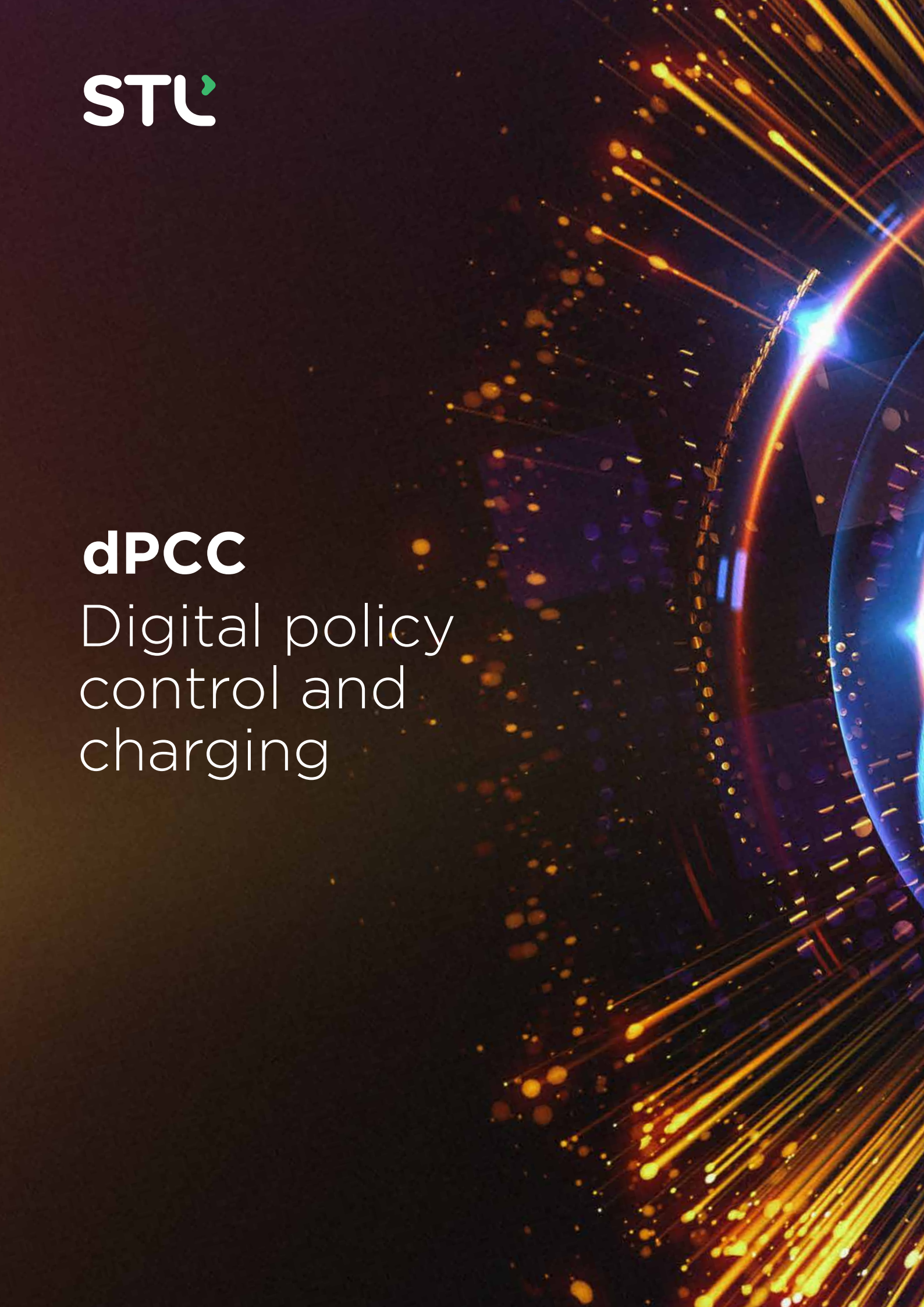


dPCC

Digital policy control and charging

The Charging Catalyst for the New Normal

With flattening ARPUs and declining loyalty, compounded by an explosion in data consumption, CSPs are under tremendous pressure to offer appealing and hyper personalized services in order to acquire and retain customers. CSPs have no choice but continue to invest in 5G, 4G, IoT, FTTH, HFC, Extreme Gaming etc. to stay relevant. CSPs are evolving into one stop, real-time digital platforms to offer multiple products and services across mobility, VoIP, broadband and cable through a single convergent charging and policy systems.

Market dynamics compel CSPs to deploy integrated policy and charging solutions, allowing them to go beyond traditional network management to increase revenue and offer better user experience.
The integrated policy and charging solutions provide better control over networks, usage flexibility to subscribers and help rapidly launch personalized offering for a wide spectrum of consumption patterns.

STL dPCC – Multidimensional Charging for New Age Digital Services

STL dPCC, a cloud-native integrated Policy Control & Charging solution that not only controls subscriber entitlement and network resource allocation but also provides a highly flexible monetization capability through a truly elastic convergent charging engine. Powered by DevOps, Analytics, Web-scale & Network Software (DAWN), dPCC is a dynamic policy control and charging platform that offers policy enforcement and convergent charging capability to CSPs real-time. By running policy and charging from a common framework, operators now have extreme flexibility to create innovative offerings such as on-demand services, promotions, real-time upgrades, service passes in minutes.

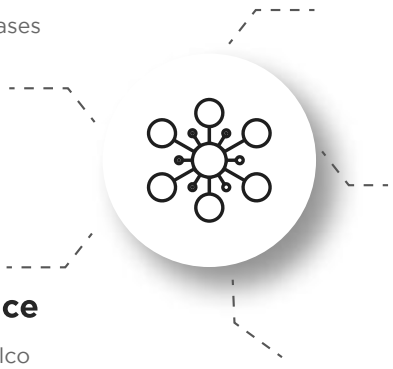
Highlights

5G Policy & charging

- Differential policy & rates offo 5G-RAT type
- Slicing, eMBB & FWA use cases
- Delayed critical GBR QCIs
- Bit rate upto 4tbps
- HTTP/2 inclusion
- 3GPP_5GS IPCAP

Convergent charging

- Convergence of Prepaid, Postpaid, Networks and Services
- Online + Offline Charging for Telco + Non-Telco Use Cases
- Re-rating in Conjunction with Version Control
- Can be Standalone or Adjunct Module



Edge policy & charging

- Edge PCRF, Edge Charging and Edge PCC Mode
- Usage Metering on Gx for Traffic Reduction
- Eliminate Sy Traffic to Centralized Charging

Charging as a service

- Capability to charge any Telco & Non Telco service
- Configurable unit of measurement via framework
- B2B2X Model; Charging over REST
- Monetizing the Charging System itself

Diameter Signaling Control

- Intelligent Signaling Framework
- Independent of External Diameter-based Load Balancer
- IETF RFC 3588, RFC 6733, 3GPP Diameter Routing Agent
- (DRA) and GSMA Diameter Edge Agent (DEA) Compliant

Advantage dPCC

Enhanced Customer Satisfaction

- On-Demand + Dynamic Service Re-authorization
- Multiple Service Offerings
- Multiple Identity Support
- Real Time Rating & Charging

Stronger Customer Acquisition

- Relevant & New Age Digital Service
- Disruptive Plans

Network Cost Optimization

- Dynamic Bandwidth Throttling
- Network Decongestion Policies
- Mobile Data Offload Usage

dPCC

Innovative Monetization

- Cross Promotions, Upselling
- Charging as a Service (ChaaS)
- Intelligence-based Products

TCO Reduction

- Faster Time to Market
- Policy & Charging in a Box
- Multi-level Overload Protection

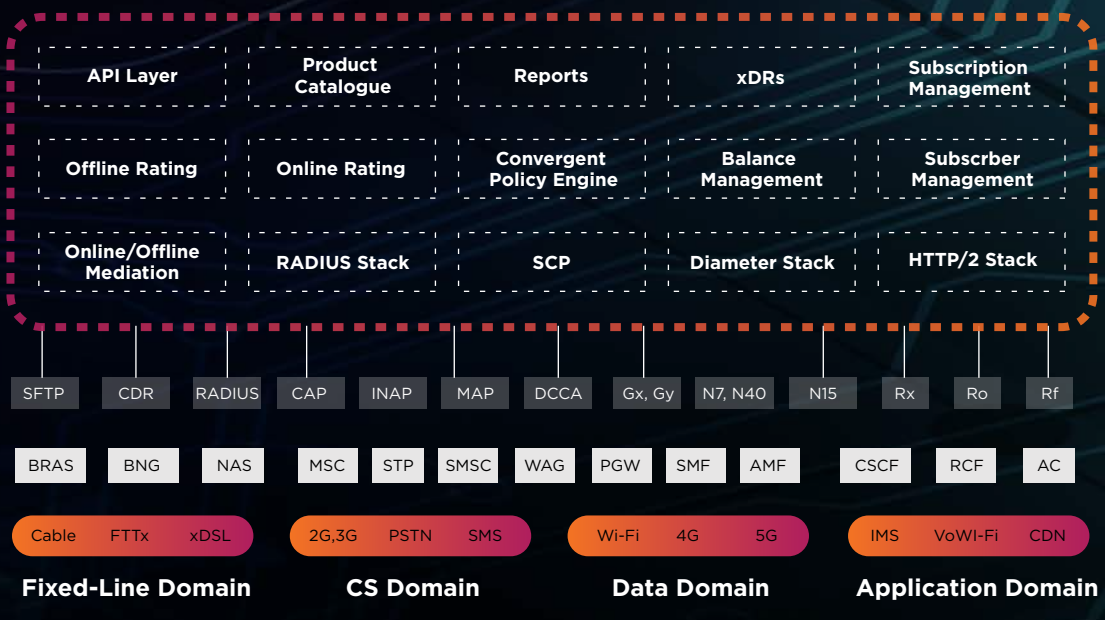
Market Differentiation

- 5G (HTTP/2), WiFi 6
- Disruptive Plan Offerings
- Scale, Speed and Service-Centricity

Unpacking Functionalities

Customer Satisfaction	• Loyalty bonues • Right time customer rewards • Balance back	• Combo plan • Roll over/Roll under • Zero rated app/URLs • Walled - garden sites	• Grace period • Sponsored data • Gifting of unused quota
Plan Personalization	• Customer roaming plan • Shared data (Family plan, shared devices)	• Time of the day • Branded free voucher • App/URL - based customized plan	• Notifications (WhatsaApp, SMS, Email & push notifications) • Redirection
Less Customer Churn	• Transparent rating (No over usage) • Bill shock prevention	• BYOD • Promotional Plan • Real Time usage details	• CDR Visibility • Device Tethering plan
Network Optimization	• FUP/ Redirection • Access Network-wise Qos • Video-On demand	• Peak + Off-peak plan • Congestion-based plan • Blocking /shaping of traffic	• Promotional plan based on cell site utilization • Selective traffic on charging system
5G Services	• 5G eMBB support (upto 4Tbps bit rate) • 5SC mode based differential charging	• Network slicing based charging • V2X support	• Delay-critical services support • Critical-Iot support
Disruptive Plan Offerings	• Data gifting Exclusive & non-exclusive • add ons	• Bill shocking prevention in roaming • First event eubscription	• Roaming travel day pass

STL dPCC – Convergent & Modular Framework



Add-on packages & Promotions

Policy Analytics

Quota Manager

Policy Rule Engine

Notification Manager

Gateway Manager

Subscriber profile
and policy repository

Service Selection Portal

Comprehensive Reports

Rating Function

Charging Trigger Function

Session Level Usage Metering

Account Balance Management
Function (ABMF)

Key Modules

dPCC Benefits

Rating & Charging-based Quota Profile for Data Package

dPCC Data Package includes both user balance and QoS information. The rating & charging-based quota profile contains information of subscribers' profile. So, real-time online charging is also added to policy control in a single box.

Multi-play Convergence

The platform supports remaining balance and daily/ weekly counters. The Radius and Diameter interfaces on the same subscribers' monetary and non-monetary balance can also be used for fetching quota instances to launch a single bucket to multiple services plan. Multiple user identities are supported for common authentication, authorization and accounting.

Plug & Play

The platform allows deployment of policy first and charging later or vice versa without impacting each other. It also offers the flexibility to integrate with other PCRF/OCS. The system is a complete access network, network vendor and hardware agnostic.

Multi-dimensional Policy Configuration

The Policy Rule Engine centrally manages all policies that can be configured based on location, service, subscriber plan, applications, usage history and network details. It further facilitates upgrading/delimiting QoS and also shares it across multiple devices. The platform enables integration with multiple networks & IT systems such as PCEF, SPR, PLM, charging, analytics to deliver policy rules and decisions to be enforced by network elements that enable the creation of monetisation and personalisation use cases. dPCC provides easy plan export/ import between configured sites and nodes

Pre-integrated with STL Billing & Subscriber Management Platform

The pre-integrated platform allows operators to rollout new use cases seamlessly. The end-to -end approach enables operators to derive better value from their new network infrastru-

-cture, be it wireline or wireless, by reducing the IT complexity associated with the creation and deployment of new services. The single-platform approach mitigates the risk and time delay associated with integrating multiple solutions and helps reduce OPEX by reducing license, support, and maintenance costs.

Onsite Creation Capability

The platform provides hooks in many places where an onsite team can inject customisation script to meet business requirements in no time.

Location-aware Services

The platform facilitates service providers to roll-out location-aware services especially on Wi-Fi networks wherein the operator's 5G/4G /3G subscribers receive SMS/E-mail notifica- -tions on entering the operator Wi-Fi hotspot zones in a given location. It does location-wise policy enforcement and charging by identifying various parameters such as current location of the user (on Rx interface), subscriber profile information, IMEI/IMEISV-based device identifi- -cation depending on TAC, brand, model, OS, hardware type, year of release etc. and intimates user with personalized notifications based on type of device like EAP-SIM, non-EAP SIM etc It also supports location-based auto-subscrip- -tion of daily roaming passes.

Promotional Offers & Add-on Packages

Different promotional plans can be offered based on the subscriber segmentation wherein a specific limit can be set for the plan. dPCC allows service providers to launch promotional plans, single add-on offers or multiple add-on packages with quota, tariff and priority defini- -tions. The add-ons offers can be bundled with the existing base plans. It also supports band -width multiplier and quota/volume top-up plans. These promotions can be rolled-out via email, SMS and an app.

Package-Hunting

Logic of dPCC allows the system to choose a particular offer for charging and bandwidth allocation out of multiple offers subscribed. The highest priority is given to the offer with the largest priority number added during subscription. If there are multiple offers with same priority, dPCC evaluates the best plan based on the below sequence checks:

- Emergency/ Promotional Offer
- Offer Priority
- Highest Speed/ Lowest Rate
- Nearest Subscription End-Date
- Earliest Subscription Start Date

Dynamic Service Re-authorisation On-demand

A successful service delivery requires an integrated framework in the back-end. Dynamic reflection of plans is necessary to enhance customer experience, shortening the delays from purchase to activation of any new plan/service. It is necessary to lower customer churn due to delayed service experience.

Real-time re-authorisation during an ongoing session.

The service-aware dPCC conveys policy details (reading re-authorisation messages) in real-time to network gateways and policy enforcement endpoints for dynamic reflections.

Device Management

The module enables service providers to launch device-specific plans for Blackberry, iPhone, Android etc. dPCC engine identifies the mobile device based on the information available from IMEI/IMEISV like TAC, brand, model, hardware type, operating system etc. On identification of any change of device, notifications are sent to users for plan upgradation or to subscribe for new device plan. Device-specific charging and QoS enforcement are also configurable.

Refreshed User Interface

Server Manager Modules are migrated to Struts 2.3.x and Hibernate 4.3.x providing single UI for server configuration, subscriber management and plan configuration. The new GUI is very flexible, access rights driven and responsive. It hides many network complexities and allows admin to enter/validate standard parameters.

MVNO/E Support

The platform provides enhanced multi-tenancy support. Operators can define multiple groups and roles in the dPCC platform and assign groups and roles as per relationship with staff. At every level, access rights can be controlled.

SPR Account Balance Management Function

Account Balance Management Function keeps a real-time balance of every wallet of a subscriber.

Counters/Usage Metering

The platform offers counters or usage mete -ring for major policy decisions based on subs -criber usage. It enables service providers to launch plans based on the level of counters that can be metered on a daily/weekly/monthly basis. It also enables monitoring and applying data caps based on hierarchy or priority defined in policies. Sy interface supports third-party PCRF and OCS communication.

Seamless IEEE 802.1X (Wi-Fi) Support

The platform supports diameter to communi- -cate with packet core networks and also supports RADIUS for IEEE 802.1X networks like Wi-Fi. This enables service providers with QoS and quota management on standard RADIUS CoA from a single dPCC deployment.

VoLTE & IMS Services Support

The platform offers a separate configuration module to manage IMS - related packages, enabling operators to quickly rollout next-gen services such as VoLTE without interrupting existing services.

The operators can configure a variety of services that they want to deliver as part of IMS subscription.
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Single Sign On

PCC provides Single Sign-On feature via out-of-box integration with Keycloak, an open source software product that allows single sign-on with Identity Management and Access Management. It also allows customers to log in using Enterprise LDAP credentials over TLS 1.2, which reduces the risk of identity theft.

Offer Versioning

the platform supports offer versioning support in stand alone as well as when deployed with Unified Product Catalog. With this, CSPs have added flexibility to offering modified versions of the plans to only new customers, while keeping the existing customers on the previous plans, thereby reducing the number of plans and associated complexity. The versioning feature is also critical for supporting re-rating and offline charging cases.

Integration with Policy Analytics

dPCC is powered by STL Intellza, an advanced analytics engine. It is TMF Analytics Big Data Repository (ABDR) compliant and provides Kafka based analytics plugins. It monitors, analyses and generates insights for Revenue, Traffic, Network Performance, Data Transfer and several other parameters. These Policy analytics and Management Information Systems (MIS) reports are auto-scheduled for selected users to optimize business decisions.

Multi-channel Centralized Notification

The platform has dNotificationManager that enables service providers to notify subscribers via SMS, email, push notification and redirects to a specific site/walled garden on the occurr -ence of specific events/rules such as exceeding quota threshold, roaming or promotions. The service providers can even personalise and configure notification templates for users as per the requirements.

Attuned to Multiple Hardware Platforms

The platform enables operators to implement cost-effective network infrastructure, which can scale up to address mobile broadband demand without eroding operator revenue on any COTS-hardware reducing deployment and implementation time. dPCC also supports cloud or virtualised environment-based implemen- -tation.

Agility

The platform provides various flexibilities like CAL layer, plan configuration GUI, flexible CDR formats, dictionary management, and On-site Service Creation Capability to shorten the project implementation timeline.

Open Source Database Support

The platform is fully compatible with Open Source PostgreSQL 9.6 and EDB Advanced Server 9.6. It also supports industry standard in -memory open source database to support high TPS with horizontal scalability. dPCC uses in- memory cloud native distributed database, bring- -ing the benefits of single-digit response times in milliseconds and on-demand elasticity to manage the unpredicted workload patterns for IoT and 5G traffic, while significantly saving the infrastruc- -ture cost in public cloud based deployments. Also provides database automation through Liquidbase.

Compliance with 3GPP Specification 32.299 for Diameter Charging Interface

The platform supports session-based charging. dPCC supports unit reservation credit authorisation model as per RFC 4006. Rating function can handle rateable instances like rating for volume, time and events along with policy/QoS enforcement.

VNF Functionality for Dynamically Scaling-out and Scaling-in

The platform uses REST API for instance creation to support and integrate with any industry standard centralized orchestration.

Open Interoperable API Interface

Server Manager UI and REST API support for configurations like DDF, SPR, roaming, location, alert, Sp interface, session, ACL group management, staff management, device management, driver management, and system management. The system is fully flexible to integrate with other systems over standard interfaces. The same interfaces are easy to customise and reduce efforts in initial project deployment.

Centralised/Decentralised Session Manager

Sessions can be managed on a remote server instead of installing a server machine. Applications layer becomes stateless and with active-active IMBD, a centralised session manager avoids CAPEX introduced with multi-session management servers.

Logical Grouping of Servers

The network architectures are usually complex with servers grouped/distributed to match the geographical needs, lower traffic congestion etc. To streamline the process, dPCC offers click-through logical grouping functionality, along with easy primary/secondary definitions, swapping and grouping. This simplifies server management and speeds-up reconfigurations.

Data Distribution Function (DDF)

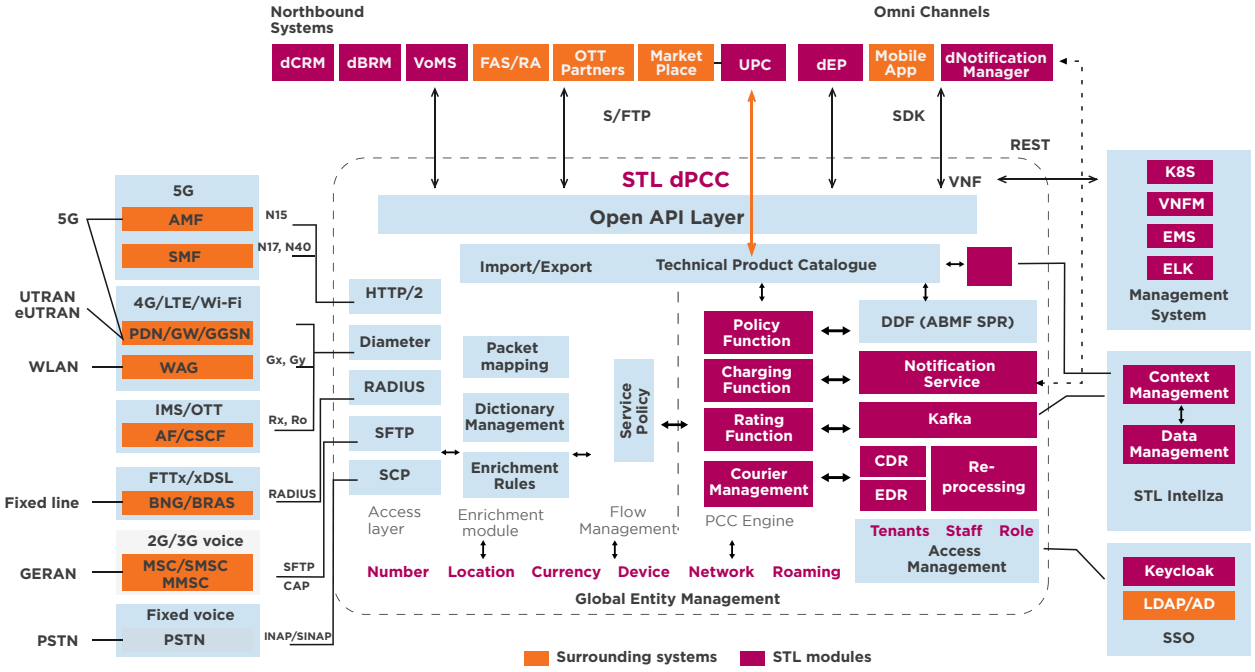
The platform enables distribution of subscribers across multiple Subscriber Profile Repositories (SPRs). DDF improves the upward scalability of the architecture by enabling communication between dPCC and SPR-based on International Mobile Subscriber Identity (IMSI) or subscriber identity.

Pre-written, Session Look-up APIs for Complex Subscriber Distribution

With the increasing flexibility in subscriber distribution across repositories, the retrieval of specific subscriber information becomes complex and time-consuming. It requires custom codes to use RESTful APIs for retrieving subscriber inform--ation. Instead, dPCC implements Message Bus style architecture for session look-up API, with pre-written intricate algorithms. This helps to fetch results faster and shows tangible improve--ments in performance, especially in distributed repositories with complex subscriber segrega--tion. dPPC uses Ambassador API Gateway along with HAProxy for high efficiencies.

Enhanced Audit Support

Enhanced audit support allows an operator to track every change and configuration. The emplo--yees of operator/admin can easily view what has been changed.



Single Gateway Management: No duplicate gateways configuration. Saves deployment time

Open API Support: Common API for PCRF and OCS reduces integration efforts

Cloud Native Platform: Hyperscale, Auto-heal, Auto-scale, Zero-touch Updates

Deep observability framework: Based on Graffan, Prometheus and ELK

Single SPR: Common subscriber entity. Drastically minimises SPR size

Synchronised Plan Definition: Plan synchronisation reduces efforts and errors

Common Logs: Logs stored in single place debugs subscriber's session faster

Single Migration: Saves time and minimise errors

No Sy for internal communication: Low message transaction reduces traffic

90% Reduction in Network Traffic

For Tier 1 CSP in APAC

Active Active	Response Time	Devops Throughput	Faster Deployment	Hyper Speed
50%	**50%**	**80%**	**66%**	**177%**
Reduction in hardware cost	Improvement in response time	Reduction in time-to-market	New services in less than 5 mins	More TXN/s sec while handling 10x capacity

Simplified Architecture

Reduced CAPEX &OPEX

Unlimited Scaling

DEVOPS for build-operate -transfer

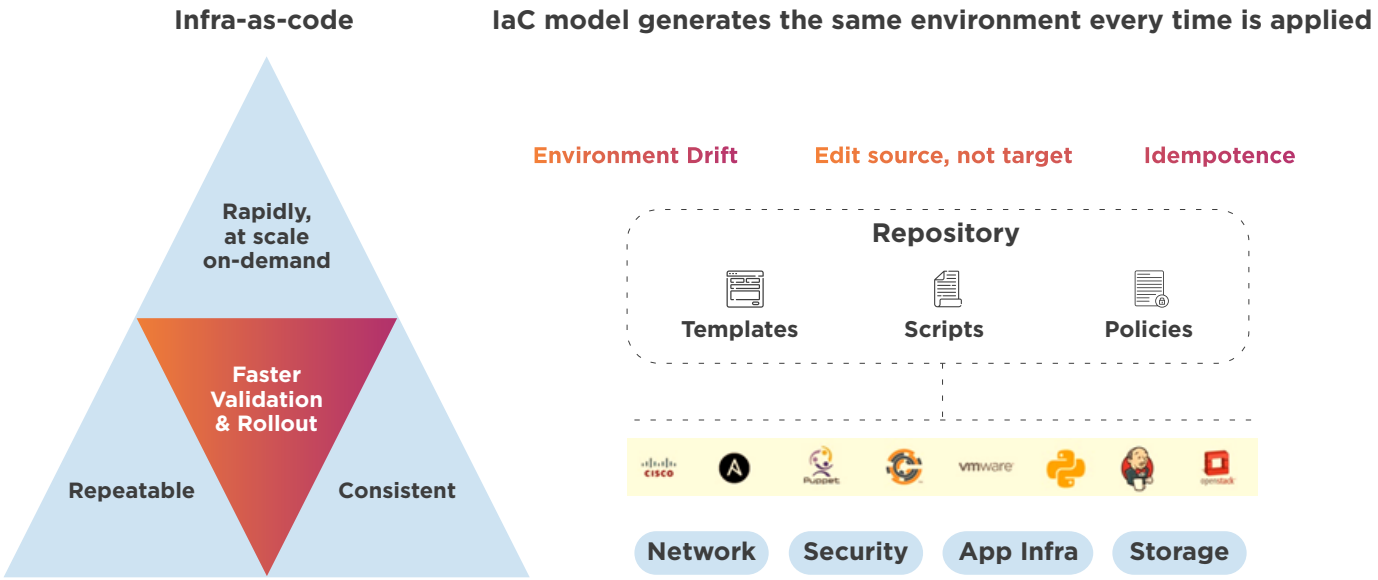
- Cloud native web scale solution
- Proven deployments on 3G, LTE, Wireline & WiMAX networks.
- Multi-tenant with full flexibility for supporting MVNO/E models
- Best-in-class TPS support
- Redundancy Support (99.999 % Availability)
- Robust & scalable to N number of policy rules for Policy & Charging
- Dashboard-based monitoring
- Pluggable PCRF and OCS modules
- Compliance with 3GPP Release 12, IP V6 ETSI TISPAN (RACS), and WiMAX PCC standards
- Lowest TCO due to high TPS support and Open Source Database.
- No dependency on system interface when deployed as PCC which reduce network traffic
- Configurable AVP definition to build any business logic around it
- Application-specific/URL-specific QoS and quota
- 50+ off-the-shelf Policy & Charging use case support
- Multiple adaptor support with 3GPP Diameter-based Gx, Gy, Gxx, Rx, Ro, DCCA, Sp, Sd, S9, Sy
- RADIUS support for 802.1X networks, SOAP API, REST, CSV, XML and other proprietary interfaces
- No OEM product involvement which gives full-flexibility to design new solutions (Offers Open Source support)
- Industry standard interface support interoperability
- Platform/Vendor/Hardware/ Network-agnostics product
- Dictionary & GUI-based approach to incorporate any new standard or vendor -specific AVP and build business logic around it even without any patch /upgrade or restart of the application
- Kafka based CDR and EDR streaming to Data Lake for near-real-time analytics and campaigns

Unique Competitive Advantage

1. Infrastructure as a code
2. Cloud Native
3. Charging as a service
4. Edge policy and charging
5. Future proof

Infrastructure as a code (IaC)

We employ IaC in addition to cloud computing to manage the infrastructure using configuration files. Apart from the obvious cost savings, speed and scalability, IaC helps achieve consistency and accountability for CSPs infra management. Our IaC toolkit comprises predominantly Declarative and immutable approaches along with Push & Pull methodologies.



Infrastructure as Code (IaC) is the management of infrsatructure (networks, virtual machines, load balances and connection topology)in a descriptive model usingDevOps methodology

Cloud Native

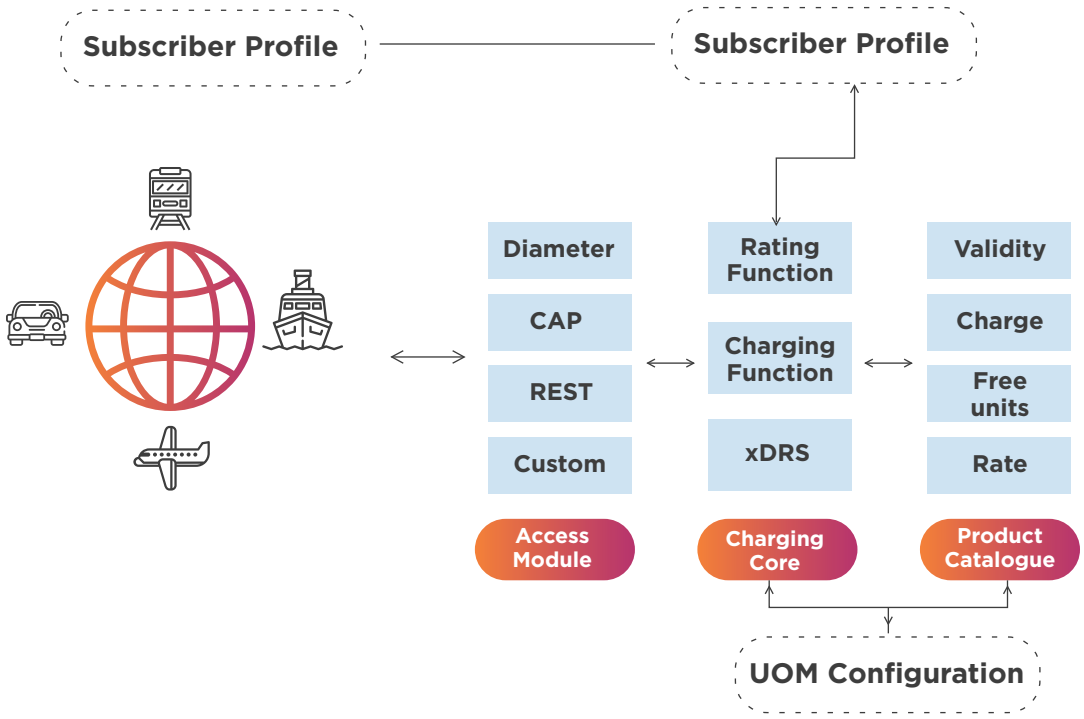
Built for Cloud – Engineered for Speed, Scale and Service Availability

- Multi-cloud ready, Proven for edge architecture
- Deep observability framework and tracing
- Ready plugins for Kafka integration with Data Analytics and Campaign Platforms
- Single pane configuration of plans and policy
- Virtual Network Functions (VNF) and Cloud Native Functions (CNF) compliant
- Proven scalability, 28,000 transactions per cluster
- Auto-scale, Self-healing,
- Zero-touch update, 99.999% availability

Charging as a Service (ChaaS)

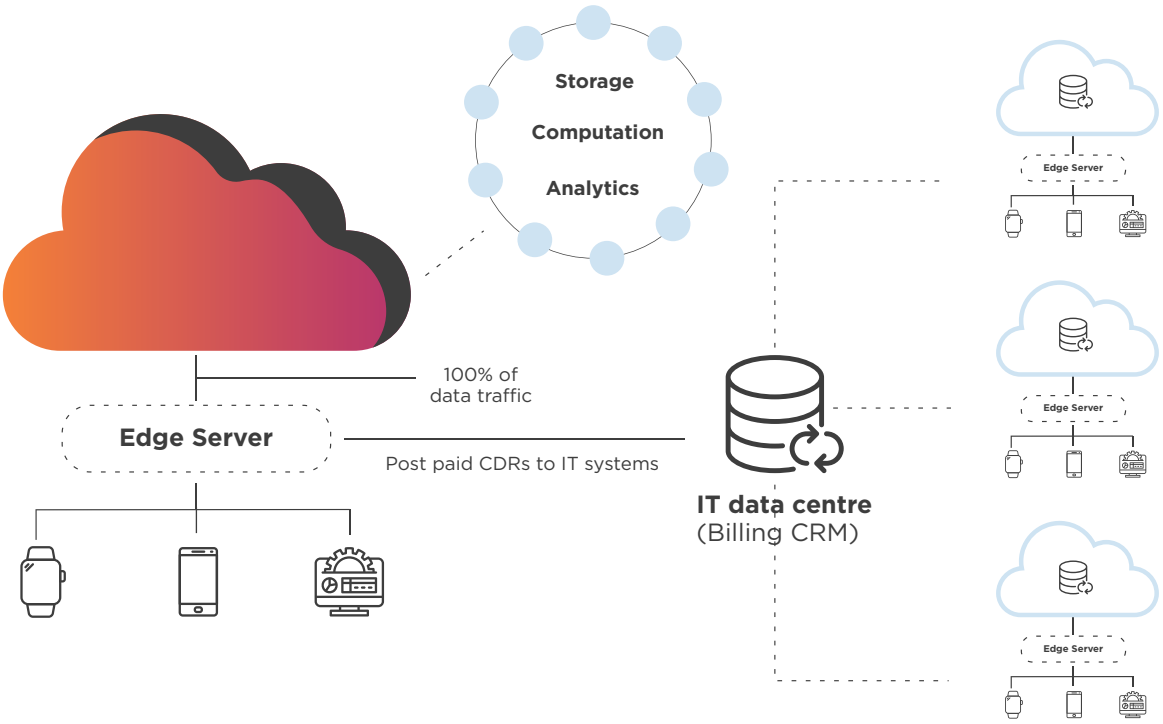
Given the era of marketplace networks, Charging as a Service (ChaaS) acts as a force multiplier of B2B2X platforms by opening up new monetization avenues for CSPs. ChaaS enables service providers to make money from the Charging itself in addition to traditional “through the” the Charging. ChaaS allows CHF to charge any digital services offered by non-Telco verticals such as IIoT, Logistics, Cab Hailing Services and Petroleum, along with the traditional Time, Volume and Event Based Charging.

STL dPCC is catalog-driven which means it comes pre-integrated with Unified Product Catalogue (UPC). Once the relevant Unit of Measure (UoM) is configured and kept independent of source code in UPC, STL dPCC can rate and charge these customized, non-telco UoMs, along with the Balance-Management of Free Units. UoMs in dPCC are not limited to kms, litres, sq.ft, kgs etc.



Edge Policy & Charging

Aside from the traditional centralized data centre based deployments, dPCC supports Edge architecture to deliver ultra-low latencies expected from 5G. In 4G, dPCC deployed on edge reduces the network traffic up to 90% through the intelligent use of usage metering on Gx. With active-active distributed in-memory database, and online charging on edge, STL’s dPCC can further reduce the subscriber provisioning traffic by up to 50%.



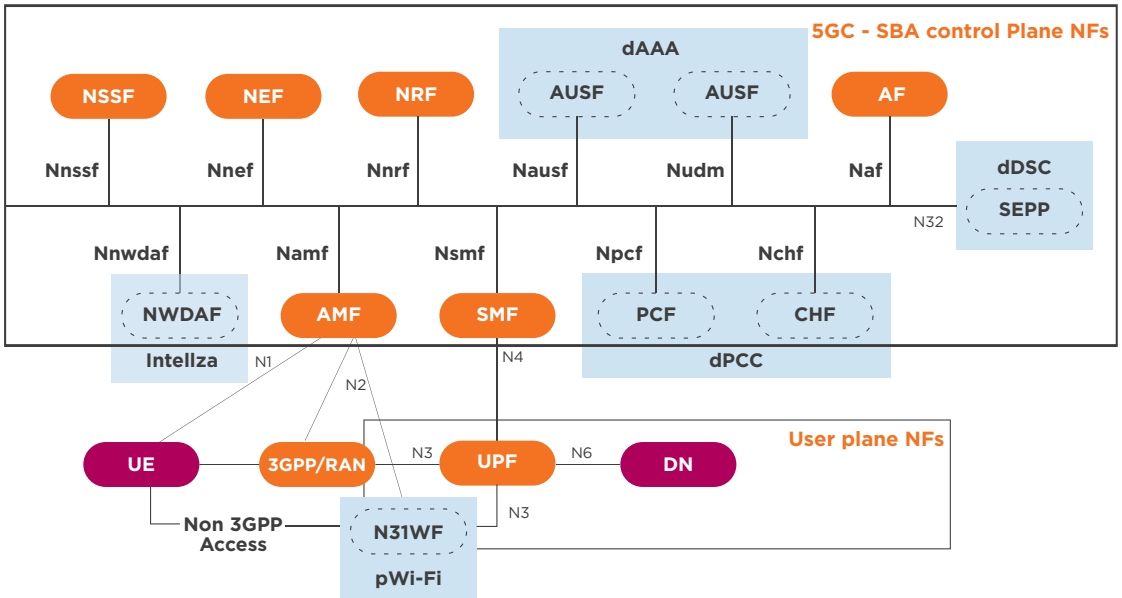
dPCC in the edge architecture can be deployed in multiple modes:

Edge PCRF mode | **Edge** charging mode | **Edge** PCC mode | **Adjunct data** charging mode

Adjunct charging mode can be used in 5G and 4G to reduce the traffic originating from IoT going to the central charging system, the majority of which is expected to be non-chargeable traffic due to use of subscription packages. By eliminating this non-chargeable traffic from hitting the centralized IT systems, it significantly reduces the CapEx and OpEx significantly.

Future Proof – Evolution from 4G to 5G

STL dPCC provides a clear path for 4G to 5G evolution and is aligned with the industry evolution from Non-standalone to standalone architecture. Moreover, pre-integrated with dAAA, DRA and Intellza, the solution can be deployed in different modes depending on the needs of the CSPs.

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