PCC (Policy and Charging Control) Applications

EFORT
http://www.efort.com

In a first EFORT tutorial related to PCC (Policy and Charging Control), the PCC architecture has been described with its entities, its interfaces and its integration within mobile data network environment (http://efort.com/media_pdf/PCC_EFORT_ENG.pdf).
In this second tutorial, the potential applications, which may be proposed by service providers based on their PCC architecture, are presented.

1 PCC : A Definition

To assure fair usage of the 3G and 4G mobile data networks, service providers will need to identify the IP service flows, control these flows (authorize, block, restrict) and charge these flows with two possible charging methods (online and offline charging). For this purpose, a PCC (**Policy and Charging Control**) architecture has been introduced.
Policy control is related to the function of authorizing/blocking IP flows and providing a given QoS to the authorized IP flows. Charging control is related to the online of offline charging of the authorized IP flows.
Mobile data networks operate in a connection oriented mode. The user establishes an end to end connectivity between his UE and the node which terminates the access (GGSN in 2G/3G and PDN GW in 4G) to send/receive IP packets. This connectivity is called PDP Context (2G/3G) or bearer (4G).
The goal of service providers is to be able on the PDP context/bearer to :

- Identify the IP flows being transported; indeed, each IP flow should be characterized to apply PCC rules on the flow.
- Authorize or block the IP flow (e.g., the freemium service proposed to users without mobile data subscription authorizes them only to send and receive HTTP flows related for example to Facebook and Twitter. Any other flow is systematically blocked.
- Offer QoS to the authorized flows (e.g., when the fair use is reached, all Internet flows are still accepted but their bitrate is reduced until the next billing cycle unless the user pays additional fees with turbo button service to increase the bitrate.
- Charge each IP flow according to different criteria (volume, duration, volume and duration, etc) and different charging methods (online, offline).

Policy control is performed by means of interactions between PCEF (Policy and Charging Enforcement Function) and PCRF (Policy and Charging Rules Function). PCEF is generally embedded within the GGSN/PDN GW, although it may be a standalone component. The DIAMETER-based interface between PCEF and PCRF is Gx.
Charging control is performed by means of interactions between PCEF and charging systems. Two charging systems exist : OCS (Online Charging System) and OFCS (Offline Charging System). The DIAMETER-based interface between PCEF and OCS is Gy. Gz is used between PCEF and OFCS.
Some vendors combine PCRF and OCS functions within the same equipement.

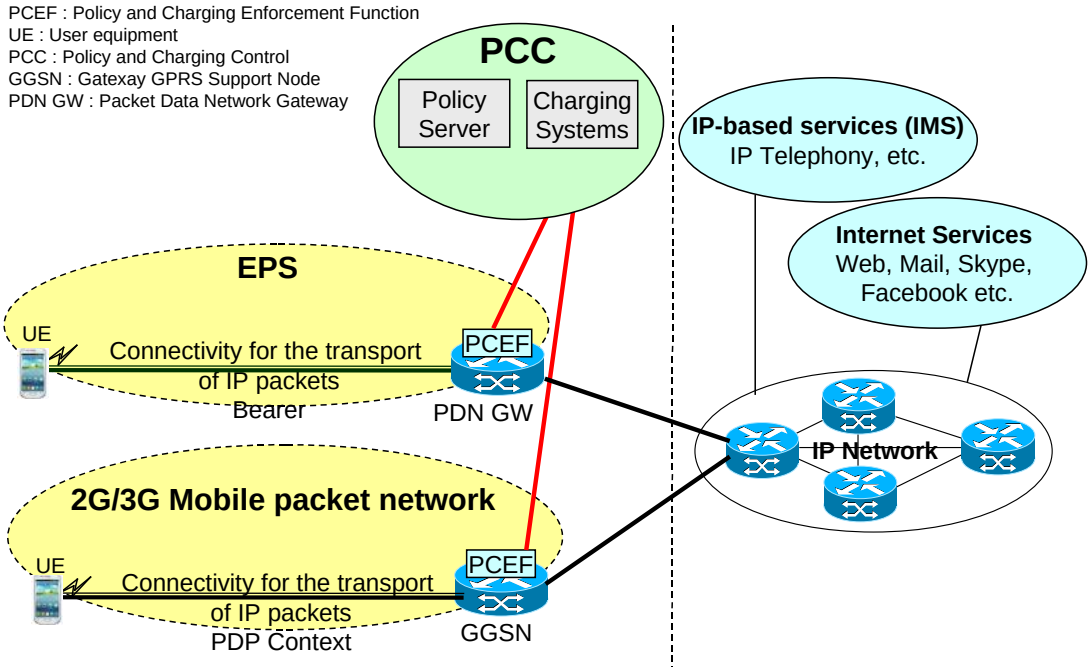

Figure 1 : Generic Policy and Charging Control Architecture

2 PCC Applications

The following applications may be proposed based on the PCC architecture. The proposed list is not exhaustive and each service provider will try to differentiate from his competitors and to increase its ARPU by introducing PCC applications or features specific to its context and its customer profiles.

Fair Usage Policy is designed to protect the service provider 's resources and all customers by controlling the use of resources in order to provide a high speed network to everyone. Given the rate at which most of the customers consume data, a customer is unlikely to exceed the data usage levels specified in the service provider's policy (e.g., 5 Gigabytes per month) in any given billing cycle unless the customer uses file sharing applications or downloads large files from the Internet. If the service provider elects to slow the customer's speeds when his data usage first exceeds the threshold mentioned above (i.e., 5 Gbytes), the service provider will slow the customer's speed for example to a speed of 128 kbit/s for downloads and 64 kbit/s for uploads until the next billing month. This should not affect any applications that require less than 128 kbit/s of download bandwidth or 128 kbit/s of upload bandwidth (such as browsing, email, voice over IP or voice streaming applications), but could affect the performance of applications that normally require greater bandwidth (e.g. video streaming or peer-to-peer file sharing). Fair usage is about policy control.

Freemium : Operators are offering Freemium services to gain new subscribers and as a promotion to support new device launches. The Freemium business model is being implemented in a few different ways. One approach involves offering a basic service for free, indefinitely or for a trial period, while charging a premium for advanced features later on. For example, operators have offered promotions to gain new subscribers by tying free access to

Facebook and twitter (to enable them socializing) for a limited time to help promote a new device launch. Other Freemium approaches have been to offer a one-month free trial for access to a particular premium video programming site, such as a sports channel, at a higher quality of service. After the trial is over, the operator offers the subscriber the opportunity to subscribe to the higher-quality service for an incremental monthly charge. Freemium is about policy control. Charging control is not involved since this feature is not rated.

Bill shock prevention : operators are obliged to agree a specified bill threshold, after which the customer will be automatically cut-off from their data connection while roaming following a warning. The default limit is €50 in Europe and the warning comes when 80 percent of the limit is reached. Protection against data roaming bill shocks is a useful step towards building customers' confidence to use mobile networks to surf the Internet when travelling around Europe. Such confidence is essential if people and businesses are to use the Internet to its full potential. Bill shock prevention is about charging control to inform the user in real time about his consumption and also about policy control to cut-off the mobile data connection.

Prepaid flat rate data service : The customer subscribes and get a given volume of data that he may consume within a billing cycle equal to a month. When this volume is reached within the billing cycle, the http requests are redirected to a specific URL to enable the recharging, by purchasing a pass which enables to get a supplementary volume of data that may be consumed. Any other data traffic is rejected by the service provider unless the user recharges his account. Prepaid flat rate data service is about policy control for traffic redirection and charging control to decrement the customer's account during Internet access.

Application control : Service providers may block or voluntarily downgrade some IP flows based on authorizations obtained from the regulator (e.g., skype, pee to peer, etc), since these applications are not compatible with the business model of the service provider. This feature is about policy control.

Roaming pass : When the user is in a roaming situation, he receives an SMS from his service provider as soon as he attaches to a visited network; this SMS proposes a Internet pass at a given price for a given volume of data for a limited usage duration (1 day or 1 week). The goal for the service provider is to generate incomes and for the user to consume based on a flat rate instead of usage. Roaming pass is about Policy and Charging Control.

Turbo button (**Speed boost)** : The proposition for the mobile operator is to gain additional revenue by offering users the ability to temporarily and dynamically increase application performance on demand. It's expected that mobile subscribers will occasionally want the ability to upgrade the performance of certain high-bandwidth applications for a specific period of time. Scanning the landscape of approaches, it seems that "Speed Boost" is generally offered to the mobile user in 2 different ways, i.e., the user selects a performance upgrade offered by the mobile operator, or the application provider "embeds" higher performance as part of its service – and in this case, does so in partnership with the mobile operator. Turbo button is also important when the user has reached his fair use before the end of the billing cycle and his bitrate is decreased significantly. The user may want to boost his speed by paying for this option. Turbo button is about policy and charging control.

Premium mobile TV : Customers that have viewed low resolution sample videos can decide to pay an incremental charge to view the videos at a higher resolution. Goal is Revenue generation from partnering with content providers. This type of option may apply to mobile TV with the customer subscribing to a number of channels he may watch continuously without impacting his fair usage preserved for internet access. Premium mobile TV is about Policy Control with the establishment of a dedicated bearer for streaming QoS.

Parental Control: Parental control helps to keep the children safe online by blocking “18” rated content. Some service providers propose three settings - Strict, Moderate and Off so parents can choose exactly what level of security they would like.
“Moderate” is the default setting for a new customer. With Moderate the customer has access to social networking sites but not 18 rated content.
“Strict” is the safe setting. This setting filters the same “18” rated content but also includes other content that is not suitable for younger children including un-moderated social networking sites, chat and dating
“Off” setting enables access to the full internet, including 18 rated content.
Parental control is about policy control.

QoS and gating control based on spending limits : This feature provides the ability to change the QoS level and flow gating based on spending limits. An example scenario would be a subscriber plan which allows for high QoS up to $2 per day (24 hours). Beyond that and in the 24 hours limit, the user may still access to some services but with a lower QoS.

Data share plan : Since it’s increasingly likely that customers have more than one device that needs a mobile data plan, e.g., a smartphone and a tablet, or a phone and a wireless hotspot, or that the customer is sharing a plan with multiple people who need data, splitting a big, shared bucket of bytes sounds logical. Service providers are now offering their customers flexible data sharing plans , e.g., a plan for a smartphone and a tablet that splits 5 GBytes a month (two SIM cards are supplied by the service provider, associated with the same data subscription). When the 5 Gbytes are consumed by any of the devices, the bitrate is lowered for the two devices until the next billing cycle, unless the customer activates the turbo button option. Data share plan is about policy control.

RAN congestion control : To apply policy control for Radio Access Network (RAN) congestion, the congestion status of the access network needs monitoring. An existing OMC-R (Operation & Maintenance Centre – Radio) is responsible for calculating the congestion level based on raw network traffic data collected by network probes in real time. The OMC-R needs then to provide these congestion information to the PCRF through a dedicated interface which is vendor specific. . Each information includes the address of an access network cell and the corresponding congestion level. Based on the congestion information it receives, the PCRF determines the congestion policies in real time and applies them to the sessions for subscribers in the congested cell. For example, an operator may decide to constrain the bandwidth of the affected sessions in a manner consistent with its business practices. Individual subscribers may be treated differently depending on the service level subscribed to or nature of the services they request. The operator’s objective is to reduce the overall congestion level of the cell with the most positive outcome possible. When the congestion level has been reduced to an acceptable level, the PCRF restores the original policies. RAN congestion control is about policy control.

Mutimedia Services over IP with IMS : Customers will get a voice over IP option proposed by the service provider when VoLTE (Voice over IP over LTE) will be introduced. For every VoIP session, the service provider reserves resources in the access to guarantee the Voice quality. This resource is called a dedicated bearer. It is a connectivity with a quality of service of conversational class established when the voLTE call starts and released at the end of the call. Guaranteeing QoS for the VoLTE call requires policy control so that resources (i.e., dedicated bearer) are reserved and only the VoIP flow of the user will benefit from it. This application is about policy control.

Content triggered QoS for Over The Top Applications (Policy Control) : Customers may purchase options to get quality of service for their favorite Internet services such as : multimedia networked games where latency should be as short as possible, skype videotelephony where latency and bitrate should be guaranteed, Internet TV where bitrate

should be guaranteed for the whole session duration. Typically a dedicated bearer with QoS of interactive class will be established for multimedia networked game session ; a dedicated bearer with QoS of conversational class is needed for skype videotelephony call ; a dedicated bearer with QoS of streaming class is required for Internet TV session. This application is about policy control.

Policy control for groups of M2M devices : M2M applications generally involve a group of devices. Typically applications today involve more than 1000 subscriptions for a single customer. From both customer and operator points of view, there is benefit in optimized handling of groups of MTC devices.
Group based policing can be used to enforce a policy for a group of MTC devices. This allows greater flexibility to the MTC application or MTC application owner compared to individual policies for each of the devices, while at the same time ensuring the operator that the particular group of MTC devices does not unduly load the network.

- A maximum bit rate for the data that is sent/received by a M2M Group shall be enforced. It is a kind of data share plan among all the members of the M2M group (policy control).
- The network operator shall be able to reject access requests per M2M device of the M2M group (e.g., set up a data connection, transfer data) outside a defined access grant time interval. The network operator shall be able to allow access outside a defined access grant time interval and charge this differently. The network shall reject access requests per M2M device of the M2M group during a defined forbidden time interval (e.g. to allow maintenance of a M2M Server). This feature is related to policy control.
- The network operator shall be able to authorize M2M devices of a group to send traffic only from a specific location area defined in the subscription (low mobility). This feature is related to policy control.
- The network operator shall be able to authorize M2M devices of a group to send traffic only to a specific IP address (e.g., address of the M2M server). This feature is related to policy control.

The course « Policy and Charging Control in 3G, LTE, IMS » proposed by EFORT defines the concepts and principles behind PCC, the PCC architecture in 2G/3G/4G mobile data environment as well as in M2M and IMS, the DIAMETER-based interfaces related to PCC and shows the different call flows related to various PCC applications.