Oracle® Communications Billing and Revenue Management

Cloud Native Performance Test Summary

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Preface

This guide provides guidelines for benchmarking your Oracle Communications Billing and Revenue Management (BRM) cloud native system. It serves as an initial reference to the benchmarking of a BRM cloud native system. The actual performance of the system can vary significantly based on the capacity and performance in the target infrastructure.

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Audience

This guide is intended for operations personnel and system administrators.

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Introduction

Oracle Communications Billing and Revenue Management (BRM) and Elastic Charging Engine (ECE) are a proven, pre-integrated solution spanning mediation, 2G to 5G converged charging, billing, and end-to-end revenue management. The solution enables techco CSPs to monetize any network, service, experience, or business model, at any scale, using cloud infrastructure.

Topics in this document:

About BRM and ECE

BRM provides industry proven, modern billing and revenue management for communications and digital businesses, offering:

- Flexible service, and industry business model support.
- Faster innovation: rapid launch of digital offers with design-time flexibility.
- IT agility: modern cloud native deployment model with low total cost of ownership, designed to be deployed in public and private cloud infrastructure.

Oracle's BRM has been designed to support the efficient scheduling and running of high performance billing and invoicing tasks, running on cloud native infrastructure. Billing and invoicing are multithreaded applications designed to optimally utilize the available compute resources to ensure large scale jobs are completed in the minimum time.

ECE, powered by industry leading in-memory grid technology, has been designed from the outset to support the technical and business monetization demands for hyperscale digital communications providers. It is a digital experience engine for the 5G era, providing 3GPP aligned real-time converged data and communications session charging and balance management, with native integration into Oracle's full suite of billing and revenue management capabilities designed in accordance with TM Forum principles.

ECE uses mesh-based in-memory technology to provide high performance, resilient and linearly scalable charging, with pre-integrations available to advanced revenue management capabilities. Built around network and IT industry standards, ECE uses an innovative high performance and coherent data management architecture to support near-linear scalability, low latency, and highly available geographically redundant deployments with transactional consistency.

Purpose and Scope

This document is designed to provide an insight to the measured performance and capacity of BRM, ECE, and Offline Mediation Controller deployed in a Cloud Native lab Environment (CNE) setup.

These are just references, since the actual performance of the system can vary significantly based on the details of the infrastructure. It is recommended that BRM, ECE, and Offline

Mediation Controller are run through a benchmark on the target cloud native infrastructure to determine the capacity and performance in the target infrastructure.

References

For more information, refer to the following books:

Oracle Communications Billing and Revenue Management Cloud Native Deployment Guide

Oracle Communications Billing and Revenue Management System Administrator's Guide

Oracle Communications Offline Mediation Controller Cloud Native Installation and Administration Guide

Oracle Communications Offline Mediation Controller System Administrator's Guide

2

Database and Hardware Configuration

This chapter provides details about the specific system configuration used as well as the various deployment components used for the benchmarking process for BRM and its components in this guide.

This information serves as a reference point for interpreting the results and understanding how your own configuration might influence the performance of your BRM and its components.

Topics in this document:

- About the Database and Hardware Configuration

About the Database and Hardware Configuration

Table 2-1 contains details of the specific configuration of the Oracle Database platform supporting the BRM system.

Table 2-1 Oracle Database Configuration

Component	Details
Database	2-Node RAC
Oracle Database version	19.21
Shape	VM.Standard.E4.Flex
Cores per VM	24 cores
Memory per VM	384 GB
Database Storage	32 TB

> **Note:**
>
> The following hardware configuration applies only to BRM and ECE components. For Offline Mediation Controller cloud native hardware configuration, see Table 7-1.

Table 2-2 contains details of the key hardware components used for Invoicing and REST API Performance Testing.

Table 2-2 Hardware Configuration for E4-based OKE Nodes (BRM and ECE)

Component	Details
Shape	VM.Standard.E4.Flex
CPU	AMD EPYC 7J13 processor
Clock Speed	2.55 GHz
Memory per Node	256 GB
oCPU Per Node	10

Table 2-2 (Cont.) Hardware Configuration for E4-based OKE Nodes (BRM and ECE)

Component	Details
Number of Worker Nodes	12
Boot Volume Size	300 GB

Table 2-3 contains details of the key hardware components used for Billing and Charging Performance Testing.

Table 2-3 Hardware Configuration for E5-based OKE Nodes (BRM and ECE)

Component	Details
Shape	VM.Standard.E5.Flex
CPU	AMD EPYC 9J14 processor
Clock Speed	2.60 GHz
Memory per Node	256 GB
oCPU Per Node	10
Number of Worker Nodes	12
Boot Volume Size	200 GB

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System Performance Benchmarking Metrics

This chapter details the key metrics employed during the benchmarking process for Oracle Communications Billing and Revenue Management (BRM) Cloud Native Deployment.

Topics in this document:

CPU Usage

The benchmarking process monitors two key CPU usage metrics: App CPU Usage and Database CPU Usage. These metrics represent the average percentage of CPU resources utilized by the application (App CPU Usage) and database server (Database CPU Usage) during peak hours.

They are calculated as follows:

- **App CPU Usage Percentage:** `(Average number of used OCPUs across all OKE nodes during peak hours) / (Total number of OCPUs per node) x 100%`
- **App CPU Usage (Cores Consumed):** `(Application CPU Usage percentage) x (Total Number of Worker Nodes) x (Number of Cores)`
- **Database CPU Usage Percentage:** `(Average number of used CPU cores across both database nodes during peak hours) / (Total number of CPU cores per database instance) x 100%`
- **Database CPU Usage (Cores Consumed):** `(Database CPU Usage percentage) x (Total Number of RAC Nodes) x (Number of Cores per Node)`

Throughput per Schema

Throughput (ops/sec) per Schema is a metric that reflects the transaction processing speed for each individual schema within the system. It essentially measures the number of transactions processed per second for a specific schema. It is calculated as follows:

```
Throughput (ops/sec) per Schema = (# of Accounts in a Schema) / (Processing Time per Account for that Schema)
```

Throughput Efficiency Indexes

The benchmarking process utilizes three Throughput Efficiency Indexes:

- Overall Throughput Efficiency Index
- Application Throughput Efficiency Index
- Database Throughput Efficiency Index

They are calculated as follows:

- **Overall Throughput Efficient Index:** This is calculated by dividing the Total Throughput (op/sec) by the sum of App oCPU consumed and DB oCPU consumed. This index provides an overall system efficiency rating, encompassing both application and database resource utilization.
- **App Throughput Efficient Index:** This metric focuses specifically on application efficiency. It's calculated by dividing the Total Throughput (ops/sec) by the App oCPU consumed alone. Analyzing this index helps identify how efficiently the application utilizes CPU resources for processing transactions.
- **Database Throughput Efficient Index:** Similar to the App Throughput Efficient Index, this metric focuses on database efficiency. It's calculated by dividing the Total Throughput (ops/sec) by the DB oCPU consumed to assess how effectively the database server utilizes its CPU resources for processing transactions.

IOPS Efficiency

The benchmarking process also evaluates input/output operations per second (IOPS) efficiency through three metrics: IOPS Overall Efficiency, IOPS Read Efficiency, and IOPS Write Efficiency.

They are calculated as follows:

- **IOPS Overall Efficiency**: This metric is calculated by dividing the Total Throughput (ops/sec) by the combined Read IOPS and Write IOPS. It provides an overall picture of IOPS efficiency for all system operations.
- **IOPS Read Efficiency**: This metric focuses on read operations specifically. It is calculated by dividing the Total Throughput (ops/sec) by the Read IOPS, offering insights into how efficiently the system processes read requests.
- **IOPS Write Efficiency**: Similar to IOPS Read Efficiency, this metric focuses on write operations. It's calculated by dividing the Total Throughput (ops/sec) by the Write IOPS, providing insights into how efficiently the system handles write requests.

Latency 95th Percentile

Latency refers to the time taken by the system to process a transaction. The 95th percentile latency is a metric that indicates the time taken to process 95% of transactions within the system.

Memory Usage

Memory usage is monitored for both the application (App Memory Usage) and the database server (DB Memory Usage) during peak hours.

They are calculated as follows:

- **App Memory Usage**: (Average used memory per OKE node during peak hours) x (Total number of OKE nodes)
- **Database Memory Usage**: (Average used memory per database instance during peak hours) x (Number of database instances)

Billing Care REST API Performance Metrics

Some common metrics captured during testing for the Billing Care REST API include:

- **Response Times:** Time taken by the API to respond to each request. Analyzed to identify potential bottlenecks.
- **Throughput (ops/sec):** Number of API requests processed per second. Provides an overall picture of processing speed under load.

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Billing and Invoicing Performance

This chapter provides an analysis of the performance of an Oracle Communications Billing and Revenue Management (BRM) 15.0 cloud native system during billing and invoicing. The performance focuses on the system's resource utilization and transaction processing speed.

Topics in this document:

Scenario 1: 14 Million Prepaid Accounts in 2 Schemas with Taxation Disabled

This scenario evaluates the billing and invoicing performance of a BRM 15.0.1 cloud native system with 14 million prepaid accounts in 2 schemas and taxation disabled.

Table 4-1 shows the various parameters used for the test.

Table 4-1 Scenario 1 Test Case and Setup Details

Parameter	Value
Account Volume	14,000,000
Subscribers per Schema	7,000,000
Schemas	2
ECE Synchronization	Enabled
Taxation	Disabled
Billing Threads	100
CM Replicas	10
Oracle DM Replicas	5
Oracle DM2 Replicas	5
OKE Nodes	12 (10 OCPUs each)
Shape	VM.Standard.E5.Flex

Scenario 2: 5 Million Wholesale Accounts in 1 Schema with Taxation Disabled

This scenario evaluates the billing and invoicing performance of a BRM 15.0.1 cloud native system with 5 million wholesale accounts in 1 schema and taxation disabled.

Table 4-2 shows the various parameters used for the test.

Table 4-2 Scenario 2 Test Case and Setup Details

Parameter	Value
Account Volume	5,063,896
Schemas	1
ECE Synchronization	Disabled
Taxation	Disabled
Billing Threads	200
CM Replicas	10
Oracle DM Replicas	10
OKE Nodes	12 (10 OCPUs each)
Shape	VM.Standard.E4.Flex

Scenario 3: 6 Million Postpaid Accounts in 2 Schemas with Taxation Enabled

This scenario evaluates the invoicing performance of a BRM 15.0 cloud native system with 6 million accounts in 2 schemas and taxation enabled.

Table 4-3 shows the various parameters used for the test.

Table 4-3 Scenario 3 Test Case and Setup Details

Parameter	Description
Account volume	6,000,000
Subscribers per Schema	3,000,000
Schemas	2
ECE Synchronization	Enabled
Taxation	Enabled
Billing Threads	100
CM Replicas	10
Oracle DM Replicas	5
Oracle DM2 Replicas	5
OKE Nodes	12 (10 OCPUs each)
Shape	VM.Standard.E4.Flex

Performance Results

Table 4-4 provides observation data for the billing performance test.

Table 4-4 Results for Billing

Test	Number of Accounts	Throughput (bills/second)	App CPU Usage (Cores Consumed)	Database CPU Usage (Cores Consumed)	Billing Efficiency
Scenario 1	14,000,000	2190	46	1043	37

Table 4-4 (Cont.) Results for Billing

Test	Number of Accounts	Throughput (bills/second)	App CPU Usage (Cores Consumed)	Database CPU Usage (Cores Consumed)	Billing Efficiency
Scenario 2	5,063,896	362	35	754	8

See "System Performance Benchmarking Metrics" for more information on how these metrics are calculated.

Table 4-5 provides observation data for the invoicing performance test that you can use for benchmarking your system.

Table 4-5 Results for Invoicing

Test	Number of Accounts	Throughput (invoices/second)	App CPU Usage (Cores Consumed)	Database CPU Usage (Cores Consumed)
Scenario 3	6,000,000	683	42	8

See "System Performance Benchmarking Metrics" for more information on how these metrics are calculated.

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Charging Efficiency

This chapter focuses on the charging efficiency of an Oracle Communications Billing and Revenue Management (BRM) 15.0.1 cloud native system, specifically its ability to handle transaction processing while maintaining optimal resource utilization.

Topics in this document:

Scenario: Voice/Data/SMS Charging Efficiency (19,700 Transactions)

This scenario evaluates the charging efficiency of a BRM 15.0.1 cloud native system by simulating a high volume of transactions. The system's performance is analyzed using Throughput Efficiency Indexes, which consider the transaction processing speed and CPU usage.

Table 5-1 shows the various parameters used for the test.

Table 5-1 Test Setup and Conditions

Parameter	Description
Account Volume	20,000,000 (all active)
Load Type	High volume
Schemas	2
Data Traffic per Diameter Gateway	15 GB
Database Optimization	Truncated partition for inserts
REM Logging Level	INFO
OKE Node Shape	VM.Standard.E5.Flex

Charging Efficiency Results

Table 5-2 shows the resource utilization, CPU usage, and memory usage of a BRM 15.0.1 cloud native system.

Table 5-2 Resource Utilization

TPS	App CPU Usage (Cores Consumed)	Database CPU Usage (Cores Consumed)	App Memory Usage	Database Memory Usage
19,700	31	5	1715 GB	434 GB

Table 5-3 shows the Throughput Efficiency Index while performing charging on a BRM 15.0.1 cloud native system.

Table 5-3 Throughput Efficiency Index

Overall	App	Database
1098	1281	7707

Table 5-4 shows the input/output operations per second (IOPS) efficiency.

Table 5-4 IOPS Efficiency

Overall	Read	Write
3.83	5.46	12.87

Table 5-5 provides latency results in milliseconds. Latency 95th percentile is taken from peak time of the process.

Table 5-5 Latency

Action	Latency (milliseconds)
Balance Query	1.57
Initiate	2.85
Terminate	3.52
Update	3.62

See "System Performance Benchmarking Metrics" for more information on how these metrics are calculated.

6

Billing Care REST API Performance

This chapter provides an analysis of the performance of Oracle Communications Billing Care REST API.

The test focuses on the API's ability to handle concurrent requests and its processing speed. Apache JMeter, a load testing tool, was used to generate and manage the API requests.

Topics in this document:

Scenario 1: Create 100,000 Accounts Using 50 Threads in 2 Schemas

This scenario evaluates the Billing Care REST API's ability to create 100,000 accounts using 50 threads in 2 schemas.

Table 6-1 shows the client configuration used for the test.

Table 6-1 Scenario 1 Test Client Configuration

Parameter	Description
CPU Cores	4 OCPU
Memory	64 GB
Network Bandwidth	8 Gbps

Table 6-2 shows the various parameters used for the test.

Table 6-2 Scenario 1 Test Case and Setup Details

Parameter	Description
Account volume	20,000,000
Number of Accounts to Create	100,000
Schemas	2
Threads	50
CM Replicas	10
Oracle DM Replicas	5
Oracle DM2 Replicas	5
OKE Nodes	12 (10 OCPUs each)
Shape	VM.Standard.E4.Flex

Scenario 2: Get 100,000 Accounts Using 50 Threads in 2 Schemas

This scenario evaluates the Billing Care REST API's ability to retrieve 100,000 accounts using 50 threads in 2 schemas.

Table 6-3 shows the client configuration used for the test.

Table 6-3 Scenario 2 Test Client Configuration

Parameter	Description
CPU Cores	4 OCPU
Memory	64 GB
Network Bandwidth	8 Gbps

Table 6-4 shows the various parameters used for the test.

Table 6-4 Scenario 2 Test Case and Setup Details

Parameter	Description
Account volume	20,000,000
Number of Accounts to Retrieve	100,000
Schemas	2
Threads	50
CM Replicas	10
Oracle DM Replicas	5
Oracle DM2 Replicas	5
OKE Nodes	12 (10 OCPUs each)
Shape	VM.Standard.E4.Flex

Performance Results

Table 6-5 shows the performance results for the Billing Care REST API.

Table 6-5 Performance Results

Test	Number of Accounts	Number of Threads	Number of Schemas	Throughput (transactions/ second)	Latency 95th Percentile (ms)
Scenario 1	100,000	50	2	142	423
Scenario 2	100,000	50	2	112	772

See "System Performance Benchmarking Metrics" for more information on how these metrics are calculated.

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Offline Mediation Controller Performance

This chapter provides an analysis of the performance of an Oracle Communications Offline Mediation Controller 15.0.1 cloud native system. The performance focuses on the system's node chain with all cartridges multithreaded.

Topics in this document:

- Scenario: Collect, Enhance, and Distribute Node Chain Performance with 5 Million CDRs
- Performance Results

Scenario: Collect, Enhance, and Distribute Node Chain Performance with 5 Million CDRs

This scenario evaluates 5 Million CDRs collected using 1 ASCII Collection Cartridge. This data is then enriched using 1 Enhancement Processor and distributed through 1 Distribution Cartridge.

Table 7-1 shows the various parameters used for the test.

Table 7-1 Scenario Test Case and Setup Details: Offline Mediation Controller Cloud Native

Parameter	Value
Number of Call Detail Records (Input Records)	5,000,000 (100,000 distributed equally across 50 files)
Maximum Number of Records per File (Output Records)	10,000
Number of Threads	• Collection Cartridge Thread Count: 2 • Enhancement Processor Thread Count: 5 • Distribution Cartridge: 5
Bulk Read and Write	Enabled
File Parse Delay	10 Seconds
Idle Write Time	10 Seconds
Read Timer	10 Seconds
Output NARs Per File for Collection Cartridge and Enhancement Processor	10,000
OKE Node Shape	VM.Standard.E5.Flex
Memory Per OKE Node	128 GB
Number of Worker Nodes	4
oCPU Per OKE Node	12
Boot Volume Size per OKE Node	200 GB

Performance Results

Table 7-2 provides observation data for the Offline Mediation Controller end-to-end performance test.

Table 7-2 Performance Results

Duration	Throughput (Number of CDRs Processed Per Second)	App CPU Usage (Cores Consumed)
40 Seconds	125,000	4