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Oracle Communications Convergent Charging and Policy Solution Performance Test

VoLTE, Data, SS7 voice, and Messaging Services

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Introduction

The rise in smartphone and tablet usage, coupled with increasing data speeds and network technology evolution, both mobile and fixed, is contributing to an exponential increase in the consumption of data services, placing greater demands for communications service providers (CSPs) to effectively monetize the "Digital Experience". The Oracle Communications Convergent Charging and Policy Solution enables CSPs to combine business and network policies to rapidly launch innovative offers and empower customers to personalize and control their usage experience, accelerating service monetization at a predictable cost of ownership.
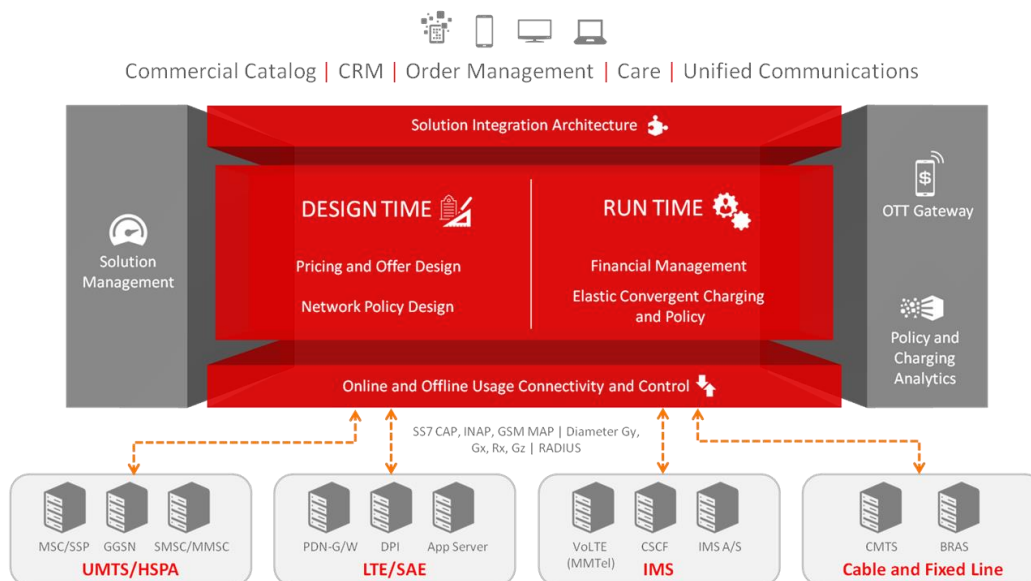

Figure 1. The Oracle Communications Convergent Charging and Policy Solution.

The Oracle Communications Performance Engineering Group conducted a comprehensive test to demonstrate the extreme performance, robust carrier-grade capabilities, and outstanding price/performance value of the Oracle Communications Convergent Charging and Policy Solution for VoLTE and SS7 voice, data, and messaging services running on Oracle Engineered Systems. Realistic test scenarios included resource sharing across groups and long data session management alongside full invoicing and bill generation. The test scenarios modeled 10 million subscribers generating continual data sessions with concurrent high volume voice and messaging traffic. **Oracle achieved an average end-to-end online charging latency under 10ms for data and messaging and less than 30ms for VoLTE and SS7 voice with a total throughput of 55,000 online and offline operations per second.**

Performance Test Description

System Configuration

This performance test focused on the end-to-end performance of the solution architecture applied to online and offline charging models. The following diagram illustrates the logical call flows and data transfers between each architectural component.
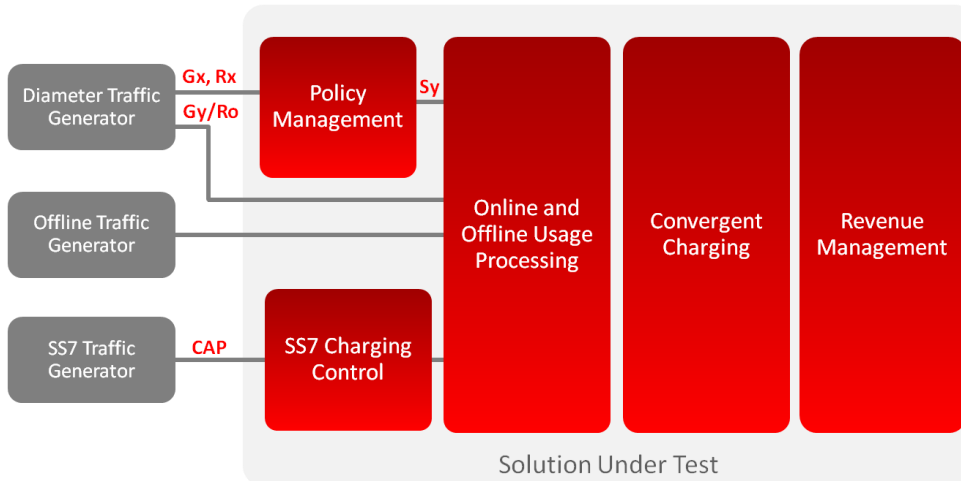

Figure 2. Solution under test showing online charging, offline charging and Sy interfaces.

Hardware

The Oracle Communications Convergent Charging and Policy Solution was hosted on Oracle Engineered Systems for extreme performance, massive scalability, and maximum availability. Engineered Systems are purposely designed to optimize application and database performance. They are comprised of powerful compute nodes which are connected to high-performance storage nodes using an ultra-fast Infiniband network fabric. Oracle's application-to-disk strategy ensures that customers benefit from having the entire stack engineered and supported by a single vendor.

Oracle Sun x86 Servers

Oracle SPARC T5

Oracle Exalogic Half Rack
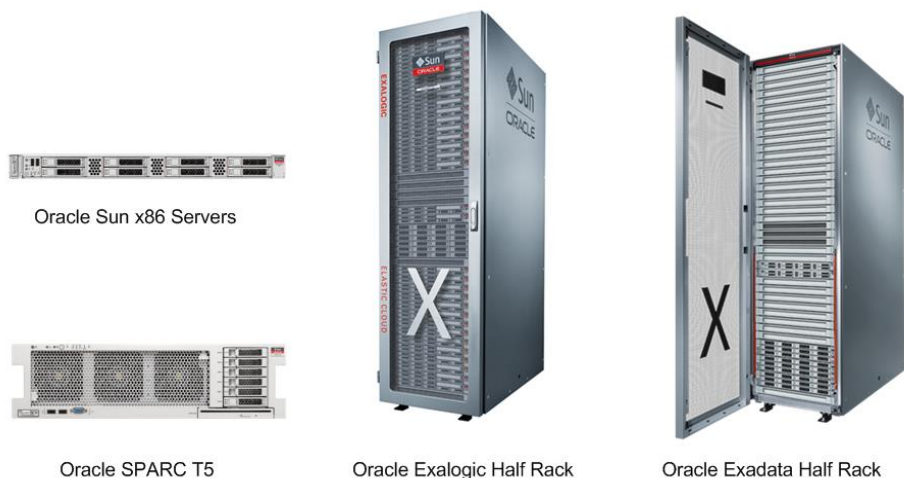
Oracle Exadata Half Rack

Figure 3. Performance test hardware.

Oracle Exalogic hosts the application nodes using an architecture that offers extreme performance and horizontal scalability. Additional capacity is provisioned by simply activating additional Exalogic bare metal servers or virtual machines. Oracle Exadata hosts the BRM database using an Oracle Database Real Application Cluster (RAC) multi-node database. Incremental database capacity is provisioned by activating additional Exadata compute nodes and storage nodes. The Oracle Exadata Smart Flash Cache accelerates the performance of Oracle Communications Billing and Revenue Management (BRM) components such as the Rated Event Loader (REL) by expanding the size of the Oracle Database SGA using optimized flash storage.

Oracle Communications Network Charging and Control is hosted on Oracle SPARC T5 systems running Oracle Solaris featuring Solaris Containers virtualization. Oracle Communications Policy Management is hosted on Oracle Sun x86 Servers running Linux-based Oracle VM. Virtualization optimizes server resource allocation and utilization allowing customers to adapt capacity according to their requirements without being constrained by the physical hardware topology or compromising on performance.

Software

The following product releases were used in this performance test:

Oracle Communications Billing and Revenue Management

- Oracle Billing and Revenue Management 7.5 PS6

- Oracle WebLogic Server 10.3.5

- Oracle Application Development Framework 11.1.1.4

- Oracle Data Integrator and Repository Creation Utility 11.1.1.5 with patch ODI_PT.ODIMM12C_GENERIC_140924.0855.S

- Oracle 11g Database Enterprise Edition 11.2 Linux 64-bit

- Java 1.6.0.45

- Oracle BRM Elastic Charging Engine 11.2.0.2

- Oracle Coherence 12.1.2.0.1

- Oracle NoSQL Database 2.1.54 (12c R1)

- Java 1.7.0.40

Oracle Communications Pricing Design Center

- Oracle Pricing Design Center 11.1.0.4

- Java 1.6.0.45

Oracle Communications Network Charging and Control

- Oracle Network Charging and Control 5.0

- Oracle 11g Database Standard Edition 11.2 SPARC 64-bit

Oracle Communications Offline Mediation Controller

- Oracle Offline Mediation Controller 6.0

- Java 1.7.0.40

Oracle Communications Online Mediation Controller

- Oracle Communications Online Mediation Controller 6.1.0.0.5 (ROLLING PATCH 5)

- Java 1.7.0.40

Oracle Communications Policy Management

- Oracle Communications Policy Management 10.5.1_4.1.0

- TPD Platform 5.1.1-73.5.1

Oracle VM 3.2.8Data Composition

Subscribers were provisioned on BRM using a combination of account types for testing various business scenarios for up to ten million subscribers. For billing and invoicing tests they were created using a mixture of 500, 1000, 1200, and 1800 historical events per account. Table 1 provides a summary of the distribution of subscribers using flat accounts, hierarchical sharing accounts, and those with shared family plans.

TABLE 1. PERFORMANCE TEST DATA COMPOSITION

1M Subscribers	5M Subscribers	10M Subscribers	Group Members	Type
300,000	800,000	1,800,000	10	Cross-account sharing
100,000	140,000	140,000	100	Cross-account sharing
50,000	50,000	50,000	1,000	Cross-account sharing
10,000	10,000	10,000	10,000	Cross-account sharing
200,000	1,000,000	2,000,000	3	Shared family plans
1,000,000	5,000,000	8,000,000	1	Flat

Performance Results

Industry-Leading Charging Performance and Scalability

Figure 4 shows the total provisioned compute capacity (as measured by the number of CPU cores) for a deployment scenario of ten million subscribers. An approximation of the average percentage utilization is shown as a proportion of the total core count. Oracle Engineered Systems are built upon Oracle's scalable modular server virtualization technologies. This provides the capabilities required to adapt to meet the demands of business growth by simply provisioning incremental physical or virtual capacity. The actual compute capacity that is deployed for a customer is determined by factors such as their business forecasts, preferred system utilization levels, and the margin required for extra capacity.

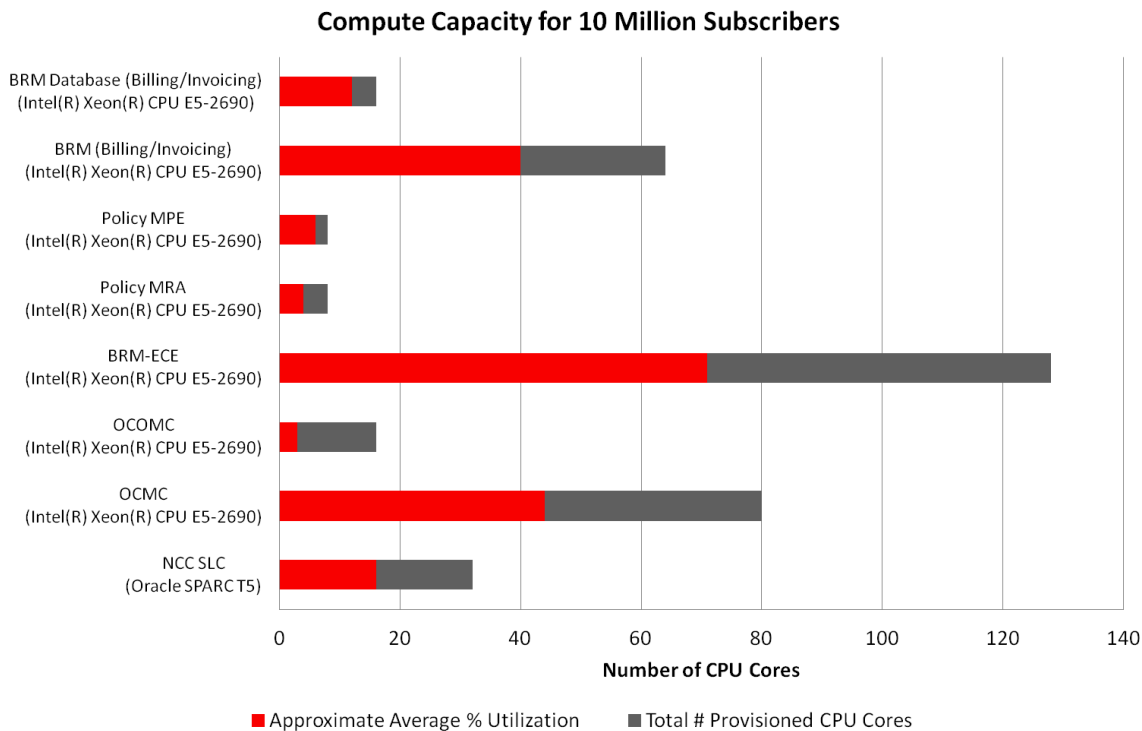### Compute Capacity for 10 Million Subscribers

Figure 4. Compute capacity scaling and utilization for 10 million subscribers

Figure 5 shows the average response times for a business scenario consisting of 10 million subscribers with 80% flat accounts and 20% on shared family plans. Traffic was generated using a rate of 5 BHCA for voice (40%) and messaging (60%), and each subscriber maintained a one hour data session with a charging update interval of five minutes. The end-to-end response times represent the complete processing flow for online (prepaid) traffic. These response times are exceptionally fast when contrasted with the low latencies for the charging of offline (postpaid) traffic.

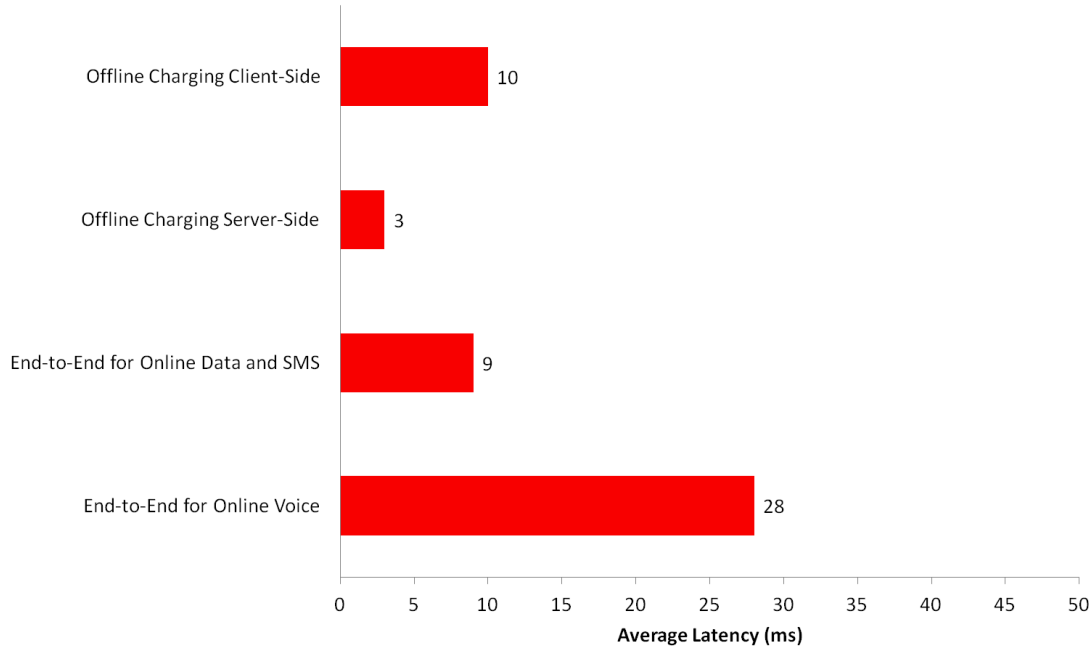## Average Response Times for 10 Million Subscribers with Shared Family Plans

Figure 5. Average response times for end-to-end online and offline charging

Table 2 summarizes the charging workload at the ten million subscriber tier for this traffic profile.

TABLE 2. PERFORMANCE TEST DATA COMPOSITION

Charging Model	Data Ops (100%)	Voice Ops (40%)	SMS Ops (60%)	Total Operations
Online (70%)	27,222	11,667	11,667	50,556
Offline (30%)	833	1,667	2,500	5,000

Integration of Policy Rules Enforcement and Notifications

This performance test demonstrates how the Oracle Communications Convergent Charging and Policy Solution has built-in capabilities for defining and enforcing policy charging rules. In the scenario tested a fair-usage policy is used to manage VoLTE subscribers and notify them of their data usage in real-time through the designated messaging gateway such as an SMSC or SMTP. The solution was tested for up to ten million subscribers where traffic was generated at constant load of 1,000 calls and 200 policy notifications per second. This translates into 720,000 notifications per hour having been handled with exceptionally low latencies.

Figure 6 shows that the latency for the Sy SNR (Spending-Status-Notification-Request) and SLR (Spending-Limit-Request) operations was observed to be consistently under 20ms. These response times were made possible via the high-performance Oracle BRM Elastic Charging Engine where the end-to-end latency for policy-aware VoLTE calls averaged only 29ms. Server-side and client-side operations on the BRM-ECE averaged 2ms and 3ms respectively.

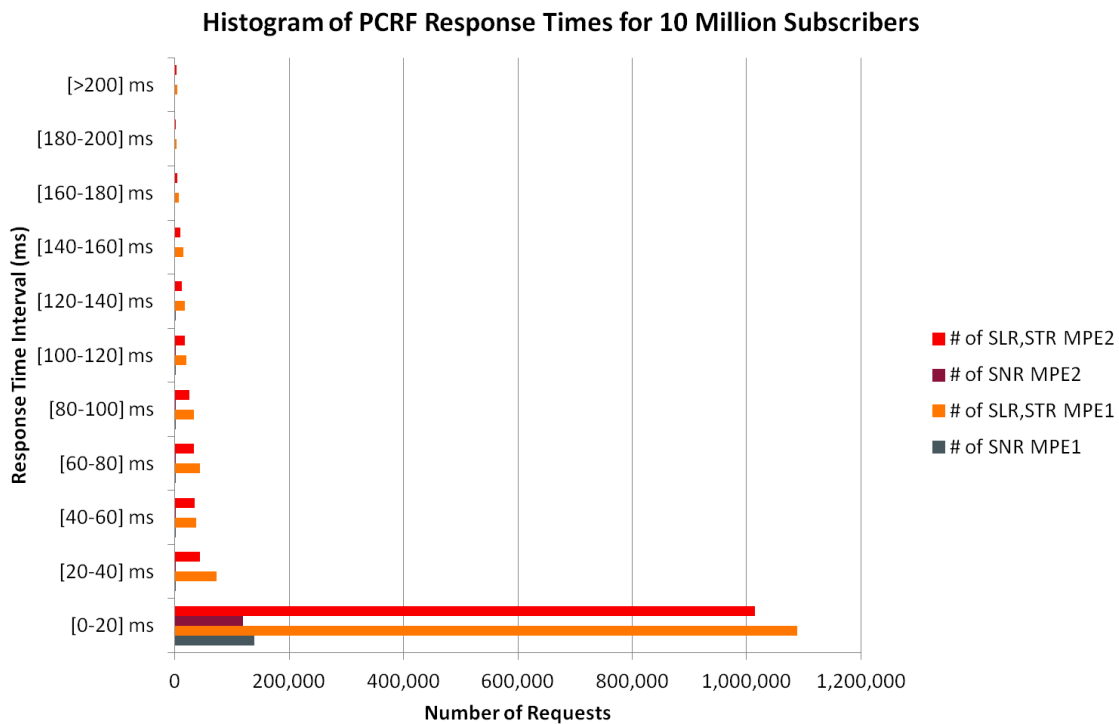## Histogram of PCRF Response Times for 10 Million Subscribers

Figure 6. PCRF Sy SNR and SLR operation latency

High Volume Billing and Invoicing Throughput

Billing and invoicing tests were conducted separately and utilized 80 and 60 threads for processing respectively. The number of events per subscriber was varied to profile the throughput and CPU utilization at different traffic patterns. The primary test scenario involved a varied number of events per account ranging between 500 and 1,800 per account. Varying the number of events per account is intended to represent the data distribution of a production environment to create realistic performance conditions.

Figure 7 compares the performance of billing and invoicing within a deployment context of 10 million accounts. It varies the number of accounts in the billing and invoicing cycle, while holding the number of events per account constant. The amount of hardware allocated to these business activities is held constant across these scenarios.It highlights that billing and invoicing throughput rates remain exceptionally high and suffer little degradation. This is made possible by the Oracle Exadata Smart Flash Cache that processed data on a single Exadata compute node at an incredible rate in excess of 2.7GB/sec.

End-to-End Throughput and Average CPU Utilization of Billing Cycles for 10M Flat and Shared Subscribers
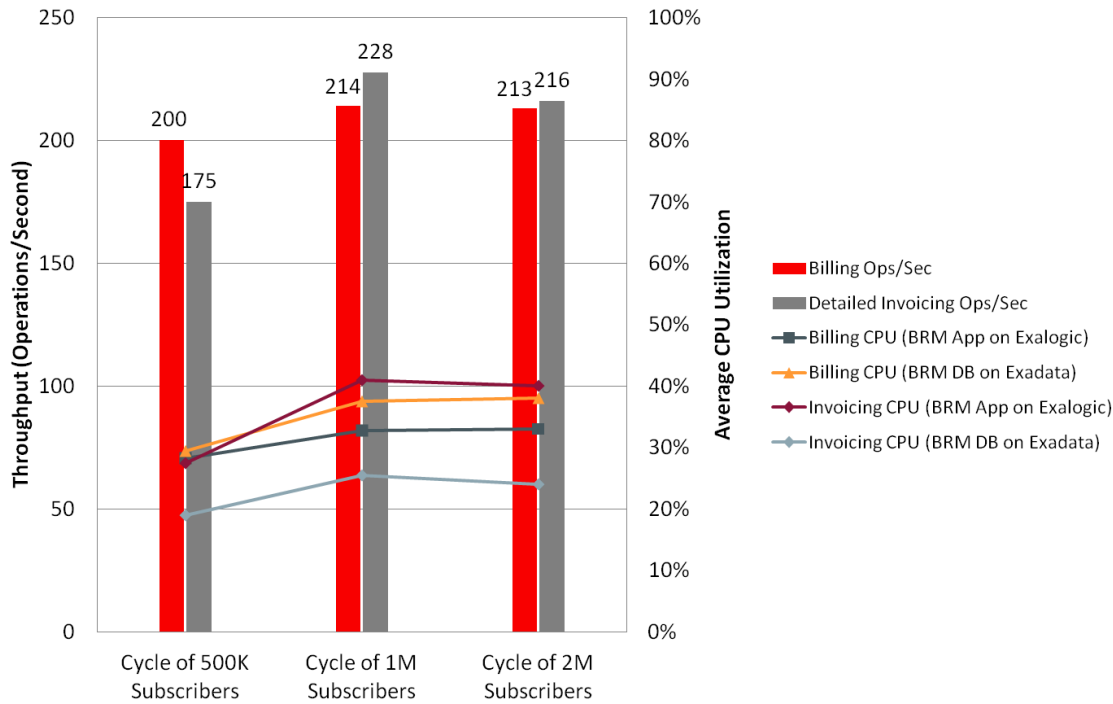

Figure 7. Billing and invoicing performance

Conclusion

This comprehensive set of performance tests demonstrates that the Oracle Communications Convergent Charging and Policy Solution can deliver unprecedented performance and scalability for service providers looking to monetize, control, and manage revenue for high-definition VoLTE calls and dynamic data offerings alongside existing communications services with a single solution.

The ground breaking Elastic Charging Engine technology at the heart of the solution enables dramatically low end to end service authorization latencies for online charging and policy control of high volume and long running data and voice sessions without compromising the exceptional performance on critical invoicing and billing loads.

The performance tests highlight how the Oracle Communications Convergent Charging and Policy Solution can support real-time rating and balance management for sophisticated pricing models, complex account structures and resource sharing models under demanding traffic loads with virtually no impact on performance, providing communications service providers with a future proof, network grade solution to control and monetize the digital experience through 4G, VoLTE and beyond.

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Hardware and Software, Engineered to Work Together

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