of configuration and management.

When disaster strikes, whether in the form of a hurricane, a blackout, or far more likely, a virus attack or software or user error, your ability to respond well to the crisis can make the difference between a bright future and the end of your business. At the very least, you are likely to incur significant costs in lost business and, perhaps more importantly, lost confidence by your customers, investors, and other stakeholders. Disaster recovery planning (DRP) is not just about insurance. It is about maintaining your competitive edge. CA XOsoft HA is designed to give you that edge.

This section contains the following topics:

[About This Guide](#) (see page 7)

[Related Documentation](#) (see page 7)

[Server Requirements](#) (see page 8)

About This Guide

This document describes how to implement a CA XOsoft HA solution for SQL Server. Please review each procedure before you begin. It is essential that you have the appropriate resources and permissions to carry out each task.

Related Documentation

Use this Guide along with the *CA XOsoft Installation Guide* and the *CA XOsoft User Guide*.

Server Requirements

To implement high availability for SQL servers, refer to the following list of requirements. If you do not have the license required to access support for a specific server type, please contact Tech Support.

Base Configuration

Base Configuration

- Two servers running Windows Server 2000, 2003, or 2008 with the same level of service packs and hot fixes installed.
- All IP addresses are statically assigned (DHCP-assigned IP addresses on the Master or Replica server are not supported)
- The protected server is not a domain controller or DNS server
- Both servers should reside in the same Active Directory forest and also be members of the same domain or trusted domain.

SQL Server Configuration Requirements

- One or more instances of Microsoft SQL Server 2000, 2005, 2005 Express, or 2008 installed on each server
 - Both servers should have the same SQL version, service packs and hot fixes installed
 - Both servers should hold identical SQL server instances (default or named)
 - Both servers should reside in the same Active Directory forest and be members of the same domain or trusted domain
 - Drive letters containing database files should be identical on both servers
 - The full path to the default system database of each instance should be identical on both servers
 - Verify that the port defined in the Network Configuration TCP/IP properties of the SQL instances is assigned statically and is identical on both Master and Replica

Log On Account Conditions

The CA XOssoft Replication and CA XOssoft HA Engine service must satisfy certain account conditions for successful communication with other components. If these requirements are not met, scenarios may not run. If you lack the permissions required, contact your local IS team.

- It is a member of the Domain Admins group. If the Domain Admins group is not a member of the built-in domain local group Administrators you must use an account that is.
- It is a member of the local machine Administrators Group. If the Domain Admins group is not a member, add the account manually.
- For servers in a workgroup, use the Local System account.
- Master and Replica servers must reside in the same Active Directory forest.

SQL Servers Operating in a Workgroup

For servers in a workgroup, set the CA XOssoft HA Engine service account to a user that is a member of the Local Administrators group. Servers in a workgroup can use Redirect DNS only with DNS servers that allow non-secure updates. You can use Move IP, switch computer name, and custom redirection scripts normally.

About Clusters

Installing on clusters is much the same as a standard installation. To configure CA XOssoft HA on a cluster, enter the Virtual Server Network Name (or IP Address) resource (in the group you intend to protect) as the Master or Replica name. Do not use node names or IP addresses when configuring the scenario. Also, you must install the CA XOssoft Engine to all cluster nodes (see *Server Setup*).

The only configuration that requires some preparation is the use of IP Move in conjunction with a cluster. For detailed instructions on how to use Move IP with clusters, please see [Cluster Move IP](#) (see page 27).

License Registration

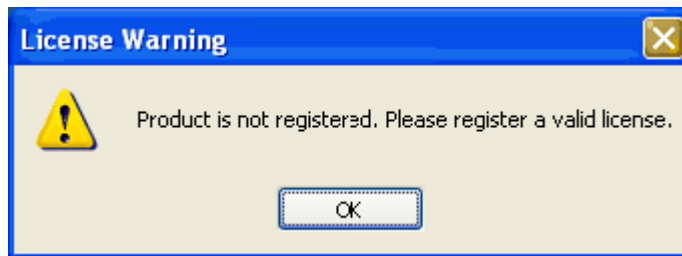
CA XOssoft licensing policy is based on a combination of several parameters, which include: the operating systems involved, the required solution, the supported application and database servers, the number of participating hosts, and the additional modules - Assured Recovery and CDP Repository. The license key that is generated for you is therefore tailored to your exact needs.

After logging in for the first time, or if your old license has expired, you need to register CA XOssoft product using your license key. To register the product, you need to open CA XOssoft Manager, which does not depend on the existence of a valid registration key. Once the Manager opens, a License Warning message appears, prompting you to register the product. A License Warning message also appears when your license is about to expire during the next 14 days.

When you are creating a scenario, some of the options might be disabled following the terms of your license. However, you can create as many scenarios as you wish, since the validity of your license key is first checked when you try to run a specific scenario. Only when you click the **Run** button, the system checks whether you are allowed to run the selected scenario according to your license key. If the system determines that you do not have the required license for running this scenario, the scenario will not run and a message will appear on the Event pane informing you of the type of license you need.

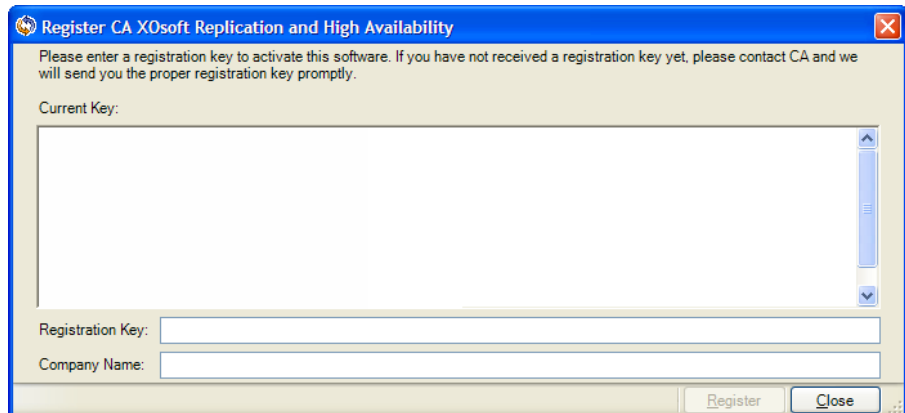
To register CA XOsoft using the license key

1. Open the Manager. The **Welcome** message appears. Then, a **License Warning** message appears informing you that your product is not registered and prompting you to register it.



2. Click **OK** to close the message. Then, open the **Help** menu and select the **Register** option.

The **Register CA XOsoft Replication and High Availability** dialog opens.



3. Enter the following information:
 - In the **Registration Key box** - enter your registration key.
 - [Optional] **Company Name** box - enter your company name
 4. Click the **Register** button to register the product and close the dialog.
- Now you can start working with the CA XOssoft Manager according to your license permissions.

Chapter 2: Creating and Using Scenarios

This chapter describes the most common setup for CA XOssoft HA for Microsoft SQL Server.

This section contains the following topics:

[Create an SQL HA Scenario](#) (see page 13)

[Scenario Properties](#) (see page 14)

[Run the Scenario from Outside the Wizard](#) (see page 18)

[View a Report](#) (see page 20)

[Stop a Scenario](#) (see page 22)

Create an SQL HA Scenario

Creating scenarios is covered in full detail in the CA XOssoft HA User Guide. This section provides additional information specific to a MS SQL High Availability scenario. The Scenario Creation Wizard guides you through the steps required to create a high availability scenario. When completed, you should run your scenario to start data synchronization. Synchronization could take a while, depending on database size and network bandwidth. Once synchronization completes, your high availability scenario now maintains the Replica server so that it can take over for the Master the moment a failure is detected.

Please read the entire procedure, including cross-referenced information, if applicable, before you proceed.

To create a SQL HA scenario

1. From the CA XOssoft Manager, choose Scenario, New or click the New Scenario button.
2. When the Welcome dialog opens, select Create New Scenario and click Next.
3. When the Select Scenario Type dialog opens, select SQL, High Availability Scenario, and Replica Integrity Testing for Assured Recovery (optional). For more information on Assured Recovery, see the *CA XOssoft User Guide*.
4. When the Master and Replica hosts dialog opens, name your scenario and provide the hostname or IP address for the Master and Replica servers. If either server is a MSCS cluster, enter the cluster resource virtual server name or IP address. Click Next. For more information, see [Redirection Methods](#) (see page 23).

5. Wait for Engine Verification to complete and click Next. If needed, click Install to upgrade the Engine on one or both servers and then click Next.

The Database for Replication dialog opens, listing all auto-discovered results for the specified Master. By default, all databases are included.

Note: You can only de-select user created databases.

6. Change selections, as desired and click Next.
7. When the Scenario Properties dialog opens, configure additional properties, if needed. If you use NTFS ACLs with domain accounts for user access control, we recommend that you choose the Replicate NTFS ACL option and click Next. For more information, see Scenario Properties or the *CA XOsoft User Guide*.

The Master and Replica Properties dialog opens.

8. Accept default settings or make the desired changes and click Next.
9. Wait for the Switchover Properties dialog to retrieve information. Configure the desired redirection properties and click Next. For more information, see [Switching Over and Switching Back](#) (see page 31).
10. From the Switchover and Reverse Replication Initiation dialog, choose automatic or manual switchover, and automatic or manual reverse replication, as needed.

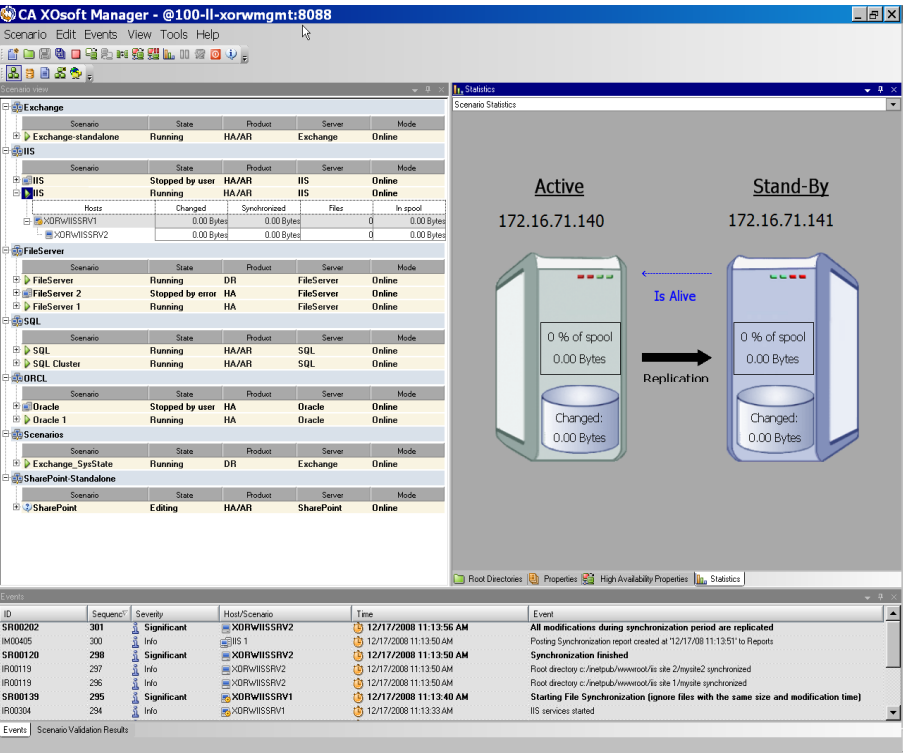
Setting both of these options to automatic is not recommended. For more information, see Scenario Properties or the *CA XOsoft User Guide*.
11. Click Next to initiate scenario verification. If errors are reported, you should resolve them before continuing. At successful verification, click Next to complete scenario creation.
12. Choose Run Now or Finish, as desired. Run Now starts synchronization. Finish allows you to run the scenario later. See [Run the Scenario from Outside the Wizard](#). (see page 22)

Scenario Properties

If you wish to change a scenario configured through the Wizard or configure additional settings, you can use the Properties pane to modify the scenario.

The Properties pane and its tabs are context-sensitive and change whenever you select a different node from a scenario folder. You must stop a scenario before configuring its properties. Certain values cannot be modified once set; they are noted. For full details on configuring scenario properties and their descriptions, see the *CA XOsoft User Guide*.

Properties are organized into tabs on the CA XOssoft Manager Framework pane. The tabs displayed are based upon server type, CA XOssoft solution, and scenario status. Select the scenario for which you wish to change properties, and then select the appropriate tab.



Settings on the Root Directories tab

Select a Master Server from the Scenario Pane. Double-click its Directories folder to add or remove Master Root Directories. Select or clear checkboxes next to folders, as desired, to include or exclude them. You may also edit directory names.

Select a Replica Server from the Scenario Pane. For each Master Root directory, you must specify a Replica Root directory. Double-click the Directories folder for the Replica server. Select or clear checkboxes next to folders, as desired, to hold the corresponding Master directory.

When you select auto-discovery of database files, a SQL auto-discovery dialog opens. The dialog displays all the SQL instances and databases available on the master SQL host. This can be done in the wizard and/or in the scenario view. You can select the instances or databases that are needed.

Note: If you select an instance, you cannot deselect the master, model or msdb databases. You can only deselect user created databases.

There is also a checkbox called "Replicate new databases in the selected root directories". If checked, new databases that are created by the user after the scenario runs will be replicated.

Settings on the Properties Tab

Scenario Properties

These settings establish default behavior for the entire scenario.

- General properties -- cannot be changed once created
- Replication properties -- choose the replication mode (Online or Scheduled), synchronization values (File or Block, Ignore Files of Same Size/Type, Registry Synchronization or System State Protection) and optional settings (Replicate NTFS Compress Attribute, Replicate NTFS ACL, Synchronize Windows Shares, Prevent Automatic Re-sync upon Error)
- Event notification properties -- specify a script to run, choose email notification, or write to the event log.
- Report Handling -- specify report settings, email distribution or script execution

Master and Replica Properties

These settings establish server properties on both Master and Replica. Some settings vary by server type.

- Host connection properties -- Enter the IP address, and Port number of the Master and Replica
- Replication properties -- These properties differ for Master and Replica. See the CA XOssoft User Guide for more information.
- Spool properties -- Set the size, minimum disk free size and directory path. See Spool Directory Settings for more information.
- Event notification properties -- specify a script to run, choose email notification, or write to event log.
- Report properties -- choose synchronization or replication reports, specify distribution or script execution
- (Replica) Scheduled Tasks -- set or suspend tasks, including Replica Integrity Testing for Assured Recovery. For more details, see the CA XOssoft User Guide.
- (Replica) Recovery properties -- set delay, data rewind properties, or scheduled tasks for replica

Settings on the HA Properties Tab

These settings control how switchover and switchback are performed

- Switchover properties -- choose automatic or manual switchover, provide switchover hostname, and reverse replication settings
- Hosts properties -- specify the Master and Replica
- Network Traffic Redirection properties -- choose Move IP, Redirect DNS, Switch Computer Name or User-defined scripts.
- Is Alive properties -- set the heartbeat frequency and check method
- DB Management properties -- instructs CA XOssoft to manage shares or services on a database server
- Action upon Success properties -- defines custom scripts and arguments for use


Run the Scenario from Outside the Wizard

After you create a scenario, you need to run it to start the replication process. Normally, before data changes on the Master will begin to be replicated on the Replica, the Master and the Replica need to be synchronized. Therefore, the first step in initiating a replication is synchronizing the Master and Replica servers. After the servers have been synchronized, online replication starts automatically, continuously updating the Replica with all of the changes that occur on the Master.

Note: In order for the replication process to succeed, verify that the user under which the CA XOsoft Engine is running has Read permission on the Master, and Read and Write permissions on each replication root directory and included files, and on all participating Replica hosts.

To run the scenario from outside the wizard

1. From the Scenario pane, select the scenario you want to run.

2. Click **Run**  on the Standard toolbar.

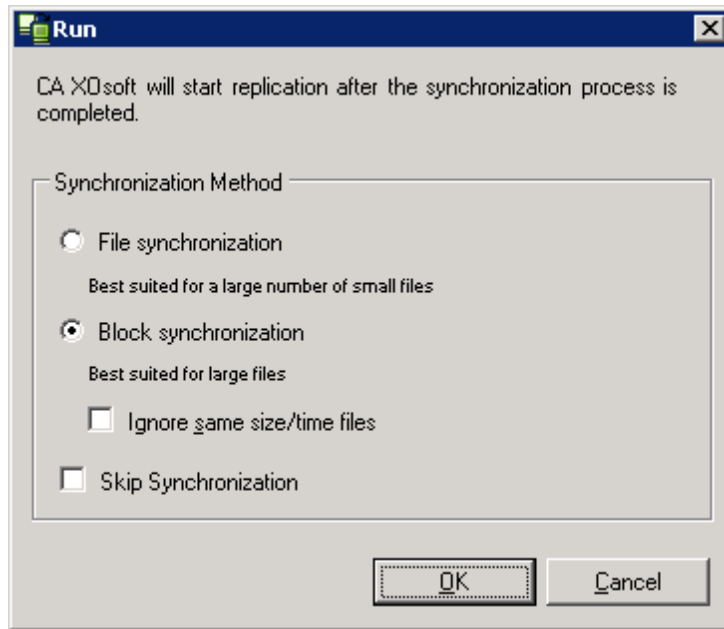
Before initiating synchronization and replication, CA XOsoft verifies your scenario configuration. When verification completes successfully, CA XOsoft Manager displays the message: *Are you sure you want to run scenario "scenario_name?"* If problems are discovered, the top pane displays any warning and error messages resulting from verification.

Note: Scenario Verification checks many different parameters between the Master and Replica servers to ensure a successful switchover. If any errors or warnings are reported you should not continue until they are resolved.

3. Correct errors before you continue. Errors are reported on the Event pane.

Note: Replication of mount points succeeds only if those were added to the Master before the Engine was started. If you included the mount points in the Master root directories when the Engine was already running, no error is reported but the replication does not start. In this case, you need to restart the Engine on the Master before initiating replication.

When no error is reported, the **Run** dialog appears and contains synchronization options.



Note: Do not use Skip Synchronization for any scenarios replicating a database.

4. Select Block Synchronization. Select the Ignore same size/time files to skip the comparison of files with the same path, name, size and modification time, which are generally identical, to reduce synchronization time. You should enable the Skip Synchronization option only when you are certain the files on both Master and Replica are identical.
5. Click the **OK** button. Synchronization may take a while, depending on database size and network bandwidth between the Master and Replica. You will receive the following message in the event window when the synchronization is complete: *All modifications during synchronization are replicated.*

At this point, the scenario is operational and active. By default, a Synchronization Report is generated when synchronization finishes. To view the report, refer to the topic, View a Report. You can also generate regular Replication Reports to monitor the replication process on each participating server. For more information, see the *CA XOssoft User Guide*.

View a Report

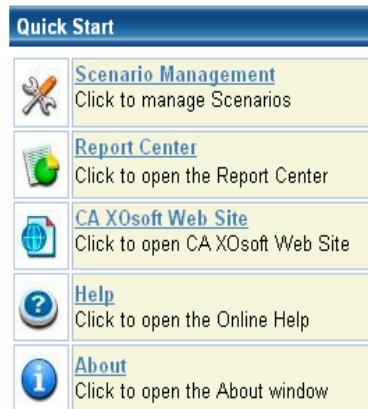
CA XOsoft can generate reports on the replication and synchronization processes. These reports can be stored on your desired location, opened for view from the Report Center, sent by email to a specified address, or they can trigger script execution.

The default storage directory of the generated reports is:
`[ProgramFilesFolder]\CA\XOsoft\Manager\reports`

To view a report

1. To view a report, first you need to open the Report Center. There are two ways to open it:

- On the Overview Page, click the **Report Center** link on the **Quick Start** pane on the left:



2. From the **Tools** menu, select the **Reports** option and then **Show Scenario Reports**.

The Report Center opens in a new window:


CA XOsoft Report Center Report Center Home Page Updated: Tuesday, December 09, 2008 1:32:09 PM

Available Reports per Scenario							
Scenario Name	Synchronization	Difference	Replication	Assessment Mode	Assured Recovery	CDP	Total Reports
SQL							
SQL	1	0	0	0	0	0	1
Backward SQL	1	0	0	0	0	0	1
Exchange							
Exchange-standalone	1	0	0	0	0	0	2
IS							
IS	1	0	0	0	0	0	2
FileServer							
FileServer	1	0	0	0	0	0	2

Reports							
Drag a column header here to group by that column							
Host	Changes	Date	Time	Type	Summary	Detailed	Size (bytes)


The Report Center consists of two tables:

- The upper table - **Available Reports per Scenario** - contains a list of all scenarios that have reports, along with the type and number of available reports for each scenario.
 - The lower table - **Reports** - contains a list of all the reports that are available for the scenario selected in the upper table.
3. To view a specific report, select from the **Available Reports per Scenario** table the scenario that this report represents. Then, from the **Reports** table below, click the report you want to open:

Drag a column header here to group by that column							
Host	Changes	Date	Time	Type	Summary	Detailed	Size (bytes)
XORMEXCH2K7-1	Unknown	Today	03:29:37	Assured Recovery			811
XORMEXCH2K7-1	Changes found	12/07/08	22:29:48	Synchronization			28415

Note: Depending on your settings, for Synchronization and Replication reports a **Detailed** report can be generated in addition to the **Summary** report. Both reports represent the same process, but the **Detailed** report also provides a list of the files that participated in the process.

The report you selected appears in a new window:


CA XOssoft Report Center
[Report Center Home Page](#)

CA XOssoft High Availability

SYNCHRONIZATION REPORT


Synchronization mode	BlockSynchronization (include files with the same size and modification time)
Scenario	Scenario001
Master host	XDRWSECN2K7-2(1)
Replica host	XDRWSECN2K7-1(2)
Scenario start time	07-Dec-08 22:23:31
Report start time	07-Dec-08 22:23:41
Report finish time	07-Dec-08 22:29:48

Summary:

Total number of files modified	154
Total number of bytes changed	171.7MB

Stop a Scenario

To stop a scenario

1. From the Scenario pane, select the scenario you want to stop.
2. To stop the scenario, click the **Stop**  button on the Standard toolbar.
A confirmation message appears prompting you to approve the scenario stopping.
3. Click **Yes** in the confirmation message. The scenario stops.
After stopping the scenario, the Manager no longer shows the green play symbol to the left of the scenario, the scenario's state turns into **Stopped by user**, and the Statistics tab is no longer available on the Framework pane.

Chapter 3: Redirection Methods

This section contains the following topics:

[How Redirection Works](#) (see page 23)

[DNS Redirection](#) (see page 23)

[Move IP Redirection](#) (see page 24)

[Switch Computer Name Redirection](#) (see page 30)

[Scripts Redirection](#) (see page 30)

How Redirection Works

Each of the server types supported by CA XOssoft can be configured to use one or more redirection methods. You should enable redirection methods based on your environment and business needs. The supported redirection methods for SQL Server follow:

DNS Redirection

DNS Redirection changes the DNS "A" Record of the Master server to resolve to IP address of the Replica server. Upon failure of the Master, the Replica server modifies the appropriate DNS record so that references to the Master server resolve to the Replica's IP address rather than the Master's IP address. This redirection method requires no network reconfiguration and works in LAN and WAN network configurations.

DNS redirection works only with A (host) type records and cannot update CNAME (Alias) records directly. However, if the CNAME record points to the modified A record, it is indirectly redirected.

Using the record that has the Master server's name is the default, however you can configure CA XOssoft HA to redirect any DNS A (host) record via the *Master's name in DNS* setting in the switchover properties tab.

Move IP Redirection

Move IP redirection involves moving the Master server IP address to the Replica server.

This redirection method is preferred for Virtual Machine scenarios and is usable only in a LAN configuration in which the Master and Replica servers reside in the same network segment. In this configuration, switchover of the Master server causes the Replica to take over one or more of the IP addresses assigned to the Master server.

Important! Use this method only when both servers are on the same IP subnet.

When using Move IP as the redirection method, you must first add IP addresses to the Master host. For more information, refer to the topic, Add IP on the Master Server.

Add IP on the Master Server

You need to add an additional IP address to the Master host, (which is denoted as *XO-IP* in the following steps) to use Move IP redirection in your HA scenarios. This new IP address is used for CA XOsoft internal communication and replication. This is necessary because once switchover occurs, the current production IP address is no longer available on the Master -- it switches to the Replica server.

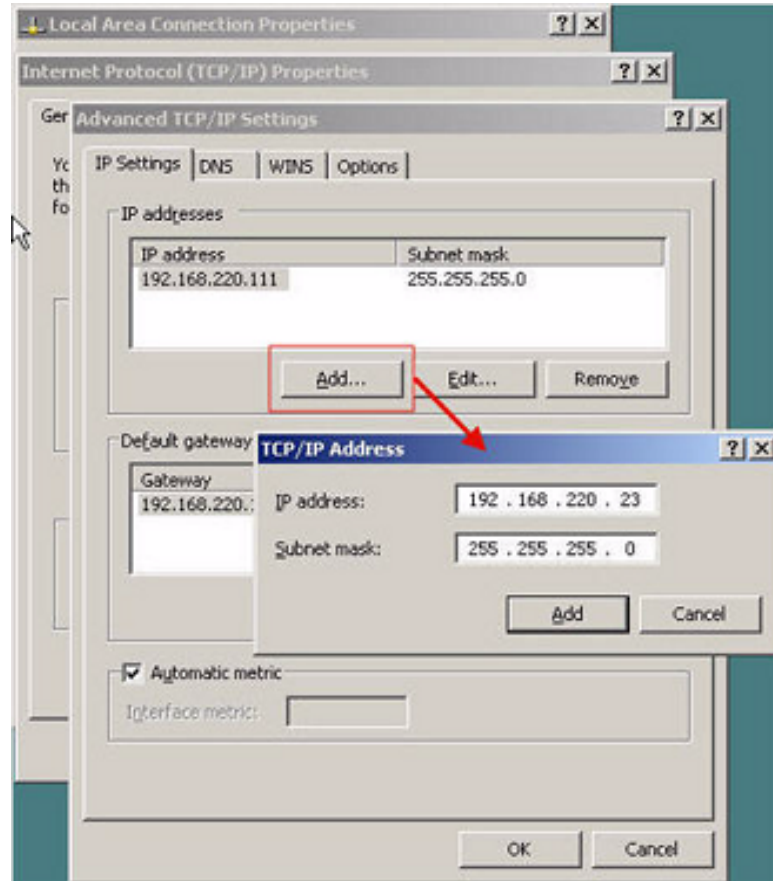
Important! Perform the following only if you are using the Move IP redirection method.

Add IP Address to Master Server

1. Open the Control Panel and choose Network Connections.
2. Right-click Local Area Network and choose Properties.
3. Click Internet Protocol (TCP/IP) and then click the Properties button.
4. Click Advanced.

5. Click Add and enter an additional IP address (XO-IP).

In the following screenshot, the XO-IP IP address is 192.168.220.23 and the current production server IP address is 192.168.220.111.



6. Click Add.
7. Click OK.
8. Click OK to exit the LAN settings.

After you add the IP to the Master, you must add the XO-IP to your HA scenarios. There are two ways to add the XO-IP address to an HA scenario:

- For new scenarios, from directly in the Wizard
- For existing scenarios, by modifying the master host name

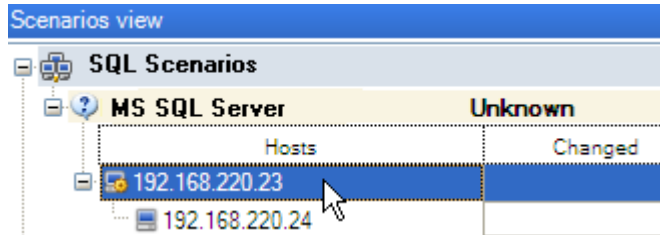
The procedures for both ways follow.

Add XO-IP to Existing Scenarios

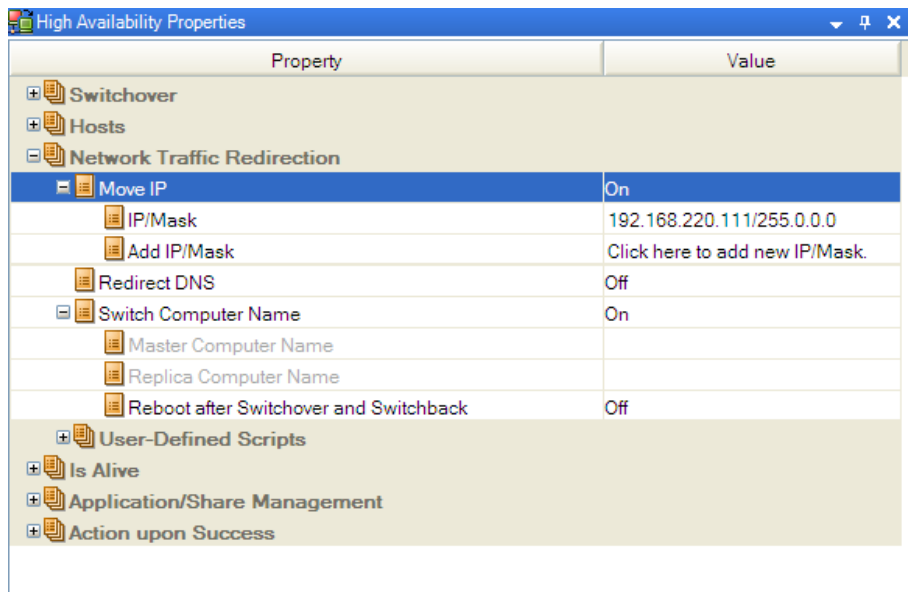
Perform this procedure only if you are using the Move IP redirection method.

To add the XO-IP to existing scenarios:

1. On the Scenario pane, select the required Master host.



2. Right-click the Master and select **Rename** from the pop-up menu. Then, enter the XO-IP address.
3. On the Framework pane, select the **Switchover** tab and then select the Replica server as the switchover host.
4. Set the **Move IP** option to On. Ensure that the IP address under **Move IP, IP/Mask** matches the production server IP address: this is the IP address that will switch over. If you are moving more than one IP address you can add multiple production IP addresses by selecting **Click here to add new IP/Mask**.



Add XO-IP to New Scenarios

Perform this procedure only if you are using the Move IP redirection method.

During the initial run of the Scenario Creation Wizard, enter the XO-IP and Replica IP addresses instead of the server names.

Scenario Creation Wizard

Master and Replica Hosts

Enter the hostname or IP address for both the Master (source) and Replica (target) hosts. If the scenario will involve more than one Replica, add one Replica now, and manually add the other Replicas in the Scenario pane once you completed the wizard steps.

Scenario Name: MS SQL Server

Master Hostname/IP: 192.168.220.23 Port: 25000

Replica Hostname/IP: 192.168.220.24 Port: 25000

☐ Assessment Mode

☒ Verify CA XOsoft Engine on Hosts

Navigation: Back, Next, Finish, Cancel

Cluster Move IP

Using Move IP redirection with a clustered Master (MSCS with shared storage) requires you to add an additional IP resource to the Master Exchange resource group. This section describes how to configure this redirection method.

Note: If both Master *and* Replica are clusters, there are special configuration issues involved in the Move IP redirection process that are not detailed in this Guide. For a cluster-cluster scenario, use Redirect DNS or contact technical support to receive detailed instructions and guidance.

Using the Master Cluster

To use Cluster Move IP through the Master cluster

1. Open the Cluster Administrator.
2. In the Master Cluster Exchange Resource Group, create a new IP resource and name it **XO-IP**.
3. Bring this resource online and verify it is visible from the Replica via the ping command. This new IP address is used for CA XOsoft HA internal communication and replication. This is necessary since the current production IP address is not available on the Master cluster after switchover -- it switches to the Replica server.

Using the Manager

This section details Cluster Move IP redirection using the Manager.

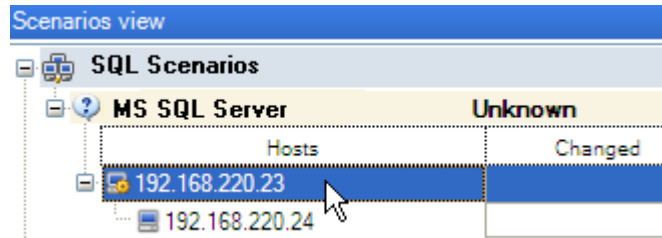
For New Scenarios

During the initial run of the Wizard, enter the XO-IP and Replica IP addresses instead of the cluster virtual server names. The following screen shows the XO-IP entered in the Master Hostname/IP field and the Replica Server IP address entered in the Replica Hostname/IP field.

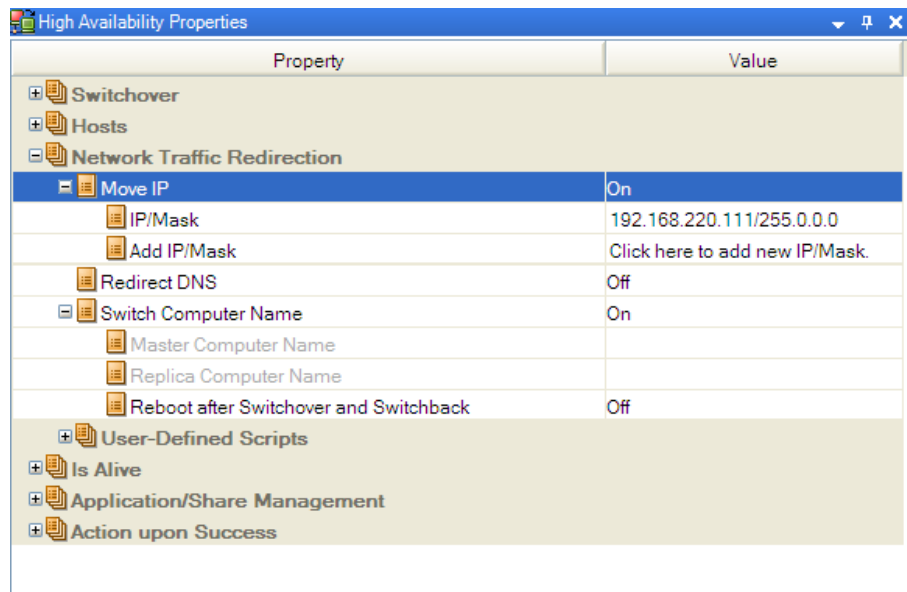
For Existing Scenarios

To use Cluster Move IP with existing scenarios

1. On the Scenario pane, select the required Master host.



2. Right-click the Master and select **Rename** from the pop-up menu. Then, enter the XO-IP address.
3. On the Framework pane, select the **Switchover** tab and then select the Replica server as the switchover host.
4. Set the **Move IP** option to On. Ensure that the IP address under **Move IP, IP/Mask** matches the production server IP address: this is the IP address that will switch over. If you are moving more than one IP address you can add multiple production IP addresses by selecting **Click here to add new IP/Mask**.



Switch Computer Name Redirection

If you are redirecting File Shares, in which clients connect via the Master server name, enable switch computer name. For example, if the Master server name is fs01 and clients connect to \\fs01\sharename or \\fs01.domain.com\sharename, using the Switch computer name method redirects clients to the failover server.

It's also recommended to enable one other method as well. The most common method is to use both DNS Redirection and Switch Computer Name. CA XOssoft HA makes the required computer name switch by assigning a temporary name to the Master server and taking over its computer name for use with the Replica server.

CA XOssoft HA updates records directly and does not generally require a reboot. If, however, you encounter any problems after switchover, consider setting the reboot option to On and testing again.

Note: For Windows Server 2008 systems, you must reboot the machine after a switchover occurs when the switch computer name method is used. We recommend setting the Reboot After Switchover and Switchback property to On when using this method.

Automatic Redirection Using Switch Computer Name

When possible during switchover, CA XOssoft HA renames the master host to *masterhostname-XO* and assigns its original name to the replica server. This step prevents name conflicts since the master's name is now assigned to the replica server. In this graceful case, if automatic reverse replication is set to on, CA XOssoft starts the backward scenario automatically. If automatic reverse replication is set to off, run the scenario again manually by selecting the Run button or choosing *Run* from the Tools menu. Once the backward scenario has run and synchronization is complete you can click the Perform Switchover button to switch back.

Scripts Redirection

Custom Scripts: CA XOssoft HA can trigger custom scripts or batch files to perform the user redirection or any additional steps not covered by built-in methods. If the above methods are not appropriate or do not fully meet all requirements, please see the *CA XOssoft User Guide* for details on scripted redirection methods.

Chapter 4: Switching Over and Switching Back

Switchover and *Switchback* is the process in which active and passive roles are exchanged between the Master and Replica servers, so that if the Master is currently active, it changes to passive after Switchover passes the active role to the Replica. If the Replica is active, it changes to passive after Switchover passes the active role to the Master. Switchover can be triggered at the push of a button or automatically by CA XOssoft HA when it detects that the Master is unavailable, if you enabled the Perform Switchover Automatically option from the Switchover and Reverse Initiation dialog. When this option is Off, the system notifies you that the Master server is down so you can manually initiate switchover from the CA XOssoft Manager.

This section contains the following topics:

[How Switchover and Switchback Work](#) (see page 31)

[Initiate Switchover](#) (see page 33)

[Initiate Switchback](#) (see page 35)

[Switchover Considerations](#) (see page 37)

How Switchover and Switchback Work

After the HA scenario starts running and the synchronization process is completed, the Replica checks the Master on a regular basis, by default every 30 seconds, to see if it is alive. The following types of monitoring checks are available:

- **Ping** -- a request sent to the Master to verify that the Master is up and responding
- **Database check** -- a request that verifies the appropriate services are running and all databases are mounted
- **User-defined check** -- a custom request you can tailor to monitor specific applications

If an error occurs with any part of the set, the entire check is considered to have failed. If all checks fail throughout a configured timeout period (by default, 5 minutes), the Master server is considered to be down. Then, depending on the HA scenario configuration, CA XOssoft HA sends you an alert or automatically initiates a switchover.

When you created an HA scenario, you defined how you want the switchover to be initiated.

- If you selected the Initiate Switchover manually option from the Switchover and Reverse Replication Initiation page, perform a manual switchover. For more information, refer to the topic, Initiate Switchover.
- If you selected the Initiate Switchover automatically option, you can still perform a manual switchover, even if the Master is alive. You can initiate switchover when you want to test your system, or you want to use the Replica server to continue the application service while some form of maintenance is performed on the Master server. Triggered (automatic) switchover is in all ways identical to manual switchover performed by the administrator, except it is triggered by a resource failure on the master server rather than by an administrator manually initiating the switchover by clicking the Perform Switchover button. The timeout parameters are configurable and are more extensively covered in the *CA XOssoft User Guide*.

When you created an HA scenario, you defined how you want the reverse scenario to be initiated.

- If you selected the Initiate Reverse Replication automatically option from the Switchover and Reverse Replication Initiation page, replication in the reverse direction (from Replica to Master) automatically begins after a switchover has finished successfully.
- If you selected the Initiate Reverse Replication manually option, you must resynchronize data from Replica to Master, even after testing a clean switchover without a Master failure.

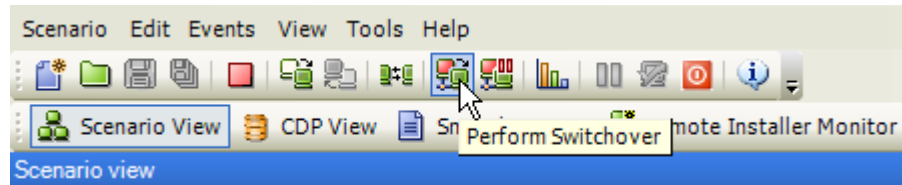
When the Reverse Replication feature is off, to start reverse replication after a switchover has occurred, click the Run button. The benefit to this feature is, if both the master and replica servers were online and connected during switchover, resynchronization in the reverse direction is not required. Resynchronization involves comparing the data on the master and replica servers to determine which changes to transfer before real-time replication starts; this can take some time. If automatic reverse replication is turned on, and both servers were online during switchover, replication is reversed without the need for resynchronization. This is the one situation in which resynchronization is not required.

Initiate Switchover

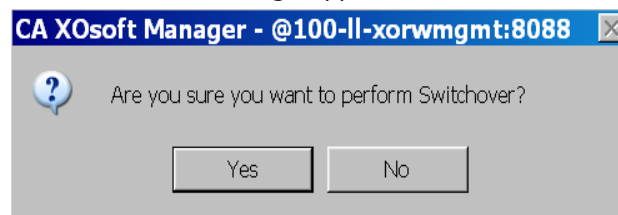
If you chose to initiate switchover automatically, after the Master is considered to be down, CA XOsoft HA automatically tries to restore the services and databases on it to their active state. First, CA XOsoft HA tries to restart the SQL services that it previously checked. If the services are running, it then tries to bring the relevant database's online. If all attempts failed, CA XOsoft HA initiates a switchover. These attempts to restore the services and databases are not performed if the switchover is initiated manually.

To initiate manual switchover

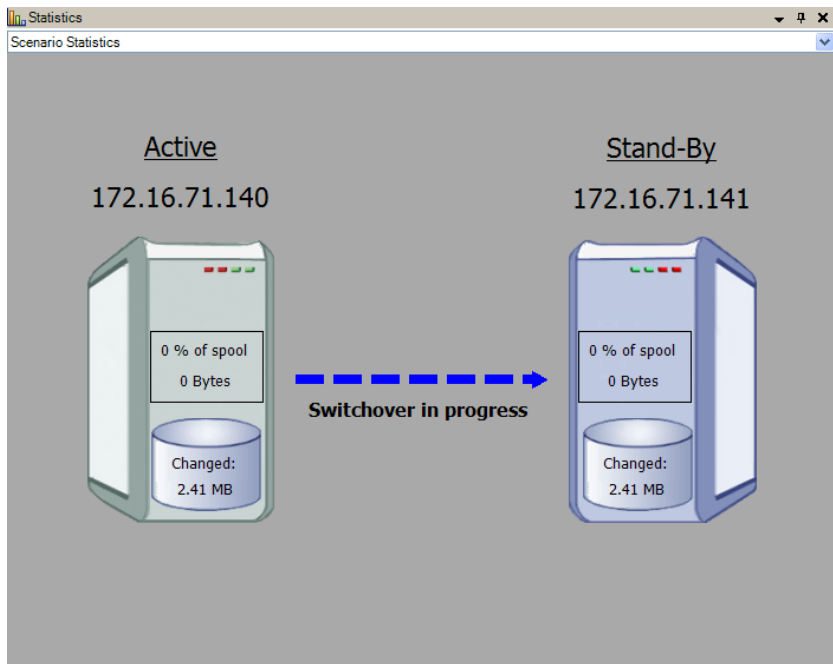
1. Open the Manager and select the desired scenario from the Scenario pane. Verify it is running.
2. Click on the **Perform Switchover** button, or select from the **Tools** menu the **Perform Switchover** option:



A confirmation message appears:



3. Click **OK** on the **Perform Switchover** confirmation message. This procedure initiates a switchover from the Master server to the Replica server:



Detailed information about the switchover processes is located in the Events pane during switchover.

4. After the switchover is completed the scenario stops:

The screenshot shows the 'HA Scenarios' window with a table of scenarios. The 'MS SQL HA' scenario is highlighted, showing its state as 'Stopped on Auto'.

Scenario	State	Product	Server	Mode
MS SQL HA	Stopped on Auto	HA	Exchange	Online
Hosts	Changed	Synchronized	Files	In spool
172.16.71.140				
172.16.71.141				

Note: The only case in which the scenario may continue to run after switchover is when **automatic reverse replication** is defined as **Start automatically**.

In the Event pane a message appears, informing you that **Switchover completed**, and then that the **Scenario has stopped**.

Now, the Master becomes the Stand-by server and the Replica becomes active server.

Initiate Switchback

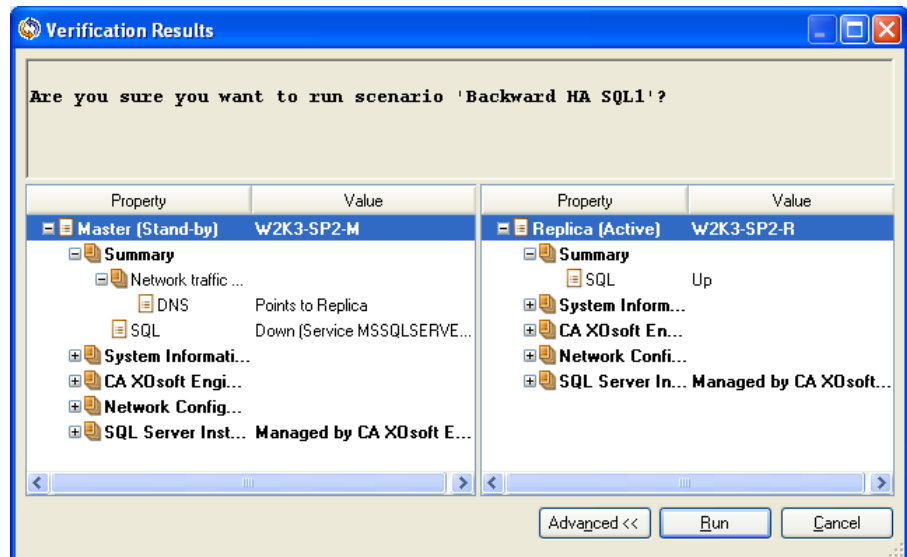
After a switchover is initiated, whether manually or automatically, at some point, you will want to reverse the server roles and make the original Master the active server again the Replica the standby server. Before you switch back the roles between servers, decide if you want to the data on the original Replica server to overwrite the data on the original Master. If yes, you must first perform a reverse scenario, called a backward scenario.

Note: The following steps are the same regardless of server type.

To initiate manual switchback

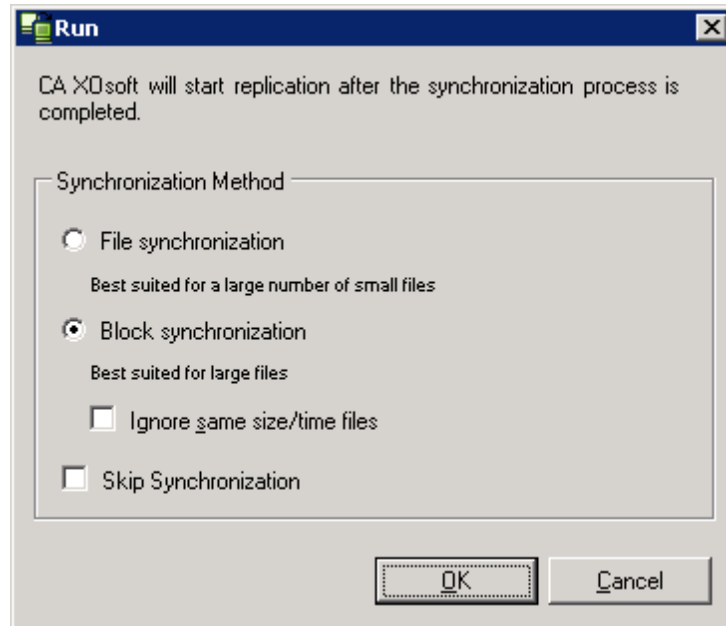
1. Ensure that both Master and Replica servers are available on the network and that the CA XOssoft Engine is running.
2. Open the Manager and select the desired scenario from the Scenario pane.
3. Perform one of the following:
 - If the scenario is already running, skip directly to Step 4
 - If the scenario is not running, perform these steps and then go to Step 4:
 - a. Click Run on the toolbar to start the scenario.

CA XOssoft HA detects that a switchover has occurred and verifies its state and configuration. After verification completes, the Verification Results dialog appears, listing existing errors and warnings if detected, and prompting you to approve the running of the backward scenario. If desired, click the Advanced button to open an additional pane with detailed information about the hosts that participate in the scenario.

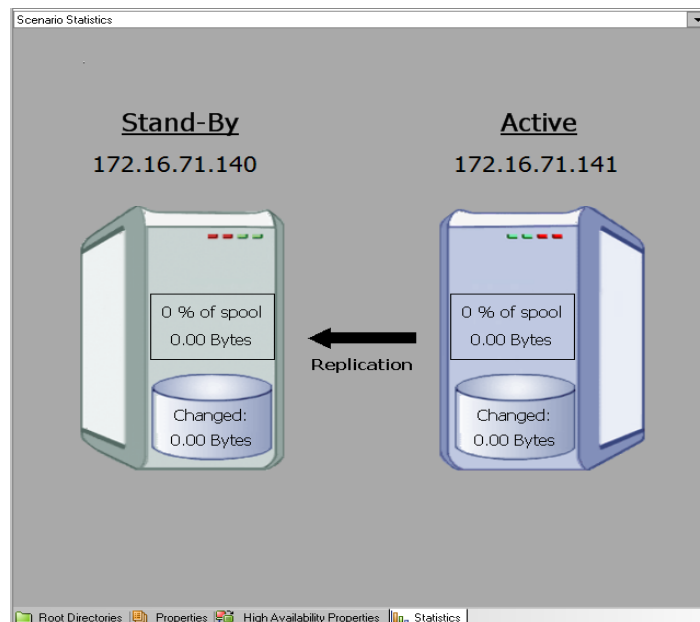


- b. Select a synchronization method from the Run dialog and click OK to start resynchronization.

Note: For SQL, choose Block synchronization.



After resynchronization completes, you receive a message in the Event pane: All modifications during synchronization period are replicated. Now, replication from the active server to the standby server begins:



Note: You are now ready to reverse the roles between the Master and Replica servers.

4. Click Perform Switchover on the toolbar while the scenario is running to reverse the server roles. A confirmation message appears.
5. Click Yes to clear the message and start the switchback process.

After the switchback is completed, the server roles are reversed back and the scenario automatically stops.

Note: The scenario will continue to run after the switchback when the Reverse Replication Initiation option is defined as Start Automatically.

You may now run the scenario again in its original (forward) state.

Switchover Considerations

It is not recommended to set both the Switchover and Reverse Replication Initiation options to automatic in a production environment. While these options are individually beneficial it is best practice to set only one or the other to automatic. The reason for this recommendation is that automatic switchover allows CA XOsoft HA to trigger a switchover, after a failure is detected, without administrative involvement. If automatic reverse replication is also on, CA XOsoft HA may start to overwrite data on the failed production server before an administrator is able to assess the failure situation. Overwriting data on a failed server before an administrator can assess the situation may have undesirable consequences. Due to this possibility, setting both options to automatic is not recommended. Please choose either one or the other depending on what best fits your requirements. When only one option is used at a time these settings can be very beneficial and may be used safely.

Chapter 5: Recovering Data

This section contains the following topics:

[The Data Recovery Process](#) (see page 39)

[Recover Lost Data from Replica](#) (see page 40)

[Setting Bookmarks](#) (see page 43)

[Data Rewind](#) (see page 44)

[Recover Active Server](#) (see page 48)

The Data Recovery Process

When an event causes loss of Master data, the data can be restored from any Replica. The recovery process is in fact a synchronization process in the reverse direction - from a Replica to the Master.

CA XOsoft enables you to recover data in two ways:

- Recover lost data from the Replica to the Master -- this option is a synchronization process in the reverse direction and requires you to stop the scenario.
- Recovery lost data from a certain event or point in time (Data Rewind) -- This option uses a process of stamped checkpoints and user-defined bookmarks to roll corrupt data on the Master back to a time before corruption occurred.

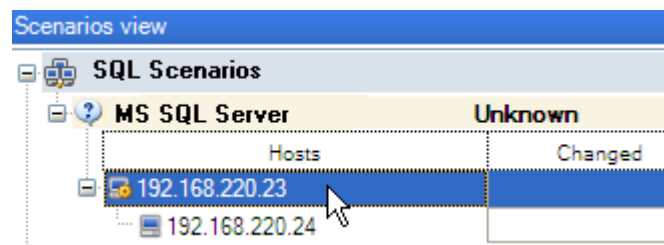
Important! You must stop replication in order to initiate recovery.

Recover Lost Data from Replica

To recover all lost data from a Replica

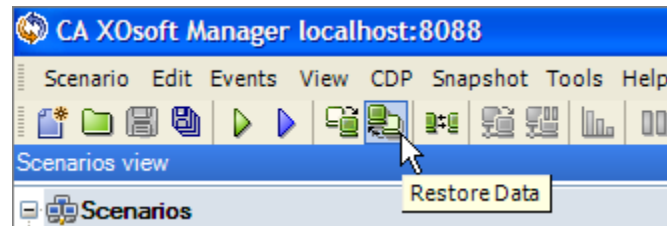
1. On the Manager, from the Scenario pane select the desired scenario and stop it.
2. [For database applications only] stop the database services on the Master host.
3. On the Manager, from the scenario folder select the Replica host:

Note: If multiple Replica servers participate in the required scenario, select the Replica from which you want to recover data.

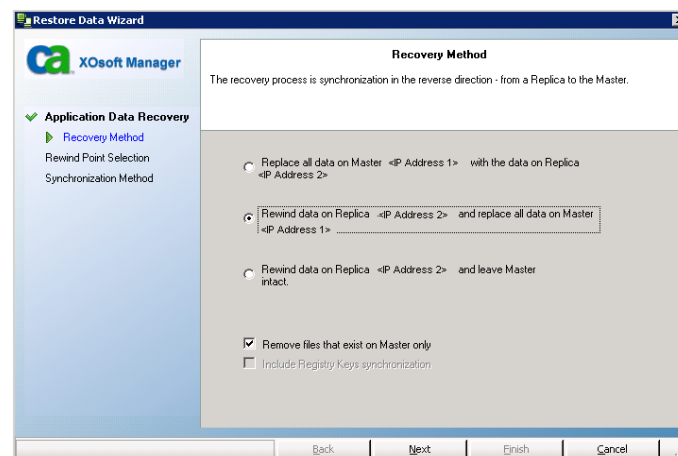


The **Restore Data** option is enabled.

4. From the **Tools** menu, select **Restore Data**, or click the **Restore Data** button on the Standard toolbar:

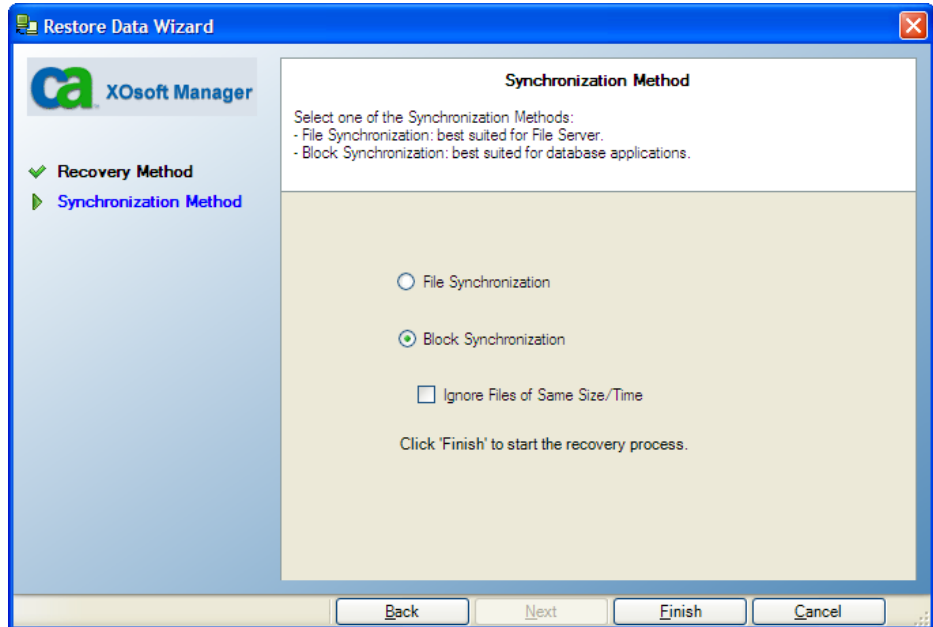


The **Recovery Method** page of the Restore Data wizard appears:



Note: If the **Data Rewind** property is set to On, another **Restore Data** dialog will appear. In this case, select the first option - Replace all data on Master with the data on Replica.

5. Click Next. The Synchronization Method page appears:



6. Make sure that the **Block Synchronization** method is selected, and click **Finish**.

Once you finished initiating the recovery process, CA XOsoft builds a temporary reverse tree using the selected Replica as the root, and the Master as the terminating node. After the Master recovery process ends, the temporary scenario is deleted, and you receive the following message in the Event pane: **Synchronization finished**.

7. By default, once a data recovery occurs a Synchronization Report is generated:



The screenshot displays the CA XOsoft Report Center interface. At the top left is the CA XOsoft Report Center logo. At the top right is a link labeled "Report Center Home Page". Below the logo, the text "CA XOsoft High Availability" is visible. The main heading is "SYNCHRONIZATION REPORT". Below this heading is a table with the following data:

Synchronization mode	BlockSynchronization (include files with the same size and modification time)
Scenario	Scenario001
Master host	XDRWSECN2K7-2(1)
Replica host	XDRWSECN2K7-1(2)
Scenario start time	07-Dec-08 22:23:31
Report start time	07-Dec-08 22:23:41
Report finish time	07-Dec-08 22:29:48

Below the table is a section labeled "Summary:" with another table:

Total number of files modified	154
Total number of bytes changed	171.7MB

Now, the replication process can restart following the original scenario.

Setting Bookmarks

A *bookmark* is a checkpoint that is manually set to mark a state that you may want to rewind back to. We recommend setting a bookmark just before any activity that may cause data to become unstable. Bookmarks are set in real-time, and not for past events.

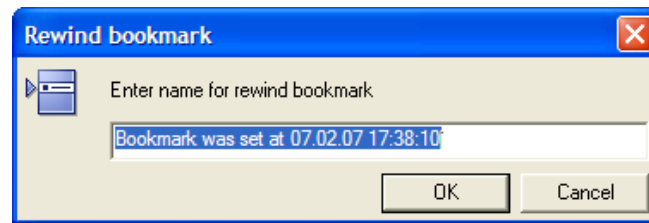
Notes:

- You can use this option only if you set the **Recovery - Data Rewind** option to **On** (default setting is Off).
- You cannot set bookmarks during the synchronization process.

To set a bookmark

1. When the required scenario is running, on the Scenario pane select the Replica host from which you want to rewind data.
2. From the **Tools** menu, select the **Set Rewind Bookmark** option.

The **Rewind bookmark** dialog opens.



The text that appears in the **Rewind bookmark** dialog will appear in the **Rewind Points Selection** dialog as the bookmark's name. The default name includes date and time.

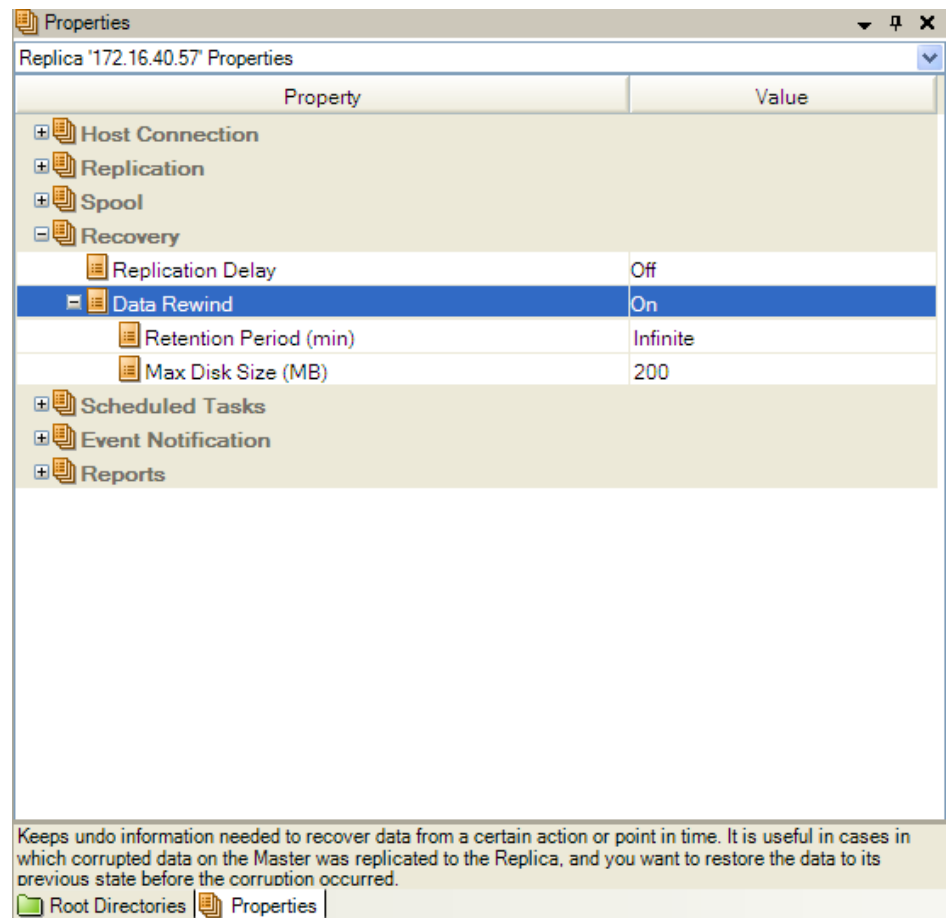
3. Accept the default name, or enter a new name for the bookmark. It is recommended to give a meaningful name that will later help you recognize the required bookmark. Then, click **OK**.

The bookmark is set.

Data Rewind

The Data Rewind recovery method allows you to rewind data to a point in time before it was corrupted. The rewind process takes place on the Replica server before the reverse synchronization process starts. The Data Rewind method uses rewind points or bookmarks that enable you to reset the current data back to a previous state.

You can use this option only if you set the **Recovery - Data Rewind** option to **On**.



If this option is set to Off, the system will not register data rewind points. For more information about Data Rewind parameters (Retention Period, Max Disk Size), see the *CA XOssoft User Guide*.

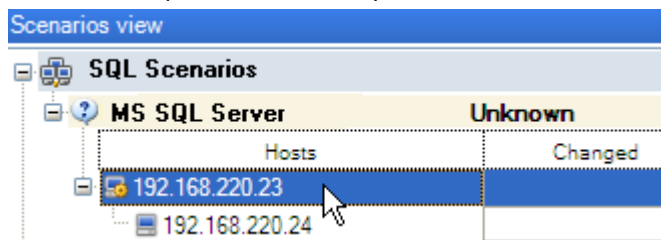
Important! The data rewind process operates in one way only - there is no replay forward. After rewind, all data subsequent to the rewind point will be lost, since data after the rewind point will be overwritten with new data.

Note: The automatic registration of the rewind points starts only after the synchronization process is completed, and the message **All modifications during synchronization period are replicated** appears on the Event pane. Similarly, you cannot manually set bookmarks during synchronization.

To recover lost data using rewind points

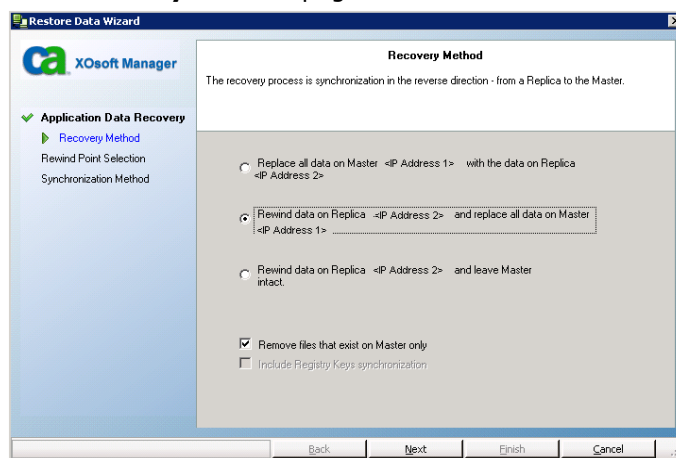
1. On the Manager, from the Scenario pane select the desired scenario and stop it.
2. [For database applications only] stop the database services on the Master host.
3. On the Manager, from the scenario folder select the Replica host:

Note: If multiple Replica servers participate in the required scenario, select the Replica from which you want to recover data.



4. From the **Tools** menu, select **Restore Data**, or click the **Restore Data** button.

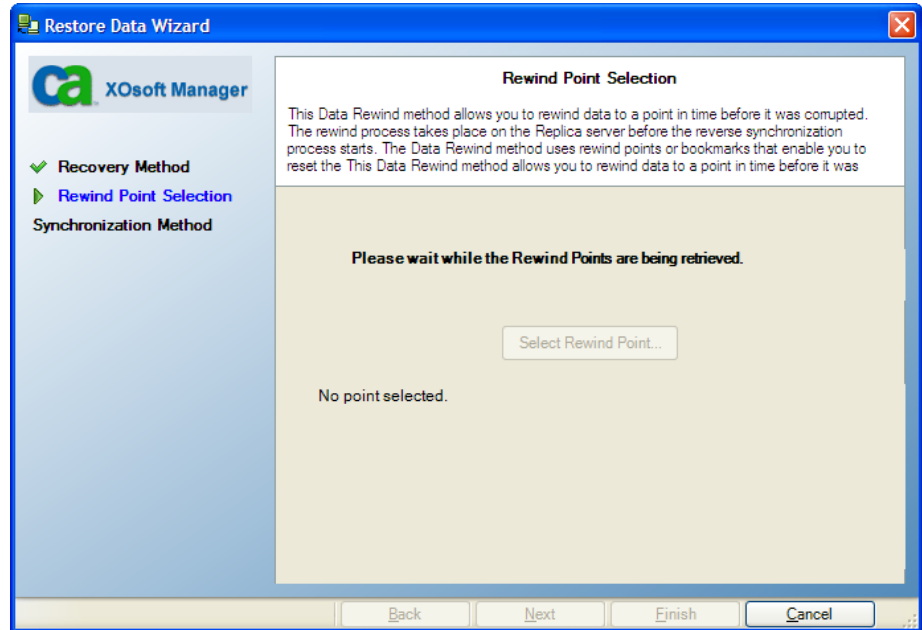
The **Recovery Method** page of the Restore Data Wizard opens.



5. Select one of the Rewind data options, depending on whether you want the rewind data synchronized back to the Master (option 2) or left on the Replica only (option 3).

After you select a Rewind data option, a Recovery scenario is automatically created. This Recovery scenario will run until the end of the rewind process.

6. Click **Next**. The **Rewind Point Selection** page is displayed.



7. Wait until the **Select Rewind Point** button is enabled, and click it to view the existing rewind points.

The **Select Rewind Point** dialog opens.

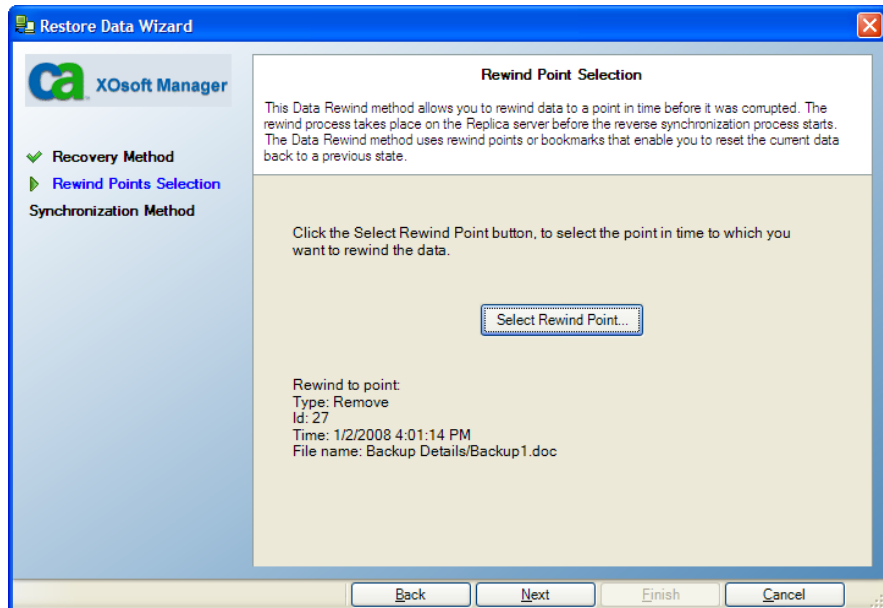
The **Select Rewind Point** dialog displays a list of all rewind points appropriate to the application you are protecting. These include modifications of folders and SQL checkpoints that were automatically registered by the system and user-defined bookmarks.

The list can be filtered according to the rewind point type or other criteria, using the **Filter Rewind Points** pane on the left.

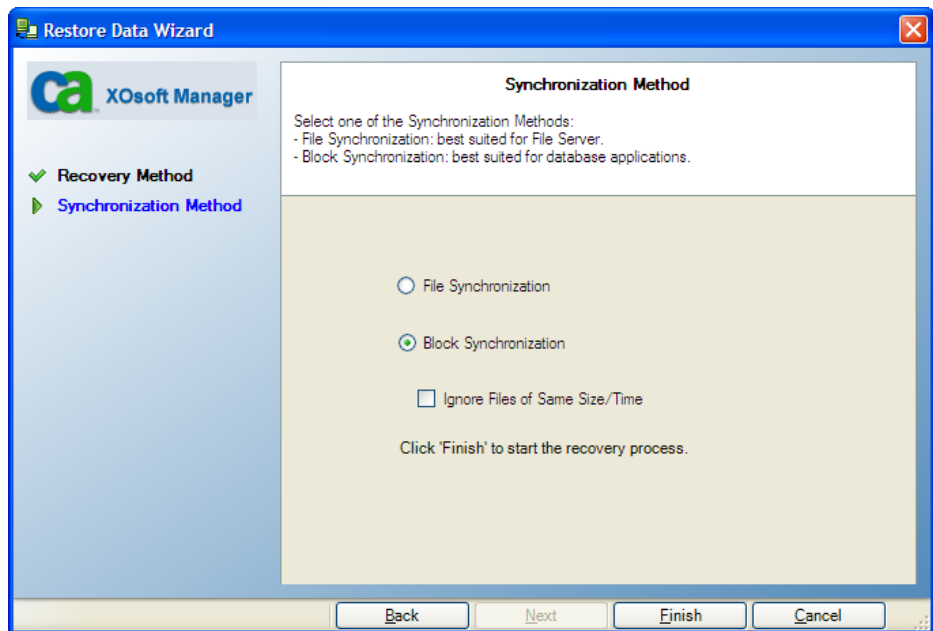
8. Select the required rewind point, and click **OK**.

Note: If you want to use a Bookmark as the rewind point, it is best practice to select the closest rewind point that indicates an actual event.

You return to the **Rewind Point Selection** page, now displaying information about the rewind point you selected.



9. Click **Next**. The **Synchronization Method** page is displayed.




10. Select the **Block Synchronization** method and click **Finish**.

CA XOsoft rewinds the data to the point you selected. After the rewind process ends, you receive the following message in the Event pane:

Rewind process is completed successfully.

If you chose to replace the data on the Master with the data on the Replica, CA XOsoft starts a synchronization process from the Replica to the Master. Once the process ends, the temporary Recovery scenario is stopped and then deleted.

11. By default, once a data recovery occurs a Synchronization Report is generated.



The screenshot displays the CA XOsoft Report Center interface. At the top left is the CA logo and the text "CA XOsoft Report Center". At the top right is a link "Report Center Home Page". Below this is the text "CA XOsoft High Availability". The main heading is "SYNCHRONIZATION REPORT". Below the heading is a table with the following data:

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Scenario start time	07-Dec-08 22:23:31
Report start time	07-Dec-08 22:23:41
Report finish time	07-Dec-08 22:29:48

Below the table is a section labeled "Summary:" with another table:

Total number of files modified	154
Total number of bytes changed	171.7MB

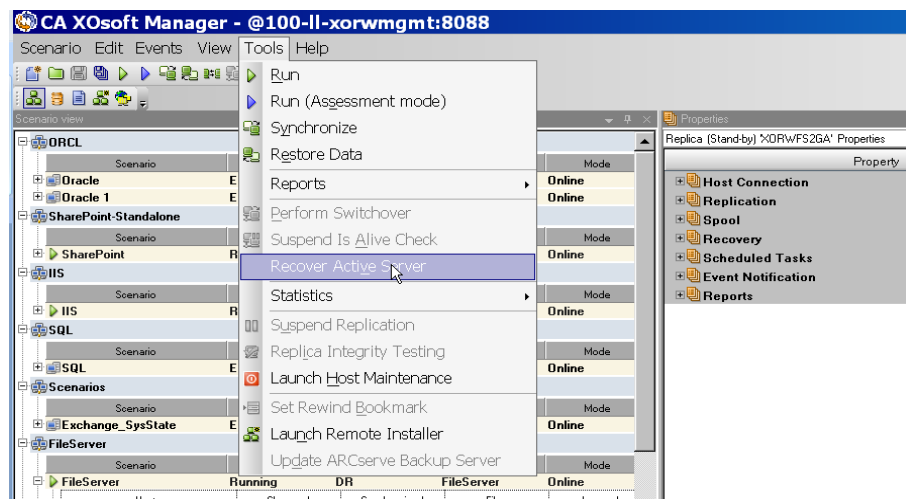
Now, the Replication process can restart on the original scenario.

Recover Active Server

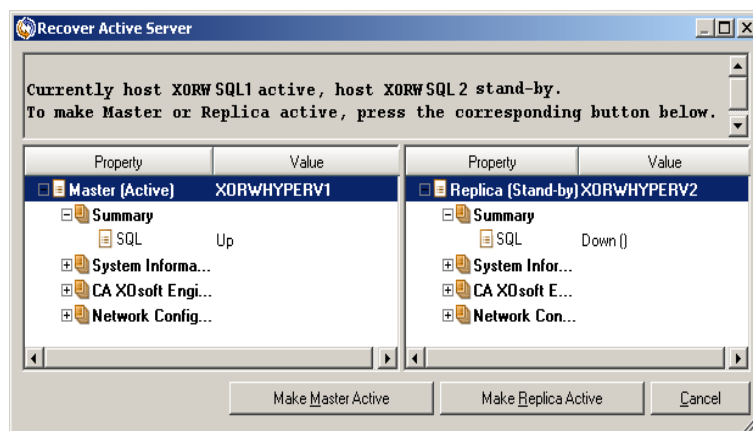
In certain circumstances, it may be necessary to forcibly make the Master or Replica server the active server without completing the data synchronization process. For example, if switchover occurred but no data was changed on the Replica server. In this case you may even have newer data on the Master server making it undesirable to synchronize data from the Replica to the Master server. CA XOsoft HA allows for this option through a process called Recover Active Server. To use this option, ensure that the scenario is stopped, and select *Recover Active Server* from the Tools menu.

Important! While this option is the right choice in many situations, use it with caution. If used improperly data loss can occur. Normally, CA XOsft HA will not allow switchover from one host to another until all data is synchronized. It is designed this way so users are not redirected to an out of date data set that then overwrites what may be a more current data set. When using Recover Active Server, CA XOsft HA is forcing users to one server or the other with no regard as to which server has the correct data set. Thus, as an administrator, you must manually ensure that the server you are making active has the most up to date data set.

If Recover Active Server does not solve the problem, you can manually recover a server. For more information, refer to the section, [Recovering Servers](#) (see page 52).



Select either *Make Master Active* or *Make Replica Active* depending onto which server you want to force the active role.



Important! If a legitimate switchover in a disaster situation occurs and users are redirected to the Replica server for any period of time, it is important to replicate all changes on the Replica back to the Master before making the Master server active. Using *Recover Active Server* in such a situation results in loss of data.

Appendix A: Additional Information and Tips

This section contains the following topics:

[Spool Settings](#) (see page 51)

[Rename the Microsoft SQL Server 2000/2005](#) (see page 52)

[Recovering Servers](#) (see page 52)

Spool Settings

The CA XOsoft spool is a folder on disk where data to be replicated is backed up (i.e., spooled) if bandwidth is not sufficient to transfer the amount of changes in real-time. Data can spool due to temporary network disconnections, network congestion, or simply because the network bandwidth is not sufficient to transfer the amount of data changing over on the server.

In addition to storing changes waiting on available bandwidth, spool space is also used as part of the normal synchronization process. Thus, some spool build up during synchronization is normal.

Place the CA XOsoft spool folder on a drive with relatively low use such as a dedicated volume or boot/system volume. Do not place the spool folder on a volume containing frequently accessed system (OS), user, or application data. Examples include volumes containing databases, shared files, or the system pagefile. By default, the spool folder is located in the tmp folder under the CA XOsoft installation directory. The spool parameters, located in the properties tab (on both master and replica) or set with the New Scenario Wizard, determines how much disk space is available for the spool. In most cases the default values are sufficient. However, if you choose to change this value, it should be at least 10% of the total dataset size. For example, if you are replicating 50GB of data on a server you should ensure that at least 5GB of space is available for spool. Please note that this space is not pre-allocated.

***Important!** If you change the spool location, please remember to remove the new path from file level antivirus scans: both scheduled and real time.*

Rename the Microsoft SQL Server 2000/2005

If you run SQL Server 2000/2005, the new name is recognized during the SQL service startup. There is no need to run Setup again or to reset the server name.

If there are any remote logins to the SQL Server, `sp_dropserver` may generate an error. To resolve the error, you may need to drop remote logins and rerun the procedure.

Note: In order to see the new SQL server in the Enterprise Manager, you need to delete an old server registration, and register the new name.

Recovering Servers

CA XOssoft can detect when a Replica server is now active and runs the recovery process automatically. If recovery does not complete correctly for some reason, do the following:

- First, perform the Recover Active Server procedure. For more information, refer to the topic, [Recover Active Server](#) (see page 48).
- If the Recover Active Server procedure does not resolve the issue, try one or more of the following manual tasks appropriate to the redirection method you use:
 - If IP Redirection is used, manually remove the IP. You cannot use this method for scenarios that do not support Move IP redirection (Hyper-V HA, CS HA). For more information, refer to the topic, [Manually Recover a Failed Server when IP Redirection is used](#). (see page 53)
 - If Switch Computer Name Redirection is used, manually switch the names. You cannot use this method for scenarios that do not support Switch Computer Name Redirection (Hyper-V HA, Exchange HA, vCenter HA if local Oracle is used). For more information, refer to the topic, [Manually Recover a Failed Server when Switch Computer Name Redirection](#) (see page 53) is used.
 - If both IP and Switch Computer Name Redirection methods are used, manually remove the IP and switch the computer names. You cannot use this method for scenarios that do not support Move IP and Switch Computer Name redirection (Exchange, CS HA). For more information, refer to the topic, [Manually Recover a Failed Server - IP and Switch Computer Name is used](#) (see page 54).

Manually Recover a Failed Server - Move IP Address

To recover a failed server when Move IP redirection is used

1. Boot the Master server without a network connection, to avoid IP conflicts.
2. From the TCP/IP properties dialog, remove the additional IP address.
3. Reboot the server and reconnect to the network.
4. If it is not already running, start the scenario from the CA XOsoft Manager. If automatic reverse replication was set to On, the scenario runs in backward mode so that the Replica server is now active and the Master server is on standby.
5. Wait for synchronization to complete.
6. Perform a manual switchover to return the active role to the Master server. It is recommended that you do so outside of normal business hours.

Manually Recover a Failed Server-Switch Computer Name

To manually recover a failed server using the Switch Computer Name redirection method

1. Boot the Master server without a network connection, to avoid duplicate network names.
2. Rename the server to <NewServerName>-XO and move it to a temporary workgroup. For example, if the server is called "Server1", rename it to "Server1-XO". You will be required to reboot this machine. After the reboot completes, the following error appears: "At least one Service could not be started." Ignore this, it is normal under these circumstances because the CA XOsoft Engine usually runs in a domain account.
3. Connect to the network.
4. Rejoin the domain, ensuring that you use the -XO name assigned in step 2.
5. Reboot the computer.
6. If it is not already running, start the scenario from the CA XOsoft Manager. (If automatic reverse replication was set to On, the scenario runs in backward mode so that the Replica server is now active and the Master server is now standby.)
7. Wait for synchronization to complete. Perform a manual switchover to make the Master server active. It is recommended that you do so outside of normal business hours.

Manually Recover Failed Server-IP and Switch Name

To manually recover a failed server when both IP and Switch Computer Name Redirection are used

1. Repair any hardware problems that could have caused the switchover, if any.
2. Reboot the server without a network connection to prevent IP conflicts.
3. From the TCP/IP properties dialog, remove the additional IP address.
4. From the System Properties, Computer Name dialog, change the Computer Name to <ServerName>-XO. For example, if your server is called Server 3, rename it to Server 3-XO.
5. Assign the server to a temporary workgroup.
6. Restart the computer to enable your changes to take effect. When rebooting completes, reconnect to the network now. Ignore the message, "At least one service failed during system startup." This is normal because the CA XOsoft Engine runs in a domain, which is not currently available.
7. Rejoin the domain, making sure you use the -XO name, and reboot again.
8. The reverse scenario begins and the Replica server assumes the active role. Wait while synchronization completes.
9. Perform a manual switchover by clicking the Perform Switchover button from the toolbar, to return the active role to the Master server.

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