Software Requirements Specifications

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CONTENTS

1 INTRODUCTION

1.1 Purpose

The purpose of this document is to define the primary objective and details of the toolkit. This document will contain guidelines that describe the purpose, features, general design, interactions with Oracle 12c database, and the constraints that the performance analysis toolkit must operate within. The target audience for this document includes any relevant stakeholders as well as any Database Administrator (DBA) or software developer that works with Oracle database 12c in any capacity.

1.2 Scope

The main purpose of this toolkit is primarily to assist with collecting and visualizing performance metrics when running database queries. By doing so, this toolkit will allow us to benchmark database performance based on different configuration schemes in order to find the best solution. Some of the configuration schemes will include modifying memory management, experimenting with varying degrees of parallelism, and altering database table partitioning.

The primary performance metric that the toolkit will be measuring is the Performance Efficiency Index (PEI), which is database time divided by wall clock time, in order to better gauge query efficiency. A higher PEI ratio (e.g. more database time spent per real world elapsed time) indicates higher database query efficiency. Another useful metric that this toolkit will monitor is real world elapsed time which ultimately determines the perceived responsive of queries made against the database.

1.3 Definitions, Acronyms, Abbreviations

Term	Definition
Command Line Interface (CLI)	A application which provides a means of interacting with a computer program by entering lines of text
Central Processing Unit (CPU)	The physical processor(s) in the machine that executes instructions.
Database	Software which stores information in an organized, easy to access manner
Database Administrator (DBA)	Ensures availability, reliability, performance, security, and scalability of database systems
Database Time	The amount of real world time the database spends consuming CPU resources
Enterprise Manager (EM)	A set of web-based tools aimed at managing software and hardware produced by the Oracle company
Gigabyte (GB)	A multiple of the storage unit byte, composed of 1024^3 bytes of memory
HP Inc. (HP)	An American multinational information technology company headquartered in Palo Alto, California
Performance Efficiency Index (PEI)	Wall clock time divided by database time. Indicates database query efficiency
Random Access Memory (RAM)	Computer memory where any byte of storage can be accessed without touching the preceding bytes
Software Developer	Performs research, design, implementation, and testing of software products
Stakeholder	Anyone who does not fall under the role of database administrator or developer but is otherwise directly or indirectly involved
Terabyte (TB)	A multiple of the storage unit byte, composed of 1024^4 bytes of memory
Virtual Private Network (VPN)	A method of providing encrypted remote access to a remote computer over the internet
Wall clock time	Real world elapsed time

1.4 References

IEEE. IEEE Std 830-1998 IEEE Recommended Practice for Software Requirements Specifications. IEEE Computer Society, 1998.

1.5 Overview

The second section of this document, Overall Description, gives an overview of software dependencies, the intended function, characteristics, constraints, and assumptions of the toolkit. This section is more geared towards general stakeholders given that it is more of a high level examination of the toolkit. The third section of this document, Specific Requirements, is primarily intended for database administrators and software developers who are familiar with the technical aspects and relevant terminology of this toolkit. These two sections are both designed to give a comprehensive overview of the toolkit to two different target audiences, one high level and one low level.

2 Overall Description

2.1 Product Perspective

The toolkit itself is not designed to be a standalone software application that runs independently of other software systems. Rather, it is a component that is designed to integrate specifically with Oracle 12c in order to give DBA's and software developers quantitative metrics and information with respect to different database configurations. The toolkit will be a compressed folder which will house many SQL scripts each serving it's own utility function. Together these scripts will comprise a set of tools which would we will make available to DBA's and other senior level software engineers.

2.1.1 System Interfaces

The primary system interfaces are Oracle Database 12c and Oracle Linux 7. This toolkit will interact with an Oracle Database 12c instance to gather performance metrics from the database itself. Additionally, the toolkit will be able to make system calls to Oracle Linux 7 in order to gather any other necessary metrics information relating to the systems processes.

2.1.2 User Interfaces

The user interface of the toolkit will be a command line interface in which the user can define parameters and execute commands that are supported by the toolkit. The minimum required screen format must at least support a standard 80 character width by 24 character long terminal.

2.1.3 Hardware Interfaces

The toolkit is purely software based and does not involve any specific piece of hardware. Since the toolkit is comprised of SQL scripts it will be executed by a system which is already configured.

2.1.4 Software Interfaces

This toolkit is intended to be used with Oracle Database 12c running in an Oracle Linux 7 environment. The required system software and additional supporting applications specifications are listed below:

- Oracle Linux 7
  - Mnemonic: OL7
  - Version: 7.2
  - Source: Oracle
- Oracle Database 12c Enterprise Edition

  - Mnemonic: 12c
  - Version: 12.1.0.2.0
  - Source: Oracle
- Oracle Enterprise Manager Database Express 12c
  - Mnemonic: EM
  - Version: 12.1.0.2.0
  - Source: Oracle
- Oracle SQL Developer
  - Mnemonic: N/A
  - Version: 4.1.5.21
  - Source: Oracle
- Command Line Interface
  - Mnemonic: CLI
  - Version: 3.8.13
  - Source: Linux

2.1.5 Communications Interfaces

There will be no communication interfaces that our toolkit will need to take into account any communication interface or network protocols. The toolkit will be a series of scripts that will act as an instruction set for a previously configured system.

2.1.6 Memory constraints

The toolkit we will be developing will consist of a collection of SQL scripts, there are no inherent memory constraints.

2.1.7 Operations

There will be only one mode of operation within the user organization which will be DBA level access. Most of the periods operation will be ran in the background. Initially the user will configure the execution parameters and supply a query, then the system will take over the processing until the results are returned. There will be no data processing or support functions and our toolkit will have no inherent backup or recovery functions.

2.1.8 Site Adaptation Requirements

There will be no site specific requirements for the use of the toolkit. It will be available to anyone who chooses to download it in order to monitor the performance of there system during query execution.

2.2 Product Functions

The overall functionality of this toolkit can be divided into four specific components. Each one of the components works in concert to generate the performance metric report. These components are as follows:

2.2.1 Querying the Database

This component will serve as the vehicle in which the user is able to submit a properly formatted SQL query against the database instance.

2.2.2 Modify Database Parameters

This component will allow for the modification of system specific setting in order to optimize query performance. We will use this to change settings within the Oracle 12c environment to increase processing efficiency.

2.2.3 Gather System Metrics

This component will use the dynamic performance views which are native to the Oracle 12c instance to monitor performance specifications during the execution of the provided query. Additionally, this component will make system calls out to the host operation system to isolate process time information that will be used as a performance metric.

2.2.4 Generate Performance Report

This component will compile all of the system performance metrics which have been evaluated into a raw data report. This report can then be utilized by the users to create a visual report.

2.3 User Characteristics

The users of our toolkit will be Senior level software developers that are writing queries on a server. These users will have experience writing queries and interacting with a database. These users should be proficient in one or more of SQL, Oracle 12c specifics, Python, shell scripting, Unix system calls, or parallel execution. Users will have some level of formal technical education but this could vary from some college experience to doctorates.

2.4 Constraints

The experiments that we will run will be limited to a specific machine, that machine will have 16 real cores, 500GB of memory and 5 TB of storage. The software package that we create will be able to run on any machine that can support Oracle SQL. There will be no regulatory polices, audit functions, safety or security considerations within the scope of the toolkit.

2.5 Assumptions and Dependencies

In developing the performance evaluation toolkit we will be assuming that the scripts will be run on an Oracle SQL database. The development of the toolkit will rely on a few specific factors which include:

- Our computers must be connected to the local HP network to access the test database instance
  - Due to company firewall, outside access to the network is not possible without VPN
- Access to physical location limited
  - Corvallis site limited to HP employees and contractors only, so an escort is needed
- No access to server room
  - If the database goes down we have no access and must rely on HP counterpart to assist

2.6 Apportioning of Requirements

Refer to the Gantt chart appended to the final page of this document.

2.7 Toolkit Environment

The toolkit environment is comprised of four entities: Users which can be DBAs and software developers, the toolkit itself, the Oracle 12c database, and the host operating system that contains the database. Users interact with the toolkit by executing commands which can range from modifying various database parameters to executing queries on the database. While the database is the processing the queries, the toolkit will then begin monitoring critical performance metrics. The sources of the metrics can come from both the database itself and by polling the host operating system for more information about the databases running processes.

3 Specific Requirements

3.1 External Interfaces

- Input
  - Name: SQL Query.
  - Description: A valid SQL that a user wants a performance report for.
  - Source: Command line input from user.
  - Valid input: Any valid SQL statement.
- Output
  - Name: System performance raw data report.
  - Description: A raw data file of the performance statistics of the machine while running the input SQL query.
  - Destination: A text file in the local directory.

3.2 Functions

1) The system shall accept an SQL query as input.
2) The system shall fetch performance database tables to get statistics on the input query.
3) The system shall organize the data and make recommendations on how to increase performance.
4) The system shall output this data in into a data sheet.

3.3 Performance Requirements

The system we are developing is a toolkit of scripts that will be easily attributable. This means the software can easily be installed and run on any number of machines simultaneously.

3.4 Logical Database Requirements

Our software package will not be writing any data to a database.

3.5 Design Constraints

The only significant design constraint that we face is that our toolkit will be developed in Oracle SQL. That means that developing and using this software will have to be done on a machine that supports Oracle SQL.

3.6 Standards Compliance

Because our system is just a toolkit made up of scripts, there are not specific standards that we must comply with.

4 Software System Attributes

4.1 Reliability

The reliability of this toolkit will be measured in it's ability to take valid SQL statements and generate a performance statistic report.

4.2 Security

The toolkit will be available on a git hub repository that will be read-access only to the public. This will protect the integrity of the source code behind the toolkit. Individual users will be using the toolkit at their own risk, because they will already have full database access. This toolkit does not pose any increased security risk.

4.3 Maintainability

The toolkit will be organized so that each significant performance test will be in its own script file. These files will be well commented so that users can make changes as per their needs. The names of these scripts should be self explanatory and unique enough to distinguish their function from the name.

4.4 Portability

The toolkit that is being created will be portable to any system that supports Oracle SQL 12c. However this toolkit will not be portable to any other type of database.

4.5 Specific Requirements

4.5.1 External Interface Requirements

1) User Interfaces: The user will interact with our software toolkit through the command line. Users will run these scripts on a SQL server to get a performance report.
2) Hardware Interfaces: This software toolkit does not interact with hardware.
3) Software Interfaces:
    - Oracle Linux 7
        - Mnemonic: OL7
        - Version: 7.2
        - Source: Oracle
    - Oracle Database 12c Enterprise Edition
        - Mnemonic: 12c
        - Version: 12.1.0.2.0
        - Source: Oracle
    - Oracle Enterprise Manager Database Express 12c

  - Mnemonic: EM
  - Version: 12.1.0.2.0
  - Source: Oracle
- Oracle SQL Developer
  - Mnemonic: N/A
  - Version: 4.1.5.21
  - Source: Oracle
- Command Line Interface
  - Mnemonic: CLI
  - Version: 3.8.13
  - Source: Linux

4) Communications Interfaces: This toolkit will not interact with any communication or network protocols.

4.5.2 Functional Requirements

4.5.2.1 Database Administrator User Class:

1) The system shall accept an SQL query as input.
2) The system shall fetch performance database tables to get statistics on the input query.
3) The system shall organize the data and make recommend adjustments to increase performance.
4) The system shall output this data in into a data sheet.

4.5.3 Performance Requirements

The toolkit will be distributed across many machines, meaning it will be run on any number of machines simultaneously.

4.5.4 Design Constraints

This toolkit will be limited to Oracle SQL 12C

4.5.5 Software System Attributes

- Reliability
  - The reliability of this toolkit will be measured in it's ability to take valid SQL statements and generate a performance statistic report.
- Security
  - The toolkit will be available on a git hub repository that will be read-access only to the public. This will protect the integrity of the source code behind the toolkit. Individual users will be using the toolkit at their own risk, because they will already have full database access this toolkit does not pose any increased security risk.
- Maintainability
  - The toolkit will be organized so that each significant performance test will be in its own script file. These files will be well commented so that users can make changes as per their needs. The names of these scripts should be self explanatory and unique enough to distinguish their function from the name.
- Portability
  - The toolkit that is being created will be portable to any system that supports Oracle SQL 12c. However this toolkit will not be portable to any other type of database.

4.5.6 Other Requirements

There are no additional requirements for this project other than what been outlined above.

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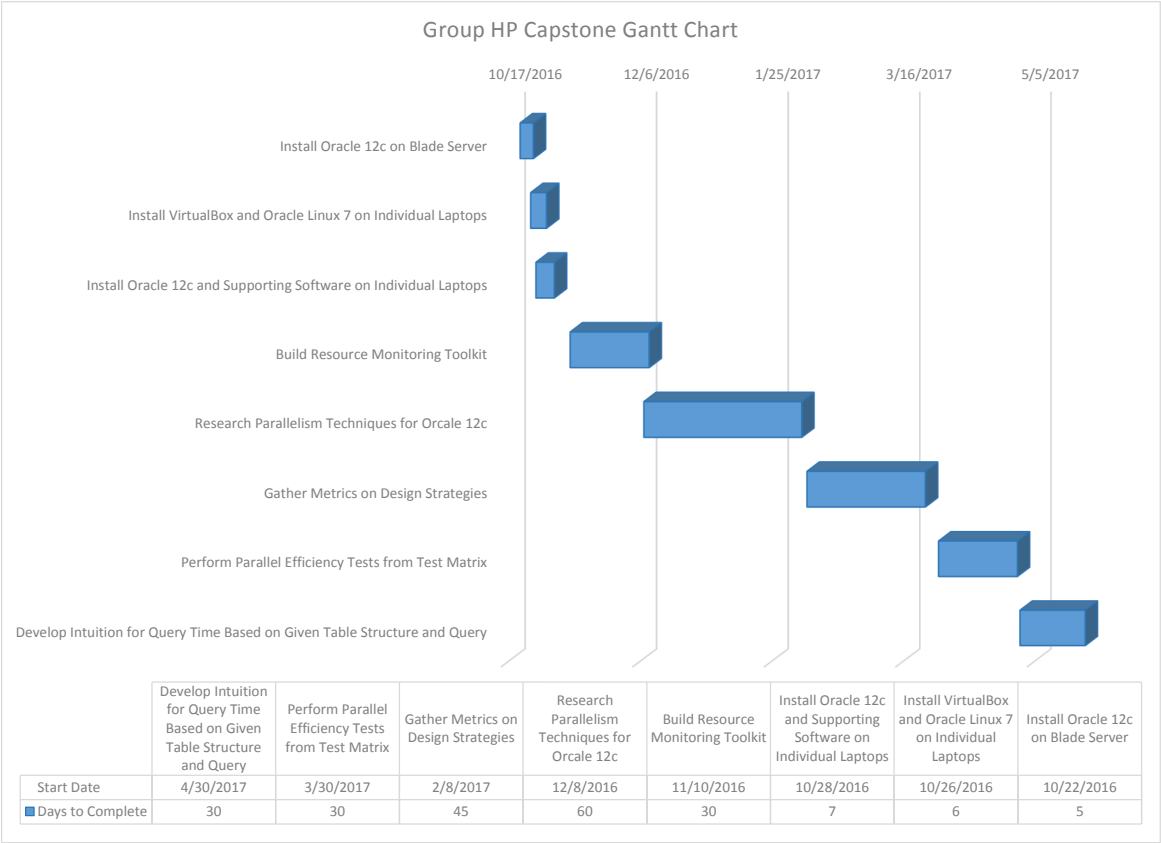

	Develop Intuition for Query Time Based on Given Table Structure and Query	Perform Parallel Efficiency Tests from Test Matrix	Gather Metrics on Design Strategies	Research Parallelism Techniques for Orcale 12c	Build Resource Monitoring Toolkit	Install Oracle 12c and Supporting Software on Individual Laptops	Install VirtualBox and Oracle Linux 7 on Individual Laptops	Install Oracle 12c on Blade Server
Start Date	4/30/2017	3/30/2017	2/8/2017	12/8/2016	11/10/2016	10/28/2016	10/26/2016	10/22/2016
Days to Complete	30	30	45	60	30	7	6	5