SQL Server HA / DR

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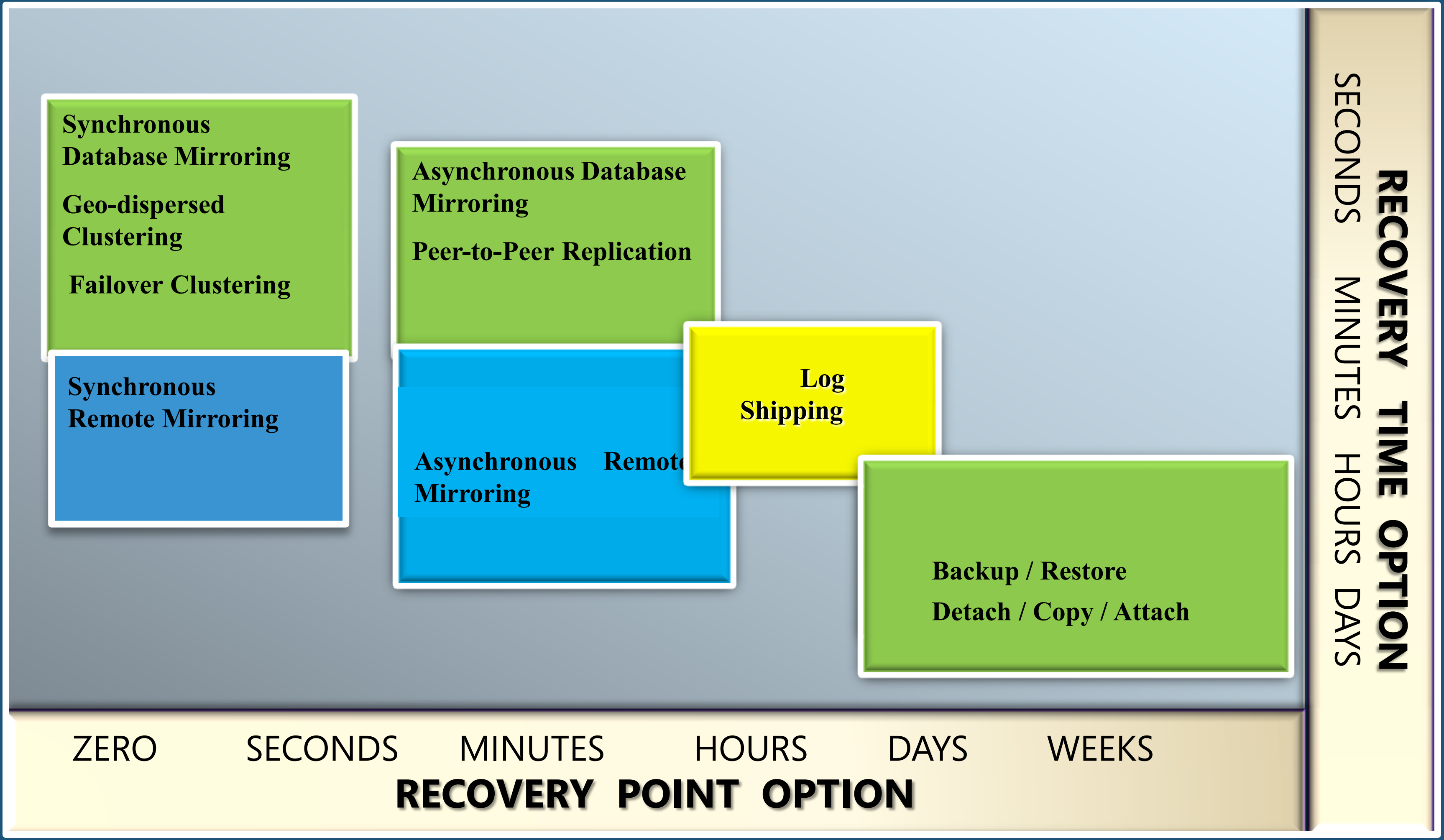
Session Objectives & Takeaways

- Plan, test and retest your SQL Server 2008 upgrade
- In HA environments upgrades can be achieved with downtime limited to minutes
- Benefit from Database Mirroring log compression in SQL Server 2008
- Educate and test new Cluster Setup with Windows Server 2008
- Evaluate sub-minute log shipping for your environment

Technology Positioning



Synchronous Database Mirroring

Geo-dispersed Clustering

Failover Clustering

Synchronous Remote Mirroring

Asynchronous Database Mirroring

Peer-to-Peer Replication

Asynchronous Remote Mirroring

Log Shipping

Backup / Restore

Detach / Copy / Attach

Availability Decision Matrix

		SLA		Failover				Redundancy and Utilization			Cost		
Solutions		Data Loss RPO=0	RTO in secs	Failover Unit			Auto Failover	Read	>1 Sites\ Copy	Read Write	Hardware	App Perf Impact	Manageability
				Inst	DB	Tab							
Cluster		✓	✓	✓	✗	✗	✓	✗	✗	✗	High	Low	Low
SAN Replication		✓	✓	✓	✗	✗	✓	✗	✓	✗	High	*Low	High
DB M	Sync	✓	✓	✗	✓	✗	✓	*✗	✗	✗	Low	High	Low
	Async	✗	✗	✗	✓	✗	✗	*✗	✗	✗	Low	Low	Low
Log Shipping		✗	✗	✗	✓	✗	✗	*✗	✓	✗	Low	Low	Low
Transactional Replication		✗	✗	✗	✗	✓	✗	✓	✓	✗	Low	Low	High
Peer-Peer Replication		✗	✗	✗	✗	✓	✗	✓	✓	✓	Low	Low	High

*Database Mirroring with database snapshots and Log Shipping using standby mode can provide point in time read capability

*Clustering can provide regional DR by utilizing stretch SANS

Content

- SQL Server Database Mirroring
  - Selected SQL Server 2008 enhancements
- SQL Server Fail Over Clustering
  - Selected SQL Server 2008 enhancements
- Other enhancements

SQL Server 2008:
Database Mirroring Enhancements

- Automatic recovery from page corruption
  - Works for 824 ‘soft-IO’ errors, some 823 ‘hard-io’ errors, 829 ‘restore needed’ errors
- Backup Compression helps in setting up DBM
  - Reduced backup, file copy & restore time
  - Some users have reported the following
    Your mileage will vary:
    - 25 to 85% space saving
    - 35 to 50% faster backup & restore time
- Log stream compression: helps in both synchronous & asynchronous modes
  - For example, in one SAP deployment
    - Log Bytes Sent/sec = 300 K
    - Log Compressed Bytes Sent/sec = 110 K

DBM Log Stream Compression

- Synchronous
  - Helps improve throughput. More pronounced on lower bandwidth networks
- Asynchronous
  - Helps reduce the average Send Queue
  - Helps flush the Send Queue more quickly after a log intensive task
- Compression ratio is a function of the application data. Not dependent upon network bandwidth
- Benefits come with extra CPU usage on the principal as well as the mirror

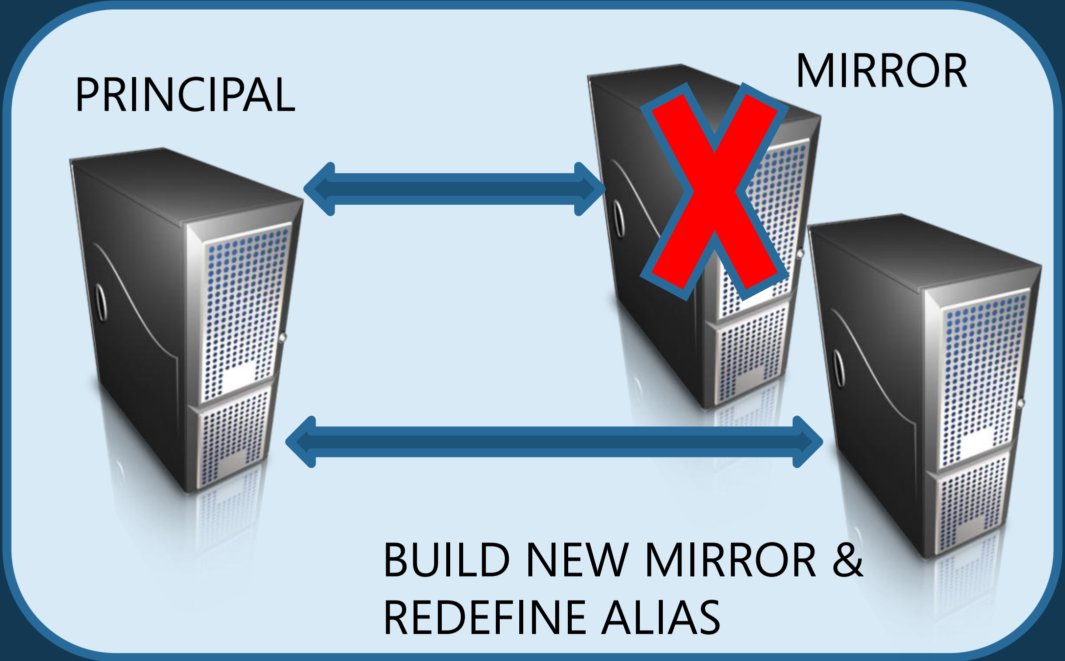
DB Mirroring Lessons Learned

- IOs on Mirror server (data files) can be significantly higher than on Principal –
  Does not wait for checkpoint to flush
  - Trace flag 3499 can alter the IO behavior
  - Deploy ONLY if necessary. TEST before deploying
  - Trade-off: Longer failover delay
- If an application uses multiple databases, “Synchronous with Witness” mode not recommended
  - Fail-over granularity is database
- Cannot Restore from a Database Snapshot on the Principal

DB Mirroring Lessons Learned

- Application Connection using aliases
  - Helps in uninterrupted replacement of the mirror
  - Only alias definition needs to be altered

Data Source=Alias1;Failover
Partner=Alias2;InitialCatalog=DBMTest;
Integrated Security=True



PRINCIPAL

MIRROR

BUILD NEW MIRROR &
REDEFINE ALIAS

DB Mirroring Lessons Learned

- Managing Long Disconnects
  - Mirroring state = DISCONNECTED or SUSPENDED
  - Log records keep accumulating at the Principal
  - Transaction log cannot be truncated, even if you backup transaction log
  - May eventually fill up the transaction log space and the database comes to halt
  - Look at LOG_REUSE_WAIT_DESC column in sys.databases
  - RESUME the mirroring session, or break it
- Planned Maintenance of the Witness
  - Such as upgrading or applying a patch
  - Disable the witness before you take down the witness for maintenance, and re-enable after maintenance is complete
  - Otherwise, while the witness is down, if you lose connectivity with the mirror, the principal will lose quorum and hence stop accepting any transactions, resulting in unwanted “downtime”.

DB Mirroring Lessons Learned

- Number of threads for mirroring:
  - Sum of fixed and variable components
  - On Principal:
    - Fixed = 1 per instance, plus
    - Variable = [1 +1] * number of mirrored databases
      For example, on a server with 180 DBs, #threads= 1+ [1+1]*180= 361
  - On Mirror
    - Fixed = 1 per instance, plus
    - Variable = [1 + 1 + 1 + (number of cores +3)/4] * number of mirrored databases.
      For example, on a 8-core server with 180 DBs, # threads= 1+ [1+2+2]*180=901

      On a 16-core server with 180 DBs, # threads= 1+ [1+2+4]*180=1261
  - Plan appropriately for #threads (max worker threads) and memory (max server memory)
- No token or DMV to relate specific threads or session ids to a specific data base.
  - DMV sys.dm_exec_requests can be used to identify the threads associated with database mirroring

    ```
    select * from sys.dm_exec_requests where command = 'DB MIRROR'
    ```

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SQL Server 2008

Failover Cluster New Features

- First time in SQL Server: Rolling upgrade/patch support for SQL Server failover clusters to minimize downtime
- Improve failover cluster setup reliability
  - Integrated OS cluster health checks
  - Integrated SQL Server setup health checks
- New setup architecture
  - Distributed setup on each node – No remote execution
- Align with Windows Server ® 2008 features

SQL Server 2008

Removal of Setup Remote Execution

- Setup distribution technology not core to SQL Server product mission
- Windows Server ® 2008 remote execution limitations
- Previous versions complex and difficult to support
- Future partnering with an enterprise deployment solution, such as Microsoft System Center ®

SQL Server 2008

Alignment with Windows Server® 2008

- Heterogeneous hardware and iSCSI support
  - No need for certified hardware
- Windows Server ® 2008 Cluster Validation Tool
- Service SIDs remove requirement for domain groups
- IPV6 and DHCP support
- Up to 16-node failover clusters
  - SQL Server limits to 2 nodes for SQL Server Standard Edition
- Not aligned with IP-OR dependencies for multi-subnet (stretch) clusters
  - Same as SQL Server 2005:
    VLAN with SAN replication needed

SQL Server 2008
Failover Cluster Setup Operations

- Installation options
  - Integrated Install
    - Install local machine bits and create single-node SQL Server cluster in one integrated step
    - Run AddNode on each additional node
  - Advanced/Enterprise Install
    - Prepare – install local machine bits first on each node
    - Complete – combine prepared nodes and create SQL Server cluster as final step
- Add Node
- Remove Node
- Rolling Upgrade/Patch
- Repair

SQL Server 2008 Failover Clustering

Best Practices

- Migration as an upgrade option
  - Instead of Rolling Upgrade discussed earlier
  - Install Side-by-Side on the same hardware (or separate hardware)
    - Then detach / attach the database
    - No major change in the behavior from previous versions
- Rolling upgrade enables minimal service unavailability
  - Failover clustering alone or with Database Mirroring
- Be aware of subtle differences between Windows Server 2008 and Windows Server 2003 Clustering

SQL Server 2008 Failover Clusters

Rolling Upgrade Best Practice

- Pre-install prerequisites on all nodes before upgrade
  - Upgrade only shared components starting with passive nodes.
    - This will install Microsoft .NET Framework ® 3.5 SP1, Microsoft Windows Installer ® 4.5, and Microsoft SQL Server ® 2008 setup support files.
  - For Database Engine installations on Windows Server ® 2003 SP2, install Windows Server hotfix needed for FileStream (KB 937444)
  - Fail over to an upgraded node.
  - Upgrade shared components on the last node.
- Start failover cluster upgrade process with passive nodes, making your way towards the active node.

SQL Server 2008 Failover Clusters

Windows Server 2008 R2

- SQL Server 2008 RTM cluster install does not work on Windows Server 2008 R2
  - **Required:** SQL Server 2008 CU2 and above using SQL Server 2008 patchable setup process
  - **Recommended:** SQL Server 2008 SP1 and above using slipstream process

- SP1 download site: http://www.microsoft.com/downloads/details.aspx?FamilyID=66ab3dbb-bf3e-4f46-9559-ccc6a4f9dc19
  - Key features:
    - ***Slipstream***: install RTM+SP1 (+CU) in one step
      - Instructions: http://blogs.msdn.com/petersad/archive/2009/02/25/sql-server-2008-creating-a-merged-slisptream-drop.aspx
    - ***SP uninstall***: be able to remove SP
    - ***Detection of files in use***

SQL Server 2005

Windows Server 2008 R2

- Known Issue:
  - We require SQL Server 2005 SP3 or above for SQL Server failover clusters on Windows Server 2008 R2
  - Applying SQL Server 2005 SP3 and SP3 CUs might leave remote nodes at down-level if disk space on nodes less than 2GB
- Workaround: Verify all the nodes are at the same service level. If not, run SP3 and SP3 CU/hotfix on each node that is left down-level.

Windows Server 2008

Issue with SQL Server 2008 Remote Discovery

- SQL Server 2008 Failover Cluster discovery takes too long on Windows Server 2008
  - It took 10-15 minutes per remote node with about 60 LUNS
  - Root cause: SMB v2 has a known issue that was fixed in a Windows Server 2008 QFE, and SP2
    - Option 1. Apply Windows Server 2008 SP2
    - Option 2. If customer cannot apply SP2, apply the Windows QFE (KB 950836)
- http://support.microsoft.com/Default.aspx?kbid=2000219

SQL Server 2008 Failover Clustering References

- Useful pointers
  - SQL Server 2008 Failover Clustering http://sqlcat.com/whitepapers/archive/2009/07/08/sql-server-2008-failover-clustering.aspx
  - Rolling in-place cluster upgrade process http://msdn.microsoft.com/en-us/library/ms191295.aspx
  - How to create a single node SQL Server 2008 failover cluster http://msdn.microsoft.com/en-us/library/ms179530.aspx
  - How to add node to a SQL Server 2008 failover cluster http://msdn.microsoft.com/en-us/library/ms191545.aspx
  - An advanced cluster installation option, which prepares cluster nodes first and then completes the cluster across prepared nodes http://msdn.microsoft.com/en-us/library/ms144259.aspx

Content

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  - Selected SQL Server 2008 enhancements & Demos
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Sub-Minute Log Shipping

- SQL Server 2005
  - SQL Server 2005 SSMS allows the frequency of the log shipping scheduled jobs to be 1 minute or more
  - If stored procedures used - instead of SSMS - for setup
    - sp_add_jobschedule and sp_add_schedule allow frequency settings in only minutes & hours
  - Work around => Use sp_update_schedule to change schedule after setting up log shipping (either through SSMS or stored procedures)
    - After doing this change, if you open the schedule in the SSMS, the user interface will throw an error “Property accessor … ‘TimeIntervalUnit’ … not valid. …”.
- SQL Server 2008
  - Allows log shipping jobs to run as frequently as 10 seconds or more
  - Both through SSMS and Stored Procedures

SQL Server 2008 Enables

- Database Mirroring Support for Replication Subscriber
  - After a mirroring failover of a subscription database to the mirror server, it is necessary to redirect the replication stream to the new subscription database
  - A new synchronization type, “initializing from an LSN” makes it practical to initialize the subscription for large subscribers
- Database Mirroring for the Replication Publisher
  - Log Reader Agent waits for log records to harden on the mirror before replicating them to the distributor
  - With trace flag 1448 enabled, Log Reader Agent can continue replicating changes regardless
  - KB article: http://support.microsoft.com/kb/937041
- Partition Switching with Replication
  - Definitions must exactly match at publisher & subscriber
  - New parameters for sp_addpublication and sp_changepublication

Summary

- Plan, test and retest your SQL Server 2008 upgrade
- In HA environments upgrades can be achieved with downtime limited to minutes
- Benefit from Database Mirroring log compression in SQL Server 2008
- Test new Cluster Setup with Windows Server 2008
- Evaluate sub-minute log shipping for your environment

Appendix – Clustering

- SQL Server 2008 Failover Clustering http://sqlcat.com/whitepapers/archive/2009/07/08/sql-server-2008-failover-clustering.aspx
- Cluster Team Site: http://www.microsoft.com/windowsserver2008/en/us/failover-clustering-multisite.aspx
- KB Article: Deployment Considerations for Windows Server 2008 failover cluster nodes on different, routed subnets
- Webcast: TechNet Webcast: Geographically Dispersed Failover Clustering in Windows Server 2008 Enterprise
- Webcast: How You Can Achieve Greater Availability with Failover Clustering Across Multiple Sites (Level 300)
- Whitepaper: Multi-site Clustering
- Webcast: Multi-Site Clustering in Windows Server 2008
- Guide: http://technet.microsoft.com/en-us/library/cc771509.aspx
- Multi-Site Cluster http://download.microsoft.com/download/3/b/5/3b51a025-7522-4686-aa16-8ae2e536034d/WS2008%20Multi%20Site%20Clustering.doc

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