Technical Specification Group Services and System Aspects ***TSGS#15(02)0144***

Meeting #15, Jeju-do, Korea, 5-14 March 2002

**Source:** **TSG SA WG2**
**Title:** **TR 23.815 v.2.0.0 and cover page**
**Agenda Item:** **7.2.3**

SA2 wish to submit TR 23.815 on " Charging implications of IMS architecture " to SA plenary #15, as all items are now solved except the following ones:

1. Offline charging architecture: for the interconnection of Application Servers with CCFs there have been two different solutions identified; one of these needs to be agreed on.
   *Comment from the rapporteur: This should be part of the SA5 work.*
2. The detailed effects of certain complex scenarios (e.g. forking, multiparty sessions) to the charging correlation principles are for further study.
   *Comment from the rapporteur: This should be part of SA5 and CN1 work.*
3. The exchange of charging information between networks needs to be investigated further.
   *Comment from the rapporteur: It is unclear what can be provided in the release 5 time frame.*

Comment from the rapporteur: It is understood that for IMS Charging some further work on stage 2 level is required, e.g. definition of the functionality supported at the Ro reference point in the release 5 time frame. This is in-line with the work item description and according to the agreed work split between SA2 and SA5.

# 3GPP TR 23.815 V2.0.0 (2002-03)

*Technical Report*

## 3rd Generation Partnership Project;
## Technical Specification Group Services and System Aspects;
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# Contents

# Foreword

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

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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

# 1 Scope

The present document identifies the charging implications of the IMS architecture, which is described in 23.002 [5] and 23.228 [4].

It is expected that the content of this TR will act as a basis for

- change requests against the architecture specifications [4, 5] of SA2, clarifying the architecture implications on charging,
- change requests against the Charging Principles specification [3] of SA5, which contains the charging architecture and mechanisms.
- detailed specification of Charging Data Description [6] in SA5.

# 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 41.001: "GSM Release specifications".

[2] 3GPP TS 21.905: "Vocabulary for 3GPP Specifications".

[3] 3GPP TS 32.200: "Charging Principles".

[4] 3GPP TS 23.228: "IP Multimedia (IM) Subsystem - Stage 2".

[5] 3GPP TS 23.002: "Network architecture".

[6] 3GPP TS 32.225: "Charging Data Description for IMS".

[7] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the following terms and definitions given in TS 21.905 [2] and the following apply.

**Billing:** The functions whereby charging data are transformed into bills requiring payment. In case of pre-paid, billing means the deduction of an account. As an outcome of the transformation an invoice, including an optional list of detailed charges, has to be delivered to the user. The billing function is located in the appropriated billing domain, which is not a part of the CS domain, PS domain or IMS.

**IMS Advice of Charge:** A service that provides the IMS subscriber with information about the applicable charging rates at session establishment or when charging rates change during the session. The IMS provides the capabilities to provide the AoC service to the subscriber. The AoC service itself is not to be standardized.

**Pre-paid billing:** Billing arrangement between customer and operator/service provider where the customer deposits an amount of money in advance, which is subsequently used to pay for service usage.

**Post paid billing:** Billing arrangement between customer and operator/service provider where the customer periodically receives a bill for service usage in the past period.

Note: Pre-paid and post-paid are different payment methods for the subscribers. These payment methods could be based on both on-line and off-line charging mechanisms. To get full credit control, pre-paid should be built on on-line charging. If the operator would like to have post-paid subscribers on credit control, these subscribers should be charged with the on-line charging mechanism.

**Charging:** The functions whereby information related to a chargeable event is formatted and transferred in order to make it possible to determine usage for which the charged party may be billed. This applies for all charging levels (e.g., transport, service, content, etc.).

**On-Line Charging:** A charging process where charging information can affect, in real-time, the service rendered and therefore directly interacts with the session/service control.

Note: Due to the real-time interaction between charging and session/service control, this mode requires real-time interfaces.

**Off-line charging:** A charging process where charging information does not affect, in real-time, the service rendered.

Note: No real-time interaction is required between charging and session/service control but charging information may be delivered in real time or near real time.

## 3.2 Symbols

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

| | |
|---|---|
| Rb | On-line Charging Reference Point between Session Charging Function and Correlation Function |
| Rc | On-line Charging Reference Point between ECF and Correlation Function |
| Re | On-line Charging Reference Point towards a Rating Server |
| Rf | Off-line Charging Reference Point between an IMS Network Entity and CCF |
| Ro | On-line Charging Reference Point between an AS or MRFC and the ECF |

## 3.3 Abbreviations

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

| | |
|---|---|
| AS | Application Server |
| BGCF | Breakout Gateway Control Function |
| BS | Billing System |
| CCF | Charging Collection Function |
| CDR | Charging Data Records |
| CGF | Charging Gateway Function |
| CPCF | Content Provider Charging Function |
| CS | Circuit Switched |
| CSCF | Call Session Control Function |
| ECF | Event Charging Function |
| GCID | GPRS Charging ID |
| GGSN | Gateway GPRS Support Node |
| HPLMN | Home PLMN |
| ICID | IMS Charging Identifier |
| I-CSCF | Interrogating-CSCF |
| IM | IP Multimedia |
| IM CN SS | IP Multimedia Core Network Subsystem |
| IMS | IP Multimedia Core Network Subsystem |
| IMSI | International Mobile Subscriber Identity |
| IOI | Inter Operator Identification |
| IP | Internet Protocol |
| ISDN | Integrated Services Digital Network |

| | |
|---|---|
| MGCF | Media Gateway Control Function |
| P-CSCF | Proxy-CSCF |
| PLMN | Public Land Mobile Network |
| PSTN | Public Switched Telephone Network |
| QoS | Quality of Service |
| RAB | Radio Access Bearer |
| SCCF | Subscriber Content Charging Function |
| S-CSCF | Serving-CSCF |
| SGSN | Serving GPRS Support Node |
| SIP | Session Initiation Protocol |
| UE | User Equipment |

# 4. General Charging Requirements

Note: The following requirements are to be reviewed further by SA1, SA2, and SA5.

The called network can be – depending on regulatory and operational / trust conditions – the same IMS network as calling's party network or another IMS network or a non IMS network as e.g. Internet / PSTN / ISDN / CS domain of a PLMN.

1. The IMS charging architecture and mechanisms shall allow different charging models as required by regulatory conditions and inter-network policies. At least the following charging models shall be possible in a network:

   - The calling party incurs charging entirely for both the IMS session level charging and the transport level charging (e.g. charging done at GPRS) at calling and called party sides.

   - The calling party incurs transport level charging on calling party's side only and the entire charges related to the IMS session level. In this charging model, a called party incurs the transport level charging associated with that session on called party's side.

2. If the called party requests additional media components with regard to the initial request from calling party then called party can –depending on operational conditions of the service- be charged for these additional components.

3. The A and B parties home networks shall be able to exchange information on the charging to be applied to the current session or to some media component of the session. The calling party's home network can then, according to the service and inter-operator agreement, apply appropriate charging.

4. During session forwarding (e.g. A calls B and is "forwarded to C"), the initial calling party (A) incurs the charges from A to B while the forwarding party (B) incurs charges due to the "forwarded" session (e.g. from B to C).

5. In case of roaming (A calls B that is roaming to IMS network C), the calling party (A) incurs charges up to the home network of B. The latter incurs additional charges due to roaming from home network B to network C.

6. The IMS charging architecture shall allow the operator to support IMS Advice of Charge.

7. The IMS charging architecture shall allow the operator to charge for the transport and/or for the session service and/or for the content.

8. The IMS charging architecture shall allow the operator to charge per media component (e.g. voice, video).

9. The IMS charging architecture shall allow the operator to provide a single pre-paid account for a subscriber. In this case, that account combines the charges incurred by services in CS, PS, IMS, and other domains.

10. Charging indications received from the called network (such as free of charge) shall be taken into account by the Pre-paid mechanisms.

11. The IMS charging architecture shall provide means to correlate charging information generated at transport, service and content charging levels by the network entities in PS domain and IMS.

# 5 Architectural Concept

## 5.1 Architecture and Reference Points

### 5.1.1 Architecture reference model for off-line charging

Figure 5.1 below presents the off-line IMS charging architecture for non-roaming scenario.

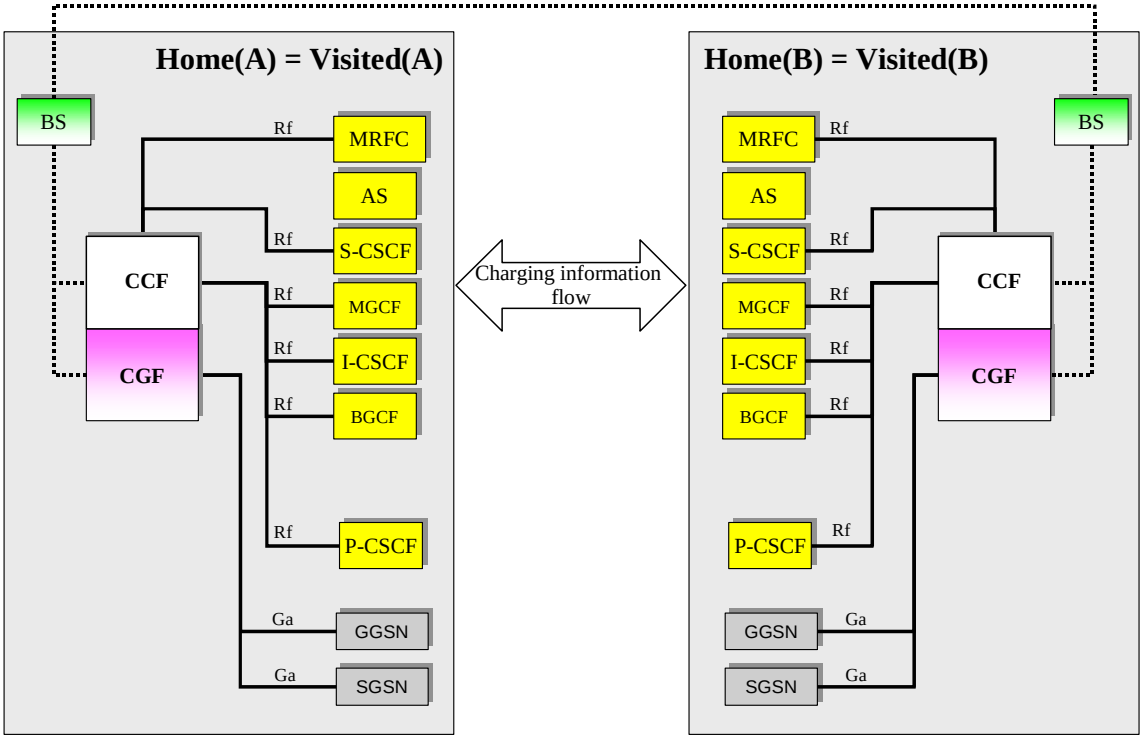


**Figure 5.1 Off-line IMS Charging architecture for non-roaming scenario**

*Note-i: the topological merging of some of the lines representing the Ga or Rf reference points for connecting with the CCF are performed for figure layout purposes only, and do not imply any other logical or physical association.*

*Note-ii: The interconnection of Application Servers with CCFs is depicted separately below in Figures 5.3 and 5.4.*

Figure 5.2 below presents the off-line IMS charging architecture for roaming scenario.

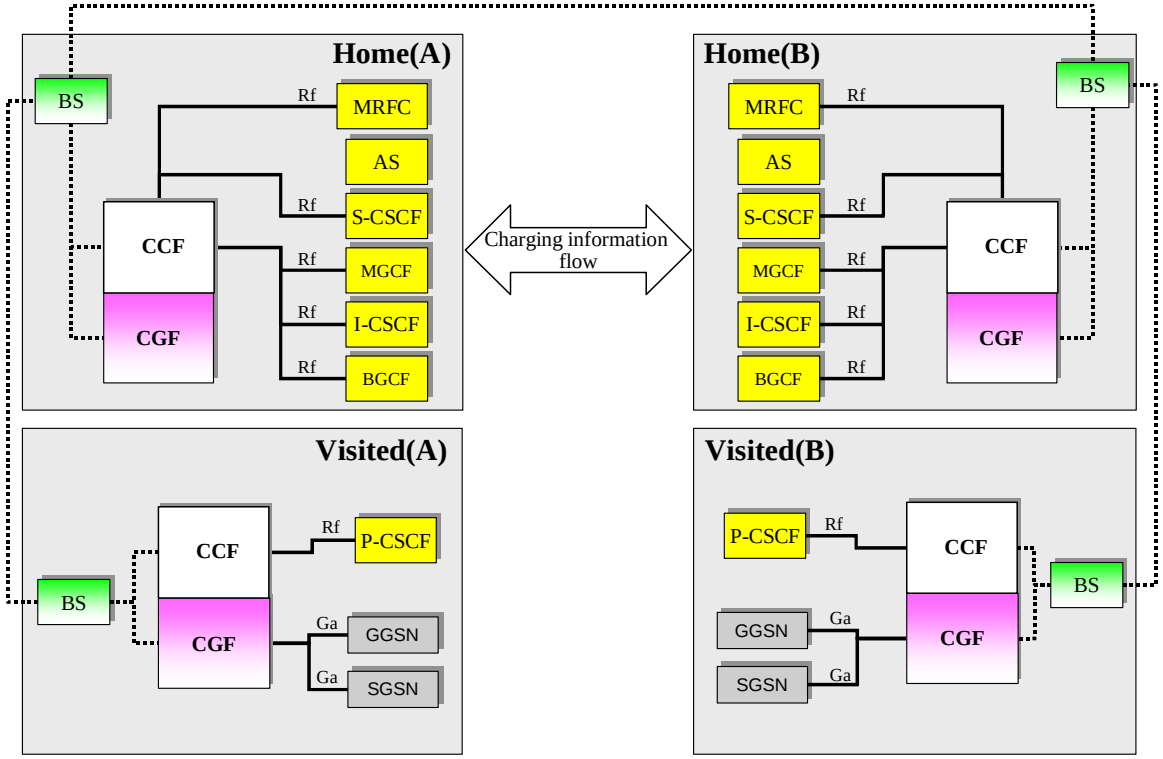


**Figure 5.2: Off-line IMS Charging architecture for roaming scenario**

*Note-i: the topological merging of some of the lines representing the Ga or Rfreference points for connecting with the CCF are performed for figure layout purposes only, and do not imply any other logical or physical association.*

*Note-ii: The interconnection of Application Servers with CCFs is depicted separately below in Figures 5.3 and 5.4.*

For the interconnection of Application Servers with CCFs there have been two different solutions identified. These two solutions are depicted in Figures 5.3 and 5.4.

1. The Application Server may be directly connected to the CCF via an off-line charging interface (Ra). This alternative is depicted in Figure 5.3 below.

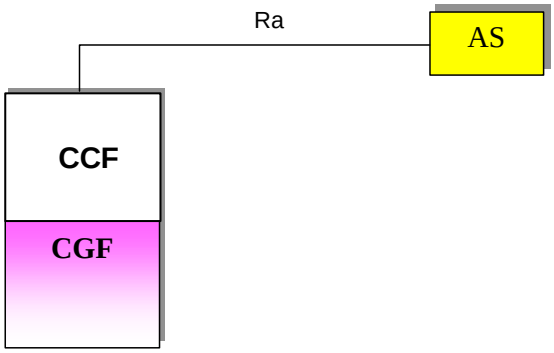


**Figure 5.3: AS and CCF are directly connected via an off-line charging interface (Ra)**

2. The Application Server may be connected to the CCF via the S-CSCF (ISC and Rf interfaces). This alternative is depicted in Figure 5.4 below.

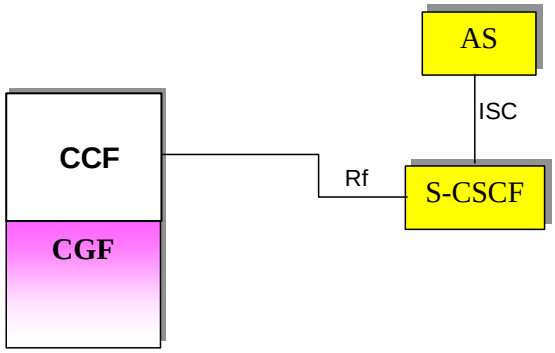


**Figure 5.4: AS and CCF are connected via the S-CSCF (ISC and Rf interfaces)**

### 5.1.1.1 Charging Collection Function

The CCF (Charging Collection Function) represented in the Figure 5.1 and 5.2 is a logical function, which will provide charging support for the IMS subscribers.

For off-line charging the CCF supports the following charging related functionality:

- The CCF has functionalities for IMS network entities equivalent to the CGF's functionalities as described in TS 32.200 [3], clause 4.2, for the PS domain. It also supports the following additional functionalities:
  - To enable charging based on different types of traffic (e.g. service charging, usage charging),
  - To enable validating, combining, aggregating and consolidating of the charging information, e.g. access charging information with the respective service (usage) charging information,
  - To enable consolidation of the relevant charging information into configurable format(s) to meet the business requirements (e.g. tariffing criteria, usage information, subscriber identifiers and service identifiers),
  - To enable charging information collection and aggregation in a function within each network from all involved charging information generating network entities. Whether this is conducted on a per- subscriber and/or per-session and/or per-service basis is FFS.
  - To perform correlation of charging information delivered from transport, session, service levels
  - To enable the removal of duplicated charging data.

It is assumed that there is communication taking place between CGF and CCF. Specification of this communication and an interface between CGF and CCF is for further study.

## 5.1.2 Architecture reference model for on-line charging

Figure 5.5 below presents the on-line IMS charging architecture.

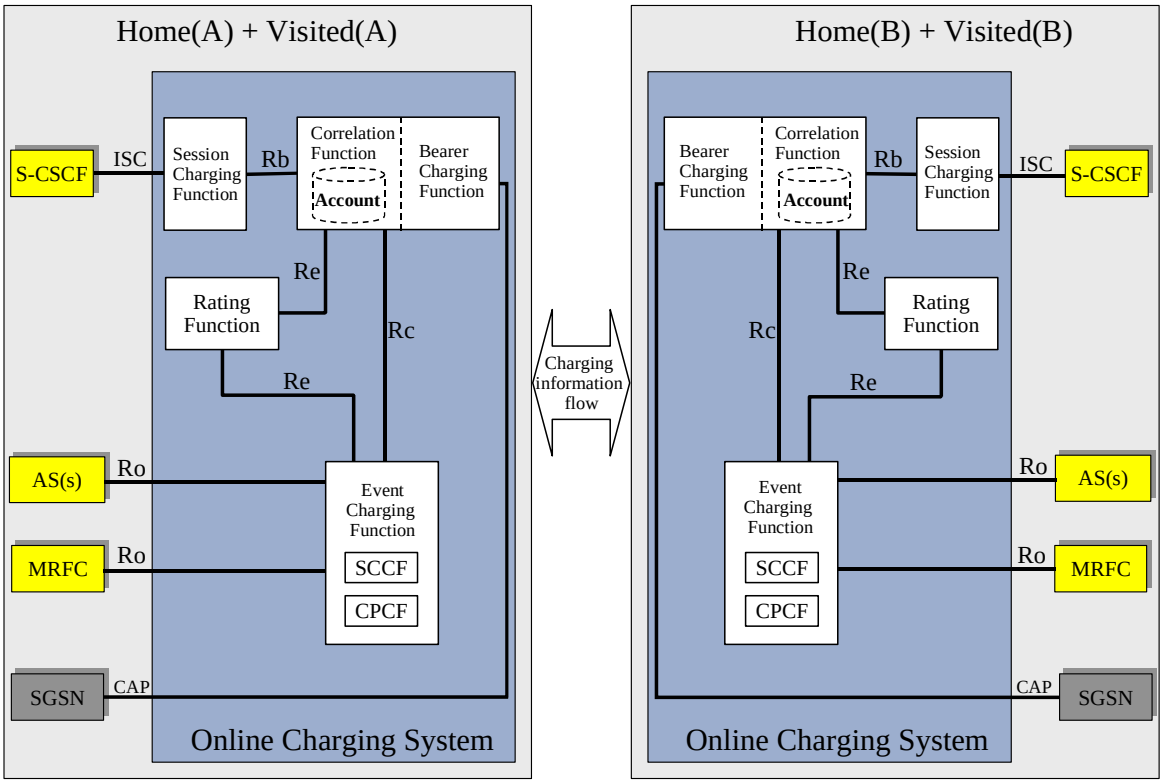


**Figure 5.5 On-line IMS Charging architecture**

Access Charging is performed using the CAP interface from the SGSN to the Bearer Charging Function.

Session Charging is performed using the ISC interface between the IMS Session Charging Function and the S-CSCF. Routing to the Session Charging Function is performed as per regular ISC procedures [4].

Event-based charging between an AS or MRFC and the Event Charging Function (ECF) is performed using the Ro reference point. The Ro reference point is described in sub-clause 5.2.3.2. ECF address information is distributed using SIP signalling such that Application Servers can use it to find the ECF.

Although it is desirable to standardise the Rb, Rc and Re reference points, this is not realistic within the Release 5 time frame.

The Re reference point allows the interaction with a Rating server.

The Rc reference point allows to perform the following functions:

- Interaction of the Event Charging Function with the Correlation Functions. Via the Correlation Function, the Bearer Charging Function and the Session Charging Function can be reached.
- Correlation
- Access to the Account of the subscriber.

The Rb reference point allows to perform the following functions:

- Interaction of the Session Charging Function with the Correlation Functions. Via the Correlation Function, the Bearer Charging Function and the Event Charging Function can be reached.
- Correlation
- Access to the Account of the subscriber.

#### 5.1.2.1 Session Charging Function

The Session Charging Function is responsible for Session Charging including the session control such as e.g. session termination. Other functions such as the Correlation Function communicate with the Session Charging Function via the Rb reference point.

#### 5.1.2.2 Bearer Charging Function

The Bearer Charging Function performs the Bearer Charging.

#### 5.1.2.3 Event Charging Function

The Event Charging Function (ECF) performs event-based charging (content charging). It makes use of the rating function. The ECF communicates with the Account via the Rc reference point. The ECF may correlate several event-based charging requests. It communicates with the Correlation Function to correlate Event Charging with Bearer Charging and Session Charging.

The SCCF and the CPCF, which are described in sub-clause 5.1.5, constitute parts of the ECF.

### 5.1.3 IMS charging architecture reference points

#### 5.1.3.1 Offline Charging Reference Point IMS Network Entity - CCF (Rf)

The Rf reference point supports off-line mechanisms between the CCF and each of the IMS network entities I-CSCF, P-CSCF, S-CSCF, MGCF, MRFC, BGCF.

The Rf reference point shall allow for at least the following features:

- Reliable transfer of Charging Information with acknowledgement mechanisms from the Network Element to the CCF.
- Support redundancy mechanisms.
- Enable re-routing in the event of communication link / node failures, network congestion, or network re-configuration. In addition, network nodes generating and sending CDRs shall support buffering mechanisms.
- Support early detection of congestion at the receiving node in order to activate re-routing.
- Support detection of node / link recovery for re-establishing routing of Charging information.
- Ability of a (the) CCF to advertise to the Network Elements about its CDR receiving capability (e.g. after a period of service downtime).
- Support for multiple payload types to cater for transferring a variety of different charging data.

#### 5.1.3.2 Ro Reference Point (AS/MRFC – ECF)

Event-based charging between an AS or MRFC and the ECF is performed using the Ro reference point.

- Ro shall be an open standardised interface within Release 5.
- The protocol selected for the Ro reference point shall be easily extendable to include additional online charging functions.
- The Ro reference point needs to support integrity protection and authentication for the case that the AS is outside the operator domain.

### 5.1.4 Discovery and distribution of Charging Function address(es)

The address(es) of the Charging Function(s) are allocated on a per-subscriber-profile basis.

The Charging Function name(s) to be contacted for a particular SIP dialog and/or service shall be uploaded to the S-CSCF from the HSS during the registration phase, and is applicable for the duration of the registration. There may be a separate primary and secondary Charging Function address used.

After the selection of the Charging Function name(s) has been done in the S-CSCF, these name(s) shall be transferred to all network elements (CSCFs, ASs, etc.) involved in charging for a particular SIP dialog and/or IMS service within a particular IMS network. This transfer shall be done within appropriate session signalling messages (SIP). The Charging Function name(s) shall not be passed beyond the boundaries of a particular IMS network.

IMS entities beyond the home IMS network are assumed to be using (a) pre-configured Charging Function(s).

### 5.1.5 Content Charging Functions

#### 5.1.5.1 Subscriber Content Charging Function (SCCF)

The **Subscriber Content Charging Function (SCCF)** is located in the operator network where the account of the subscriber is located. This account can be a prepaid or a post-paid account. The SCCF handles content charging requests that are made when the subscriber accesses the content. Upon such a content charging request, the SCCF may for example check or debit the subscriber's account. Content charging requests are typically received from the Content Provider Charging Function (CPCF). In particular, the SCCF has the following responsibilities:

- to handle charging requests from the CPCF
- to find the account of the subscriber. The account may be either a prepaid account or a postpaid account.
- to initiate a procedure to get a charging confirmation from the subscriber, if such a confirmation is needed.
- to debit or to credit a certain amount from/to the account of the subscriber.

#### 5.1.5.2 Content Provider Charging Function (CPCF)

The **Content Provider Charging Function (CPCF)** is located in the operator network and/or in another network such as for example a Service Provider network that supports the content server. It is not expected that every content server has a business relationship with every IMS network. The CPCF receives content charging request from the content server, processes them, and relays them to the Subscriber Content Charging Function (SCCF). Additionally, the CPCF manages the account that is maintained for the content provider. Upon receipt of a charging request from the content server, the CPCF processes the request and relays it to the SCCF. The CPCF modifies the account of the content provider accordingly. In particular, the CPCF has the following responsibilities:

- to handle charging requests from the content server.
- to communicate with the SCCF that manages the subscriber's account. This may imply a request to the SCCF to charge or to credit the account of the subscriber.

## 5.2 Correlation of Charging Information from Different Network Elements and Domains

### 5.2.1 Charging Correlation Levels

The following levels of correlation for IMS charging shall be considered:

1. **Correlation within a session.** A session may comprise a number of media components. It shall be possible to correlate the charging data of the different media components belonging to a session.

2. **Correlation at media component level.** For a session comprising several media components (such as audio and video), charging data is generated for each media component and needs to be correlated between network elements. For this, a component identifier shall be unique and shall clearly identify to which media component of a session this charging information belongs to. This component identifier is not exchanged between network elements and is based on the ordering of media flows in the SDP. This ordering is the same as the one used in the binding information passed to the PS Domain.

Correlation between the IMS and the PS domain shall take into account the above described levels.

### 5.2.2 Charging Correlation Principles

To support the correlation of charging information, the following principles apply to both offline and online charging:

1. The correlation of charging information for an IMS session is based on the use of IMS Charging Identifiers.
2. The first IMS network entity within the SIP signalling path is responsible for assigning an ICID. This ICID shall then be passed along the whole SIP signalling path in an end-to-end manner. However, this shall not preclude further elements (CSCFs) along the session path generating additional identifiers to be passed along. When the AS is the initiator of the session, the AS is responsible for assigning the ICID.
3. The ICID is passed to all IMS network entities in the SIP signalling path. This is performed using SIP signalling.
4. For the charging correlation between the PS domain and the IMS, one or more GPRS Charging IDs, which identify the PDP contexts of the session [7], are passed from the PS domain to the IMS. More specifically, these identifiers need to be transferred from the GGSN to the P-CSCF.
   Also, the P-CSCF passes the ICID to the GGSN. The ICID is not passed to the SGSN
5. The GPRS Charging IDs (GCIDs) and GGSN Address are passed by the P-CSCF to the S-CSCF and the AS using SIP signalling. Along with the ICID, the S-CSCF passes the GCIDs and GGSN address to on-line and off-line charging functions. The GCIDs and GGSN address are not transferred from one Home IMS (e.g. of the A-Party) to another Home IMS (e.g. the one of the B-Party).
6. The ICID applies for the duration of the event with which it is associated. For example, and ICID assigned for registration is valid for all registration-related charging procedures until a de-registration occurs, an ICID assigned for session establishment is valid until session termination, etc.
7. The charging correlation identifiers (ICIDs, GCIDs) shall not be passed to the UE. They may however be passed to a content server connected as an endpoint.

The charging correlation principles outlined above shall be applicable to other types of access networks. For instance, it shall be possible to use instead of "GPRS charging ID and GGSN address" an equivalent term of the associated access network.

The detailed effects of certain complex scenarios (e.g. forking, multiparty sessions) to these charging correlation principles are for further study.

## 5.3 Exchange of Charging Information between Networks

### 5.3.1 Charging information flow between home IMS networks

The Charging information flow may support the following functionalities:

- Indication of who wants to subsidize whom (e.g. "A-party pays" or "reverse charge call")
- Indication of media resources to be subsidized (e.g. final SDP negotiated between A and B UEs)

The following mechanisms have been identified for charging information flow:

- Pre-arranged mechanism based on secure relation between networks
- Additionally, real-time negotiations on a per-session basis may be conducted:
  - Using the session initiatiation protocol
  - Negotiation between the charging domains (CCFs)

### 5.3.2 Identification of operators for charging

To enable the different operators involved in IMS sessions to identify each other, the Inter Operator Identification concept (IOI) is introduced. Inter Operator Identification allows operators involved with session signalling to identify each other by exchanging operator identification information within the SIP signalling. The Inter Operator Identification (IOI) concept may help to support inter operator charging.

The following requirements relate to the Inter Operator Identification concept:

- The Inter Operator Identification concept shall allow operators to uniquely identify each other for the SIP based requests; for example between A's HPLMN and B's HPLMN.
- The Inter Operator Identification concept can be used for inter operator accounting identification purposes.
- It shall be possible to prevent the information used for Inter Operator Identification from being passed to the UE.
- It shall be possible to apply the Inter Operator Identification concept on a peer to peer basis between operators. It shall be possible to use different identity values for operator identification between operators involved in IMS sessions.
- Inter Operator Identification identities shall be included within SIP signalling:
  - When a SIP request is passed out of a network the Inter Operator Identification identity of that network shall be included in the SIP signalling.
  - When a SIP response is returned the Inter Operator Identification identity of that responding network shall be included in the SIP signalling.
- Each network is responsible for including its own unique Inter Operator Identification Identity into the SIP signalling. The Inter Operator Identification Identity shall be unique for each operator (for example the Inter Operator Identification Identity of Home Operator A is different from Home Operator B).
- Inter Operator Identification Identities received in the session signalling shall be incorporated into the CDRs produced by the IMS network elements. The operator identification information may be used for inter operator accounting purposes.
- The format of the IOI and the possible reuse of existing SIP protocol tools to cover the IOI concept is subject to stage-3 design.
- The allocation of the IOI values for the operators is outside the scope of 3GPP standardization.

Note: The relationship of the Inter Operator Identification concept with security aspects between operators is for further study.

# 6 Examples for Charging Scenarios

## 6.1 Transactions of Content Charging

In the following scenario, we assume that a subscriber (UE-A) accesses content provided by a content server (UE-B).

Figure 1 shows the transactions that are required between UE-A, SCCF, CPCF, and the content server in order to perform content charging.

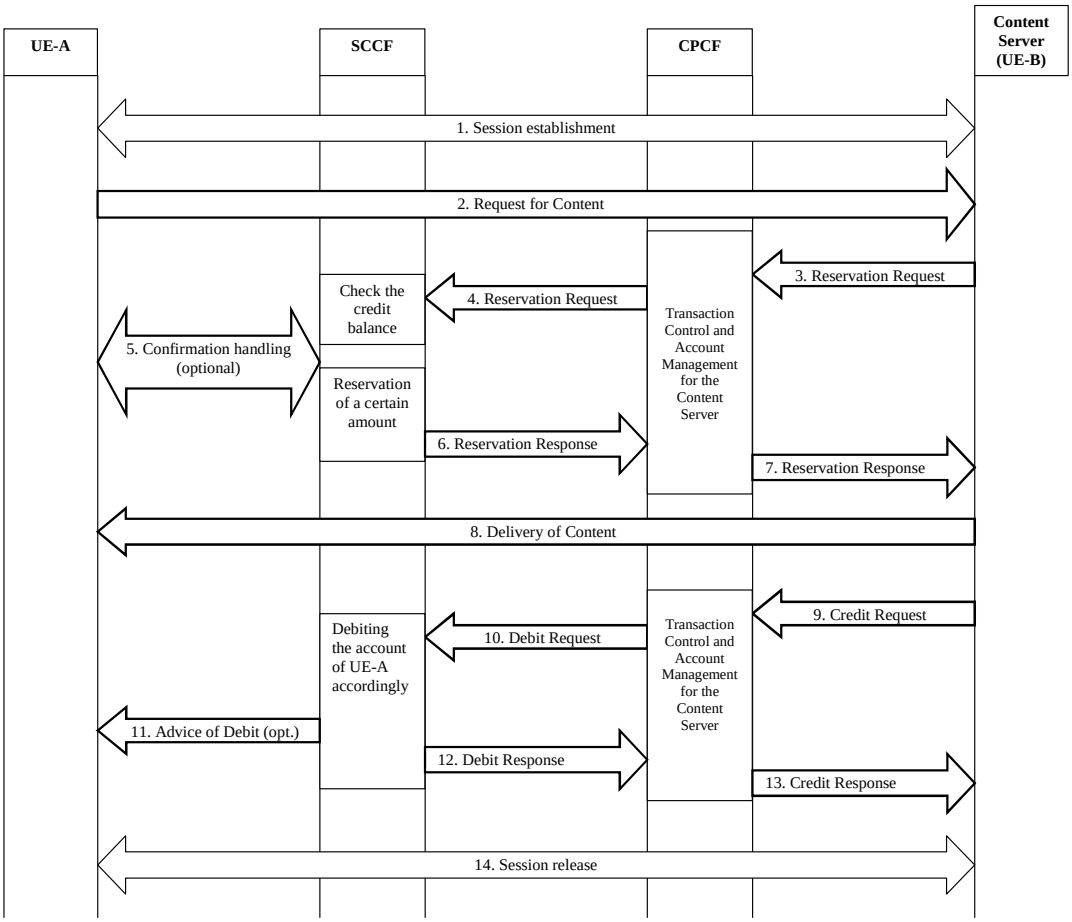


**Figure 6.1: Transactions for content charging**

Description of the transactions between the involved entities:

1. The session is established.
2. UE-A requests the desired content from the content server.
3. The content server sends a credit reservation request to the CPCF. The CPCF supervises the transaction and manages the account that is maintained for the content server.
4. The CPCF forwards the reservation request to the SCCF. The SCCF checks the credit balance of UE-A.
5. SCCF initiates a confirmation handling to the UE-A, if such a confirmation is desired.
6. If the credit balance is sufficient, the SCCF reserves the amount of money in advance and sends a reservation response to the CPCF.
7. The credit approval is forwarded to the content server by sending a reservation response.
8. As requested by UE-A, the content server delivers the desired content.
9. The content server sends a credit request to the CPCF. The CPCF supervises the transaction and manages the account that is maintained for the content server.
10. On reception of a debit request, the SCCF debits the subscriber's account.
11. Optionally, the SCCF may send an advice of debit to the subscriber (UE-A).
12. The SCCF acknowledges the debit request by sending a debit response to the CPCF.
13. The CPCF acknowledges the credit request by sending a credit response to the content server.

14. The session is released.

# 7 Charging Message Flows

## 7.1 Distribution of charging information from different network elements and domains

Various information supporting On-line and Off-line charging mechanisms need to be distributed within the IMS. It is necessary to have available information to allow the correlation of charging data from the GPRS transport, from the IMS session control, and from Application Servers.

The correlation of CDRs generated by GPRS and by the IMS is done by identifying the set of GPRS CDRs by their GPRS Charging ID and GGSN Address and associating them with CDRs generated by IMS entities. This is done by including the GCIDs and GGSN Address in the Charging Data generated by the S-CSCF. The specific methods for correlation is up to the correlating entity but may be done either for off-line charging or for on-line charging. The following sections identify the procedures related to the generation and distribution of GPRS and IMS Charging IDs.

It is necessary to pass the GCIDs and GGSN Address and the IMS Charging ID, to be used for IMS CDRs, to the IMS elements that require this information. In addition, CDRs from the IMS elements must be passed on to a Charging Collection Function for Off-line charging and to an On-line Charging Function for On-line charging.

In order to obtain the GCID in the IMS, this information is passed from the GGSN to the P-CSCF at the time of PDP context establishment. From the P-CSCF it is passed on to the S-CSCF in appropriate SIP messages.

### 7.1.1 Registration

On Registration, the P-CSCF generates a unique IMS Charging ID (ICID) and sends this information in the registration request on to the S-CSCF. The S-CSCF includes the ICID in any CDRs related to registration.

This flow shows the use of charging IDs in SIP registration operation. The SGSN, I-CSCF and HSS are not shown to simplify the flows.

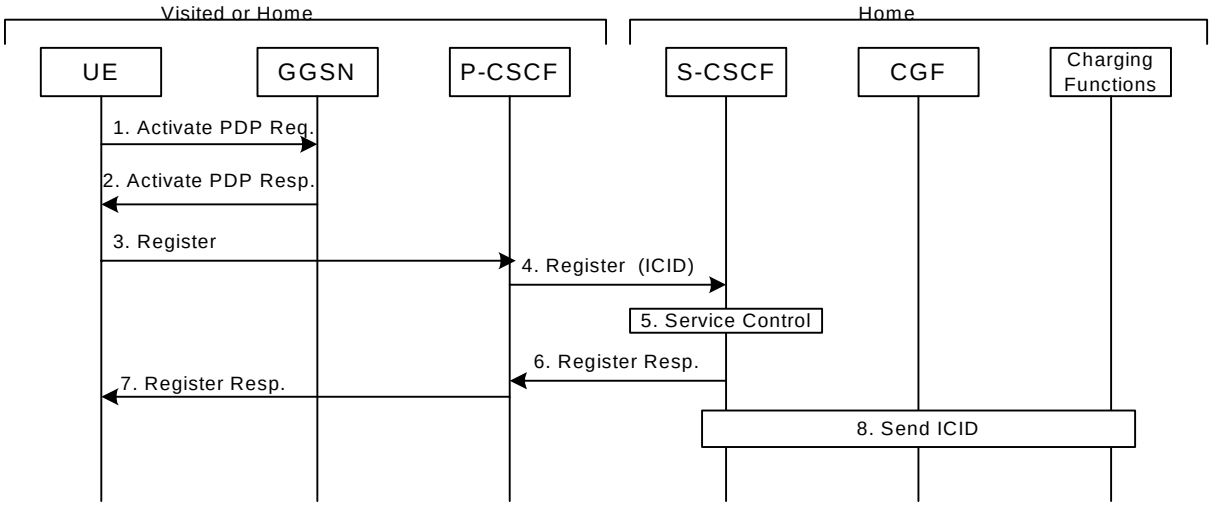


**Figure 7.1. Charging information distribution and use at SIP registration time**

1. The UE activates a PDP context for SIP signaling.
2. The GPRS subsystem activates the signaling PDP context and a P-CSCF is discovered.
3. Sometime after activating the PDP context, the UE initiates SIP registration to the P-CSCF.

4. The P-CSCF generates an ICID and forwards the SIP registration toward the home network (I-CSCF/S-CSCF) including the ICID. Following interactions between the I-CSCF and HSS, the S-CSCF is identified and the SIP registration is forwarded on. The S-CSCF records the ICID.

5. If registration time service control is performed, the ICID would be passed to the AS at this time.

6. The Registration Response message is sent to the P-CSCF.

7. The Registration Response message is forwarded to the UE with the charging information removed.

8. The ICID is sent from the S-CSCF to the Charging Functions. How and at what time this information is transferred is subject to Stage-3 design.

### 7.1.2 Session Establishment – Mobile Origination

On receipt of an Invite from the UE, the P-CSCF generates an ICID and inserts it in the forwarded Invite. The S-CSCF keeps the generated ICID and includes it in any CDRs related to this session. The ICID may be captured and used by any IMS entities on the signaling path, including the calling and called networks. The originating home S-CSCF and other desired entities will include this ICID in CDRs associated with this session.

If the UE activates/modifies one or more PDP contexts for session bearers, a GCIDs and GGSN Address are generated by the GGSN for each context activated/modified and is passed to the P-CSCF. The P-CSCF will include this information in the next SIP message to the S-CSCF. The S-CSCF will keep it for inclusion, along with the associated ICID, and pass this information in any subsequent CDRs or in On-line charging data exchanges with the Online Charging System related to this session.

This flow shows the use of charging IDs in a mobile originated session initiation operation. The SGSN, I-CSCF and HSS are not shown to simplify the flows.

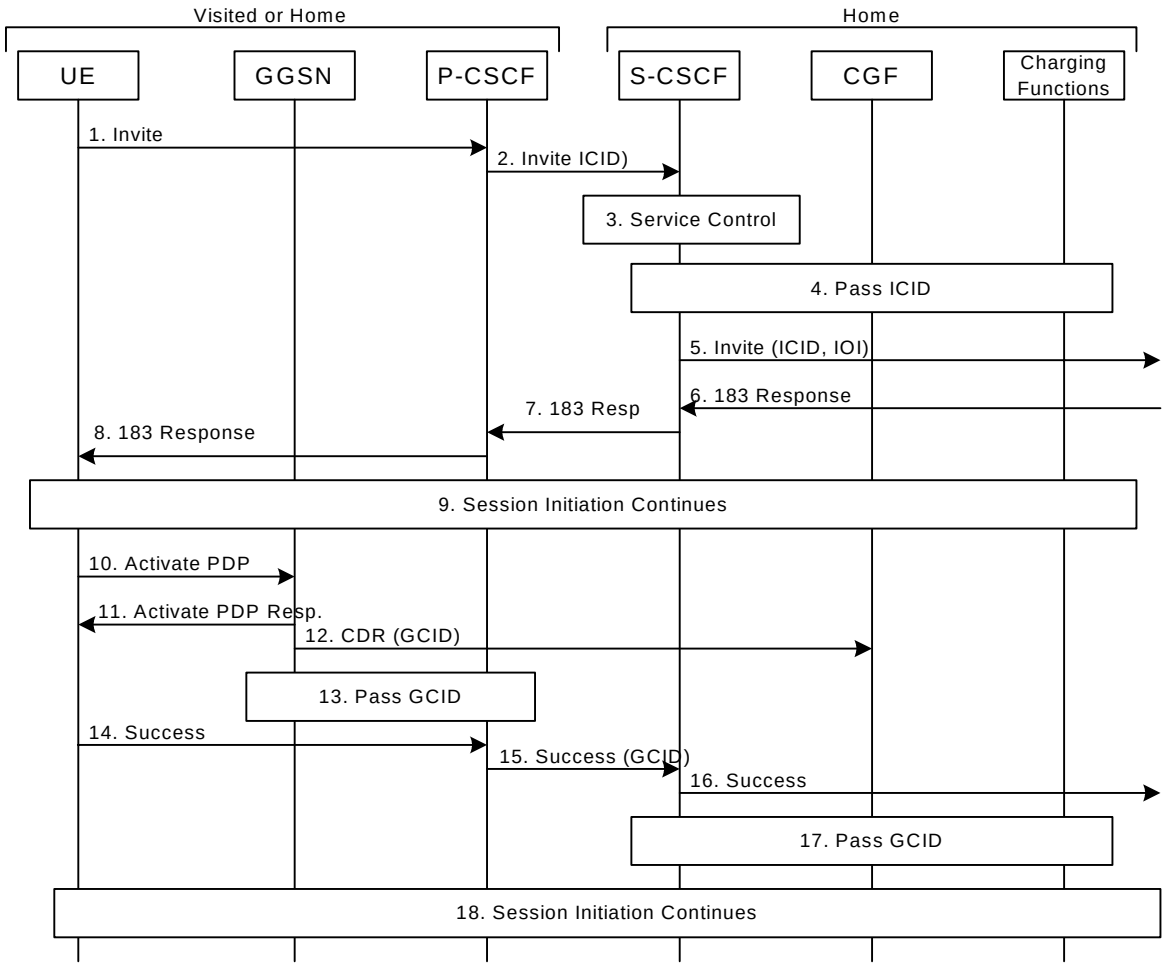


**Figure 7.2. Charging information distribution and use at SIP mobile origination**

1. The UE sends an Invite message via the P-CSCF.
2. The P-CSCF generates an IMS Charging ID for this session. The P-CSCF forwards the Invite to the S-CSCF.
3. If Service Control is performed for this session, the S-CSCF interacts with the AS and passes the ICID.
4. The ICID is passed from the S-CSCF to the Charging Functions. How and at what time this information is transferred is subject to Stage-3 design.
5. The Invite is forwarded from the S-CSCF toward the called party. This includes the ICID and the IOI.
6. The 183 Response is received from the called direction. This may or may not still contain the ICID and it may contain an IOI from the called party network.
7. The 183 Response is forwarded to the P-CSCF.
8. The 183 Response is forwarded to the UE without the ICID.
9. The session initiation continues.
10. After sending the Final SDP message, the UE activates/modifies one or more PDP contexts for session bearers.
11. The GPRS subsystem responds for each activation/modification.
12. Sometime after activating/modifying the PDP context, the GGSN sends a CDR(s) to the CGF with the GCID(s).

13. The GCIDs and the GGSN Address are passed from the GGSN to the P-CSCF. How and at what time this information is transferred is subject to stage-3 design.

14. The UE sends the SIP resource reservation success indication to the P-CSCF.

15. The P-CSCF forwards the Success message to the S-CSCF including the GCID(s) for this session.

16. The S-CSCF records the GCID(s) for use for this session. The S-CSCF then forwards the resource reservation success indication.

17. The GCIDs and the GGSN Address are passed from the S-CSCF to the Charging Functions. How and at what time this information is transferred is subject to Stage-3 design.

18. The session initiation continues as usual.

### 7.1.3 Session Establishment – Mobile Termination

On receipt of an Invite from an MGCF or from another IMS or IP endpoint, the first IMS network element will generate an ICID and insert it in the forwarded Invite. If the Invite already contains an ICID assigned by the calling network, the called network may add additional local charging identifier information as necessary.

The ICID is received by the P-CSCF, which removes it from the Invite and keeps it for inclusion in any CDRs related to this session.

If the UE activates/modifies one or more PDP contexts for session bearers, a GPRS Charging ID and GGSN Address are generated by the GGSN for each context activated/modified and is passed to the P-CSCF. The P-CSCF will include this information in the next SIP message to the S-CSCF. The S-CSCF will keep it for inclusion, along with the associated ICID, in any subsequent CDRs related to this session.

This flow shows the use of charging IDs in SIP mobile terminated session initiation operation. The SGSN, I-CSCF and HSS are not shown to simplify the flow.

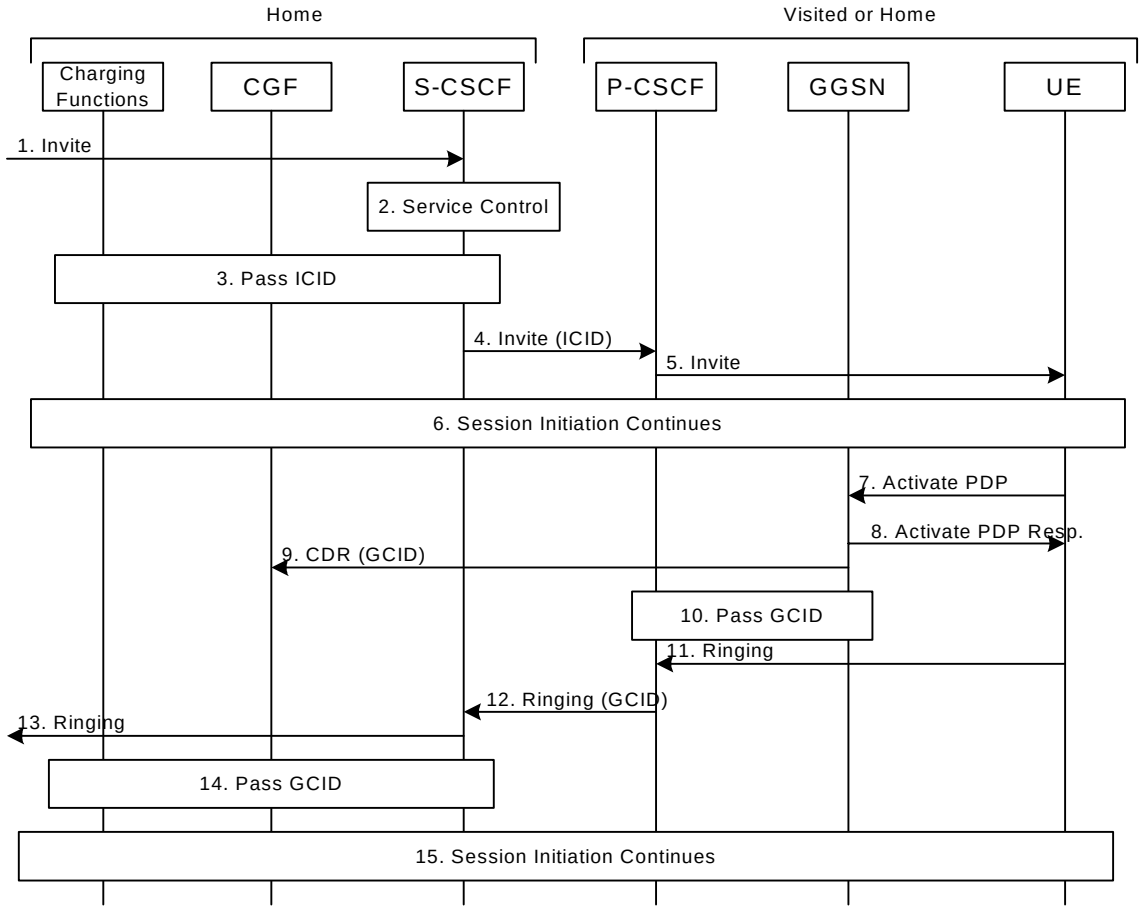


**Figure 7.3. Charging information distribution and use at SIP mobile termination**

1. An Invite arrives at the network of the called party. If the invite conatins an ICID, this is used (perhaps augmented with additional local network data). Otherwise the first IMS entity in the called network generates the ICID.

2. If terminating services are invoked, the ICID would be passed to the AS at this time.

3. The ICID is passed from the S-CSCF to the Charging Functions. How and at what time this information is transferred is subject to stage-3 design.

4. The S-CSCF forwards the Invite to the P-CSCF including the ICID.

5. The P-CSCF forwards the Invite to the UE without the ICID.

6. Session initiation continues as usual.

7. After receiving a resource reservation successful indication from the other end, the UE activates/modifies PDP contexts as necessary for session bearers.

8. The GPRS subsystem returns a successful response.

9. Sometime after activating/modifying the PDP context, the GGSN sends a CDR(s) to the CGF with the GCID.

10. The GCIDs and the GGSN Address are passed from the GGSN to the P-CSCF. How and at what time this information is transferred is subject to stage-3 design.

11. Continuing session establishment, the UE sends a ringing indication to the P-CSCF.

12. The P-CSCF forwards the Ringing indication toward the S-CSCF with the GPRS Charging ID(s) and GGSN Address included.

13. The S-CSCF forwards the Ringing indication on without the GCID.

14. The GCIDs and the GGSN Address is passed from the S-CSCF to the Charging Functions. How and at what time this information is transferred is subject to stage-3 design.

15. The session initiation continues as usual.

### 7.1.4 Use by Application Servers

The ICID is made available in the SIP signaling to Application Servers acting in a service control mode and can be made available to those acting as a SIP endpoint. Such applications would include the ICID in any CDRs related to this session.

# Annex A:
# Change history

*It is usual to include an annex (usually the final annex of the document) for reports under TSG change control which details the change history of the report using a table as follows:*

| Change history | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Date** | **TSG #** | **TSG Doc.** | **CR** | **Rev** | **Subject/Comment** | **Old** | **New** |
| 2002-03 | | | | | Output of SA2#23 in Sophia Antipolis, technical content identical to version 1.2.0 | 1.2.0 | 2.0.0 |