**BITS ZG628T: Dissertation Outline**

By

**SHASHI KUMAR**

**BITS-ID: 2016HT12761**

**Dissertation work carried out at**

***IBM INDIA PVT LTD, Kolkata***


**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE**

**PILANI (RAJASTHAN)**

April, 2018

**SAP-ERP PERFORMANCE AND STORAGE OPTIMIZATION WITH ORACLE 12C DATABASE**

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Submitted in partial fulfillment of M.Tech. Software Systems degree programme
Under the Supervision of Kaustuv k De, Kolkata, India


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# CERTIFICATE

This is to certify that the dissertation entitled SAP-ERP PERFORMANCE AND STORAGE OPTIMIZATION WITH ORACLE 12C DATABASE and submitted by Shashi Kumar having ID-NO 2016HT12761 for the partial fulfillment of the requirements of MTECH Software Systems degree of BITS, embodies the bonafide work done by him under my supervision.

_____
Signature of the Supervisor

Name & Designation & Organization & Location: _____

_____

Date:

Place:

# ABSTRACT


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**DISSERTATION TITLE** : SAP-ERP PERFORMANCE AND STORAGE OPTIMIZATION WITH ORACLE 12C DATABASE

**ABSTRACT** :


The main goal of this project is to provide and implement recommendations about performance and storage optimization tasks that have to be performed on a regular basis to ensure SAP-ERP system performance and it's stability.

The amount of data that enterprises are storing and managing is growing rapidly and this rapid growth of data presents challenges for database performance during daily activities.

This Performance problems occur during different Database activities and the cause cannot be limited to a single SQL Statement.

**The causes may be due to,**

A) Unbalanced Database Setup
B) Incorrect Database Parameter Settings
C) Application issues
D) Wrong Storage optimizations

The important part of this project is that, ORACLE as well as SAP recommendations has been used for DATABASE optimization. This makes the project completely compatible, reliable for SAP-ERP products like SAP BW, SAP ERP, SAP CRM or SAP XI or SAP solutions like SAP IS-U, SAP IS-Banking or SAP IS-Retail..


Broad Academic Area of Work : **Database Systems and Applications**

_____

**Signature of the Student**

**Name:** _____

**Date:**

**Place:**

_____

**Signature of the Supervisor**

**Name:** _____

**Date:**

**Place:**

# Acknowledgement

I take this opportunity to owe a great many thanks to people who helped and supported me during the accomplishment of this dissertation.
I would like to extend my gratitude and thanks to Mr. Kaustuv Kumar de the supervisor of this project for guiding and helping me out technically during all the phases of this project with attention and care. He has helped me collecting necessary requirements and channeled my effort to get in touch with correct end-users and take inputs from them.
He has taken all the necessary steps to go through the project and make necessary corrections as and when needed.
I express my deep sense of gratitude to Mr. Saurav Kumar the additional examiner of this project for his timely support and technical guidance.
He has been a great support while doing testing related to the implementation approach and making it more relevant to concepts.
Thanks and appreciation to the helpful people at TSE project, IBM Kolkata for their support.
I would like to thank BITS, Pilani for providing me this great opportunity to explore in new areas.

Shashi Kumar

Date:

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# 1. Introduction

## 1.1 CHALLENEGES

The amount of data that enterprises are storing and managing is growing rapidly and this rapid growth of data presents challenges for database performance. Performance problems occur during different Database activities and the cause cannot be limited to a single SQL Statement.

The causes may be due to,

A) Unbalanced Database Setup
B) Incorrect Database Parameter Settings
C) Application issues

After moving to 12c database in my current project we are facing new issues in day to day activities related to operational database and ERP application performance. We agreed to short out and implement the recommendations in a planned approach to attend these issues.

**Challenges are:**

A) Performance diagnostics and tuning: How to maintain production databases at their peak performance to maintain committed service levels.
B) Testing and test data management: How to reduce the risk of rolling out changes through testing and managing test data in database environments at lower costs.
C) Ongoing administration: How to automate day-to-day repetitive tasks to focus on more strategic requirements, such as security and business continuity.
D) Cloud consolidation and Exadata management: How to consolidate databases onto a common infrastructure to reduce data center costs and increase server efficiency.

## 1.2 SOLUTION

While there are other causes of performance problems in SAP-ERP (e.g. network performance, external RFC interfaces, SAP instance configuration, SAP sort, etc.), database performance are the most common and generally have the biggest impact.

Performance issues reported in a database can be classified in following four categories,

A) Persistent performance problems
B) Transient performance problems
C) Comparative performance problems
D) Real-Time performance problems

Now in this technical report, considered a process-based approach in four phases, where different goals are pursued via different processes and tools.

A) Checklist for performance problems in SAP Oracle Databases
B) Automated Oracle DB parameter check
C) Automatic Data Optimization with Oracle Database 12c
D) Oracle Database 12c Application Optimization

## 2. Implementation Overview

2.1 Prepare Checklist for performance problems in SAP Oracle Databases

This approach considers the SAP recommended checklist that are required to minimize the risk of performance problems. With checklist points we can ensure Oracle database has been set up as required by SAP as well as can determine where the most time is spent.

2.2 Automated Oracle DB parameter check

This approach is to run the SAP recommended script that automatically check the current running database environment Oracle DB parameters, and gives SAP recommendations for that parameter values as per SAP standard.

2.3 Automatic Data Optimization with Oracle Database 12c

In Oracle Database 12c, Heat Map and ADO (Automatic Data Optimization) make it easy to use existing innovations in Oracle Database compression and partitioning technologies, which help reduce the cost of managing large amounts of data, while also improving application and database performance. Together these capabilities help to implement Information Lifecycle Management in Oracle Database.

2.4 Oracle Database 12c Application Optimizations

Typically, performance problems result from a lack of throughput (the amount of work that can be completed in a specified time), unacceptable user or job response time (the time to complete a specified workload), or both. The problem might be centered to specific application modules or it might span the system.

Improved performance can be measured in terms of business goals rather than system statistics. Database statistics provide information about the type of load on the database and the internal and external resources used by the database.

Approach is to identify New Features in 12c and tools to perform day-to-day database performance tuning tasks using features provided by Oracle Diagnostics Pack, Oracle Tuning Pack, and Oracle Enterprise Manager Cloud Control (Cloud Control).

## 3. Implementation Approach

### 3.1 Checklist for performance problems in SAP Oracle Databases :

This covers recommendations (Action Points) about daily monitoring and tasks that have to be performed on a regular basis to ensure system performance and stability in a SAP-ERP system.

**Action Point -1:** Make sure the Oracle Dictionary and System statistics are collected.

**Description:** New Oracle dictionary statistics should always be created usually the case in the following situations,

A) After installing a database patch set.
B) New objects may have been created in the dictionary during upgrade.
C) If a further SAP system has been installed or uninstalled in the database (MCOD), as this has changed the number of objects in the database significantly.
D) Regardless of these changes, It is recommend that you create new statistics in the Oracle dictionary once per quarter.
E) For dynamic performance tables (X$ tables,'fixed objects'), you should create statistics when the database is carrying a typical and representative load.

**Points:**

1. Dynamic performance tables are part of the **Oracle dictionary** and contain information about the current database activity.
   For Ex: Create these statistics when the database is carrying a typical and representative load.
   SQL>begin
   DBMS_STATS.GATHER_FIXED_OBJECTS_STATS(NO_INVALIDATE => FALSE);
   end; /

2. Recommendations for the creation of **system statistics**:
   A. In case of changes to the hardware of the DB server (more CPUs & disks, faster network)
   B. System statistics should be created during a typical load phase.
   C. System statistics should be created:
      1. After creating new tablespace
      2. After a database upgrade
      3. After installing a new patch set
   D. Independent of such changes, system statistics should be newly created once per quarter.

**Artifacts:**

1. Performed oracle statistics update after oracle 12c database upgrade

2. Performed oracle statistics update after SAP-ERP SPS upgrade.

```
brconnect -u // -c -f stats -t system_stats
brconnect -c -u // -f stats -t all -f collect -p 24
brconnect -u // -c -f stats -t oradict_stats
```

**Action Point -2:** Import the pre-configured statistics if not yet done.

**Description:** In certain situations, the Cost Based Optimizer (CBO) may make unfavorable decisions, although there are no CBO errors, for example:

**Artifacts:**

We had severity P1-High priority incident for SMQ2 inbound queue entries are stuck in SAP production PR4 system.

**Findings:** Observed that recent Table statistics were missing for table ARFCSDATA, ARFCSSTATE, ARFCRSTATE.

**Considerations:** Queue processing in SAP systems can be made to run without any delays by Re-indexing and updating the statistics of the tables like

**Action Point -3:** If the problem exists with CBO and RBO, perform the necessary steps to solve it.

**Description:** There are several possible causes of long SQL statement runtimes.
These may be bugs and Oracle optimizer features that may frequently cause problems in the SAP environment.
**Recommendation**- see SAP NOTE: 176754 - Problems with CBO and RBO
If the problem is listed in the recommended note perform the necessary steps to solve.

**Artifacts:**

By running update statistics regularly, you make sure that the database statistics are up-to-date, so improves database performance. The Oracle cost-based optimizer (CBO) uses the statistics to optimize access paths when retrieving data for queries.
If the statistics are out-of-date, the CBO might generate inappropriate access paths (such as using the wrong index), resulting in poor performance.
Hence we have ensured successful execution of statistics update daily for the SAP standard tables.

Scheduled and Performed oracle statistics update daily for SAP standard tables to ensure optimized performance.

**Action Point -4:** Check 'Avg.Proc: Time', 'O CPU Time','O DB Time' values in ST03 transaction

**Description:** In ST03 transaction If most time is spent on O CPU Time, the issue is not caused by the Oracle Database, so the reason must reside somewhere else.

**Artifacts:**

**Root Cause Analysis for -High Priority incident:** IDOC processing from SAP ECC-PR4 system to SAP BW-PW4 system was running but the issue was related to slow process of

**ST03N:**

**Action point -5:** Create 3-different AWR/ASH reports in HTML form covering the timeframe before /during /after the issue happened

**Description:** By creating 3-AWR/ASH reports, we can compare the database execution times/different characteristics and may find meaningful conclusions on the cause if database is the responsible.

**Artifacts: As continuation of workaround of Root Cause Analysis for -High Priority incident:**
IDOC processing from SAP ECC-PR4 system to SAP BW-PW4 system delayed.
Following AWR report data has been captured and analyzed to conclude the solution of this issue.

**Workaround:**
Two separate active transactions SCT Dilo jobs and BI load were running and being squeezed in the time window 00:00-03:00 (roughly) causes constraints, especially in the write performance of the SAN (Network) involved two different sites (Ijmuiden and Amsterdam).

**Action Point -6:** If a specific transaction, program or client is affected

**Description:** Use transaction STAD to get more details about the characteristics and execution times. When available, best option to quickly check for more clues.

**Artifacts:**
Sometimes we get user requests or incidents for long running jobs and reports from specific sap user account.
SAP single statistical record has main records and many sub-records.
SAP provides "corresponding buttons" in STAD detail screen to help you locate information

**Action Point -7:** If the whole system is slow,

**Description:** Use ST01 to trace e.g. DB Access (SQL Trace), Table Buffer Trace, or Kernel Functions.

**Artifacts:**
You can use SAP system trace function to trace the authorization that are checking when you perform different operations in your SAP system. System trace is used for analyzing authorizations, DB accesses, Kernel functions, Kernel modules, DB accesses, Access to Table buffers, Lock operations. In the initial screen of ST01, you can select the components

commands…etc
The trace files are stored in the directory: c:usrSAP<SID><Instance_Directory>logTRACE

**Action Point -8:** Database Patches for 12c

**Description:** SBP patches must be installed to ensure that the database is working properly. In general, it is recommended to install the latest SBP. Install the latest Bundle Patch to ensure that the SAP system functions properly. The two most recent Bundle Patch of SBP and one actual Bundle Patch of GI, EXA, ODA is always located on Marketplace SWDC.

**Artifacts:**

1. In our project during SOLMAN 7.2 SPS06 upgrade we had faced one issue that was show stopper for the upgrade activity and it's resolution was identified to upgrade the latest SBP(SAP12102P_1711-20012297.ZIP patch level 1711) to proceed including execute a script for table compression.

Recommendations for this issue resolution:

2. After the installation of the Oracle Database software, you need to install the current (that is, the latest) SAP bundle patch (SBP) into the new Oracle home.
   We had performed the SBP upgrade during 12c oracle upgrade to ensure this is up to date as per recommendations.

Perform SBP upgrade:

3. Multiple High-P1 severity incidents were coming in our queue for : ORA-12751: cpu time or run time policy violation

**Work Arounds:**

1. Identified the relevant trace file from alert log file and later on based on this SAP NOTE-2475497 - ORA-12751: CPU time or run time policy violation, two scripts attached to this SAP note has been manually executed at database level for its resolution.

### 3.2 Automated Oracle DB parameter check :

This covers recommendations (Action Points) to run the SAP recommended script that

automatically compare the current Oracle DB parameter settings with SAP standard recommendations and provide the list of corrections including validations of respective parameter values as per SAP standard DB setup.

**Action Point -1:** Download relevant script for Oracle DB parameter check and Operating system.

**Description:** Recommended SAP NOTES for this approach:

A) 1171650 - Automated Oracle DB parameter check
B) 2124058 - Oracle Parameter Updater
C) 1888485 - Database Parameter for 12.1.0.2

The script helps to adjust the parameters that are not properly set in your database as per SAP standard values.
It scans the output of the parameter check script from note 1171650 and generates the command lines to run in sqlplus and adjust your database settings.

STEP 1- Download the check script from note 1171650 and save it to a known and accessible location to ora<sid>.

**Artifacts:**

STEP-1: Download the parameter file parameter_check_12.txt attached in SAP NOTE-1171650

STEP-2: Our environment is in AIX hence downloaded the script compatible to same.

STEP-3: Executed the script and collected the recommendations for corrections and Validations

**Action Point -2:** Verify recommended correction, validation of parameter values and implement the same.

**Description:** Identify the suggested parameters consideration as per Action Point-1 and made it compatible for your current environment.

**Artifacts:**

STEP-1: Prepare a script to apply for corrections as recommended in ACTION POINT-1.

Implementation Plan:

**Procedure:**

STEP-1: Take backup of current spfile from $ORACLE_HOME/dbs directory.
Ex- cp /oracle/SC4/121/dbs/spfilePR4.ora /oracle/SC4/121/dbs/spfilePR4.ora.SAV

### 3.3 Approach for Automatic Data Optimization

As per project outline plan this implementation approach will be started as per below mentioned time line

| | | |
|---|---|---|
| Automatic Data Optimization with Oracle Database 12c | START DATE-17-02-18,END DATE 04-Mar-18 | Yet to start |

### 3.4 Approach for Database Application Optimizations

As per project outline plan this implementation approach will be started as per below mentioned time line.

| | | |
|---|---|---|
| Oracle Database 12c Application Optimizations | START DATE-05-03-18,END DATE 20-03-18 | Yet to start |

## 4. SAP on ORACLE 12c

### 4.1 SAP on Oracle development update 2017 & 2018

Please refer this attached whitepaper to understand the Features, Supported Releases & Timeline, 12c Products Support, 12c Notes & Documentation, Oracle Database In-Memory, 12c Oracle Multitenant, 12c Advanced Data Optimization, Update Exadata & Exalogic, SAP NW Business Intelligence Flat InfoCubes, Virtualization Update Oracle VM,

Performance ABAP Core Data Services, SAP on Oracle Database- Release Strategy.

### 4.2 Details of work done till date and Plan of work yet to be done

In this project work, tried to implement performance and storage optimization tasks in four phases of implementation approach.

**Details of work done till date and Plan of work yet to be done:**

| SL No. | Description of work | Proposed Completion date | Progress status |
|---|---|---|---|
| 1 | Prepare Checklist for performance problems in SAP Oracle Databases | 30-Jan-18 | Completed |
| 2 | Automated Oracle DB parameter check | 16-Feb-18 | Completed |
| 3 | Automatic Data Optimization with Oracle Database 12c | 04-Mar-18 | Yet to start |
| 4 | Oracle Database 12c Application Optimizations | 20-Mar-18 | Yet to start |

### 4.3 Directions of future work

The following shall be designed and implemented in future

A) As of December 18, 2017, Oracle Database 12c Release 2 (12.2.0.1) is certified and available to upgrade for all NetWeaver-based SAP products and solutions.

B) The new feature SAP BW Flat Cube design for BW InfoCubes is now available for Oracle database 12c Release 1 with Oracle Database In-Memory as of SAP BW 7.40 SP15. Benefits for SAP BW customers:

C) Oracle Database Appliance (ODA) for SAP
The Oracle Database Appliance is a complete plug-n-go highly available clustered

## 5. References

SAP NOTE-1919276-Performance issues when running a SAP Upgrade

SAP NOTE-1918774- Performance issues when running an SAP Installation or System Copy

SAP NOTE-2178980-Using Oracle Database In-Memory with SAP NetWeaver based products

**Declaration by Student:**

I certify that I have properly verified all the items in this checklist and ensure that the report is in proper format as specified in the course handout.

**Place: _____**

**Date: _____**

_____

**Signature of the Student**

**Name: _____**

**ID No.: _____**