

Detailed overview of SQL Server Database Mirroring, covering various aspects such as modes, components, prerequisites, and use cases:

Aspect	Details
Feature	SQL Server Database Mirroring
Modes of Operation	<ul style="list-style-type: none">- High Safety Mode (Synchronous): Transactions are committed on both the principal and mirror databases simultaneously, ensuring no data loss but with higher latency.
	<ul style="list-style-type: none">- High Performance Mode (Asynchronous): Transactions are committed on the principal database without waiting for the mirror, allowing for lower latency but with potential data loss.
	<ul style="list-style-type: none">- High Safety with Automatic Failover: Includes a witness server that can automatically fail over to the mirror in case the principal fails.
Editions	<ul style="list-style-type: none">- Enterprise Edition: Supports all mirroring modes and automatic page repair.
	<ul style="list-style-type: none">- Standard Edition: Supports High Safety mode with manual failover only.
Components	<ul style="list-style-type: none">- Principal Server: The server hosting the primary (principal) database.
	<ul style="list-style-type: none">- Mirror Server: The server hosting the mirrored copy of the principal database.
	<ul style="list-style-type: none">- Witness Server: An optional third server that enables automatic failover by ensuring quorum.
	<ul style="list-style-type: none">- Endpoint: A TCP/IP connection established for communication between the principal, mirror, and witness servers.
Prerequisites	<ul style="list-style-type: none">- SQL Server Version: Both principal and mirror servers must run the same version of SQL Server.
	<ul style="list-style-type: none">- Network Configuration: Proper network configuration to allow communication between principal, mirror, and witness servers over TCP/IP.
	<ul style="list-style-type: none">- Same Database Name: The mirrored database must have the same name as the principal database.
	<ul style="list-style-type: none">- Full Recovery Model: The principal database must use the full recovery model.
	<ul style="list-style-type: none">- Backup and Restore: A full backup of the principal database must be restored on the mirror server before mirroring can be started.

High Availability (HA) Features	- Automatic Failover: With a witness server, the system can automatically fail over to the mirror server if the principal becomes unavailable.
	- Manual Failover: The administrator can manually fail over to the mirror server.
	- Transparent Client Redirect: Applications can automatically reconnect to the mirror server after a failover using the same connection string.
	- Automatic Page Repair: Corrupted pages on the principal server are automatically repaired using a good copy from the mirror server (Enterprise Edition only).
Disaster Recovery (DR) Features	- Data Redundancy: Maintains an exact copy of the principal database on the mirror server, providing disaster recovery.
	- Geographic Dispersal: The principal and mirror servers can be located in different geographic regions for added disaster recovery protection.
	- Minimal Downtime: Quick failover to the mirror database minimizes downtime in case of a failure.
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Performance Considerations	- Synchronous Mirroring (High Safety): May introduce latency as transactions are committed to both principal and mirror before completion.
	- Asynchronous Mirroring (High Performance): Minimizes latency by committing transactions on the principal first but may result in data loss if the principal fails.
	- Network Bandwidth: Requires sufficient network bandwidth between principal and mirror servers to handle transaction log transfers.
Monitoring and Management	- SQL Server Management Studio (SSMS): Used to configure, monitor, and manage database mirroring sessions.
	- Dynamic Management Views (DMVs): Use views like <code>`sys.database_mirroring`</code> to monitor the status of mirroring.
	- Performance Counters: SQL Server provides mirroring-specific performance counters to monitor the performance of the mirroring session.
	- Alerts and Notifications: Set up SQL Server Agent alerts for mirroring state changes or failures.

Security	- Encryption: Data sent between principal and mirror servers is encrypted using SSL/TLS to ensure secure communication.
	- Authentication: Endpoints use Windows Authentication or certificates to authenticate the connection between principal, mirror, and witness servers.
Use Cases	- High Availability: Provides a high-availability solution for critical databases with options for automatic or manual failover.
	- Disaster Recovery: Ensures that a copy of the database is always available on a separate server, ready to take over in case of a disaster.
	- Zero Data Loss: In High Safety mode, ensures no data loss by synchronously committing transactions to the mirror server.
Limitations	- Deprecation: Database mirroring is a deprecated feature in SQL Server, with Always On Availability Groups recommended as a replacement.
	- Single Database Limitation: Mirroring is configured per database, meaning you have to manage each mirrored database separately.
	- No Load Balancing: Unlike Always On Availability Groups, mirroring does not support read-only replicas or load balancing of read operations.
	- Witness Dependency: Automatic failover requires a third server (witness) to avoid split-brain scenarios.
	- No Support for System Databases: Only user databases can be mirrored, not system databases like <code>`master`</code> or <code>`msdb`</code> .
Licensing	- Enterprise Edition: Required for using asynchronous mirroring (High Performance mode) and automatic page repair.
	- Standard Edition: Supports synchronous mirroring (High Safety mode) with manual failover and no automatic page repair.

This table provides a comprehensive overview of SQL Server Database Mirroring, summarizing its key features, components, modes, prerequisites, and limitations. It serves as a quick reference for understanding and implementing database mirroring in SQL Server environments.