

N-Squared Online Charging Solution

Introduction

The N-Squared Online Charging Solution (OCS) consists of an Online Charging Server (N2OCS), Voucher Server (N2VS), Customer Relationship Management System (N2CRM) and Web Self-Care Portal (N2WSC). The online charging solution is a software system for real-time rating and charging, session control, wallet, and subscriber management.

The OCS leverages modern NoSQL database engines, data-sharding, and replication to provide both high availability and linear horizontal scalability. Deployed on Linux and commodity x86-64 hardware, the OCS provides a robust solution with both low hardware and minimal third-party licensing costs. The result is a cost-effective deployment which can be easily upscaled in response to future business growth. The standard base-level OCS deployment supports up to 10m active subscriber accounts, 500k concurrent sessions and 2,000 transactions/second, with an average transaction response time of < 300ms. Extended deployments scale accordingly.

Internally, OCS wallets store multiple buckets of monetary values, time, and units, and CRM accounts group wallets and other resources into customer-specific accounts. OCS subscriptions support the regular application of actions against wallets, with customizable lifecycles.

The OCS rating engine supports event and session-based rating with the application of rating rules, including rating based on usage, time, and rating context. Policies can be associated with each rule to constrain geography, time-of-day, group membership, product type and other concepts.

Architecture

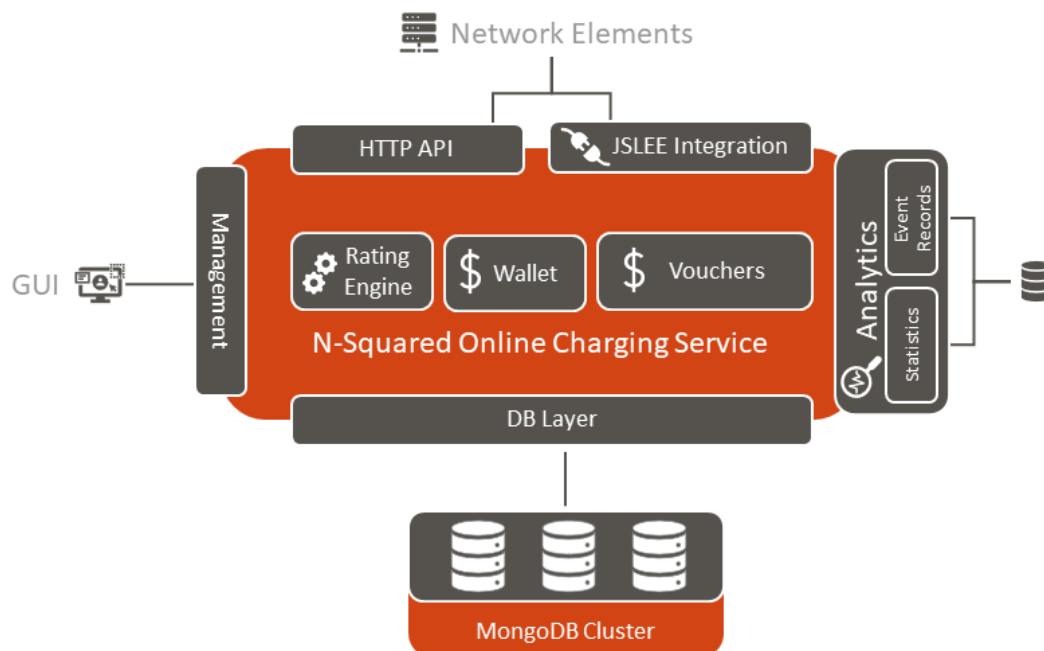


Figure 1 - N2OCS High Level Architecture

The OCS can be deployed either in-premises and self-hosted, or cloud-based as a third-party virtualized solution. Clustering across multiple mid-range servers provides high availability through data replication and redundancy at an optimum price/functionality.

The OCS exposes its core rating & charging functions for leveraging by connected systems as:

- Northbound BSS systems access the OCS to provide a complete solution for invoicing, customer management, dunning, asset management, centralized product catalog, data mining, reporting interface, and other enterprise features.
- Southbound Network components are connected to the OCS via real-time billing protocols.

For upstream integration, the OCS provides a fully featured and documented HTTP REST API for administrative actions. Real-time session control to the network is by Diameter, HTTP, or other proprietary protocols (via a protocol gateway).

Account Features

The OCS stores subscriber wallets, consisting of:

- Buckets, including the unit (monetary, time, data, or general), value, and expiry.
- Status, aligned with the associated customizable lifecycle.
- Arbitrary extended wallet information.
- Active subscriptions, with associated status and associated customizable lifecycle.
- Active rating sessions.
- Linked wallets, for shared wallet functionality.

Rating Features

The OCS rating engine allows integrated systems to perform both event- and session-based charging, price enquiry, and “available funds” calculation requests.

Configurable rating policies allow rating to be performed based on time of data usage, source and destination of the usage, subscriber type, service class, and many other criteria. Extension points within the rating engine allow the built-in rating policies to be complemented with custom rating logic.

Charging is applied to subscriber buckets based on policy logic, identifying buckets which may be used to fulfill a charge and unit conversion that may be applied to the transaction. Bucket cascades allow control over which buckets are used, and in which order they are used, for any charging scenario.

Extensibility

The N-Squared Online Charging Solution offers multiple extensibility hook points, including a full HTTP API to access all engine resources, scriptable hook points for extended functionality, and programmable plugin hooks for deeper control over the rating engine.

Other Features

The OCS provides all key management features, including:

- Generating file-based EDRs for all events, both administrative auditing and real-time rating.
- Publishing statistics to external third-party monitoring tools, including Graphite, Prometheus and Grafana.
- Generating alarms to system logs and other log targets on unexpected errors.
- A small-scale data-processing pipeline, data warehouse and BI dashboard/reporting solution leveraging Apache Nifi and Apache Superset with PostgreSQL database storage.

User Interfaces

To complement the core HTTP and Diameter interfaces, the OCS provides web-based GUIs for administration management of subscriber accounts, wallets, and services.

Login access to the user interface is through centralized Identity Management (IM) services using OAuth 2.0, such as Red Hat Keycloak and Azure AD.

The N2OCS administration screen supports management of all features of the OCS configuration, including rating, policies, vouchers, account details, and extension hooks.

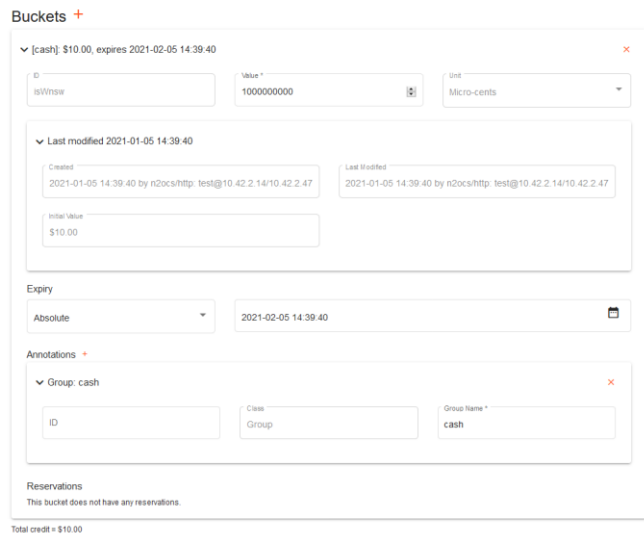


Figure 2 OCS Bucket Management

The OCS may optionally be deployed with a co-located small-scale BI solution, providing scalable enterprise data pipelining and aggregation for the purposes of direct reporting and 3rd party system integration.

The customer relationship manager GUI provides customer support representatives (CSRs) with a simple-yet-functional web interface for the management of customer accounts and account wallets.

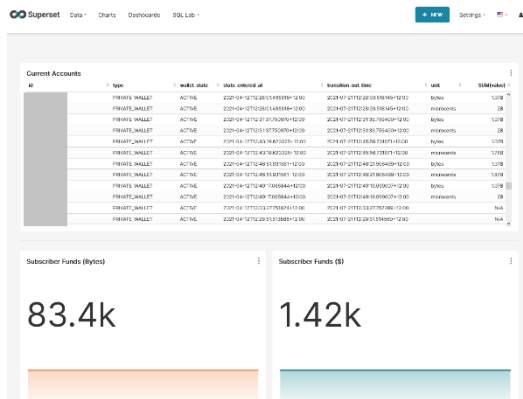


Figure 3 BI Dashboard for OCS

The CRM, secured via OAuth 2, supports core CSR functions including the ability to perform balance adjustments, view wallet EDRs, and create and manage wallets and accounts on behalf of subscribers.

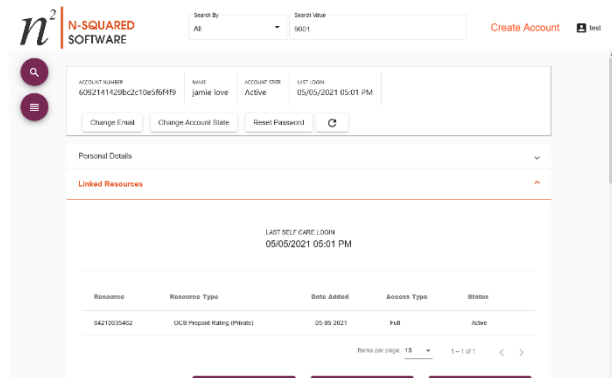


Figure 5 Customer Relationship Manager

The self-care web-application supports subscriber self-management of their account through web-enabled devices.

The self-care GUI can be white labelled to align with customer branding, and accessible user features can be enabled/disabled per-deployment.

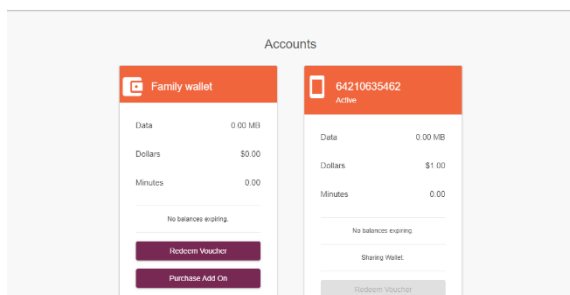


Figure 4 User self-management via web self-care