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Database Mirroring Disaster Recovery Drill in SQL Server is a controlled failover process to test the disaster recovery (DR) readiness of a database mirroring setup.

This drill ensures that the mirrored database can take over smoothly if the primary database fails.

Performing regular DR drills helps ensure that the system is resilient and the mirror database can function properly during an actual disaster.

Below is a detailed step-by-step guide to performing a Database Mirroring Disaster Recovery Drill.

1. Overview of Database Mirroring Components

Database mirroring involves two primary components:

- **Principal Database:** The active database that accepts read/write operations.

- **Mirror Database:** The standby database that remains synchronized with the principal database.

- **Witness Server (Optional):** Helps automate failover by voting which server should be the principal in high-safety mode with automatic failover.

2. Preparation for the DR Drill

a. Understand the Modes of Mirroring

Before starting the DR drill, it's important to understand the mirroring mode you are using:

- **High-Safety Mode with Automatic Failover:** Synchronous mirroring with a witness, allowing automatic failover.

- **High-Safety Mode without Automatic Failover:** Synchronous mirroring, but requires manual failover.

- **High-Performance Mode:** Asynchronous mirroring, where some data loss can occur.

The failover process may vary slightly depending on the mode of mirroring.

b. Confirm Synchronization

Make sure the mirror database is in sync with the principal database. This can be checked by running the following query:

```
SELECT database_id, mirroring_state_desc, mirroring_role_desc

FROM sys.database_mirroring;
```

- The `mirroring_state_desc` should be SYNCHRONIZED before you proceed with the DR drill. This ensures that no data loss will occur during the failover.

c. Communication

Notify all stakeholders (DBAs, application teams, and users) that a DR drill will be conducted. It's important to perform this drill during non-business hours or a planned maintenance window to avoid disrupting operations.

3. Steps for Database Mirroring DR Drill

Step 1: Stop User Activity on the Principal Database

To prevent data loss or inconsistencies during the failover, stop all user activity on the principal database.

1. Set the database to single-user mode on the principal to block new connections and terminate existing connections:

```
ALTER DATABASE [YourDatabaseName] SET SINGLE_USER WITH ROLLBACK IMMEDIATE;
```

Step 2: Initiate Manual Failover

Initiating a manual failover will make the mirror server the new principal. The steps vary depending on whether you are using synchronous or asynchronous mirroring.

a. Synchronous Mirroring (High-Safety Mode)

In synchronous mirroring, failover happens with no data loss as the principal and mirror are fully synchronized.

1. On the principal server, run the following command to initiate failover:

```
ALTER DATABASE [YourDatabaseName] SET PARTNER FAILOVER;
```

This command initiates the failover and switches the roles of the principal and mirror databases. The mirror will now become the new principal.

b. Asynchronous Mirroring (High-Performance Mode)

In asynchronous mirroring, there is a possibility of data loss during the failover because the mirror database may not be fully synchronized with the principal.

1. Monitor the log send queue to understand how much data could be lost:

```
SELECT database_id, mirroring_state_desc, log_send_queue_size

FROM sys.database_mirroring;
```

2. If you are okay with the risk of data loss, execute the same failover command as above:

```
ALTER DATABASE [YourDatabaseName] SET PARTNER FAILOVER;
```

Step 3: Verify that the Failover is Complete

After initiating the failover, confirm that the failover has completed successfully and that the mirror database is now the principal.

1. Check the role of the new principal:

```
   SELECT database_id, mirroring_role_desc

   FROM sys.database_mirroring;
```

You should see the mirror now acting as the PRINCIPAL.

2. Also, verify the status in SQL Server Management Studio (SSMS):

- Go to Databases > Mirroring and ensure that the status has updated to reflect the new principal and mirror roles.

4. Validation After Failover

a. Validate Database Integrity

On the new principal server (the former mirror), run `DBCC CHECKDB` to ensure the database's integrity:

```
DBCC CHECKDB('YourDatabaseName');
```

Make sure there are no consistency issues or corruption in the database.

b. Check Data Consistency

Validate that the data in the new principal database is consistent. This can include:

- Running queries to check that critical tables have the expected row counts.

- Comparing data against the data before failover, especially if you're using asynchronous mirroring.

c. Run Application Tests

Work with application teams to validate that the new principal database (previous mirror) works as expected. Test major functionalities like:

- Data insertions and updates.

- Reporting and read operations.

- Application performance.

d. Verify the Mirroring Configuration on the New Principal

Check that the original principal server is now functioning as the mirror (if it is still online and operational):

```
SELECT database_id, mirroring_state_desc, mirroring_role_desc

FROM sys.database_mirroring;
```

- The old principal server should now have the MIRROR role.

5. Post-Drill Options: Failback or Keep the Current Setup

After testing the failover and validating the functionality, you can either choose to:

- Keep the new principal as the permanent principal server.

- Failback to the original principal server.

Option 1: Keep the New Principal

If you want to keep the mirror server as the new principal server, no additional steps are required beyond ensuring that the original principal is now acting as the mirror.

Option 2: Failback to the Original Principal

1. Initiate a Failback: After validating the new principal, you may want to return the original principal to its role by manually failing back.

2. On the new principal (formerly the mirror), run the following command:

```
ALTER DATABASE [YourDatabaseName] SET PARTNER FAILOVER;
```

This will switch the roles back, making the original principal server the active database once again.

3. Verify the Failback: Once the failback completes, ensure the databases are in the correct roles using the following query:

```
   SELECT database_id, mirroring_role_desc

   FROM sys.database_mirroring;
```

4. Revalidate the Setup: After failing back, revalidate the database integrity and functionality just as you did during the initial failover.

6. Post-Drill: Monitor and Document

a. Monitor for Any Issues

Even after the DR drill, continue to monitor both servers to ensure that the roles have been switched properly, and there are no issues with database mirroring. Use SSMS and monitoring tools to track any alerts or problems.

b. Document the Drill Process

Keep detailed documentation of the drill, including:

- Time taken for each step.

- Issues encountered and how they were resolved.

- Lessons learned and potential improvements for the future.

This documentation will serve as a guide for future DR drills or actual disaster recovery events.

7. Key Points to Remember

- **Synchronization**: Ensure that the databases are synchronized before initiating failover to prevent data loss.

- **Failover Types:** Understand the mirroring mode (synchronous or asynchronous) and how it affects failover (with or without data loss).

- **Testing and Validation**: Run both data validation and application testing after failover to ensure that the new principal is fully functional.

- **Failback Planning:** Decide whether to failback to the original principal or keep the current setup.

Summary of the Process

1. Stop user activity on the principal database.

2. Initiate a manual failover to switch the mirror to the principal role.

3. Validate the failover by checking database integrity, data consistency, and application functionality.

4. Choose whether to failback to the original principal or keep the new principal.

5. Monitor the system post-drill and document the entire process.

By performing these steps, you can ensure your SQL Server environment is ready for a real disaster recovery scenario, and that the database mirroring setup functions properly during a failover.