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Replication and clustering for high availability for IBM Lotus Domino on i5/OS

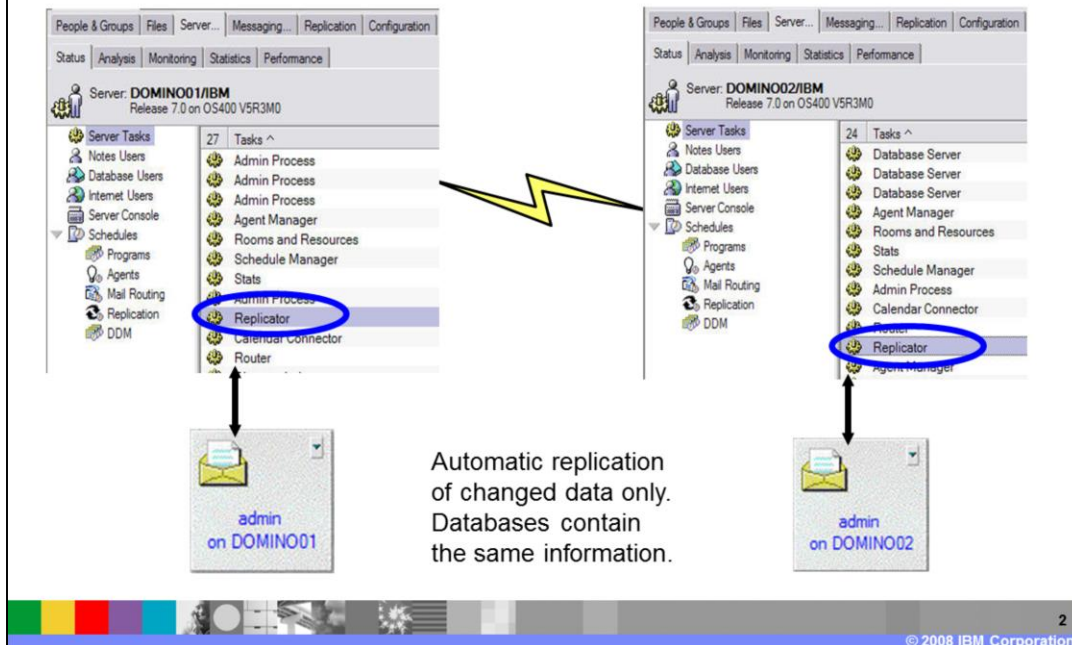


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This education series consists of three modules that cover backup and recovery strategies for a Lotus® Domino® implementation on i5/OS®. This second module focuses on using replication and clustering for high availability.

Illustration of Domino replication



In this illustration, there are two Domino servers (Domino01 and Domino02) with the admin mail file on both servers. Domino replication sends the changes between the servers so that both databases contain the same information. This example is used in more detail throughout this presentation.

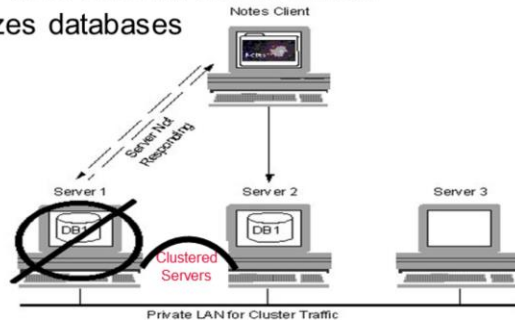
Comparison of replication and clustering

- Domino replication
 - ▶ Maintains identical copies of databases on two Domino server instances
 - ▶ May be on same or different server or platform
 - ▶ Scheduled
 - ▶ Provides warm standby
- Domino clustering
 - ▶ Maintains identical copies of databases on two Domino server instances
 - ▶ May be on same or different server or platform
 - ▶ Automatic, real-time replication
 - ▶ Provides hot standby (load balancing and automatic failover for Notes clients)

Domino replication maintains identical copies of a database on two Domino servers. These servers may or may not be on the same physical hardware. Replication can be scheduled to occur automatically. It can provide a warm standby for the server. Clustering provides real-time replication or a hot standby. It is typically used for load balancing and automatic failover for Lotus Notes clients.

What is Domino clustering?

- A Domino cluster is a collection of two to six Domino servers which provides high availability and workload balancing.
- How does it work?
 - ▶ Two or more servers are selected to be in a cluster (up to six servers)
 - ▶ Each servers contain replica databases of the applications which are to be clustered
 - ▶ If user accesses a clustered server and it is not available, Notes opens a replica of the database on a different cluster server.
 - ▶ Domino continuously synchronizes databases



A Domino cluster is a collection of two to six Domino servers, which can provide high availability or load balancing for your users. When dealing with a cluster, each server will contain its own replica copy of the clustered database or application. The Domino servers will continuously synchronize the databases.

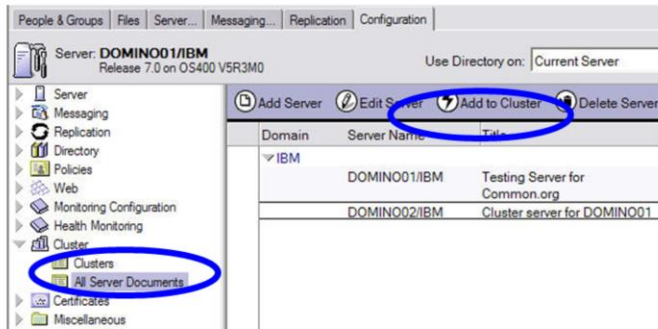
Requirements to deploy clustering

- Domino version 6, 7 or 8 with **Enterprise Service License**
- Connection to a high speed network using TCP/IP
- Adequate disk space for replica databases
- Adequate processor resources to handle additional replication requirements (20% increase)
- Domino clustering is **not** hardware clustering, it is application clustering
- All servers in a cluster must be in the same Domino domain and share a common Domino Directory.
- A server can be a member of only one cluster at a time.

You must purchase a Domino Enterprise Service License to configure clustering in your environment. You will also need a high-speed network connection using TCPIP between the clustered servers. You must ensure that you have adequate disk and processor resources to handle the extra workload that clustering requires. Note that Domino clustering is application clustering and not hardware clustering. Also, note that the clustered servers must share the same Domino directory. Finally, a Domino server can only be a member of one cluster.

Setting up Domino clustering

- Specify which servers you want add or remove from a cluster
 - ▶ Configuration -> Cluster

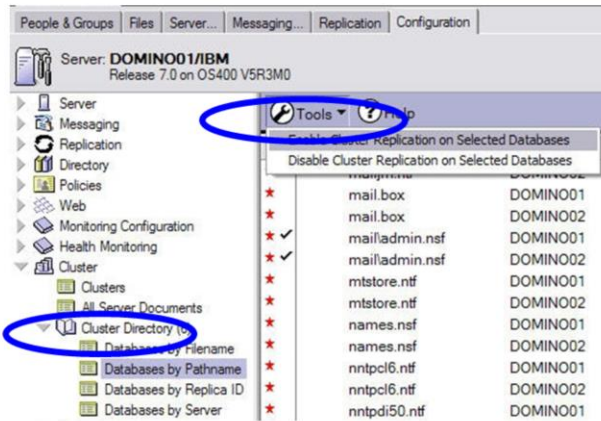


- ▶ Create replica database on other server (if they do not already exist)
- ▶ Add Cluster Replicator and Cluster Database Directory server tasks to notes.ini of both clustered servers
 - ServerTasks=Replica,Router,...,Event,CLDBDIR,CLREPL
- ▶ Restart Domino servers
- ▶ Manually replicate clbdir.nsf between cluster servers
- ▶ Restart Domino servers again

You can configure a new cluster from the Configuration tab of the Domino Administrator client. From there, you can select to add a server to a cluster. This process adds the cluster database directory (clbdir) task and the cluster replicator (clrepl) tasks to the server. The process will also create a clbdir.nsf database, which you must replicate to the other servers in the cluster. Note that only databases where replica copies exist on both servers will have failover capabilities in the new cluster. To ease the cluster setup, it is a good idea to create replica databases on the other server before creating the cluster.

Setting up Domino clustering (continued)

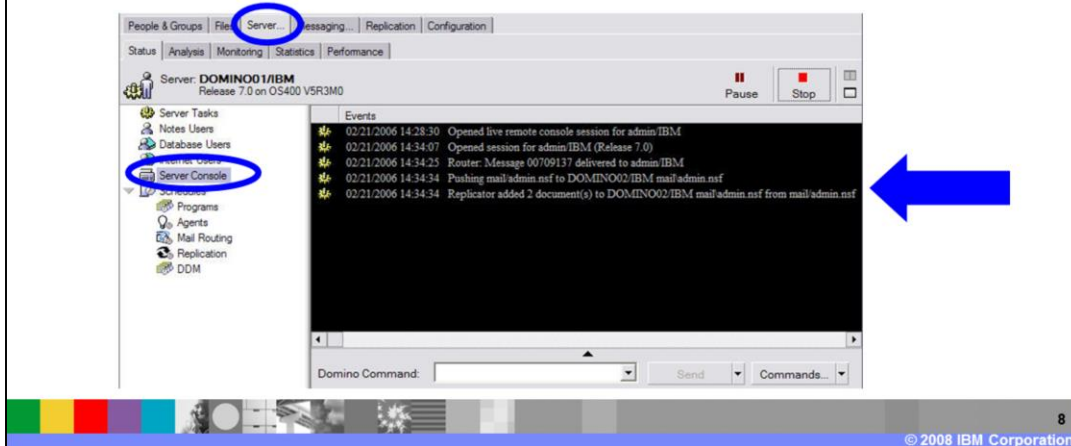
- Open the Cluster Database Directory (clbdbir.nsf) on the clustered servers
 - Configuration > Cluster > Cluster Directory(6)
 - Manage your replica copies and choose which databases to cluster



After you configure your cluster, you will then specify which databases to cluster. Perform this step by opening and editing the clbdbir.nsf database. Automatically clustered are databases that have a replica on the other server - meaning they contain the same replica ID on both servers.

What really happens with clustering

- Replication on steroids
 - ▶ When new mail is received it replicates it real-time to the replica copy in the Domino cluster
 - ▶ Replication synchronizes database replica copies within the cluster
 - ▶ Server > Status > Server Console > Live



In a cluster, the server sends database changes to the other server.

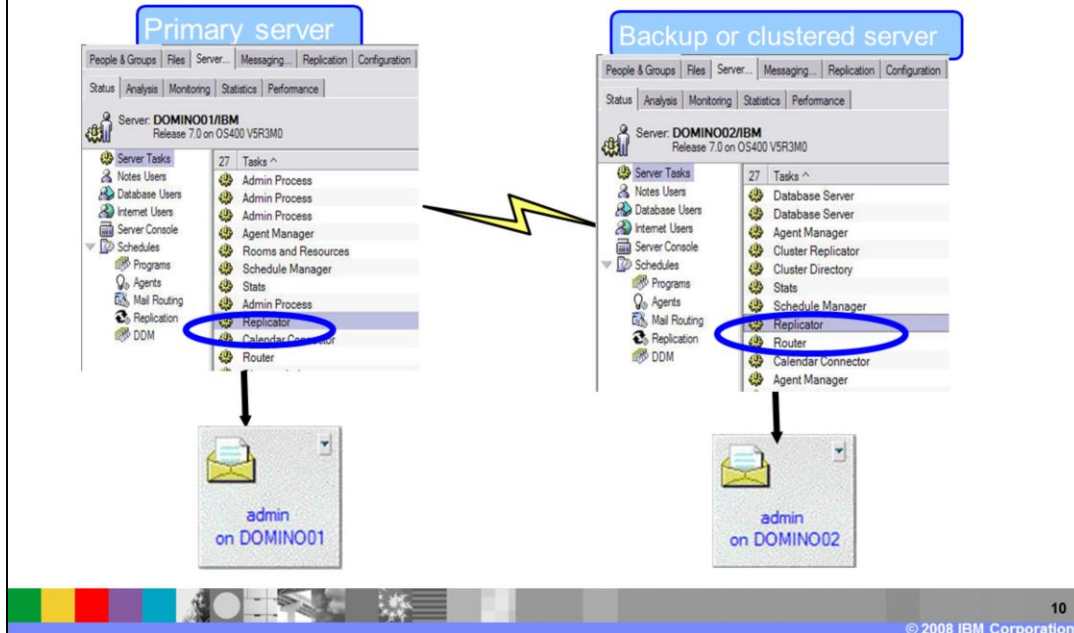
Replication and clustering as a backup strategy

- Advantages
 - ▶ Free with Domino (if you purchase an Enterprise license)
 - ▶ Does not require iSeries® skills
 - ▶ Provides fault tolerance
 - ▶ No media to manage
 - ▶ No downtime

- Disadvantages
 - ▶ Requires additional disk space
 - less than double if indexes are not maintained
 - ▶ Accidental deletions are propagated (No recovery for deleted documents)
 - ▶ No history or point-in-time recovery

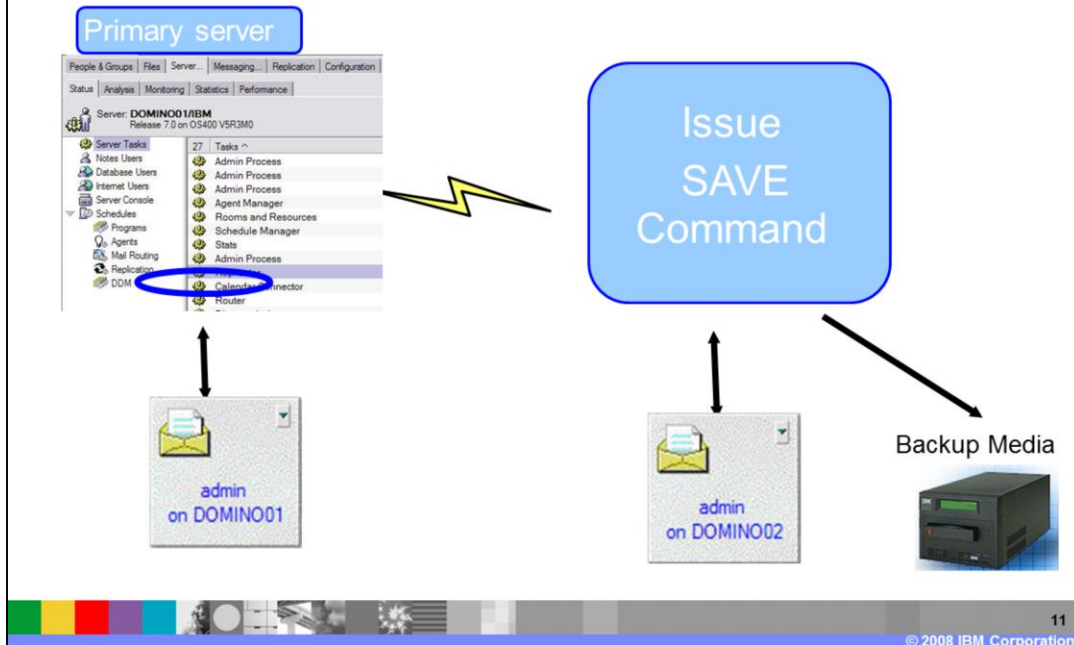
You should consider the advantages and disadvantages of using replication or clustering as a backup strategy. If you already purchased an enterprise service license for Domino, you do not need to purchase any additional software. You will also always have a hot backup available. The disadvantage is that you need double the disk space if you want to cluster all files. Also, deletions propagate. Thus, you should not use replication and clustering as the exclusive backup for your environment.

Replicating using the SAVE command



Using replication or clustering with the i5/OS Command Language (CL) SAVE commands is an attractive option for some. In this way, because there is always a warm backup available, you will not need to take the primary server down for backups.

Replication and SAVE commands



When using replication with the SAVE commands, you will first replicate all of the databases, and then end the secondary server to perform the backup.

Replication and clustering with CL SAVEs

▪ Advantages

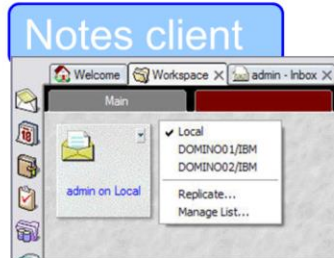
- ▶ No additional software
- ▶ No downtime
- ▶ Faster backups
- ▶ Fault tolerance
- ▶ Deleted documents are recoverable

▪ Disadvantages

- ▶ Requires additional disk space
 - Less than double if indexes are not maintained
- ▶ No point-in-time recovery
- ▶ Incremental and differential backups of little use
 - All backups are essentially "full" backups
 - Lots of storage

Here are some immediate benefits of using replication and clustering with i5/OS CL SAVE commands. It requires no additional software, no downtime of the primary server and deleted documents are recoverable. The disadvantages include the fact that it requires additional disk space and there is no option for incremental saves or point in time recovery.

Scenario: Documents accidentally deleted

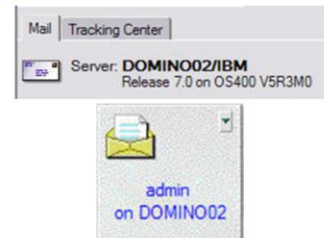


Documents are accidentally deleted on server Domino01's replica

Server Domino01

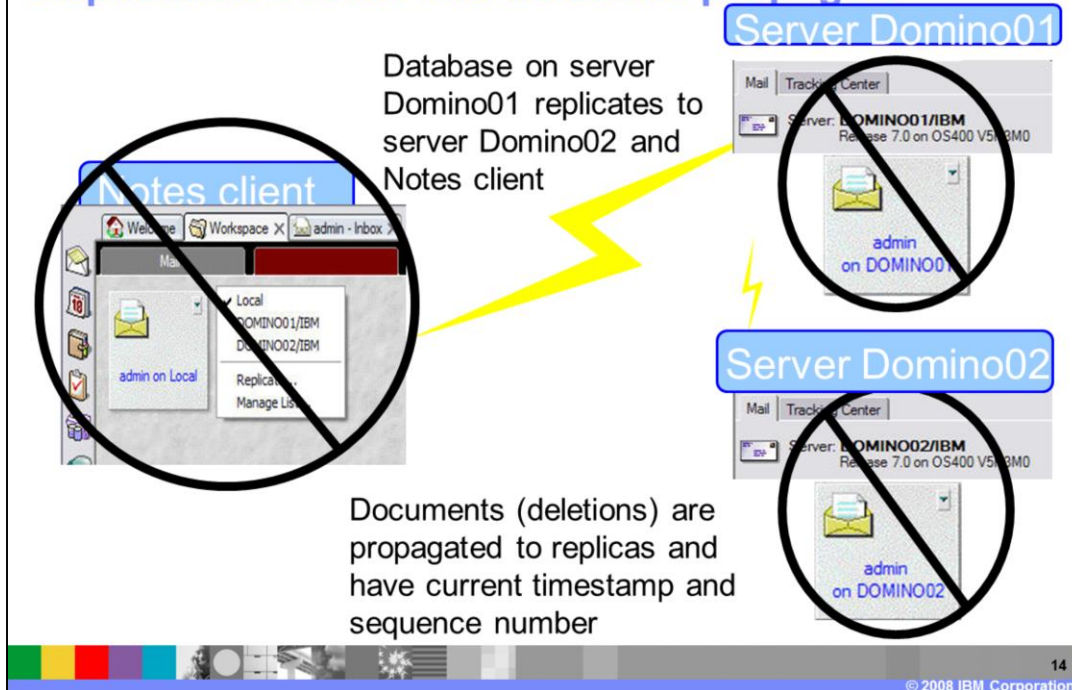


Server Domino02



When you have replica databases in your environment, you must take special care when recovering a database. Here is an example to help you understand what can happen. Assume that the admin database has replica copies Domino01, Domino02 and their Lotus Notes client. The user accidentally deletes some documents from the copy on Domino01.

Replication occurs and deletions propagate

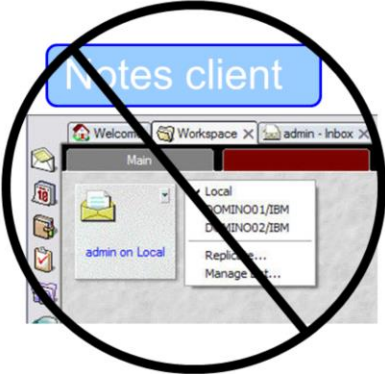


Since the administrator configured replication to occur automatically, the deletions replicate to the other database copies. Now the documents have been deleted from all three copies of the database.

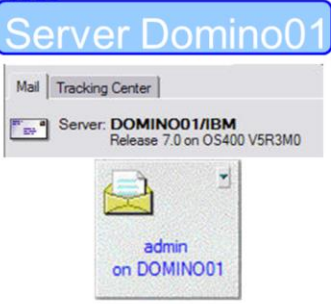
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Database is recovered from backup


Notes client



Server Domino01



Server Domino02



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The administrator has been notified that the documents have been deleted and the database has been restored from backup to server Domino01.

Deletions replicate to recovered database

- Timestamp and sequence number on replicas are newer than those on the recovered database. The deletions are “replicated” back to recovered database.



Because the timestamp and sequence number of the deletion is newer than the documents in the recovered database, the documents are again deleted from the database on Domino01.

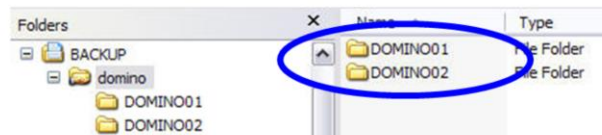
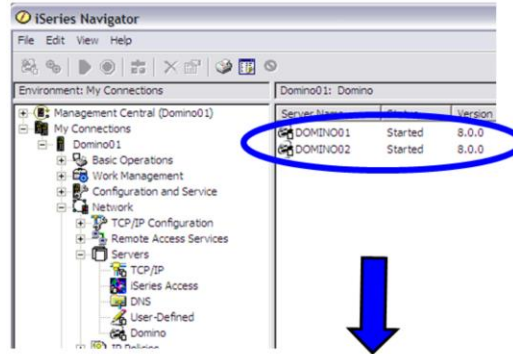
Solution #1: Change replica ID

- If you cannot be certain that a replica exists which can overwrite the recovered database, change the replica ID
 - ▶ File > Database > New Copy
 - ▶ ANTRID utility
 - Go to <http://www.ibm.com/software/lotus/support> and search on "ANTRID"
 - Download from <http://www.rprsystems.com/index.php>
 - ▶ You must distribute new replicas
- Beware if a system database is involved (such as names.nsf)
- Note: Purging deletion stubs may be an option if you discover the problem before the database replicates. See technote 1095683 for details at <http://www.ibm.com/software/lotus/support/>

One option to resolve this problem is to change the replica ID of the recovered database. You can download a utility to update the replica ID. However, this will break replication because you must create new replicas on Domino02 and the Lotus Notes client. Thus, be aware if a system database like names.nsf is involved. Names.nsf must replicate between all servers in the Domino domain. If you change the replica ID of names.nsf or another system database, you must place a new replica copy of names.nsf on all other Domino servers in the domain. One thing to note is that if you discover the deletions before replication occurs, it is possible to purge the deletion stubs from the affected database. In this situation, you can follow the instructions in technote 1095683.

Solution #2: Create database restore server

- Put the database on a different server that does not replicate with any of the production mail servers
 - ▶ A different restore server for every Domino iSeries system (or LPAR)
 - Directories for each server on the system



Another option to resolve this problem is to have a database restore server. The purpose of a restore server is to have a place to restore Domino databases where replication is not scheduled to occur. When you use a database restore server, you must open the database on the restore server and then paste the missing documents into replica copies of the database. You can then let the regularly scheduled replication put the documents back on the other server and Lotus Notes client. In this example, a backup Domino server called "Backup" exists. On this server, a subdirectory for each server is used as a temporary holding place for restored databases.

Considerations

- If a replica of a database to be recovered exists on another server:
 - ▶ If replicas are OK, restore database and allow replication to bring recovered database up to date
 - ▶ If corruption or deletion has been propagated to replicas, they must be recovered also or "bad" data will ruin the recovered database.
 - ▶ If a database is replicated to Notes or iNotes™ client, replicas on clients must be deleted or replica ID must be changed if client has delete authority.
- Restoring a clustered database to an alternate server allows database to be manipulated without risk of replication (works for only full backups)

In summary, care must be made when a replicated database is recovered from backup. If you have removed the database from the server where the documents were incorrectly modified or deleted, but the change had not replicated to the remote server you can restore the database to the server where the problem existed and allow Notes replication to run with no further action. However, if the deletions or problem with the database has already replicated to other servers you need to restore the database on both the original server and the cluster or replica server. If you do not do this, the recovered database will be damaged. This same thought process exists for clients that have a replica databases. If the client replica does not contain the problem, no action is needed when the server copy is restored to the server. If the client replica is also damaged or missing documents, a new client replica must be created to protect the server copy from getting the newest changes back into the database. Finally, if you are going to restore the database to a database restore server or another server that does not replicate, you can open the restored database, copy and paste documents from it without having to consider how it will affect your other replica databases.