Glossary

Colored Contents	Represents
BLACK	Normal DB Activities (Managed Services)
RED	New Implementations (Professional Services)

Support Type	Related Tasks
Full Support	Covers all **BLACK** + **RED** Colored tasks mentioned in this document. **NOTE**: All **RED** colored contents will be executed in Serial manner (one task at a time). If any multiple **RED** colored tasks needed to be executed in parallel will be carried over with additional costs based on the workload proposed.
Normal Support	Covers ONLY BLACK colored tasks mentioned in this document

Equivalent Work Experience

Tasks Level	
Level-0	Freshers
Level-1	1-2 years exp
Level-2	3-5 years exp
Level-3	5+ years exp
Level-4	8+ Technology & Leadership exp
ITIL	Process Expertise

Microsoft SQL Server Database Project & Support Services

Database Health Check (level-1)

a. Instance & supported services availability status check,

b. Event log check.

c. Backup status Check (Re-run to succeed in case of any failures)

d. DR synchronization check (Mirroring, Log shipping, Replication & AlwaysON)

e. Database Space check

f. OS Space check

g. Proactive basic Performance check (i.e.: Invalid objects, table locks, invalid sessions, etc.)

Database Design, Installation & Configuration. (Level-3)

a. Design OS requirements: Choosing & configuring the appropriate CPU, Memory, storage, and ancillary software

b. Design Instance requirements: Creating scalable architectures that allow for expansion

c. Preparing SqlServer documentation

d. Designing SQL database for high-speed, high-volume transactions

e. Conducting design reviews

f. Installation & configuration of all types of Database client side & server tools for both windows & Linux.

Backup & Disaster Recovery Implementation & Management (Level-2)

Backup your data**:** Regularly backing up your data will ensure that you have access to your information even if a cyberattack or system failure occurs.

a. **Implement optimal backup and recovery strategy:** Configure new backups

b. Re-Run failed backups

c. Ensure, all backups (data & T-logs) are stored in a safer remote location to restore consistency.

d. Point in Time Database Recovery from latest backups.

e. Adhoc Database restore based on user requests.

f. Restoring schema objects in case of any human error on end-user data management.

g. Restore Validity check

Backup Types: -

- **Tail backup** – Can take backups only when db is down with no format option

- **Full database backups: -** Total image but disturbs all previous log backup. Without full backup we cannot generate it. Full db backup including part of transaction logs. only takes allocated data. Force checkpoint to write updates from pages to disk ->

- **Differential database backups: -** Incremental backup from last full backups. Kind of incremental backup in Oracle. Without full backup we cannot generate it.

- **File backups: -** Datafile backup individually. If we have multiple datafiles or size is huge. (Full/Diff)

- **Differential File backup: -**

- **Filegroup backups: -** One or more datafiles belongs to one file group. In default, one datafile will be created for primary file group. Take backup of entire file group in case if any file groups are read-only and want to omit it from routine backup.

- **Partial backups: -** introduced from 2005, to take backup of PRIMARY & all READWRITE file groups along with any additionally specified files. This also helps for backups without read-only filegroups.

- **Differential Partial backup: -**

- **Copy-Only backups: -** Kind of full back up without disturbs log backup. [SQL Server tracks transaction logs using LSN-Log Series Number - three-part number]. Starts from 2005, usually taking backups stores LSN's of the backup in backup file and getting referenced during restore as it allows only sequence of backups will be restored as per LSN's. In case if we want full backup + transaction logs in the middle of scheduled backup without affecting LSN's then use COPY-ONLY. Also, restore will not take this COPY-ONLY backup in LSN sequence.

- **Mirror backups: -** Duplicating backup files as multiple copies and use it when one set is corrupted.

- **Transaction log backups: -** backup the active part of the transaction log. After the transaction log backup is issued, the space within the transaction log can be reused for other processes. Take backup only from LDF.

Restore Types

- **Simple Recovery Model (No Arch Mode)**

  - Only uncommitted transaction in log and all committed transactions removed when checkpoint raised. So log file never grows more, but cannot perform log backup - so cannot PITR. Can only restore till latest full/diff backup. SO here Tlog only used for transaction rollbacks and crash recovery
  - All dbs except Model db will come under this.
  - Cannot configure log shipping/mirroring/Always ON
  - If switching from simple to Full/Bulk, then take full/diff db backup to start log chain, without this backup full/diff models will not take effect
  - After switching to simple recovery, stop scheduled t-log backups and ensure frequent full backup as it is only option here for data protection.

- **Full Recovery Model:**
  - Only Model db comes under this.
  - All DML logged and maintained in logfile.Commited transactoins in those logs captured in backup, so we can PITR. So take periodic log backups to avoid log being full.
  - If we want to have mirroring - only possible is full recovery model.

- **BULK Recovery Model**
  - where only the page allocations are logged, not the actual insertion of data
  - Full recovery model + bulk data modification activity logged using minimal logging (only allocation changes will be logged) - ex: index rebuild or bulk load, but no PITR. Cons is, if log is damaged (or) bulk log operation occurred since most recent log backup, changes from that backup should be redone.
  - once bulk operations completed immediately switch to full recovery and take log backup

Standby Database & High Availability Management (Level-2 & 3)

a. Architecting & building a new standby database.
b. Re-sync if in case of any smaller gaps
c. Rebuild the DR setup in case of any bigger gaps or DR database corruption.
d. Periodic database switch test between production and DR environment to ensure the DR database is always ready to be available during any production failover.

<u>Types of Standby:</u>

Mirroring

Edition:
  - Full support – Enterprise, Business Intelligence, Standard
  - Witness Only – Web, Express with Advanced Services & Express with Tools

Pros:

- No lag (live sync up)

Cons: -

- Manual failover
- One target only
- Cannot open target read-only

Modes:-

- **High Safety (High Secuirty):** For data safety in standby, it commits only after standby commits else primary will hung.
  High Performance (Asynchornous): It care performance of primary, wont care about standby data safety
- **High safety with automation (Synchornous):** primary & mirror writes at same time & Can automate failover with data safety option (But need 3rd witness server - can use test server by creation separate sql instance for monitoring & confirming primary failed.)

Logshipping

Edition: All (except standard edition)

Pros:

- Easy setup
- Disaster recovery purpose
- Multi target
- Can open Target read-only. [see restore priority option below]
- Can combine with (Always on, Replication & Mirroring)

Cons:

- Manual failover
- Chance to data loss (based on lag - backup sync time) default 15mins

Modes:

- Standby Mode: - Read-only, but not available when restore process in running
- Restore Mode: - db not accessible

> NOTE: --Restore priority option: (Available in standby mode).

- if we select this option, it forces disconnects user during log transaction restore, so it disconnects all users every lag time and user must connect back to db manually.
- Else, it collects all the log transaction backups and apply together when all user disconnects

ALWAYSON - Introduced in SQL Server 2012

- Active – Active replication
- Separate Storage for nodes.
- Combined with WSFC (Windows Server Failover Cluster)

Replication

Can replicate

- Tables
- Views
- Stored Procedures

Types

- **Transaction Replication:-** suits for critical db's with less downtime / large data that changes frequently / where data need on incremental basis

- **Snapshot Replication** (Take photo DB changes and replicate to target):- suits when db is not critical / less frequent data changes / for reporting db

- **Merge Replication:** (Bi-Directional):-

Database User and Security Management (Level-1 & 2)

a. User creation with proper authentication(credentials) & authorization (Privileges).
b. User Management in existing setup.
c. Auditing for user compliance with data storage rules and regulations.
d. Deploy security fixes in OS & DB level
e. Perform penetration testing and fix the findings
f. Whitelisting the incoming connections to the DB layer
g. Database encryption and setup SSL connectivity to App servers
h. Full audit of role-based security
i. Full audit of fine-grained access control

Access Types:
- Direct DB access (USERS)
    - Authentication to use database. password maintained by local policy
    - Domain admin with windows authentication can create login locally
    - The database user can use the same name as the login, but that is not required.

- Windows pass-through (LOGINS)
    - Authentication to use sql server instance. If need access to specific db, login has to mapped with db user.
    - A login can be mapped to different databases as different users but can only be mapped as one user in each database
    - Only allows AD users. password maintained by domain policy.
    - High security & Protection, Easy trace out of mal login using AD

User Types:
- Restricted
- Single
- Multi

Server Roles: -

- **SYSADMIN** –Perform any action on the server.

- **SECURITYADMIN** –Manage server level permissions GRANT, DENY, REVOKE as well manage DB level, if they have access to a DB. Additionally, they can reset passwords for SQL Server logins.

- **SERVERADMIN** –Manage server configurations and start/stop services.

- **PROCESSADMIN** –Kill processes running on the instance.

- **SETUPADMIN** –Add/remove linked servers by using Transact-SQL statements. (Sysadmin membership is needed when using Management Studio

- **BULKADMIN** –Able to run BULK INSERT and execute bulk operations.

- **DISKADMIN** –Manage server disk files.

- **DBCREATOR** –Create, alter, drop, and restore databases.

- **PUBLIC** –Generic role that all users are a member of. When a server principal has not been granted or denied specific permissions on a securable object, the user inherits the permissions granted to public on that object. Only assign public permissions on any object when you want the object to be available to all users. You cannot change membership in public.

Database Roles: - All below roles brings "VIEW ANY DATABASE" roles with it.

- **DB_OWNER** -Perform all activities(configuration/Maintenance) on the database, and can also drop the database. Granted with GRANT option: CONTROL

- **DB_SECURITYADMIN** –Manages role membership and permissions on the database. Adding principals to this role could enable unintended privilege escalation. Granted: ALTER ANY APPLICATION ROLE, ALTER ANY ROLE, CREATE SCHEMA, VIEW DEFINITION

- **DB_ACCESSADMIN** –Manages login access (add/remove) to the database for Windows logins, Windows groups, and SQL Server logins. ALTER ANY USER, CREATE SCHEMA and GRANT option of CONNECT.

- **DB_BACKUPOPERATOR** –Can backup the database (BACKUP DATABASE, BACKUP LOG, CHECKPOINT).

- **DB_DDLADMIN** –Able to run any DDL command.

- **DB_DATAWRITER** –Able to modify data (DELETE, INSERT, UPDATE) in all user tables.

- **DB_DATAREADER** –Able to SELECT data in all user tables.

- **DB_DENYDATAWRITER** –Denied the ability to modify data(Insert/Update/delete) in all user tables. Denied override grants.

- **DB_DENYDATAREADER** –Denied the ability to read data in all user tables.

Database Capacity Planning & Space Management (Level-3)

a. Designing database storage requirements by considering immediate future growth.

b. Performing periodic capacity reviews (daily, Weekly, Monthly, and Quarterly based on customer requirements & send database growth report regularly.

c. Add additional space by taking approval from management.

d. Pro-active housekeeping activities to compress T-log, clear (old Audit logs, Trace files, Backup files, Backup logs) from the OS database drive, as per customer standards to avoid last-minute space hiccups.

Database Performance Tuning: (level 2 & 3)

Tune database performance by analyzing the following data's

- Application statistics (transaction volumes, response time)
- Database statistics
- System statistics
- Disk I/O statistics
- Network statistics

Database Tunning

- Auto-Explain, Execution plan, SQL Profiler, DB Engine Tuning Advisor, Index re-org & Rebuild

- Top weight reports – such as bottlenecks- that can be tuned

- Long-running top SQL

- Analyze and kill, blocks & locks

- Storage configuration

- Memory settings: Paging, Memory consumption/configuration

- Various Database Parameters reconfig

- Disk IO statistica

- Transactions throughout

- Troubleshoot issues related to TempDb, Transaction Log and System Databases.

- Implementing Table level partitioning for better performance.

- Activity Monitor (inbuild tool in sql sever): shows processor time percentage, number of waiting tasks, database I/O operations in MB/sec, and the number of batch requests.

- **Connection Timeout**: SQL Server itself doesn't have timeout, it should be from application server which is 2 types: - Some apps has both, some has anyone. Each has diff way of troubleshooting
    - **connection Timeout** (Engine down/browser-service down/TCPIP disabled/server name typo/network issue/instance damaged need repair/db engine TCPIP port is blocked by firewall)
    - **Query Timeout** (Block/waits/resource-bottlenecks/bad queries/others- i.e.: mirroring sync commit/command timeout)

- **Bottleneck Analysis** (Demand greater than supply)
    - **External Resource: -** CPU / IO / MEM / Server Conf
    - **Internal Resource: -** Waits/blocks/bad queries/timeouts
- **Comparative Analysis (Baseline Available):** Compare diagnostic data (bad vs good) & locate diff.

Tools
- PERFMON counters
- Extended events
- Profiler traces
- PERFSTATS
- PssDiag
- SQL Nexus
- SQLDiag
- Performance Dashboard
- QDS (query data store)
- DTA

SQL Query Tunning

- Improve the use of SELECT queries

- Check for indexes

- Work with the smallest data set required

- Remove unnecessary fields and tables

- Remove calculations in your JOIN and WHERE clauses.

- Use wildcards only at the end of a phrase

- SQL profiling – to fix the execution plan

- SQL Hints – To improve the performance and execution

- Run your query during off-peak hours

Database Patch & Upgrade (Level-2)

- Test & Applying patches, Service Packs & upgrades to maintain security level

- Rolling patches in Cluster Environment for high availability.

- Patching the database in a Cloud environment.

- Version upgrades: release upgrades within the same version.

- Major Version upgrades: Version upgrades to different higher versions.

- Upgrade database with minimal time window.

- upgrade in the DR environment.

- Edition upgrade of sql server binaries.

Database Refresh (Level-2)

a. Perform DB refresh using full/diff/T-log backup/restore.

b. Refresh data using the Export/Import method

c. Refresh data from TAPE (storage)

d. Refresh Tables using DB LINK (using CTSA)

Database Migration: (Level-3)

a. Straight Platform (Between same Operating Systems)

b. Cross Platform (Between different Operating Systems)

c. Homogeneous (Between Same Database Technologies)

d. Heterogeneous (Between different Database Technologies)

e. Zero Downtime Migration: Migrate the database using the Golden Gate replication technique to avoid downtime & logical replication technique

f. Cloud Migration: Migrating database from on-premises to Cloud & vice-versa

g. Migrating database from Exadata

h. Migrating database from one Datacenter to another, using the DR technique

Vendor & Licensing Management (Level-2)

a. Utilizing our vendor relationships, we increase turn-around speed and get licensing information quickly.

b. We navigate the licensing maze, providing you with all the licensing options available.

c. We regularly work with software vendors to get the "best pricing" for our clients.

Database Continuous Monitoring (Level-1)

a. Implementation of Customized Monitoring using Shell & PowerShell.

b. Database Availability, services, Storage and process, DB performance.

c. Splunk: Monitor the logs and raise on-call alerts to DBAs at the time of an incident.

d. Proactive checks based on the monitoring alerts help DBAs to keep the system healthy.

Database Process Implementation, Documentation & Orientation (ITIL)

- Introducing best-fit processes for database administration using ITIL global standards.

- Deriving & implementing new processes & periodically reviewing existing processes, in Incident Management, Problem Management, Change Management & Release management.

- Can Manage ITIL portfolio by supplying, Incident Manager, Problem Manager, Change Manager, Release Manager.

- Documenting the SOP (Standard Operating Procedures) for end-to-end database administration portfolio for your various environments Prod, QA & Development.

- Also we educate your IT / Non-IT staffs for the Process & SOP structured.

Database Status Reporting to IT Management (Level 1)

1. **Backup Status Report:** (Daily/Weekly/Monthly/Quarterly) backup status reports for end-to-end database environment.

2. **Daily Status Check Report:** Services Availability Status, Storage Status & Standby Sync status, HA Availability Status.

3. **Performance Status Report:** Periodic database Locking, Blocking, Inactive sessions status.

4. **Capacity Growth Report:** Periodic database storage growth (Daily/Weekly/Monthly/Quarterly) for Production databases.

5. **Others:** Other Database related report as the customers customized requirements.

Cloud 'Database as Service' support (Level-2 & 3)

End to End Database Consultation, Administration & Management in all Cloud Technologies (as well as in Hybrid Model)

We are expertise in supporting below cloud environments

Cloud We Support

Also we are in Technical Partnership with **SpeedCloud** cloud company and provide special discounted rates for our customers on our Techno-partner **SpeedCloud** cloud platform.

Our Database Support in cloud includes: -

- **Rehost patterns** (from on-perm database to self managed* in Amazon EC2, Azure VM, Compute Engine in GCC etc.)

- **Re-platform patterns** (from on-perm database to cloud DBaaS*)

- **Re-architect patterns** (from on-perm one database Technology to other open-source or cloud-native database Technologies)

- Setup monitoring of DBs using cloud native tools. (Eg: Cloud watch)

- Setup and manage DB in muti, hybrid cloud environment like AWS, AZURE & GCC along with On-Perm

- **Database Consulting in Cloud Infra**
  - Start with a comprehensive plan and a governance framework
  - Run the right database in the right cloud
  - Use data services that support multi-cloud environments
  - Exploit managed database services, or DBaaS
  - Consider database portability across multiple clouds
  - Optimize data access for applications and end users
  - Connect cloud networks to reduce data latency

- **Cloud Security**

  - Define standards, security, and compliance policies. Cloud database vendors rarely enforce more than the most obvious weaknesses in the out-of-the-box installations of their platforms
  - Run vulnerability assessments. Since databases are often an organization's largest repository of sensitive information, they should be evaluated to not only search for potential vulnerabilities but also to ensure they fulfill any relevant regulatory compliance requirements
  - Understand user privilege and access. As people change roles or leave an organization, user privileges are often not kept up-to-date, and, as a result, organizations lack a full understanding of who has access to sensitive data.
  - Use data analytics to mitigate risks. Remediating high-risk vulnerabilities and misconfigurations within your databases not only reduces your risk of compromise, but it also narrows the scope of any required compensating controls you might need, such as exploit monitoring.
  - Respond to policy violations in real time. For vulnerabilities that cannot be remediated or patched in a timely manner, real-time database activity monitoring (DAM) can be an appropriate compensating control.
  - Database encryption
  - Data Masking
  - Multi-Factor Authentication (MFA)

- **Cloud Database Migration**

    - Migrate your existing database platform from On-premises datacenter to any cloud Technologies includes (AWS, Azure, Google Cloud, Oracle Cloud & other 3rd party cloud services) & Vice versa, Cloud to On-premises datacenter
    - New database design and implementation in Cloud platform.
    - Cloud database integration with other cloud services as per your business functional requirements.

- Cloud Database Performance Tuning

DBaaS* (Database as a service), Managed database service that are fully managed by the vendor, which could be a cloud platform provider or another database vendor that runs its cloud DBMS on a platform provider's infrastructure

Self-managed database*: This is an infrastructure as a service (IaaS) environment, in which the database runs in a virtual machine on a system operated by a cloud provider