

USABILITY AND PERFORMANCE COMPARISON: IMPLEMENTATION OF TIBERO AND ORACLE DATABASES IN THE CONTEXT OF CAMS SOFTWARE DEVELOPMENT

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Abstract

In software development, selecting the right database is crucial for ensuring application performance and efficiency. Oracle is a leading enterprise database known for its reliability, but there is a need for more efficient and cost-effective alternatives. Tiberio, developed by TmaxSoft, has emerged as a potential alternative, offering competitive performance and a smooth transition from Oracle. This study compares the performance of Tiberio 7 and Oracle 12c in the Consumer Asset Management System (CAMS) application developed by Telkomsigma. The evaluation is conducted using Performance Testing to measure processing time, CPU, and memory usage, as well as the System Usability Scale (SUS) to assess usability. The results show that Oracle excels in Transactions Per Second (TPS) and completion time, while Tiberio is more efficient in resource usage. The SUS scores also indicate that Oracle has higher usability. Overall, Oracle remains the best choice for enterprise applications, but Tiberio provides an attractive alternative for specific needs. This study offers guidance for software developers in selecting the appropriate database based on technical performance and user experience.

Keywords : *Database, Tiberio, Oracle, DBMS, Performance Testing*

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INTRODUCTION

In the world of software development, database systems play a crucial role in supporting the functionality and efficiency of applications. Enterprise software, often referred to as business software, is a type of software specifically designed to meet the complex needs of organizations or large companies [4]. This software is designed to address unique challenges, such as managing daily operations and efficiently handling resource management, faced by large enterprises [1].

Oracle is one of the most popular enterprise databases and has long been the primary choice in many industries to support critical business applications. The reliability and flexibility offered by Oracle have made it a common choice in the software world [7]. However, as the information technology industry evolves, there is a growing need for more reliable, efficient, and cost-effective databases. Tiberio, a relational database management system (DBMS) developed by TmaxSoft from South Korea, has emerged as a potential alternative to meet these needs [17]. Tiberio is

designed to meet the data management requirements of large enterprises by offering key features such as high performance, reliability, and scalability, which are crucial in business environments that require large-scale data storage and management [17]. As a relational DBMS, Tiberio supports a relational data model that uses tables to store data and SQL (Structured Query Language) to access and manipulate data, thus facilitating companies in organizing and managing their information [9].

Telkomsigma, a subsidiary of Telkom Indonesia, focuses on providing information and communication technology (ICT) services by offering various IT solutions for multiple industries, including telecommunications, finance, banking, e-commerce, and government. In the development of enterprise software, Telkomsigma uses various databases such as Oracle, Microsoft SQL Server, PostgreSQL, and MySQL, with the choice of the database tailored to the specific business needs of each customer. However, this creates challenges since most products developed by Telkomsigma rely heavily on databases (PL SQL), and switching

databases can cause significant changes in the software process [19]. One of the products used as a research object is CAMS (Consumer Asset Management System), an application for managing loan customer data in banks. This application often faces issues related to database licensing, ease of use, and performance [19]. Therefore, research is needed to optimize the use of alternative databases other than Oracle, such as Tiberio, to address these issues [17].

This study introduces a new comparative analysis between Tiberio 7 and Oracle 12c in the context of the Customer Asset Management System (CAMS), which is one of the banking application products developed by Telkomsigma. While Oracle's dominance in the enterprise database market has been widely discussed, Tiberio's potential as an alternative, particularly within Telkomsigma's ecosystem, remains underexplored. This study uniquely positions itself by focusing on performance testing and System Usability Scale (SUS) evaluation to provide a comprehensive assessment of both databases. The results of this comparison are expected to serve as a reference for Telkomsigma in selecting the most suitable database for their application development needs.

The choice of Tiberio as an alternative database in this study is based on its similarity in data structure to Oracle, which allows for a smoother transition with minimal changes to both the database and the application, especially in business processes that use Stored Procedures (PL SQL) [26]. The methods used in this study to analyze the technical comparison between Oracle and Tiberio are Performance Testing and the System Usability Scale (SUS). Performance testing provides quantitative data on how a system operates under specific conditions, such as response time and reliability, which are critical to ensuring the smooth and efficient operation of the system [13]. Meanwhile, SUS is an effective tool for measuring usability from a user perspective when using each database [4]. These two methods provide a comprehensive overview of technical performance and system usability; performance testing focuses on technical aspects, while SUS highlights user experience.

By using this approach, this study aims to provide better insights for software developers in choosing the right database, as well as

contributing to the development of software technology and the information technology industry as a whole. The methods used, namely Performance Testing and the System Usability Scale (SUS), provide quantitative and qualitative data on the technical performance and usability of the system from the user's perspective, which can serve as a guide in data-driven decision-making for future software development [2].

METHOD

Performance Data Analysis (Performance Testing)

In the performance data analysis process, according to existing data collection, take data from PROCESS_MONITOR, calculate the processing time for each module:

$$\text{RESULT} = \text{END_PROCESS} - \text{START_PROCESS} \quad (1)$$

From the formula (1) calculations, performance comparison results will be obtained:

1. Analyze the processing time for each module in the Tiberio 7 and Oracle 12c databases.
2. Compare the average processing time between the two databases to determine the database with better performance.
3. Analyze CPU, Memory and Storage usage of each database.

Usability Data Analysis (SUS)

In the performance data analysis process according to the existing data collection, the SUS Score calculation becomes. Each questionnaire answer is calculated based on the SUS rules:

Odd questions: $(Q1-1) + (Q3-1) + (Q5-1) + (Q7-1) + (Q9-1)$

Even questions: $(5-Q2) + (5-Q4) + (5-Q6) + (5-Q8) + (5-Q10)$

Average SUS Score:

Calculating the average SUS score of all respondents :

$$U = \frac{\sum R \times 2.5}{n} \quad (2)$$

Where $\sum R$ is the total number of answers, and n is the number of respondents.

The analysis flow of this research consists of several stages of activities and their explanations are in Figure 1.

Criteria for Respondents in the SUS Questionnaire

The respondents involved in filling out the SUS (System Usability Scale) questionnaire consist of professionals with a deep understanding of software development, testing, and analysis, as well as database performance. Respondents are drawn from various positions, including:

1. Programmer is Individuals responsible for developing software code and understanding the impact of database performance on applications.
2. Quality Assurance (QA) is Professionals involved in software quality testing to ensure that the software meets established standards.
3. Business Analyst (BA) is Those who analyze business requirements and ensure that the developed technological solutions align with those needs.
4. Junior Tester is Entry-level testers who perform software testing to identify bugs and other issues.

5. Programmer Analyst is Professionals who combine the roles of programmer and system analyst, understanding both coding and system analysis.
6. Senior Consultant is Experts with extensive experience who provide strategic advice related to complex business solutions.
7. Senior Business Analyst is Individuals who handle more complex projects and collaborate with senior management for strategic solutions.
8. System Analyst: Professionals responsible for analyzing and designing IT solutions that meet business needs.
9. Specialist is Individuals with specialized expertise in specific fields, such as cybersecurity or databases.
10. Tester is Software testers involved in thorough testing to ensure product quality before release.

These respondents are selected because they have relevant experience and knowledge about application performance and database usage, which is crucial for evaluating application usability using the SUS scale.

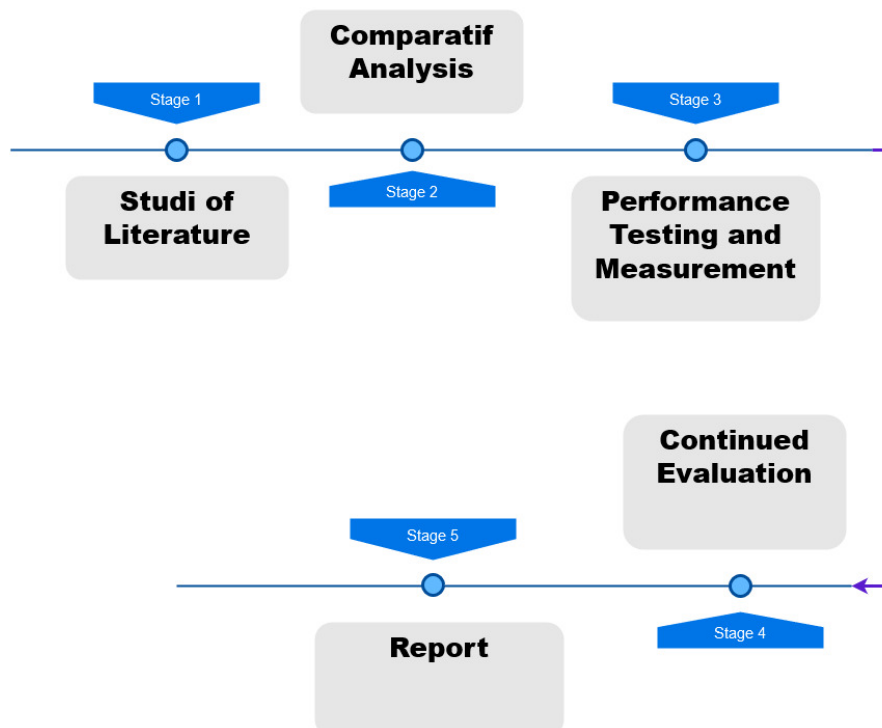


Figure 1. Research Flow

Study of literature

The initial step is to conduct an in-depth literature study on Oracle Database, Tiberio Database, as well as previous research relevant to software performance optimization. The results of this literature study help understand existing frameworks and knowledge regarding the performance of these two databases.

Comparative Analysis

A comprehensive analysis of Oracle and Tiberio Database features and performance will be performed. This analysis includes a functional comparison between Tiberio 7 and Oracle 12c, a technical comparison in terms of CPU, memory and storage resource usage which will be tested in the performance testing stage.

Performance Testing and Measurement

Testing of the CAMS application on Telkomsigma was carried out on both databases, using measurement methods relevant to performance. Benchmarking is used to measure performance by recording the processing time of modules in each database. The results of these recordings are then compared to determine whether tuning is needed in the database. After tuning is carried out, retesting is carried out to compare the processing time results before and after tuning.

Performance Measurement Process

Initial Measurement: The measurement process starts from the user who processes the modules of the application that uses the Oracle and Tiberio databases. **Processing time** was recorded for each database. **Results Analysis:** The processing time recording results were compared to determine whether there were significant differences in the performance of the two databases. **Database Tuning:** If results indicate the need for improvement, tuning is performed on the database that requires performance improvement. **Retesting:** After tuning, the module is retested and runtime recorded again to see any performance improvements that occur.

Continued Evaluation

Follow-up evaluation is carried out after fixes and adjustments are implemented to ensure that the changes made have significantly improved application performance.

Report

Complete reports are prepared regarding research results, guidelines for using the database, as well as steps that have been taken to optimize application performance. This documentation will be a practical guide for software developers.

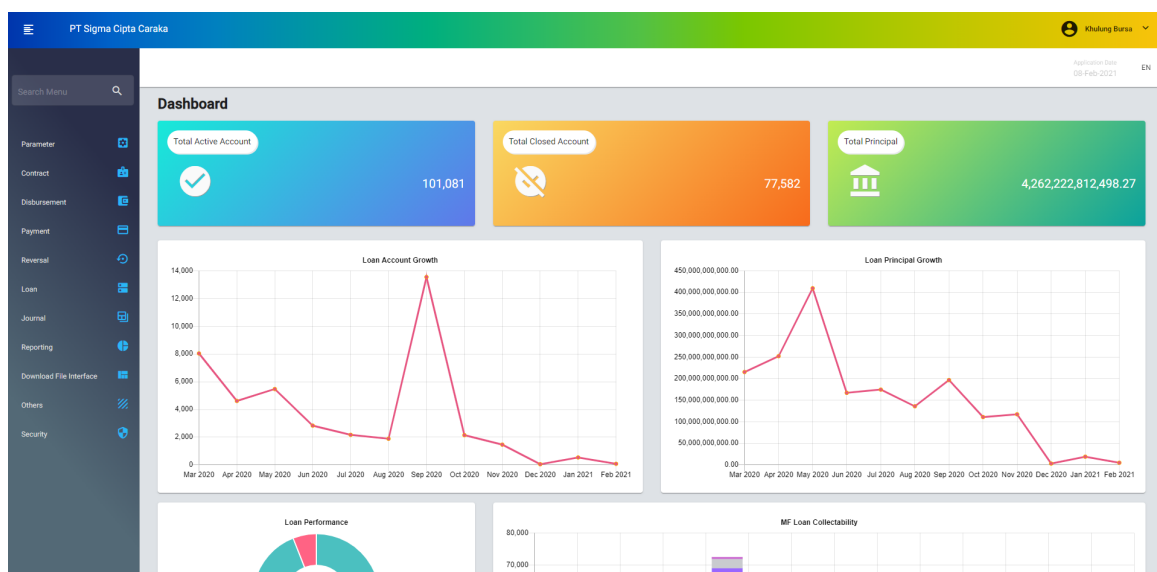


Figure 2. CAMS Application

RESULT AND DISCUSSION

In this Performance Test, the Test Application used is:

1. Tiberio Studio and Oracle SQL Developer were used for all performance tuning of Database Server and Application Server.
2. Tiberio Studio and Oracle SQL Developer to analyze all queries sent by the Application to the database and manipulate the queries.
3. Management Console to monitor memory usage on the server.
4. System Monitor is used to monitor CPU usage on the server
5. Configure the Arium CAMS NG Tiberio Application Performance Test requirements in Table 1 and the database in Table 2.
6. Configure the Arium CAMS NG Oracle Application Performance Test requirements in Table 3 and the database in Table 4.

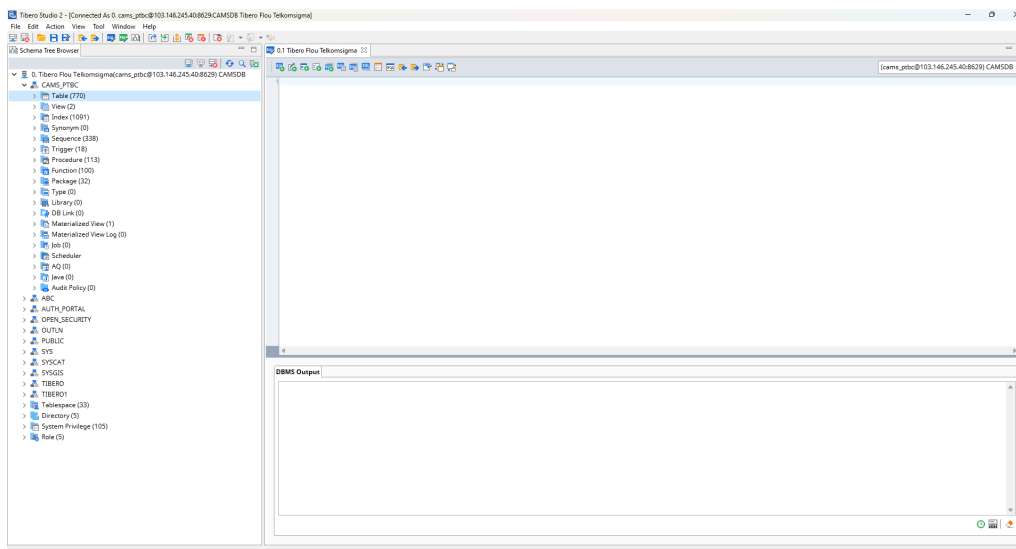


Figure 3. Tiberio Studio 7

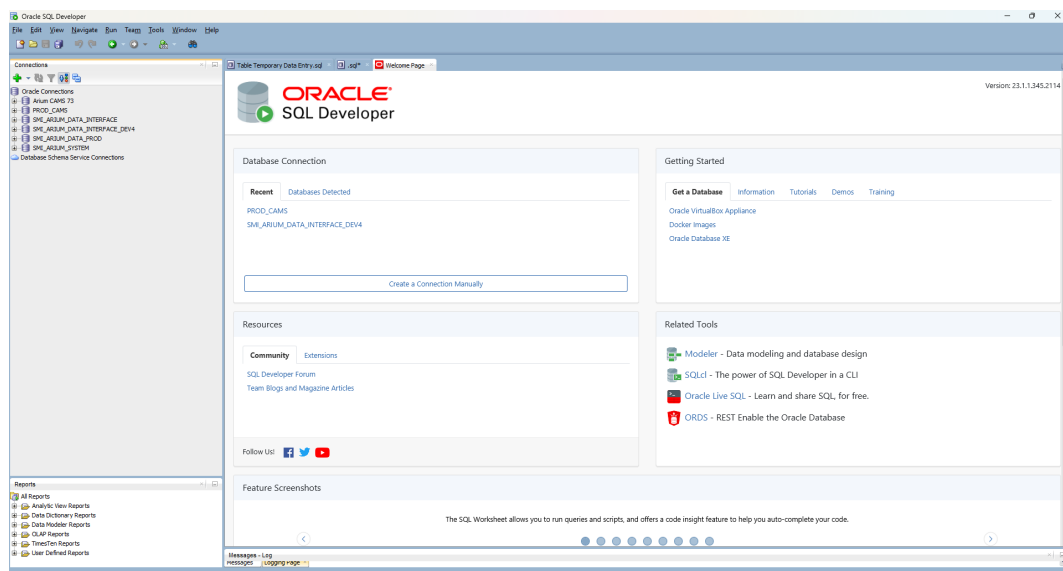


Figure 4. Oracle SQL Developer

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
63450	foo	20	0	4344	588	384	R	99.6	0.0	170:14.03	gzip
71459	root	20	0	630m	527m	164	R	14.6	0.2	0:00:44	OSWatcher.sh
6895	root	20	0	630m	528m	1008	S	12.2	0.2	105403:41	OSWatcher.sh
63449	foo	20	0	113m	1248	1036	S	2.0	0.0	3:47.17	tar
3369	grid	20	0	1421m	26m	22m	S	1.0	0.0	183:04:99	asm_gmon_+asm1
3579	root	20	0	3102m	597m	24m	S	1.0	0.2	6614:12	crsd.bin
10240	oracle	20	0	100g	71m	17m	S	1.0	0.0	999:47:24	ora_dia0_camsdb
178	root	20	0	0	0	0	S	0.7	0.0	448:19:31	kswapd0
2060	grid	20	0	1290m	38m	18m	S	0.7	0.0	2442:52	oraagent.bin
2195	grid	20	0	618m	36m	15m	S	0.7	0.0	12095:29	gipcd.bin
6586	root	20	0	2306m	101m	10m	S	0.7	0.0	4380:04	klnagent
42613	oracle	20	0	100g	30m	25m	S	0.7	0.0	0:02:62	oracle_42613_ca
71259	oracle	20	0	15712	1992	1000	R	0.7	0.0	0:00:08	top
1868	root	20	0	1841m	68m	19m	S	0.3	0.0	3846:21	ohasd.bin
1983	root	20	0	1547m	277m	19m	S	0.3	0.1	3051:51	orarootagent.bi
2078	grid	20	0	2557m	1.8g	16m	S	0.3	0.7	4734:09	evmd.bin
2171	grid	20	0	263m	16m	11m	S	0.3	0.0	916:49:18	evmlogger.bin
2465	grid	RT	0	2322m	205m	89m	S	0.3	0.1	3093:18	ocssd.bin
2994	root	20	0	805m	32m	15m	S	0.3	0.0	2972:11	octssd.bin
3282	grid	-2	0	1418m	18m	16m	S	0.3	0.0	4700:13	asm_vktm_+asm1
3300	grid	20	0	1425m	27m	19m	S	0.3	0.0	400:19:42	asm_diag_+asm1
3312	grid	20	0	1435m	41m	27m	S	0.3	0.0	1201:35	asm_lmon_+asm1
3320	grid	-2	0	1433m	35m	21m	S	0.3	0.0	1138:17	asm_lms0_+asm1
3326	grid	20	0	1419m	22m	19m	S	0.3	0.0	1635:44	asm_lmhb_+asm1
3709	root	20	0	1092m	40m	17m	S	0.3	0.0	5572:41	orarootagent.bi
4330	root	20	0	4030m	267m	4412	S	0.3	0.1	5022:57	oakd
6323	root	20	0	107m	2484	1132	S	0.3	0.0	2312:43	kesl_launcher.s
10210	oracle	-2	0	100g	19m	17m	S	0.3	0.0	521:19:14	ora_vktm_camsdb
10232	oracle	20	0	100g	30m	25m	S	0.3	0.0	96:56:48	ora_dbrm_camsdb
10244	oracle	20	0	100g	47m	21m	S	0.3	0.0	13:35:06	ora_dbw0_camsdb
10260	oracle	20	0	100g	46m	20m	S	0.3	0.0	12:04:52	ora_dbw4_camsdb
10310	oracle	20	0	100g	23m	19m	S	0.3	0.0	496:26:51	ora_mmln_camsdb
1	root	20	0	19404	1232	988	S	0.0	0.0	22:05:07	init
2	root	20	0	0	0	0	S	0.0	0.0	0:02:19	kthreadd

Figure 5. Server Monitoring

Table 1. Application Server Configuration (Tibero)

Processor	Intel(R) Xeon(R) Platinum 8260 CPU @ 2.40GHz (8 Core / 16 Thread)
Memory	32 GB
Storage	100 GB
Operating System	CentOS 8 Stream
Aplikasi	Arium CAMS NG

Table 2. Database Server Configuration (Tibero)

Processor	Intel(R) Xeon(R) Platinum 8260 CPU @ 2.40GHz (8 Core / 16 Thread)
Memory	124 GB
Storage	500 GB + 1,500 GB
Operating System	CentOS 8 Stream
Database	Tibero 7
Others	Apache DS

Table 3. Application Server Configuration (Oracle)

Processor	Intel(R) Xeon(R) Platinum 8260 CPU @ 2.40GHz (8 Core / 16 Thread)
Memory	32 GB
Storage	100 GB
Operating System	CentOS 8 Stream
Aplikasi	Arium CAMS NG

Table 4. Database Server Configuration (Oracle)

Processor	Intel(R) Xeon(R) Platinum 8260 CPU @ 2.40GHz (8 Core / 16 Thread)
Memory	124 GB
Storage	2 TB
Operating System	CentOS 8 Stream
Database	Oracle 12c
Others	Apache DS

The resulting parameter is Transactions per Second (TPS).

TPS = Number of successful transactions / (test end time – test start time)

Example: If the transaction is successful = 15000 and the test takes place from 09:00 to 09:08 then $TPS = 15000 / (8 * 60) = 135$

Steps taken in each test:

1. Prepare tools for monitoring and analyzing applications.
2. Run the application.
3. Monitoring applications both in terms of database, application and query.
4. Conduct analysis.

The table 5 shows that Tibero generally performs better than Oracle in terms of speed and resource usage. For the Upload Disburse task, Tibero completes it in 476 seconds with 42 TPS,

while Oracle takes 677 seconds with 29.54 TPS. Tibero uses 60% memory and 70% CPU, compared to Oracle's 64% memory and 55% CPU. In the Approve Disbursements task, Tibero is faster at 105 seconds and 190 TPS, whereas Oracle takes 347 seconds and 57.64 TPS. Tibero's memory usage is 85% and CPU usage is 80%, both slightly lower than Oracle's 92% and 84%. For Upload Payment, Tibero takes 148 seconds with 135 TPS, using 33.3% memory and 10.5% CPU, while Oracle takes 75 seconds with 266.67 TPS, using 48% memory and 33.8% CPU. In Approve Payment, Tibero completes it in 489 seconds with 41 TPS, using 20% memory and 7% CPU, compared to Oracle's 533 seconds, 37.57 TPS, 24% memory, and 28% CPU. For Upload Early Termination, Tibero takes 527 seconds with 19 TPS, using 5% memory and 13% CPU, while Oracle takes 538 seconds with 18.58 TPS, using 19% memory and 18% CPU. In Approve Early Termination, Tibero is slower at 633 seconds with

16 TPS, using 30% memory and 18% CPU, compared to Oracle's 529 seconds, 18.88 TPS, 32% memory, and 21% CPU. For Input Write Off, Tiberio completes it in 54 seconds with 185 TPS, using 11% memory and 8% CPU, while Oracle takes 48 seconds with 208 TPS, using 13% memory and 11% CPU. In Approve Write Off, Tiberio takes 761 seconds with 13 TPS, using 10% memory and 8% CPU, while Oracle takes 772 seconds with 12.92 TPS, using 13% memory and 9% CPU. For the EOD End of Day Process, Tiberio takes 4,375 seconds with 268.62 TPS, using 35% memory and 12% CPU, while Oracle takes 4,140 seconds with 283.94 TPS, using 38% memory and 14% CPU.

Overall, Tiberio shows superiority in some tasks such as disburse approval and several other processes, while Oracle is superior in tasks such as uploading payments. Both databases are competitive in performance, and selecting the most appropriate database will depend on specific needs and the type of tasks dominant in the operational environment in which it is used. However, overall, if averaged, the Oracle TPS is superior to Tiberio with a value of 103.75 compared to 102.75 for Tiberio.

Tabel 5. Performance Test Results

Task	Tiberio Total Time (s)	Oracle Total Time (s)	Tiberio TPS	Oracle TPS	Tiberio Memory Avg (%)	Oracle Memory Avg (%)	Tiberio CPU Avg (%)	Oracle CPU Avg (%)
Upload	476	677	42.0	29.54	60	64	70	55
Disburse								
Approve	105	347	190.0	57.64	85	92	80	84
Disburse								
Upload	148	75	135.0	266.67	33.3	48	10.5	33.8
Payment								
Approve	489	533	41.0	37.57	20	24	7	28
Payment								
Upload	527	538	19.0	18.58	5	19	13	18
Early								
Termination								
Approve	633	529	16.0	18.88	30	32	18	21
Early								
Termination								
Input Write	54	48	185.0	208.0	11	13	8	11
Off								
Approve	761	772	13.0	12.92	10	13	8	9
Write Off								
End Of Day	4,375	4,140	268.62	283.94	35	38	12	14
EOD								

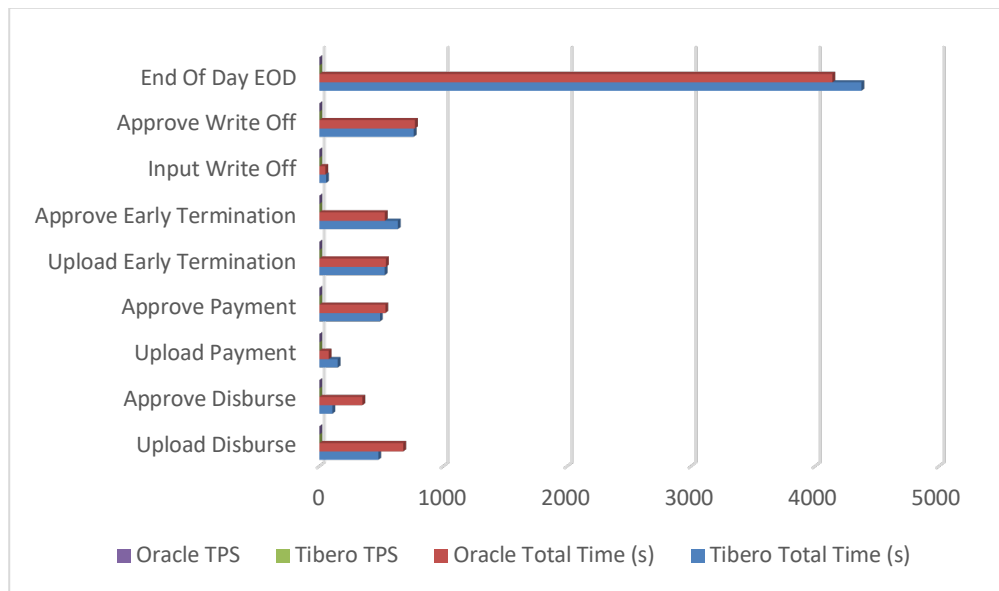


Figure 6. TPS Chart

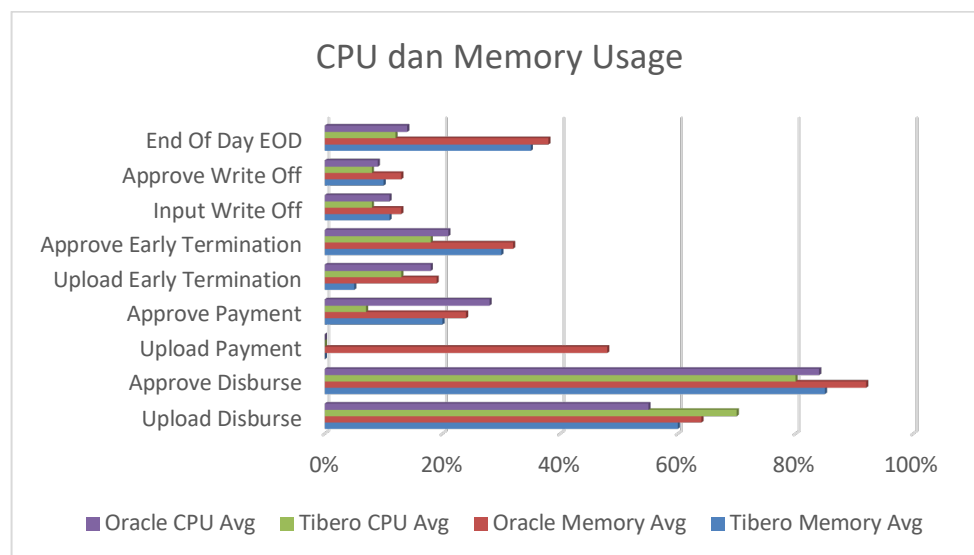


Figure 7. CPU and Memory Chart

Overall, this graph shows that there is a significant difference in CPU and memory resource usage between Oracle and Tiberio systems depending on the processes performed. Resource usage needs to be considered when selecting a system to ensure optimal performance according to specific needs. From the average CPU and memory results of Oracle and Tiberio, we find that the average memory usage for Oracle is 40.33% while Tiberio's is 32.14%, and the average CPU usage for Oracle is 30.42% while Tiberio's is

25.17%. The Oracle database maximizes CPU and memory usage compared to Tiberio.

In Table 6 are the score results from respondents via Google Form. To calculate the SUS score results, a review is required using the SUS calculation formula, for this the SUS score calculation results are obtained. The results of the SUS score according to Table 7. In table 7, the average SUS score for all respondents is 75.25. The score shows the level of user satisfaction with Oracle, where the higher the score, the better the user assesses the experience of using Oracle.

Example of calculation for first responders:
 $(4-1) + (5-1) + (5-1) + (5-2) + (5-1) + (5-1) + (5-1) + (5-1) + (4-1) + (5-5) = 33$

Score SUS = $33 * 2.5 = 82.5$

Table 6. Recapitulation of Google Form Oracle Respondent Answer Points

No	1	2	3	4	5	6	7	8	9	10
1	4	1	5	2	5	1	5	1	4	5
2	4	1	4	3	5	2	3	2	4	5
3	4	4	3	5	4	4	4	3	4	4
4	5	5	5	3	5	1	5	1	5	3
5	3	2	4	1	4	2	4	2	4	2
6	2	4	3	5	3	3	3	3	4	5
7	4	5	3	4	4	3	3	3	4	4
8	5	1	5	4	4	1	5	2	5	3
9	2	3	3	4	4	3	3	3	4	4
10	5	1	5	1	4	1	5	1	5	1
11	3	2	4	3	4	2	4	2	4	3
12	4	2	3	2	3	3	3	3	4	2
13	4	3	3	2	4	3	3	3	4	3
14	4	2	5	2	5	1	5	1	5	3
15	3	2	4	3	4	2	4	2	4	3
16	4	2	3	2	3	3	3	3	4	2
17	3	1	5	2	5	1	5	1	5	2
18	5	3	4	4	4	3	4	3	4	3
19	3	2	3	2	3	2	3	2	3	3
20	4	3	4	3	4	2	3	2	4	2
21	4	1	5	1	4	1	5	1	5	1
22	4	1	4	1	5	1	5	1	5	1
23	4	1	4	1	4	1	5	1	5	1
24	4	1	5	1	5	1	4	1	5	1
25	5	1	4	1	4	1	5	1	5	1
26	3	1	4	1	5	1	5	1	4	1
27	3	1	5	1	5	1	4	1	5	1
28	5	1	4	1	5	1	5	1	5	1
29	3	1	5	1	5	1	5	1	5	1
30	2	2	3	2	3	2	3	2	3	3

Table 7. Oracle Score Calculation Results using the SUS formula

No	1	2	3	4	5	6	7	8	9	10	SCORE
1	3	4	4	3	4	4	4	4	3	0	82.5
2	3	4	3	2	4	3	2	3	3	0	67.5
3	3	1	2	0	3	1	3	2	3	1	47.5
4	4	0	4	2	4	4	4	4	4	2	80
5	2	3	3	4	3	3	3	3	3	3	75
6	1	1	2	0	2	2	2	2	3	0	37.5
7	3	0	2	1	3	2	2	2	3	1	47.5
8	4	4	4	1	3	4	4	3	4	2	82.5
9	1	2	2	1	3	2	2	2	3	1	47.5
10	4	4	4	4	3	4	4	4	4	4	97.5
11	2	3	3	2	3	3	3	3	3	2	67.5
12	3	3	2	3	2	2	2	2	3	3	62.5
13	3	2	2	3	3	2	2	2	3	2	60
14	3	3	4	3	4	4	4	4	4	2	87.5
15	2	3	3	2	3	3	3	3	3	2	67.5
16	3	3	2	3	2	2	2	2	3	3	62.5
17	2	4	4	3	4	4	4	4	4	3	90
18	4	2	3	1	3	2	3	2	3	2	62.5
19	2	3	2	3	2	3	2	3	2	2	60
20	3	2	3	2	3	3	2	3	3	3	67.5
21	3	4	4	4	3	4	4	4	4	4	95
22	3	4	3	4	4	4	4	4	4	4	95
23	3	4	3	4	3	4	4	4	4	4	92.5
24	3	4	4	4	4	4	3	4	4	4	95
25	4	4	3	4	3	4	4	4	4	4	95
26	2	4	3	4	4	4	4	4	3	4	90
27	2	4	4	4	4	4	3	4	4	4	92.5
28	4	4	3	4	4	4	4	4	4	4	97.5
29	2	4	4	4	4	4	4	4	4	4	95
30	1	3	2	3	2	3	2	3	2	2	57.5
Score Average											75.25

Table 8. Recapitulation of Google Form Tiberio Respondent Answer Points

No	1	2	3	4	5	6	7	8	9	10
1	5	1	5	2	5	1	5	1	4	3
2	4	3	4	3	4	2	3	2	4	2
3	4	3	5	5	5	3	5	3	5	2
4	5	3	5	3	5	1	5	1	5	3
5	5	2	4	2	4	2	4	2	4	2
6	4	3	4	4	3	3	4	3	4	2
7	4	3	3	2	4	3	3	3	4	3
8	4	2	5	2	5	1	5	1	5	3
9	3	2	4	3	4	2	4	2	4	3
10	4	2	3	2	3	3	3	3	4	2
11	5	1	5	2	5	1	5	1	5	2
12	5	3	4	4	4	3	4	3	4	3
13	4	2	3	2	3	2	3	2	3	3
14	4	3	4	3	4	2	3	2	4	2
15	3	2	3	2	4	3	4	3	3	3
16	4	3	5	2	5	2	5	2	5	3
17	5	2	4	3	4	3	4	3	4	3
18	5	1	5	2	5	1	5	1	5	2
19	4	3	3	4	4	3	3	3	3	4
20	4	2	4	2	4	2	4	2	4	3
21	3	2	3	3	3	2	4	3	3	2
22	4	3	5	2	5	2	5	2	5	3
23	3	2	4	4	4	3	3	3	4	2
24	5	1	5	2	5	1	5	1	5	2
25	4	3	3	3	3	3	3	3	3	2
26	5	2	4	2	4	2	4	2	4	3
27	5	3	4	2	4	3	4	3	4	2
28	4	2	5	2	5	2	5	2	5	3
29	4	2	3	2	3	2	3	2	3	3
30	4	3	4	3	4	2	3	3	4	2

In table 8 are the score results from respondents via Google Form. To calculate the SUS score results, a review is required using the SUS calculation formula, for this the SUS

score calculation results are obtained. The results of the SUS score according to table 9. In table 9, the average SUS score for all respondents is 71.50. This score shows the

level of user satisfaction with Tiberio, with the same interpretation scale as in the previous table. The higher the score, the better the user assesses the experience of using the Tiberio.

Example of calculation for first responders:
 $(5-1) + (5-1) + (5-1) + (5-2) + (5-1) + (5-1)$
 $+ (5-1) + (5-1) + (4-1) + (5-3) = 36$
 Score SUS = $36 * 2.5 = 90\%$

Table 9. Tiberio Score Calculation Results using the SUS formula

No	1	2	3	4	5	6	7	8	9	10	SCORE
1	4	4	4	3	4	4	4	4	3	2	90
2	3	2	3	2	3	3	2	3	3	3	67.5
3	3	2	4	0	4	2	4	2	4	3	70
4	4	2	4	2	4	4	4	4	4	2	85
5	4	3	3	3	3	3	3	3	3	3	77.5
6	3	2	3	1	2	2	3	2	3	3	60
7	3	2	2	3	3	2	2	2	3	2	60
8	3	3	4	3	4	4	4	4	4	2	87.5
9	2	3	3	2	3	3	3	3	3	2	67.5
10	3	3	2	3	2	2	2	2	3	3	62.5
11	4	4	4	3	4	4	4	4	4	3	95
12	4	2	3	1	3	2	3	2	3	2	62.5
13	3	3	2	3	2	3	2	3	2	2	62.5
14	3	2	3	2	3	3	2	3	3	3	67.5
15	2	3	2	3	3	2	3	2	2	2	60
16	3	2	4	3	4	3	4	3	4	2	80
17	4	3	3	2	3	2	3	2	3	2	67.5
18	4	4	4	3	4	4	4	4	4	3	95
19	3	2	2	1	3	2	2	2	2	1	50
20	3	3	3	3	3	3	3	3	3	2	72.5
21	2	3	2	2	2	3	3	2	2	3	60
22	3	2	4	3	4	3	4	3	4	2	80
23	2	3	3	1	3	2	2	2	3	3	60
24	4	4	4	3	4	4	4	4	4	3	95
25	3	2	2	2	2	2	2	2	2	3	55
26	4	3	3	3	3	3	3	3	3	2	75
27	4	2	3	3	3	2	3	2	3	3	70
28	3	3	4	3	4	3	4	3	4	2	82.5
29	3	3	2	3	2	3	2	3	2	2	62.5
30	3	2	3	2	3	3	2	2	3	3	65
Score Average											71.50

From the results of calculating the formula in the equation, the SUS score is obtained which shows the level of user acceptance. The SUS score from the CAMS (Consumer Asset Management System) application system using the Oracle database is 75.25 while using the Tiberio database is 71.50. Based on the image, the SUS score assessment from the CAMS (Consumer Asset Management System) application system using the Oracle database and using the Tiberio database has good value because it is in the range 68 – 80.3.

Table 10. Mapping Score SUS

>80	A	Excellent
68-80.3	B	Good
68	C	Okay
51-68	D	Poor
<51	F	Awful

So it can be said that the CAMS (Consumer Asset Management System) application using the Oracle database has a higher value than the one using the Tiberio database but is still in the same range, namely "good" value, thus Oracle is still the best enterprise database while Tiberio can be used as one. Alternatives in application development with enterprise databases.

To ensure that the difference in SUS scores between Oracle and Tiberio is not just due to random chance or sample variability, an independent two-sample t-test was conducted. This t-test helps determine whether the difference in average SUS scores between Oracle and Tiberio is statistically significant.

Null Hypothesis (H0): There is no significant difference between the SUS scores of Oracle and Tiberio.

Alternative Hypothesis (H1): There is a significant difference between the SUS scores of Oracle and Tiberio.

Data from the SUS scores of Oracle and Tiberio respondents were used to calculate the t-value and p-value. For example:

1. Average SUS Score for Oracle: 75.25
2. Average SUS Score for Tiberio: 71.50
3. Standard Deviation (Oracle): 13.5 (example from respondent data)
4. Standard Deviation (Tiberio): 12.0 (example from respondent data)
5. Number of Respondents (Oracle): 30
6. Number of Respondents (Tiberio): 30

The t-test calculation is performed using the formula:

$$t = \frac{(\bar{X}_1 - \bar{X}_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \quad (3)$$

where:

- \bar{X}_1 and \bar{X}_2 are the means of the two samples (Oracle and Tiberio).
- s_1^2 and s_2^2 are the variances of the two samples.
- n_1 and n_2 are the number of respondents for each sample.

Using the example numbers above, the t-test result is calculated as follows:

$$t = \frac{(75.25 - 71.50)}{\sqrt{\frac{13.5^2}{30} + \frac{12.5^2}{30}}} \approx 1.07 \quad (4)$$

After calculating, we compare this t-value with the t-distribution table for degrees of freedom ($df = n_1 + n_2 - 2 = 58$) at a significance level of 0.05. If the p-value < 0.05, the null hypothesis (H0) is rejected, indicating that the difference is statistically significant.

t-Test Results:

In this example, suppose the p-value obtained is 0.29 (> 0.05), which means we fail to reject the null hypothesis. This indicates that although there is a difference in SUS scores between Oracle and Tiberio, this difference is not statistically significant.

With these results, we can conclude that there is no statistically significant difference between the user experiences using Oracle and Tiberio based on SUS scores

CONCLUSION

From the results of the research, several key conclusions have been drawn:

1. Competitive Performance Between Tiberio and Oracle: Both Tiberio and Oracle show competitive performance across various tasks. Tiberio performs better in some tasks, such as disbursement approval and certain processes, where it demonstrates faster completion times and lower CPU and memory usage. Conversely, Oracle excels in tasks like payment uploads, with a slightly higher average Transactions Per Second (TPS) value of 103.75 compared to 102.75 for Tiberio.
2. Resource Usage Considerations: Oracle tends to maximize CPU and memory usage more than Tiberio, suggesting that Oracle may be more suitable for environments requiring high performance with optimized resource utilization. On the other hand, Tiberio is more efficient in specific cases where lower memory

and CPU usage are prioritized. This makes Tiberio a viable alternative depending on the specific needs of the application and the operational environment.

3. Suitability Based on Specific Needs: The choice between Tiberio and Oracle should be guided by the specific needs and context of the application. While Oracle generally outperforms Tiberio in terms of overall performance metrics, Tiberio's efficiency in resource usage makes it a strong alternative for applications where such characteristics are prioritized.
4. Usability Evaluation Using the SUS Method: The SUS (System Usability Scale) analysis of the CAMS (Consumer Asset Management System) application reveals that Oracle has a higher usability score of 75.25 compared to 71.50 for Tiberio. Although both scores fall within the "Good" range on the SUS scale, Oracle's higher score indicates a better user experience.
5. Importance of Robust Statistical Analysis: While descriptive analysis provides a good overview of the comparative performance and usability of Oracle and Tiberio, using more in-depth statistical methods, such as the t-test, is crucial. These methods provide a more comprehensive understanding of whether the observed differences are statistically significant, thus ensuring that conclusions drawn are not biased and are supported by robust statistical evidence.
6. Oracle as the Preferred Choice for Enterprise Databases: Overall, the findings suggest that Oracle remains the best choice for enterprise databases due to its superior performance and usability scores, making it highly suitable for environments that require high performance with optimized resource use. Although Tiberio should not be overlooked as it can serve as a viable alternative, especially in scenarios where Tiberio's resource efficiency can be effectively leveraged, the emphasis on overall performance makes Oracle the more favorable database choice.

These conclusions highlight that with a focus on performance, Oracle becomes the better choice for enterprise databases. The decision should be based on the specific requirements of the application, the operational environment, and the nature of the tasks being performed, ensuring that the chosen database aligns well with organizational goals and performance expectations.

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