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Log Shipping is a disaster recovery solution in SQL Server that allows you to automatically send transaction log backups from a primary database to a secondary database on a different server. The secondary database can be used as a backup in case of failure, thus providing high availability and disaster recovery for your SQL Server environment.

Here's a detailed breakdown of how **Log Shipping** works, its components, configuration steps, and common considerations:

1. Components of Log Shipping

Log shipping involves three primary components:

1. **Primary Server**:
   - The main server where the production database resides. Transaction log backups are created here.
2. **Secondary Server(s)**:
   - This server receives the transaction log backups from the primary server and applies them to a secondary database to keep it in sync with the primary database.
3. **Monitor Server** (Optional):
   - A server that monitors the log shipping process, including backup, copy, and restore operations. It raises alerts if there are any failures or delays in the log shipping process.

2. Log Shipping Process

Log shipping operates in a cycle of three key steps:

1. **Backup**:
   - Transaction log backups are created on the primary database at regular intervals. These backups contain changes made to the database since the last backup.
2. **Copy**:
   - The transaction log backups are copied from the primary server to a shared folder, and then to the secondary server.
3. **Restore**:
   - The copied transaction log backup is restored to the secondary database. The secondary database remains in a restoring state to accept the new transaction logs continuously, ensuring it is up-to-date with the primary.

3. Prerequisites for Log Shipping

- Both the primary and secondary servers must run SQL Server (any edition supporting log shipping).
- The secondary database should have the same SQL Server version as the primary.
- SQL Server Agent should be enabled and running on both servers.
- The SQL Server instance must be in Full or Bulk-logged recovery model to allow transaction log backups.

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4. Configuring Log Shipping

To set up log shipping, follow these steps:

Step 1: Enable Log Shipping on the Primary Database

- Connect to the SQL Server instance on the primary server.
- In SQL Server Management Studio (SSMS), right-click the database you want to configure for log shipping and click **Properties**.
- Go to the **Transaction Log Shipping** page and check the box to enable log shipping.

Step 2: Configure Transaction Log Backup Settings

- Specify the network path where the transaction log backups will be stored.
- Set the backup frequency (e.g., every 15 minutes) and retention period.
- SQL Server Agent will manage these jobs for automatic backup.

Step 3: Add Secondary Server

- Click the **Add** button to configure the secondary server.
- Provide the name of the secondary server and database.
- You can either initialize the secondary database using a full backup of the primary database or restore it manually.

Step 4: Configure the Secondary Database Restore Mode

- The secondary database must be in either "No Recovery Mode" or "Standby Mode."
- In **No Recovery Mode**, the database cannot be read or used, while in **Standby Mode**, the database can be read-only between restores.

Step 5: Configure Copy and Restore Jobs

- Define where to copy the log backup files on the secondary server.
- Set up the frequency at which log backups should be restored.

Step 6: Monitor Server (Optional)

- Set up a monitor server (optional) to track the status of backup, copy, and restore jobs. This server will raise alerts in case of failures.

Step 7: Finish Configuration and Start Log Shipping

- Finalize the configuration, start the log shipping jobs, and monitor them via SQL Server Agent and SQL Server Management Studio.

5. Monitoring Log Shipping

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You can monitor log shipping using several methods:

- **SQL Server Agent Jobs**: The jobs for backup, copy, and restore should be monitored for success or failure.
- **SSMS**: Under the "Transaction Log Shipping" page in the database properties, you can view the current status.
- **Log Shipping Reports**: These reports are available in SSMS for tracking performance and ensuring the secondary database is up-to-date.

6. Role of Failover in Log Shipping

Unlike other high-availability solutions such as **SQL Server Always On Availability Groups** or **Failover Clustering**, log shipping doesn't provide automatic failover. If the primary server goes down, the DBA must manually restore the secondary database to full recovery mode to make it usable.

7. Key Considerations

- **Latency**: Since log shipping involves periodic backups, there will be some data loss between the last backup and the failover.
- **Network Bandwidth**: The process involves copying large files (transaction log backups) over the network, so ensure sufficient bandwidth.
- **Backup Size**: Transaction log backups can grow quickly depending on the volume of transactions on the primary database.

8. Advantages of Log Shipping

- **Simple to Set Up**: Log shipping is relatively simple compared to other disaster recovery solutions.
- **Low Cost**: It is available in Standard, Web, and Enterprise editions of SQL Server, making it cost-effective.
- **Scalability**: Multiple secondary servers can be configured for one primary database.
- **Disaster Recovery**: Provides a reliable mechanism to maintain a warm standby server for failover purposes.

9. Limitations of Log Shipping

- **Manual Failover**: There is no automatic failover; it requires DBA intervention.
- **No Real-Time Synchronization**: Log shipping works based on transaction log backups, so there is a delay in synchronizing changes.
- **Secondary Database Usage**: The secondary database is either in read-only mode (Standby) or unusable (No Recovery), so it cannot be fully utilized unless in Standby mode.

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10. Scenarios for Using Log Shipping

Log shipping is ideal for:

- Disaster recovery across geographically distant locations.
- Setting up a read-only reporting server (in Standby mode).
- A cost-effective high-availability solution for smaller businesses that cannot afford more advanced solutions.

11. Comparison with Other Solutions

- **Replication**: Log shipping is simpler but lacks the near real-time update that replication offers.
- **Mirroring**: Log shipping is not as instantaneous as database mirroring, but it supports multiple secondaries and doesn't require constant monitoring.
- **Always On Availability Groups**: This is a more advanced solution with automatic failover but requires SQL Server Enterprise edition, while log shipping is available in lower editions.

Conclusion

Log shipping is a robust and relatively simple disaster recovery solution for SQL Server that provides a warm standby solution.

It's particularly useful for systems where data can tolerate some delay in synchronization and where cost considerations are important.

However, its lack of automatic failover and real-time replication limits its use in highly critical applications.