Benchmarking Oracle Billing and **Revenue Management** (BRM) platform processes on **Amazon Web Services** (AWS) at Aarav Solutions Centre of **Excellence Lab.**

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Performance
Benchmark / Dec **2018**

Content

Executive Summary

Aarav Solutions conducted an extensive performance benchmarking process for **Oracle Billing and Revenue Management v 7.5 (BRM) components on Amazon Web Services (AWS) EC2** cloud Infrastructure. The performance benchmarking had been conducted for key crucial process workloads, customer/subscriber accounts, paying accounts, CDRs volume, billing and invoicing for accounts to evaluate linear scalability and throughput. The primary goal of this benchmark was to determine if application can meet the performance requirements and scale as per business needs of CSPs (Voice and data service providers) / Telcom service providers as deployed on AWS Cloud Infrastructure. This benchmarking process also establishes the fact that Oracle Billing and Revenue Management platform on AWS cloud infrastructure can be scalable for any other industry, viz. **Telecom, Banking and Finance, Insurance, Media and SaaS solution providers.**

Aarav Solutions being first organization to conduct an extensive benchmarking process of Oracle BRM on AWS, processed **One hundred thousand parent accounts, One Million Child accounts and One hundred million CDRs (Call Data Record) and the transactions, processes were modelled over AWS cloud infrastructure.** The benchmarking conducted by Aarav Solutions' Centre of Excellence (CoE) team not only established the right process of implementing Oracle BRM on AWS, but also developed strategies for performance tuning, to get exceedingly better results and how service providers can **drastically reduce the infrastructure costs and thus reduce total cost of ownership of Oracle Billing and Revenue Management platform.**

The benchmark tested for an end to end process starting with service configurations, account creation, rating rule definitions and rating processes and billing and invoicing for child and parent accounts, respectively. Complete benchmark process was measured through Common Migration Tool, Batch pipeline rating, billing and invoicing. Aarav Solutions' execution strategy was modelled for any typical B2B customer model.

Below is the snapshot of key performance indicators of benchmarking and tuning of Rating and Billing-Invoicing processes on AWS. The following section provides detailed information of the same and hardware & software configurations and test results.

Rating Performance for 97.7M CDRs

Billing & Invoicing for 100,000 Parent Accounts and 1.1M Child Accounts
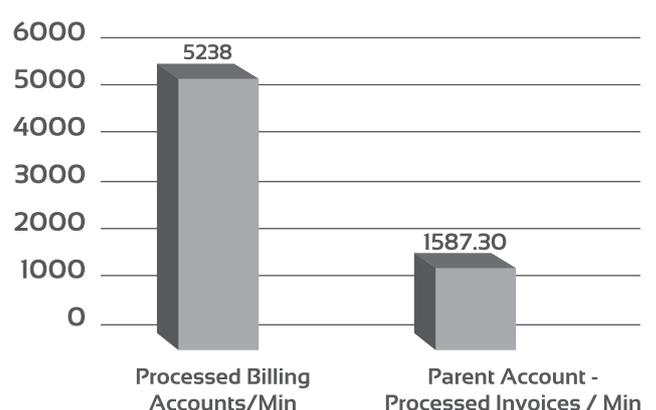
Rating Perfromance -

Billing & Invoicing Performance -
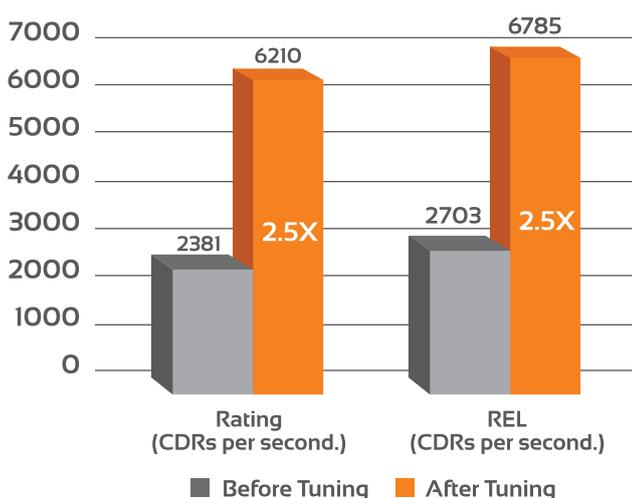
Iteration	Average Memory Utilization	Average CPU Utilization	Throughput (CDRs per hour)
Before Tuning	~20% to 25%	~17% to 20%	8,571,600
After Tuning	~ 20% to 23%	~ 20% to 25%	22,356,000

Introduction

This whitepaper describes a detailed account of benchmarking performance test & its results for Oracle Billing and Revenue Management (BRM) 7.5 on AWS EC2. The performance of Oracle Billing and Revenue management was scaled to 1.1 million billing accounts, 100 million rating CDRs where each account using multiple services and pricing rules. The benchmarking process ensured that Oracle Billing and Revenue management platform on AWS cloud infrastructure can be scaled to billions of transactions with right hardware configuration and performance tuning strategy. The benchmarking process established a positive case of deploying of Oracle Billing and Revenue Management on cloud infrastructure and the strategy of implementation by Aarav Solutions' is Cloud vendor agnostic. Thus, Oracle Billing and Revenue management can be deployed on any cloud service provider e.g. Google Cloud, Oracle Cloud, AWS or any other cloud service provider.
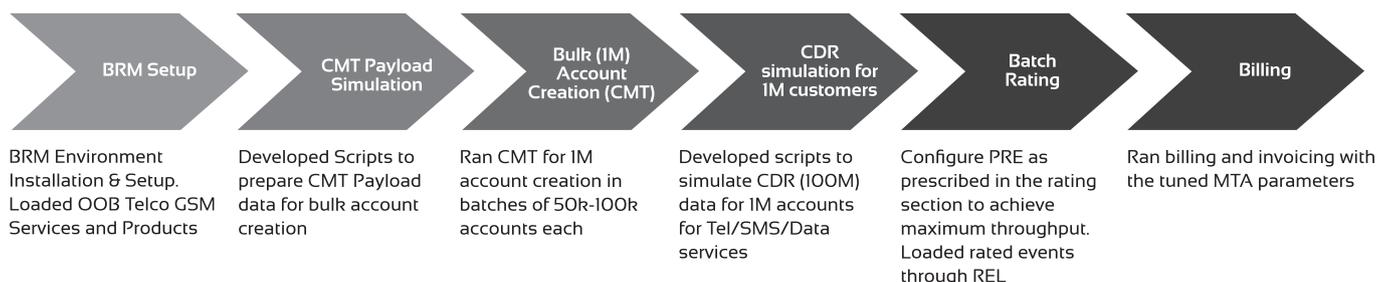
Background/Problem Statement

As the service providers intend to scale their ecosystem, cloud migration becomes the one the key factors to reduce cost, increase efficiency & ease to manage infrastructure and facility to scale on-demand without investing CAPEX in infrastructure. Cloud platforms provide the right opportunity for CSPs to scale with OPEX. Billing and Revenue management being one the most crucial aspect in CSP ecosystem also needs to adapt to the new demands of cloud infrastructure. As Aarav Solutions' conducted the benchmarking of Oracle Billing and Revenue Management on AWS cloud in Dec' 18, our customers were facing the challenge of whether the cloud deployment can be achieved or not and will it be scalable. So far, all the benchmarking tests were done for On-premises deployments only. Aarav Solutions' Centre of Excellence (CoE) team re-iterated the customer real-time scenarios with voice, data and SMS services to rate and bill 1Million billing accounts.

Benchmarking Methodology

Aarav Solutions benchmarking methodology comprised of preparing the Oracle BRM environment, CMT and load processing, batch rating and billing. The key to performance testing involved following activities:

- Oracle BRM Setup: Oracle BRM environment installation and Setup.
- CMT Payload Simulation: This involves simulating the complex rating rules, processing scenarios for multiple services for each billable account. On any typical business day all the complex scenarios may not occur simultaneously.
- Bulk Account Creation: Bulk accounts were created in batches.
- CDR simulation for customers: Next step is to generate the CDRs for respective services usage for customers.
- Batch Rating: Batch Rating was performed through PRE for best results.
- Billing and invoicing: Billing and Invoicing process execution with tuned AWS cloud parameters.

Performance Testing

BRM Setup	CMT Payload Simulation	Bulk (1M) Account Creation (CMT)	CDR simulation for 1M customers	Batch Rating	Billing
BRM Environment Installation & Setup. Loaded OOB Telco GSM Services and Products	Developed Scripts to prepare CMT Payload data for bulk account creation	Ran CMT for 1M account creation in batches of 50k-100k accounts each	Developed scripts to simulate CDR (100M) data for 1M accounts for Tel/SMS/Data services	Configure PRE as prescribed in the rating section to achieve maximum throughput. Loaded rated events through REL	Ran billing and invoicing with the tuned MTA parameters

Benchmarking Environment

The benchmarking environment at Aarav Solutions Centre of Excellence Lab is described in sub-sections below. It includes the Oracle BRM components, Tools for real-time transaction simulation and processing, hardware and software configurations.

Benchmarking Profile

- Key Oracle BRM components for benchmarking to measure the batch performance of various Oracle BRM components
  - CMT
  - Batch Pipeline Rating
  - Revenue Assurance
  - Billing
  - Invoicing
- Underlying hardware provided by AWS Cloud
- Tools Used
  - Common Migration Tool for Account Loading
  - Oracle BRM Batch Pipeline Rating
  - Revenue Assurance Controls
  - Billing
  - Invoicing

Setup and Configurations for Benchmarking

Business Case Configuration

Following table provides the benchmarking snapshot of the business scenario for any telecom service provider.

|	
Paying Accounts	100,000
Subscriber Accounts	1,100,000
Total CDRs Volume	9770000
No. of Products per Child Account	4
No. of Services per Child Account	3
No. of child accounts per parent account	10

Hardware Infrastructure

Oracle Billing and Revenue Management was deployed on hardware instance T2 - 2xlarge of AWS EC2 Virtual Machine.

Cloud Environment: Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides secure, resizable compute capacity in the cloud. Amazon EC2's simple web service interface allows one to obtain and configure capacity with minimal friction. It provides complete control of computing resources and lets administrators run on Amazon's proven computing environment.

T2 instances are Burstable Performance Instances that provide a baseline level of CPU performance with the ability to burst above the baseline. T2 Unlimited instances can sustain high CPU performance for as long as a workload needs it, thus ensuring the scalability for benchmarking (environments).
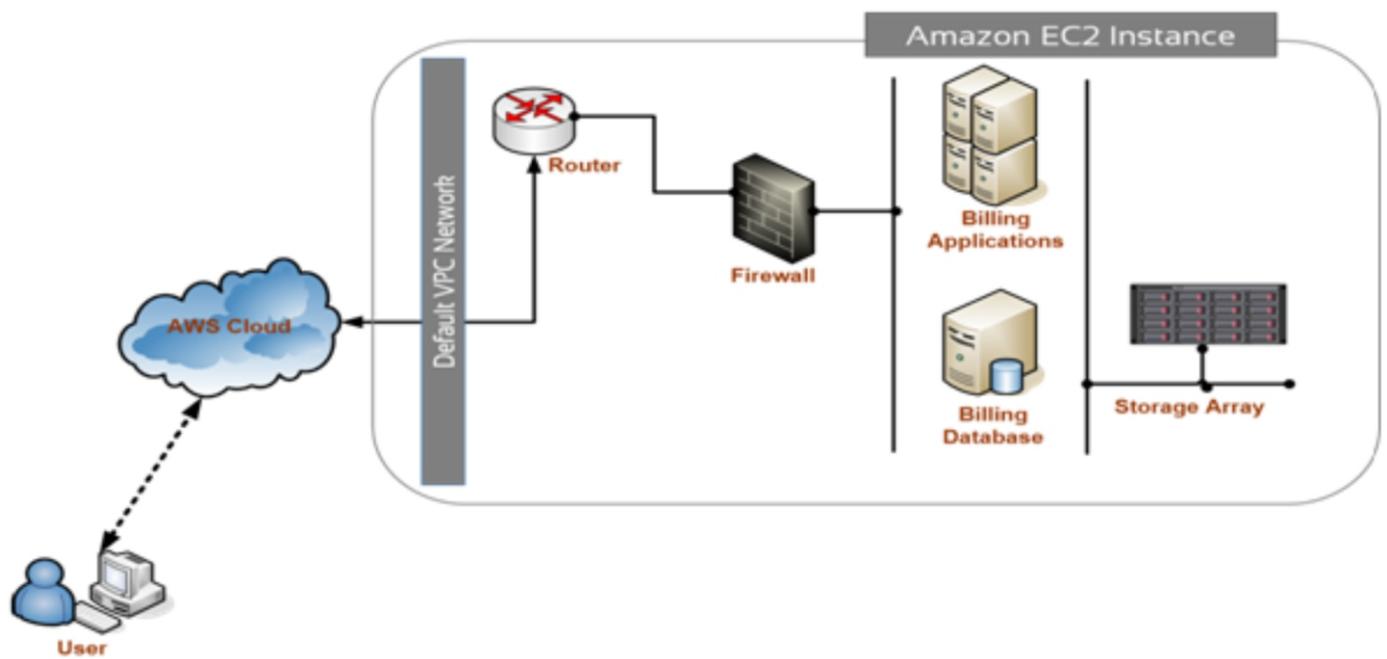
Hardware & Software Configuration

A lean hardware and software configurations were used for benchmarking to ensure maximum throughput with optimal infrastructure. Following table provides the hardware and software configurations for benchmarking environment.

OS	No. CPU	RAM	HDD
Red Hat Enterprise Linux Server release 7.5 (Maipo)	8 (Intel(R) Xeon(R) CPU E5-2686 v4 @ 2.30GHz)	32GB	500 (SSD)

Performance Test Results

The tests have shown scalability and better performance achievement with right deployment and tuning strategy. Following sections provide the key tests and respective results of performance benchmarking process.

Customer Data

Parent Accounts	Child Accounts	Products/Account	System Size
115,885	1,017,194	3 Products (Voice, SMS, Data) + Cycle fee	BRM DB: 40GB Oracle Filesystem Size: 63GB

CMT Average Performance for average Batch size

Iterations (No. of batches)	Parent Accounts	Child Accounts	Import Time/ Iterations	Deploy Time/ Iterations
10	10,000	-	2 Mins	2 Mins
22	-	50,000	55 Mins	10 Mins

High Level Rating Configuration
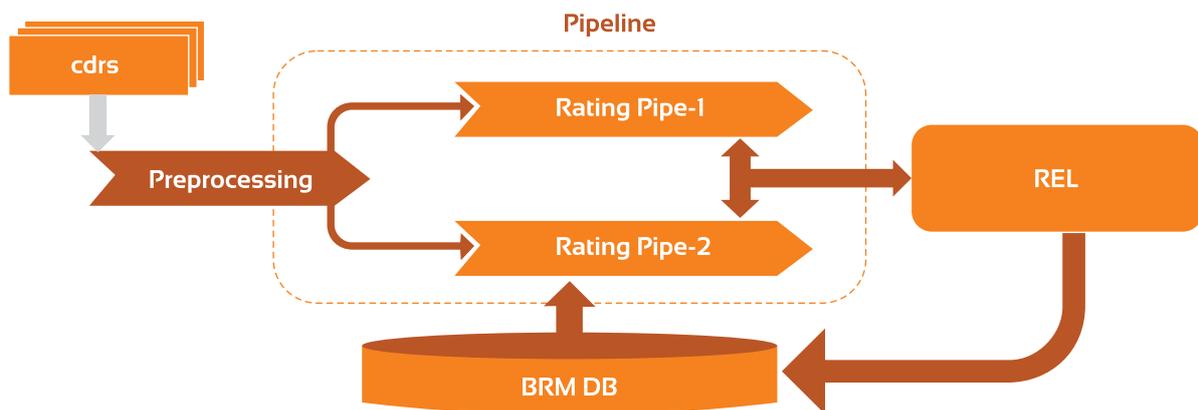
Rating Statistics Summary

Iteration	CDR Volume (in Million)	Throughput (Rating CDRs per Sec.)	Throughput (REL CDRs per Sec.)	Average Memory Utilization	Average CPU Utilization
Before Tuning	97.7M	2381	2703	~20% to 25%	~17% to 20%
After Tuning	97.7M	6210	6785	~20% to 23%	~20% to 25%

- Total Input CDRs - 97708230
- Successfully rated - 93327150
- Rejected CDRs - 3751080 (ERR_CUSTOMER_LOGIN_SERVICE_NOT_FOUND, ERR_CUSTOMER_LOGIN_NOT_FOUND)
- Rating started - 07:03:44 UTC 2018 (files submitted to rating pipelines for processing)
- Rating finished - 11:20:44 UTC 2018

Billing & Invoicing Statistics

Cycle	Child Accounts	Parent Accounts	Throughput (Bills & Inv. Per Sec.)	Time (In Mins)	Average Memory Utilization	Average CPU Utilization
November'2018	1.1M (Billing)	100K (Bills & Invoices)	8	210	~25% to 28%	~45% to 50%

Conclusion

The performance indicators for this benchmarking exercise highlight that Oracle BRM 7.5, with Oracle Database 12c and AWS cloud platform, provides flexibility, scalability, and reliability for Tier 1 service providers to launch their services confidently. The performance metrics also conclude that Oracle BRM 7.5 provides high performance with low cost of operations.

Key performance indicators are:
- Aarav Solutions could run the 1.1 M subscriber's billing and invoicing within 4 hours. Therefore, we could meet the client's SLA for a month end BAU activities.
- During the generation of 100K Bills and invoices, the CPU and memory been effectively used to save resources.
- The Platform is capable of processing 6210 rating requests per sec, with all the complexities of a real-world scenario of complex rating and discounts for around 100Million CDRs.
- Platform processes above 4000 billing requests per min for about more than 1 million accounts. This shows the scalability to handle load and business complexity as well.

The innovators of the next generation have a different set of challenges. This demand the performer to build a dynamic infrastructure compare to what was previously required. The record shows that the company's success mostly depends on the platform that has the demographics of the communication model and not on their assets. Thus, to stay in business, the company must reinvent themselves to bridge the requirement in the customer-oriented market making our existence more relevant in coming future.

Appendix

Application Stack and Parameters

Database	OBRM	PRE (Pipeline Rating Engine)
Oracle Database 12c Enterprise Edition Release 12.2.0.1.0 - 64bit Production	**PRODUCT_NAME=Portal_Base** VERSION=7.5.0 COMPONENTS= "Portal Base Install Scripts","Rogue Wave Libraries","Common Database Scripts","batch_controller","pin_billd","pin_cfg_bpdump","pin_inv","cmmp","cm_proxy","sample","dm_email","pin_export_price","config_export","credit_control","sox_unlock_service","adu","infmgr","infmgr_cli","dm_invoice","DM Feature","dm_oracle","bip_udf","formatter","null","nmgr","pin_subscription","testnap","uei","cm", "Java PCM Files","Shared Objects for Communication","Shared Perl Modules","load_config","storable_class_to_xml","Common Install Scripts", BUILD_TIME= 10-31-2011 10:17:10 INSTALLED_TIME=Thu, 20 Sep 2018 05:57:25 +0000	PRODUCT_NAME=Pipeline VERSION=7.5.0 COMPONENTS= "Common files","Pipeline Framework Files","Pipeline Sample Files","Pipeline TimesTen(TT) Multi Partition","Pipeline Database Scripts","Pipeline Misc Files","Pipeline Tools files","PDK files","Rogue Wave Files", BUILD_TIME= 10-31-2011 6:35:12 INSTALLED_TIME=Thu, 20 Sep 2018 10:04:52 +0000

Application Stack and Parameters

Database	OBRM	PRE (Pipeline Rating Engine)
	PRODUCT_NAME=TelcoFrameworkMgr VERSION=7.5.0 COMPONENTS= "tcframework","fm_prov_wireless","dm_prov_telco", BUILD_TIME= 10-31-2011 10:21:50 INSTALLED_TIME=Thu, 20 Sep 2018 08:48:31 +0000 PRODUCT_NAME=RevAssuranceMgr VERSION=7.5.0 COMPONENTS= "araframework", BUILD_TIME= 10-31-2011 10:24:29 INSTALLED_TIME=Thu, 20 Sep 2018 08:57:32 +0000 **PRODUCT_NAME=ConversionMgr** VERSION=7.5.0 COMPONENTS= "cmt", BUILD_TIME= 10-31-2011 10:7:41 INSTALLED_TIME=Thu, 20 Sep 2018 09:02:59 +000 **PRODUCT_NAME=RatedEventLoader** VERSION=7.5.0 COMPONENTS= "rel", BUILD_TIME= 10-31-2011 10:19:23 INSTALLED_TIME=Sat, 22 Sep 2018 04:01:33 +0000 **PRODUCT_NAME=GSM_Mgr** VERSION=7.5.0 COMPONENTS= "gsm", BUILD_TIME= 10-31-2011 10:11:16 INSTALLED_TIME=Tue, 25 Sep 2018 06:39:59 +0000 **PRODUCT_NAME=WirelessSuite** VERSION=7.5.0 COMPONENTS= "number_manager","sim_manager","gsm","fm_prov_wireless","tcframework","dm_prov_telco", "tcf_aaa","gsm_aaa","gprs_30","gprs_aaa","rrf", "vouchermanager","inventory" BUILD_TIME= 10-31-2011 10:14:54 INSTALLED_TIME=Thu, 27 Sep 2018 03:06:15 +0000 **PRODUCT_NAME=AccountSynchTool** VERSION=7.5.0 COMPONENTS= "cm_eai","EAI_JS Feature","dm_ifw_sync","cm_acctsync", BUILD_TIME= 10-31-2011 10:6:3 INSTALLED_TIME=Thu, 27 Sep 2018 03:28:04 +0000 **PRODUCT_NAME=PartitionUpg** VERSION=7.5.0 COMPONENTS= "Partition Upgrade" BUILD_TIME= 10-31-2011 10:15:42 INSTALLED_TIME=Thu, 27 Sep 2018 12:12:05 +0000	

About Aarav Solutions

Aarav Solutions is a global product engineering and IT Consulting Services Provider. Our clientele comes from a broad array of industries –

Telecommunications, Banking & Finance, Government, Power and Utilities among various other B2B segments.

We have our R&D offices in India and the USA. We are also present across the globe in South East Asia, Australia and MEA regions and we have successfully helped organizations in their digital transformation journey. Since our inception in 2012, we are focused on 'Driving Horizons' for our stakeholders viz. employees, customers and partners with innovation and delivery excellence.

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