SQL Server High Availability

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MVP Data Platform
Session Agenda

- Understanding High Availability
- Common terms
- Planned and Unplanned Downtime
- Disaster Recovery
- High Availability vs. Disaster Recovery
- SQL Server 2016 features for High Availability
High Availability

Availability = \frac{MTBF}{MTBF + MTTR}

downtime per year (in days) = (1 - uptime ratio) * 365

uptime ratio = \frac{Availability}{100}
Example

- **Operations Log (12 hours)**
  - Recovered from previous failure at 00:00:00 Hours
  - Malfunctioned again at 10:00:00 Hours
  - Repaired and operational at 10:06:00 Hours

- **Availability (Service)**
  - Mean Time Between Failures (MTBF) = 10 Hours
  - Mean Time To Repair (MTTF) = 0.1 Hour
  - Availability = \( \frac{10}{10+0.1} = 99\% \)

- **Downtime (Systems)**
  - Uptime ratio = \( \frac{99}{100} = 0.99 \)
  - Downtime per year (in days) = \((1-0.99) \times 365 = 3.65\) Days

<table>
<thead>
<tr>
<th>Availability</th>
<th>Downtime per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>99%</td>
<td>3.65 Days</td>
</tr>
<tr>
<td>99.9%</td>
<td>8.76 Hours</td>
</tr>
<tr>
<td>99.99%</td>
<td>52.56 Minutes</td>
</tr>
<tr>
<td>99.999%</td>
<td>5.26 Minutes</td>
</tr>
<tr>
<td>99.9999%</td>
<td>31.5 Seconds</td>
</tr>
<tr>
<td>99.99999%</td>
<td>3.15 Seconds</td>
</tr>
</tbody>
</table>
What is causing downtime?

- **Planned**
  - Software releases
  - OS Patch releases
  - SQL Server service packs and hotfixes
  - Database maintenance and upgrades

- **Unplanned**
  - Hardware component failure
  - Security breaches
  - Human error
  - Natural disasters
Components of server high availability

- Hardware, Network and Storage
- Operating System
- SQL Server Instance
- Database
- Tables
RTO & RPO

Business Continuity Plan

Business Function

Database Service Management

Online → Offline → Online

IT Operations

Online → Offline → Online

Recovery Time Objective

Data loss

Recovery Point Objective
High Availability in SQL Server

- Basic AlwaysOn Availability Groups
- AlwaysOn Failover Clustering
- Database Mirroring
- Log Shipping
- Replication
AlwaysOn Availability Groups

- Multiple database coordinated failover for applications that require multiple databases on a single instance (e.g. SharePoint)
- Simplified application connectivity and automatic redirection through the implementation of Availability Group Listener and Application Virtual Name
- Built in compression and encryption
- Synchronous or asynchronous data movement
- Automatic or manual failover modes with configurable failover trigger levels
- Automatic repair of page corruptions
- Readable secondary replicas
- Support for FILESTREAM, FILETABLE, RBS and Service Broker
- Simplified configuration wizards, PowerShell integration and Availability Group Dashboard for monitoring
Basic AG Limitations

- One database in AG
- No readonly access
- No backup on secondary
- Two nodes only
DEMO
AlwaysOn Availability Groups
Failover Clustering

- Instance level Configuration
- A/P and A/A cluster
- Up to 64 nodes
- Shared storage between nodes
Common Cluster Scenarios
Database Mirroring

- Database level Configuration
- High performance vs. High Safety
- Automatic or manual failover
DEMO
Database Mirroring
Log Shipping

- Scheduled backup and restore of transaction log
- Can include monitoring server
DEMO
Log Shipping
## Edition Comparison

<table>
<thead>
<tr>
<th>Technology</th>
<th>Standard</th>
<th>Enterprise Core</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clustering</td>
<td>Yes (2 nodes)</td>
<td>Yes (OS max)</td>
</tr>
<tr>
<td>MultiSubnet Cluster</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Mirroring</td>
<td>Yes (Full Safety)</td>
<td>Yes</td>
</tr>
<tr>
<td>Log Shipping</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Change tracking</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Merge replication</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Transactional replication</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Peer to Peer</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>AlwaysOn AG</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>AlwaysOn AG Basic</td>
<td>Yes</td>
<td>No !</td>
</tr>
<tr>
<td>Database Snapshot</td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>
Summary

- High availability overview
- Disaster Recovery
- Common HA/DR Scenarios
  - AlwaysOn
  - Clustering
  - Mirroring
  - Log Shipping
  - P2P Transactional Replication
Session End

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