

# Digital Policy and Charging Rules Function (dPCRF)

Techsheet



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With explosion in data consumption & network load and continuous evolution in networks such as 5G, 4G, LTE, FTTH, HFC, IMS, etc., the DSPs are under extreme pressure to offer hyper personalized services and QoE through innovative offerings. DSPs are evolving into real-time platforms to offer multiple products and services across mobility, VoIP, broadband and cable from one digital mesh.

DSPs are focusing on providing ubiquitous data and voice services that are high in quality, reliable and affordable by upgrading their core connectivity infrastructure. STL Digital Policy and Charging Rules Function (dPCRF) allows the DSPs in managing their networks more effectively and efficiently

by reducing the network load through usage metering on Gx, while using a zero-touch webscale platform that's designed for mission-critical applications. dPCRF further enables DSPs in becoming more responsive to changing consumer preferences and competitive market dynamics by providing a single interface for modelling and launching products offers in minutes.

dPCRF is the market's leading, scalable, resilient and dynamic network policy control and bandwidth management system. It allows the Network Service Providers to offer flexible and personalized plans to the subscribers as per their preference.

Modules	Features
<p><b>Product Offers and its Types</b></p>	<p>Product Offer, in dPCRF, comprises of different components grouped and packaged together in a single entity. Product Manager can leverage Policy Designer features to quickly and easily develop and implement various offers such as volume based, time based, bandwidth control, Fair-Usage-Policy (FUP), Happy Hour plans, time based QoS, Night Hour plans and many more.</p>
<p><b>Basic and Add-on Offers</b></p>	<p>Basic product offer acts as a starter kit for new customers and allows them to start using the services. These offers comprise of bundle of services along with free quota and bandwidth for data service.</p> <p>Add-on product offers are the additional offers on top of basic offer. Such offers allow the operator to provide bandwidth boosters and additional value-added services (VAS).</p> <p>It may be noted that a subscriber can subscribe to multiple add-on offers but can have only a single basic offer at a time.</p>
<p><b>5G Non-Standalone (NSA) Framework</b></p>	<p>dPCRF complies to 3GPP Release 15 standards for 5G Non-Standalone (NSA) architecture and features. dPCRF is capable of supporting bitrate upto 4TBPS along with new 5G QIs (QoS Class Identifiers) including 'Delay-Critical-GBR' and Extended-BW AVPs.</p>
<p><b>Bandwidth-on-Demand</b></p>	<p>Bandwidth-on-Demand (BoD) offers work as speed boosters to subscribers existing data speed. Product Manager can configure such offers, which multiplies the bandwidth in the subscribed basic offer with the configured multiplication factor.</p>
<p><b>Emergency Packages</b></p>	<p>dPCRF provides the ability to the operators to plan and launch emergency offers during critical situations like riots, war, protests and many more. The services or certain applications of the end users can be controlled/ blocked for certain duration as per government's order. This offer acts as a global plan and is directly applied to the subscription without explicitly purchasing it. Such offers hold highest priority and its eligibility is based on the offer dates. If eligible, the QoS defined in this plan is applicable and overrides other subscribed offers.</p>

Modules	Features
<p><b>Promotional Offers</b></p>	<p>dPCRF allows the operator to launch promotional offers with specific bandwidth and free quota for a certain period of time. Such offers are the global offers and applied directly without any explicit requirement of subscription. The application of this offer depends on its date eligibility and configurations. If the preferred QoS is enabled, the end user will be given the configured data speed of the promo offer. While if preferred QoS is disabled, the end user will get the best speed across all the active subscribed offers.</p>
<p><b>Convergent Product Offers</b></p>	<p>The operators can launch offers based on prepaid and postpaid type as per the business. However, Policy Designer of dPCRF enables the Product Manager to configure offers irrespective of the type. During acquisition, based on the charging method, dPCRF allows the operator to choose prepaid or postpaid for the specific subscriber.</p>
<p><b>Product Offer Lifecycle Management</b></p>	<p>Product lifecycle defines the lifespan of an individual product from concept to retirement. Each entity in Policy Designer has its own mode. Following modes are supported for each entity - Design, Test and Live. Apart from modes, dPCRF provides the feature of status for each entity. The statuses supported are- Active, Inactive and Retired.</p> <p><b>Design:</b> This mode is used by Product Designer when the offer is under configuration and not completed yet. The customers cannot purchase such offers.</p> <p><b>Test:</b> This mode is used by Product Designer when the configuration of an offer is done while it is under testing. Test customers can subscribe to these offers.</p> <p><b>Live:</b> This mode is used by the Product Manager to launch the offers in the market. Once any offer is live, all the customers can purchase and use the services.</p> <p><b>Active:</b> During design, test and live mode, the offer has to be in active state for the customers to use. Retired: An offer can be marked as Retired when the operator decides its end-of-life. Marking an offer to this status does not affect the existing active subscriptions with this offer but ensures there are no further subscriptions for this offer.</p> <p><b>Inactive:</b> An offer can be marked as Inactive from Retired when there are no active subscriptions for this particular offer. Marking an offer to Inactive affects the active subscribers and prevents them from any further usage.</p>
<p><b>Multiple Device Support</b></p>	<p>The same subscriber can subscribe a single package for using services on multiple devices such as a dongle as well as a mobile handset. For example, an offer subscribers with 50 GBPS HSQ and 25 GBPS FUP will get the same bandwidth on both devices ( a dongle and a mobile phone) as per QoS level.</p>
<p><b>Product Versioning</b></p>	<p>Product Versioning, in dPCRF, allows the operator to launch a new version of an existing offer for a specific customer segment. It prevents the operator from applying changes to the subscribers with an older version of an offer. The new version is applicable for new acquisitions only. It increases offer manageability and reduces the number of offers in the system over a period of time. This functionality is extended via APIs as well.</p>

Modules	Features
<b>Save Plans as Draft</b>	This feature gives flexibility to the Product Managers to create product offers in the draft mode if all the details required for creation are not available at the time of offer modelling.
<b>Bulk update of Plans</b>	Bulk update feature provides the ability to update thousands of records together eliminating the need to update it individually.
<b>Cloning Product Offer</b>	The cloning feature allows duplication of pre-created product offers, both manually as well as through the RESTful APIs.
<b>Export and import of Product Offers</b>	The export-import feature allows operators to test the product offers in the pre-production environments and perform bulk export/import to other environments.
<b>Multi-channel Notification</b>	dPCRF provides multi-channel notification to the subscribers based on the usage metering done by dPCRF. dPCRF uses STL's Microservices based dNotificationManager module for multi-channel notification through a template based configuration and Open API based integration. Notifications templates for non-monetary quota can be set in dNotificationManager and consumed in dPCRF. dPCRF supports notifications through Email and SMS channels.
<b>Integration with Enterprise Product Catalogue</b>	dPCRF comes pre-integrated with STL's Unified Product Catalog over Restful APIs, giving CSPs' product marketing manager agility and flexibility to launch new services and offers through a single interface. CSPs have a choice to use either an external product catalogue or an intuitive product designer interface within dPCRF for modelling and launch of new offers.
<b>Subscribing to various offers</b>	The system allows the subscriber to buy a basic offer through a starter kit. Access to services, free quota, data speed is given which can be charged at the defined cost. Moreover, subscribers can buy additional offers to get bandwidth boosters and additional services.
<b>Auto-subscription of an add-on offer</b>	This feature allows the Product Manager to create a bundle offer of basic and add-on offers. On subscription of the basic offer, associated add-on offers is made available to the subscriber. Based on the eligibility of the defined conditions, add-on is auto-subscribed by dPCRF. The offer validity and cost of the add-on gets applied as per the configuration.
<b>Future Add-on Subscription</b>	dPCRF allows the end user to subscribe for an add-on offer in advance although it gets activated on the desired date. The benefits and consumption from that add-on offer is available from the activation date.

Modules	Features
<p><b>Offer Prioritization during subscription</b></p>	<p>dPCRF provides the support of maintaining priority of the add-on offers during subscription itself. CSR staff can let the end user choose the priority of the add-on during purchase and the same is considered by dPCRF. Such prioritization facilitate the customer in choosing the sequence of bandwidth consideration when there are multiple offers with the same QoS details. Here, lower is the number, higher is the priority. The add-on offer subscribed with lowest-number priority is given highest priority. By default, dPCRF considers default number 100 as the priority. If there are multiple add-on offers with the same priority, dPCRF applies package hunting logic to qualify the offer.</p>
<p><b>Change Product Offer</b></p>	<p>End users are allowed to change their Basic offer based on their requirements. On change plan request, the existing plan is discontinued while new offer is provisioned. QoS and Bandwidth details will be applicable as per the new offer.</p>
<p><b>Balance Reservation and Slice Configuration</b></p>	<p>dPCRF provides the feature of reserving balance in chunk to avoid revenue loss and manage concurrent sessions smoothly.Slice configuration is used by dPCRF to reserve a chunk of available balance (customer's free balance) when it receives a request (initial or update) from the network. Once the provided chunk is exhausted, it again provides a new chunk of balance. This continues till the OCS receives a termination request or till the balance lasts. This reservation slice configuration can be a flat number or in form of percentage (%) of available balance.</p> <p>System provides the ability to configure dynamic slicing for non-monetary quota buckets as flat or in percentage value.</p>
<p><b>Network and Service Agnostic</b></p>	<p>The system supports policies for different applications having different bandwidth requirements through different networks and services such as WiMAX, Wi-fi, CDMA, 2G, 2.5G, 3G, IMS, Broadband, LTE, and others.</p> <p>dPCRF supports the Gx, Rx and Sy interface of the Diameter protocol. Apart from this, it also supports RADIUS protocol. It supports the configuration of different Diameter Peers and RADIUS Clients.</p>
<p><b>Data Distribution Function (DDF)</b></p>	<p>Data Distribution Function, that is DDF, is used to divide the subscriber details in multiple Subscriber Profile Repository (SPR). dPCRF supports single SPR for subscriber and subscription details which does not allow the horizontal scaling. DDF is used to achieve high level of horizontal scalability and faster identification of subscribers across multiple profiles by creating multiple virtual SPRs. The data distribution across multiple SPRs can be done by configuring identity patterns based on Subscriber Identity.</p>
<p><b>Service Policy</b></p>	<p>Service policy enables the system engineering team to define the flow in which PCRF requests would be served. It allows the team to configure conditional based subscriber lookup in different SPRs, subscriber identity attribute, CDR generation file/ Kafka and others. It also allows the operator to define the treatment given to the unknown user. The operator can either accept or reject the requests received from an unknown user. A default offer can be assigned to the unknown user in case the request needs to be processed. This flow definition can be different for the requests received from different gateways/ peers.</p>

Modules	Features
<p><b>Multiple Identity Support</b></p>	<p>dPCRF supports multiple identifiers for the system to identify a subscriber uniquely. These identifiers can range from mobile number, IMSI, service account username, MAC IP address and many more. This gives the flexibility to support alternate identity based bandwidth control and quality-of-service, a critical requirement for 5G.</p>
<p><b>Package Hunting</b></p>	<p>Package Hunting logic of dPCRF allows the system to choose a particular offer for 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, dPCRF evaluates the best plan based on the below sequence checks:</p> <ul style="list-style-type: none"> <li>• Emergency/ Promotional Offer</li> <li>• Best QoS</li> <li>• Offer Priority</li> <li>• Highest Speed</li> <li>• Nearest Subscription End-Date</li> <li>• Earliest Subscription Start Date</li> </ul> <p>It may be noted that the system doesn't restrict the number of offers a particular subscriber can subscribe to.</p>
<p><b>URL Redirection</b></p>	<p>The system enables the network to redirect the user to a particular page when the defined QoS profile gets eligible alongwith .</p>
<p><b>Call Detail Record (CDR) and Event Detail Record (EDR)</b></p>	<p>Call Detail Records (CDRs) are data produced by dPCRF during the rating &amp; charging process. CDR contains all the information related to usage done along with call details, usage details, bandwidth and QoS applicable. It is the single-point of truth. CDRs can be stored in database as well as in file, based on configuration. dPCRF recommends to store these data in CSV file to experience high throughput.</p> <p>Event Detail Records (EDRs) contain the transactional and historical data of subscriber profile, subscriptions and free quota balances. EDR is generated for all the activities and changes done in subscriber profile, change in subscription or purchasing new offer and balance related changes. EDRs can be stored in a database or in a file, based on configuration.</p>
<p><b>ToD support for Gy interface</b></p>	<p>Time of day (ToD) support helps reduce the network load by allowing Time Activation &amp; Deactivation support for PCC rule. For example, if multiple PCC rules are selected (after policy hunting) for an user with multiple packages, then ToD sends all the applicable PCC rule for whole day. This significantly reduces the number of update requests for a new policy over the network. dPCRF supports ToD over Gy interface for the following packages, ensuring reduction in the network load</p> <ul style="list-style-type: none"> <li>• Exclusive add-ons</li> <li>• Non-exclusive add-ons</li> <li>• Promotional preferred network type add-ons</li> <li>• Promotional non-preferred channel type add-ons</li> <li>• Future dated exclusive and non-exclusive add-ons</li> </ul>

Modules	Features
<b>Integration with Analytics</b>	<p>dPCRF provides the flexibility of integration with any analytics platform over Kafka queue for the real-time CDRs and EDRs generated by the system. dPCRF comes pre-integrated with STL's flagship analytics and data management platform - Intellza.</p>
<b>Subscriber Location Identification</b>	<p>The system is able to identify the real-time location of the end user when the services are accessed. Based on the parameters received in Diameter/ RADIUS request, the system can identify the geography, country, region/ state, city and area from where the service is utilized. These attributes can be further used for launching location based offers where the bandwidth and quality of service can be provided as per the location.</p> <p>For the Product Manager/ Product Designer to configure the offer effectively, dPCRF allows conversion of location attributes into understandable format like country, city, state, area and geography.</p>
<b>Support of Usage Metering on GX</b>	<ul style="list-style-type: none"> <li>• Quota granting on Gx call flow during policy management that allows smooth handling of subscriber session concurrency.</li> <li>• Support of Session level metering for RnC Quota Profile thus enabling compliance with gateways that support session level metering.</li> <li>• Support for Multiple Quota Management Type thus enabling easy handling of non-monetary quota in a single package.</li> <li>• Importing/exporting of RnC based Product Offer (optional Quota Profile) with the Imported Product Offer allowing usage metering on Gx.</li> <li>• Reducing the need to configure RnC Quota Profile when the Quota Profile Type is selected as RnC Quota Profile.</li> <li>• Generation of CDRs for the reported quota when the RnC profile is optional.</li> <li>• Unified view of Non-Monetary Quota Management owing to the flexibility of selecting Quota Management Type in the RnC Quota Profile.</li> <li>• Allowing Data package creation with Quota Profile and Rate Card thus enabling working of Non-Monetary Quota on Gx and Rate Card on Gy within the same package.</li> </ul>
<b>Time of Day (ToD) Support for Gx Interface</b>	<p>Time of day (ToD) support helps to reduce network load. By allowing Time Activation &amp; Deactivation support for PCC rule. When a subscriber has multiple packages &amp; after policy hunting multiple PCC rule are selected in that case When ToD enable it sends all the applicable PCC rule for the whole day. This reduces the number of update requests for a new policy over the network. .</p> <p>dPCRF supports ToD over Gx interface for the following packages ensuring reduction in the network load:</p> <ul style="list-style-type: none"> <li>• Exclusive add-ons</li> <li>• Non-exclusive add-ons</li> <li>• Promotional preferred network type add-ons</li> <li>• Promotional non-preferred channel type add-ons</li> <li>• Future dated exclusive and non-exclusive add-ons</li> </ul>

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<p><b>Exclusive and Non-exclusive Add-on offers</b></p>	<p>dPCRF supports two types of add-on offers: Exclusive and Non-Exclusive. Exclusive add-on offers override the bandwidth and quality-of-service details of basic offers and the end user is given the speed as defined in the exclusive add-on offer. While for non-exclusive add-on offer, the system merges the quality-of-service definition with that of other subscribed offers and provides the best-speed to the end user.</p>
<p><b>Device based offers</b></p>	<p>QoS policies defined in the Policy Designer of PCRF allows the operators to launch various device based offers depending on device's OS, Brand, Make-Model and Launch Year.</p>
<p><b>Customization Framework</b></p>	<p>PCRF supports the customization framework which helps the delivery unit to extend the capability and features by installing groovy scripts. PCRF requests and responses can be customized to modify the call flows as per the deployment.</p>
<p><b>Rx Interface Support</b></p>	<p>Rx reference point is used to exchange application level session information between the PCRF and AF. This information is part of the input used by the PCRF for the Policy and Charging Control (PCC) decisions.</p> <ul style="list-style-type: none"> <li>• The types of requests that supported from AF to PCRF through Rx interface are:</li> <li>• AA-Request Command.(AAR)</li> <li>• Re-Auth-Request Command (RAR)</li> <li>• Session-Termination Request Command (STR)</li> <li>• Abort Session Request Command (ASR)</li> </ul>

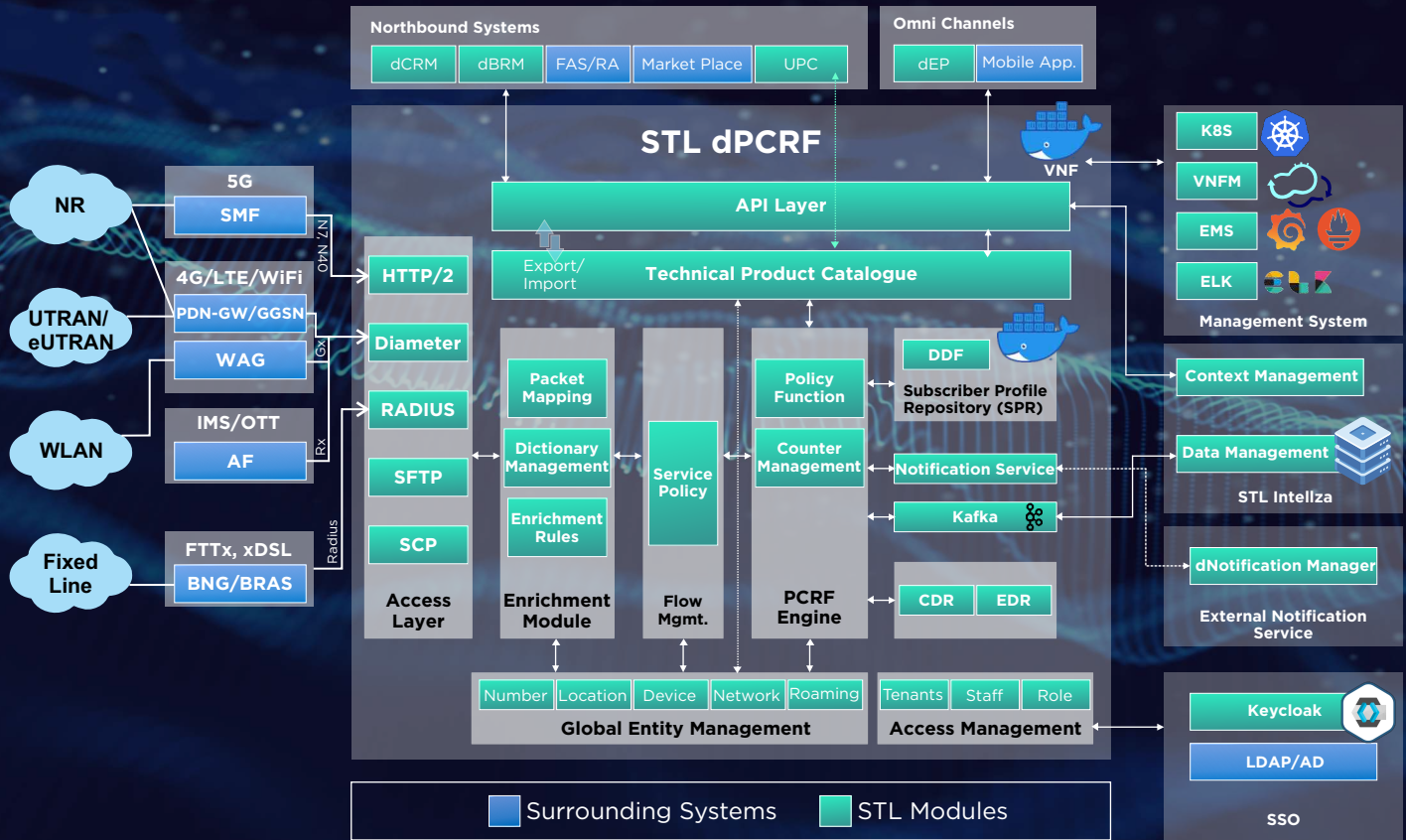


## Non-Functional Aspects of dPCRF

Modules	Features
<p><b>Cloud Ready</b></p>	<p>The webscale technology benefits operators by providing unparalleled elasticity and resilience. It enables Digital Service Providers in taming the unpredictability arising from ever-increasing workload patterns while optimizing infrastructure usage through auto-scale capabilities.</p> <p>Using the webscale compliant modern technology, open-source tools and DevSecOps based methodologies; dPCRF is a carrier-grade mission critical real-time system designed to ensure zero-downtime and zero-touch upgrade. The application is always available and online, with self-heal capabilities, enabling automated scale-out and scale-in while dealing with unusual load conditions.</p>
<p><b>On premise and cloud deployment</b></p>	<p>dPCRF infrastructure-agnostic, multi-tenant, multilingual solution can be deployed in both private or public cloud data centers. While private data center based deployment is conventional, cloud deployment provides a cost-effective way of owning and accessing PCRF capabilities, something that most operators look forward to. dPCRF on cloud provides flexibility, auto-updates, increased collaboration, security as well as disaster recovery features.</p>
<p><b>In-Memory &amp; Distributed Database</b></p>	<p>PCRF uses in-memory cloud native distributed database, bringing the benefits of single-digit response times in milliseconds and on-demand elasticity to manage the unpredicted workload patterns, while significantly saving the infrastructure cost in public cloud based deployments.</p>
<p><b>Support Active-Active Server Group</b></p>	<p>dPCRF provides the ability to:</p> <ul style="list-style-type: none"> <li>• Configure multiple instances in the server group to support active-active load balancing</li> <li>• Manage failover scenarios</li> <li>• Add new instances within the server group</li> <li>• Session management in active-active setup for seamless customer experience.</li> </ul>
<p><b>Single Sign-On</b></p>	<ul style="list-style-type: none"> <li>• dPCRF provides a Single Sign-On feature via out-of-box integration with Keycloak . KeyCloak is an open source software product that allows single sign-on with Identity Management and Access Management. It allows customers to log in using Enterprise LDAP credentials over TLS 1.2, which reduces the risk of identity theft.</li> <li>• With Keycloak integration, dPCRF users are authenticated through Keycloak rather than PCC application. This enables centralized user and role-based access management. Once logged-in to Keycloak, users don't have to login again and again to switch between various Sterlite applications (or Products).</li> <li>• SSO can be enabled or disabled through configurations. When enabled, the staff profile is configured and managed through Keycloak. In such cases, features like Staff Management and Password Policy are not in use by dPCRF.</li> </ul>

Modules	Features
<p><b>Password Policy</b></p>	<p>The password policy is required to create passwords that are not easy to crack and thus provides security. The password policy has certain parameters like required alphabets, numbers, special characters, prohibited characters and password length which can be used in different combinations for creating passwords. The system also allows the administrator to mandate the change of password of staff's first login. It also restricts the staff to re-use the historical password.</p>
<p><b>Staff Profile and Change Password</b></p>	<p>The system offers functionality to manage staff profile for administrator in case of any query, update email address, and others details. The administrator can also maintain the tenancy group and access details for individual staff. The staff can also view his/ her own profile and update the required details like profile picture, email address and mobile number.</p>
<p><b>Audit Control</b></p>	<p>Audit control is a feature that keeps track of all the configurations done by any staff through GUI or API. It maintains the history of who did what and when. It is a source of records that provide documentary evidence of the sequence of activities that have affected at any time a specific operation, procedure, or event has occurred. It provides detailed insight on increased security and risk management.</p> <p>dPCRf maintains the configuration changes track at two levels: entity level and staff level. Any changes done for a particular entity can be viewed at entity level while all the changes done by the logged in staff can be viewed under staff audit.</p>
<p><b>User Access Control/ Staff Role</b></p>	<p>The system provides access rights, based on the staff's role. When you create a role, you define access rights that a staff member have access to certain modules/ entities and permissions to perform actions for an entity.</p>

# Technical Architecture



## Technical Specifications

<b>Standard Compliance</b>	IETF RFC 4006, RFC 2866, RFC 6733, 3GPP TS 29.212, 3GPP TS 29.213, 3GPP TS 29.214, 3GPP TS 29.219
<b>Standard Protocols/ Adapters</b>	DIAMETER based Gx,Rx, Sy, Sp and RADIUS support for 802.1x network
<b>Technology Support</b>	WiMAX, Wi-Fi, CDMA, 2G, 2.5G, 3G, 4G, 5G, IMS, Broadband, LTE
<b>IP Support</b>	IPv6, IPv4
<b>Hardware and OS support</b>	Redhat Linux, Cent OS
<b>Monitoring and Management</b>	CLI, SNMP/ NMS
<b>3rd Party Integrations</b>	Enterprise Product Catalog, Data Analytics System, Network Monitoring System (NMS), Charging System, P-Gw, Application Function (AF)

Sterlite Technologies Limited (STL) is a global leader in end-to-end data network solutions.

We design and deploy high-capacity converged fibre and wireless networks. With expertise ranging from optical fibre and cables, hyper-scale network design, and deployment and network software, we are the industry's leading integrated solutions provider for global data networks. We partner with global telecom companies, cloud companies, citizen networks and large enterprises to design, build and manage such cloud-native software-defined networks.

STL has innovation at its core. With intense focus on end-to-end network solutions development, we conduct fundamental research in next-generation network applications at our Centres of Excellence. STL has strong global presence with next-gen optical preform, fibre and cable manufacturing facilities in India, Italy, China and Brazil and two software-development centres.



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