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PASS

Microsoft
Architecting SQL Server HA and DR Solutions on Windows Azure VMs

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Session Objectives & Goals

• Define how to integrate SQL Server and Windows Azure for a better HA & DR solution
• Identify product capabilities, limitations, and trade-offs for various needs
• Explain lessons learned from multiple implementation
Agenda

• Windows Azure Overview
• SQL Server HA&DR Features
• What’s New in SQL Server 2014 and Windows Azure
• SQL Server HA&DR Solutions on Cloud
  – HA within Windows Azure
  – DR between On-Premise and Windows Azure
  – DR across multiple Windows Azure Datacenters
Windows Azure Overview
**Windows Azure Overview**

**Scalability**

- On-demand or scheduled scaling of Compute Services
  - Management Portal
  - PowerShell
  - CLI
  - Rest API
  - SDKs

- You can scale for up to 8 cores and 56 GB of memory (reboot required)
  - Standard Instances
  - Memory Intensive Instances

- Extend storage on-demand
  - Stand-alone VHDs up to 1 TB
  - Using striped volumes enables to extend 1 TB and performs better

- Create/Add new VMs easily on-demand
  - Increase compute power
  - Offload primaries

SQL Server 2014 CTP2 Images are now available in Windows Azure
Windows Azure Overview

Scalability
- Windows Azure Infrastructure Services is GA
- SLA exists for VM Level Availability
- Service Level Availability doesn’t exist (such as SQL Server Service)

High Availability / DR
- Availability Sets for better HA, decreases down-time due to planned maintenance
- Built-in Geo-distributed DR
  - Worst-case scenario but nice to have capability
- Pooled resources on 8 Geo-Distributed Datacenters
  - 4 in America
  - 2 in Europe & MEA
  - 2 in APAC

Global Footprint
Windows Azure Overview

- **Scalability**
- **High Availability / DR**
- **True Cloud Economics**

Pay **only** for what you use:
- Compute
- Storage
- Networks

Pay by minute, billing stops when you stop:
- Stopped VMs are deallocated and doesn’t consume any compute resources

VHDs costs for only used space:
- If you create a 1 TB VHD but store 100 GB of data, you’ll only pay for 100 GB

- You can use out-of-box SQL Server Embedded Images
- NO CAPEX for hardware or software
- Better ROI
Windows Azure Overview

- **Scalability**
  - New software based VPN gateway supports many connectivity options

- **High Availability / DR**
  - Point-to-Site VPN is Supported
  - Generic VPN Devices are supported
    - Cisco
    - Juniper
    - F5
    - Citrix
    - WatchGuard

- **True Cloud Economics**
  - Support for Windows Server 2012 RRAS – software based VPN gateway
    - Create site-to-site VPN using Windows Server 2012

- **Connectivity**
  - AlwaysOn Availability Groups Listeners are now fully supported
SQL Server HA&DR Features
# SQL Server HA & DR Features

## AlwaysOn Availability Groups

<table>
<thead>
<tr>
<th>Multiple Secondaries to Improve Redundancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Up to 4</td>
</tr>
<tr>
<td>✓ Max 2 Sync</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Active Secondaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Offloading read workloads</td>
</tr>
<tr>
<td>✓ Backups on Secondary</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Multiple Database Failover</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Automatic Failover</td>
</tr>
<tr>
<td>✓ Flexible Failover Policies</td>
</tr>
</tbody>
</table>

| Virtual Network Name (Listener)         |
SQL Server HA & DR Features

- **AlwaysOn Availability Groups**
  - Multiple Windows Domains are Supported
  - Supports only 1 Mirror Server

- **Database Mirroring**
  - Automatic Failover with Witness Server
  - Mirror Database can be Read by Using Database Snapshot

Diagram:
- **Witness Server**
- **Principal Server**
- **Mirror Server**
- **Client**
- **Transaction Log Stream**
SQL Server HA & DR Features

- AlwaysOn Availability Groups
- Database Mirroring
- Log Shipping

Potential Data Loss
No Automatic Failover

Perform Backup

Primary Database

Secondary Databases
- Restore Backups
- Restore Backups
- Restore Backups
SQL Server HA & DR Features

- **AlwaysOn Availability Groups**
- **Database Mirroring**
- **Log Shipping**
- **Backup to URL**

### CREATE CREDENTIAL mycredential
WITH IDENTITY = 'mystorageaccount',
SECRET = '';

### BACKUP DATABASE AdventureWorks2012 TO URL =
'https://mystorageaccount.blob.core.windows.net/mycont/db.bak'
WITH CREDENTIAL = 'mycredential',
STATS = 5;

### RESTORE DATABASE AdventureWorks2012 FROM URL =
'https://mystorageaccount.blob.core.windows.net/mycont/db.bak'
WITH CREDENTIAL = 'mycredential';
Comparison of SQL Server HA&DR Features

<table>
<thead>
<tr>
<th>Technology</th>
<th>AlwaysOn Availability Groups</th>
<th>Database Mirroring</th>
<th>Log Shipping</th>
<th>Backup to URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database Redundancy</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Zero data loss</td>
<td>✓ *</td>
<td>✓ *</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Auto Failover</td>
<td>✓ *</td>
<td>✓ *</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Readable Copy</td>
<td>✓</td>
<td>✓ **</td>
<td>✓ ***</td>
<td></td>
</tr>
<tr>
<td>Multiple Secondaries</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>N/A</td>
</tr>
</tbody>
</table>

* Zero data loss and automatic failover are possible with synchronous AlwaysOn Availability Groups and database mirroring.
** The mirror database itself is not directly readable, but a static, point-in-time view of it can be read by using a database snapshot
*** The log shipping secondary database can be read when the transaction log backups are restored by using the WITH STANDBY option.
What’s New in SQL Server 2014 and Windows Azure

• Windows Azure
  – AlwaysOn Availability Groups Listeners are now fully supported.
  – SQL Server 2014 CTP2 Images are now available in Windows Azure
  – Native support for SQL Server database files stored as Windows Azure blobs

• SQL Server 2014
  – Up to 8 Availability Groups Secondaries
  – AlwaysOn Availability Groups Add Azure Replica Wizard
  – Deploy Database to Windows Azure VM
  – Smart Backup to Azure
    • An agent that manages and automates SQL Server backup policy
SQL Server HA&DR Solutions on Cloud
## SQL Server HA&DR Solutions on Cloud

<table>
<thead>
<tr>
<th>HA Within Windows Azure</th>
<th>DR between On-Premise and Windows Azure</th>
<th>DR across Windows Azure DCs</th>
</tr>
</thead>
</table>
| • Availability of SQL Server in Azure VMs  
• Protection from issues impacting SQL Server service or VM infrastructure  
• Using another SQL Server VM in same Azure DC | • Ensure availability of primary site SQL Server (On-Premise or Azure VMs)  
• Protection from issues impacting primary site DC  
• Using another SQL Server in secondary site (On-Premise or Azure VMs) | • Availability of SQL Server in Azure VMs  
• Protection from issues impacting the Azure DC  
• Using another SQL Server VM in different Azure DC |
SQL Server HA within Windows Azure
Requirements

• Windows Azure Failure Detection only exists on host level
  – SQL Server service could be down or hung
  – Planned maintenance may cause downtime

• Windows Azure service healing or upgrade involves restarting of VMs
  – Each restart can cause up to 15 minutes downtime
  – SLA: %99.9 (43m per month)

• Customer solution may require additional HA implementation
  – Availability Groups, Database Mirroring, etc
Offerings

Availability Group

Domain Controller

WSFC Cluster

Primary Replica  Synchronous Commit  Secondary Replica  File Share Witness

Database Mirroring

Domain Controller

Principal  High Safety  Mirror  Witness

Listener
Offering - Availability Groups

• Provide many other capabilities:
  – AG Listeners
    • There is a special hotfix that needs to be installed on all cluster nodes
  – Flexible Failover Policy
  – Readable Secondaries
  – Improved Manageability
  – FileStream & FileTable support

• But require:
  – Windows Cluster (Though no shared storage)
  – Same Windows Domain (Needs an Active Directory Domain Controller)
Implementation

• Configure SQL Server Technologies
  – Availability Groups
    • Listener Configuration in Windows Azure
  – Database Mirroring
Demo Environment

Availability Group

ContosoDC
(File Share Witness)

WSFC Cluster

ContosoSQL1

ContosoSQL2

Synchronous Commit

contListener
SQL Server HA on Windows Azure VMs using AlwaysOn Availability Groups
SQL Server DR between On-Premise and Windows Azure
Requirements

• An event can cause primary site to become unavailable
  – Temporarily (e.g. hardware or gateway failure)
  – Permanently (e.g. flooding or earthquake)

• An on-premise disaster recovery site is expensive
  – Site rent + maintenance
  – Security
  – Hardware
  – Ops
Offering - Availability Groups

• Provide additional benefits:
  – Integrated HA/DR
  – Readable secondaries
    • Readable secondaries allow offloading to read queries, reporting/BI apps
    • Backup & DBCC CHECKDB operations can be done on secondaries

• Remember it requires:
  – All replicas must be in the same Windows Domain
    • Active VPN connection is required between sites
Implementation - 1

- Configure VPN tunnel b/w on-premise and Azure
  - VPN Device
  - Win Server 2012 RRAS
Implementation - 2

• Configure SQL Server Technologies
  – Backup and Restore for SQL Server in Windows Azure Virtual Machines to URL
Demo

SQL Server DR between On-Premise and Windows Azure using AlwaysOn Availability Groups
SQL Server DR across Windows Azure DCs
Requirements

• If you use multiple disks
  – Azure’s Geo-Replication doesn’t guarantee write order across disks
  – This can break SQL Server’s recovery requirement (log and data files synchronization may break up)

• If Azure’s DR doesn’t satisfy your requirements
  – NO SLA
  – Based on Azure tests:
    • VM recovery: <~24h
    • Data loss: <~30 min
Offerings

* Most customers use Async Mode (High Performance) to avoid impacting primary performance
* Async Mode only supports Force Failover to make DR (and potential data loss) a conscious decision
Implementation

• Configure SQL Server Technologies
  – Database Mirroring
    • Configure a public endpoint for each VM
  – Backup and Restore for SQL Server in Windows Azure Virtual Machines to URL
    • Tutorial:
Demo Environment

Database Mirroring

SC3NEServer
North Europe

High Performance

SC3WEServer
West Europe
Demo

SQL Server DR across Windows Azure DCs using Database Mirroring
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THANK YOU!
For attending this session and
PASS SQLRally Nordic 2013, Stockholm

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