MICROSOFT OFFICIAL COURSE

Appendix A

**Core Concepts in
SQL Server High
Availability and Replication**

Appendix Overview

- Core Concepts in High Availability
- Core Concepts in Replication

Lesson 1: Core Concepts in High Availability

- Discussion: Previous Experience with High Availability
- Database Mirroring
- Failover Clustering
- AlwaysOn Availability Groups
- Log Shipping
- Choosing Between High Availability Options

Discussion: Previous Experience with High Availability

- What do you understand by the term "High Availability"?
- What techniques have you used to try to achieve high availability?
- How successful have these attempts been?

Database Mirroring

- Software based solution
  - Increases availability of a database
  - Increases data protection
- Operating modes
  - High safety
  - High performance
- Role switching
  - Manual
  - Automated (requires witness)

Principal

Witness
(Optional)

Mirror Partner
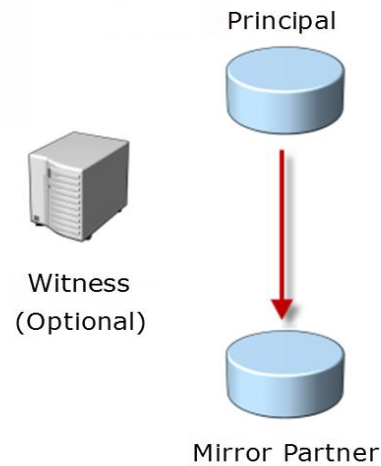
Failover Clustering

- SQL Server® instance or instances installed across Windows Server failover cluster nodes
- Protects against server failure by providing a virtual server for client applications to connect to
- Disk subsystem is a single point of failure and needs built-in redundancy options
- Automated failover

Server A

Shared Disk
Subsystem

Virtual SQL Server

Clients

Virtual SQL Server

Server B
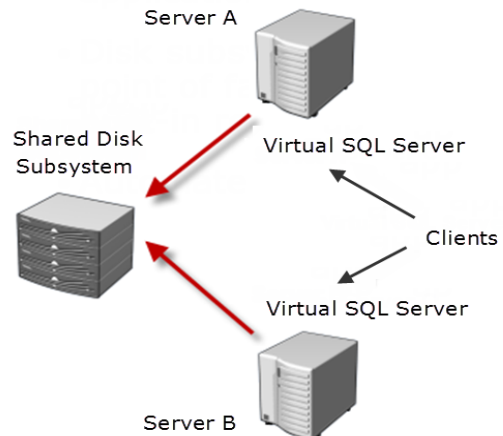
AlwaysOn Availability Groups

- Enterprise-level high availability alternative
- Provide options to improve database availability and improve resource usage
  - Supports one primary and up to four secondary replicas
  - Replicas can support alternative availability modes (asynchronous vs. synchronous)
  - Supports further failover options such as planned manual failover
  - Availability group attempts to failover rather than single database
- Secondary replicas can provide additional support
  - Read-only access
  - Backup operations

Log Shipping

- Mature and reliable technology
- Widely deployed
- No automation of failover supplied
- Core process
  - Backup transaction log
  - Copy logs to another server
  - Restore transaction log on second server

## Choosing Between High Availability Options

Aspect	Database Mirroring	Failover Clustering	Availability Groups	Log Shipping
Failover unit	Database	Server	Group of databases	Database
Automated failover	Yes, with witness	Yes	Yes	No
Data Replicas	1	0	4	Unlimited
Complexity	Medium	Medium	Medium	Low
Replica Availability	Read-only via snapshot	N/A	Read-only, backup	Read-only between restores

Lesson 2: Core Concepts in Replication

- SQL Server Replication Architecture

- Snapshot Replication

- Transactional Replication

- Peer-to-Peer Transactional Replication

- Merge Replication

- Choosing Between Replication Options

SQL Server Replication Architecture

- Can play a role in high availability but mostly targeted at data distribution

- Based on a magazine publisher metaphor

  - Publisher
  - Publication
  - Article
 - Distributor
  - Subscriber
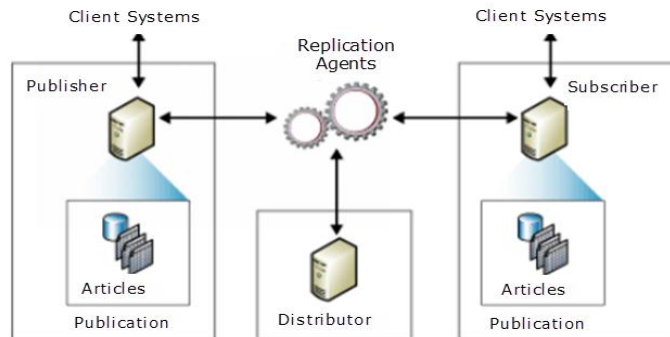
Snapshot Replication

- Simplest form of replication

- All published data copied each time

- Use when:

  - Data does not change often
  - Out of date data at the subscriber is acceptable
  - Volume of data is relatively small
  - Large volume of changes occur over short time periods
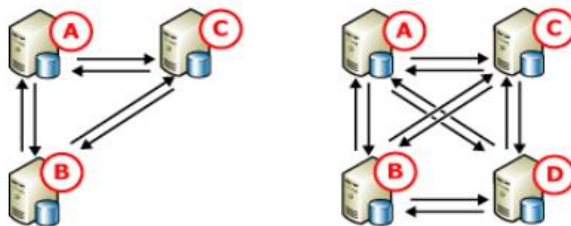
Transactional Replication

- Changes are applied to subscribers shortly after they occur

- Process involves:
  - Initial snapshot of the data is taken
  - Changes to the data (and to the schema) are delivered to the subscriber as they occur

- Changes are applied at subscriber in the same order as they occurred
 - Also within the same transaction boundaries as they occur at the publisher
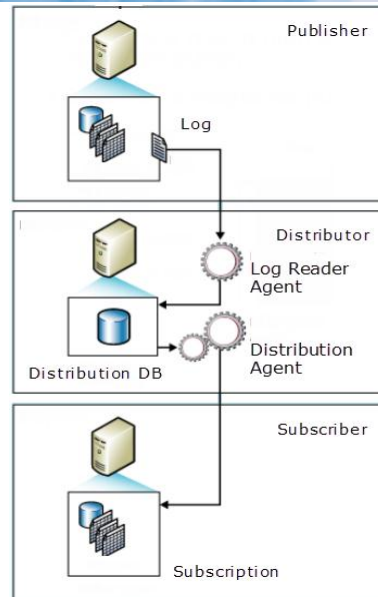
Peer-To-Peer Transactional Replication

- Configurable option within transactional replication

- Typically used with autonomous servers
  - Appropriately partitioned data is critical
  - Conflicts can be detected but need to be avoided

Merge Replication

- Commonly used for simple client-server applications

- Supports non-SQL Server nodes

- Not transactionally consistent

- Performance suffers with
  - Large amounts of data
  - Large numbers of subscribers
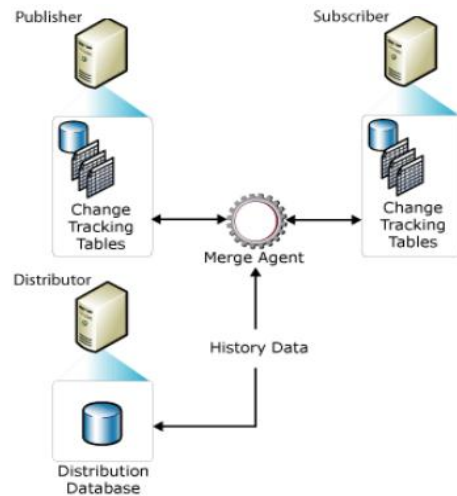
Choosing Between Available Replication Options

Aspect	Snapshot	Transactional	Peer-To-Peer	Merge
Transactional	No	Yes	Yes	No
Complexity	Low	Medium	High	Medium
Subscribers can update	No	With limited options	With partitioned data	Yes
Conflict Detection	No	No	Yes	Yes
Conflict Resolution	No	No	No	Yes
Performance	Medium	High	High	Low