Agenda Key: 25FH

Session #: 580131

Creating a Domino HA Environment

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About Amy Hoerle

- Consultant at Kim Greene Consulting, Inc.
- 1st "real" job was as an AS/400 administrator in 1997
- Worked on IBM Lotus Domino support team for 11 ½ years
- Specializing in Lotus products on IBM i & Windows since 1999
- XPages development
- Author of numerous technotes, articles and the "Optimizing Domino Administration" IBM Redbooks Wiki
- Email – ahoerle@kimgreene.com
- Blog - www.bleedyellow.com/blogs/ilotusdomino
- Twitter - iLotusDomino

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Agenda

- Planning for HA
- Understanding Domino Replication
- Overview of Domino Clustering
- Clustering Custom Applications

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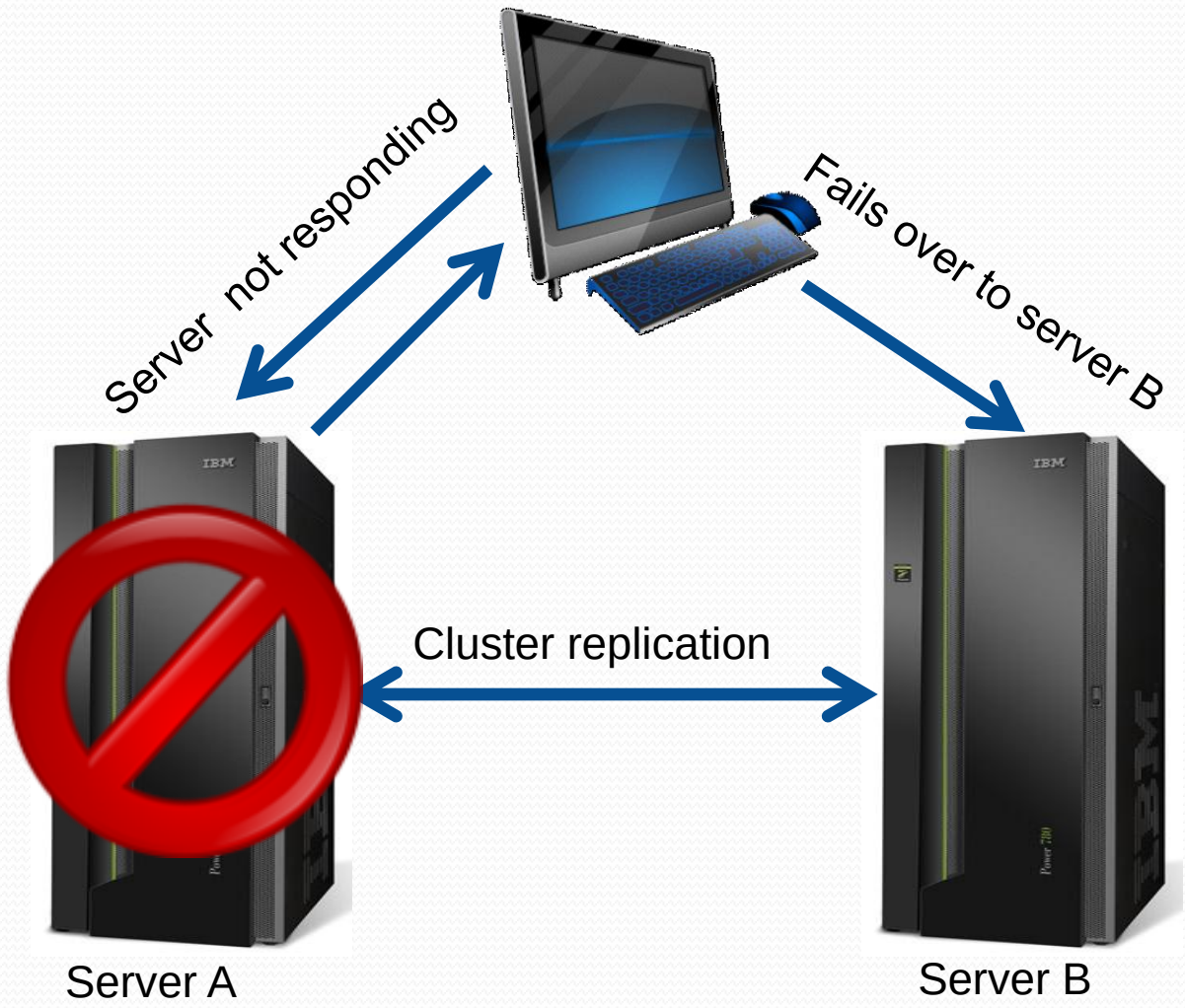
Planning for HA

- What is the goal?
- What will be clustered?
- Which 3rd Party Products are in use?
- Review Backup and Recovery Plan
- Review Firewall, Mail Routing and DNS Configuration

Failover with the Notes Client



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Clustering Other tasks

- Not using the Notes client?
  - iNotes
  - POP3
  - IMAP
- Hosting web applications?
- Other applications looking up names from the Domino directory (LDAP)?

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Internet Cluster Manager (ICM)

- Why ICM?
  - Way to route browsers to a specific Domino server
  - Understands Domino clustering and thus can identify where cluster replicas exists, availability of server..
- Why not ICM?
  - Requires the browser hit the ICM for the redirection
  - Must cluster the ICM or you just moved your single point of failover
  - Requires unique IP or non-standard port to run on server hosting the web application

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Other Clustering Options

- IP Sprayer
  - Most common method for enabling failover for
    - Web Browsers
    - POP3
    - LDAP
  - Disadvantage
    - Is not aware of which applications are on the server
    - Administrator must ensure that all applications have been replicated to the cluster server

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Other Clustering Options

- OS Clustering
  - Clustering the server at the Operating System level
  - Only required when trying to cluster IMAP as each message has a unique message id

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Domino Replication and Clustering

- Domino Replication
  - Maintains identical copies of databases on two Domino server instances
  - May be on same or different server or platform
  - Automatic, scheduled
  - Provides warm standby

- Clustering
  - Real-time replication
  - Provides hot standby (load balancing and automatic failover for Notes clients)

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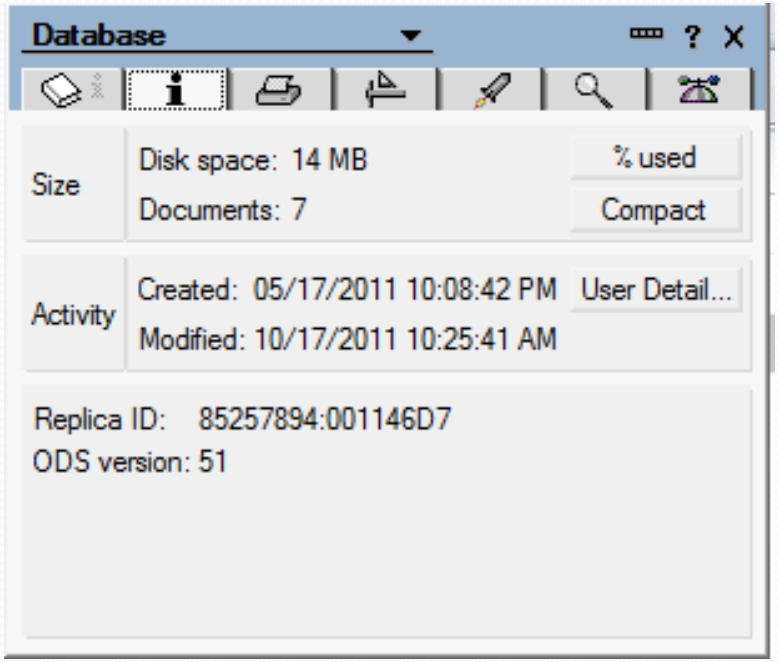
Replication

- Allows you to have multiple instances of an application on servers or clients where data is kept synchronized by the Domino server

- Databases are considered Replicas when the replica ID matches (file name does not matter)



File → Application → Properties

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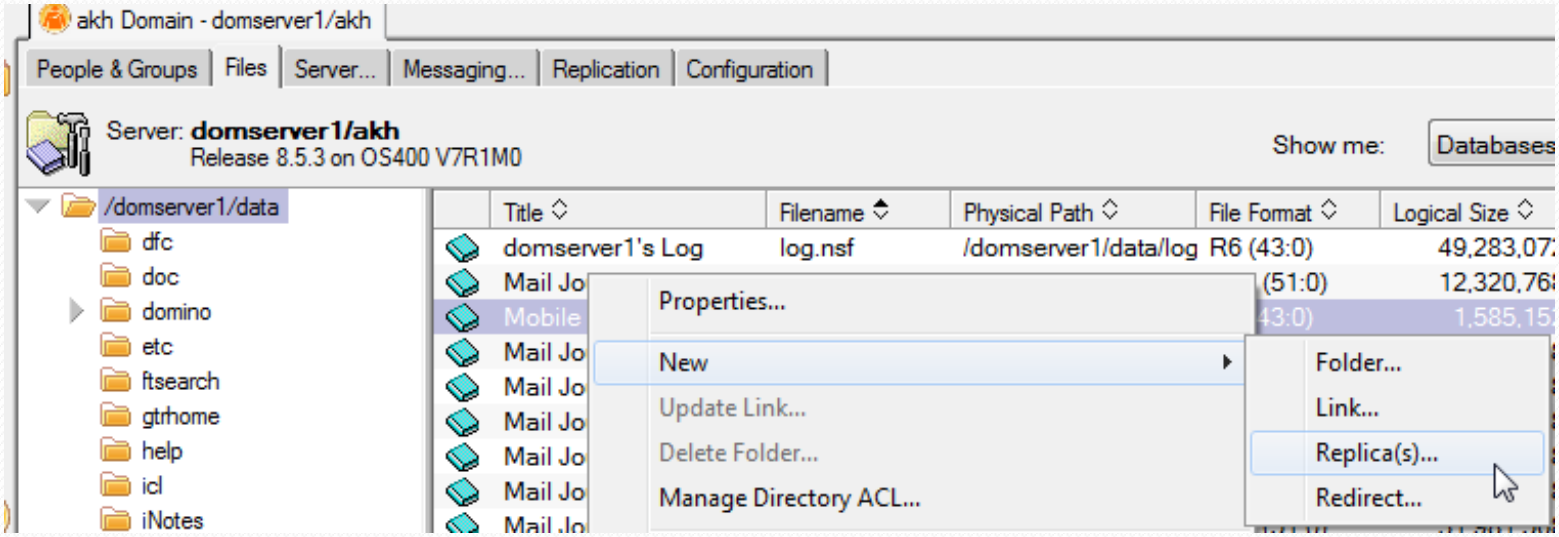
Creating a New Replica

- Multiple Methods
  - Manually (File → Replication → New Replica)
  - Via the Administrator client



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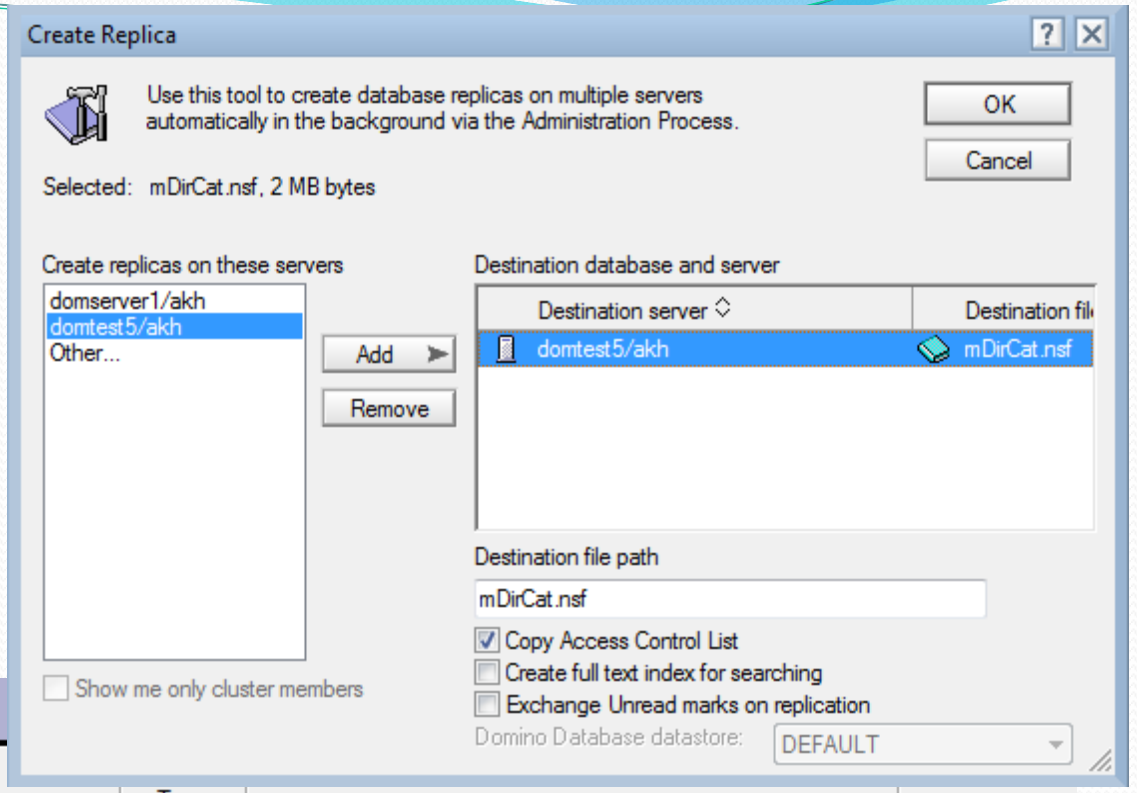
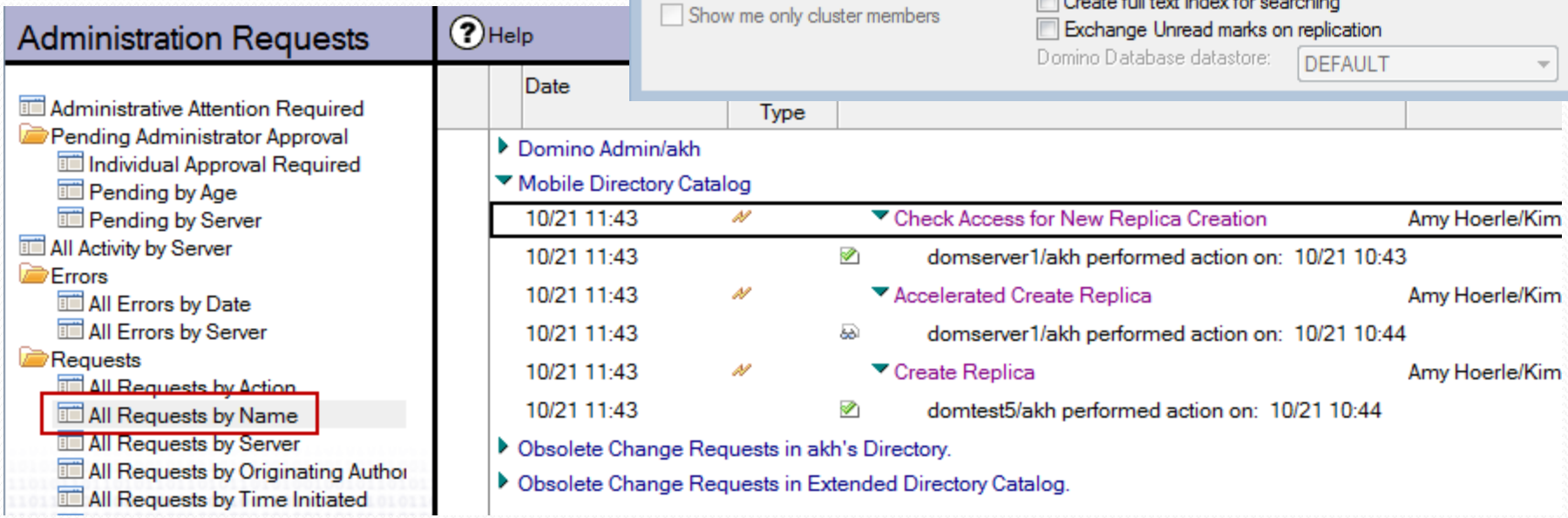
New Replica

Creating a new replica via the Domino Administration Process (adminp)





Who can create replicas

- The *Create new replicas* field determines who can create a new replica database on the server

Server document →

Security tab

Server Access	Who can –
Access server:	☑ users listed in all trusted directories and */Kim Greene Consulting LocalDomainServers
Not access server:	
Create databases & templates:	Domino Administrators Help Desk Employees LocalDomainServers
Create new replicas:	Domino Administrators LocalDomainServers
Create master templates:	DominoAdministrators
Allowed to use monitors:	*
Not allowed to use monitors:	
Trusted servers:	

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Replication Types

- **Push**: Send changes here to the remote server
- **Pull**: Receive changes from the remote server
- **Rep**: Performs a pull followed by a push to send and receive changes to and from the remote server

  Rep *Remote_Server App.nsf*

- The ACL still rules! If the server does not have authority to read the updates or write to the database the replication will not work as expected.

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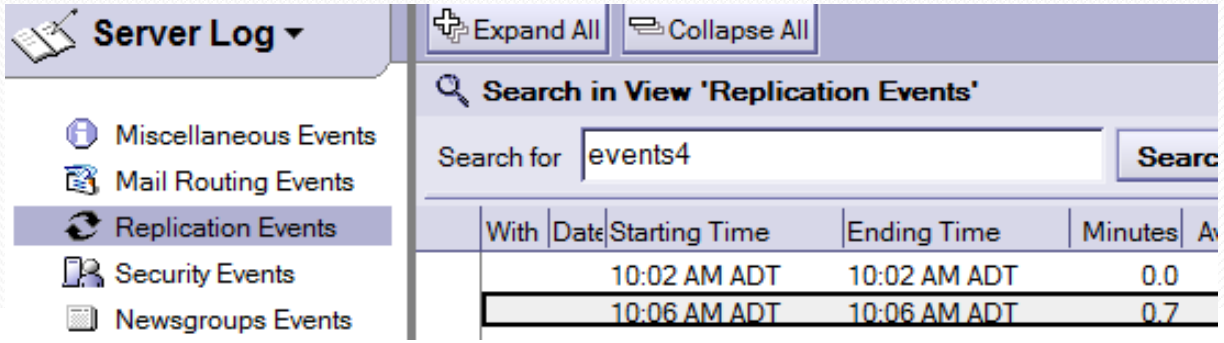
Logging

- Log.nsf



Name: domserver1/akh
Time: 10/18 10:06 AM ADT - 10/18 10:06 AM ADT
Remote Server: domtest5/akh
Initiated By: domserver1/akh
Elapsed Time: 0.7 minutes

Events:

Access control is set in catalog.nsf to not allow replication from domtest5/akh catalog.nsf
Access control is set in domtest5/akh catalog.nsf to not allow replication from catalog.nsf

Databases replicated:	Access:	Added:	Deleted:	Updated:	KB Rec'd:	KB Sent:
domserver1 names.nsf From: domtest5 names.nsf (PULL)	Manager	1	24	442	10,832.41	5.75
domtest5 names.nsf From: domserver1 names.nsf (PUSH)	Manager	4	0	3	8.22	60.98
domserver1 events4.nsf From: domtest5 events4.nsf (PULL)	Manager	1	0	0	592.96	0.47
domtest5 events4.nsf From: domserver1 events4.nsf (PUSH)	Manager	251	0	473	250.99	7,785.53
domtest5 admin4.nsf From: domserver1 admin4.nsf (PUSH)	Manager	32	3	111	16.66	1,621.22

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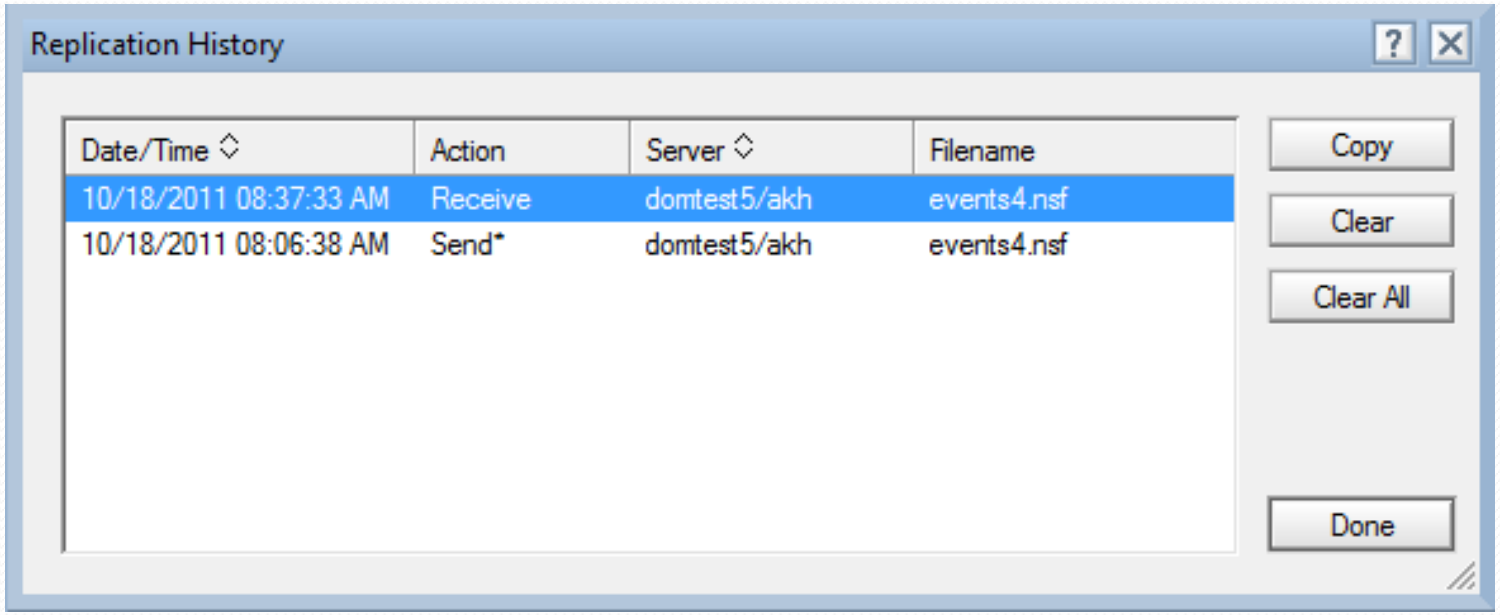
The Replication History

- Access the Replication history from the menu (**File** → **Replication** → **History…**)



- Does not show client replications!
- Hundred servers or more in your domain? See http://www-01.ibm.com/support/docview.wss?uid=swg21270104

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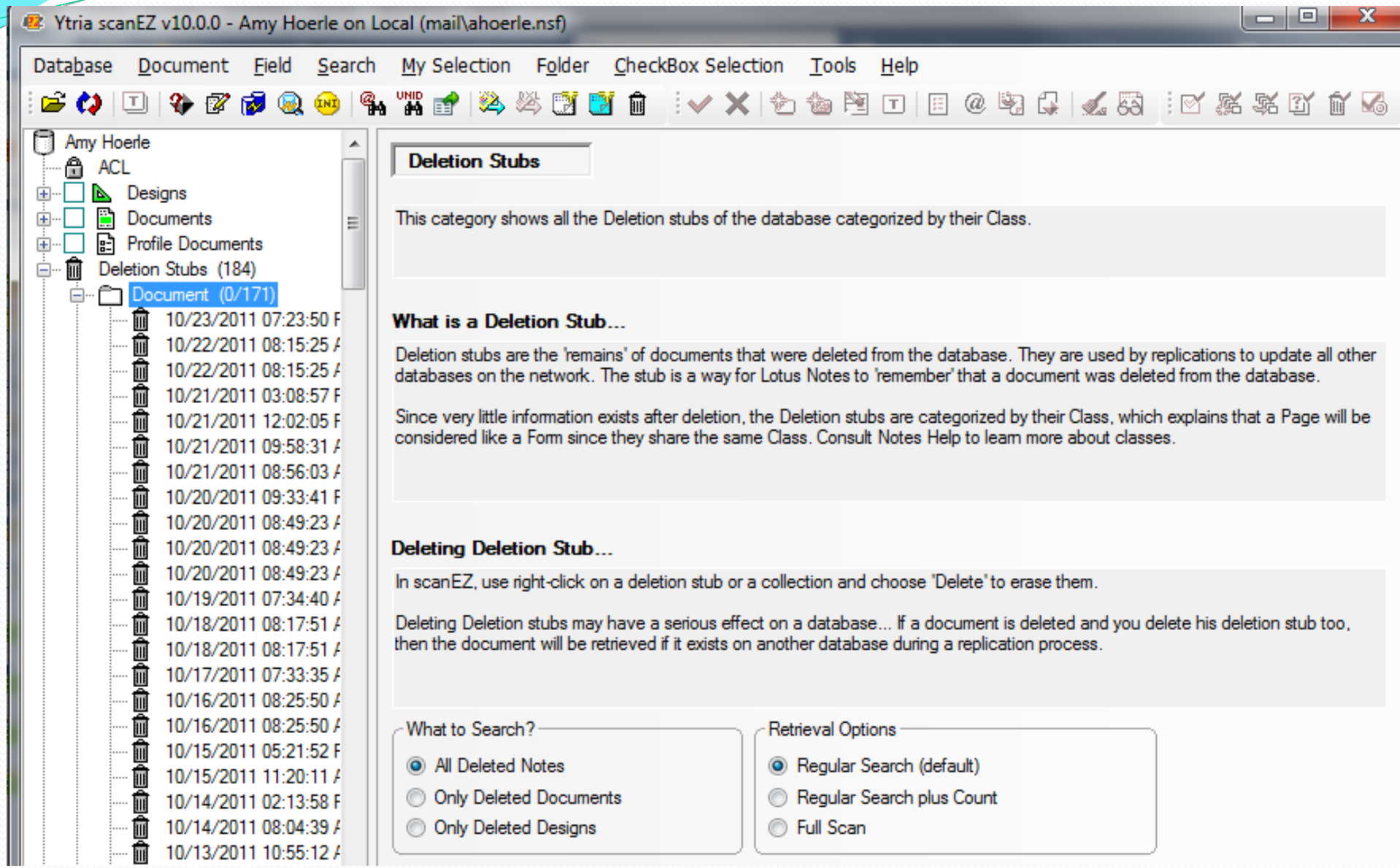

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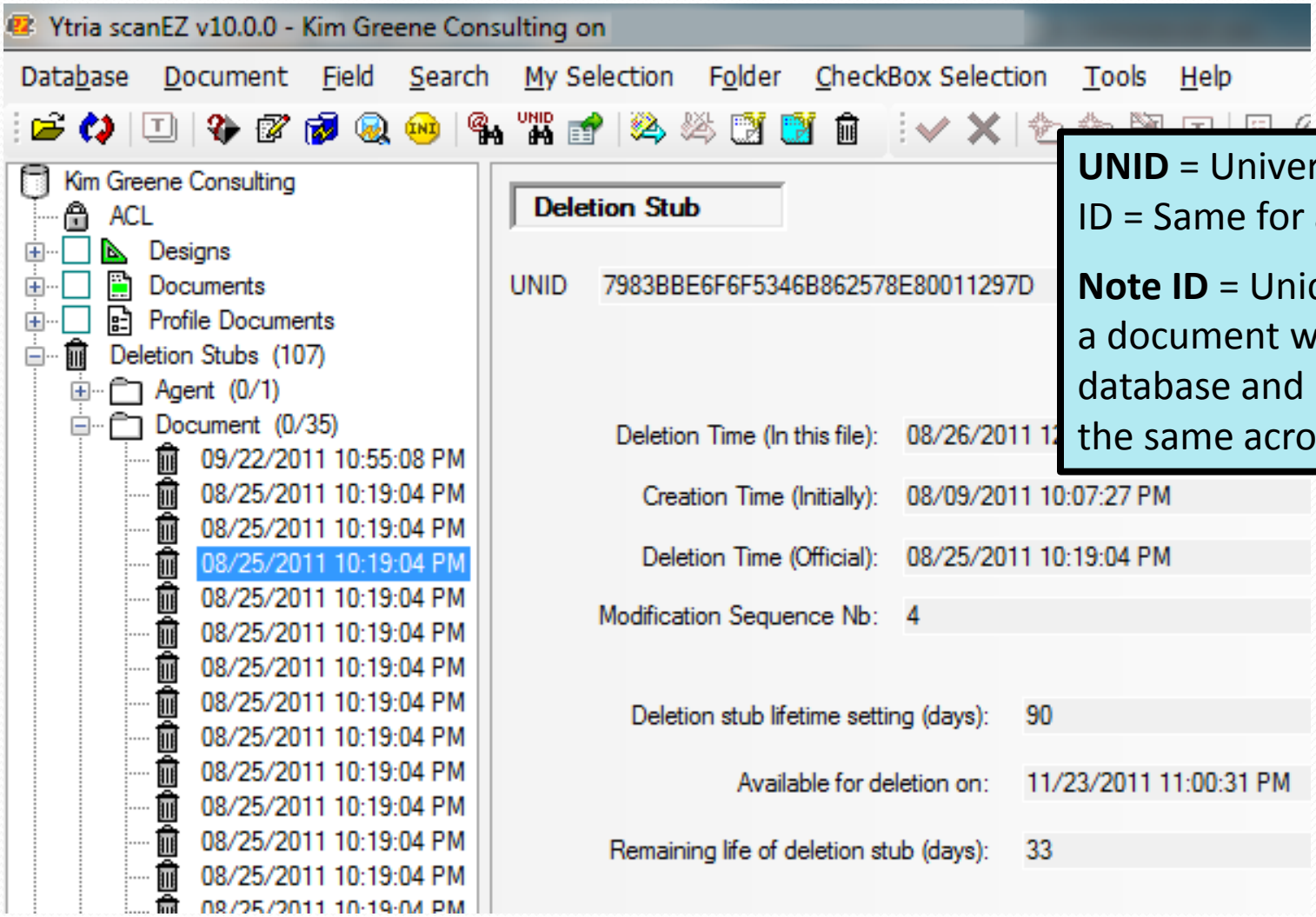
Understanding Deletion Stubs



UNID = Universal document ID = Same for all replicas

Note ID = Uniquely identifies a document within a database and may or not be the same across replicas.

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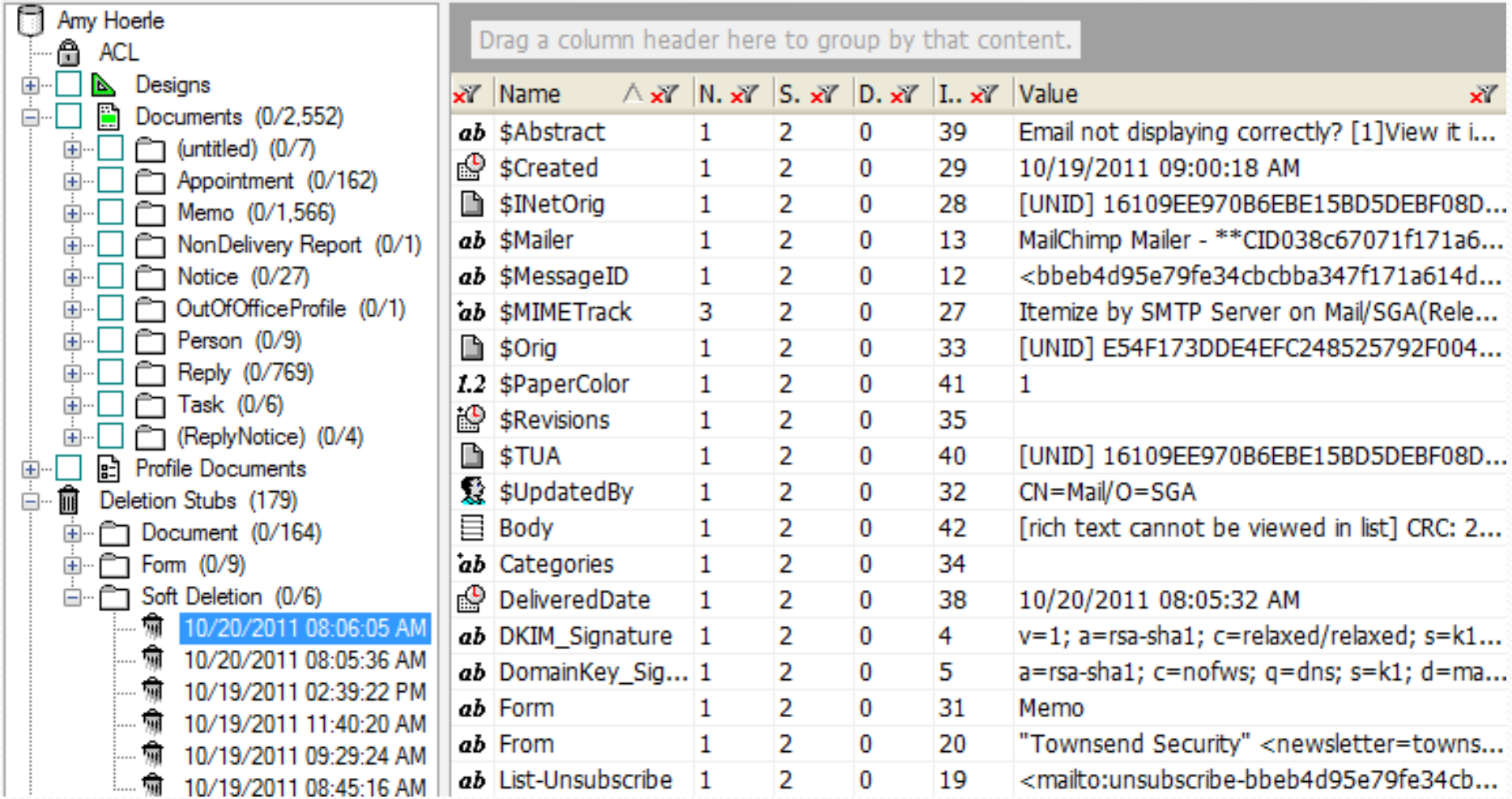
Soft Deletes



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Recovering Accidental Deletions

- Be careful when restoring!
  - If a replica with deletion stubs still exists the documents will be removed again
  - If you can't be certain that a replica exists which can overwrite the recovered database, change the replica ID
    - File → Application → New Copy
    - 3rd Party Products (ANTRID)
    - New replicas must be distributed
- Beware if a system database, such as NAMES.NSF is involved

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Replication Save Conflicts

- A conflict occurs when the same document is
  - Modified by 2 different users on the same server
  - Modified on 2 different servers between replication cycles

- Administrator or manager of application must take action to resolve
  - Update the Original document
  - Delete the conflict document

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Application Designer in Control

- The Application Designer is in control with replication save conflicts
- Form property determines what will happen when a conflict occurs
  - **Create Conflicts** – doesn't matter what changed, create the conflict document
  - **Merge Conflicts** – if changes are not in the same field combine the changes into the single document
  - **Merge/No Conflicts** – merge the changes and if the same field was changed in both documents, Domino picks a winner
  - **Do Not Create Conflicts** – Domino will pick one of the documents as the current document and the other changes will be lost

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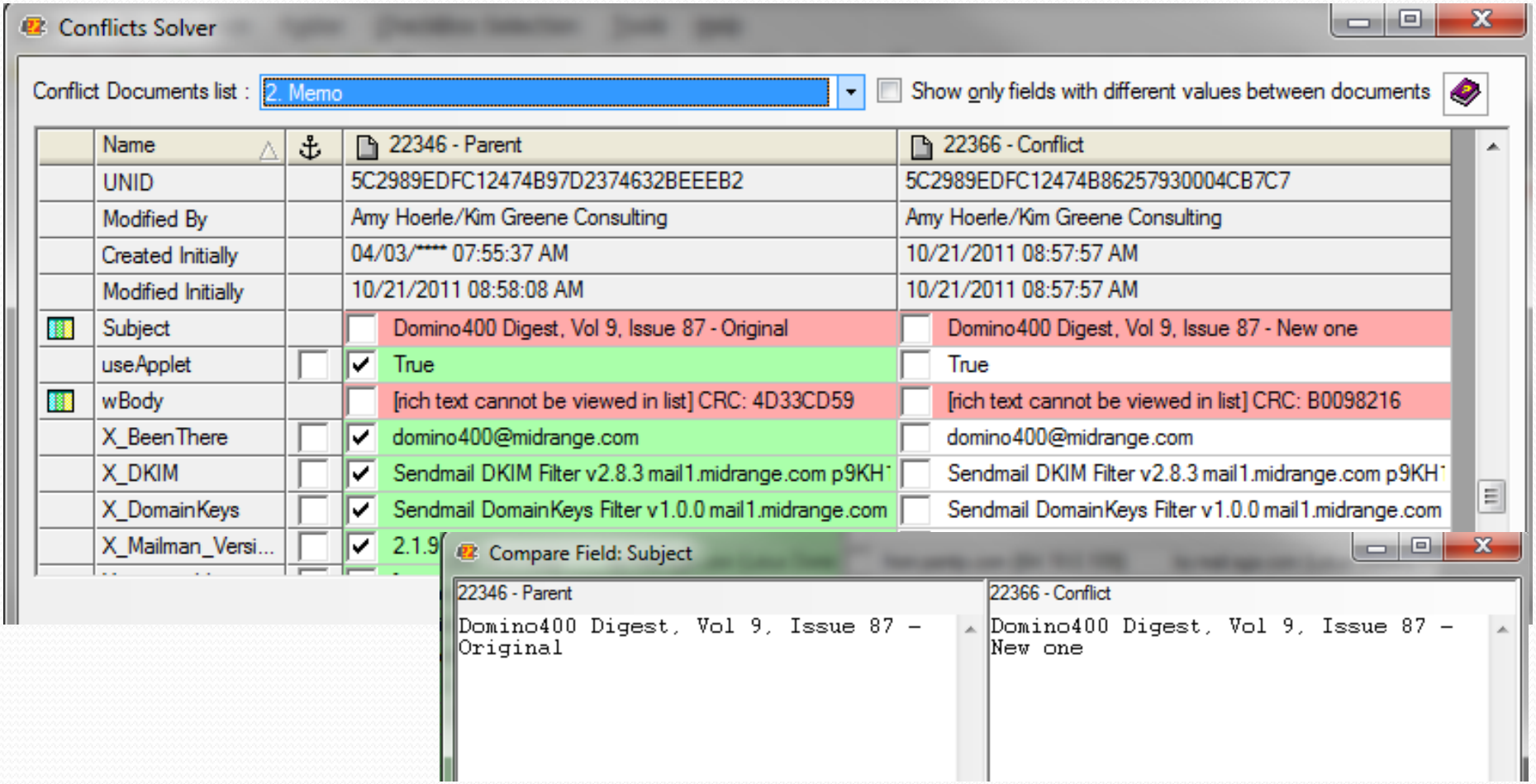
Example Replication Save Conflict



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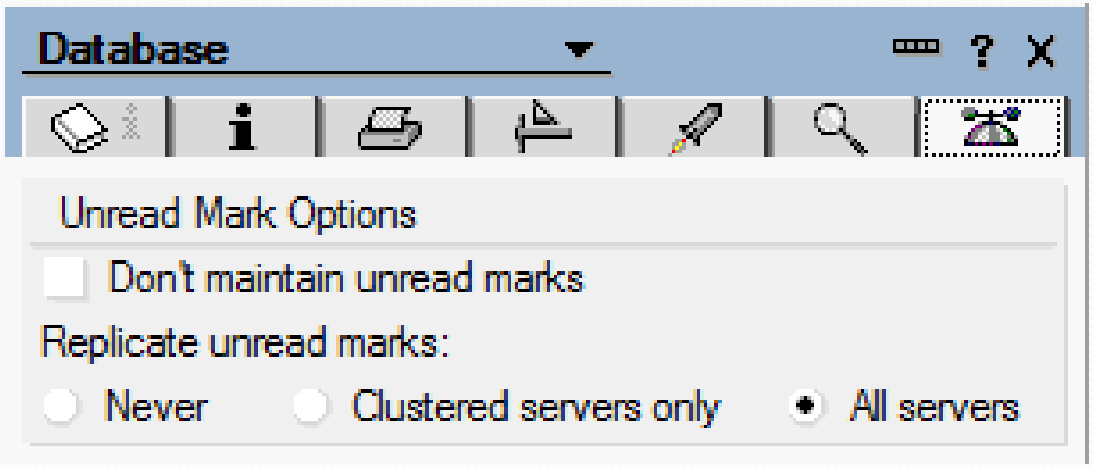
Understanding Unread Marks

- How does Domino know what you read?
  - Tracked by person
  - Many changes on functionality over the past few years
  - Optionally replicate unread marks
  - Review Database properties



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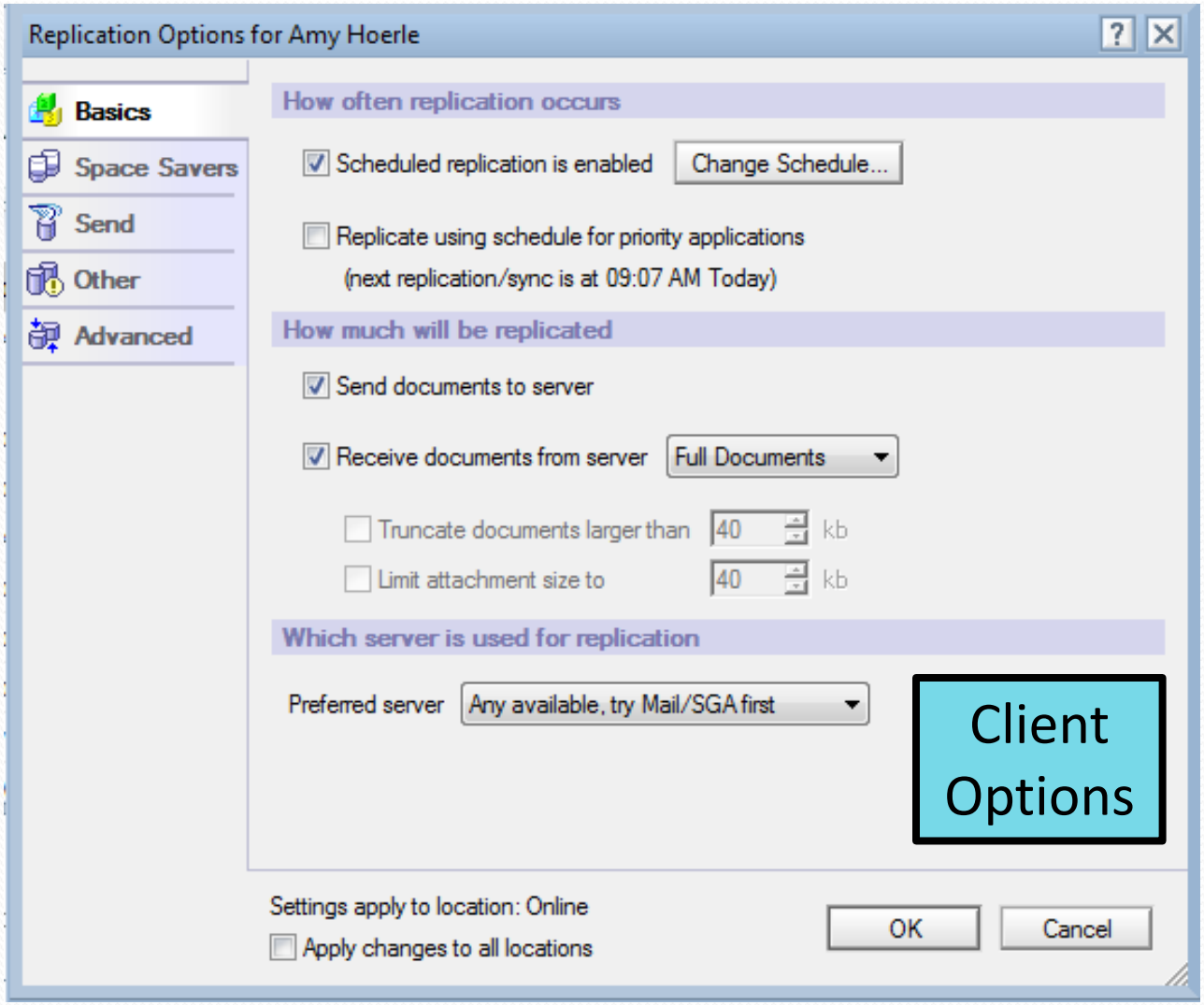
Looking at the Replication Options

Application Properties → Replication Settings button

OR

File → Replication → Options for this Application…



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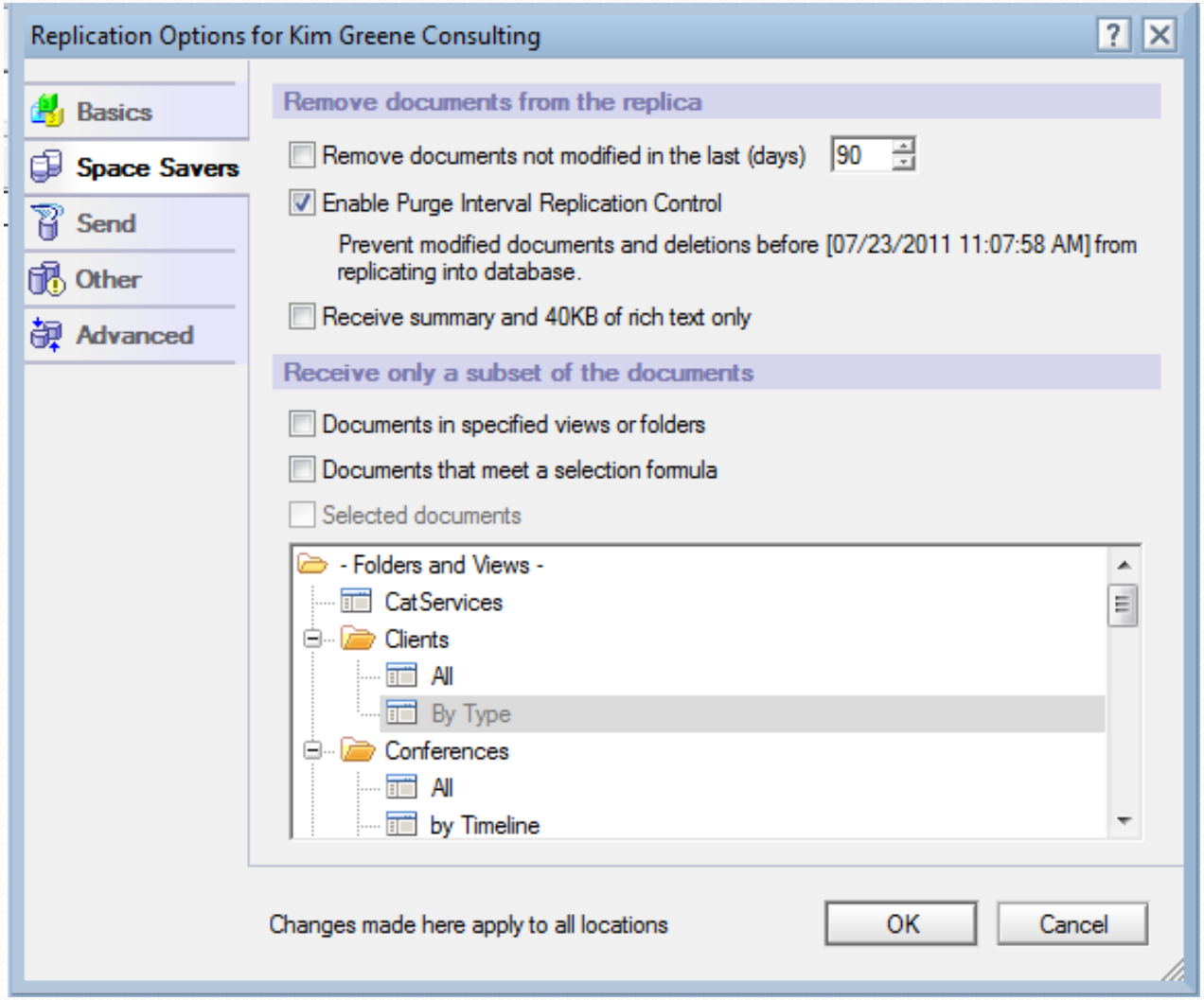
Looking at the Replication Options

Use the **Space Savers** options to limit the data in the application

Use the **Remove documents not modified in the last (days)** option on any application.

- It does not need to replicate!
- Use this to keep your log files small!



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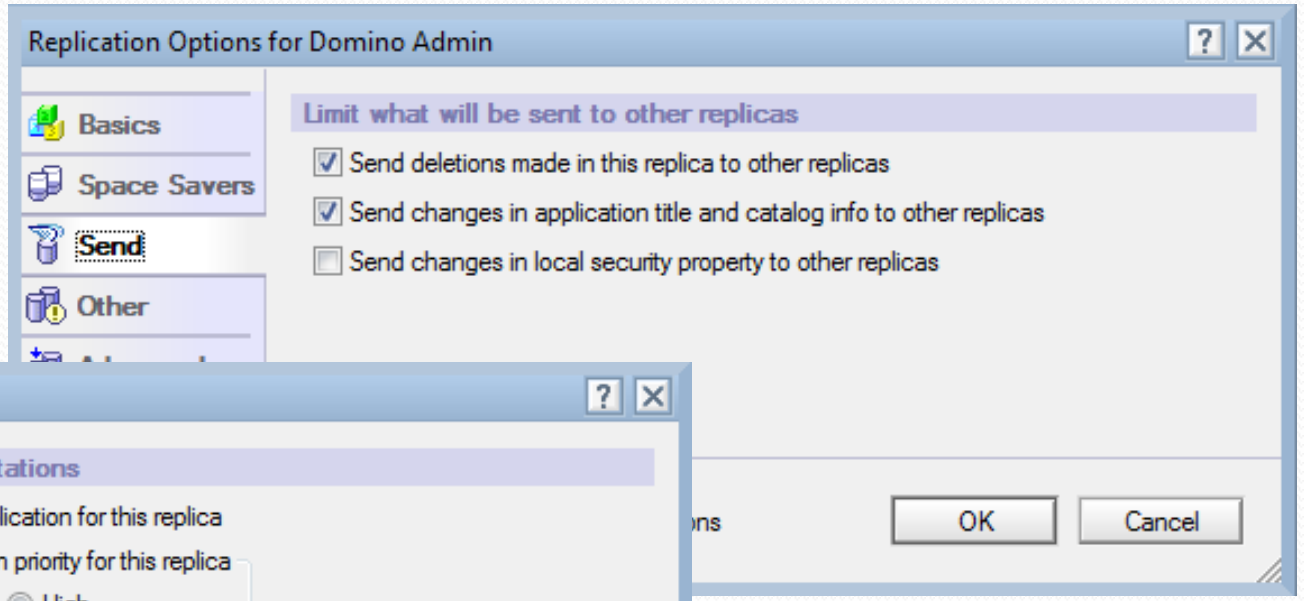
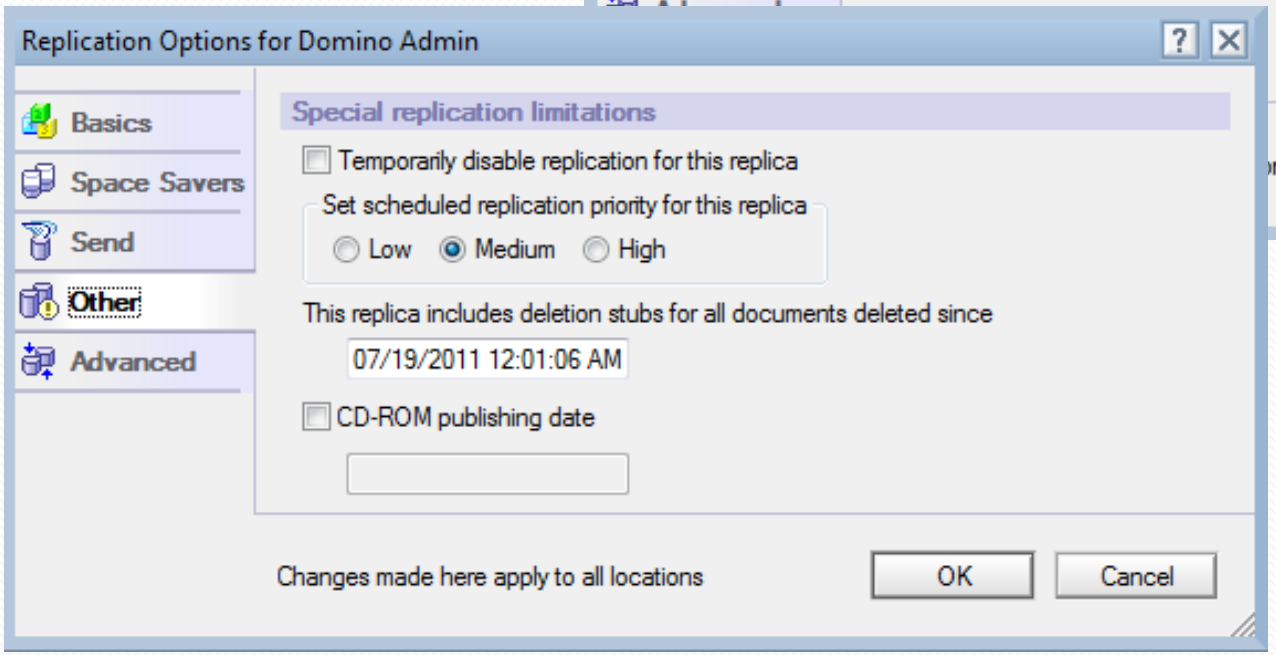
Looking at the Replication Options

Do you want to send deletions, application title or security?





Need to temporarily disable replication?

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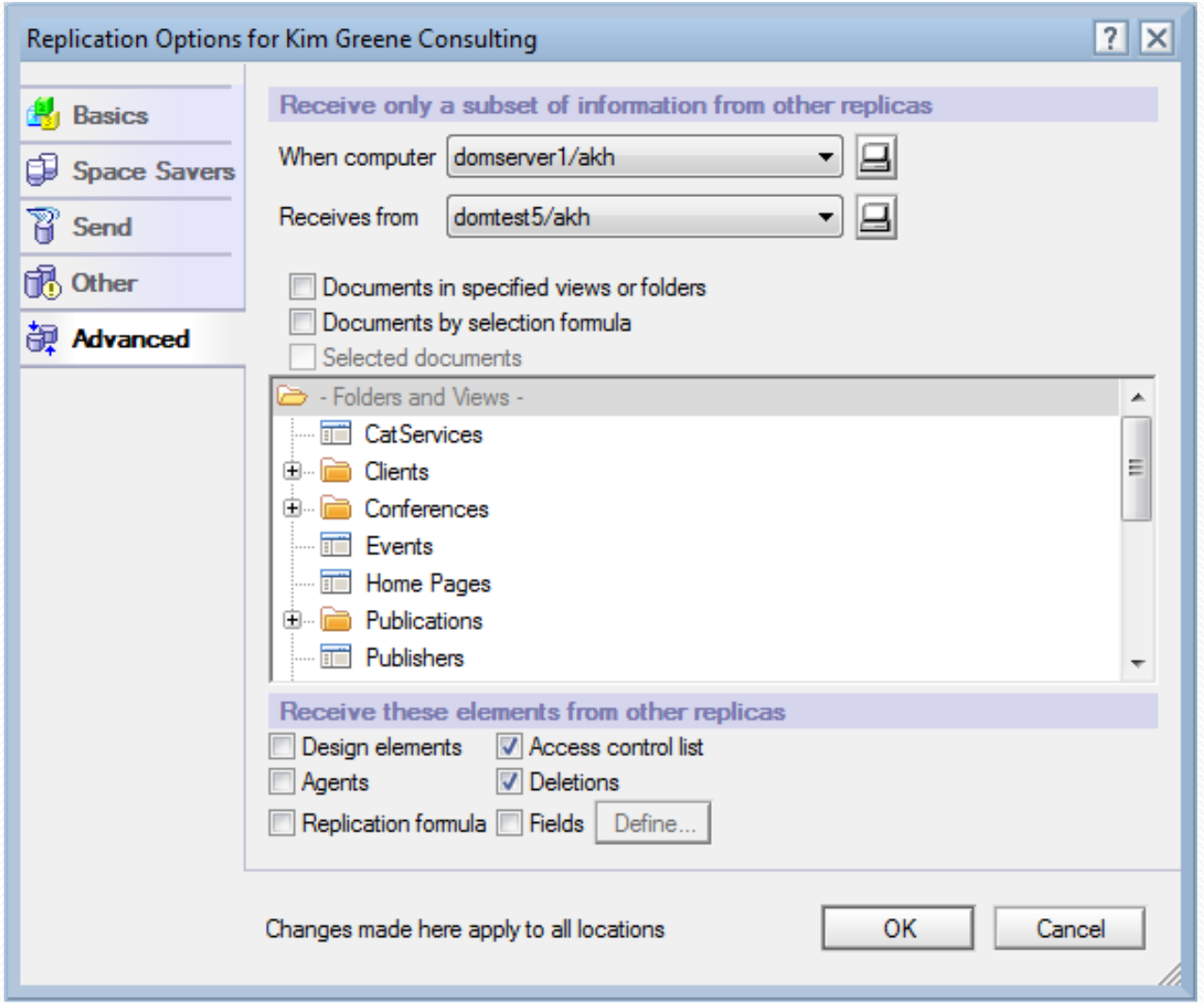
Looking at the Replication Options

A simple way to prevent Database design or deletions from being replicated.

Can define for All servers or limit changes from a specific server.



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Limiting what replicates

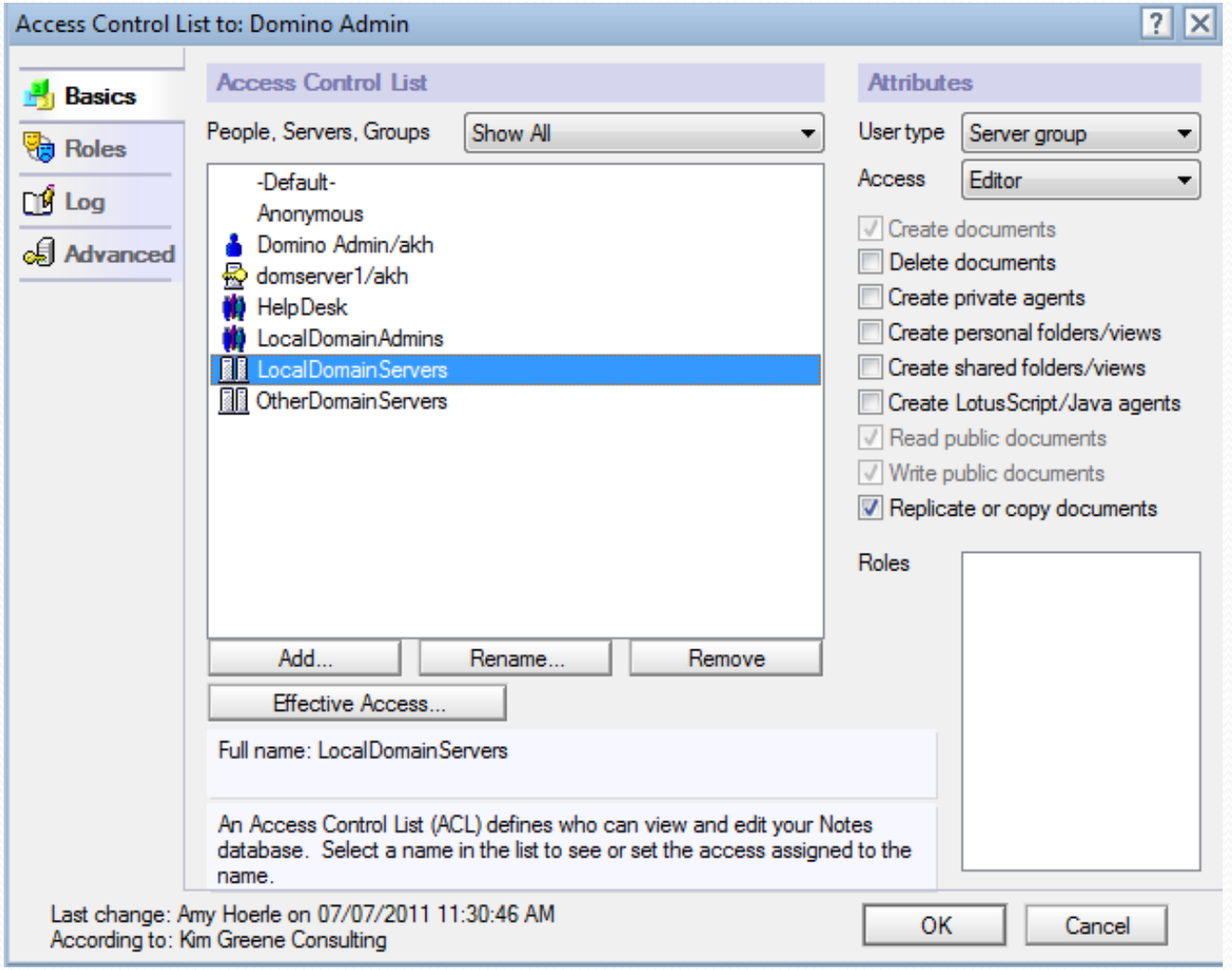
Use the ACL to control what data the server can update

For example:

Mail server = Manager

LocalDomainServers = Editor

OtherDomainServers = Reader



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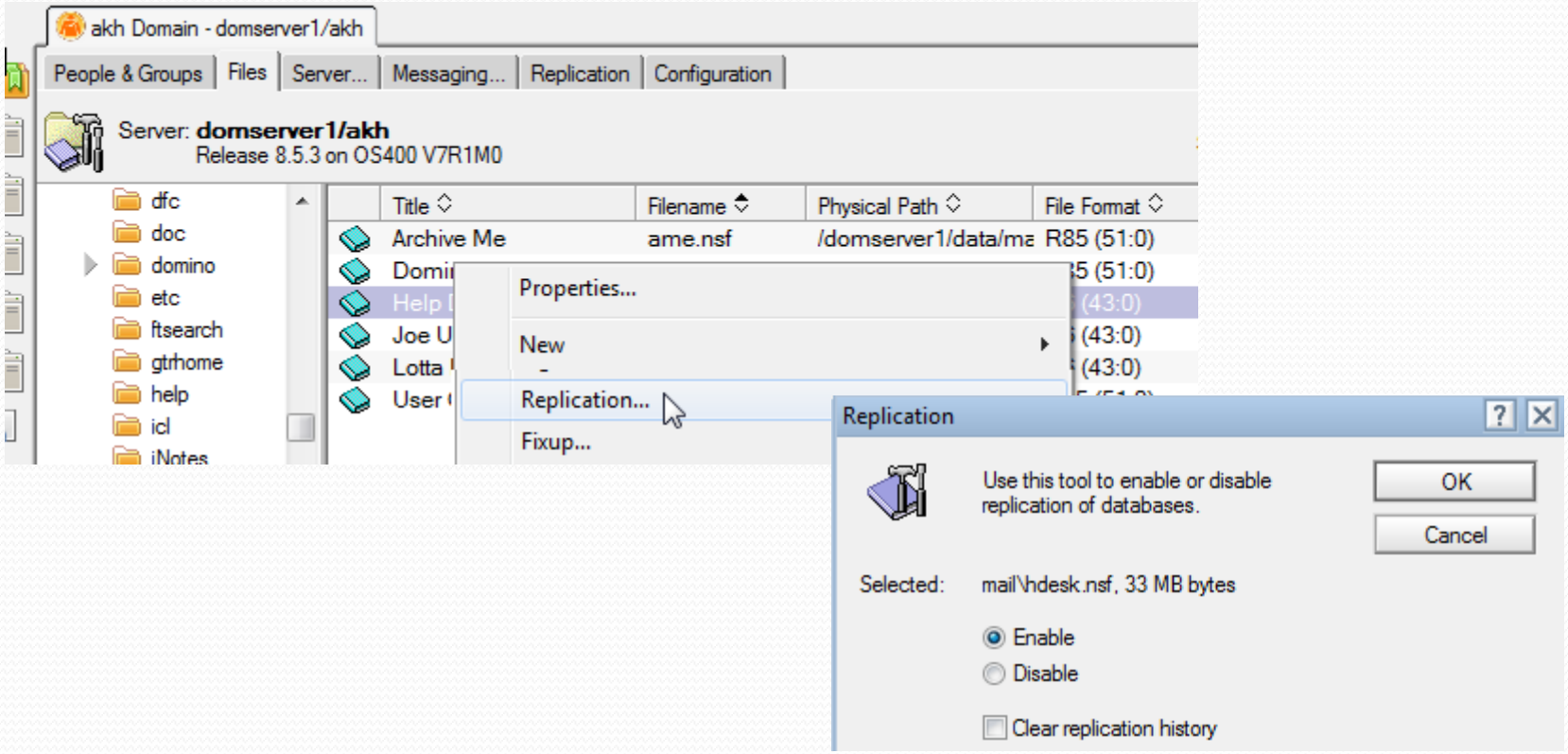
Disabling Replication

Replication can be disabled for an application at any time



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Clustering

What is Domino Clustering

- A Domino cluster is a collection of 2 to 6 Domino servers which provides high availability and workload balancing.

- How Does it work?
  - 2 or more servers are selected to be in a Cluster (up to 6 servers)
  - Each server contains replicas of the applications which are to be clustered
  - If user attempts to access a clustered application and it is not available, Notes opens a replica of the database on a different cluster server
  - Domino continuously synchronizes databases

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Domino Clustering Requirements

- Connection to a high speed network
- All servers in a cluster must share a common Domino Directory
- A server can be a member of only One cluster at a time
- Adequate Disk for replica databases
- Adequate CPU resources to handle additional replication requirements
- Be aware - Domino Clustering is not hardware clustering, it is application clustering

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Clustering Tasks

- CLREPL = Cluster Replication
  - As the name implies, performs cluster replication
- CLDBDIR = Cluster Database Directory
  - Responsible for maintaining cldbdir.nsf application
  - Will create application if it does not exist
- New in 8.5.x versions
  - Clustering tasks automatically start
  - Do not need to specify tasks in ServerTasks

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Types of Clustering

- Failover
  - Server in Domino cluster provides services while primary server is unavailable
  - Provides HA solution for Lotus Domino servers
- Workload balancing
  - Spreads workload among servers
  - Limits how busy a specific server will become
  - Provides more consistent performance for end users

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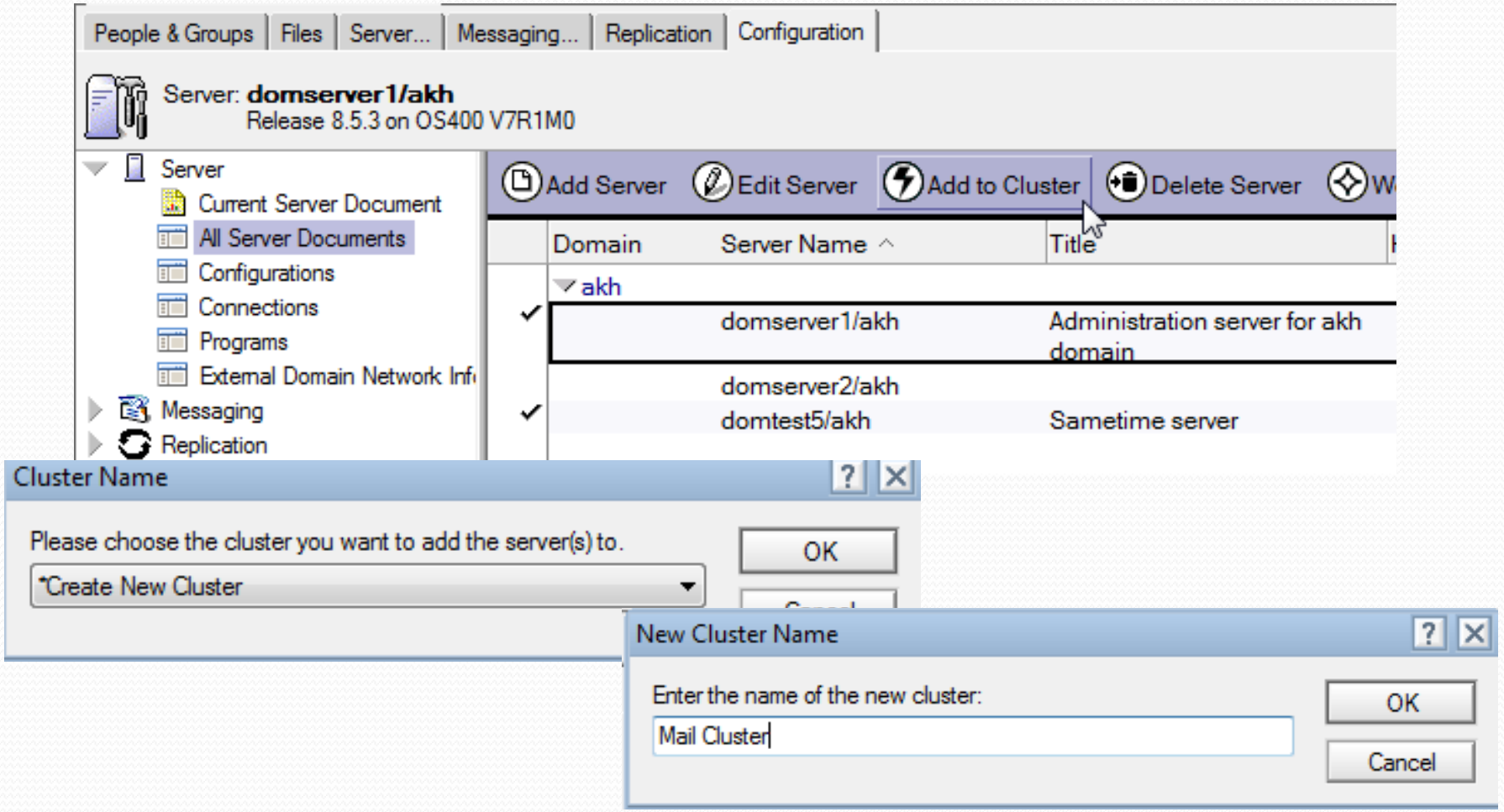
Configuring Domino Clustering



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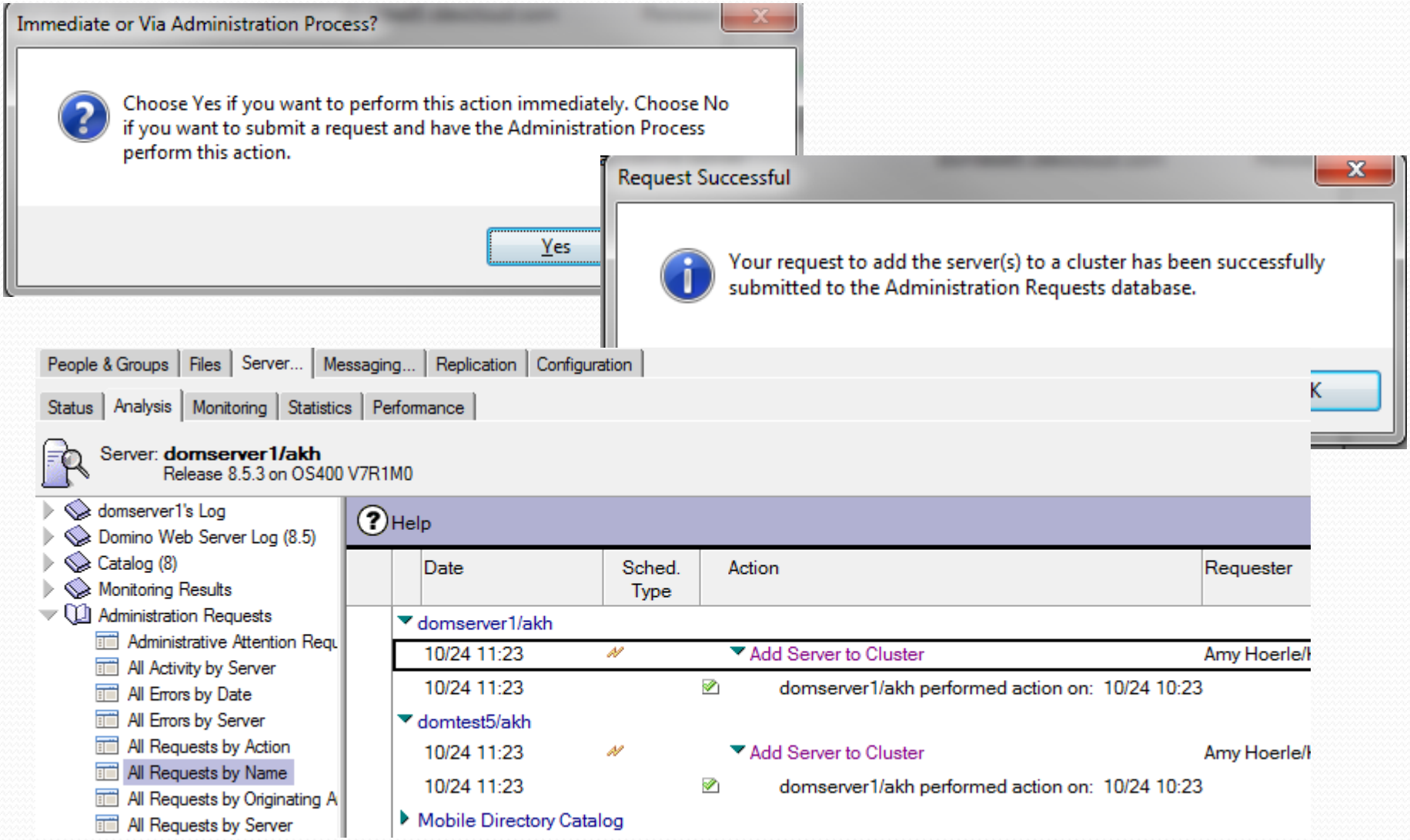
Configuring Domino Clustering



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What just happened?

Adding server to cluster Mail Cluster

Cluster Database Directory started

Directory Assistance is updating server info in internal tables (Server records in primary directory have changed)

RnRMgr: Error switching busy time database from busytime.nsf to clubusy.nsf: RnRMgr: Error switching cluster busy time database, Rooms and Resources Manager shutdown complete

Recovery Manager: Assigning new DBIID for /domserver1/data/cldbdir.nsf (need new backup for media recovery).

Created database Cluster Database Directory: cldbdir.nsf

Finished initialization of Cluster Database Directory

Replicating Cluster Database Directory with domtest5/akh

Starting replication with server domtest5/akh

Unable to update Cluster Database Directory: None of the selected databases has a replica on the server

Cluster Replicator started, Cluster Replicator is set to Ignore Database Quotas

Pulling cldbdir.nsf from domtest5/akh cldbdir.nsf

Replicator added 170 document(s) to cldbdir.nsf from domtest5/akh cldbdir.nsf

Replicator updated 2 document(s) in cldbdir.nsf from domtest5/akh cldbdir.nsf

load rnrmgr

Rooms and Resources Manager started

RnRMgr: Informational: Schedule Manager is responsible for the busytime database on this server.

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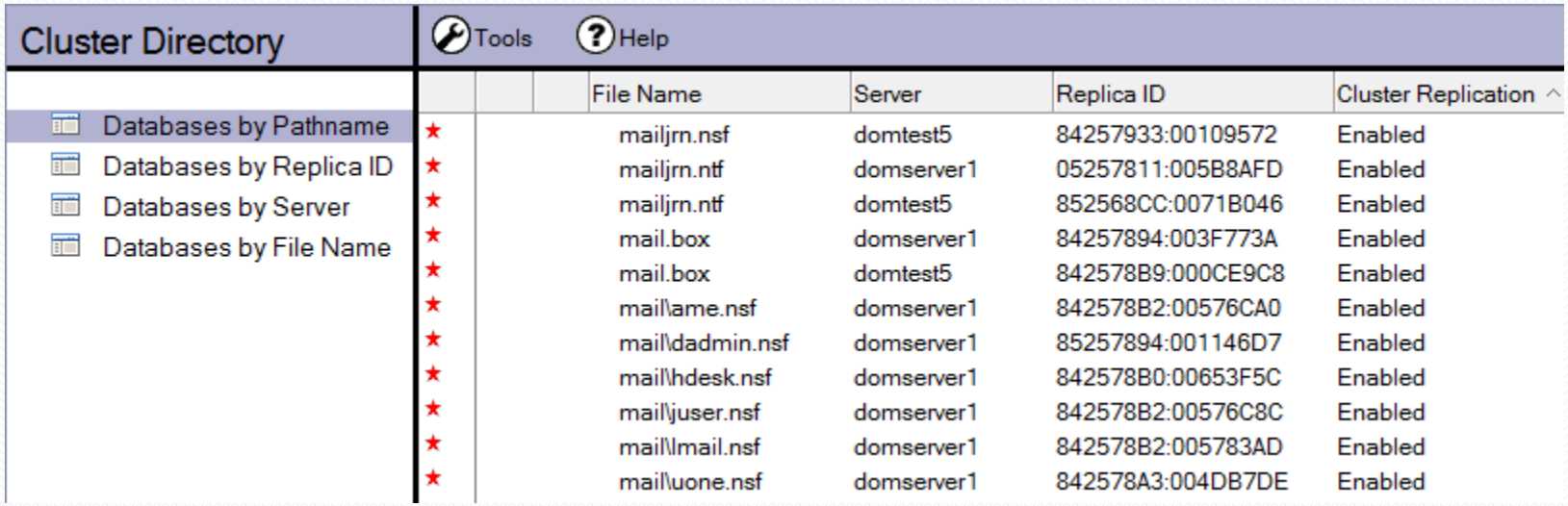
Cluster Database Directory

- Cldbdir.nsf



File Name	Server	Replica ID	Cluster Replication
mailjrn.nsf	domtest5	84257933:00109572	Enabled
mailjrn.ntf	domserver1	05257811:005B8AFD	Enabled
mailjrn.ntf	domtest5	852568CC:0071B046	Enabled
mail.box	domserver1	84257894:003F773A	Enabled
mail.box	domtest5	842578B9:000CE9C8	Enabled
mail\ame.nsf	domserver1	842578B2:00576CA0	Enabled
mail\dadmin.nsf	domserver1	85257894:001146D7	Enabled
mail\hdesk.nsf	domserver1	842578B0:00653F5C	Enabled
mail\juser.nsf	domserver1	842578B2:00576C8C	Enabled
mail\lmail.nsf	domserver1	842578B2:005783AD	Enabled
mail\uone.nsf	domserver1	842578A3:004DB7DE	Enabled

- Only ddm.nsf is disabled “out of the box”
- Does this mean you are done?

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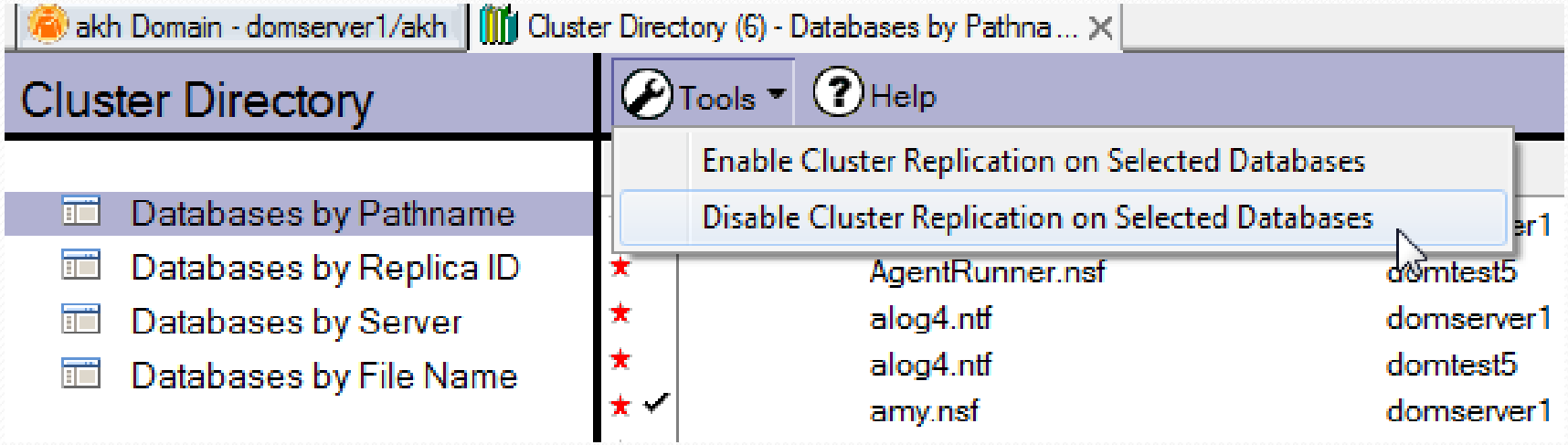
Managing a Cluster Database Directory

- Ensure all servers in the cluster are included in the directory!



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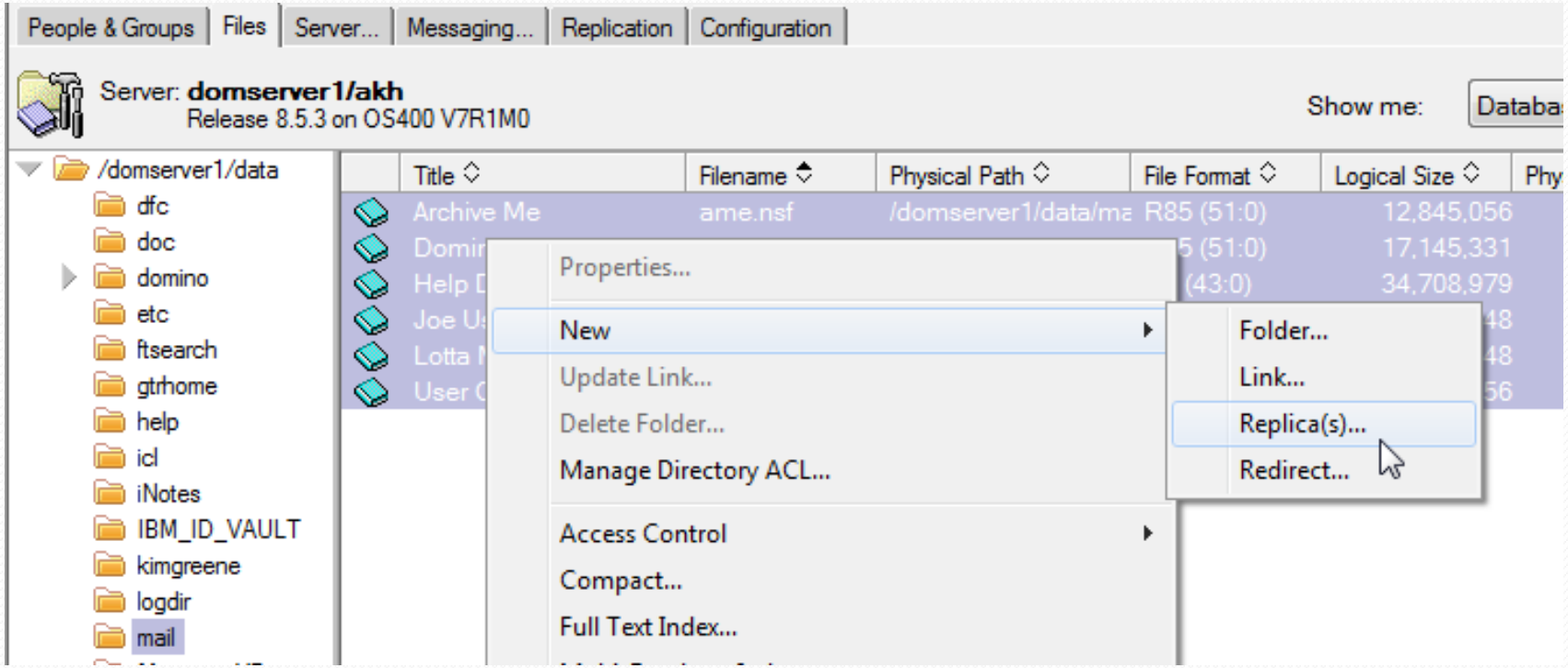
Creating Replicas

- Create replicas of any applications that need to be clustered



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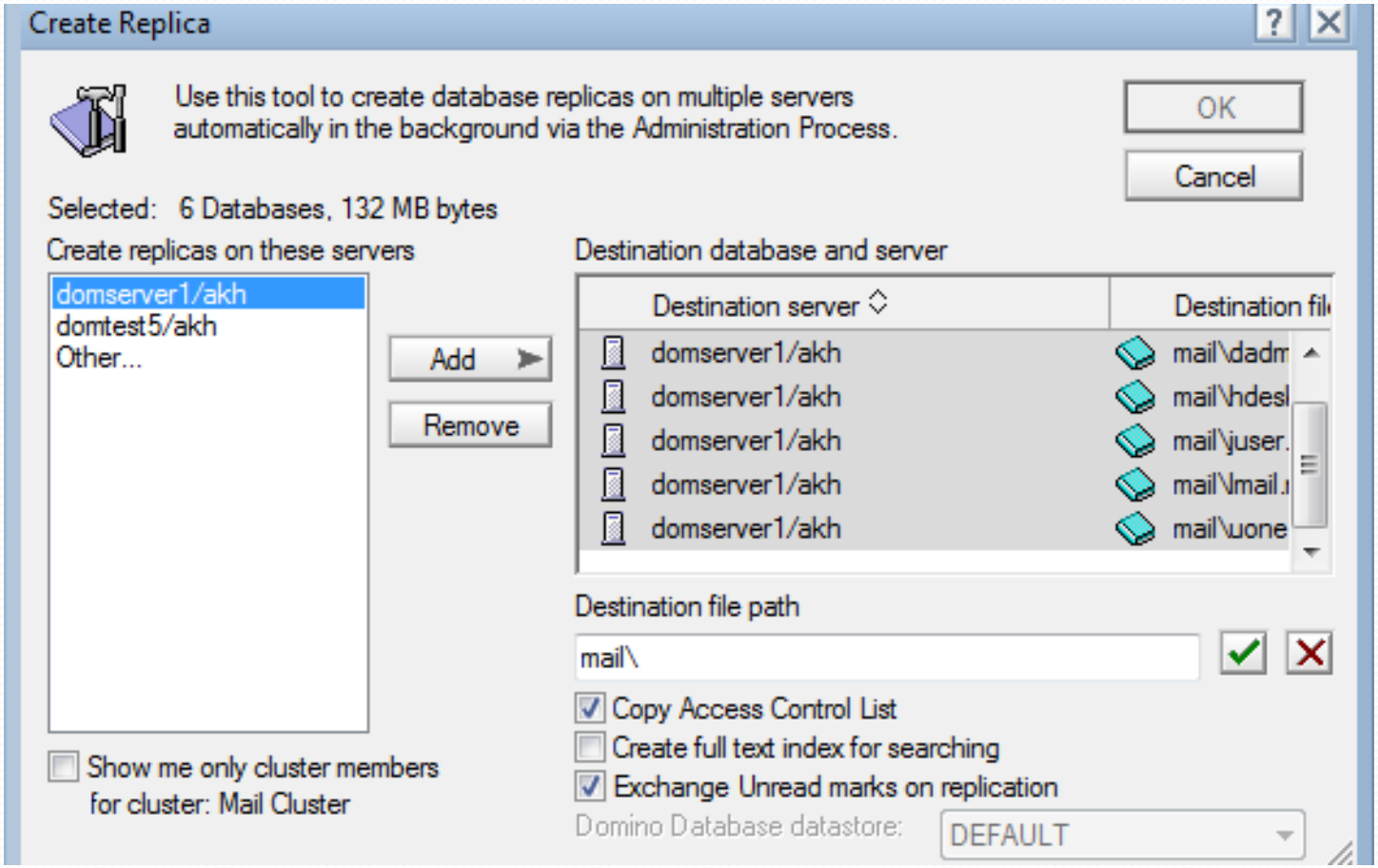
Creating Replicas



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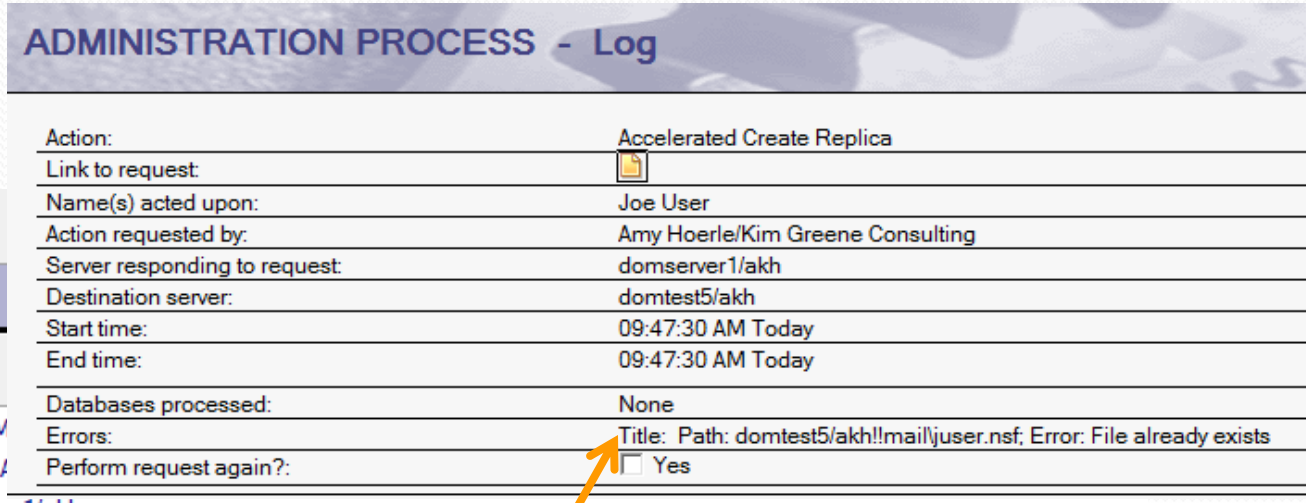
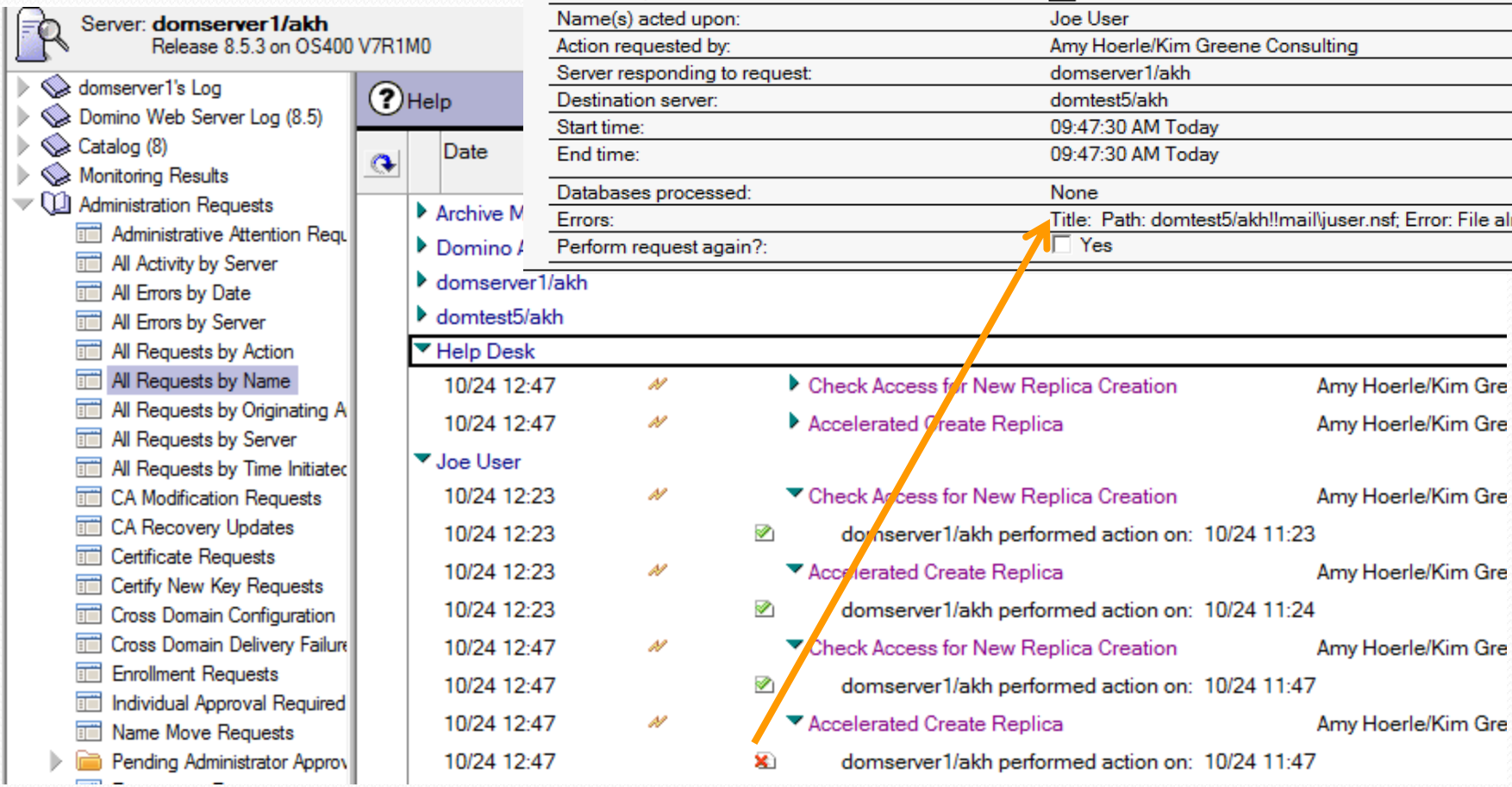
Oops, I did it again!





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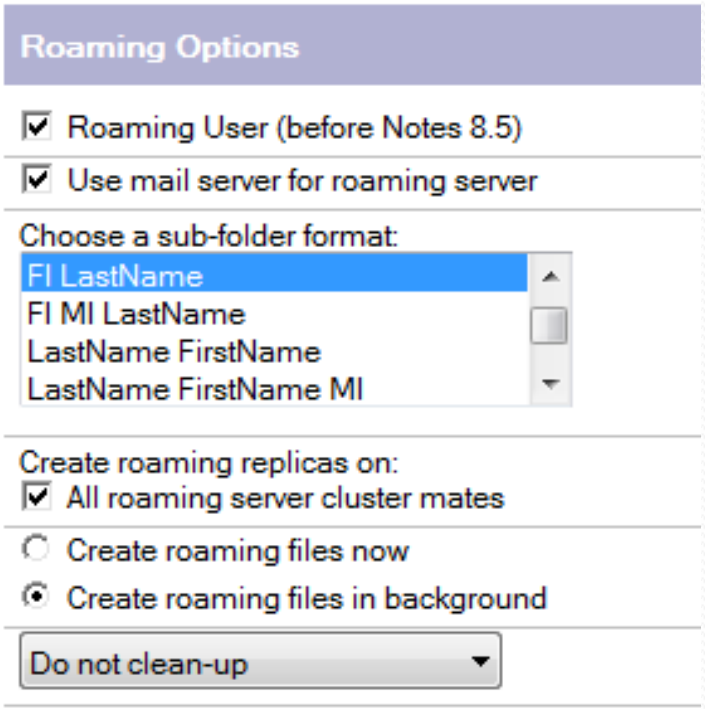
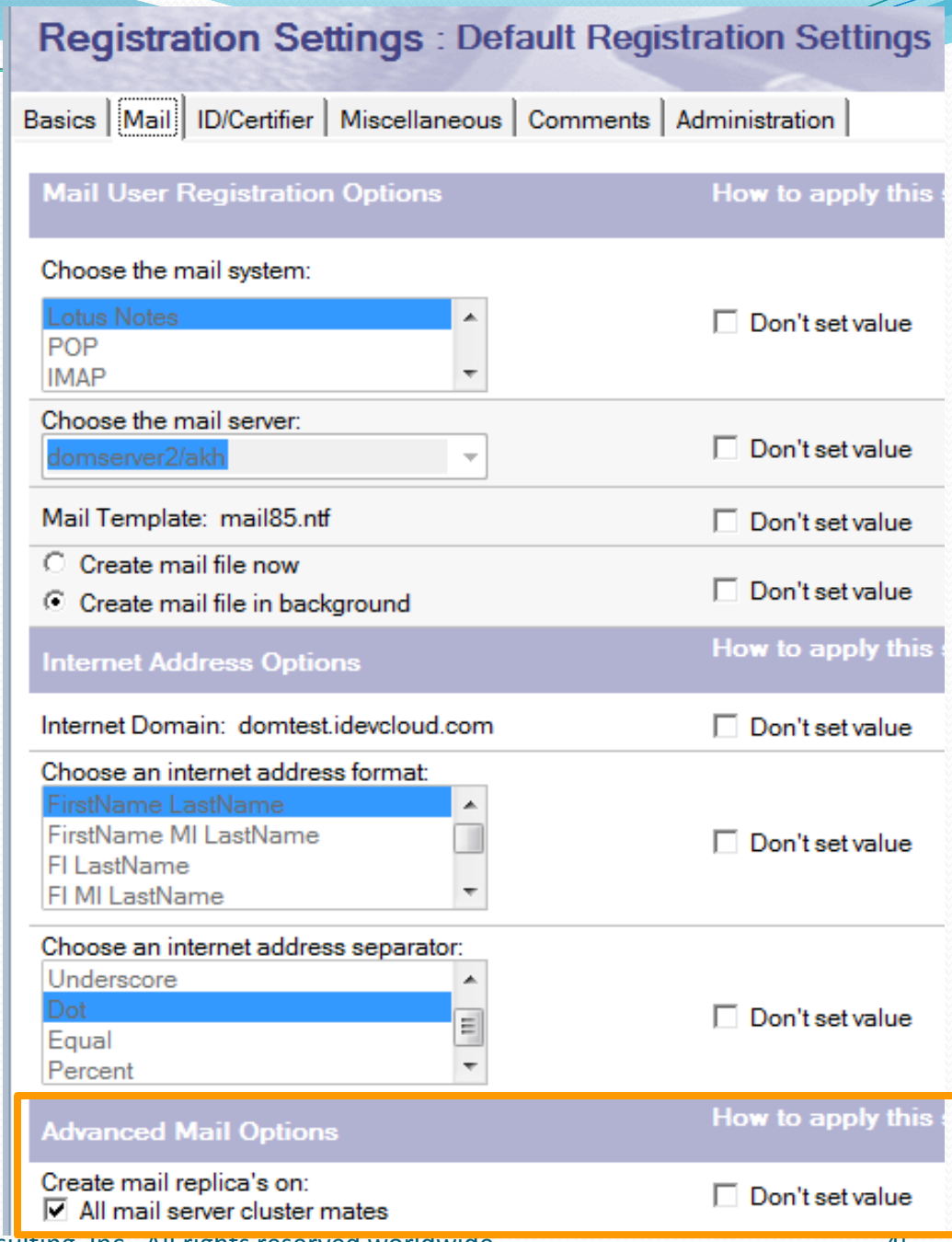
Automatically Create Replicas

Use a registration policy!





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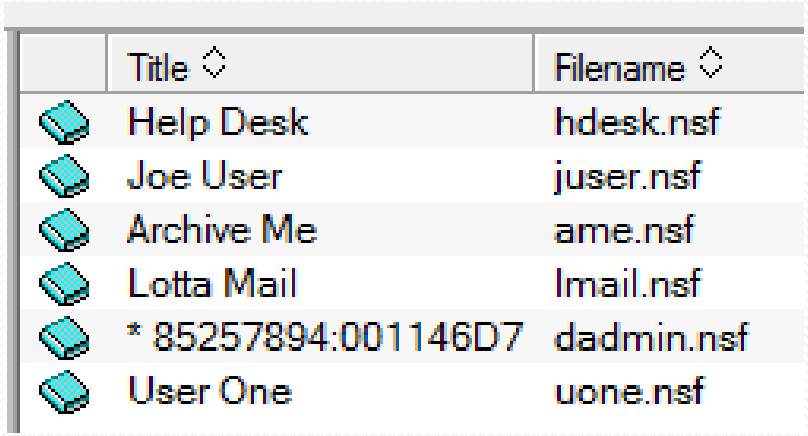
Replication Stub

- When creating replicas you may see a “replication stub”
- Empty “shell” with properties
- Database will be populated the first time it is replicated



Title	Filename
Help Desk	hdesk.nsf
Joe User	juser.nsf
Archive Me	ame.nsf
Lotta Mail	lmail.nsf
* 85257894:001146D7	dadmin.nsf
User One	uone.nsf

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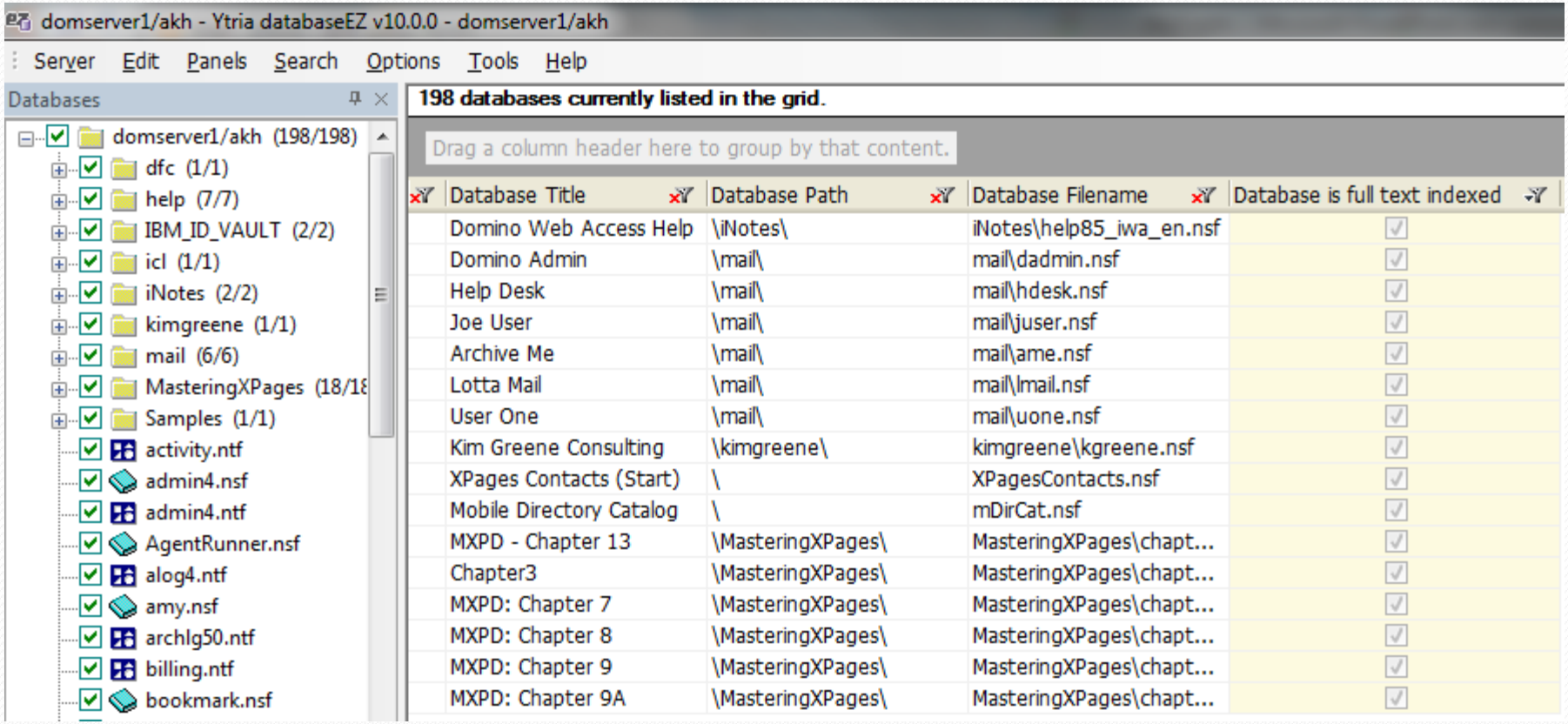
Full Text Indexes



Database Title	Database Path	Database Filename	Database is full text indexed
Domino Web Access Help	\iNotes\	iNotes\help85_iwa_en.nsf	☑
Domino Admin	\mail\	mail\dadmin.nsf	☑
Help Desk	\mail\	mail\hdesk.nsf	☑
Joe User	\mail\	mail\juser.nsf	☑
Archive Me	\mail\	mail\ame.nsf	☑
Lotta Mail	\mail\	mail\lmail.nsf	☑
User One	\mail\	mail\uone.nsf	☑
Kim Greene Consulting	\kimgreene\	kimgreene\kgreene.nsf	☑
XPages Contacts (Start)	\	XPagesContacts.nsf	☑
Mobile Directory Catalog	\	mDirCat.nsf	☑
MXPD - Chapter 13	\MasteringXPages\	MasteringXPages\chapt...	☑
Chapter3	\MasteringXPages\	MasteringXPages\chapt...	☑
MXPD: Chapter 7	\MasteringXPages\	MasteringXPages\chapt...	☑
MXPD: Chapter 8	\MasteringXPages\	MasteringXPages\chapt...	☑
MXPD: Chapter 9	\MasteringXPages\	MasteringXPages\chapt...	☑
MXPD: Chapter 9A	\MasteringXPages\	MasteringXPages\chapt...	☑

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Quotas

- Cluster replication will ignore database quotas
- Quotas are unique to the server
  - Will only get set on cluster when replica is first created
  - Changes do not replicate
- Therefore, you must set the quota on the cluster server to match the primary.

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Understanding Cluster Replication

- In memory replication - as changes occur they are queued and sent to the cluster server
- The cluster server then applies the changes to the database
- Can be disabled during upgrades with *DISABLE_CLUSTER_REPLICATOR=1*

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Streaming cluster replication

- First introduced in Domino 8.0 and had a few issues
  - Was disabled by default in 8.0.2
  - Disable with *DEBUG_SCR_DISABLED=1* at 8.0.x
  - Now works fine and is recommended for all 8.5.x servers

- In memory means, if the server goes down….
  - Changes are lost
  - Traditional replication needed to synchronize the databases
  - Thus, always leave replication scheduled between the servers after enabling clustering

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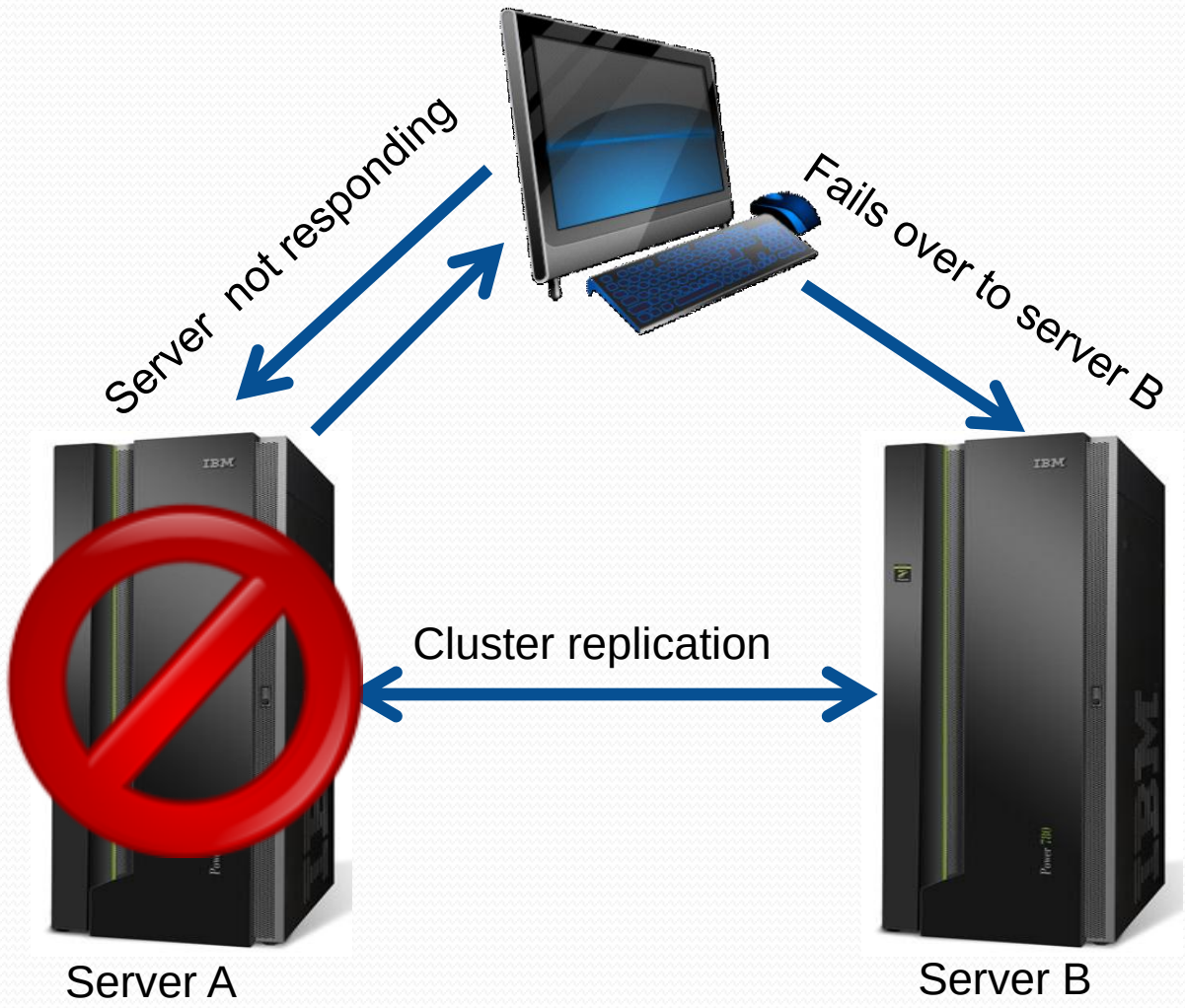
How Failover Works



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How Failover Works

- Notes client attempts to open database on Server A
- Notes client realizes Server A is not responding
- Notes client looks in its cluster cache (cluster.ncf), finds name of other servers in cluster
- Notes client accesses next server listed in cluster cache

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How Failover Works

- Cluster Manager looks in Cluster Database Directory, finds servers in cluster with replica of desired database
- Cluster Manager looks in server cluster cache, determines availability of servers containing a replica
  - Builds list of servers in cluster containing a replica
  - Sorts list in order of availability
  - Sends list to Notes client
- Notes client opens replica on first server in list
  - If that server is no longer available, opens replica on next server in list

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Actions that may trigger a failover

- Creating a new mail, calendar or To Do
- Opening a document in an application
- Opening a folder or view
- Replying or forwarding a document or mail message
- Deleting a document
- Sending a message
- Opening an application using a “bookmark”

- Starting with the 8.5.2 client – Notes will automatically switch back to the Primary server when it becomes available

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When Failover does not occur

- Attempting to open the server directly (CTRL + O)
- Opening an application using a workspace icon
  - The workspace icon determines which replica will be opened
- During a server hang
  - If Port is active, but Domino server job is “hung”

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Server Availability Index (SAI)

- Percentage of total server capacity still available
- Determined by each server in a cluster
  - As response times increase, the SAI goes up
- Ranges from 0 to 100
  - 0 indicates a heavily loaded server
  - 100 indicates a lightly loaded server
- Example:
  - If SAI = 55, still have about 55% of the server capacity available

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SERVER_AVAILABILITY_THRESHOLD

- Key factor in balancing cluster workload
- Represents lowest acceptable value of availability you want the server to reach before it starts failing users over to a cluster mate
- Setting too high results in failover occurring unnecessarily
- Setting too low results in poor performance for users
- Ranges from 0 to 100
  - 0 indicates a fully available server; workload balancing is disabled
  - 100 indicates the server is busy; Cluster Manager redirects user requests to other cluster servers

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SERVER_AVAILABILITY_THRESHOLD

- Monitor statistics to set properly
  - Sh cluster

```
Cluster information:
Cluster name: Domtest Cluster, Server name: domtest2/KGCI
Server cluster probe timeout: 1 minute(s)
Server cluster probe count: 15084
Server cluster default port: *
Server cluster auxiliary ports:
Server availability threshold: 0
Server availability index: 100 (state: AVAILABLE)
Server availability default minimum transaction time: 3000
Cluster members (2):
   Server: domtest1/KGCI, availability index: 100
   Server: domtest2/KGCI, availability index: 100
```

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Desktop Policy

- Check your desktop policy…
- Have you enabled these settings?

Client Settings		How to apply this setting:
Auto-retrieve document setting:	Disable	☑ Don't set value
Enable server to poll for new mail and trigger replication on notification of new mail:	Enable	☐ Don't set value
Enable silent failover when a server goes down:	Enable	☐ Don't set value
Enable upgrade of all local NSFs to latest ODS version:	Enable	☐ Don't set value

Desktop Settings Document → Mail tab

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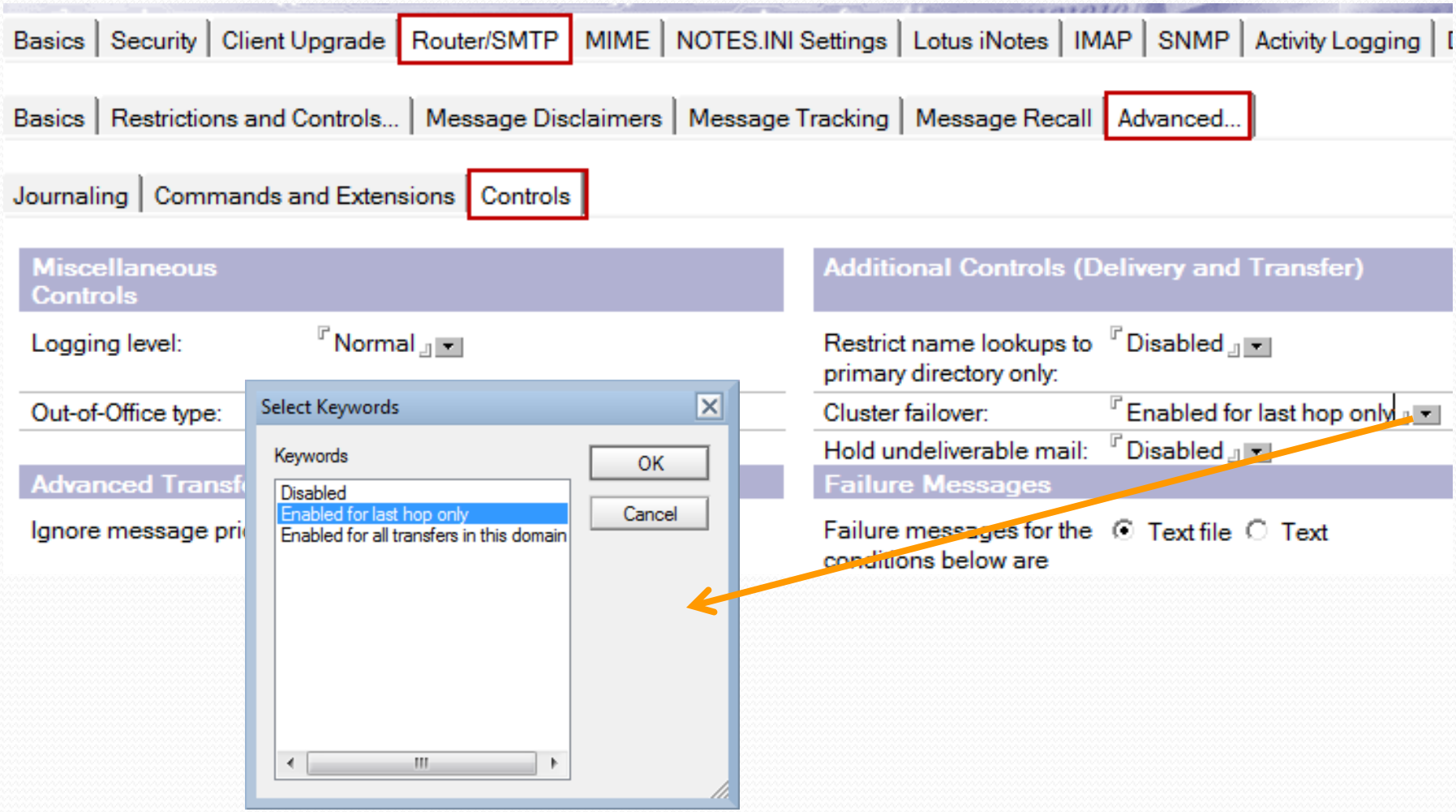
Mail Cluster Failover



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Mail Cluster Failover

- What happens if primary server is down?
  - Server checks the cluster cache to find a cluster server
  - Message delivered to cluster server
  - Cluster server checks Primary server availability
  - If cluster not available and local replica is available, message is delivered
  - If cluster not available and local replica is not available message is delivered to alternate cluster member where replica is available or message is held in mail.box until the primary server is active.

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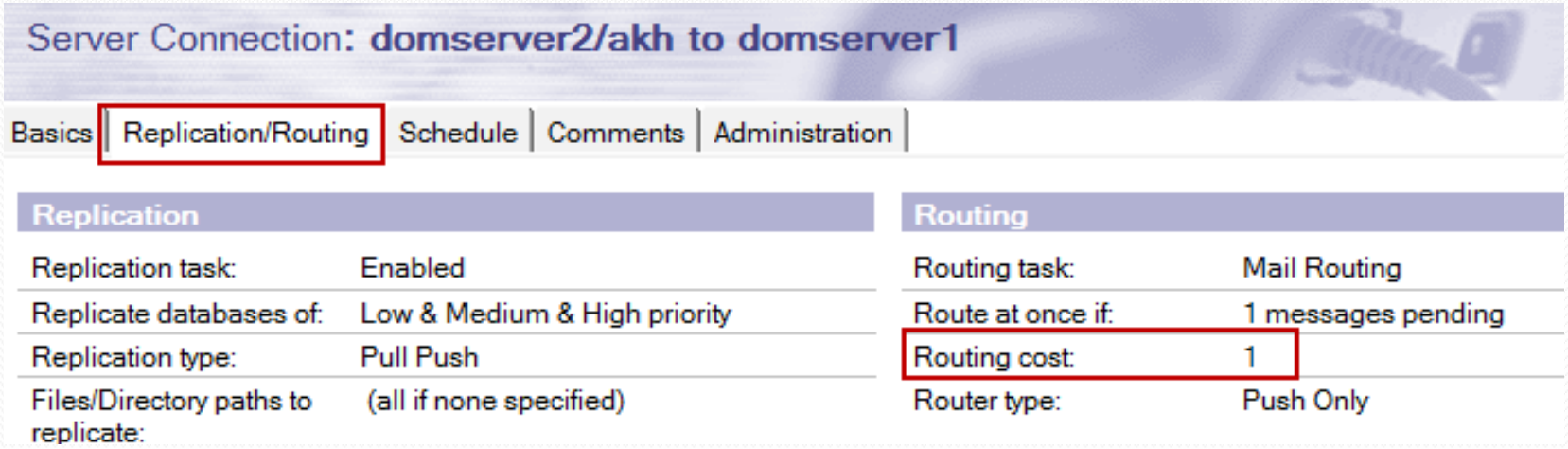
Avoid Routing Loops

- Routing cost still important
  - Especially important for larger clusters
  - Same cost? Alphabetical

- Do not set a high routing cost for a clustermate!



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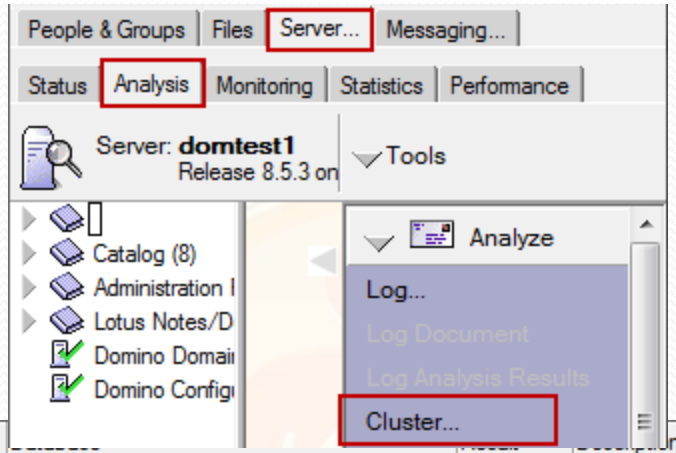
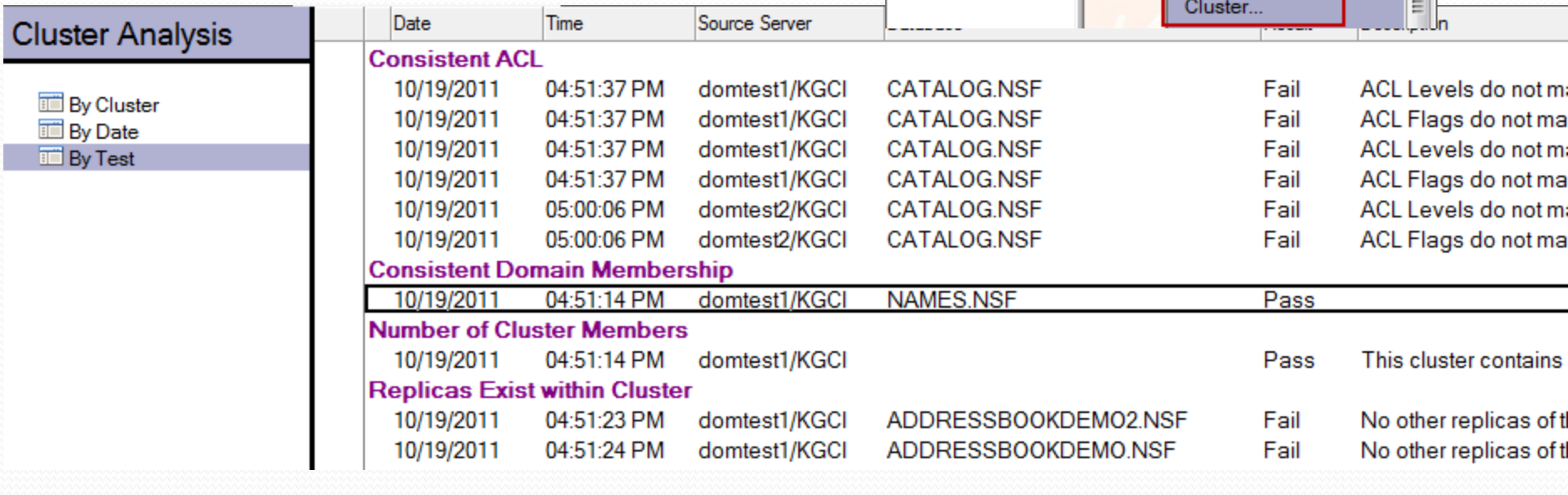
Cluster Health

- Use the cluster analysis tool to evaluate the health of your cluster





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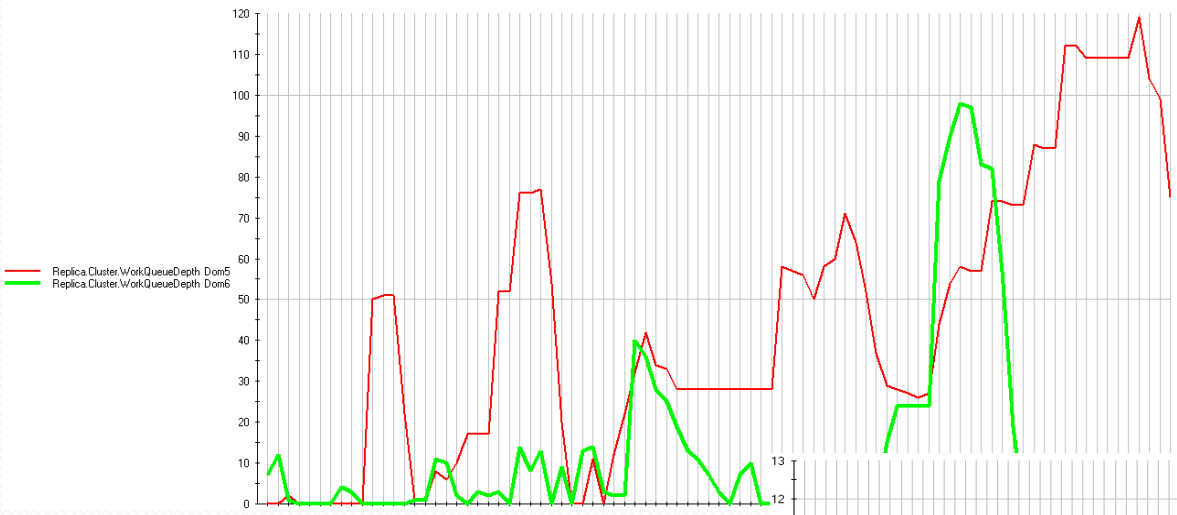
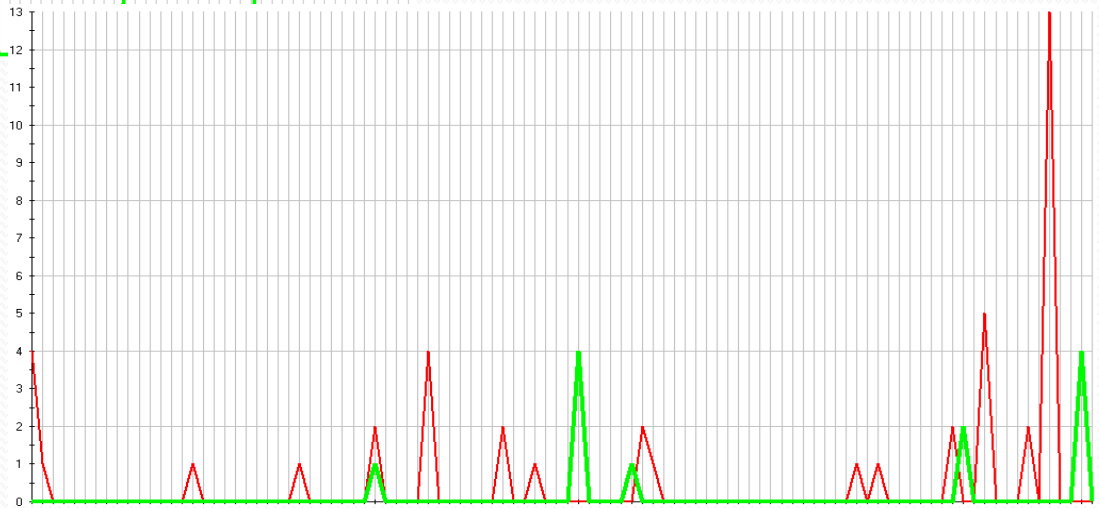
Cluster/Replicator Queue Depth



Impact of increasing Cluster Replicators from 1 to 3

CLUSTER_REPLICATORS=3

Replica.Cluster.
WorkQueueDepth



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Clustering Applications

- Clustering applications outside of mail?
  - Calendaring and scheduling clustering is built in
    - Configured for you when clustering is enabled (busytime.nsf becomes clubusy.nsf)
  - RNRMGR supports clustering
    - Be aware that only one other server in the cluster will be allowed to process requests
    - Be aware that if the home server (administration server in ACL) is down when RNRMGR starts it will not process any requests to protect cases where the database is out of date from the primary server

      http://www-10.lotus.com/ldd/dominowiki.nsf/dx/clustering-the-resource-reservation-database-in-ibm-lotus-domino

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Clustering Applications

- Clustering applications outside of mail?
  - Custom applications
    - Fully supported by Domino
    - Be careful with scheduled agents
      - Agents triggered by new mail will automatically fail over
      - Scheduled agents may not run or may run too often
      - Multiple examples on the web regarding how critical agents can be clustered by querying primary server availability

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Clustering Applications

- Clustering applications outside of mail?
  - Lookups
    - @DBLookup, @DBColumn, @Picklist
  - Server Names
    - Are server names hardcoded within the application?
  - RDBMS Integration?
    - Where does remote data reside?
    - Will code still function if placed on another server, platform or system

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Clustering Applications

- Clustering applications outside of mail?
  - Readers fields can interfere with replication and agents
    - Agents may not run all documents
    - Documents can be removed from the server during replication
    - Always ensure that “LocalDomainServers” is included in all readers fields
  - Encryption
    - Are you encrypting fields or documents in an application?

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Questions

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