MATRIXX Digital Commerce Platform

Performance Benchmark on:

- Red Hat OpenShift on IBM Cloud
- IBM Cloud for Telecommunications
- Intel® Xeon® Processors

MATRIXX SOFTWARE

Contents

Introduction

MATRIXX regularly works with partners and CSPs to validate the performance and scalability of our digital commerce platform on various infrastructure platforms, including public and private cloud offerings. MATRIXX recently worked with IBM and Intel to validate and benchmark performance on Red Hat OpenShift in the IBM Telco Cloud lab environment in Dallas, Texas with 2nd Generation Intel® Xeon® Scalable Processors. MATRIXX Digital Commerce Platform (DCP) includes a 5G converged charging system (CCS) which provides real-time rating and charging and was the focal point of this benchmark. Together with IBM and Intel, we are able to share publicly the results of the benchmark as well as this more detailed report. During the benchmark, we demonstrated that MATRIXX, IBM and Intel can enable CSPs to run critical network workloads in the cloud at the same performance levels as on-premise environments. This enables CSPs to move critical network workloads such as charging to the cloud as they transition to 5G, enabling more cost-effective infrastructure that elastically scales as they monetize and grow 5G offerings.

As CSP business models evolve to take advantage of 5G network functions and meet changing market demands, offer packaging and pricing models are also evolving. Traditional charging models that count messages, minutes or megabytes are being replaced with more contextual value-based models that consider many parameters such as device, service, application, slice characteristics and service level agreements. MATRIXX strives to deliver validation and benchmarking using more realistic business models that leverage many different pricing levers so that CSPs are assured their infrastructure is future-proof. The expansion of 5G in particular unlocks a wealth of contextual information about service usage that enable more robust, personalized and value-driven monetization models, and charging engines must be able to accommodate this context without degradation of throughput or latency.

This performance benchmark is crucially different from those performed by other vendors who provide real-time rating and charging applications. Our benchmark did not artificially simplify network traffic data and pricing structures that minimize the executed business logic being measured. We did not strip back scenarios to a bare minimum of functionality simply for the purpose of maximizing TPS throughputs in order to produce headline-grabbing results that have little in common with what a CSP would see in a carrier-grade, real-time operational environment. Instead, MATRIXX focuses on simulating production-ready environments, with a mix of 4G and 5G network traffic and complex account and balance relationships, to validate how the solution supports real-world customer usage and offer pricing, enabling CSPs to accurately forecast infrastructure requirements.

Guided by our customers from every region, MATRIXX understands that we must provide options for how they process, transmit and store customer data and charging information to comply with local regulatory requirements and to ensure they protect customer data. By benchmarking on Red Hat OpenShift on IBM Cloud with 2nd Generation Intel® Xeon® Scalable Processors, MATRIXX has demonstrated consistent and predictable performance of the DCP's cloud native charging solution that can be deployed on the public cloud, on private clouds, in on-premise data centers and in hybrid environments. With Red Hat OpenShift on IBM Cloud and 2nd Generation Intel® Xeon® Scalable Processors, MATRIXX DCP delivers the most performant charging solution on the market, supporting 4G and 5G operations on a single platform.

Benchmark Setup

In April 2021, the MATRIXX engineering team, supported by IBM's Hybrid Cloud Ecosystem team, conducted a performance test of the MATRIXX DCP deployed in a fully containerized cloud native architecture orchestrated by Red Hat OpenShift on 2nd Generation Intel® Xeon® Scalable Processors enabled in the IBM cloud environment. The purpose of the benchmark was to demonstrate the sustained scalability and low latency required for a Tier-1 cloud native 5G converged charging system (CCS) deployed in a public cloud environment.

To properly reflect a Tier-1 CSP operating both 4G and 5G technologies, the following parameters were selected for the benchmark:

- 100M active devices
- 200K TPS total network usage requests with full session management, quota management, rating and recording of reported usage
- Minimum of 20% of network requests via 5G SBA protocol, reflecting the forecasted subscriber migration to 5G over the coming years. While the 5G SBA protocol has many advantages, it requires more processing overhead than the 4G diameter protocol, and therefore realistic benchmarking activity must include SBA traffic in the load profile
- Average end-to-end latency across all network requests must be less than 10msec as measured by the load generators – this is critical to ensure support for 5G URLL and other latency sensitive applications

Deployment Configuration

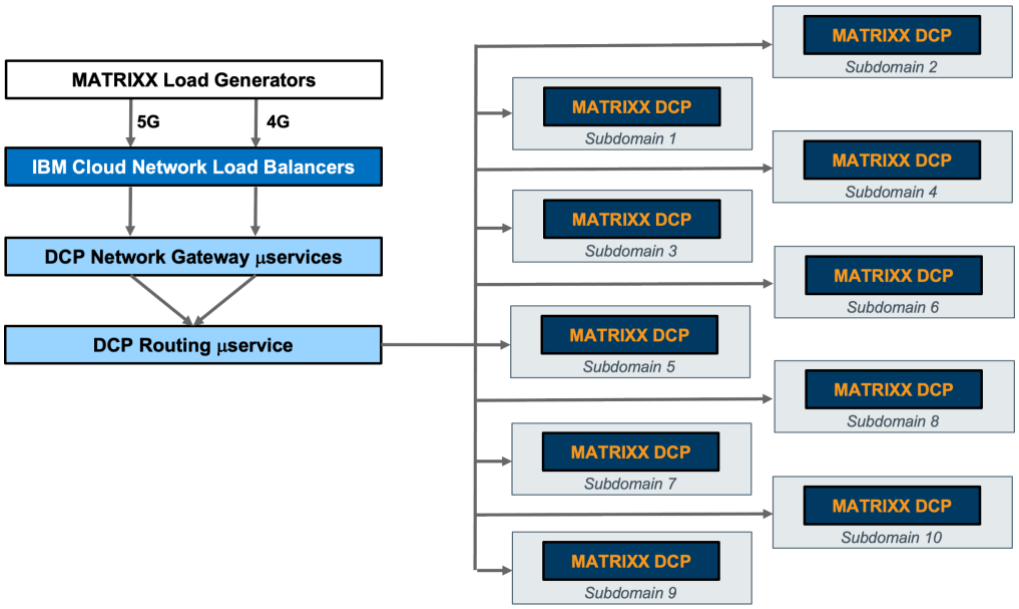

Figure 1: 100M Subscriber Benchmark Deployment with 10 Subdomains

Figure 1 illustrates the DCP deployment configuration for our 100M subscriber benchmark.

- Load generation was performed using the open-source Seagull core network simulator emulating the 4G diameter Gy interface and a combination of in-house and k6 open-source SBA traffic generators emulating the N40 interface
- The DCP Network Gateway and Routing microservices were deployed as global ReplicaSets – all latency measurements included these layers to accurately represent a Tier-1 scale production environment
- The 100M subscribers were evenly distributed across 10 DCP Subdomains which provide linear horizontal scaling of both TPS throughput and subscriber base to any capacity required

The following specific software and hardware was utilized for the benchmark:

- MATRIXX DCP Release 5213 (production software release with no modifications)
- IBM Cloud OCP version: 4.6.18_1533
- IBM Cloud Kubernetes: v1.19.0
- IBM Cloud CNI: Calico 3.17.2
- IBM Cloud Linux OS: RHEL 7.8-64
- IBM Cloud nodes: mb4c.32x384.3.8tb.ssd.encrypted (64 vCPUs, 384GB memory)
- IBM Cloud CPU: Intel® Xeon® Gold 5218 CPU @ 2.5Ghz

MATRIXX DCP Benchmark Results

MATRIXX benchmarks run for several hours at a time, with multiple iterations, to ensure consistency, sustainability, and repeatability of the results. Performance remained consistent across all tests, so the most representative run was chosen for presenting specific performance results.

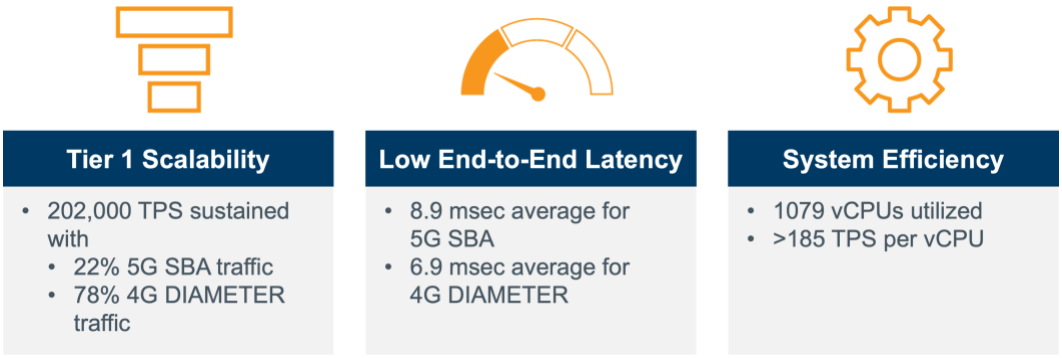

Figure 2: DCP Red Hat OpenShift Benchmark Results

Conclusions

The results of this DCP benchmark reflect real-world CSP business model pricing configuration and a realistic deployment of our converged charging system, demonstrating that MATRIXX can deliver the scalability, latency and system efficiency required of a Tier-1 CSP deploying 5G. There are numerous considerations when forecasting charging system investment, including:

The complexity of the deployed charging model has a measurable impact on a charging service's TPS throughput and latency. Therefore, realistic TPS and latency measurements simulating CSP production environments are critical to understanding and forecasting cost and operational performance; oversimplified usage metering scenarios will not suffice. This includes incorporating large enterprise account models that leverage assets and shared resources across devices and departments, as well as evolving B2B2X models, combined wholesale/retail charging models, value-based pricing and dynamic pricing models.

Cloud native, microservice-based architectures offer tremendous opportunities to simplify and automate the orchestration, upgrading, scaling and failover of complex, high-volume applications. This DCP benchmark on Red Hat OpenShift on IBM Cloud fully adhered to all cloud native principles, proving that cloud native is "ready for prime time" even for network grade, latency-sensitive applications like converged charging.

As 5G transforms the telco industry, operators face the challenge of managing growing volumes of data, voice and multi-media services from hundreds of millions of end devices. This benchmark with IBM Red Hat Open Shift proves that MATRIXX and the IBM Cloud for Telecommunications are designed to address these specific challenges and transform operator networks into flexible platforms that can efficiently scale.

This benchmark demonstrated the continued value of Intel processors, with the 2nd Generation Intel Xeon Scalable Processors delivering predictable, scalable performance thanks to its innovative 'mesh' on-chip interconnect topology, which lets traffic flow at the optimal speed without congestion. This meets the exacting demands of MATRIXX DCP's operations in a public cloud, latency-sensitive and resource sharing environment.

More About MATRIXX

Innovative CSP Monetization Now & in the Future

The MATRIXX Digital Commerce Platform (DCP) is a cloud native, real-time monetization solution delivering 3GPP-compliant rating and charging functionality along with a rich array of digital commerce capabilities, such as subscription management, event streaming and management, personalization and digital payments. DCP supports all generations of telecommunications services and is at the forefront of 5G convergent charging where CSPs will increasingly monetize emerging and diverse business models enabled by network slices and mobile edge computing resources.

With DCP's microservices-based architecture, CSPs can continuously redefine their value propositions delivering digital products and services to highly engaged customers with great agility and efficiency. MATRIXX enables rich and intuitive customer experiences and supports innovative, easily customized services, self-care and precise real-time visibility into and control of their accounts and balances.

Microservices Overview

MATRIXX DCP is architected as a loosely coupled pipeline of microservices. Each microservice is separately scalable and configurable for the desired level of performance and resilience.

MATRIXX is deployed on Kubernetes using Helm with 100% native controls and without plugins or an external provisioning overlay. This is possible due to its inherent microservices design – even including the stateful in-memory database components – and is achieved through the use of deployments and the operator framework.

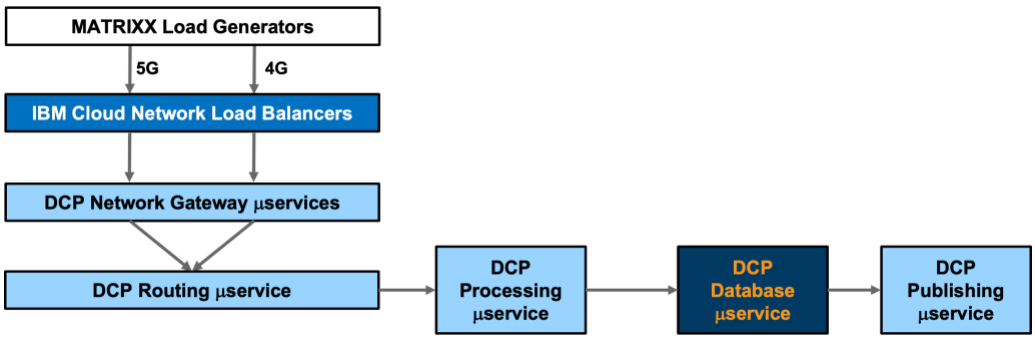

Figure 3: DCP Microservices in Network Request-Response Path

Figure 3 illustrates the core microservices in MATRIXX DCP that are involved in processing network requests.

DCP NETWORK GATEWAY MICROSERVICES

These stateless microservices are responsible for registering the MATRIXX DCP deployment with the networks and managing all communications between the networks and MATRIXX DCP. They also translate all requests and responses between the native network protocols and a common messaging format used within DCP. DCP Network Gateway microservices are available for all common telecommunications protocols, including 5G SBA, 3G/4G DIAMETER, CAMEL and REST.

DCP ROUTING MICROSERVICE

This stateless microservice uses dynamically built routing tables to forward each network request to the optimal instance of the DCP Processing microservice based on load and geographic affinity to the relevant subscriber data. It also informs the DCP Processing microservice which DCP Database instance holds the subscriber data needed to process the request.

DCP PROCESSING MICROSERVICE

This stateless microservice contains the business logic – the session management and rating logic – needed to process and respond to network requests and record the results in the DCP Database.

DCP DATABASE MICROSERVICE

This stateful microservice hosts the subscriber data using MATRIXX DCP's patented non-locking database technology. Resiliency is provided by all-active clustering both at the primary site and at one or more geo-redundant sites.

DCP PUBLISHING MICROSERVICE

This stateless microservice receives a real-time stream of committed transactions from the Database microservice and creates full disk-based audit trails of both the transaction records and their associated Event Detail Records (EDRs). The transaction records are also streamed in real-time to the geo-redundant site(s) for disaster recovery, and the EDRs are fed into a filterable pub/sub-platform for streaming to external IT systems, including CRM, billing, data warehouse, fraud detection and other applications.

Scaling DCP

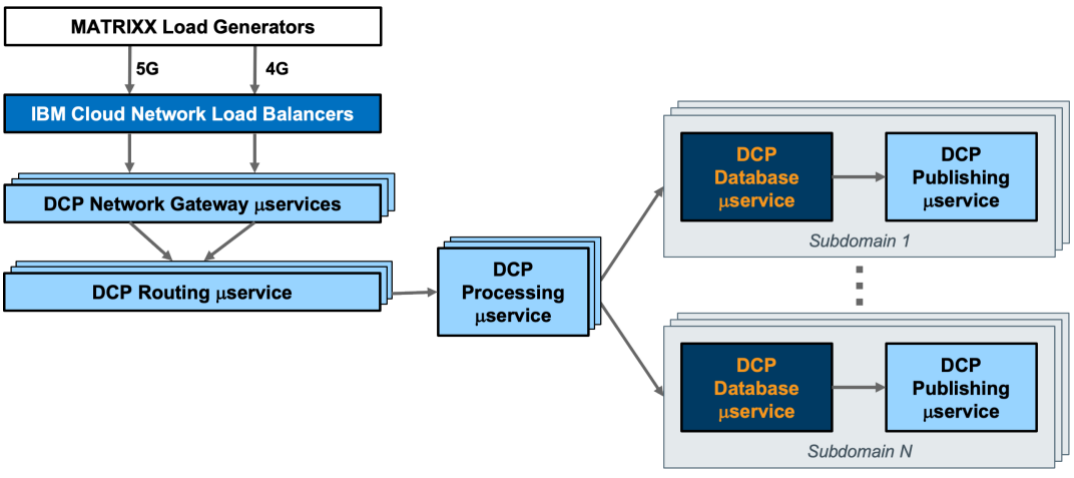

Figure 4: Scaling DCP Microservices

The DCP Network Gateway, Routing and Processing microservices are all stateless and scale through the use of Kubernetes ReplicaSets. The ReplicaSets can be configured to maintain any number of active pods, and any number of ReplicaSets can be deployed to achieve further scale and full geo-redundancy. All pods across all sites are active and can process requests relating to any subscriber in the deployment.

Because the DCP Database microservice contains an in-memory stateful subscriber database, it scales horizontally using a shared-nothing partitioning model called Subdomains. While some partitioned databases use a primary key or generated hash to share the data, MATRIXX Subdomains allow the business logic to actively decide how the overall subscriber data is distributed into the Subdomains to allow the optimal layout for high-performance processing of requests. Each Subdomain in a DCP deployment utilizes a K8s StatefulSet to create an all-active Database cluster for local redundancy as well as one or more identical georedundant clusters for disaster recovery.

While the DCP Publishing microservice is itself stateless, each instance is tightly affiliated with a specific Database Subdomain since it is responsible for the audit trails relating to that Subdomain. Therefore, an instance of the DCP Publishing microservice is deployed with each Database Subdomain. A K8's ReplicaSet is used to instantiate each Publishing microservice.

About MATRIXX Software

MATRIXX Software is a global leader in 5G monetization for the communications industry. Serving many of the world's largest operator groups, regional carriers and emerging digital service providers, MATRIXX delivers a cloud native digital commerce solution that enables unmatched commercial and operational agility. Unifying IT and networks, MATRIXX delivers a network-grade converged charging system (CCS) enabling efficient hyper-scaling of infrastructure to support consumer services, wholesale and enterprise marketplaces. Through its relentless commitment to product excellence and customer success, MATRIXX empowers businesses to harness network assets and business agility to succeed at web scale.