**Oracle 3Node DB RAC Prerequisites for Debit Card Management Suite**

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**Classification:** Confidential - For Implementation Use Only

**Executive Summary**

This document outlines the comprehensive prerequisites for configuring a 3-Node Oracle RAC environment specifically optimized for the Debit Card Management Suite. It provides detailed implementation guidelines for the bank's technical team to set up the infrastructure on on-premise virtual machines within the bank's VMware cloud environment.

The configuration parameters have been carefully selected based on best practices to ensure:

* **High Performance:** Optimized for payment transaction processing with sub-50ms response times
* **Robust Security:** Implementation of defense-in-depth security controls including TDE
* **High Availability:** Resilient architecture with minimal downtime through Oracle RAC
* **Regulatory Compliance:** Audit capabilities and data protection measures
* **Scalability:** Architecture supporting growth in transaction volumes

**1. System Architecture Overview**

**1.1 PoC Environment (3-Node Oracle RAC)**

| **Component** | **Specification** | **Purpose** |
| --- | --- | --- |
| Database Version | Oracle Database 19c Enterprise Edition (19.25.0 or higher) | Enterprise-grade database with long-term support |
| Cluster Configuration | 3-Node Oracle RAC on VMware | High availability active-active-active configuration |
| CPU Resources | 24 vCPUs (8 vCPUs per node) | Support for payment transaction processing |
| Memory Resources | 144GB RAM (48GB per node) | Optimized for in-memory operations and buffer cache |
| Storage Configuration | 2TB ASM Storage | Redundant, high-performance storage for payment data |
| Operating System | RHEL 8.x | Oracle-optimized Linux distribution |

**2. Hardware and Software Requirements**

**2.1 Virtual Machine Requirements**

| **Component** | **Requirement** | **Responsibility** |
| --- | --- | --- |
| Server Hardware | 3 VMware VMs with 8 vCPUs and 48GB RAM per node | Bank |
| Storage | 2TB storage with redundancy for ASM | Bank |
| Network | 10Gbps for Oracle RAC interconnect, redundant network connections | Bank |
| Operating System | Oracle Linux 8.x or RHEL 8.x (with UEK for Oracle Linux) | Bank |
| Oracle Grid Infrastructure | Oracle Grid Infrastructure 19c (19.25.0 or higher) | Bank |
| Oracle Database Software | Oracle Database 19c Enterprise Edition (19.25.0 or higher) | Bank |
| Oracle Database Options | Partitioning, Advanced Security (TDE), Diagnostics, Tuning | Bank |
| Clusterware | Oracle Clusterware 19c | Bank |
| Storage Management | Oracle ASM 19c | Bank |

**3. Installation and Configuration Responsibility Matrix**

**3.1 PoC Environment (3-Node Oracle RAC)**

| **Task** | **Bank Team** | **Description** |
| --- | --- | --- |
| Hardware Provisioning | ✓ | Provision virtual machines, storage, and network resources |
| OS Installation and Configuration | ✓ | Install and configure RHEL/OEL with required prerequisites |
| OS Hardening | ✓ | Apply security configuration according to CIS benchmarks |
| ASM Disk Provisioning | ✓ | Provision and present ASM disks to database servers |
| Grid Infrastructure Installation | ✓ | Install Oracle Grid Infrastructure 19c |
| Grid Infrastructure Configuration | ✓ | Configure Oracle ASM disk groups and Clusterware |
| Oracle Database Software Installation | ✓ | Install Oracle Database 19c Enterprise Edition |
| Database Creation | ✓ | Create and configure database for Debit Card Management Suite |
| Database Parameter Configuration | ✓ | Apply initialization parameters as specified in this document |
| Database Security Configuration | ✓ | Configure TDE, auditing, and security parameters |
| Tablespace Creation | ✓ | Create and configure tablespaces as specified |
| User and Role Creation | ✓ | Create application users and roles as specified |
| Network Configuration | ✓ | Configure database listeners and network connectivity |
| Performance Tuning | ✓ | Apply performance tuning recommendations |

**4. Operating System Prerequisites**

**4.1 Oracle Linux/RHEL Configuration**

| **Parameter** | **Recommended Value** | **Description** |
| --- | --- | --- |
| Kernel Version | 4.18.0 or later (RHEL 8.x) | Latest supported kernel version |
| Packages | oracle-database-preinstall-19c | Automatically sets kernel parameters and dependencies |
| File Systems | XFS for Oracle binaries, ASM for database files | Recommended file systems for Oracle database |
| Swap Space | 16GB | Equal to 1/3 of RAM for systems with 32-192GB RAM |
| User Limits | See section 4.3 | Shell limits for oracle/grid users |
| Kernel Parameters | See section 4.2 | Required for Oracle database operations |
| Huge Pages | Enabled and sized for SGA | Improves memory performance |
| Transparent HugePages | Disabled | Can cause performance issues with Oracle |
| SELinux | Permissive or Disabled | Prevents Oracle installation issues |
| Firewall | Configured for Oracle ports | Allow required Oracle communication |
| NTP | Configured and synchronized | Time synchronization between nodes |

**4.2 Required Kernel Parameters**

# Add to /etc/sysctl.conf

fs.file-max = 6815744

kernel.sem = 250 32000 100 128

kernel.shmmni = 4096

kernel.shmall = 1073741824

kernel.shmmax = 4398046511104

kernel.panic\_on\_oops = 1

net.core.rmem\_default = 262144

net.core.rmem\_max = 4194304

net.core.wmem\_default = 262144

net.core.wmem\_max = 1048576

net.ipv4.conf.all.rp\_filter = 2

net.ipv4.conf.default.rp\_filter = 2

fs.aio-max-nr = 1048576

net.ipv4.ip\_local\_port\_range = 9000 65500

vm.min\_free\_kbytes = 524288

vm.swappiness = 10

vm.dirty\_background\_ratio = 3

vm.dirty\_ratio = 80

vm.dirty\_expire\_centisecs = 500

vm.dirty\_writeback\_centisecs = 100

**4.3 Shell Limits for Oracle Users**

# Add to /etc/security/limits.conf

oracle soft nofile 1024

oracle hard nofile 65536

oracle soft nproc 16384

oracle hard nproc 16384

oracle soft stack 10240

oracle hard stack 32768

oracle soft memlock 3145728

oracle hard memlock 3145728

grid soft nofile 1024

grid hard nofile 65536

grid soft nproc 16384

grid hard nproc 16384

grid soft stack 10240

grid hard stack 32768

grid soft memlock 3145728

grid hard memlock 3145728

**4.4 Required Packages**

For Oracle Linux 8 or RHEL 8:

dnf install -y oracle-database-preinstall-19c

dnf install -y bc

dnf install -y binutils

dnf install -y compat-libcap1

dnf install -y compat-libstdc++-33

dnf install -y elfutils-libelf

dnf install -y elfutils-libelf-devel

dnf install -y fontconfig-devel

dnf install -y glibc

dnf install -y glibc-devel

dnf install -y ksh

dnf install -y libaio

dnf install -y libaio-devel

dnf install -y libX11

dnf install -y libXau

dnf install -y libXi

dnf install -y libXtst

dnf install -y libXrender

dnf install -y libXrender-devel

dnf install -y libgcc

dnf install -y librdmacm-devel

dnf install -y libstdc++

dnf install -y libstdc++-devel

dnf install -y libxcb

dnf install -y make

dnf install -y net-tools

dnf install -y nfs-utils

dnf install -y smartmontools

dnf install -y sysstat

dnf install -y unixODBC

dnf install -y unixODBC-devel

dnf install -y chrony

**5. Storage Configuration Requirements**

**5.1 ASM Disk Groups**

| **Disk Group** | **Redundancy** | **Minimum Size** | **Purpose** | **Allocation Units** | **Content** |
| --- | --- | --- | --- | --- | --- |
| +DATA | Normal | 1.2TB | Primary data storage | 4MB | Database data files, control files |
| +REDO | Normal | 200GB | Redo logs | 1MB | Online redo logs, multiplexed copies |
| +FRA | Normal | 600GB | Fast recovery area | 16MB | Archive logs, flashback logs, backup pieces |

**5.2 ASM Disk Configuration Parameters**

| **Parameter** | **Value** | **Description** |
| --- | --- | --- |
| asm\_power\_limit | 6 | Maximum power for rebalance operations |
| asm\_diskstring | '/dev/oracleasm/disks/\*' | ASM disk discovery string |
| asm\_diskgroups | 'DATA,REDO,FRA' | Disk groups to mount automatically |
| disk\_repair\_time | 3.6h | Time limit for disk repair |
| redundancy | NORMAL | Default redundancy for disk groups |
| au\_size | See disk group details | Allocation unit size for each disk group |

**5.3 Storage Performance Requirements**

| **Metric** | **Requirement** | **Description** |
| --- | --- | --- |
| Read IOPS | 20,000 | Required read operations per second |
| Write IOPS | 8,000 | Required write operations per second |
| Read Throughput | 400 MB/s | Required read bandwidth |
| Write Throughput | 200 MB/s | Required write bandwidth |
| Latency | <1ms | Maximum acceptable storage latency |

**6. Network Configuration**

**6.1 Network Interface Requirements**

| **Network Type** | **Minimum Speed** | **Redundancy** | **Purpose** |
| --- | --- | --- | --- |
| Public Network | 1Gbps | Required | Client connections, application traffic |
| Private Interconnect | 10Gbps | Required | RAC node communication, cache fusion |
| Storage Network | 10Gbps | Required | ASM disk access if using IP-based storage |

**6.2 Network Configuration Parameters**

| **Parameter** | **Value** | **Description** |
| --- | --- | --- |
| SCAN Name | dcms-scan.bank.local | Single Client Access Name for the cluster |
| SCAN IP Addresses | 3 addresses on public subnet | Round-robin DNS or GNS configuration |
| SCAN Listener Ports | 1689 | Default Oracle listener port |
| Node Virtual IPs | 1 VIP per node | For client connection failover |
| Hostname Resolution | DNS or /etc/hosts | Must resolve all public, private, VIP, and SCAN names |
| MTU Size | 9000 (jumbo frames) | For private interconnect |

**6.3 Required Open Ports**

| **Service** | **Port(s)** | **Protocol** | **Purpose** |
| --- | --- | --- | --- |
| Oracle Listener | 1689 | TCP | Database connection |
| SCAN Listener | 1689 | TCP | Client access to the cluster |
| Oracle Enterprise Manager | 5500 | TCP | Database management |
| Cluster Manager | 8088 | TCP | Cluster management |
| GNS (Grid Naming Service) | 53 | TCP/UDP | Name resolution (if using GNS) |
| HAIP (High Availability IP) | 42424 | UDP | High Availability communications |
| Oracle Clusterware | 6200-6300 | TCP/UDP | Cluster node communications |

**7. Database Instance Configuration**

**7.1 Memory Configuration**

| **Parameter** | **Value** | **Description** |
| --- | --- | --- |
| memory\_target | 0 | Disable Automatic Memory Management |
| sga\_target | 28GB | Total SGA size |
| sga\_max\_size | 28GB | Maximum SGA size |
| pga\_aggregate\_target | 12GB | Target size for PGA |
| shared\_pool\_size | 8GB | Size of shared pool |
| db\_cache\_size | 16GB | Size of buffer cache |
| large\_pool\_size | 1GB | Size of large pool |
| java\_pool\_size | 512MB | Size of Java pool |
| streams\_pool\_size | 512MB | Size of streams pool |
| result\_cache\_max\_size | 1GB | Size of result cache |

**7.2 Storage Configuration**

| **Parameter** | **Value** | **Description** |
| --- | --- | --- |
| db\_create\_file\_dest | +DATA | Default location for datafiles |
| db\_create\_online\_log\_dest\_1 | +REDO | First destination for online logs |
| db\_create\_online\_log\_dest\_2 | +REDO | Second destination for online logs |
| db\_recovery\_file\_dest | +FRA | Location for recovery files |
| db\_recovery\_file\_dest\_size | 500GB | Maximum size for recovery area |
| db\_block\_size | 8KB | Database block size |
| db\_files | 1000 | Maximum number of datafiles |
| db\_writer\_processes | 4 | Database writer processes |
| log\_buffer | 128MB | Redo log buffer size |

**7.3 Process and Session Configuration**

| **Parameter** | **Value** | **Description** |
| --- | --- | --- |
| processes | 600 | Maximum number of OS processes |
| sessions | 660 | Maximum number of sessions |
| transactions | 726 | Maximum number of transactions |
| open\_cursors | 1000 | Maximum number of open cursors per session |
| max\_dispatchers | 5 | Maximum number of dispatcher processes |
| max\_shared\_servers | 20 | Maximum number of shared server processes |
| job\_queue\_processes | 20 | Maximum number of job queue processes |
| aq\_tm\_processes | 2 | Advanced Queuing time manager processes |

**7.4 Performance Parameters**

| **Parameter** | **Value** | **Description** |
| --- | --- | --- |
| db\_block\_checking | MEDIUM | Level of block checking |
| db\_block\_checksum | FULL | Level of block checksum checking |
| optimizer\_mode | FIRST\_ROWS | Optimizer mode |
| optimizer\_adaptive\_features | TRUE | Enable adaptive optimization features |
| parallel\_max\_servers | 24 | Maximum parallel query servers |
| parallel\_min\_servers | 6 | Minimum parallel query servers |
| parallel\_degree\_policy | LIMITED | Parallel degree policy |
| fast\_start\_mttr\_target | 60 | Maximum time for instance recovery (seconds) |
| filesystemio\_options | SETALL | I/O options for file system access |
| disk\_asynch\_io | TRUE | Enable asynchronous I/O |

**7.5 Security Parameters**

| **Parameter** | **Value** | **Description** |
| --- | --- | --- |
| audit\_trail | DB,EXTENDED | Enable database auditing |
| audit\_sys\_operations | TRUE | Audit SYS user operations |
| sec\_case\_sensitive\_logon | TRUE | Enable case-sensitive passwords |
| sec\_max\_failed\_login\_attempts | 3 | Maximum failed login attempts |
| sec\_return\_server\_release\_banner | FALSE | Hide server version in error messages |
| resource\_limit | TRUE | Enable resource limits |
| remote\_login\_passwordfile | EXCLUSIVE | Password file type |
| os\_authent\_prefix | '' | Prefix for OS authenticated users |

**8. Transparent Data Encryption (TDE) Configuration**

**8.1 TDE Setup Requirements**

| **Component** | **Requirement** | **Description** |
| --- | --- | --- |
| Keystore Location | /etc/oracle/wallet/$ORACLE\_SID | Location for TDE keystore |
| Keystore Type | Password-based | Type of keystore |
| Master Key | AES-256 | Encryption algorithm for master key |
| Auto-login Wallet | Optional | For automated database startup |
| Encrypted Tablespaces | All application tablespaces | Tablespaces to be encrypted |
| sqlnet.ora Configuration | Required | Define encryption wallet location |

**8.2 TDE Configuration Steps**

-- Configure sqlnet.ora

-- Add to $ORACLE\_HOME/network/admin/sqlnet.ora

ENCRYPTION\_WALLET\_LOCATION =

(SOURCE =

(METHOD = FILE)

(METHOD\_DATA =

(DIRECTORY = /etc/oracle/wallet/DCMS)

)

)

-- Create TDE Keystore

ADMINISTER KEY MANAGEMENT CREATE KEYSTORE '/etc/oracle/wallet/DCMS' IDENTIFIED BY "strong\_password";

-- Open the keystore

ADMINISTER KEY MANAGEMENT SET KEYSTORE OPEN IDENTIFIED BY "strong\_password";

-- Create master encryption key

ADMINISTER KEY MANAGEMENT SET KEY IDENTIFIED BY "strong\_password" WITH BACKUP;

-- Set tablespace encryption as default

ALTER SYSTEM SET ENCRYPT\_NEW\_TABLESPACES = ALWAYS SCOPE=BOTH;

**8.3 Key Rotation Policy**

| **Policy** | **Value** | **Description** |
| --- | --- | --- |
| Master Key Rotation | Every 12 months | Scheduled rotation of the master encryption key |
| Key Rotation Procedure | Documented | Established procedure for key rotation |
| Key Backup Strategy | Required | Regular backup of encryption keys |
| Key Recovery Plan | Required | Documented process for key recovery |

**9. Connection Pool Configuration**

**9.1 Connection Pool Parameters for Microservices**

| **Parameter** | **Value** | **Description** |
| --- | --- | --- |
| initialSize | 10 | Initial size of the connection pool |
| minIdle | 10 | Minimum number of idle connections |
| maxActive | 75 | Maximum number of active connections |
| maxIdle | 25 | Maximum number of idle connections |
| maxWait | 30000 | Maximum wait time in milliseconds |
| validationQuery | SELECT 1 FROM DUAL | Query to validate connections |
| testOnBorrow | true | Test connections when borrowed |
| testOnReturn | false | Test connections when returned |
| testWhileIdle | true | Test idle connections |
| timeBetweenEvictionRunsMillis | 60000 | Time between eviction runs |
| removeAbandoned | true | Remove abandoned connections |
| removeAbandonedTimeout | 60 | Timeout for abandoned connections |

**9.2 JDBC URL Configuration**

jdbc:oracle:thin:@(DESCRIPTION=

(CONNECT\_TIMEOUT=10)

(RETRY\_COUNT=3)

(TRANSPORT\_CONNECT\_TIMEOUT=3)

(ADDRESS\_LIST=

(LOAD\_BALANCE=ON)

(FAILOVER=ON)

(ADDRESS=(PROTOCOL=TCP)(HOST=dcms-scan.bank.local)(PORT=1689))

)

(CONNECT\_DATA=(SERVICE\_NAME=dcms\_svc))

)

**9.3 Connection Pool Properties**

# Common connection pool properties for microservices

oracle.jdbc.fanEnabled=true

oracle.jdbc.ReadTimeout=30000

oracle.jdbc.FastConnectionFailoverEnabled=true

oracle.jdbc.implicitStatementCacheSize=50

oracle.net.CONNECT\_TIMEOUT=10000

oracle.net.RETRY\_COUNT=3

oracle.net.RETRY\_DELAY=3000

**10. Oracle RAC Services Configuration**

**10.1 Service Definition**

| **Service Name** | **Preferred Instances** | **Available Instances** | **TAF Policy** | **Connection Load Balancing Goal** | **Runtime Load Balancing Goal** |
| --- | --- | --- | --- | --- | --- |
| dcms\_oltp\_svc | node1 | node2,node3 | BASIC | SHORT | SERVICE\_TIME |
| dcms\_batch\_svc | node2 | node1,node3 | NONE | LONG | THROUGHPUT |
| dcms\_admin\_svc | node3 | node1,node2 | BASIC | LONG | SERVICE\_TIME |

**10.2 Service Creation Commands**

srvctl add service -db dcms -service dcms\_oltp\_svc -preferred dcms1 -available "dcms2,dcms3" -role PRIMARY -policy AUTOMATIC -failovertype SELECT -failovermethod BASIC -failoverretry 30 -failoverdelay 5 -notification TRUE -clbgoal SHORT -rlbgoal SERVICE\_TIME -drain\_timeout 60 -stopoption IMMEDIATE

srvctl add service -db dcms -service dcms\_batch\_svc -preferred dcms2 -available "dcms1,dcms3" -role PRIMARY -policy AUTOMATIC -failovertype SESSION -failovermethod BASIC -failoverretry 30 -failoverdelay 10 -notification TRUE -clbgoal LONG -rlbgoal THROUGHPUT -drain\_timeout 120 -stopoption IMMEDIATE

srvctl add service -db dcms -service dcms\_admin\_svc -preferred dcms3 -available "dcms1,dcms2" -role PRIMARY -policy AUTOMATIC -failovertype SELECT -failovermethod BASIC -failoverretry 30 -failoverdelay 5 -notification TRUE -clbgoal LONG -rlbgoal SERVICE\_TIME -drain\_timeout 30 -stopoption IMMEDIATE

**11. Tablespace Configuration**

**11.1 Tablespace Sizing**

| **Tablespace Name** | **Purpose** | **Initial Size** | **Autoextend** | **Max Size** | **Encryption** | **Compression** |
| --- | --- | --- | --- | --- | --- | --- |
| SYSTEM | System data | 2GB | Yes | 4GB | No | No |
| SYSAUX | System auxiliary data | 4GB | Yes | 8GB | No | No |
| UNDOTBS1 | Undo for instance 1 | 8GB | Yes | 16GB | No | No |
| UNDOTBS2 | Undo for instance 2 | 8GB | Yes | 16GB | No | No |
| UNDOTBS3 | Undo for instance 3 | 8GB | Yes | 16GB | No | No |
| TEMP | Temporary data | 8GB | Yes | 16GB | No | No |
| DCMS\_DATA | DCMS data files | 50GB | Yes | 1.2TB | Yes | No |
| DCMS\_IDX | DCMS indexes | 25GB | Yes | 800GB | Yes | No |

**11.2 Tablespace Creation Scripts**

-- Create DCMS\_DATA tablespace

CREATE TABLESPACE DCMS\_DATA

DATAFILE '+DATA'

SIZE 50G

AUTOEXTEND ON

NEXT 1G

MAXSIZE 200G

EXTENT MANAGEMENT LOCAL

SEGMENT SPACE MANAGEMENT AUTO

ENCRYPTION USING 'AES256'

DEFAULT STORAGE(ENCRYPT);

-- Create DCMS\_IDX tablespace

CREATE TABLESPACE DCMS\_IDX

DATAFILE '+DATA'

SIZE 25G

AUTOEXTEND ON

NEXT 1G

MAXSIZE 100G

EXTENT MANAGEMENT LOCAL

SEGMENT SPACE MANAGEMENT AUTO

ENCRYPTION USING 'AES256'

DEFAULT STORAGE(ENCRYPT);

**12. Database User Configuration**

**12.1 User Accounts**

| **User Account** | **Purpose** | **Default Tablespace** | **Temporary Tablespace** | **Authentication** | **Profile** |
| --- | --- | --- | --- | --- | --- |
| DCMS\_OWNER | Schema owner | DCMS\_DATA | TEMP | Password + TDE | DCMS\_ADMIN\_PROFILE |
| DCMS\_APP | Application user | DCMS\_DATA | TEMP | Password + TDE | DCMS\_APP\_PROFILE |
| DCMS\_READ | Read-only user | DCMS\_DATA | TEMP | Password + TDE | DCMS\_READ\_PROFILE |
| DCMS\_ADMIN | Administrative user | DCMS\_DATA | TEMP | Password + TDE | DCMS\_ADMIN\_PROFILE |
| DCMS\_AUDIT | Audit collection user | DCMS\_DATA | TEMP | Password + TDE | DCMS\_AUDIT\_PROFILE |

**12.2 User Creation Scripts**

-- Create profiles

CREATE PROFILE DCMS\_ADMIN\_PROFILE LIMIT

FAILED\_LOGIN\_ATTEMPTS 3

PASSWORD\_LIFE\_TIME 60

PASSWORD\_REUSE\_TIME UNLIMITED

PASSWORD\_REUSE\_MAX UNLIMITED

PASSWORD\_LOCK\_TIME 1/24

PASSWORD\_GRACE\_TIME 10

PASSWORD\_VERIFY\_FUNCTION ora12c\_verify\_function;

CREATE PROFILE DCMS\_APP\_PROFILE LIMIT

FAILED\_LOGIN\_ATTEMPTS 5

PASSWORD\_LIFE\_TIME 60

PASSWORD\_REUSE\_TIME UNLIMITED

PASSWORD\_REUSE\_MAX UNLIMITED

PASSWORD\_LOCK\_TIME 1/24

PASSWORD\_GRACE\_TIME 10

PASSWORD\_VERIFY\_FUNCTION ora12c\_verify\_function

IDLE\_TIME 60

CONNECT\_TIME 240;

CREATE PROFILE DCMS\_READ\_PROFILE LIMIT

FAILED\_LOGIN\_ATTEMPTS 5

PASSWORD\_LIFE\_TIME 60

PASSWORD\_REUSE\_TIME UNLIMITED

PASSWORD\_REUSE\_MAX UNLIMITED

PASSWORD\_LOCK\_TIME 1/24

PASSWORD\_GRACE\_TIME 10

PASSWORD\_VERIFY\_FUNCTION ora12c\_verify\_function

IDLE\_TIME 120

CONNECT\_TIME 480;

-- Create users

CREATE USER DCMS\_OWNER IDENTIFIED BY "strong\_password"

DEFAULT TABLESPACE DCMS\_DATA

TEMPORARY TABLESPACE TEMP

QUOTA UNLIMITED ON DCMS\_DATA

QUOTA UNLIMITED ON DCMS\_IDX

PROFILE DCMS\_ADMIN\_PROFILE

ACCOUNT UNLOCK;

CREATE USER DCMS\_APP IDENTIFIED BY "strong\_password"

DEFAULT TABLESPACE DCMS\_DATA

TEMPORARY TABLESPACE TEMP

QUOTA 20G ON DCMS\_DATA

QUOTA 10G ON DCMS\_IDX

PROFILE DCMS\_APP\_PROFILE

ACCOUNT UNLOCK;

CREATE USER DCMS\_READ IDENTIFIED BY "strong\_password"

DEFAULT TABLESPACE DCMS\_DATA

TEMPORARY TABLESPACE TEMP

PROFILE DCMS\_READ\_PROFILE

ACCOUNT UNLOCK;

CREATE USER DCMS\_ADMIN IDENTIFIED BY "strong\_password"

DEFAULT TABLESPACE DCMS\_DATA

TEMPORARY TABLESPACE TEMP

QUOTA UNLIMITED ON DCMS\_DATA

QUOTA UNLIMITED ON DCMS\_IDX

PROFILE DCMS\_ADMIN\_PROFILE

ACCOUNT UNLOCK;

CREATE USER DCMS\_AUDIT IDENTIFIED BY "strong\_password"

DEFAULT TABLESPACE DCMS\_DATA

TEMPORARY TABLESPACE TEMP

QUOTA 50G ON DCMS\_DATA

PROFILE DCMS\_ADMIN\_PROFILE

ACCOUNT UNLOCK;

**12.3 Role Configuration**

-- Create roles

CREATE ROLE DCMS\_CONNECT\_ROLE;

CREATE ROLE DCMS\_READONLY\_ROLE;

CREATE ROLE DCMS\_READWRITE\_ROLE;

CREATE ROLE DCMS\_ADMIN\_ROLE;

-- Grant system privileges to roles

GRANT CREATE SESSION TO DCMS\_CONNECT\_ROLE;

GRANT DCMS\_CONNECT\_ROLE TO DCMS\_READONLY\_ROLE;

GRANT SELECT ANY TABLE TO DCMS\_READONLY\_ROLE;

GRANT DCMS\_READONLY\_ROLE TO DCMS\_READWRITE\_ROLE;

GRANT INSERT, UPDATE, DELETE ANY TABLE TO DCMS\_READWRITE\_ROLE;

GRANT DCMS\_READWRITE\_ROLE TO DCMS\_ADMIN\_ROLE;

GRANT CREATE ANY TABLE, ALTER ANY TABLE, DROP ANY TABLE TO DCMS\_ADMIN\_ROLE;

GRANT CREATE ANY INDEX, ALTER ANY INDEX, DROP ANY INDEX TO DCMS\_ADMIN\_ROLE;

GRANT CREATE ANY PROCEDURE, ALTER ANY PROCEDURE, DROP ANY PROCEDURE TO DCMS\_ADMIN\_ROLE;

GRANT CREATE ANY TRIGGER, ALTER ANY TRIGGER, DROP ANY TRIGGER TO DCMS\_ADMIN\_ROLE;

GRANT CREATE ANY VIEW, ALTER ANY VIEW, DROP ANY VIEW TO DCMS\_ADMIN\_ROLE;

GRANT SELECT ANY DICTIONARY TO DCMS\_ADMIN\_ROLE;

-- Grant roles to users

GRANT DCMS\_ADMIN\_ROLE TO DCMS\_OWNER;

GRANT DCMS\_READWRITE\_ROLE TO DCMS\_APP;

GRANT DCMS\_READONLY\_ROLE TO DCMS\_READ;

GRANT DCMS\_ADMIN\_ROLE TO DCMS\_ADMIN;

GRANT SELECT ANY DICTIONARY TO DCMS\_AUDIT;

**13. Backup and Recovery Configuration**

**13.1 RMAN Configuration**

| **Parameter** | **Value** | **Description** |
| --- | --- | --- |
| Backup Strategy | Incremental Level 0 (Weekly), Level 1 (Daily) | Backup schedule |
| Archive Log Backup | Every 30 minutes | Frequency of archive log backups |
| Retention Policy | Recovery window of 7 days | Backup retention period |
| Backup Compression | MEDIUM | Level of backup compression |
| Backup Destination | +FRA | Location for backups |
| Control File Autobackup | Enabled | Automatic backup of control file |
| Catalog Database | Optional | RMAN catalog usage |

**13.2 RMAN Configuration Commands**

-- Configure RMAN

CONFIGURE RETENTION POLICY TO RECOVERY WINDOW OF 7 DAYS;

CONFIGURE DEFAULT DEVICE TYPE TO DISK;

CONFIGURE CONTROLFILE AUTOBACKUP ON;

CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK TO '+FRA/DCMS/AUTOBACKUP/%F';

CONFIGURE DEVICE TYPE DISK PARALLELISM 4;

CONFIGURE DATAFILE BACKUP COPIES FOR DEVICE TYPE DISK TO 1;

CONFIGURE ARCHIVELOG BACKUP COPIES FOR DEVICE TYPE DISK TO 1;

CONFIGURE COMPRESSION ALGORITHM 'MEDIUM';

CONFIGURE ENCRYPTION FOR DATABASE ON;

CONFIGURE ENCRYPTION ALGORITHM 'AES256';

**14. Step-by-Step Implementation Guide**

**14.1 Pre-Installation Tasks**

**14.1.1 Verify Hardware Requirements**

1. Confirm 3 VMs with 8 vCPUs and 48GB RAM each are provisioned
2. Verify storage of 2TB is available for ASM
3. Confirm 10Gbps network connectivity between RAC nodes

**14.1.2 Install and Configure Operating System**

On each node:

# Install Oracle Linux 8.x or RHEL 8.x

# Configure hostname and IP addresses

hostnamectl set-hostname DCMS1.bank.local # Change for each node

# Set static IP addresses for all network interfaces

# Install required packages

dnf install -y oracle-database-preinstall-19c

dnf install -y ksh

dnf install -y libaio

dnf install -y libaio-devel

dnf install -y libXrender

dnf install -y libX11

dnf install -y net-tools

dnf install -y nfs-utils

dnf install -y sysstat

dnf install -y smartmontools

dnf install -y chrony

dnf install -y unixODBC

dnf install -y xorg-x11-utils

# Configure kernel parameters

cat > /etc/sysctl.d/97-oracle-database-sysctl.conf << EOF

fs.file-max = 6815744

kernel.sem = 250 32000 100 128

kernel.shmmni = 4096

kernel.shmall = 1073741824

kernel.shmmax = 4398046511104

kernel.panic\_on\_oops = 1

net.core.rmem\_default = 262144

net.core.rmem\_max = 4194304

net.core.wmem\_default = 262144

net.core.wmem\_max = 1048576

net.ipv4.conf.all.rp\_filter = 2

net.ipv4.conf.default.rp\_filter = 2

fs.aio-max-nr = 1048576

net.ipv4.ip\_local\_port\_range = 9000 65500

vm.min\_free\_kbytes = 524288

vm.swappiness = 10

vm.dirty\_background\_ratio = 3

vm.dirty\_ratio = 80

vm.dirty\_expire\_centisecs = 500

vm.dirty\_writeback\_centisecs = 100

EOF

sysctl -p /etc/sysctl.d/97-oracle-database-sysctl.conf

# Disable Transparent HugePages

echo "echo never > /sys/kernel/mm/transparent\_hugepage/enabled" >> /etc/rc.local

echo "echo never > /sys/kernel/mm/transparent\_hugepage/defrag" >> /etc/rc.local

chmod +x /etc/rc.local

echo never > /sys/kernel/mm/transparent\_hugepage/enabled

echo never > /sys/kernel/mm/transparent\_hugepage/defrag

# Configure user limits for oracle and grid

cat > /etc/security/limits.d/oracle-database-limits.conf << EOF

oracle soft nofile 1024

oracle hard nofile 65536

oracle soft nproc 16384

oracle hard nproc 16384

oracle soft stack 10240

oracle hard stack 32768

oracle soft memlock 3145728

oracle hard memlock 3145728

grid soft nofile 1024

grid hard nofile 65536

grid soft nproc 16384

grid hard nproc 16384

grid soft stack 10240

grid hard stack 32768

grid soft memlock 3145728

grid hard memlock 3145728

EOF

# Configure time synchronization with chronyd

systemctl enable chronyd

systemctl start chronyd

# Configure firewall for Oracle Grid Infrastructure and RAC

firewall-cmd --permanent --add-port=1689/tcp

firewall-cmd --permanent --add-port=5500/tcp

firewall-cmd --permanent --add-port=6200-6300/tcp

firewall-cmd --permanent --add-port=6200-6300/udp

firewall-cmd --permanent --add-port=42424/udp

firewall-cmd --permanent --add-service=ssh

firewall-cmd --reload

# Set SELinux to permissive mode

setenforce 0

sed -i 's/^SELINUX=enforcing/SELINUX=permissive/' /etc/selinux/config

# Create necessary groups for Oracle

groupadd -g 54321 oinstall

groupadd -g 54322 dba

groupadd -g 54323 oper

groupadd -g 54324 backupdba

groupadd -g 54325 dgdba

groupadd -g 54326 kmdba

groupadd -g 54327 asmdba

groupadd -g 54328 asmoper

groupadd -g 54329 asmadmin

groupadd -g 54330 racdba

# Create oracle and grid users

useradd -u 54321 -g oinstall -G dba,oper,backupdba,dgdba,kmdba,asmdba,racdba oracle

useradd -u 54322 -g oinstall -G dba,asmadmin,asmdba,asmoper,racdba grid

# Set passwords for oracle and grid users

passwd oracle

passwd grid

# Create Oracle directories

mkdir -p /u01/app/19c/grid

mkdir -p /u01/app/grid

mkdir -p /u01/app/oracle

mkdir -p /u01/app/oracle/product/19c/dbhome\_1

mkdir -p /u01/app/oraInventory

chown -R grid:oinstall /u01/app/19c/grid

chown -R grid:oinstall /u01/app/grid

chown -R oracle:oinstall /u01/app/oracle

chown -R grid:oinstall /u01/app/oraInventory

chmod -R 775 /u01

**14.1.3 Configure SSH Equivalence Between Nodes**

# On first node as grid user

su - grid

mkdir -p ~/.ssh

chmod 700 ~/.ssh

ssh-keygen -t rsa -b 2048 -f ~/.ssh/id\_rsa -N ""

cat ~/.ssh/id\_rsa.pub >> ~/.ssh/authorized\_keys

chmod 600 ~/.ssh/authorized\_keys

# Copy SSH keys to other nodes and configure passwordless SSH

for node in DCMS2.bank.local DCMS3.bank.local; do

ssh-copy-id -i ~/.ssh/id\_rsa.pub grid@$node

done

# Test SSH connectivity

for node in DCMS1.bank.local DCMS2.bank.local DCMS3.bank.local; do

ssh grid@$node date

done

# Repeat the same for oracle user

exit

su - oracle

mkdir -p ~/.ssh

chmod 700 ~/.ssh

ssh-keygen -t rsa -b 2048 -f ~/.ssh/id\_rsa -N ""

cat ~/.ssh/id\_rsa.pub >> ~/.ssh/authorized\_keys

chmod 600 ~/.ssh/authorized\_keys

# Copy SSH keys to other nodes

for node in DCMS2.bank.local DCMS3.bank.local; do

ssh-copy-id -i ~/.ssh/id\_rsa.pub oracle@$node

done

# Test SSH connectivity

for node in DCMS1.bank.local DCMS2.bank.local DCMS3.bank.local; do

ssh oracle@$node date

done

**14.1.4 Configure ASM Disk Devices**

# On each node as root user

# Create ASM disks using ASMLib or UDEV

# Option 1: Using ASMLib (if installed)

/usr/sbin/oracleasm configure -i

/usr/sbin/oracleasm init

/usr/sbin/oracleasm createdisk DATA01 /dev/sdb1

/usr/sbin/oracleasm createdisk DATA02 /dev/sdc1

/usr/sbin/oracleasm createdisk DATA03 /dev/sdd1

/usr/sbin/oracleasm createdisk REDO01 /dev/sde1

/usr/sbin/oracleasm createdisk REDO02 /dev/sdf1

/usr/sbin/oracleasm createdisk FRA01 /dev/sdg1

/usr/sbin/oracleasm createdisk FRA02 /dev/sdh1

/usr/sbin/oracleasm listdisks

# Option 2: Using UDEV rules

cat > /etc/udev/rules.d/99-oracle-asmdevices.rules << EOF

KERNEL=="sdb1", SYMLINK+="oracleasm/disks/DATA01", OWNER="grid", GROUP="asmadmin", MODE="0660"

KERNEL=="sdc1", SYMLINK+="oracleasm/disks/DATA02", OWNER="grid", GROUP="asmadmin", MODE="0660"

KERNEL=="sdd1", SYMLINK+="oracleasm/disks/DATA03", OWNER="grid", GROUP="asmadmin", MODE="0660"

KERNEL=="sde1", SYMLINK+="oracleasm/disks/REDO01", OWNER="grid", GROUP="asmadmin", MODE="0660"

KERNEL=="sdf1", SYMLINK+="oracleasm/disks/REDO02", OWNER="grid", GROUP="asmadmin", MODE="0660"

KERNEL=="sdg1", SYMLINK+="oracleasm/disks/FRA01", OWNER="grid", GROUP="asmadmin", MODE="0660"

KERNEL=="sdh1", SYMLINK+="oracleasm/disks/FRA02", OWNER="grid", GROUP="asmadmin", MODE="0660"

EOF

udevadm control --reload-rules

udevadm trigger

**14.2 Install Oracle Grid Infrastructure**

**14.2.1 Prepare Grid Infrastructure Installation Response File**

Create a response file grid\_install.rsp with the following content:

oracle.install.responseFileVersion=/oracle/install/rspfmt\_crsinstall\_response\_schema\_v19.0.0

INVENTORY\_LOCATION=/u01/app/oraInventory

oracle.install.option=CRS\_CONFIG

ORACLE\_BASE=/u01/app/grid

oracle.install.asm.OSDBA=asmdba

oracle.install.asm.OSOPER=asmoper

oracle.install.asm.OSASM=asmadmin

oracle.install.crs.config.scanType=LOCAL\_SCAN

oracle.install.crs.config.gpnp.scanName=DCMS-scan.bank.local

oracle.install.crs.config.gpnp.scanPort=1689

oracle.install.crs.config.ClusterConfiguration=STANDALONE

oracle.install.crs.config.configureAsExtendedCluster=false

oracle.install.crs.config.clusterName=DCMS-cluster

oracle.install.crs.config.gpnp.configureGNS=false

oracle.install.crs.config.autoConfigureClusterNodeVIP=true

oracle.install.crs.config.clusterNodes=DCMS1.bank.local:DCMS1-vip.bank.local,DCMS2.bank.local:DCMS2-vip.bank.local,DCMS3.bank.local:DCMS3-vip.bank.local

oracle.install.crs.config.networkInterfaceList=eth0:10.0.0.0:1,eth1:10.0.1.0:2

oracle.install.crs.configureGIMR=false

oracle.install.asm.configureGIMRDataDG=false

oracle.install.crs.config.storageOption=ASM\_STORAGE

oracle.install.crs.config.useIPMI=false

oracle.install.asm.diskGroup.name=DATA

oracle.install.asm.diskGroup.redundancy=NORMAL

oracle.install.asm.diskGroup.AUSize=4

oracle.install.asm.diskGroup.disks=/dev/oracleasm/disks/DATA01,/dev/oracleasm/disks/DATA02,/dev/oracleasm/disks/DATA03

oracle.install.asm.diskGroup.diskDiscoveryString=/dev/oracleasm/disks/\*

oracle.install.asm.monitorPassword=password

oracle.install.asm.SYSASMPassword=password

oracle.install.asm.configureAFD=false

oracle.install.crs.rootconfig.executeRootScript=false

**14.2.2 Run Oracle Grid Infrastructure Installer**

# As grid user on the first node

cd /path/to/grid/software

./gridSetup.sh -silent -responseFile /path/to/grid\_install.rsp

**14.2.3 Run Root Scripts**

After the installation completes, run the root scripts as prompted:

# On the first node as root

/u01/app/oraInventory/orainstRoot.sh

/u01/app/19c/grid/root.sh

# On the other nodes as root (after first node completes)

/u01/app/oraInventory/orainstRoot.sh

/u01/app/19c/grid/root.sh

**14.2.4 Configure ASM Disk Groups**

After Grid Infrastructure installation, create the REDO and FRA disk groups:

# As grid user

sqlplus / as sysasm

-- Create REDO disk group

CREATE DISKGROUP REDO NORMAL REDUNDANCY

DISK

'/dev/oracleasm/disks/REDO01',

'/dev/oracleasm/disks/REDO02'

ATTRIBUTE

'compatible.asm' = '19.0.0',

'compatible.rdbms' = '19.0.0',

'au\_size' = '1M',

'content.type' = 'recovery';

-- Create FRA disk group

CREATE DISKGROUP FRA NORMAL REDUNDANCY

DISK

'/dev/oracleasm/disks/FRA01',

'/dev/oracleasm/disks/FRA02'

ATTRIBUTE

'compatible.asm' = '19.0.0',

'compatible.rdbms' = '19.0.0',

'au\_size' = '16M',

'content.type' = 'recovery';

exit;

**14.3 Install Oracle Database Software**

**14.3.1 Prepare Database Software Installation Response File**

Create a response file db\_install.rsp with the following content:

oracle.install.responseFileVersion=/oracle/install/rspfmt\_dbinstall\_response\_schema\_v19.0.0

oracle.install.option=INSTALL\_DB\_SWONLY

UNIX\_GROUP\_NAME=oinstall

INVENTORY\_LOCATION=/u01/app/oraInventory

ORACLE\_HOME=/u01/app/oracle/product/19c/dbhome\_1

ORACLE\_BASE=/u01/app/oracle

oracle.install.db.InstallEdition=EE

oracle.install.db.OSDBA\_GROUP=dba

oracle.install.db.OSOPER\_GROUP=oper

oracle.install.db.OSBACKUPDBA\_GROUP=backupdba

oracle.install.db.OSDGDBA\_GROUP=dgdba

oracle.install.db.OSKMDBA\_GROUP=kmdba

oracle.install.db.OSRACDBA\_GROUP=racdba

oracle.install.db.rootconfig.executeRootScript=false

**14.3.2 Run Oracle Database Software Installer**

# As oracle user on the first node

cd /path/to/database/software

./runInstaller -silent -responseFile /path/to/db\_install.rsp

**14.3.3 Run Root Script**

After the installation completes, run the root script as prompted:

# On each node as root

/u01/app/oracle/product/19c/dbhome\_1/root.sh

**14.4 Create and Configure Oracle Database**

**14.4.1 Prepare Database Creation Response File**

Create a response file dbca.rsp with the following content:

gdbName=DCMS

sid=DCMS

createAsContainerDatabase=false

templateName=General\_Purpose.dbc

sysPassword=password

systemPassword=password

emConfiguration=NONE

datafileDestination=+DATA

recoveryAreaDestination=+FRA

storageType=ASM

diskGroupName=+DATA

characterSet=AL32UTF8

nationalCharacterSet=AL16UTF16

listeners=LISTENER

databaseType=MULTIPURPOSE

automaticMemoryManagement=false

totalMemory=36864

**14.4.2 Create the Database Using DBCA**

# As oracle user on the first node

dbca -silent -createDatabase -responseFile /path/to/dbca.rsp

**14.5 Configure TDE for the Database**

# As oracle user

sqlplus / as sysdba

-- Set wallet location in sqlnet.ora

!mkdir -p /etc/oracle/wallet/DCMS

-- Create and configure wallet

ALTER SYSTEM SET ENCRYPTION\_WALLET\_LOCATION="(SOURCE=(METHOD=FILE)(METHOD\_DATA=(DIRECTORY=/etc/oracle/wallet/DCMS)))" SCOPE=BOTH;

-- Create wallet

ADMINISTER KEY MANAGEMENT CREATE KEYSTORE '/etc/oracle/wallet/DCMS' IDENTIFIED BY "strong\_password";

-- Open wallet

ADMINISTER KEY MANAGEMENT SET KEYSTORE OPEN IDENTIFIED BY "strong\_password";

-- Create master key

ADMINISTER KEY MANAGEMENT SET KEY IDENTIFIED BY "strong\_password" WITH BACKUP;

-- Set encryption as default for new tablespaces

ALTER SYSTEM SET ENCRYPT\_NEW\_TABLESPACES=ALWAYS SCOPE=BOTH;

exit;

**15. Oracle Database Parameters for High Transaction OLTP Workload**

The following parameters are specifically optimized for high transaction OLTP workloads with a target response time of 50ms or less:

**15.1 Memory and Buffer Cache Parameters**

| **Parameter** | **Value** | **Purpose** |
| --- | --- | --- |
| memory\_target | 0 | Disable AMM in favor of manual memory management |
| sga\_target | 28GB | Set overall SGA size |
| sga\_max\_size | 28GB | Maximum SGA size |
| pga\_aggregate\_target | 12GB | Target size for PGA |
| shared\_pool\_size | 8GB | Shared pool for SQL execution plans and shared cursors |
| db\_cache\_size | 16GB | Buffer cache size for data blocks |
| db\_keep\_cache\_size | 6GB | Keep buffer pool for frequently accessed objects |
| db\_recycle\_cache\_size | 2GB | Recycle buffer pool for infrequently accessed objects |
| result\_cache\_max\_size | 1GB | Result cache for frequently executed queries |
| shared\_pool\_reserved\_size | 2GB | Reserved area in shared pool for large objects |
| java\_pool\_size | 512MB | Java pool size |
| large\_pool\_size | 1GB | Large pool for RMAN and parallel operations |
| db\_flash\_cache\_size | 0 | Not using flash cache |
| use\_large\_pages | ONLY | Use HugePages for SGA memory allocation |

**15.2 Multi-block and Cache Parameters**

| **Parameter** | **Value** | **Purpose** |
| --- | --- | --- |
| db\_block\_size | 8192 | Database block size |
| db\_file\_multiblock\_read\_count | 128 | Maximum blocks read in one I/O |
| db\_cache\_advice | ON | Enable cache sizing advice |
| db\_16k\_cache\_size | 0 | No 16K buffer cache |
| oltp\_compression\_max\_level | 11 | Compression level for OLTP tables |
| session\_cached\_cursors | 2000 | Number of cursors to cache per session |
| open\_cursors | 1000 | Maximum cursors per session |
| cursor\_sharing | EXACT | Force exact cursor matching |

**15.3 Parallelism and Concurrency Parameters**

| **Parameter** | **Value** | **Purpose** |
| --- | --- | --- |
| parallel\_max\_servers | 24 | Maximum number of parallel query servers |
| parallel\_min\_servers | 6 | Minimum number of parallel query servers |
| parallel\_degree\_policy | LIMITED | Parallel degree policy for OLTP |
| parallel\_threads\_per\_cpu | 2 | Threads per CPU for parallel operations |
| parallel\_min\_time\_threshold | 10 | Minimum time threshold for auto parallelization |
| parallel\_server\_target | 16 | Target parallel servers per instance |
| transactions | 1000 | Maximum concurrent transactions |
| processes | 600 | Maximum operating system processes |
| sessions | 660 | Maximum sessions |
| max\_dispatchers | 5 | Maximum dispatcher processes |
| max\_shared\_servers | 20 | Maximum shared server processes |
| job\_queue\_processes | 20 | Job queue process for background tasks |

**15.4 Redo Log and I/O Parameters**

| **Parameter** | **Value** | **Purpose** |
| --- | --- | --- |
| log\_buffer | 128MB | Size of the redo log buffer |
| fast\_start\_mttr\_target | 30 | Target recovery time in seconds |
| db\_block\_checking | MEDIUM | Level of data block checking |
| db\_block\_checksum | FULL | Enable full block checksums |
| db\_lost\_write\_protect | TYPICAL | Detect and protect against lost writes |
| filesystemio\_options | SETALL | Optimize I/O options |
| disk\_asynch\_io | TRUE | Enable asynchronous I/O |
| db\_writer\_processes | 8 | Database writer processes |
| dbwr\_io\_slaves | 4 | I/O slave processes per DBWR |
| lgwr\_io\_slaves | 4 | I/O slave processes for LGWR |

**15.5 Optimizer Parameters for OLTP**

| **Parameter** | **Value** | **Purpose** |
| --- | --- | --- |
| optimizer\_mode | FIRST\_ROWS\_10 | Optimize for fast first N rows |
| optimizer\_index\_cost\_adj | 10 | Adjust cost of index access paths |
| optimizer\_index\_caching | 90 | Percentage of index cached in buffer pool |
| optimizer\_dynamic\_sampling | 2 | Dynamic sampling level |
| optimizer\_adaptive\_features | TRUE | Enable adaptive query optimization |
| optimizer\_adaptive\_plans | TRUE | Enable adaptive plans |
| optimizer\_adaptive\_statistics | FALSE | Disable adaptive statistics for OLTP |
| optimizer\_secure\_view\_merging | TRUE | Security for view merging |
| query\_rewrite\_enabled | TRUE | Enable query rewrite |
| statistics\_level | TYPICAL | Default statistics level |

**15.6 PL/SQL and Java Parameters**

| **Parameter** | **Value** | **Purpose** |
| --- | --- | --- |
| plsql\_code\_type | NATIVE | Enable native compilation of PL/SQL |
| plsql\_optimize\_level | 3 | Maximum PL/SQL optimization |
| plsql\_warnings | 'ENABLE:ALL' | Enable all PL/SQL warnings |
| java\_jit\_enabled | TRUE | Enable Java JIT compilation |

**15.7 Network Parameters**

| **Parameter** | **Value** | **Purpose** |
| --- | --- | --- |
| dispatchers | '(PROTOCOL=TCP)(DISPATCHERS=5)' | Configure dispatchers |
| local\_listener | 'LISTENER\_DCMS' | Local listener name |
| remote\_listener | 'DCMS-scan.bank.local:1689' | SCAN listener |
| service\_names | 'DCMS.bank.local,DCMS' | Service names |
| tcp.validnode\_checking | YES | Validate client IP addresses |
| tcp.invited\_nodes | '\*' | Allow connections from all nodes |

**15.8 Locking and Transaction Parameters**

| **Parameter** | **Value** | **Purpose** |
| --- | --- | --- |
| dml\_locks | 4000 | DML locks |
| enqueue\_resources | 3000 | Resources for enqueues |
| lock\_sga | FALSE | Don't lock SGA in memory |
| ddl\_lock\_timeout | 0 | DDL lock timeout |
| commit\_write | BATCH,NOWAIT | Optimize commit performance for OLTP |
| commit\_logging | BATCH | Batch commit logging for performance |
| commit\_wait | NOWAIT | Don't wait for redo to be written to disk |

**15.9 Sample init.ora Configuration for High Transaction OLTP**

# Database Identification

db\_name='DCMS'

db\_unique\_name='DCMS'

cluster\_database=TRUE

instance\_number=1 # Different for each node (1, 2, 3)

instance\_name='DCMS1' # Different for each node (DCMS1, DCMS2, DCMS3)

thread=1 # Different for each node (1, 2, 3)

undo\_tablespace='UNDOTBS1' # Different for each node (UNDOTBS1, UNDOTBS2, UNDOTBS3)

# Memory Parameters for OLTP

memory\_target=0

sga\_target=28G

sga\_max\_size=28G

pga\_aggregate\_target=12G

shared\_pool\_size=8G

db\_cache\_size=16G

db\_keep\_cache\_size=6G

db\_recycle\_cache\_size=2G

large\_pool\_size=1G

java\_pool\_size=512M

streams\_pool\_size=512M

shared\_pool\_reserved\_size=2G

result\_cache\_max\_size=1G

use\_large\_pages=ONLY

# ASM Storage Parameters

db\_create\_file\_dest='+DATA'

db\_create\_online\_log\_dest\_1='+REDO'

db\_create\_online\_log\_dest\_2='+REDO'

db\_recovery\_file\_dest='+FRA'

db\_recovery\_file\_dest\_size=500G

control\_files='+DATA/DCMS/controlfile/control01.ctl','+REDO/DCMS/controlfile/control02.ctl'

# OLTP Performance Parameters

db\_block\_size=8192

db\_file\_multiblock\_read\_count=128

session\_cached\_cursors=2000

open\_cursors=1000

cursor\_sharing=EXACT

db\_writer\_processes=8

log\_buffer=134217728 # 128MB

fast\_start\_mttr\_target=30

db\_block\_checking=MEDIUM

db\_block\_checksum=FULL

filesystemio\_options=SETALL

disk\_asynch\_io=TRUE

dbwr\_io\_slaves=4

lgwr\_io\_slaves=4

# Optimizer Parameters for OLTP

optimizer\_mode=FIRST\_ROWS

optimizer\_index\_cost\_adj=10

optimizer\_index\_caching=90

optimizer\_dynamic\_sampling=2

optimizer\_adaptive\_features=TRUE

optimizer\_adaptive\_plans=TRUE

optimizer\_adaptive\_statistics=FALSE

# Concurrency Parameters

processes=600

sessions=660

transactions=1000

dml\_locks=4000

enqueue\_resources=3000

commit\_write='BATCH,NOWAIT'

commit\_logging=BATCH

commit\_wait=NOWAIT

# Parallelism Parameters for OLTP

parallel\_max\_servers=24

parallel\_min\_servers=6

parallel\_degree\_policy=LIMITED

parallel\_threads\_per\_cpu=2

parallel\_server\_target=16

# Security Parameters

audit\_trail='DB,EXTENDED'

audit\_sys\_operations=TRUE

sec\_case\_sensitive\_logon=TRUE

sec\_max\_failed\_login\_attempts=3

sec\_return\_server\_release\_banner=FALSE

resource\_limit=TRUE

remote\_login\_passwordfile='EXCLUSIVE'

encryption\_wallet\_location="(SOURCE=(METHOD=FILE)(METHOD\_DATA=(DIRECTORY=/etc/oracle/wallet/DCMS)))"

# RAC Parameters

cluster\_database=TRUE

remote\_listener='DCMS-scan.bank.local:1689'

local\_listener='(ADDRESS=(PROTOCOL=TCP)(HOST=DCMS1-vip.bank.local)(PORT=1689))' # Adjust for each node

**15.10 Critical Performance Monitoring Metrics for OLTP Workload**

| **Metric** | **Target Value** | **Description** |
| --- | --- | --- |
| Average Active Sessions | < 70% of CPUs | Monitor workload against CPU capacity |
| Database CPU Usage | < 85% | Overall CPU usage by database |
| Buffer Cache Hit Ratio | > 98% | Percentage of logical reads satisfied from buffer cache |
| SQL Response Time | < 50ms | Average SQL execution time |
| Redo Log Switch Time | > 15 minutes | Frequency of redo log switches |
| Top 5 Wait Events | N/A | Identify top performance bottlenecks |
| Parse to Execute Ratio | < 20% | Ratio of parse calls to executions |
| Shared Pool Latch Hit % | > 99% | Shared pool latch efficiency |
| Buffer Busy Wait Time | < 1% of DB time | Contention for buffer blocks |
| Enqueue Wait Time | < 1% of DB time | Contention for enqueues |

**16. Implementation Checklist**

**16.1 Pre-Installation Checklist**

* [ ] Verify 3 VMs with 8 vCPUs and 48GB RAM each
* [ ] Verify 2TB storage for ASM
* [ ] Install RHEL/OEL 8.x with required packages
* [ ] Configure kernel parameters and user limits
* [ ] Disable Transparent HugePages
* [ ] Configure ASM disks
* [ ] Verify SSH connectivity between nodes

**16.2 Grid Infrastructure Installation Checklist**

* [ ] Create response file for Grid Infrastructure
* [ ] Run Cluster Verification Utility
* [ ] Install Grid Infrastructure software
* [ ] Run root scripts on all nodes
* [ ] Create ASM disk groups
* [ ] Verify ASM diskgroups are mounted

**16.3 Database Installation Checklist**

* [ ] Install Oracle Database software
* [ ] Create database using DBCA
* [ ] Apply performance parameters for OLTP workload
* [ ] Configure TDE
* [ ] Create tablespaces
* [ ] Create users and roles
* [ ] Configure database services
* [ ] Setup connection pooling

**16.4 Post-Installation Verification Checklist**

* [ ] Verify all instances are running
* [ ] Validate RAC services
* [ ] Test OLTP workload performance
* [ ] Verify sub-50ms response time
* [ ] Test failover scenarios
* [ ] Validate backup configurations
* [ ] Perform security hardening

This comprehensive document provides all the necessary steps and configurations to implement a 3-node Oracle RAC environment optimized for high transaction OLTP workloads with sub-50ms response times for the Debit Card Management Suite DCMS Software.