



Globberry

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Cloud PCRF

USING CLOUD PCRF AS A SECOND PCC SYSTEM



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Do operators need a second PCRF?

Very few people currently doubt the critical importance of the policy management part of the BSS ecosystem for business continuity, competitiveness and creation of new revenue streams. However, most telecommunication providers face a number of serious challenges while developing their policy management architecture, and, more specifically, enhancing PCRF as its key component.

Not many providers have the luxury of implementing brand new policy management architecture in a pristine BSS environment. Instead, they are struggling with the dilemma: should they integrate the new policy management with their legacy IT systems and infrastructure not designed for next generation PCC management or should they try to extend the existing policy management systems lacking true flexibility to support the new applications and revenue streams, such as M2M / IoT, MVNO and many others? Each approach has its pros and cons, and the BSS community hasn't yet come up with a single strategy and universal reference architecture capable of advanced policy management in all environments.

If a service provider has an urgent business requirement driven by government regulation or market competition, their best choice – surprisingly – may be to introduce a new PCRF while keeping their legacy policy management architecture intact. The two PCC fragments can coexist for a while, enabling the provider to deliver the new functionality first, and integrate it with the legacy stack later. Depending on the specific product pricing and licensing policies, such a solution may not only be more practical, but also less expensive, enabling costly PCRF features for only the subscribers who need advanced policy management.

In such a dual PCRF setup, subscriber traffic separation represents a major challenge. The issue is so serious that many operators choose to forego the new business opportunities and wait for months or even years for a “proper” BSS upgrade. As a result, they may suffer revenue loss, customer churn and regulatory penalties.

This document discusses the issues arising in operator environments with two PCRFs, presents a few possible options for subscriber traffic separation, and shows how Globberry's **Cloud PCRF** and **Cloud DRA** products can enable consistent and logical policy management in a dual PCRF architecture.

Policy management separation at the network level

With some telecommunications providers, subscriber data plans and tariffs may be segmented naturally at the physical level. This segmentation may occur by geographical location, when the provider operates a number of loosely coupled regional networks, or segmentation by access technology may occur, when data plans in the networks of different generations are substantially different. When such providers need a policy management upgrade, they become natural candidates for a dual PCRF setup, where traffic from different network elements is simply routed to two different PCRFs, which could be supplied by different vendors. The more advanced PCRF becomes responsible for policy management in the next generation network or in a pilot region, while the legacy PCRF maintains existing service conditions for subscribers using the less advanced network or located in regions that might be upgraded later.

Option 1. When old and new subscriber traffic is segmented naturally within the network, an advanced PCRF can be installed to work in parallel with the existing PCRF

The suggested network architecture for this case is shown below:

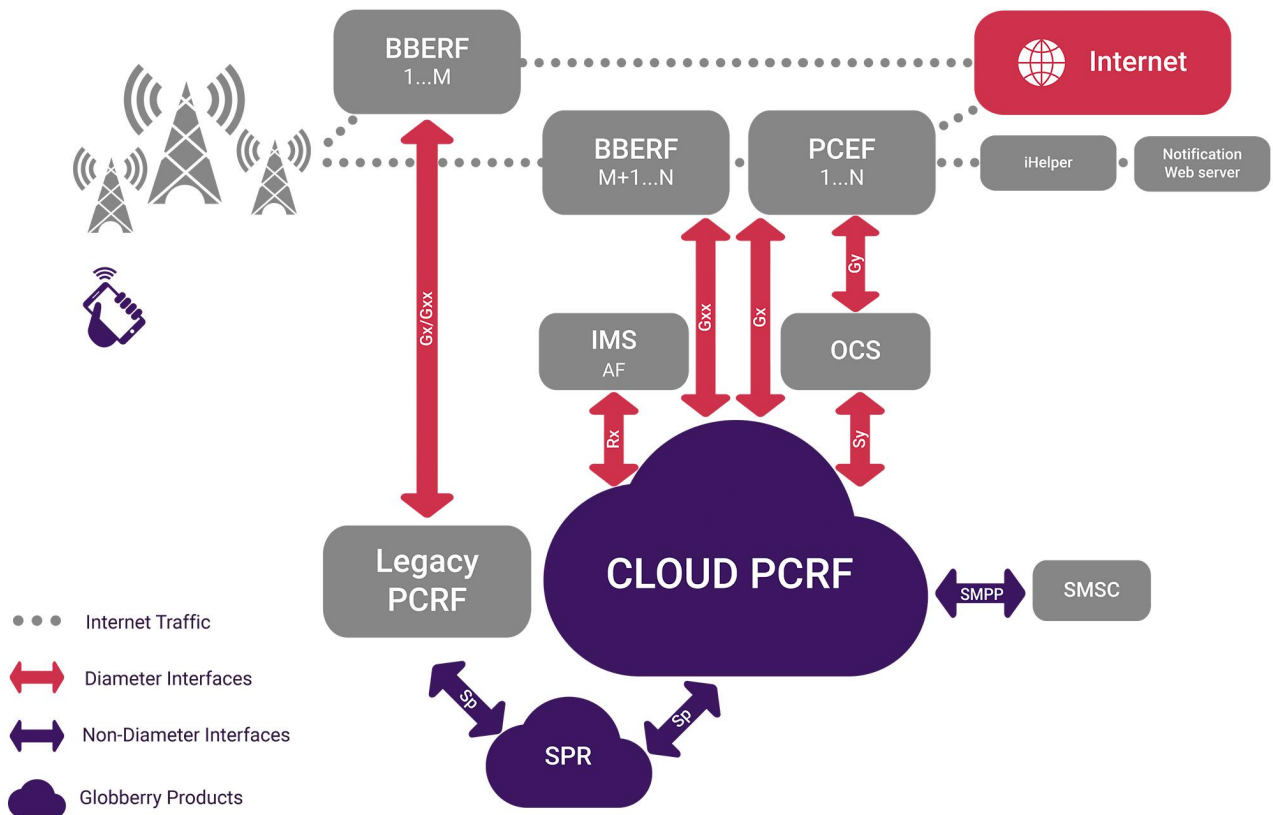
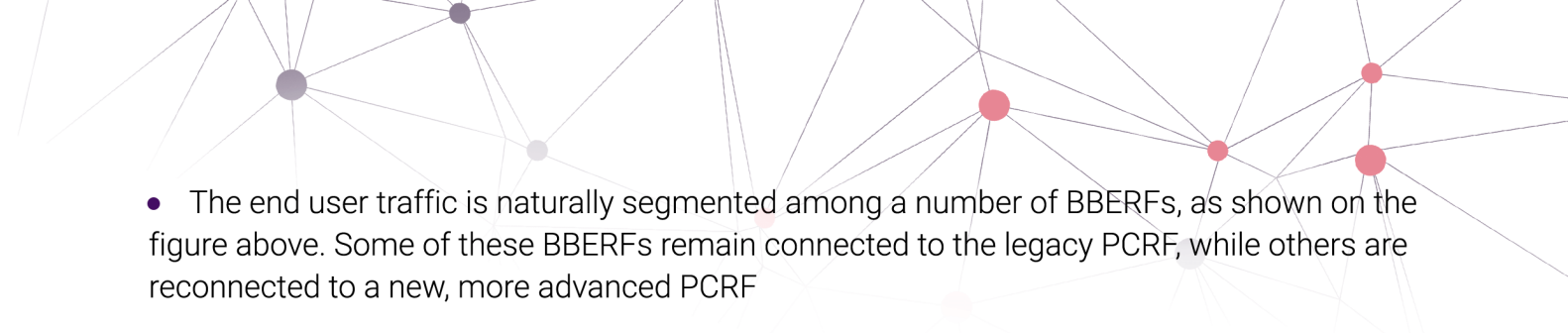


Figure 2. Policy Management Separation at the Network Level

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- The end user traffic is naturally segmented among a number of BBERFs, as shown on the figure above. Some of these BBERFs remain connected to the legacy PCRF, while others are reconnected to a new, more advanced PCRF
 - The policy management is enforced by the PCEF controlled by the PCRF over the Diameter Gx interface. If both the legacy and the new traffic channels are controlled by a PCEF, each PCEF is connected to its respective PCRF. Presence of a PCEF in the legacy traffic channels is not required, in which case the combination of the new PCEF and PCRF manages only the subscriber segments requiring advanced policies
 - Both the legacy and the new PCRFs may work with subscriber profiles in the same Subscription Profile Register (SPR), or they may use two different SPRs. The data in the two SPRs may be synchronized, or – if the subscribers are clearly segmented – each SPR may contain its own set of subscribers and no synchronization may be necessary. In fact, the legacy PCRF may not use an SPR at all, if the legacy policies have no dependency on the subscriber and his or her data usage
 - Since the data traffic is split “at the source”, it is charged separately in the Online Charging System (OCS), on two independent interfaces. Similarly, the offline charging in the Offline Charging System (OFCS) also occurs independently from two separate CDR file flows
 - If the advanced subscribers are served by **Globberry Cloud PCRF**, they can take advantage of the SMS and web notifications, data usage reporting and all its other features described below in this document.

Policy management separation with DRA

When data plans and tariffs are not segmented naturally at the physical network level, it is still possible to separate the subscribers' PCC by splitting the signaling traffic from the same network elements between two PCRFs. This is done with a Diameter Routing Agent (DRA) whose main functionality is to distribute Diameter messages among multiple target servers, based on the contents of these messages. In most cases, segmentation rules are determined by subscriber attributes such as subscriber category and tariff plan. These attributes are fetched by DRA from the already mentioned SPR.

Option 2. When old and new subscriber policies are segmented by market or tariff plans, a DRA may be used to separate the signaling traffic between the two PCRFs

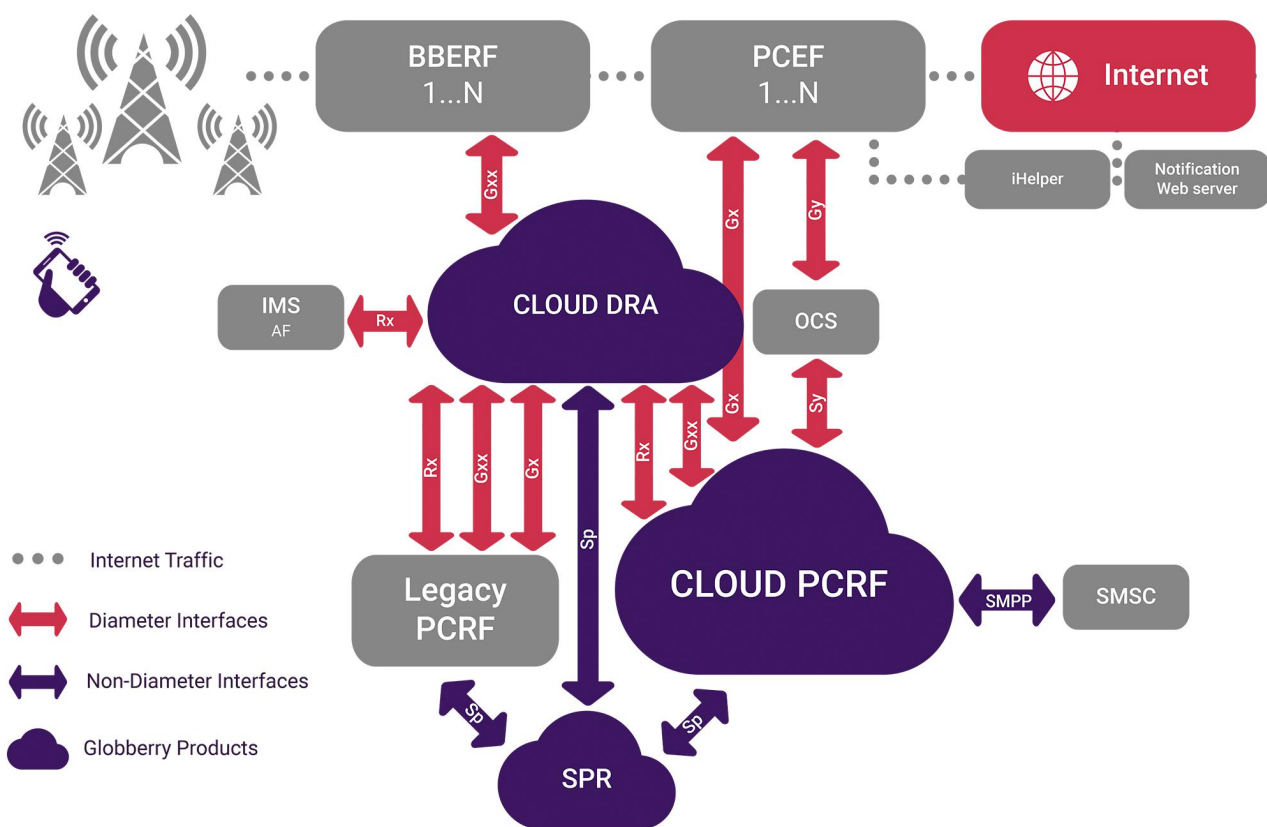
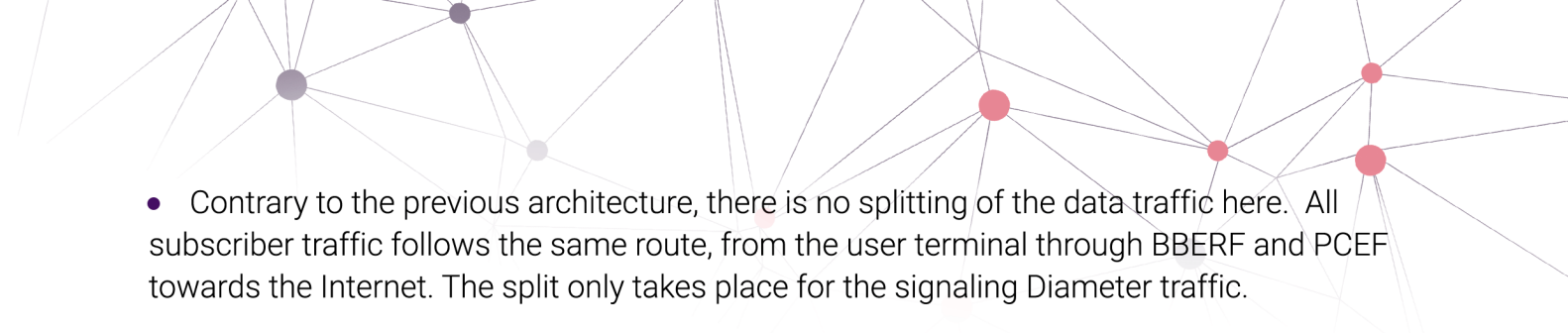


Figure 2. Policy Management Separation with DRA

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- Contrary to the previous architecture, there is no splitting of the data traffic here. All subscriber traffic follows the same route, from the user terminal through BBERF and PCEF towards the Internet. The split only takes place for the signaling Diameter traffic.
 - When PCEF or BBERF try to communicate with PCRF, all messages are sent to the **DRA (Diameter Routing Agent)**. If the business rules dictate that segmentation should occur at the subscriber level, the DRA looks up the subscriber in the SPR and decides on the PCRF that should service the subscriber. Then the message is forwarded to either the Cloud PCRF or the legacy PCRF.
 - The PCRF response with PCC policies is returned by the same route, via Cloud DRA. Regardless of the PCRF that calculated the policy, PCEF/BBERF applies the policy to the subscriber traffic and enforces the policy throughout the session.
 - Cloud DRA guarantees consistent routing of the messages throughout the data session, not only between the new PCRF and the legacy PCRF, but also between multiple instances of the same PCRF deployed for geographical reservation, redundancy or any other reason.
 - Cloud DRA can also adjust the message content, in case the new PCRF and the legacy PCRF expect somewhat different fields or return different attributes.
 - The Gy/Sy messaging with OCS is also based on the Diameter protocol and can be routed via Cloud DRA, if necessary.
 - Identically to previous architecture options, the subscribers served by **Cloud PCRF** can take advantage of the SMS and web notifications, data usage reporting and all its other advanced features described below in this document.

Globberly SPR integrates naturally with Cloud PCRF and Cloud DRA, to be used as a Subscription Profile Repository containing all relevant subscriber data

Cloud DRA Key Features

In the traffic split architecture option, **Globberry's Cloud DRA** can be used as a generic DRA to manage the subscriber separation between the two PCRFs. Its main features and functions are listed below:

- **Message Relay:** Distributing Diameter messages transmitted over various signaling interfaces to the target network components, with flexible and configurable rules for routing, load balancing and failover
- **Subscriber-Dependent Routing:** Distributing Diameter messages to the target components responsible for servicing a specific subscriber group, when subscribers are split into logical groups based on the operator's policies
- **Session Binding:** Routing of all related messages for the same data transfer session to the same set of service components, including messages from different Diameter interfaces, such as Gx/Rx in VoLTE
- **Host/Realm Anonymizing:** Deleting the host/realm data from the Diameter responses, thereby preventing external systems from discovering the equipment type and host addresses of any components inside the operator's network, except for the DRA itself
- **Mediation:** Modification of certain attributes inside the routed Diameter messages, with the purpose of maintaining compatibility between various equipment types and/or enriching the messages with information about the current subscriber and his or her session
- **Interworking:** Conversion of RADIUS messages to the Diameter format, and vice versa
- **Throttling:** Limiting the load on internal network components during unexpected peaks/bursts of incoming Diameter messages, with the goal of protecting them from failure and maintaining the overall health of the operator's network.

Cloud PCRF Key Features

In both architectures, **Globberry's Cloud PCRF** can be used to manage the data usage policies for subscribers. It has the following main features and functions:

- **Policy Control:** Calculation and real-time application of the data access policies for telecommunication network subscribers, based on business rules of any complexity, configured in the enterprise-level BRMS
- **Flow-Based Charging:** Installation of policies separating the subscriber data into flows based on traffic direction, protocol or Internet application, with different charging conditions based on the assigned rating group
- **Shaping and Gating:** Limiting data transfer speeds or blocking data transfer at a flow level or at the session level

- **Usage-Based Policing and Charging:** Accumulation of traffic usage data on a session, service or flow basis, policy modification based on the traffic volumes consumed for a given period
- **Service Personalization:** Service and parameter-dependent data usage policies, real-time policy modification with service or parameter changes
- **SMS and Web Notifications:** Policy change notifications via SMS messages or by http traffic redirection to preconfigured web pages with relevant information
- **Usage and Policy Reporting:** Integration with self-service portals and other operator systems with the purpose of providing data on the subscriber's traffic usage and the current service conditions
- **Policy Control in Roaming:** Application of special data usage policies for subscribers in roaming
- **Advice of Charge:** Control and notification of excessive data usage, especially by subscribers in roaming, with the goal of preventing unexpected charges.

Globberry SPR

In both architectures, **Globberry's Cloud PCRF** can be used in the role of the Subscription Profile Repository maintained by the operator. **Globberry's SPR** is pre-integrated with **Cloud DRA** and **Cloud PCRF**, and can be integrated with any legacy PCRF in the operator's network.

Key products that can be implemented with Cloud PCRF

Prepaid Traffic Bundles

The product provides subscribers with a bundle of free traffic at unlimited access speeds for a daily, weekly or monthly fee, with shaping or charging after the bundle is exhausted. The bundle can apply to all subscriber traffic, or it can cover only traffic filtered by certain directions, protocols or Internet applications, such as YouTube. By analyzing and interpreting the session attributes, the bundle may also be tied to a geographic region, terminal model/type or the APN being used. If the subscriber purchases several traffic bundles, the active bundles are applied sequentially, in order of priority.

Personalized and Complimentary Bundles

The individual subscriber's quota size and some other bundle attributes can be personalized, letting the subscribers select their preferred balance between the received amount/quality of the service and the bundle cost. Operators can also motivate and reward their subscribers by giving them complimentary bundles, through marketing campaigns or on a case-by-case basis.

Turbo Buttons

Turbo buttons are a kind of traffic bundles, purchased by subscribers explicitly and for a relatively short period of time. A Turbo button lets the subscriber continue using the network at a high speed after the main bundle has come to an end. For the operator, Turbo buttons are a convenient way of receiving additional revenue from heavy data users.

Data Sharing Plans

With Data Sharing Plans (DSP), several subscribers – such as members of the same family – or several devices of the same subscriber can access and use a common traffic quota from the same bundle. Except for their shared use by several subscribers, Data Sharing Plans have many of the features of regular traffic bundles. They can have daily, weekly or monthly renewed quotas, are applied according to their priority relative to the other bundles, and may cover only traffic, filtered by certain directions, protocols or Internet applications, rather than all traffic.

Access to Free Sites

Cloud PCRF lets the operators filter traffic from certain URLs or IP addresses and provide this traffic to the subscriber free of charge. This functionality can be used to allow free access to various sites, such as the operator's web portal or external account refill sites.



Data Access Suspension for Insufficient Account Balance

Cloud PCRF can block subscribers with insufficient account balance from accessing the data network without disconnecting their data sessions. When a subscriber is blocked, his or her http traffic can be redirected to an informational web page maintained by the operator, explaining the reason for refusing access. This web page may contain links to the refill sites where the subscriber could replenish the account to resume the data network usage.

Alternative Roaming Rules

For subscribers in roaming, Cloud PCRF lets the operators formulate an alternative set of data service policies substantially different from the policies in the home network. Roaming packages can be attached to a specific roaming country or region, or to a certain roaming operator servicing the subscriber. In most other aspects, roaming bundles come with the same functionality as the home network bundles, but usually with a smaller quota and a higher cost. The same as in the home network, subscribers in roaming may use complimentary bundles, Turbo buttons, DSP bundles and any other functionality described above, but configured specifically for roaming.

At the beginning of the first data session in roaming, Cloud PCRF can inform the subscriber of the roaming tariffs and other service conditions via an SMS or by http-redirection to the operator's informational web page. Subscribers in roaming may also be notified about excessive traffic usage above the pre-configured limits; the so called AoC (Advice of Charge) is especially useful in roaming due to high traffic costs.

Standards and Specifications

3GPP

Policy and Charging Control Architecture: [TS 23.203](#)

Charging rule provisioning over Gx interface: [TS 29.210](#)

Rx interface and Rx/Gx signaling flows: [TS 29.211](#)

Policy and Charging Control (PCC) over Gx reference point: [TS 29.212](#)

Diameter Routing Agent (DRA): [TS 29.213](#)

Policy and Charging Control (PCC) over Rx reference point: [TS 29.214](#)

Cx and Dx interfaces based on the Diameter protocol: [TS 29.229](#)

Policy and Charging Control (PCC) over S9 reference point: [TS 29.215](#)

Policy and Charging Control: Spending limit reporting over Sy reference point: [TS 29.219](#)

Subscription Locator Function (SLF): [TS 29.228](#)

Diameter charging applications: [TS 32.299](#)

IETF

Diameter base protocol: [RFC 3588/RFC 6733](#)

Diameter Redirect/Translation Agent: [RFC 3588](#)

Diameter Commands for 3GPP: [RFC 3589](#)

Diameter Credit-Control Application: [RFC 4006](#)

GSMA

LTE and EPC Roaming Guidelines: [IR.88](#)

IMS Profile for Voice and SMS: [IR.92](#)

IMS Profile for Conversational Video Service: [IR.94](#)



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