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Technical Report

**3rd Generation Partnership Project;
Technical Specification Group Services and System Aspects;
Telecommunication management;
Charging management;
Rc reference point study
(Release 10)**

Keywords
Charging, Management

Contents

Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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    x the first digit:

        1 presented to TSG for information;

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    y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

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1 Scope

The present document is a study report for Rc reference point supported by ABMF (Accounting Balance Management Function).

The study covers the drive and requirement analysis, existing architectures, key issues analysis, recommandations, etc.

The study aims at producing recommendations for the following aspects:

- 3GPP work item and specification;

- Charging requirements and principles;

- Charging architecture and Rc networking scenarios;

- Charging data and protocols;

- Technical recommandations

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1]   3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2]   3GPP TS 22.115 "Service aspects; Charging and billing".

[3]   3GPP TS 32.240: "Telecommunication management; Charging management; Charging Architecture and Principles".

[4]   3GPP TS 32.296: "Telecommunication management; Charging management; Online Charging System (OCS) applications and interfaces".

[5]   3GPP TS 32.297: "Telecommunication management; Charging management; Charging Data Records (CDR) file format and transfer".

[6]   3GPP TS 32.299: "Telecommunication management; Charging management; Diameter charging application".

[7]   3GPP TS 29.230 "Technical Specification Group Core Network and Terminals; Diameter applications; 3GPP specific codes and identifiers".

[8]   IETF RFC3588 "Diameter Base Protocol".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1], 3GPP TS 32.240 [3], 3GPP TS 32.296 [4] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1], 3GPP TS 32.240 [3] and 3GPP TS 32.296 [4].

Account: structure residing in the OCS for holding dynamic subscription data with monetary equivalence.   Accounts may have balances/counters of currency or a unit type. An account can have one or more users associated with it. Examples of account type could include individual, family, corporate, etc. As opposed to bank accounts, transaction history is not necessarily kept in the OCS account data structure.

Account balance: represents the current numerical value from which service delivery decisions can be determined.

Charging: a function within the telecommunications network and the associated OCS/BD components whereby information related to a chargeable event is collected, formatted, transferred and evaluated in order to make it possible to determine usage for which the charged party may be billed (offline charging) or the subscribers account balance may be debited (online charging).

Counter: aggregation of units of service usage or monetary units, which may be in relation to subscriber contractual terms (e.g. number of used SMS per day or number of free minutes per month).
These form the basis for any type of loyalty program like discounts or bonus.

Offline charging: charging mechanism where charging information does not affect, in real-time, the service rendered

Online charging: charging mechanism where charging information can affect, in real-time, the service rendered and therefore a direct interaction of the charging mechanism with session/service control is required.

Tariff: set of parameters defining the network utilization charges for the use of a particular bearer / session / service.

Subscriber: A Subscriber is an entity (associated with one or more users) that is engaged in a Subscription with a service provider. The subscriber is allowed to subscribe and unsubscribe services, to register a user or a list of users authorised to enjoy these services, and also to set the limits relative to the use that associated users make of these services.

Subscription: A subscription describes the commercial relationship between the subscriber and the service provider.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

Rc	Online Charging Reference Point towards the Account Balance Management Function.
Ro	Online Charging Reference Point towards the online charging functions (EBCF, SBCF).
Rr	Online Charging Reference Point towards an external account recharging server.
Re	Online Charging Reference Point towards the Rating Function

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ABMF	Accounting Balance Management Function
CCA	Credit Control Answer
CCR	Credit Control Request
CDR	Charging Data Record
CGF	Charging Gateway Function
EBCF	Event Based Charging FunctionOCF Online Charging Function
OCS	Online Charging System
RF	Rating Function
SBCF	Session Based Charging Function

4 Requirement analysis for Rc Reference Point

4.1 Requirement and Drive Analysis

3GPP has introduced OCS architecture since Release 5. The principle drives for the completion of the Rc reference point are:

1) To support a standardized connection by ABMF

This works as the key drive for Rc reference point specifications. The technologies related with OCS is on the way to be complete in R8 or previous releases which have been facilitate the application of OCS specifications. Whereas Rc reference point was identified as outstanding in previous releases. In current market each solution has its own way for this interconnection. For the operator, the upgrading or corresponding action was limited to vendor specific. A standardized way will bring a unified style for the connection.

As identified it's up to complete in late release. Through such, an operator can benefit from multi-vendors existing environment, convenient inter-connecting of accounting information within charging domains.

2) To facilitate interconnecting between OCF and ABMF

Within an operator's telecommunication network, especially for a vast network, OCF and ABMF may be distributed in multi physical locations. For offering a seamless service for the subscribing, local OCF may be requested to connect to ABMF which physically belongs to another domain.

As the drives above, the specification of Rc reference point, the message exchange, the flow need take into account the requirements above.

4.2 Rc Reference Point Scenarios

The Rc reference point is used to open account and balance management functionality. As the main drives and requirement, it has following scenarios:

- To fetch subscriber's accounting information including account balance and/or counters from ABMF;

- To debit units from subscriber's account from ABMF independent service requested;

- To refund units to subscriber's account in ABMF independent service requested;

- To perform balance check independent of service.

- To reserve units in subscribers' account from ABMF independent service requested;

  Editor's notes: other primary scenarios are ffs.

5 OCS Architecture Concept

5.1 Charging Architectures

The main requirements and high-level principles for charging and billing are established in the 3GPP TS 22.115.

The logical online and offline charging architecture are introduced in the 3GPP TS 32.240.

5.2 OCS Charging Architecture Consideration

Below is the logical ubiquitous online charging architecture, 3GPP TS 32.296 [4] gives a detailed architecture of OCS as Figure 5.2.1.
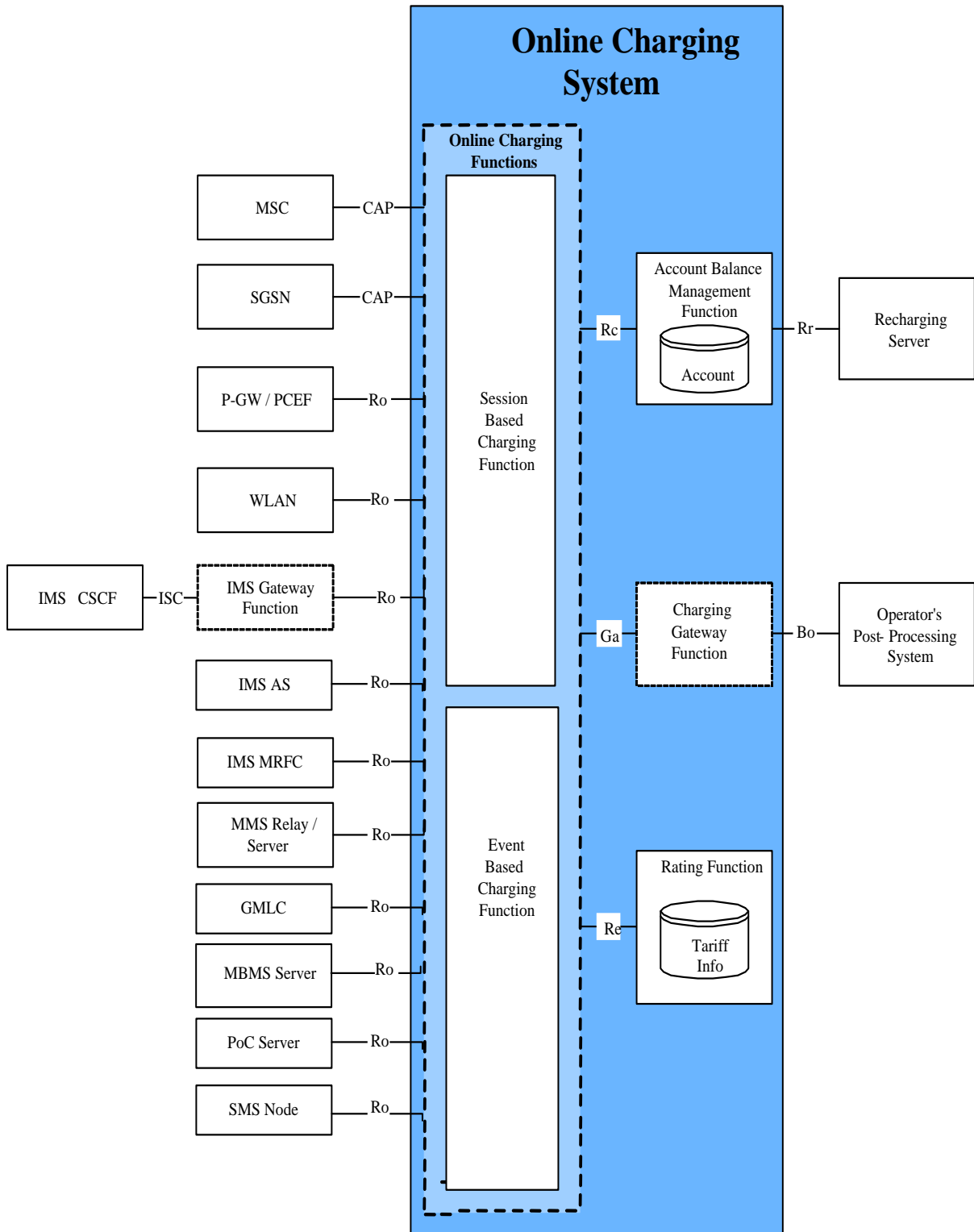
Figure 5.2.1: Online charging system architecture

The ABMF is the location of the subscriber's account balance. It supports interface for account balance management towards external account management servers e.g. recharge server, hot billing server. Its functions include:

- check account balance;

- account balance update (credit/debit);

- account balance reservation;

- get/set counters;

- get/set expiry date of the (prepaid) account (optional).

The OCF consists of two distinct modules, namely the Session Based Charging Function (SBCF) and the Event Based Charging Function (EBCF), and communicates with the ABMF to query and update the subscribers' account and counters status (counters are not applicable if a class "B" Rating Function is used).

Reference points:

- The Rc reference point allows the interaction between the Online Charging Functions (SBCF, EBCF) and the Account Balance Management Function (ABMF) to access the subscribers account balance on the OCS.

- The Rr reference point allows the interaction between the Account Balance Management Function and an external recharging server.

- The Re reference points connect the Online Charging Functions (SBCF, EBCF) with the Rating Function.

- The Ga reference point allows the collection and transfer of charging information from the Charging Data Functions (CDF) to the Charging Gateway Function (CGF).

- The Bo reference point allows the transfer of charging information from the Charging Gateway Function to the operator's post-processing system as the OCS variant of the Bx interface description in 3GPP TS 32.297.

5.3 ABMF Networking Impact Analysis

As specified in 3GPP TS 32.296 [4], the Online Charging System (OCS) shall support mechanisms for account balance management towards external account management servers e.g. recharge server, hot billing server.

Figure 5.3.1 provides an overview of ABMF based charging architecture for fulfilling the requirements in section 4.
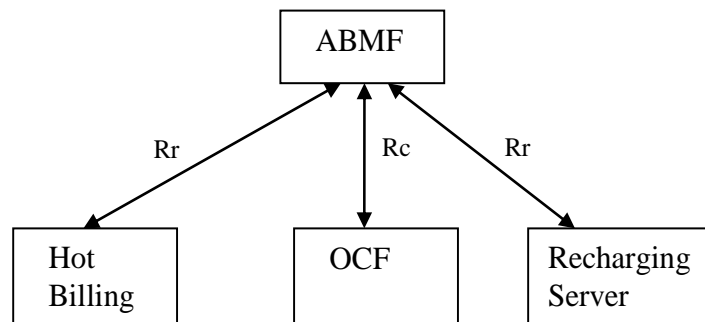
Figure 5.3.1: ABMF based Charging Architecture

In the architecture, the ABMF is the OCF-independent module. The interface between ABMF and the OCF is Rc reference point The hot billing server and recharging server will access the ABMF through Rr reference point for account balance management.

Note: ABMF is an internal functionality in OCS. ABMF and OCF can be collocated physically in online charging, in this case, the interface between AMBF and OCF corresponding to Rc reference point is not necessary. The present study report analyzes a case where Rc interface is used to separate AMBF from OCF physically.

6 Key Issues of Rc reference point

6.1 Message Exchange

The messages and data types on Rc reference point could be defined based on the messages specified for the 3GPP Ro Diameter application [6] or Re Diameter application [7].

The solution based on Ro Diameter application is a feasible option to provide Rc functionality in the case where ABMF manages only monetary units.

The following describes the contents of the messages.

6.1.1 Functionality Analysis on Rc Reference Point

Following functionality of Rc Reference Point is proposed:

- Request Account Information
  OCF uses this message to fetches user account information over Rc reference point from ABMF. In class "A" rating mode, counters reside in ABMF, OCF fetches counters together with account information over Rc reference point.

- Initial Account Reservation
  The OCF uses this message to initiate a reservation over the Rc reference point against a subscriber's account in the ABMF.

- Account Reservation Update
  The OCF uses this message to update an existing reservation made against a subscriber's account in the ABMF over the Rc reference point. This message triggers the ABMF to perform a debit of previous reservation and updates account reservation for the service.

- Debit Account Reservation
  The OCF uses this message to request the debiting of used service units from an existing reservation made against a subscriber's account in the ABMF over the Rc reference point.

- Debit Unit
  The OCF uses this message to request to perform a debit of units from user account balance or counters over Rc reference point. The ABMF performs debit used units for the service.

- Check Balance
  OCF uses this message to request for checking balance of subscriber's account over Rc reference point from ABMF. The ABMF retrieves the subscriber's account balance and checks whether the subscriber's account is sufficient for the service usage.

- Refund
  The OCF uses this message to request a refund of debited service units to subscriber's account over Rc reference point. The ABMF performs account refund.

6.1.2 Basic Operation Analysis for Rc Reference Point

Depending on the above functionality, the ABMF should support following basic logic operations:

- "*Enquiry Request*"; sent from OCF → ABMF
  OCF requests subscriber's account or counters information from ABMF using an *Enquiry Request*. This operation can also be sent by OCF for checking account balance of subscriber over Rc reference point.

- "*Enquiry Response*"; sent from ABMF → OCF
  ABMF replies with a *Enquiry Response* which transfers to the OCF of subscriber's account or counters information.
  When OCF requests for checking account balance of subscriber, ABMF replies with an *Enquiry Response* which informs OCF of the result of checking balance.

- "*Reserve Units Request*"; sent from OCF → ABMF

OCF requests to reserve a number of units for the service using a *Reserve Units Request*.

- "*Reserve Units Response*"; sent from ABMF → OCF
  Response from ABMF which informs the OCF of the number of units that were reserved as a result of the *Reserve Units Request*.

- "*Debit Units Request*"; sent from OCF → ABMF
  OCF requests to debit units from subscriber's account or counters in ABMF. For refund purpose, the OCS sends a *Debit Units Request* to the OCF as well.

- "*Debit Units Response*"; sent from ABMF → OCF
  Response from ABMF which informs OCF of the result of debitting or refund operation.

Table 6.1.2.1 and table 6.1.2.2 describe the content of these operations.

Table 6.1.2.1:Enquiry, Debit Units and Reserve Units Request Content

Enquiry, Debit Units and Reserve Units Request	Category	Description
Session Identifier	M	This field identifies the operation session.
Operation Type	M	This field defines the transfer type: event for event based operation and start, interim, stop for session based operation.
Operation Number	M	This field contains the sequence number of the transferred messages.
Service Context Information	M	This field identifies the domain, subsystem or service and release.
Origination Timestamp	O_C	This field contains the time when the operation is requested.
Subscriber Identifier	O_M	This field contains the identification of the mobile subscriber (i.e. MSISDN) that uses the requested service.
Requested Action	O_C	This field contains the requested action.
Multiple Unit Operation	O_C	This field contains the parameter for the quota management.
Service Information	O_M	This parameter holds the individual service specific parameters, e.g. service type,

Table 6.1.2.2: Enquiry, Debit Units and Reserve Units Response Content

Enquiry, Debit Units and Reserve Units Response	Category	Description
Session Identifier	M	This field identifies the operation session.
Operation Result	M	This field identifies the result of the operation.
Operation Type	M	This field defines the transfer type: event for event based operation and start, interim, stop for session based operation.
Operation Number	M	This field contains the sequence number of the transferred messages.
Account Status	O_C	This field indicates the status of user account, e.g. low balance.
Multiple Unit Operation	O_C	This field contains the parameter for the quota management.
Service Information	O_C	This parameter holds the individual service specific parameters.
Account Information	O_C	This field contains the subscriber's account and counter information residing in ABMF. Editor's notes: The structure of this parameter is ffs.

6.2 Protocol Implementation options

The protocol implementation supported by Rc reference point is discussed in the section.

The following options were appraised in considering an appropriate protocol implementation for the Rc reference point.

Based on the IETF guidelines designing Diameter applications, the following are potential options for approaches to designing the Diameter application to meet the requirements of the Rc interface:

1. New functionality added to an existing Diameter application without defining a new application

2. Generate a new Diameter application by extending an existing application.

3. Generate a new Diameter application without using any components of an existing application.

Design Evaluation Summary:

Design Option #3

There is existing Diameter functionality that can be applied to the Rc interface. IETF's direction is as general theme to reuse commands, AVPs and AVP values as much as possible. 3GPP should endeavour to reuse as much existing Diameter functionality as is feasible. Therefore option #3 above was discounted as a feasible option.

Design Option #1

Could an existing Diameter application be extended without having to define a new application? The prefered candidate was 3GPP Re Diameter Application. This approach has positive features such that it:

- Follows the theme of re-use

- Less administrative overheads i.e. no need to apply to IANA for entries in its Diameter registry.

Some concerns about this approach include:

- Shall it impose significant backward compatibility issues?

- Shall it impose significant forward compatibility issues?

- Shall it lead to excessive command message payloads i.e. carrying AVPs that are redundant to ABMF operations

- Does it provide all the functionality that will be required for the Rc interface e.g.

  - Can we be sure that no new command code codes are required for the Rc operations e.g. the operation *Enquiry Request (Request Account Information)* doesn't appear to map easily to an existing Diameter Credit Control message?

  - Can we be sure that no new AVPs with the M-bit set are required to be added to the existing command messages, refer [8]?

Design Option #2

This approach has been used by 3GPP frequently in the past (e.g. Re, Gx, Gxx, Rx, S9, Cx/Px, Sh, Wx, etc. refer [7]) and more specifically used by the charging working group for the Re reference point within the OCS, refer [2]. This approach has positive features such that it:

- Follows the theme of re-use

- Means there would be no initial backward compatibility issues

- Allows for optimized command message payloads

- Enables new command messages to be added if required

- Allows new "mandatory to understand" AVPs to be added if required

If this approach is adopted further investigation is required to address issues such as:

- Which (if any) command messages would be re-used by the new application? Diameter CCR/CCA messages would be candidates. Diameter RAR/RAA would also merit consideration.

- Would any new command messages be required e.g. does it make sense to map an *Enquiry Request (Request Account Information)* to a new AccountInformationRequest command?

- What AVPs are required to be added to existing command messages

  - Mandatory to understand AVPs

  - Optional AVPs

- Which (if any) AVPs can be deleted from the command messages that are re-used.

- Is there any Diameter Accounting support required for the new application?

The consensus was that design option #1 using the 3GPP Re Diameter application was the most suitable option for implementing the interface protocol for the Rc reference point.

6.3 Message Flow

This subclause describes message flows for the Rc Reference Point.

6.3.1 Account Balance Request scenario

The following sub-sections describe the basic scenario for account balance request from A BMF for ECUR and SCUR.

6.3.1.1 Account Balance Request scenario with Account Reservation

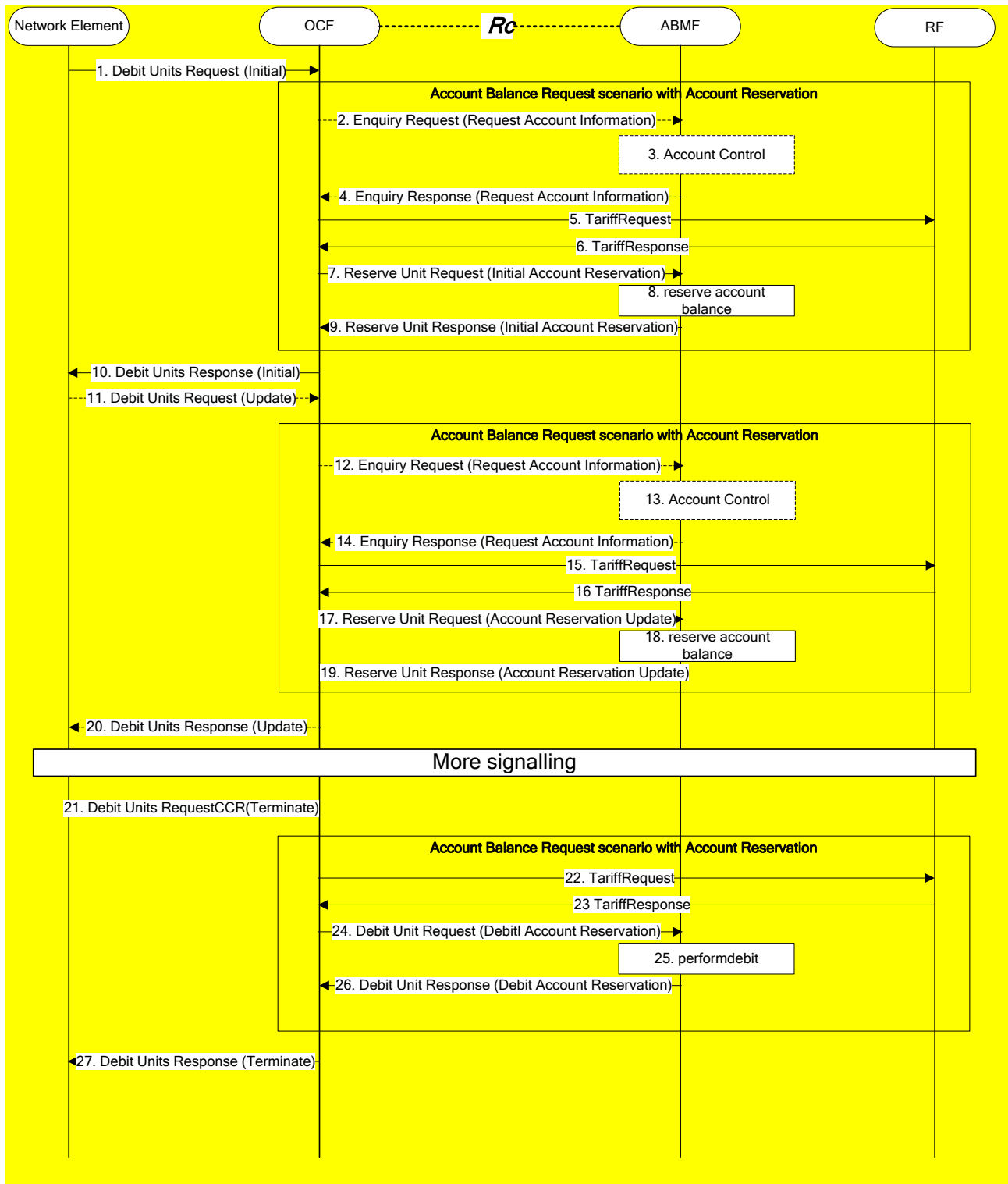The following figure describes the case for unit reservation.

Network Element | OCF | Rc | ABMF | RF

1. Debit Units Request (Initial)

Account Balance Request scenario with Account Reservation

2. Enquiry Request (Request Account Information)

3. Account Control

4. Enquiry Response (Request Account Information)

5. TariffRequest

6. TariffResponse

7. Reserve Unit Request (Initial Account Reservation)

8. reserve account balance

9. Reserve Unit Response (Initial Account Reservation)

10. Debit Units Response (Initial)

11. Debit Units Request (Update)

Account Balance Request scenario with Account Reservation

12. Enquiry Request (Request Account Information)

13. Account Control

14. Enquiry Response (Request Account Information)

15. TariffRequest

16 TariffResponse

17. Reserve Unit Request (Account Reservation Update)

18. reserve account balance

19. Reserve Unit Response (Account Reservation Update)

20. Debit Units Response (Update)

More signalling

21. Debit Units RequestCCR(Terminate)

Account Balance Request scenario with Account Reservation

22. TariffRequest

23 TariffResponse

24. Debit Unit Request (Debitl Account Reservation)

25. performdebit

26. Debit Unit Response (Debit Account Reservation)

27. Debit Units Response (Terminate)

Figure 6.3.1: Account Balance Request scenario with Account Reservation

Step 1: The OCF receives a *Debit Units Request* (Initial) request referring to an MS's bearer usage/session/service resource usage.

Step 2(Optional): The OCF requests account information for the subscriber from the Account Balance Management Function (ABMF) using *Enquiry Request (Request Account Information)* message.

Step 3(Optional): The ABMF retrieves subscriber's counter information.

Step 4(Optional): The ABMF returns the account information to the OCF using *Enquiry Response (Request Account Information)* message.

Note: Steps 2, 3, 4 are required for OCS RF class "A" and therefore not needed for OCS RF class "B".

Step 5:   The OCF requests the appropriate tariff to be applied for the bearer/session/service from the Rating Function.

Step 6:   The Rating Function returns the tariff information to the OCF.

Step 7:   The OCF requests for reserving account balance from the Account Balance Management Function using *Reserve Units Request (Initial Account Reservation)* message.

Step 8:   The ABMF reserves account balance for the service.

Step 9:   The ABMF returns the result code to the OCF using *Reserve Units Response (Initial Account Reservation)* message.

Step 10:   The OCF returns *Debit Units Response* (Initial).

Step 11(Optional): The OCF receives a *Debit Units Request* (Update) request updating an MS's bearer usage/session resource usage.

Step 12(Optional): The OCF requests for updating account reservation from the Account Balance Management Function using *Enquiry Request (Request Account Information)*.

Step 13(Optional):The ABMF performs debit of previous reservation and updates account reservation for the service.

Step 14(Optional): The ABMF returns the result code to the OCF using *Enquiry Response (Request Account Information)* message.

Note: Steps 12, 13, 14 are required for OCS RF class "A" and therefore not needed for OCS RF class "B".

Step 15:   The OCF requests the appropriate tariff to be applied for the bearer/session/service from the Rating Function.

Step 16:   The Rating Function returns the tariff information to the OCF.

Step 17:   The OCF requests for reserving account balance from the Account Balance Management Function using   *Reserve Units Request (Account Reservation Update)* message.

Step18:   The ABMF reserves account balance for the service.

Step 19:   The ABMF returns the result code to the OCF using   *Reserve Units Response (Account Reservation Update)* message.

Step 20:   The OCF returns *Debit Units Response* (Update).

Step21:   The OCF receives a *Debit Units Request* (Terminate) request debiting an MS's bearer usage/session resource usage.

Note: Steps 12, 13, 14 may be re-applied here for OCS RF class "A" to have accurate rating taken into consideration for parallel services consumed between steps 20 and 21. These steps are not needed for OCS RF class "B".

Step 22:   The OCF requests the appropriate tariff to be applied for the bearer/session from the Rating Function.

Step 23:   The Rating Function returns the tariff information to the OCF.

Step 24: The OCF requests for debiting used service units from the Account Balance Management Function using *Debit Units Request (Debit Account Reservation)*.

Step 25: The ABMF performs debit used units for the service.

Step26: The ABMF returns the result code to the OCF using *Debit Account Response (Debit Account Reservation)*.

Step 27: The OCF returns *Debit Units Response* (Terminate).

6.3.1.2 Account Balance Request scenario with Refund

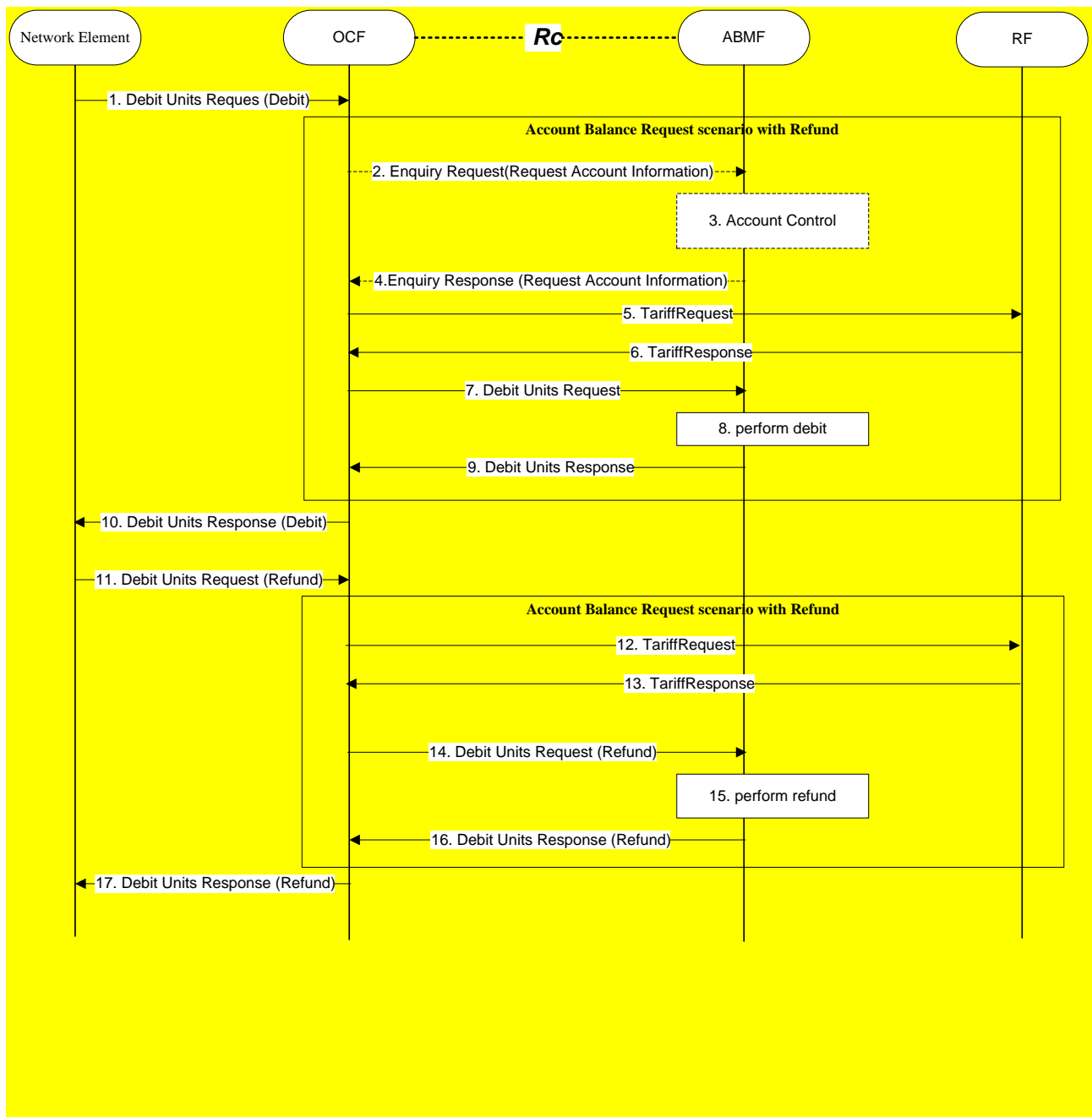The following figure describes the case for refund.

Figure 6.3.2: Account Balance Request scenario with Refund

Step 1: The OCF receives a *Debit Units* request debiting an MS's bearer usage/session resource usage.

Step 2(Optional): The OCF requests account information for the subscriber from the Account Balance Management Function using *Enquiry Request (Request Account Information)*.

Step 3(Optional): The ABMF retrieves subscriber's Account information.

Step 4(Optional): The ABMF returns the account information to the OCF using *Enquiry Request (Request Account Information)*.

Notes: Steps 2, 3, 4 are required for OCS RF class "A" and therefore optional for OCS RF class "B".

Step 5: The OCF requests the appropriate tariff to be applied for the bearer/session from the Rating Function.

Step 6: The Rating Function returns the tariff information to the OCF.

Step 7: The OCF requests for debiting used service units from the Account Balance Management Function using *Debit Units Request*.

Step 8: The ABMF performs debit operation for the service.

Step 9: The ABMF returns the result code to the OCF using *Debit Units Response*.

Step 10: The OCF returns *Debit Units Response*.

Step 11: The OCF receives a *Debit Units Request* (Refund) request refunding an MS's bearer usage/session resource usage.

Step 12 (Optional): The OCF requests the appropriate tariff to be applied for the bearer/session from the Rating Function.

Step 13 (Optional): The Rating Function returns the tariff information to the OCF.

Step 14: The OCF requests for refund some debited service units from the Account Balance Management Function using *Debit Units Request (Refund)*.

Step15: The ABMF performs account refund.

Step16: The ABMF returns the result code to the OCF using *Debit Units Response (Refund)*.

Step17: The OCF returns *Debit Units Response* (Refund).

6.3.1.3 Account Balance Request scenario with Check Balance

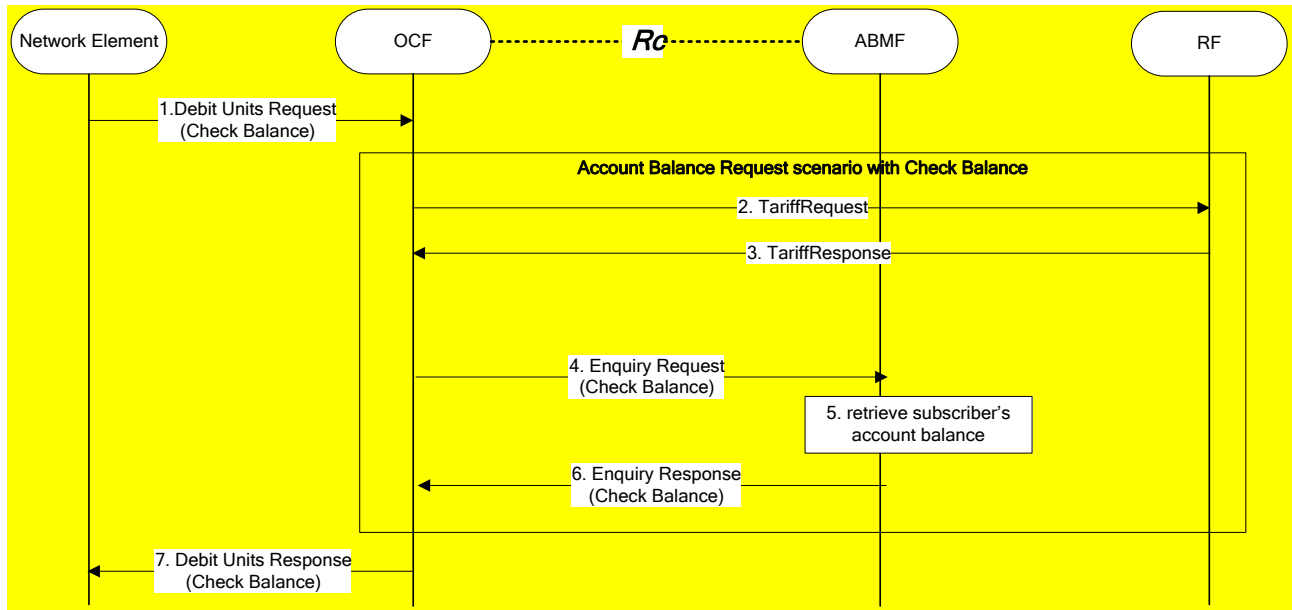The following figure describes the case for balance check.

Figure 6.3.4: Account Balance Request scenario with Check Balance

Step 1:   The OCF receives a *Debit Unit Request* (Check Balance) request checking account balance.

Step 2 (Optional):   The OCF requests the appropriate tariff to be applied for the bearer/session/service from the Rating Function.

Step 3 (Optional):   The Rating Function returns the tariff information to the OCF.

Step 4:   The OCF requests for checking balance of the subscriber's account from the Account Balance Management Function using *Enquiry Request (Check Balance)*.

Step 5:   The ABMF retrieves the subscriber's account balance.

Step 6:   The ABMF returns the result code to the OCF using *Enquiry Response (Check Balance)* message.

Step7:   The OCF returns *Debit Units Response* (Check balance).

6.3.1.4   Account Balance Request scenario for event based Direct Debiting operation

The following figure describes direct debit operation in order to perform the IEC.
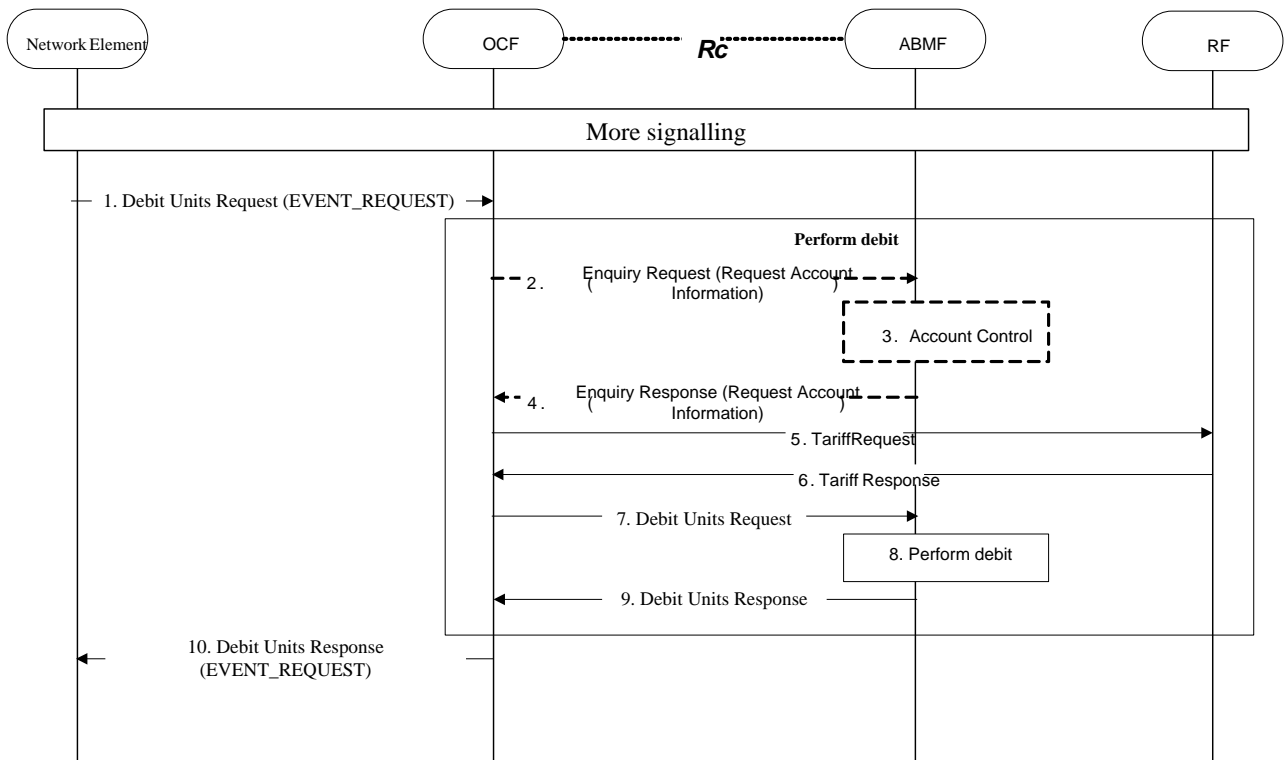
Figure 6.3.1.4: Account Balance Request scenario with debit operation

Step 1: The OCF receives a *Debit Units Request* with *CC-Request-Type* AVP indicating EVENT_REQUEST. The *Requested-Action* AVP (RA) is set to DIRECT_DEBITING. If known, the network element may include *Requested-Service-Unit* AVP (RSU) (monetary or non-monetary units) in the request message..

Step 2(Optional): The OCF requests account information for the subscriber from the Account Balance Management Function (ABMF) using *Enquiry Request (Request Account Information)* message.

Step 3(Optional): The ABMF retrieves subscriber's counter information.

Step 4(Optional): The ABMF returns the account information to the OCF using *Enquiry Response (Request Account Information)* message.

Notes: Steps 2, 3, 4 are required for OCS RF class "A" and therefore not needed for OCS RF class "B".

Step 5: The OCF requests the appropriate tariff to be applied for the bearer/session from the Rating Function.

Step 6: The Rating Function returns the tariff information to the OCF.

Step 7: The OCF requests for debiting used service units from the Account Balance Management Function using *Debit Units Request*.

Step 8: The ABMF performs debit used units for the service. Unused reserved units are released, if applicable.

Step 9: The ABMF returns the result code to the OCF using *Debit Units Response* message.

Step 10: The OCF acknowledges the reception of the CCR message by sending *Debit Units Response* message with *CC-Request-Type* AVP indicating EVENT_REQUEST (*Granted-Service-Unit* AVP (GSU) and possibly *Cost-Information* AVP (CI) indicating the cost of the service and *Remaining-Balance* AVP are included in the *Credit-Control-Answer* message).

7 Conclusions and Recommendations

7.1 Conclusions

In summary, the 3GPP Online Charging System (OCS) represents a collection of constituent functional components: Online Charging Functions (Session Based Charging Function, Event Based Charging Function), Account Balance Management Function, Charging Gateway Function, and Rating Function. 3GPP has also declared a set of references for the online charging system's functional components e.g. Ro, Rc, Re, Rr, Bo and CAP. It has been noted during this study that OCSs have been ubiquitously deployed by operators providing 3GPP access despite the fact that for a subset of the OCS functional component reference points such as Rc or Rr are not specified whilst other such as Re have not evolved significantly since its initial specification. The implication of this for the Rc reference point is that in existing deployments the operator has either chosen a single vendor for OCF and ABMF functional components with no integration required as the interface for the Rc reference point is an internal interface, or where different vendors are chosen to provide OCF and ABMF functional components have employed bespoke/proprietary means achieve the integration. During the study a number of operators have declared their desire to have an open standard based alternative to the above options. Concerns were raised that initial versions of a standardised interface for Rc reference point would lack the functionality of the existing proprietary interfaces but this is unavoidable and is not unique to this scenario and this gap should diminish as the standard evolves. Another concern raised was that there is an IPR divergence across ABMF vendors and this may provide challenges in defining an inclusive set of functionality for the standardised interface for the Rc reference point although this has not been explored in depth during the study period. Some companies pointed out that the use of external interfaces would have additional performance/latency overheads compared with internal interfaces although the operator feedback was to acknowledge this but that this was a tradeoff that they have already accepted.

An observation that raised disquiet during the study period was that the experience for the one other standardised interface between two OCS constituent functional components i.e. the Re interface has not been widely adopted.

Not all areas were fully explored within in the study e.g. could certain Ro functions deliver all the required Rc functionality and thus have OCF simply proxy Ro messages to the ABMF with small enhancements.

Notwithstanding some of the concerns and caveats raised above a number of operators articulated specific use cases addressing challenges such as:

- A converged ABMF across charging domains (e.g. for operators who have consolidated their business lines wireless, wireline, cable, ISP, etc.)

- A plurality of OCF vendors across geographically diverse regions integrating with a centralised ABMF.

- An evolutionary path for operators leveraging their existing investment in legacy ABMF deployments (e.g. IN platforms) to a 3GPP compliant OCS.

The operators have defined a desire to have the option to use a standardised interface for the Rc reference point to assist in overcoming these challenges.

7.2 Recommendations

To provide operators with optional guidance for deploying the options for Rc reference point in the form of an informative annex to TS 32.296 (OCS).

Annex A:
Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2009-06	SP-44	SP-090301	--	--	Presentation to SA for information	--	1.0.0
2010-10	SA#47	SP-100068	--	--	Presentation to SA for approval	1.0.0	2.0.0
2010-03	--	--	--	-	Publication of SA approved version	2.0.0	10.0.0