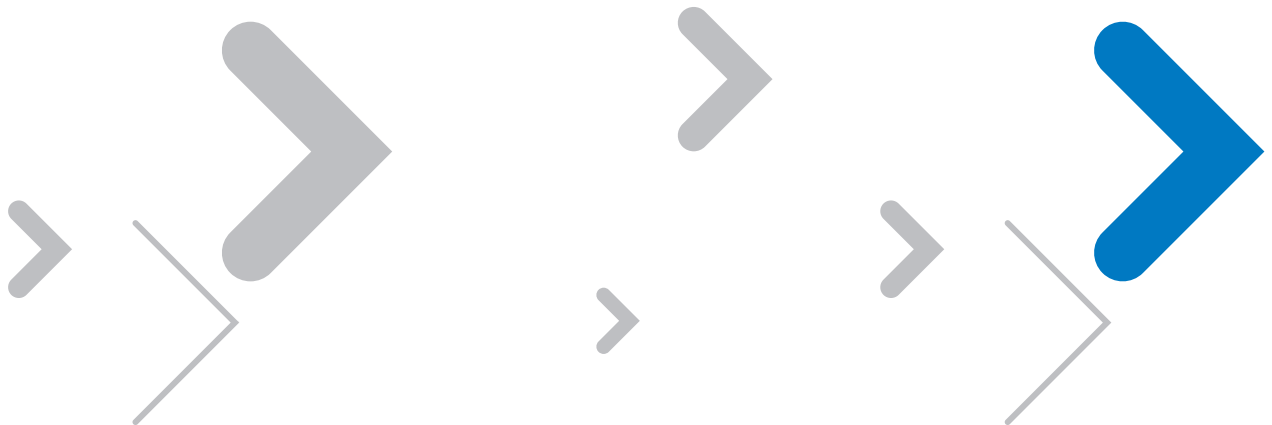




# Content Based Billing

The data delivery mechanism that enables maximum revenue at deployment



**SOLUTION BRIEF**

Content Based Billing: The data delivery mechanism that enables maximum revenue at deployment



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## Executive Summary

With the implementation of packet-based data and next generation wireless networks, the number of data related services that can be offered, is increased significantly. The wireless carrier will be able to move from offering wireless telecommunications services (the "pipe") to offering wireless telecommunication services plus a number of personalized Value Added Services that are accessible through the network. The transition from today's environment to one in which a vast number of services will be included in the product mix requires changes in both business operations and billing systems.

The next generation IP and Content Based Billing systems allow the operators to maximize their revenues from such services. These systems will enable operators to offer and bill for application-based (IP) and content-based services, rather than for just bytes of data.

This paper elaborates on the Content Based Billing system, its data delivery mechanism and how operators can maximize their revenue by deploying such a feature into their network.



## 1 Introduction

Wireless service providers in today's world realize the importance of always-on wireless packet data networks enabling many new service offerings. Mobile users are willing to pay a premium for the content and services they are interested in. Those services are video broadcast, multimedia services, news, gaming, internet browsing, music download and many more.

Content Based Billing (CBB) not only allows service providers to bill for application-based (IP) and content-based services, but allows them to generate additional revenue by differentiating their service charges. The service providers, with CBB functionality, will be able to charge a premium for selected data transfers, monitor the development and usage of mobile content and differentiate their mobile data charges to gain a competitive advantage.

Hence, a Content Based billing (CBB) system is a vital element of wireless data business development.

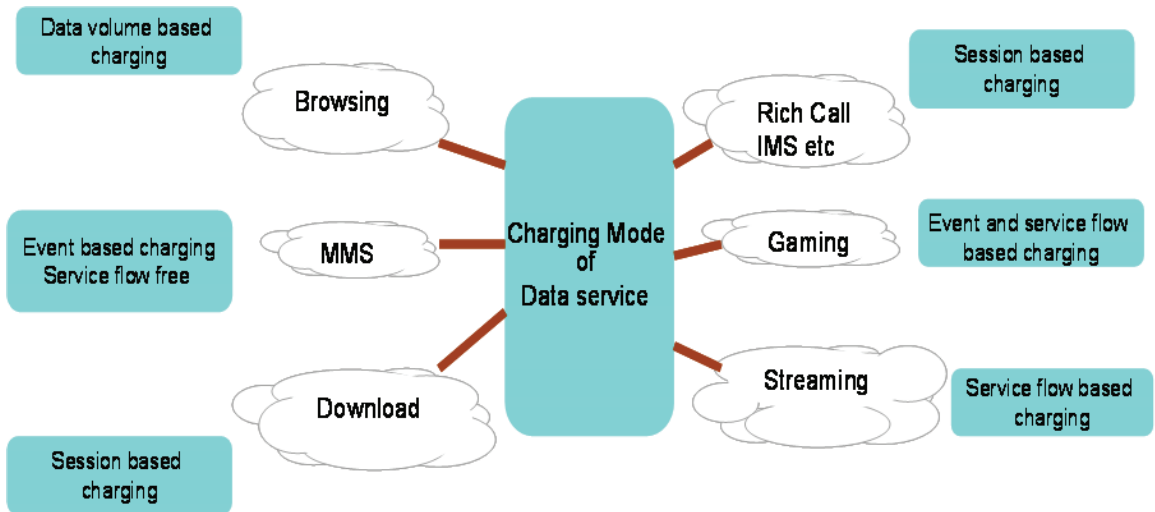


Figure 1: Data service charging modes

### 1.1 Content Based Billing (CBB)

In GPRS and UMTS networks, the GGSN (Gateway Support Node) plays a significant role in the rollout of next-generation networks. It provides a primary interface between the carrier's cellular network and the IP services layer. The GGSN is capable of offering enhanced service creation, billing, and IP traffic management by using its full visibility of the sessions' bearer traffic. These functionalities enable the collection of data and the billing of newly launched services, making it possible for the operator to measure the rate of adoption.

The Content Based Billing (CBB) feature offered by Motorola's C-GGSN, enables differentiation between the various data flows, allowing different billing models to be applied. Motorola's Content Based Billing solution provides key functionality including support of per-subscriber personalized IP packet filtering and IP flow based recording and reporting.

Content Based Billing uses the same technology as the GGSN firewall functions, to filter traffic into flows based on IP quintuples (source IP address, destination IP address, port numbers, protocol and/or URL). A set of patterns can be configured by the operator where each pattern corresponds to a rating bucket. When traffic

passing through the GGSN matches a rule, the data packet will be accumulated in the related rating bucket. The CBB feature supports both post-paid and pre-paid users. For prepaid users, the GGSN demands coupons in real-time to charge for the traffic and gates the corresponding IP flow. Coupon acquisition and return is passed to the online charging systems for rating, credit checking and control.

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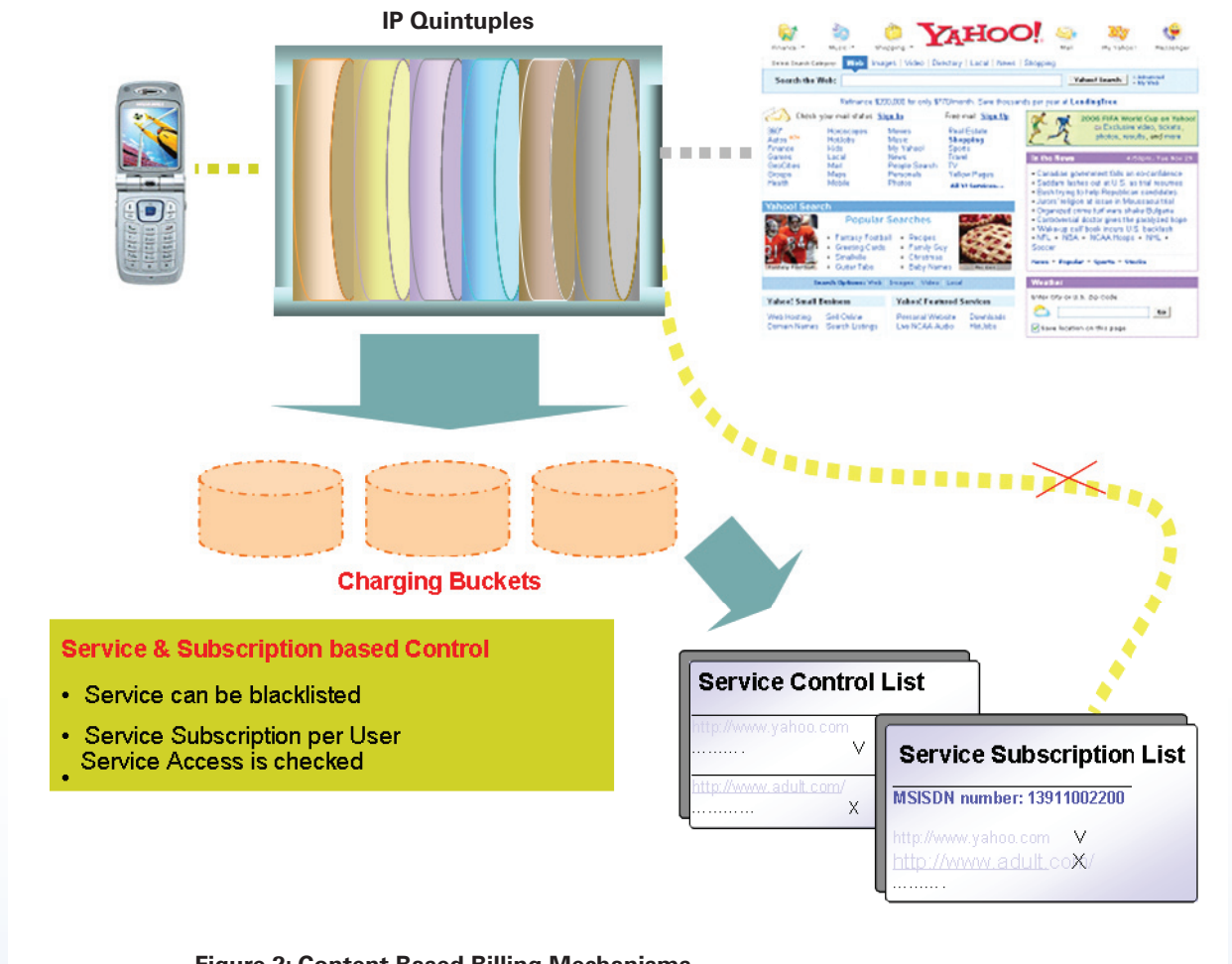


Figure 2: Content Based Billing Mechanisms



## 2 Motorola Content Based Billing (CBB) Solution

The Motorola C-GGSN complies with 3GPP TS 21.0.15 standards, and is based on a Quidway hardware platform. The high end router -NetEngine40 (NE40) - is designed to support demanding billing applications. The C-GGSN provides rich billing functions, enabling an operator to exercise flexible subscriber billing policies. The GGSN supports the following three basic billing related functions:

- Volume-based billing
- Duration-based billing
- Content-based billing

Volume-based and duration-based billing can no longer meet the needs of the new data services that have been launched lately. Content-based billing introduces different billing rate tables based on the value of the data content to be delivered. In this case, the operator can charge for both basic network access services and value-added services.

Motorola's C-GGSN allows the network operators to specify the server for each data user and monitor port traffic, duration of the session and charge according to different application-layer protocols. The Motorola C-GGSN currently supports application-layer protocols including FTP, RTSP, HTTP, SMTP/POP3, WAP, KJAVA etc.

The operator can define a special service charging rate (from zero charging rate through full charging rate) for a specific content-based billing based on service market policy, price mechanism, and relationship with the Internet content provider. The Call Detail Records (CDRs) generated by CBB system can be delivered through G-CDR extension attributes over the Ga interface, or be used directly to generate billing records according to charging rate information set by the user on the GGSN.

The GGSN can report billing records or information over different interfaces:

- GTP (Ga interface) as in GTP accounting to Charging Gateway Function (CGF),
- IETF RADIUS messaging (Gi interface) as in RADIUS accounting to AAA servers
- TCP/IP based Diameter protocol (Gy interface) as in real-time Prepaid. Together with a Prepaid Server which could be an SCP and/or an Online Charging System, the GGSN offers an integrated real-time prepaid solution that facilitates roaming.

Motorola's Content Based Billing (CBB) and pre-paid solution, Intelligent Packet Network (IPN), provides the following capabilities:

- Charging based on service flow event session and duration
- Prepaid and Postpaid Charging
- Service & Subscription based access control
- QoS based access control
- Flexible service control
- DPI (Deep Packet Inspection)
- Flexible deployment
- Smooth standards evolution

The IPN architecture is shown in Figure 3 below.

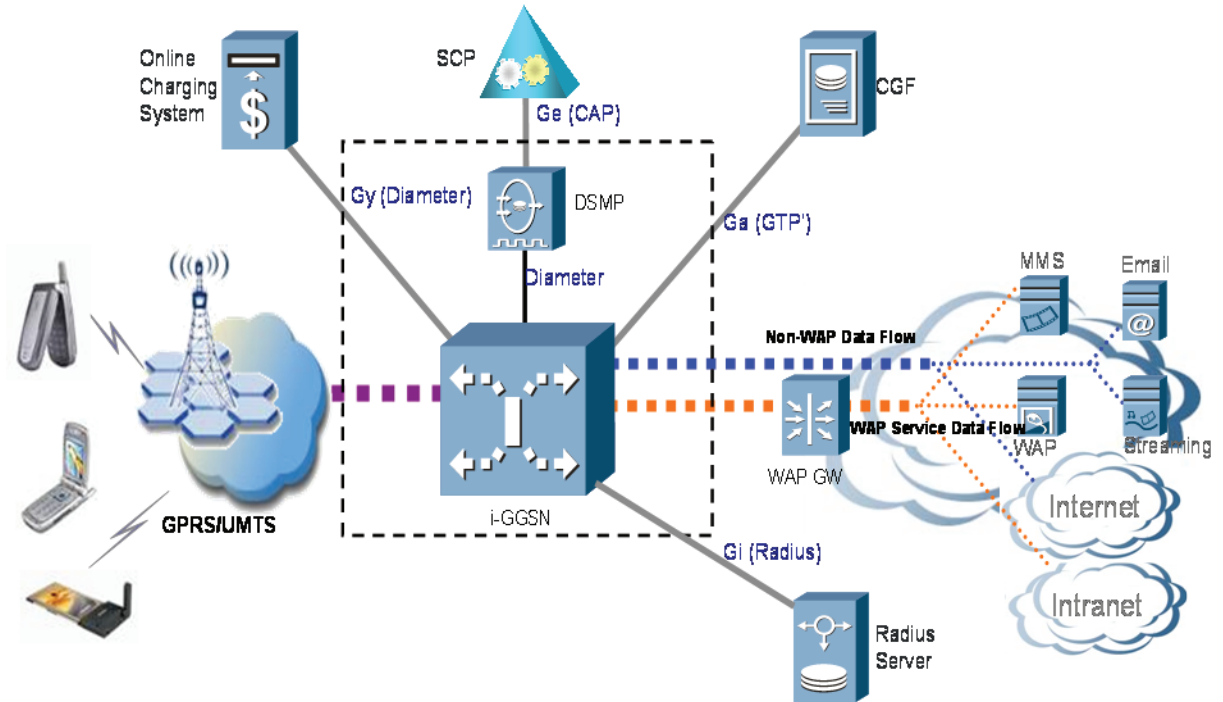


Figure 3: Motorola IPN Architecture

## 2.1 IPN Platform

The IPN Platform contains two main components: the C-GGSN and the DSMP.

1. C-GGSN functions (This will be called iGGSN –Intelligent GGSN)
  - Deep packet inspection DPI
  - Online/offline charging
  - Service authentication
  - Service control
  - Service based QoS control
  
2. DSMP functions
  - Common charging
  - Service directory center
  - Service authentication
  - Common provisioning

The C-GGSN is a high-performance, carrier-grade platform designed to support processing-demanding billing tasks. The GGSN billing function is distributed across the Service Processing Unit (SPU) and the Compress Service Processing Card (CSPC). The CSPC is on a PMC module added to the SPU card.

The CSPC provides close control over the user session, packet filtering and inspection when CBB is enabled.

It controls the billing process, which includes keeping counts on current rated content usage, timestamps and prepaid coupon monitoring. The CSPC transfers this billing information to the SPU during context updates (QoS, fallback/fall forward).

## 2.2 Billing Recording and Generation

The Motorola C-GGSN enables rich billing functions; it generates the GGSN Call Detail Record (G-CDR). The G-CDR is a data service billing record generated by the C-GGSN which records the billing information relating to the external network usage. These records will be sent via Ga interface to the charging gateway for handling. The processed Call Detail Records (CDRs) are then forwarded to the billing center for further processing.

Billing begins after a mobile user activates a PDP context which creates and opens a billing record. When the PDP context is deactivated, the billing record is closed and billing stops. Each activated PDP context has a corresponding G-CDR billing record.

Billing methods can be classified as follows:

- GTP accounting and hot billing: G-CDRs
- RADIUS accounting: RADIUS accounting messages
- GGSN integrated Prepaid: Coupons (for time or data volume)

A G-CDR can have several containers. The GGSN generates new accounting containers under the following conditions:

- Volume counter limit is reached for the specific PDP session and the volume counter limit is configured through SPU in the APN profile.
- QoS profile changes when the GTP version remains unchanged.
- Configurable times of the day based on a ToD Profile. An APN profile may be assigned a ToD Profile allowing for the generation of a new container at any hour of the day.

## 2.3 Billing Reporting

There are various billing reporting features which are supported in CBB system:

**Periodic G-CDR Generation:** If a subscriber occupies a data connection for a long time, the CDR function will generate a CDR at specified intervals. The billing interval can be pre-configured.

**G-CDR Generation Based on Traffic:** The CDR function will generate a CDR after the subscriber transmits a certain volume of data. The traffic threshold can be configured.

**G-CDR Generation Based on the Times of Billing Condition Changes:** If the times of billing conditions (such as QoS, charging rate, etc.) reach a certain number, the CDR function will be triggered to generate a CDR. The times of billing condition changes can be configured.

The CDR function will generate a CDR if the billing conditions (such as QoS, Charging Rate, etc) change a configurable number of times.

**G-CDR Generation Based on number of SGSN Changes:** The CDR function will generate a CDR if the SGSN address changes a configurable number of times during the connection.

**Multiple Charging Rate Periods:** The C-GGSN supports flexible billing time segment settings. The traffic measurement is conducted according to the specific billing rate period.

**CG Selection Function:** The C-GGSN supports the CG selection function. If all CGs are configured as the same level, when multiple PDP contexts are activated, the idler CG of the same level can be selected to send the CDRs for different PDP contexts according to the configuration so as to realize the master/ slave CDR delivery relationship of CGs.

**Hot Billing:** Hot billing is the same as normal billing with the exception that it generates the CDR' in near real-time.

**Content Based Billing:** Different billing rate tables are defined based on the value of data content delivered. The operator can charge for basic network access service, data content and value-added services applications.

### 3 CBB Services and Filtering Rules

When Content-Based Billing (CBB) is applied to a user session, all packets flowing between the user terminal and the destination content/application servers are subject to inspection and categorization into different flows. A flow is made up of packets that match a particular packet filtering rule. An IP packet flow is typically characterized by the IP quintuple flow identification:

- Layer 3 source and destination IP addresses
- Layer 4-7 protocol type
- Source and destination port (TCP/UDP) numbers

The GGSN uses the IP 5-tuple flow identification as the basis for filtering IP flows. However, there are IP packet flows that require more than this 5-tuple filtering, as they involve application protocols that exert complex or static behaviors, and involve complex addresses and multiple port channels. These flows call for deep packet inspection. The C-GGSN is capable of filtering beyond the basic 5-tuple filtering. The general IP stack with its overlaying application protocols is shown in Figure 5 below.

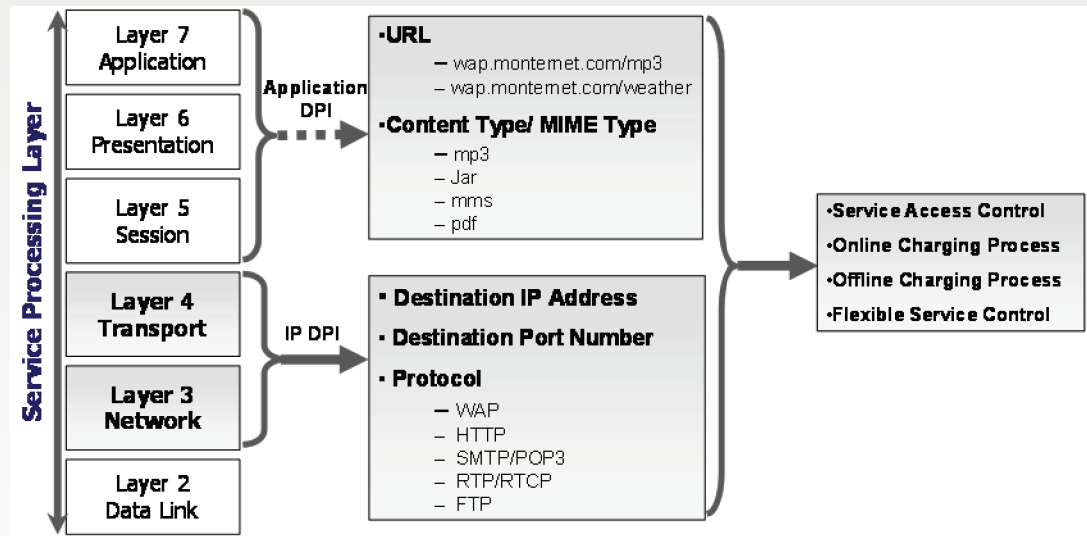


Figure 4: C-GGSN Filtering Function

The C-GGSN CBB function supports the following protocols and services:

- HTTP
- WAP 1.X/2.0
- MMS over WAP
- POP3/SMTP
- RTSP
- FTP
- KJAVA Download and Application

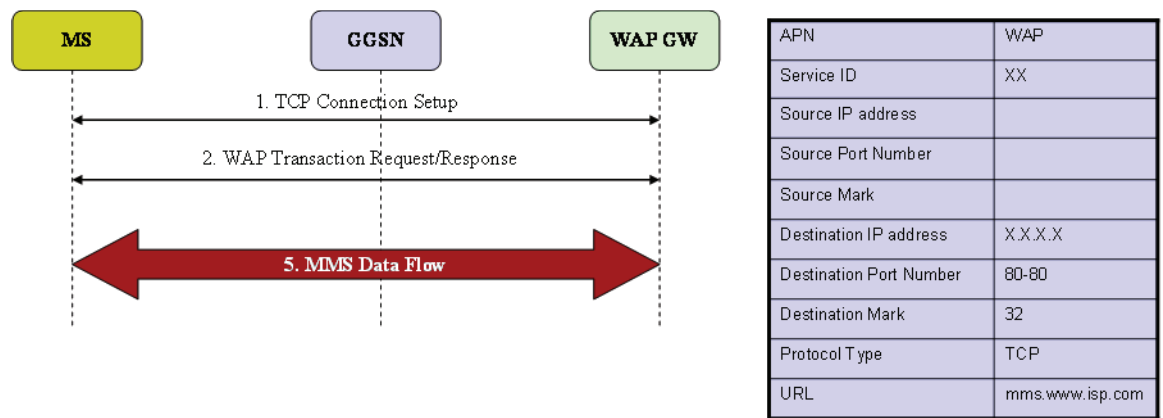
The following section explains two most important Protocols and services in detail.

### 3.1 MMS over WAP

The C-GGSN is capable of differentiating and recording MMS payload data from regular WAP bearer traffic. This capability is supported by the built-in WAP Filter which can read contents of WAP messages, from WAP version 1.x to WAP 2.0. The support for detection of WAP-Based MMS enables the operator to perform differential charging for different services within a session thus enhancing user experience while avoiding overhead such as additional APNs.

Like the HTTP filter described above, the WAP filter is made up of two levels of filtering: basic IP 5-tuple filtering and URL matching. The WAP filter uses the same URL filtering capability as described above.

The following diagram illuminates the setup procedure for MMS over WAP 2.0

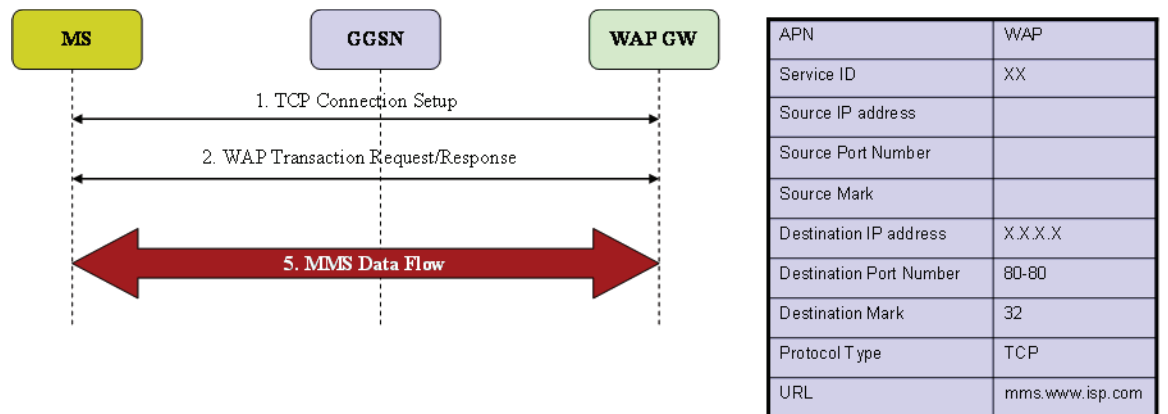


**Figure 5: Procedure for MMS over WAP2.0**

### 3.2 Streaming Services over RTSP

The C-GGSN identifies traffic matching the basic IP 5-tuple provisioned in the rule. This filter is for protocols such as RTSP, which use separate dynamically assigned UDP port number for bearer traffic. It can identify and apply the same CBB rule over these bearer traffic flows.

The following diagram illuminates the setup procedure of RTSP for Multimedia Streaming Service.



**Figure 6: typical procedure for streaming service**

#### 4 Evolution to 3GPP R7 Flow Based Charging

Flow Based Charging (FBC) is defined in 3GPP R6/R7. FBC is a charging architecture that can be applied to the packet core bearers used for Multimedia services based on IP flow (Content). The 3GPP Flow Based Charging architecture is shown in Figure 11 below.

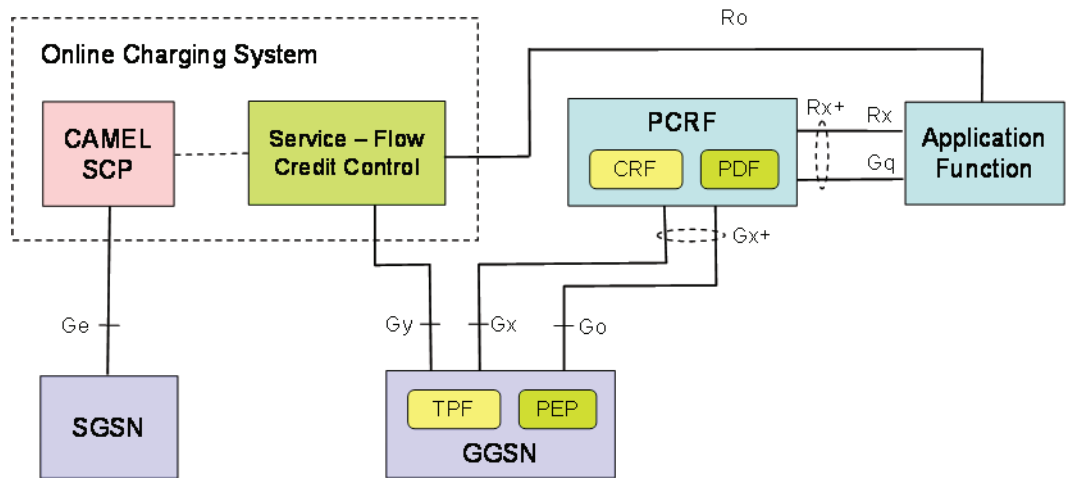


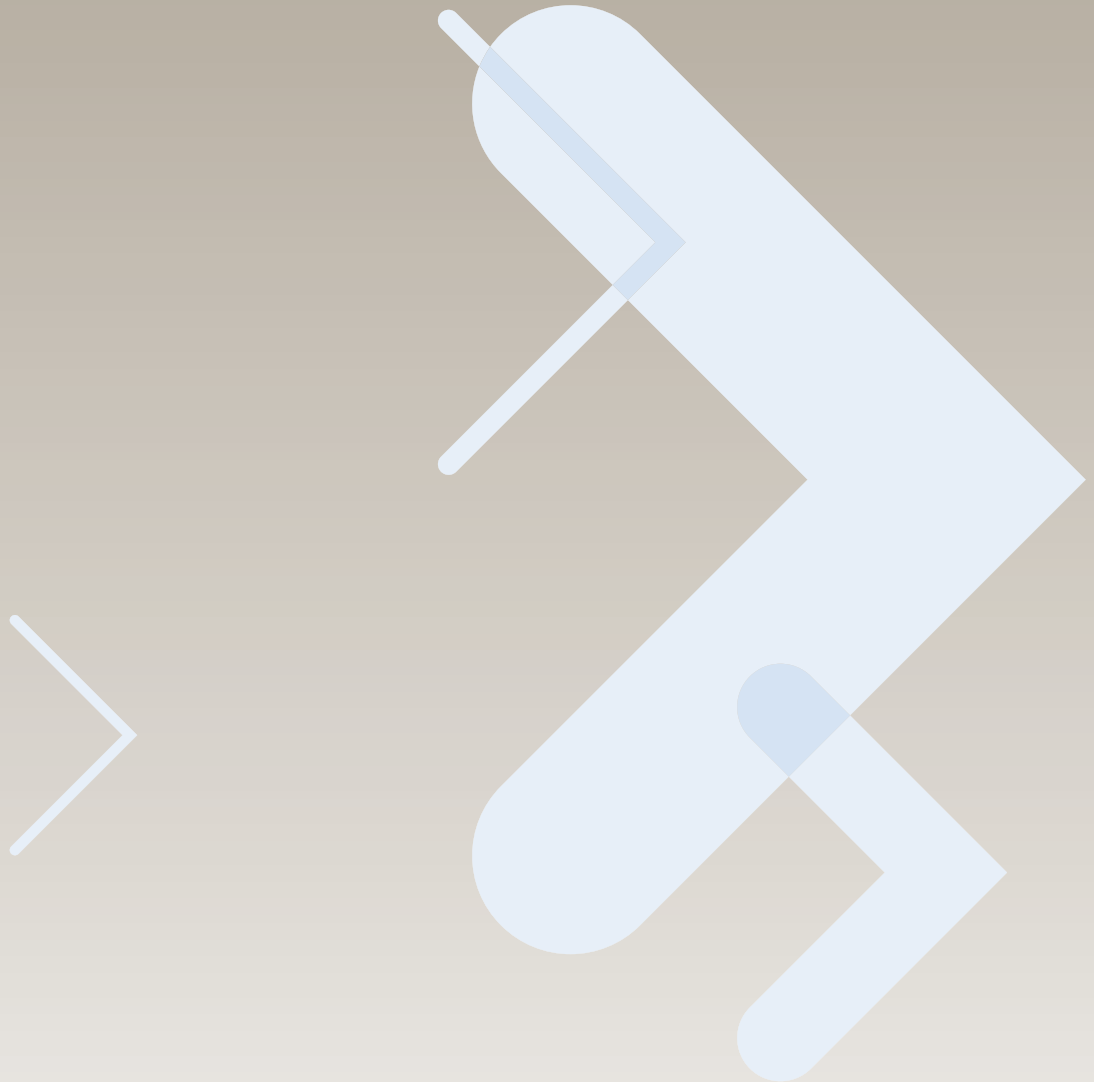
Figure 7: Evolution to 3GPP R7 Flow Based Charging

The Motorola CBB and pre-paid solution provides similar charging functionality to the 3GPP R6 Flow Based Charging and can be considered as the subset of FBC (pre-defined Filtering Rule on the GGSN/TPF). Motorola's CBB solution is based on the 3GPP standard and enables smooth migration from the initial phase to the PCC architecture (Flow Based Charging & Flow Based Policy) defined in 3GPP R7.

## Summary

Motorola's CBB solution is a mature and proven solution for the implementation of Content Based Billing in both 2G and 3G networks. Operators will be able to develop billing structures to maximize the revenue and their competitive position in the fast growing and dynamic market. By automatically gathering data on content and usage, the CBB solution helps the operator to develop and manage content partnerships quickly and effectively in an environment where the end users place more demands on innovative and useful mobile data services. This agility is a key success factor in the Mobile Data business.





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