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Oracle Cloud Scale Billing Performance Test

Summary of Enterprise Scale Performance Testing

Technical Brief

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Public

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Oracle Communications Cloud Scale Billing

The key to supporting flexibility, innovation, agility, and customer-centricity required for successful service providers is the underlying revenue management system. Revenue management is the end-to-end process for generating, capturing, and collecting revenue for each service and customer. Oracle Communications Cloud Scale Billing is a leading revenue management solution with the functional richness and operational performance to support the customer-centric, innovative business and revenue growth demands required by today's digital service providers.

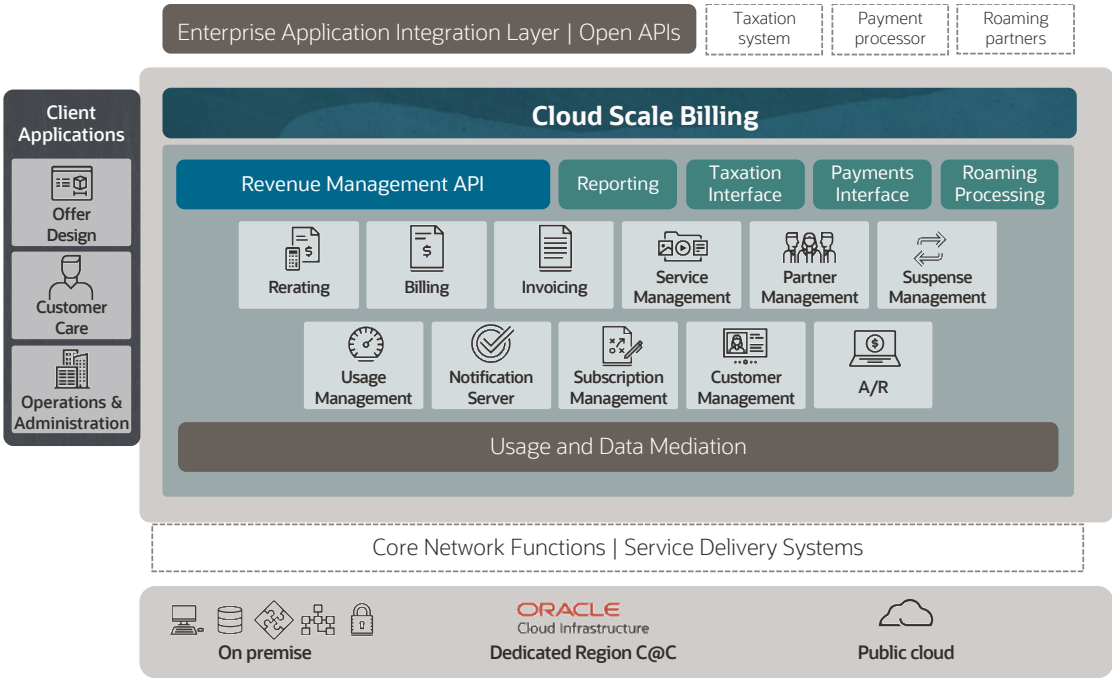

Figure 1 – Oracle Communications Cloud Scale Billing

Cloud Scale Billing 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

Key capabilities include support for:

- Flexible billing to support new services and business models
- Comprehensive billing operations to ensure an accurate and consistent billing experience to help minimize customer billing complaints
- Billing for complex hierarchical structures including flexible group account plans, roll-up rules, bill time discounts, adjustments, recurring, usage and purchase charges

Cloud scale B2B billing and invoicing for large enterprises

Running large scale billing and invoicing processes across potentially complex enterprise hierarchies is typically a resource intensive and time-consuming activity that can contribute to a poor customer experience and high operational costs if not performed optimally. Efficiently rolling up usage, one-time and recurring charges across

potentially millions of employee accounts, taking into account different departmental structures and varying levels of payment responsibility is a critical function of a modern B2B revenue management architecture.

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

The billing operation is decomposed into multiple parallel smaller processes enabling efficient scalability and is well aligned with dynamic Kubernetes autoscaling. Increasing the number of hierarchies and/or sub-ordinate accounts in a hierarchy yields predictable throughput and scalability characteristics.

In addition to a high-performance cloud native architecture, powerful operational capabilities are available to configure, schedule and view billing, invoicing and other key revenue management functions (figure 2 shows a view of Business Operations Center).

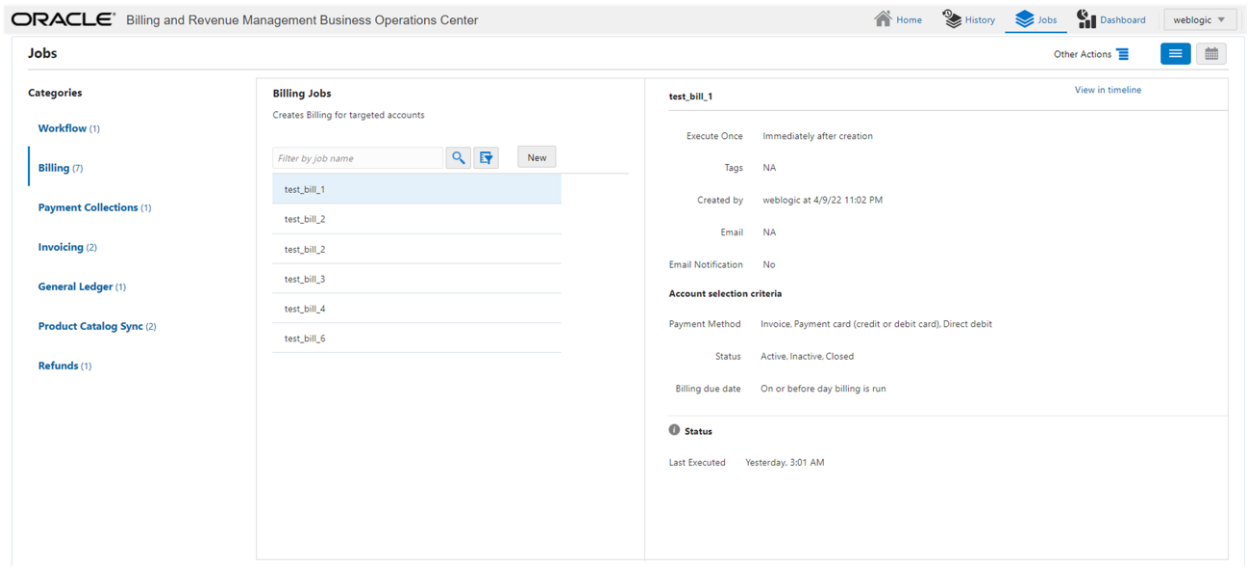

Figure 2 – Business Operations Center (Jobs page)

B2B billing and invoicing performance test

Oracle's multithreaded billing and invoicing architecture is ready to support the requirements of large B2B communications service providers serving enterprises with million plus employee bases and large scale IoT business scenarios. For this test, Oracle conducted cloud native billing and invoicing process performance testing on Oracle Cloud Infrastructure with a representative mix of large and complex B2B account hierarchies from 5 to 10 million hierarchy accounts to investigate the product's inherent performance and scalability characteristics.

Oracle Communications Cloud Scale Billing demonstrated compelling performance characteristics for complex B2B enterprise billing and invoicing scenarios, including successful cloud native autoscaling of billing processes.

Test setup

Methodology

The performance test varied depth and breadth across four different types of enterprise account hierarchies. Two representative B2B price plans were deployed.

The following test scenarios were deployed in the performance test:

- **Scenario 1** – Baseline performance test for 5 million accounts (subscription and parent)
- **Scenario 2** – Automatic horizontal (pod) scaling for 5 million accounts

- **Scenario 3** – Incremental load testing up to 10 million accounts

Billing and invoicing jobs were initiated using the Business Operations Center (BOC) web client. Performance related system KPIs were observed, including:

- Throughput (accounts processed per hour, invoices generated per hour)
- Job duration
- Number of accounts processed

The invoicing process generated summary invoice data in XML format. Detail on each subscription account was stored in the database.

Configured price plans

The two price plan configurations were used in the test with constituent product offerings including various pricing element combinations taken from a set of monthly recurring charges (in advance and arrears), non-currency recurring charges and one-time charges.

Hierarchy Models and Test Accounts

A mix of different types of account hierarchy with different depth (number of levels in the hierarchy), breadth (number of accounts per invoice) and levels of rollup were used in the test scenarios, as described in table 1.

HIERARCHY STRUCTURE	HIERARCHY LEVELS	MAX ACCOUNTS PER INVOICE	TOTAL ACCOUNTS ACROSS HIERARCHY (SUBSCRIPTION AND PARENT)
Wide and flat with one level of rollup	2	3	1,200,001
Deep structure with immediate rollup	5	200	1,287,965
Deep structure with multi-level rollup	5	15,500	1,287,965
Deep structure with large multi-level rollup	5	311,600	1,287,965

Table 1 – Account hierarchy models configured for the performance test

An illustrative representation of one of the four account hierarchy models (deep structure with multi-level rollup) is shown in figure 3; in this diagram the dotted arrows indicate the payment roll-up relationships across the hierarchy. Subscription accounts represent entities using B2B services, parent accounts represent a logical grouping of accounts for billing purposes, and invoice accounts represent the entities receiving an invoice.

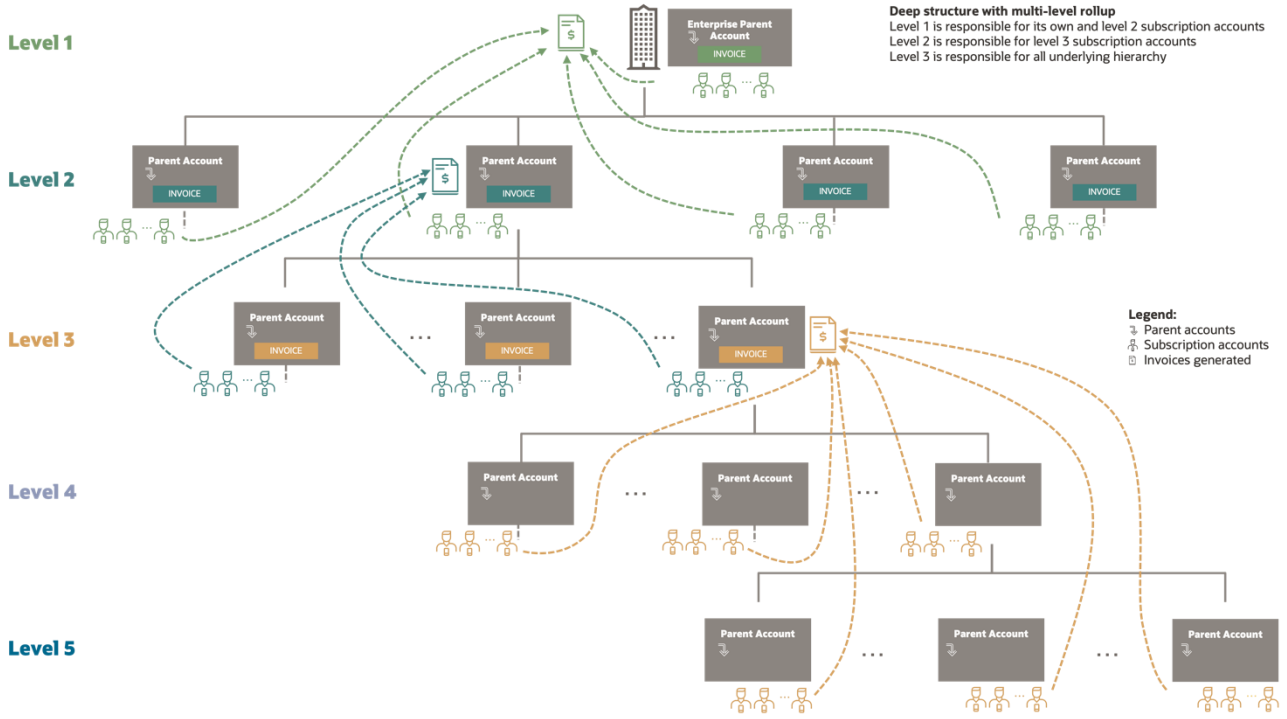

Figure 3 – Deep structure with multi-level rollup test hierarchy

Test Enterprise Accounts

For test scenarios 1 and 2, approximately 5 million accounts (measured across both subscription-level and parent-level accounts) across the mix of hierarchy types were used, with scenario 3 using loads of approximately 6, 7 and 10 million accounts.

A summary of the test accounts is shown in table 2.

TEST SCENARIO	LOAD	NUMBER OF HIERARCHIES	TOTAL ACCOUNTS
1, 2	~5M	4	5,063,896
3	~6M	5	6,351,861
3	~7M	6	7,639,826
3	~10M	8	10,127,792

Table 2 – Included test hierarchies for scenarios 1, 2 and 3

Software environment

The application software under test consisted of:

- BRM 12.0.0.4.0 (cloud native deployment)
- Oracle Database 19c Enterprise Edition High Performance Release19.11.0.0.0

Deployed on:

- Oracle Kubernetes Engine 1.18.10
- Docker 19.03.11-ol
- Helm 3.5.4
- Oracle Linux 7.2

Hardware environment and deployment architecture

Figure 4 shows a representation of the physical deployment architecture in Oracle Cloud Infrastructure.

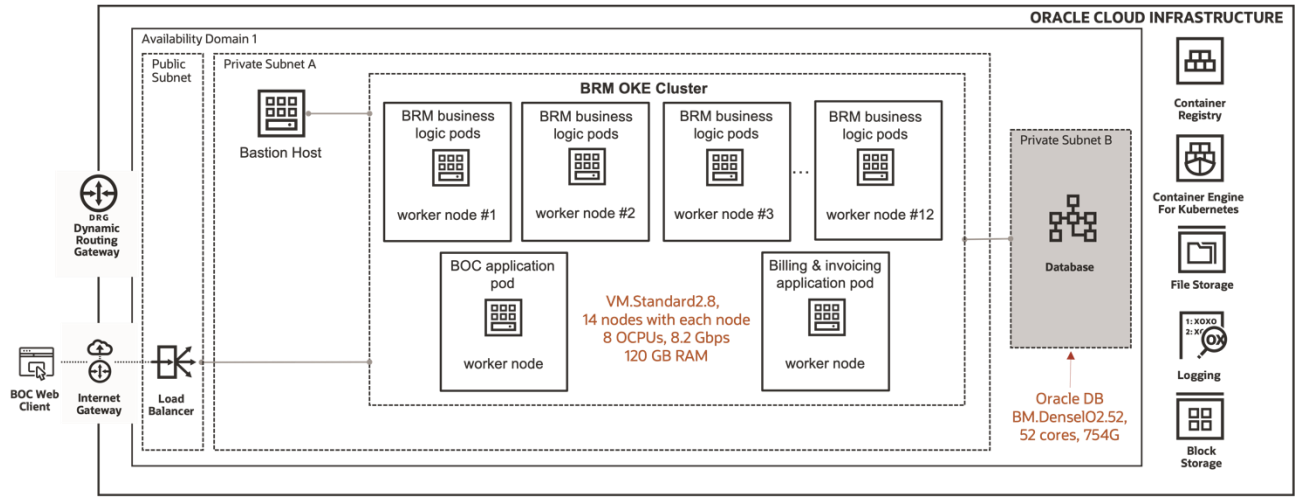

Figure 4 – Oracle Cloud Infrastructure deployment architecture

Test results

The test results demonstrate Oracle Cloud Scale Billing capabilities to support high throughput, cloud native billing and invoicing job performance for large B2B enterprise accounts.

Scenario 1 observations – Baseline performance test for 5 million accounts (subscription and parent)

Scenario 1 measured billing and invoicing throughput as a baseline for subsequent tests. The test comprised of three stages:

1. running billing for the subscription accounts
2. running billing for the parent accounts
3. running invoicing

Table 3 summarizes the results achieved for scenario 1, which demonstrate high performance billing and invoicing across the account hierarchies.

Test Phases	Throughput	Number of Accounts processed	Duration (mins)
Billing	2.35M/hour	5,063,896	129
Invoicing	5.06M/hour	340,976	4

Table 3 – Scenario 1 results (5 million account baseline)

Scenario 2 – Automatic horizontal (pod) scaling for 5 million accounts

Scenario 2 tested automatic pod scaling (up and down) using the Kubernetes Horizontal Auto Scaler (HPA) for billing processes. The threshold CPU level to add a pod was set to 50%, with the minimum and maximum number of pods set to 3 and 12 respectively.

The results of the tests successfully demonstrated:

- an automatic gradual increase in the number of billing business logic pod replicas up to maximum of 12 pods when the average CPU utilization exceeded 50%
- an automatic gradual decrease in the number of billing business logic pod replicas to minimum of 3 pods as the billing processes completed and the average CPU utilization went below 50%

The auto scaling results are visually represented in figure 5.

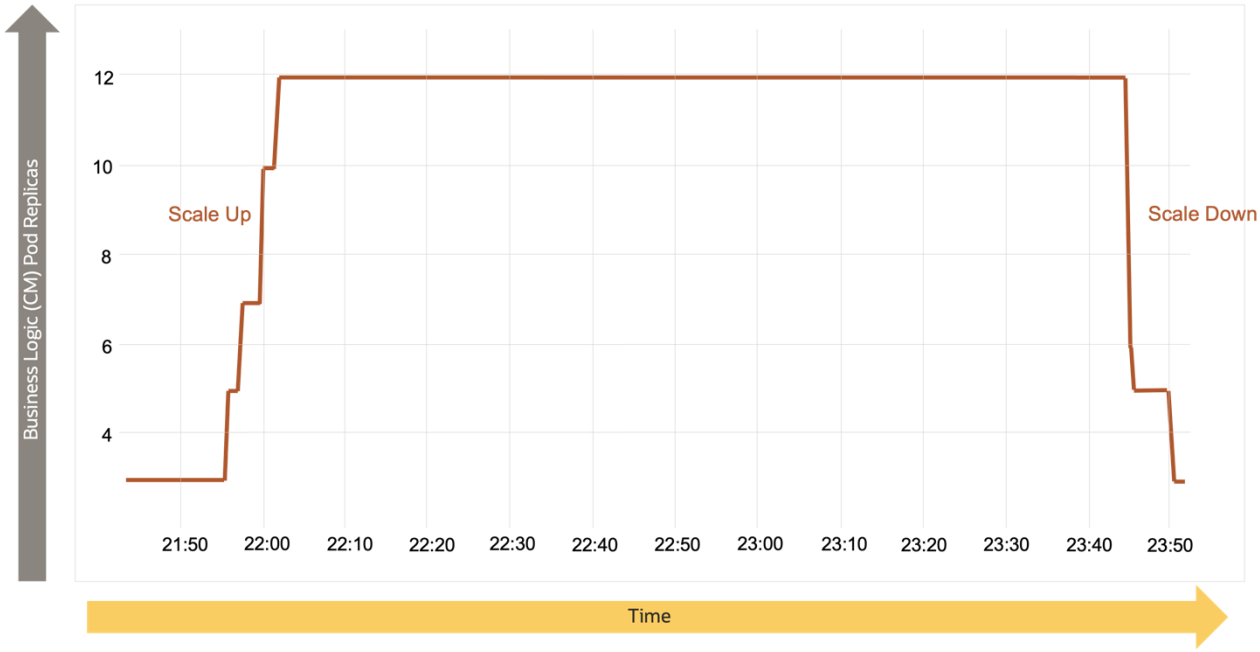

Figure 5 – Scenario 2: horizontal pod autoscaling results

Scenario 3 – Incremental load testing up to 10 million accounts

Scenario 3 investigated the effect on performance of incrementally increasing the total number of hierarchy accounts to 6M, 7M and 10M account loads. After every incremental loading, billing and invoicing performance characteristics were recorded.

The results demonstrated favorable throughput characteristics with the increase in the number of accounts. Table 4 summarizes the incremental load testing results.

Test Phases	Throughput	Number of Accounts processed	Duration (mins)
~6 million accounts across hierarchies			
Billing	2.28M/hour	6,351,861	167
Invoicing	4.58M/hour	381,861	5
~7 million accounts across hierarchies			
Billing	2.18M/hour	7,639,826	210
Invoicing	5.72M/hour	381,946	4
~10 million accounts across hierarchies			
Billing	2.29M/hour	10,127,792	265
Invoicing	5.11M/hour	681,952	8

Table 4 – Scenario 3: incremental load testing results

Figure 6 shows a graphical summary of the incremental load testing results.

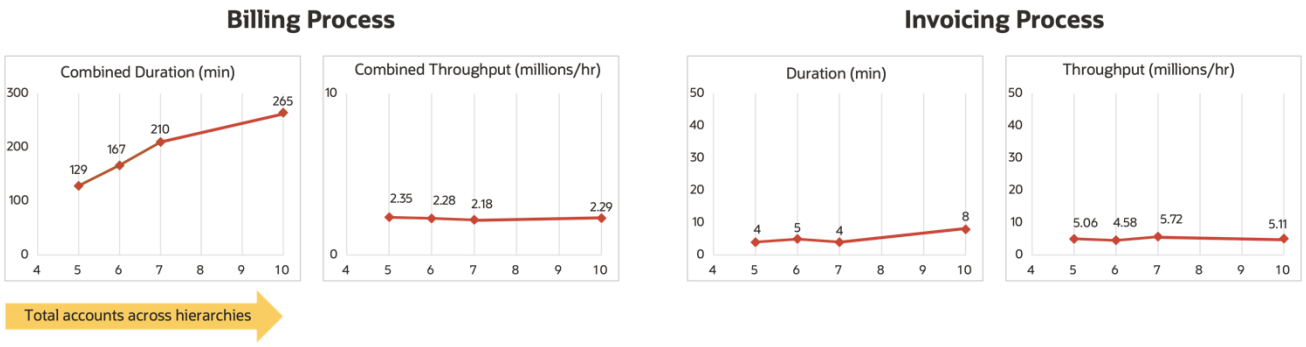

Figure 6 – Scenario 3: incremental load testing results graphical summary

Table 5 compares the 5M and 10M account results for billing and invoicing. The billing duration scaled linearly with the increased load, showing a very small deviation of 0.05%. Similarly, the invoicing duration also scaled linearly with the increased load, showing a negligible deviation of 0.02%.

Billing Process

	5M	10M	10M in relation to 5M
Accounts	5,063,896	10,127,792	2.00 x
Billing Duration (min)	129	265	2.05 x
Throughput (M/hr)	2.35	2.29	0.97 x

Invoicing Process

	5M	10M	10M in relation to 5M
Invoiced Accounts	340,976	681,952	2.00x
Invoicing Duration (min)	4	8	1.98 x
Throughput (M/hr)	5.06	5.11	1.01 x

Table 5 – Scenario 3: linearity between 5 million and 10 million account loads

Additionally, observations of CPU and memory resource utilization exhibited favourable scaling characteristics across the 5 and 10 million loads.

Summary

Innovations in modern broadband networking technology (5G, fibre and cable), and the emergence of large scale industrial IoT deployments are driving new opportunities for CSP technology companies to serve large enterprises and organizations with innovative offerings to enhance their employee experience. Efficiently monetizing these offerings will require high performance billing and invoicing capabilities that can take maximum advantage of modern cloud computing technology.

Using a test mix of large enterprise account hierarchies with varying number of levels and subscriptions per invoice, Oracle Communications Cloud Scale Billing demonstrated:

- High performance, short duration billing and invoicing across complex hierarchies with a rollup of charges occurring at various levels.
- Cloud native horizontal autoscaling (up and down) based on CPU utilization, enabling optimization of compute resources during the running of billing jobs.
- Linearity of scaling for billing and invoicing jobs.

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