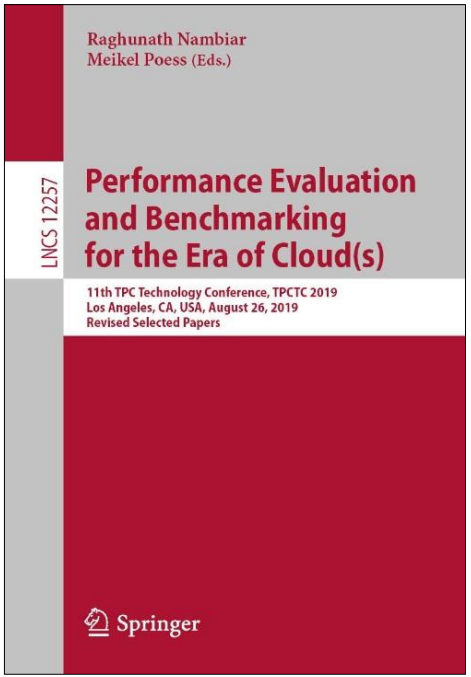
peakmarks

peakmarks® Workloads

For Oracle 19c, Oracle 21c and Oracle 23ai

June 2025



peakmarks® presented its software at the 11th Technology Conference of the Transaction Processing Performance Council (TPC) 2019 in Los Angeles.

Copyright Information

Abbreviations and Metrics

Nodes	number of cluster nodes
Jobs	number of workload processes
[GBps]	gigabyte per second
[MBps]	megabyte per second
[kBps]	kilobyte per second
[kBpt]	kilobyte per transaction
[IOPS]	I/O operations per second
[dbps]	database blocks per second
[rbps]	redo blocks per second
[s]	seconds
[ms]	milliseconds
[µs]	microseconds
BuCache	Database Buffer Cache
FlCache	Database or Exadata Flash Cache
[qps]	queries per second
[rps]	rows per second
[tps]	transactions per second
[sps]	SQL executions per second
[Mops]	million operations per second

Agenda

1 Introduction to peakmarks® Software

2 Server Systems Performance

3 Storage Systems Performance

4 Log Writer Processes Performance

5 Database Writer Processes Performance

6 Data Load Performance

7 Data Analytics Performance

8 Online Transaction Processing Performance

9 PL/SQL Application Program Performance

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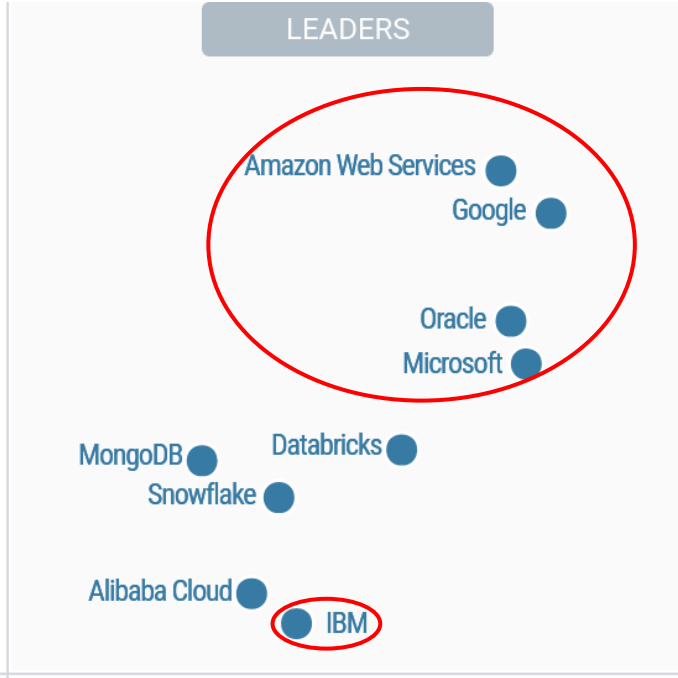
Performance is not everything.
But without performance, everything is worth nothing.

Introduction to peakmarks® Software

Transparency on Performance

Questions raised by customers



Source: Magic Quadrant for Cloud Database Management Systems; Gartner (October 2024)

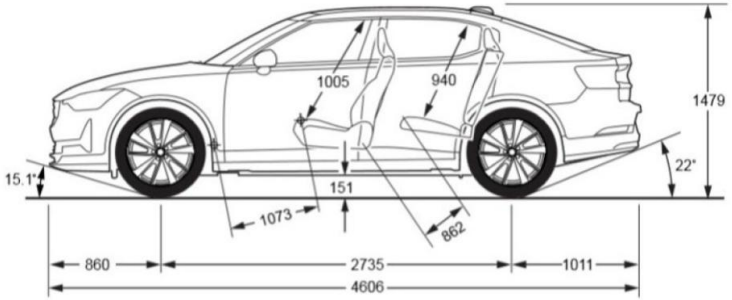
- Which cloud service/on-premises solution offers the best price/performance ratio?
- Which cloud service/on-premises solution requires the fewest Oracle licenses when using the BYOL model?
- What metrics should be used for capacity planning when migrating from the current legacy platform to a new cloud infrastructure?
- Cloud service providers can change their infrastructure and settings without warning. How can customers periodically check, such as monthly or quarterly, to ensure they are receiving consistent performance?
- How can customers evaluate the platform's stability during peak periods?

Simple and understandable Performance Metrics

No clear and transparent performance metrics are currently available for Oracle database platforms, whether hosted on cloud services or installed on-premises.

However, Peakmarks has taken inspiration from the automotive industry, which uses easily understandable and comparable performance indicators.

Access to reliable performance metrics is crucial for a better understanding of Oracle database infrastructure performance. These metrics allow for cross-vendor comparability and support the evaluation, quality assurance, and capacity planning of Oracle database infrastructures, resulting in higher cost efficiency.



Long range Single motor	Long range Dual motor	Long range Dual motor with Performance pack
Driveline Rear-wheel drive	Driveline All-wheel drive	Driveline All-wheel drive
Power[1] 220 kW / 299 hp	Power[1] 310 kW / 421 hp	Power[1] 335 kW / 455 hp
Torque[1] 361 lb-ft	Torque[1] 546 lb-ft	Torque[1] 546 lb-ft
0-60 mph[1] 5.9 seconds	0-60 mph[1] 4.3 seconds	0-60 mph[1] 4.1 seconds
Top speed[1] 127 mph	Top speed[1] 127 mph	Top speed[1] 127 mph
Range up to[2] 320 mi (EPA)	Range up to[2] 276 mi (EPA)	Range up to[2] 247 mi (EPA)*
Towing power Up to 2000 lbs	Towing power Up to 2000 lbs	Towing power Up to 2000 lbs
Battery 400 V Lithium-ion battery 82 kWh capacity, 27 modules	Battery 400 V Lithium-ion battery 78 kWh capacity, 27 modules	Battery 400 V Lithium-ion battery 78 kWh capacity, 27 modules

Source: www.polestar.com

Simple and understandable Performance Metrics

Scope	Key Performance Metric	Measurement Unit	Workloads
Server Performance	▪ Query throughput ▪ Query response time ▪ Buffer cache scan rate	[qps] [ms] [MBps]	Look-up queries, complex queries, reports, scans, mixed queries on data in the buffer cache (no I/O operations).
Storage Performance	▪ SQL sequential read throughput ▪ SQL random I/O throughput ▪ SQL random I/O service time	[MBps] [IOPS] [µs]	Conventional storage and intelligent storage with offload technology.
LGWR Performance	▪ Log writer throughput ▪ Log writer latency	[tps], [MBps] [ms]	Transactions generating varying REDO sizes.
DBWR Performance	▪ Database writer throughput	[dbps]	Massive block changes in the database buffer cache.
Data Load Performance	▪ Data load rate	[MBps], [rps]	Buffered data load (transactional systems), direct data load (data warehouse and analytic systems), and streamed data load (IOT applications).
Data Analytics Performance	▪ Data scan rate	[MBps], [rps]	Conventional storage, intelligent storage with offload technology, row store, column store.
Online Transaction Processing Performance	▪ Transaction throughput ▪ Transaction response time	[tps] [ms]	OLTP operations of different complexity; read-intensive operation mix with reporting and data load; write-intensive operation mix with heavy updates and data load.
PL/SQL application program Performance	▪ PL/SQL operation throughput ▪ PL/SQL algorithm processing time	[Mops] [s]	Arithmetic operations on different numeric data types, mixed built-in operations on different data types, recursive Fibonacci number algorithm, prime number algorithm.

Transparency on Performance

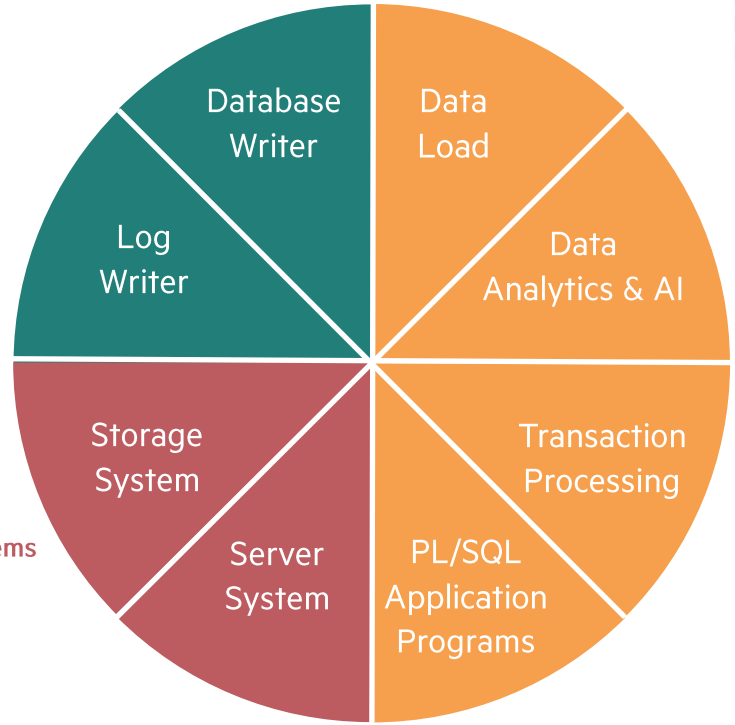
Over 30 workloads across 8 core database disciplines

Workload for Database Writer
- DBWR-THR

Workloads for Log Writer
- LGWR-LAT
- LGWR-THR

Workloads for Storage Systems
- STO-READ
- STO-OFFLOAD
- STO-RANDOM
- STO-SCATTER

Workloads for Server Systems
- SRV-REPORT
- SRV-LOOKUP
- SRV-QUERY
- SRV-SCAN
- SRV-MIXED



Workloads for Data Load
- DL-BUFFER
- DL-DIRECT
- DL-STREAM

Workloads for Data Analytics & AI
- DA-STORAGE
- DA-OFFLOAD
- DA-ROWSTORE
- DA-COLSTORE

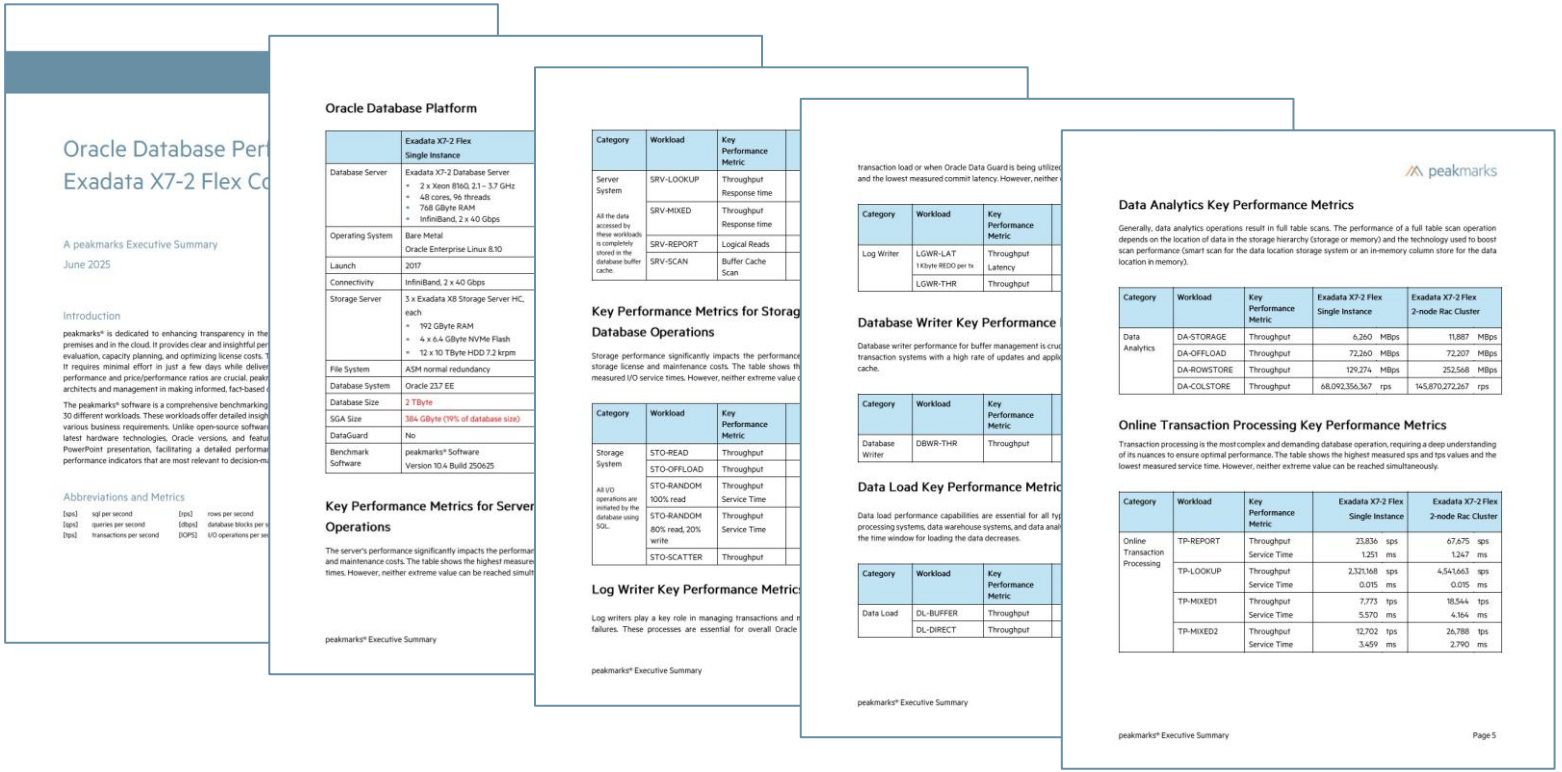
Note: AI workloads are currently being evaluated.

Workloads for Transaction Processing
- TP-REPORT
- TP-LOOKUP
- TP-LIGHT
- TP-MEDIUM
- TP-HEAVY
- TP-MIXED1
- TP-MIXED2

Workloads for PL/SQL Application Programs
- PLS-ADD
- PLS-BUILTIN
- PLS-FIBO
- PLS-PRIME
- PLS-MIXED

Transparency on Performance

peakmarks® Executive Summary - Simple and understandable Performance Metrics – within 48 hours



Oracle Database Perf
Exadata X7-2 Flex Co

A peakmarks Executive Summary
June 2025

Introduction

peakmarks® is dedicated to enhancing transparency in the
premises and in the cloud. It provides clear and insightful per
evaluation, capacity planning, and optimizing license costs. T
It requires minimal effort in just a few days while deliver
performance and price/performance ratios are crucial, peakr
architects and management in making informed, fact-based
The peakmarks® software is a comprehensive benchmarking
30 different workloads. These workloads offer detailed insigh
various business requirements. Unlike open-source software
latest hardware technologies, Oracle versions, and featu
PowerPoint presentation, facilitating a detailed performa
performance indicators that are most relevant to decision-m

Abbreviations and Metrics

[sps] sql per second
[qps] queries per second
[tps] transactions per second
[rps] rows per second
[dbps] database blocks per s
[IOPS] I/O operations per se

Oracle Database Platform

	Exadata X7-2 Flex Single Instance
Database Server	Exadata X7-2 Database Server ▪ 2 x Xeon 8160, 2.1 – 3.7 GHz ▪ 48 cores, 96 threads ▪ 768 GByte RAM ▪ InfiniBand, 2 x 40 Gbps
Operating System	Bare Metal Oracle Enterprise Linux 8.10
Launch	2017
Connectivity	InfiniBand, 2 x 40 Gbps
Storage Server	3 x Exadata X8 Storage Server HC, each ▪ 192 GByte RAM ▪ 4 x 6.4 GByte NVMe Flash ▪ 12 x 10 TByte HDD 7.2 krpm
File System	ASM normal redundancy
Database System	Oracle 23.7 EE
Database Size	2 TByte
SGA Size	384 GByte (19% of database size)
DataGuard	No
Benchmark Software	peakmarks® Software Version 10.4 Build 250625

Key Performance Metrics for Server
Operations

The server's performance significantly impacts the performar
and maintenance costs. The table shows the highest measure
times. However, neither extreme value can be reached simult

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Category	Workload	Key Performance Metric
Server System All the data accessed by these workloads is completely stored in the database buffer cache.	SRV-LOOKUP	Throughput Response time
	SRV-MIXED	Throughput Response time
	SRV-REPORT	Logical Reads
	SRV-SCAN	Buffer Cache Scan

Key Performance Metrics for Storag
Database Operations

Storage performance significantly impacts the performance
storage license and maintenance costs. The table shows th
measured I/O service times. However, neither extreme value

Category	Workload	Key Performance Metric
Storage System All I/O operations are initiated by the database using SQL.	STO-READ	Throughput
	STO-OFFLOAD	Throughput
	STO-RANDOM 100% read	Throughput Service Time
	STO-RANDOM 80% read, 20% write	Throughput Service Time
	STO-SCATTER	Throughput

Log Writer Key Performance Metric

Log writers play a key role in managing transactions and r
failures. These processes are essential for overall Oracle

peakmarks® Executive Summary

transaction load or when Oracle Data Guard is being utilize
and the lowest measured commit latency. However, neither

Category	Workload	Key Performance Metric
Log Writer	LGWR-LAT 1 kbyte REDO per tx	Throughput Latency
	LGWR-THR	Throughput

Database Writer Key Performance

Database writer performance for buffer management is cruc
transaction systems with a high rate of updates and applic
cache.

Category	Workload	Key Performance Metric
Database Writer	DBWR-THR	Throughput

Data Load Key Performance Metric

Data load performance capabilities are essential for all typ
processing systems, data warehouse systems, and data anal
the time window for loading the data decreases.

Category	Workload	Key Performance Metric
Data Load	DL-BUFFER	Throughput
	DL-DIRECT	Throughput

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Data Analytics Key Performance Metrics

Generally, data analytics operations result in full table scans. The performance of a full table scan operation depends on the location of data in the storage hierarchy (storage or memory) and the technology used to boost scan performance (smart scan for the data location storage system or an in-memory column store for the data location in memory).

Category	Workload	Key Performance Metric	Exadata X7-2 Flex Single Instance	Exadata X7-2 Flex 2-node Rac Cluster
Data Analytics	DA-STORAGE	Throughput	6,260 MBps	11,887 MBps
	DA-OFFLOAD	Throughput	72,260 MBps	72,207 MBps
	DA-ROWSTORE	Throughput	129,274 MBps	252,568 MBps
	DA-COLSTORE	Throughput	68,092,356,367 rps	145,870,272,267 rps

Online Transaction Processing Key Performance Metrics

Transaction processing is the most complex and demanding database operation, requiring a deep understanding of its nuances to ensure optimal performance. The table shows the highest measured sps and tps values and the lowest measured service time. However, neither extreme value can be reached simultaneously.

Category	Workload	Key Performance Metric	Exadata X7-2 Flex Single Instance	Exadata X7-2 Flex 2-node Rac Cluster
Online Transaction Processing	TP-REPORT	Throughput	23,836 sps	67,675 sps
		Service Time	1.251 ms	1.247 ms
	TP-LOOKUP	Throughput	2,321,168 sps	4,541,663 sps
		Service Time	0.015 ms	0.015 ms
	TP-MIXED1	Throughput	7,773 tps	18,544 tps
		Service Time	5.570 ms	4.164 ms
	TP-MIXED2	Throughput	12,702 tps	26,788 tps
		Service Time	3.459 ms	2.790 ms

peakmarks® Executive Summary Page 5

peakmarks® full disclosure Report (~ 80 slides) for System Architects and Capacity Planner

peakmarks ® Software provides detailed KPM reports tailored to specific workloads. It is the only benchmark software that accurately reflects system behavior under various load conditions.

Run	Test	Workload	Wri [%]	Nodes	Jobs	DOP	CPU busy [%]	CPU user [%]	CPU sys [%]	CPU idle [%]	CPU iow [%]	Phys reads total [IOPS]	IO time read [ms]	Phys reads total [MBps]	Phys reads FlCache [MBps]	FlCache read [%]	BuCache read [%]	Elapsed time [s]
12	65	STO-RANDOM	0	2	2	1	1	0	0	99	0	82,471	0.097	653	653	100.00	15.40	302
	66	STO-RANDOM	0	2	48	1	11	8	2	89	0	1,849,315	0.024	14,548	14,548	100.00	8.26	302
	67	STO-RANDOM	0	2	96	1	15	11	3	85	0	2,512,334	0.032	19,758	19,758	100.00	9.07	302
	68	STO-RANDOM	0	2	144	1	17	12	3	83	0	2,834,981	0.040	22,296	22,296	100.00	9.54	301
	69	STO-RANDOM	0	2	192	1	24	24	0	76	0	5,198,402	0.083	40,865	40,865	100.00	8.91	302
	70	STO-RANDOM	0	2	240	1	30	30	0	70	0	5,169,123	0.098	40,642	40,471	99.58	9.30	302

With its unique adaptive load algorithms, peakmarks® Software ensures that the utilization is always in sync with the platform's performance capabilities. The KPM reports are instantly available, providing real-time insights.

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Simple. Representative. Fast.

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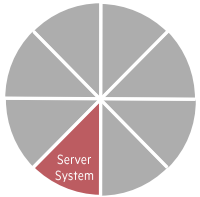
Workloads to determine the Server Performance in Oracle Database Operations



Motivation

The server's performance significantly impacts the performance of all database operations, as well as the license and maintenance costs.

The goals of System Architects and Capacity Planners are to

- Validate the performance capabilities (speed, throughput, scalability) of server components in database operations, including processors, main memory, and internal memory channels.
- Determine the impact of server virtualization, multithreading, NUMA effects, and encryption on server performance.
- Optimize database license and maintenance costs for the server system, focusing on per-core performance.

Notes

- SPEC numbers are not necessarily indicative of Oracle's performance on a specific processor.
- Cloud service providers may use undocumented processors, resulting in a lack of SPEC numbers for these processors.
- Some manufacturers, such as IBM, offer limited or no SPEC information for their processors.
- Customers need to know the per-thread performance, which significantly impacts application process performance.
- Customers need to know the per-core performance, which significantly impacts Oracle license costs. In some cases, Oracle licensing costs exceed the costs of infrastructure.

Server System Workloads

Key Performance Metrics

- SQL query throughput on cached data in queries per second [qps]
- SQL query response time on cached data in milliseconds [ms]
- Logical reads on cached data in database blocks per second [dbps]
- SQL buffer cache scan rate on cached data in megabytes per second [MBps]

peakmarks® KPM Reports

- kpm_query.sql
- kpm_scan.sql

Description

Workload	Measurement Unit	Action
SRV-LOOKUP	[qps] [ms]	Latency-oriented lookup query – select one row via index, e.g., select customer, account, product, order, invoice. This workload demonstrates maximum query throughput and minimal response time for simple queries.
SRV-QUERY	[qps] [ms]	Data volume-oriented look-up query – select approximately 25 rows via index, such as retrieving last month's bank account transactions or the item list of an order. This workload demonstrates maximum query throughput and minimal response time for more complex queries.
SRV-REPORT	[dbps]	Online Report – select Ø 125 rows via index, e.g., select last month's cell phone call records. This workload shows maximum logical read throughput.
SRV-SCAN	[MBps]	Search on non-indexed data (full table scan). This workload shows a maximum database buffer cache scan rate.

Notes

- All accessed tables are stored in the database buffer cache and operated under optimal conditions.
- There are almost no I/O operations, and all SRV workloads are CPU-bound.
- These queries occur in all applications in all industries and demonstrate performance in real-world operations.

Description

Workload	Measurement Unit	Action
SRV-MIXED	[qps] [ms]	The workload involves mixed queries and full table scans on cached data. It includes the following functionalities: SRV-LOOKUP (78%), SRV-QUERY (19%), SRV-REPORT (2%), and SRV-SCAN (1%). It is important to note that SPEC numbers may not always be available or may not accurately reflect Oracle database operations. To evaluate the performance of the server system during Oracle database operations, we use the peakmarks workload SRV-MIXED to compare various CPU architectures, including ARM, Intel Xeon, AMD EPYC, IBM POWER, and IBM Z.

Notes

- All accessed tables are stored in the database buffer cache and operated under optimal conditions.
- There are almost no I/O operations, and all SRV workloads are CPU-bound.
- These queries occur in all applications in all industries and demonstrate performance in real-world operations.

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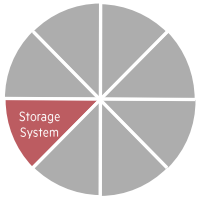
Workloads to determine the Storage Performance in Oracle Database Operations



Motivation

Storage performance has a significant impact on the efficiency of all database operations and can also affect related costs such as storage licensing and maintenance.

The objectives of System Architects and Capacity Planners are to:

- Validate the performance capabilities of the storage system in relation to database operations.
- Assess how various storage technologies, such as deduplication, compression, encryption, replication, offloading, and tiering, impact database performance and storage space utilization.
- Optimize costs associated with storage system licenses and maintenance.

Notes

- Some cloud service providers do not publish their storage components and configurations.
- Components and configurations of cloud services are subject to change without notice.

Storage System Workloads

Key Performance Metrics

- SQL sequential read throughput in megabytes per second [MBps]
- SQL random read throughput in I/O operations per second [IOPS]
- SQL I/O read service time in milliseconds [ms]
- SQL random write throughput in database blocks per second [dbps]

peakmarks® KPM Reports

- kpm_ioread.sql
- kpm_iowrite.sql

Description

Workload	Measurement Unit	Action
STO-READ	[MBps]	SQL statements performing a sequential table scan using conventional storage devices. This workload delivers maximum sequential throughput using conventional storage.
STO-OFFLOAD	[MBps]	SQL statements performing a sequential table scan using smart-scan offload technology. This workload delivers maximum sequential throughput using smart-scan technology on Oracle Engineered Systems.
STO-RANDOM	[IOPS] [ms]	SQL statements read and update blocks via index access for different read/write ratios. The workload parameter specifies the write ratio as a percentage. The following values are supported {0, 1, 2, 3, ..., 99, 100}. This workload delivers maximum random I/O operations per database server and/or storage system.
STO-SCATTER	[dbps]	SQL statement performing scattered block writes, bypassing the buffer cache. The workload STO-SCATTER writes the blocks by foreground processes; in contrast, the DBWR-THR workload writes the blocks by background processes.

Notes
- In general, all STO workloads are I/O-bound. However, the STO-RANDOM workload also requires corresponding CPU power.
- These kinds of storage workloads are generic to all applications in all industries.

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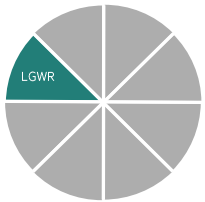
Workloads to determine the Log Writer Performance



Motivation

Log Writer processes are responsible for managing transactions and ensuring database consistency in the event of failures.

These processes are vital for overall Oracle performance, especially during periods of high transaction loads.

The objectives of System Architects and Capacity Planners include:

- Optimizing the throughput and latency of REDO log writers.
- Assessing the impact of Oracle Data Guard on local transaction performance.
- Evaluating how various factors affect log writer performance, such as data deduplication, data compression, and the use of ASM redundancy levels.

Log Writer Workloads

Key Performance Metrics

- SQL commit throughput in transactions per second [tps]
- SQL commit latency in milliseconds [ms]
- Log writer throughput in megabyte per second [MBps]

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- kpm_lgwr.sql

Log Writer Workloads

Description

Workload	Measurement Unit	Action
LGWR-LAT	[tps] [ms]	Log-Writer latency; workload uses COMMIT WRITE WAIT IMMEDIATE. This workload shows the commit rate and the commit latency; the REDO size per transaction is configurable between 1 and 256 Kbyte.
LGWR-THR	[MBps]	Log-Writer throughput; workload uses COMMIT WRITE NOWAIT BATCH. This workload shows the maximum amount of redo data written by log writer processes.

Notes:

- Log writer operations are universal across all applications and industries.
- The volume of REDO data per transaction can vary based on database size and the use of RAC technology.

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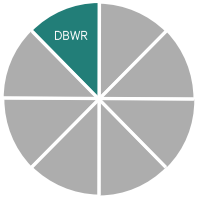
Workloads to determine the Database Writer Performance



Motivation

The performance of database writers in managing the buffer cache is essential for the overall efficiency of a database, particularly in transaction systems that experience a high volume of updates and in applications that mainly load data through the buffer cache.

System Architects and Capacity Planners aim to:

- Optimize the number of database writer processes.
- Assess how various factors, such as the ASM redundancy level and data reduction technologies, affect database writer performance.

Database Writer Workloads

Key Performance Metrics

- Database writer throughput in database blocks per second [dbps]

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- kpm_dbwr.sql

Database Writer Workloads

Description

Workload	Measurement Unit	Action
DBWR-THR	[dbps] [MBps]	This workload focuses on significant block changes within the buffer cache under a workload that uses the COMMIT WRITE NOWAIT BATCH method. In this workload, we measure the maximum number of modified blocks that the database writer processes can write back to the storage system. The number of database writer processes is determined by a configurable parameter within the Oracle instance. The DBWR-THR workload involves writing blocks by background processes, whereas the STO-SCATTER workload involves writing blocks by foreground processes.

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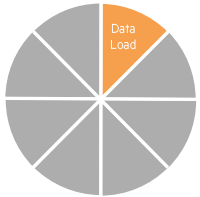
Workloads to determine the Data Load Performance



Motivation

Data load performance capabilities are essential for all kinds of database applications:

- Transaction processing systems.
- Data warehouse systems.
- Data analytics systems.

As the volume of data continues to rise, the timeframe for loading this data is becoming shorter.

The goals of System Architects and Capacity Planners are to

- Optimize data load throughput.
- Validate the impact of several factors on data load performance.

Data Load Workloads

Key Performance Metrics

- SQL data load rate in rows per second [rps] for transactional data load
- SQL data load rate in megabytes per second [MBps] for bulk load

peakmarks® KPM Reports

- kpm_dl.sql

Data Load Workloads

Description

Workload	Measurement Unit	Action
DL-BUFFER	[MBps] [rps]	Insert of program-generated data via default buffer cache into Oracle tables, includes maintenance of 1 index, uses COMMIT WRITE WAIT IMMEDIATE. The workload parameter specifies the number of rows per INSERT; the following values are supported {1, 2, 3, 4, 5, … , 99, 100}. This data load workload is mainly used in Transaction Processing systems.
DL-DIRECT	[MBps] [TBph]	Insert data by copying from other tables using CTAS technology with NOLOGGING, bypassing the buffer cache, including maintenance of 1 index, uses COMMIT WRITE NOWAIT BATCH. This data load workload is mainly used in Data Warehouse systems.
DL-STREAM (planned for future release)	[MBps] [rps]	Insert of program-generated data via memory-optimized pool into Oracle tables, includes maintenance of 1 index, does not need COMMIT operations. The workload parameter specifies the number of rows per INSERT; the following values are supported {1, 2, 3, 4, 5, … , 99, 100}. This data load workload is mainly used in Internet-of-Things systems.

Notes

- These types of data loading workloads are common across all applications and industries.
- The data load throughput depends mainly on the method (buffered, direct, streamed) and the transaction size (number of rows between commits).

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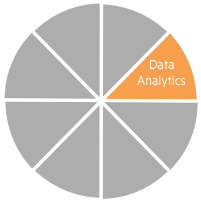
Workloads to determine the Data Analytics Performance



Motivation

In general, data analytics operations often require full table scans. The performance of a full table scan depends on the data's location within the storage hierarchy (such as in storage or memory) and the technology used to enhance scan performance, like smart scans for data stored on the storage system or in-memory column stores for data held in memory.

The primary goals of System Architects and Capacity Planners are to:

- Optimize data scan throughput.
- Manage Oracle license and maintenance costs, as some technologies require separate licenses.
- Evaluate the impact of various factors on data analytics performance, including:
  - Smart scan offload technology
  - In-memory column store technology

Data Analytics Workloads

Key Performance Metrics

- SQL data scan rate in rows per second [rps] for in-memory column store
- SQL data scan rate in megabytes per second [MBps] for all other data locations

peakmarks® KPM Reports

- kpm_da.sql

Data Analytics Workloads

Description

Workload	Measurement Unit	Action
DA-STORAGE	[MBps] [rps]	A straightforward aggregation is performed after a complete table scan and grouping, reading data from conventional storage.
DA-OFFLOAD	[MBps] [rps]	A straightforward aggregation following a complete table scan and grouping, utilizing smart-scan offload technology.
DA-ROWSTORE	[MBps] [rps]	A simple aggregate operation after performing a full table scan and grouping the data, reading the data from the row store.
DA-COLSTORE	[MBps] [rps]	Simple aggregate after full table scan and grouping, using column-store. Starting in Oracle 19.8, the base level of the in-memory option supports up to 16 GByte in-memory column store without license costs.

Note
These kinds of analytic workloads are generic to all applications in all industries.

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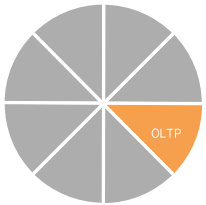
Workloads to determine the Online Transaction Processing Performance



Motivation

For effective capacity planning, it is essential to understand the performance characteristics of a platform when handling transactions of varying complexity.

Transaction processing is considered the most complex operation in a database.

The objectives of System Architects and Capacity Planners include:

- Optimizing transaction throughput and response times.
- Identifying the limiting resource.
- Validating the impact of various factors on transaction throughput and response time, such as:
  - The ratio between the database size and buffer cache size
  - Transaction size
  - I/O random read service time
  - Log writer latency

Transaction Processing Workloads

Key Performance Metrics

- SQL transaction throughput per second [tps]
- SQL transaction response time in milliseconds [ms]

peakmarks® KPM Reports

kpm_tp.sql	key performance metrics like throughput, response time, and buffer cache hit rate
kpm_tpplus.sql	logical I/O and physical I/O and REDO data per SQL statement
kpm_tpio.sql	I/O service time, log writer latency, physical read and write throughput

Description

Workload	Measurement Unit	Action
TP-REPORT	[sps]	Online report for a transaction processing application
	[ms]	SELECT Ø 25 rows using the index.
TP-LOOKUP	[sps]	Fast Lookup Query
	[ms]	This query selects a single row using an index, for example, to select an account or product. If configured, this workload utilizes tables in the memory-optimized row store (accessed via a hash key), which was introduced in Oracle 18c for faster lookups. If the memory-optimized option is not configured, it will use regular tables with a B-tree index. Starting with Oracle 19.12, the Oracle base level now supports memory-optimized tables across all platforms.

Notes:

- These transaction processing workloads are generic to all applications in all industries.
- The technology used for workload TP-LOOKUP (memory-optimized tables) is generally available in Oracle Enterprise Edition starting with 19.12.
- For Oracle versions older than 19.12, the following configuration parameter can be used to enable this functionality on all platforms:
  SQL> alter system set "_exadata_feature_on" = true scope = spfile;

Description

Workload	Measurement Unit	Action
TP-LIGHT	[tps] [ms]	Transaction Type: Light Selecting or updating a single row using an index. For example, select or update an account, product, or order with varying ratios of SELECT to UPDATE operations using SELECT FOR UPDATE locking. The workload parameter determines the update ratio as a percentage and can take values from 1 to 100.
TP-MEDIUM	[tps] [ms]	Transaction Type: Medium Selecting or updating an average of 25 rows using an index. For example, to access last month's bank account transactions. Different ratios of SELECT and UPDATE can be applied using the SELECT FOR UPDATE locking mechanism. The workload parameter determines the update ratio as a percentage and can take values from 1 to 100.
TP-HEAVY	[tps] [ms]	Transaction Type: Heavy Selecting or updating approximately 125 rows using an index. For instance, to access cell phone call records from the previous month. The workload parameter determines the update ratio as a percentage and can take values from 1 to 100.

Note
These transaction processing workloads are generic to all applications in all industries.

Description

Workload	Measurement Unit	Action
TP-MIXED1	[tps] [ms]	A transaction processing workload that is more read-intensive, consisting of equal proportions of TP-LOOKUP, TP-REPORT, TP-MEDIUM (with 30% UPDATE), and DL-BUFFER (with 3 rpt).
TP-MIXED2	[tps] [ms]	A write-intensive transaction processing mix involving various transaction types. This workload consists of equal proportions of TP-LOOKUP, TP-LIGHT (40% UPDATE), TP-MEDIUM (30% UPDATE), and DL-BUFFER (with 3 rpt).

Notes

- The difference between TP-MIXED1 and TP-MIXED2 lies in the composition of their operations.
- TP-MIXED1 and TP-MIXED2 are the most representative peakmarks® workloads used to assess Oracle transaction processing performance capabilities on a specific platform.
- These transaction processing workloads are applicable across all industry applications.
- The behavior of the two transaction types is slightly dependent on the platform, and the use of Oracle RAC technology also influences various performance metrics.
- peakmarks provides several performance reports for transaction processing workloads: kpm_tp.sql shows overall transaction performance, kpm_tpplus.sql adds information about logical reads and writes per SQL statement, as well as the amount of redo data, and kpm_tpio.sql presents physical I/O information.

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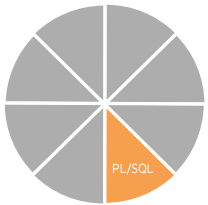
Workloads to determine the PL/SQL Application Program Performance



Motivation

Mission-critical systems utilize PL/SQL to encapsulate essential functions, ensuring efficient execution as close to the data as possible. This is particularly important in cloud environments, where databases and application servers are separate, as it helps to reduce traffic between the two.

The objectives of System Architects and Capacity Planners include:

- Validating the processor performance capabilities required to execute PL/SQL code.

Note
Separating applications and data may cause performance problems. For example, each round-trip between the application and the Oracle database in a different data center takes approximately 2 ms.

PL/SQL Application Workloads

Key Performance Metrics

- PL/SQL operation throughput in a million operations per second [Mops]
- PL/SQL computing time to process algorithms in seconds [s]

peakmarks® KPM Reports

- kpm_pls.sql
- Kpm_algorithm.sql

Description

Workload	Measurement Unit	Action
PLS-ADD	[Mops]	These workloads test the performance of adding numbers using various PL/SQL numeric data types. The workload parameter indicates the data type, and the following values are supported: {SI, SF, PI, NU, DA}. This workload demonstrates how various PL/SQL data types impact the performance of basic arithmetic operations.
PLS-BUILTIN	[Mops]	PL/SQL operations specific to different data types, including SQL built-in functions, are utilized in core banking and telco billing applications. The workload parameter indicates the data type, and the following values are supported: {SI, SF, PI, NU, VC}. This workload demonstrates how the PL/SQL data type affects the performance of typical operations..

Note
The following abbreviations for PL/SQL data types are used: SI = SIMPLE_INTEGER, SF = SIMPLE_FLOAT, PI = PLS_INTEGER, NU = NUMBER, DA = DATE, VC = VARCHAR2.

Description

Workload	Measurement Unit	Action
PLS-MIXED	[Mops]	This workload involves a mix of data type-specific PL/SQL operations, including SQL built-in functions. It consists of the following workloads: PLS-ADD (NUMBER), PLS-ADD (PLS_INTEGER), PLS_BUILTIN (NUMBER), and PLS_BUILTIN (VARCHAR2). PLS-MIXED is the most representative peakmarks workload used to assess the PL/SQL performance capabilities of an Oracle database server.
PLS-FIBO	[s]	Calculating the Fibonacci number N, where the workload parameter specifies N. Supported values are {39, 40, 41, 42, 43, 44}. This workload demonstrates the single-thread performance of a simple recursive algorithm implemented in PL/SQL.
PLS-PRIME	[s]	Calculation of the first N prime numbers. The workload parameter specifies N, with the supported values being {1000, 10000}. This workload demonstrates the single-thread performance of a simple algorithm implemented in PL/SQL.

peakmarks Mission

Identify Key Performance Metrics for Oracle Database Platforms.

On-Premises and in the Cloud.

For Quality Assurance, Evaluations, and Capacity Planning.