

Source: CN3
Title: TS 29.211 v2.0.1 Rx interface and Rx/Gx signalling flows (for approval)
Agenda item: 9.22
Document for: APPROVAL

Presentation of Specification to TSG or WG

Presentation to: TSG CN Plenary Meeting #27
Document for presentation: TS 29.211, Version 2.0.1
Presented for: Approval

Abstract of document:

The TS defines the Rx reference point specifying the Flow Based Charging information provision procedures between the Application Function (AF) and the Charging Rule Function (CRF)

Changes since last presentation to Meeting #26:

This is the first presentation for approval. The document was presented for information at CN#26

Outstanding Issues:

None

Contentious Issues:

None

3GPP TS 29.211 V42.0.0-1 (20045-0244)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Core Network; Rx Interface and Rx/Gx signalling flows (Release 6)



The present document has been developed within the 3rd Generation Partnership Project (3GPPTM) and may be further elaborated for the purposes of 3GPP.

The present document has not been subject to any approval process by the 3GPP Organizational Partners and shall not be implemented. This Specification is provided for future development work within 3GPP only. The Organizational Partners accept no liability for any use of this Specification. Specifications and reports for implementation of the 3GPPTM system should be obtained via the 3GPP Organizational Partners' Publications Offices.

Keywords

UMTS, Flow Based Charging, Gx, Rx, Signalling
Flows

3GPP

Postal address

3GPP support office address

650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet

<http://www.3gpp.org>

Copyright Notification

No part may be reproduced except as authorized by written permission.
The copyright and the foregoing restriction extend to reproduction in all media.

© 2005⁴, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TTA, TTC).
All rights reserved.

Contents

Foreword.....	5
1 Scope	6
2 References	6
3 Definitions and abbreviations	6
3.1 Definitions.....	6
3.2 Abbreviations	7
4 Rx reference point	87
4.1 Overview	87
4.2 Rx reference model	8
4.3 Functional elements and capabilities.....	109
4.3.1 Charging Rules Function (CRF).....	109
4.3.2 Application Function (AF)	109
5 FBC Procedures over Rx	109
5.1 CRF	109
5.1.1 Initial Provision of Session Information.....	109
5.1.2 Modification of Session Information	119
5.1.3 FBC Gate function.....	1140
5.1.4 AF Session Termination	1140
5.1.5 Bearer Release	1140
5.1.6 Other Bearer Events.....	1240
5.2 AF	1244
5.2.1 Provision of Service Information at session establishment	1244
5.2.2 Session modification.....	1244
5.2.3 FBC Gate function.....	1344
5.2.4 Session modification.....	1344
5.2.5 AF Session Termination	1344
5.2.6 Bearer Release	1344
5.2.7 Other Bearer Events.....	1344
6 Binding the AF Session Information to the Bearers	1342
7 Rx Protocol	1412
7.1 Protocol Support.....	1412
7.1.1 Advertising application support.....	1412
7.2 Securing Diameter messages.....	1412
7.3 Rx messages	1413
7.3.1 AA-Request (AAR) command	1513
7.3.2 AA-Answer (AAA) command.....	1513
7.3.3 Re-Auth-Request (RAR) command.....	1513
7.3.4 Re-Auth-Answer (RAA) command.....	1644
7.3.5 Session-Termination-Request (STR) command	1644
7.3.6 Session-Termination-Answer (STA) command	1644
7.3.7 Abort-Session-Request (ASR) command	1745
7.3.8 Abort-Session-Answer (ASA) command	1745
7.4 Re-used AVPs for Rx Protocol	1745
8 Rx/Gx Signalling Flows	1917
8.1 AF session establishment or modification.....	2017
8.2 Request of Charging Rule	2348
8.3 Removal of Charging Rules at AF session release.....	2520
8.4 Bearer Release.....	3022
Annex A (normative): Support for SIP forking	3423
A.1 Resources for early media for forked responses.....	3423
A.2 Updating the Charging Rules information at the final answer	3523

Annex B (informative): Change history	3524
Foreword	4
1 Scope	5
2 References	5
3 Definitions and abbreviations	5
3.1 Definitions	5
3.2 Abbreviations	6
4 Rx reference point	76
4.1 Overview	76
4.2 Rx reference model	7
4.3 Functional elements and capabilities	97
4.3.1 Charging Rules Function (CRF)	97
4.3.2 Application Function (AF)	97
5 FBC Control Procedures over Rx	98
5.1 CRF	98
5.1.1 Provision of Session Information	98
5.1.2 FBC Gate function	108
5.1.3 AF Session Termination	108
5.1.4 Bearer Release	108
5.2 AF	119
5.2.1 Provision of Service Information at session establishment	119
5.2.2 FBC Gate function	119
5.2.3 Session modification	119
5.2.4 AF Session Termination	119
5.2.5 Bearer Release	119
6 Binding the AF and the Bearer Sessions	129
7 Rx Protocol	1210
7.1 Protocol Support	1210
7.1.1 Advertising application support	1310
7.2 Gq re used AVPs	1310
8 Rx/Gx Signalling Flows	1811
Annex A (informative): Change history	3012

Foreword

This Technical Specification 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:

Version x.y.z

where:

- x the first digit:
 - 1 presented to TSG for information;
 - 2 presented to TSG for approval;
 - 3 or greater indicates TSG approved document under change control.
- 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 provides the stage 3 specification of the Rx reference point interface.

The functional requirements and the stage 2 specifications of the Rx reference point are contained in 3GPP TS 23.125 [2]. The Rx reference point is used to exchange Flow Based Charging information between the Charging Rules Function (CRF) and the Application Function (AF).

Whenever it is possible the present document specifies the ~~the~~ protocol by reference to specifications produced by the IETF within the scope of Diameter and to the Gq specification 3GPP TS 29.209 [4]. ~~The present specification also shows FBC signalling flows for provision of service level information and Charging Rules activation. The flows are used as basis for developing FBC related protocol descriptions for new and existing specifications.~~

The present specification ~~adds~~ also provides detailed signalling flows for FBC procedures over the interfaces that correspond to Rx and Gx reference points.

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 and/or edition number or version number) 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 23.125: "Overall high level functionality and architecture impacts of flow based charging; Stage 2".
- [3] 3GPP TS 29.210: "Charging rule provisioning over Gx interface".
- [4] 3GPP TS 29.209: "Policy control over Gq interface".
- [5] IETF RFC 3588: "Diameter Base Protocol".
- [6] [3GPP TS 33.210: "3G Security; Network Domain Security \(NDS\); IP network layer security"](#).
- [7] [draft-ietf-aaa-diameter-nasreq-17.txt: "Diameter Network Access Server Application"](#).
- [8] [draft-ietf-aaa-diameter-cc-06.txt: "Diameter Credit Control Application"](#).

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and [3GPP TS 23.125 \[2\]](#) and the following apply:

Application Function (AF): element offering application(s) that ~~require the control of~~ uses IP bearer resources. The AF is capable of communicating with the CRF to transfer dynamic Charging Rules application information

NOTE: ~~The AF is capable of communicating with the PDF to transfer dynamic QoS related application information.~~ One example of an AF is the P-CSCF of the IM CN subsystem.

AF Session: an application level session established by an application level signalling protocol offered by the AF that requires a session set-up with explicit session description before the use of the service. ~~An AF session is composed of one or more Service Data Flows.~~

NOTE: One example of an application session is an IMS session.

Attribute-Value Pair (AVP): See RFC 3588 [5], corresponds to an Information Element in a Diameter message.

Binding: the CRF process of associating IP flows described in AF Service Information with bearers.

~~**Charging Rule:** a set of information including the Service Data Flow Filters, and the Charging Key, for a single Service Data Flow (further details can be found in 3GPP TS 23.125 [2] clause 5.2).~~

IP flow: a unidirectional flow of IP packets with the same source IP address and port number and the same destination IP address and port number and the same transport protocol. Port numbers are only applicable if used by the transport protocol.

Packet Flow: a specific user data flow carried through the Traffic Plane Function. A Packet Flow can be an IP flow.

~~**Rx Session:** Diameter session in the Rx interface establish for one UE identifier within an AF session.~~

Service Information: The set of information conveyed from the AF to the CRF over the Rx interface to be used as a basis for Flow Based Charging decisions at the CRF, including information about the AF session (e.g. application identifier, type of media, bandwidth, IP address and port number) and parameters controlling the CRF behavior. The encoding of the Service Information is provided in 3GPP TS 29.209 [4].

~~**Service Data Flow (SDF):** aggregate set of Packet Flows. In the case of GPRS, it shall be possible that a Service Data Flow is more granular than a PDP context. From the AF point of view a Service Data Flow corresponds to a Diameter Session.~~

~~**Service Data Flow Filter:** a set of filter parameters used to identify one or more of the Packet Flows constituting a Service Data Flow. At least the following means for the Packet Flow identification shall be supported: source and destination IP address, port, transport protocol, or application protocol.~~

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply:

AAA	AA-Answer
AAR	AA-Request
AF	Application Function
ASA	Abort-Session-Answer
ASR	Abort-Session-Request
AVP	Attribute-Value Pair
CRF	Charging Rule Function
CSCF	Call Session Control Function
DCC	Diameter Credit Control
FBC	Flow Based Charging
IANA	Internet Assigned Numbers Authority
IM	IP Multimedia
IMS	IP Multimedia CN Subsystem
OCS	Online Charging System
P-CSCF	Proxy-CSCF
QoS	Quality of Service
SDI	Session Description Information
STA	Session-Termination-Answer
STR	Session-Termination-Request

TPF Traffic Plane Function

4 Rx reference point

4.1 Overview

The Rx interface is used to exchange Flow Based Charging control information between the Charging Rules Function (CRF) and the Application Function (AF). As defined in the stage 2 specifications (3GPP TS 23.125 [2]), this information is used by the CRF for the Flow Based Charging (FBC) decisions. The CRF exchanges the Flow Based Charging control information with the Traffic Plane Function (TPF) as specified in 3GPP TS 29.210 [3].

The Rx interface may be an intra- or inter-domain interface. One CRF shall be able to serve more than one AF and one given AF may interact with a number of CRFs, although on an AF session basis, it shall interact with only a single CRF.

Signalling flows related to the both Rx and Gx interfaces are specified in clause 8 in this specification.

4.2 Rx reference model

The Rx interface is defined between the CRF and the AF. The CRF is in the same PLMN as the TPF. The relationships between the different functional entities involved are depicted in figure 4.1 [a](#) and [4.1b](#).

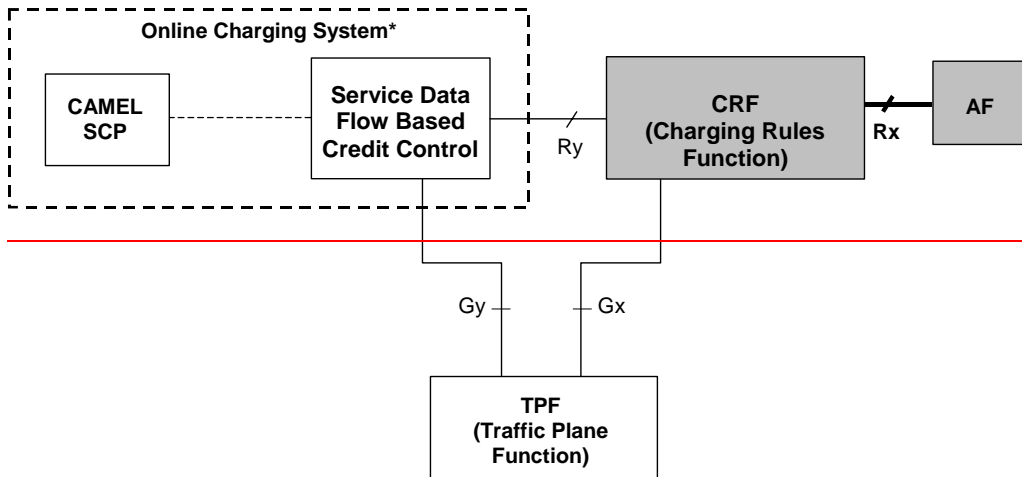
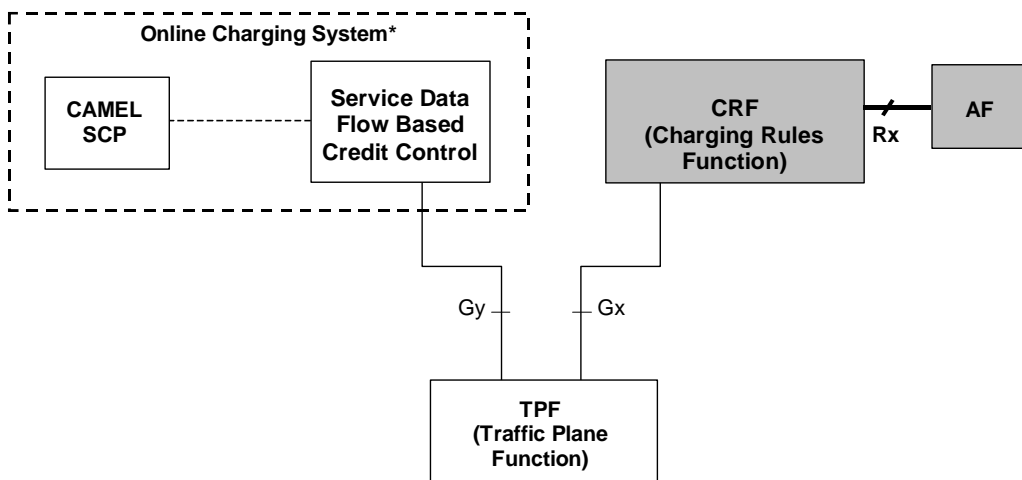
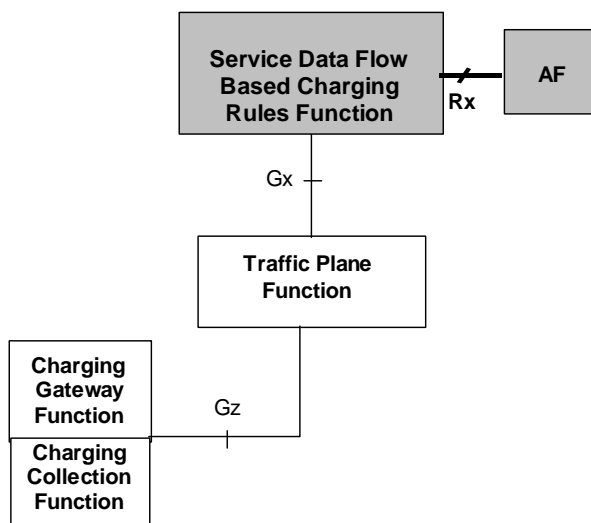


Figure 4.1a: Rx interface architecture model [for service data flow based online bearer charging](#)



[Figure 4.1b: Rx interface architecture model for service data flow based offline bearer charging](#)

4.3 Functional elements and capabilities

4.3.1 Charging Rules Function (CRF)

The Charging Rules Function provides Service Data Flow level Charging Rules to the TPF and informs AF about bearer session events. The CRF makes the Charging Rule decisions which may be based on the session and media related information obtained from the AF via the Rx reference point, the bearer and subscriber related information obtained from the TPF over the Gx reference point, and subscriber and service related data the CRF may be aware of. The CRF shall provision Charging Rules the TPF via the Gx reference point. The CRF may also provide policy control like functions based on Charging Rules provisioning to the TPF.

The CRF reports, via the Rx reference point, bearer events from the TPF to the AF, e.g. bearer release and bearer establishment.

4.3.2 Application Function (AF)

The AF is an element offering applications that require the Flow Based Charging of IP bearer resources (e.g. UMTS PS domain/GPRS domain resources). One example of an application function is the P-CSCF. The AF shall use the Rx reference point to provide session information to the CRF.

5 FBC ~~Control~~ Procedures over Rx

5.1 CRF

5.1.1 [Initial](#) Provision of Session Information

When receiving an initial AA-Request from the AF, the CRF shall check if it contains the Media-Component-Description Attribute-Value Pair(s) (AVP(s)) and if so, the CRF shall store the received Service Information.

If the Specific Action AVP is present in the AAR command, the CRF shall take into account the requested notification for the related bearers.

After storing the received Service Information, the CRF shall send back an AA-Answer to the AF. The CRF shall check whether the received Service Information requires Charging Rules to be provisioned towards existing bearer-session(s). The CRF identifies suitable bearers using the binding mechanisms described in clause 6.

If the CRF identifies that Charging Rules need to be provisioned, the CRF ~~may either start a timer or shall immediately send a Diameter RA-Request to the TPF for each of the affected bearer(s) to trigger the TPF to request Charging Rules using a Diameter CC-Request. The CRF shall provide the Charging Rules immediately to the TPF within the CC-Answer. If the timer expires before a Charging Rule request for the TPF has been received, the CRF shall initiate an unsolicited Charging Rule provisioning.~~

5.1.2 Modification of Session Information

If the AA-Request from the CRF is received for a Diameter session already active (due to an AF session modification), the CRF shall update the Service Information with the new information received. Due to the updated Service Information, the CRF may send a Diameter RA-Request to the TPF for each of the affected bearer(s) to trigger the CRF to request Charging Rules using a Diameter CC-Request. The CRF shall use the CC-Answer to install new Charging Rules and/or, to modify or remove ~~the installation, modification or removal of~~ the currently installed Charging Rules as required due to the updated Service Information ~~via an unsolicited Charging Rule provisioning. The CRF may either start a timer or provide the Charging Rule update immediately to the TPF. If the timer expires before a Charging Rule request for the TPF has been received, the CRF shall initiate an unsolicited Charging Rule provisioning.~~

5.1.23 FBC Gate function

The AF may indicate to the CRF as part of the Media-Component-Description AVP(s) whether the Packet Flows should be enabled or disabled at the bearer level. The CRF may receive a separate AA-Request message(s) from the AF to enable or disable Packet Flows Based on the received Service Information, the CRF may decide to install or remove the corresponding Charging Rule(s).

5.1.34 AF Session Termination

The CRF may receive a ST-Request from the AF, indicating an AF session termination. If any Charging Rules have been provisioned for ~~this the corresponding~~ Service Data Flow(s), the CRF ~~may either start a timer or shall immediately send a Diameter RA-Request to the TPF for each of the affected bearer(s) to trigger the CRF to request Charging Rules using Diameter CC-Request. The CRF shall use the CC-Answer to remove those~~ Charging Rules from the TPF. ~~If the timer expires before a Charging Rule request for the TPF has been received, the CRF shall initiate an unsolicited Charging Rule provisioning.~~

5.1.54 Bearer Release

If the CRF receives a CC-Request Upon a reception of a CC-Request from the TPF with an indication of bearer ~~deactivation~~ termination, the CRF shall check for each of the IP flows from AF Service Information bound to this bearer, if it needs to notify the corresponding AF. The CRF shall notify the AF if, and only if, the IP flow is no longer bound to any existing bearer. The CRF shall use the following procedures to notify the AF:

- If the CRF needs to notify the AF for all IP flows of an AF session, the CRF shall send an Diameter AS-Request. The AF will terminate the corresponding Diameter session at the Rx interface using a Diameter ST-Request.
- If the CRF needs to notify the AF for some, but not all, IP flows of an AF session, the CRF shall send an Diameter RA-Request. Within the RA-Request, the CRF shall set the value for the Specific-Action AVP to INDICATION OF TERMINATION OF BEARER, shall indicate the affected PacketIP flows with the Flows AVP(s) and shall provide the appropriate Abort-Cause AVP value.

~~for each AF session affected the following procedure will be followed:~~

- ~~—If the Charging Rule for an AF Service Data Flow applies to only one bearer of a UE IP address, the CRF shall send a RAR to the AF to inform of the bearer release.~~

~~If a Charging Rule for an AF Service Data Flow applies to more than one bearer of a UE IP address, the CRF shall send a RAR to the AF when all the bearers of a Service Data Flow for a UE IP address have been removed. Otherwise, when a Charging Rule for a particular service is allowed for multiple bearers, the AF is not aware of the removal of individual bearers.~~

~~When sending the RAR message, the value for the Specific-Action AVP set to INDICATION_OF_RELEASE_OF_BEARER and shall indicate the affected Packet flows with the Flows AVP(s) and the appropriate Abort-Cause AVP value~~

~~When the TPF informs the CRF of the bearer release and all Packet flows within the corresponding AF session are affected, the CRF shall inform the AF about this event by sending the Abort-Session-Request message with the appropriate Abort-Cause AVP value.~~

5.1.6 Other Bearer Events

If CRF receives a notification that a bearer is being established via the Gx interface and the CRF binds IP flow(s) described in the Service Information of an AF session to this bearer, and if the corresponding AF has requested a notification of bearer establishment from the CRF, the CRF shall send a RA-Request including the Specific Action AVP with the value set to INDICATION_OF_ESTABLISHMENT_OF_BEARER and shall indicate the affected IP flows with the Flows AVP(s) if not all IP flows within an AF session are affected.

NOTE: If the IP flow is being bound to several bearers, the AF will receive several of such notifications.

If the CRF receives a notification that a bearer is modified to the bandwidth of 0 kbit via the Gx interface, and an AF with IP flow(s) bound to that bearer has requested a notification at the loss of a bearer, the CRF shall send a RA-Request with the value for the Specific-Action AVP set to INDICATION_OF_LOSS_OF_BEARER to this AF and shall indicate the affected IP flows with the Flows AVP(s) if not all IP flows within an AF session are affected.

NOTE: If an IP flow is bound to several bearers, the AF may receive several of such notifications.

If the CRF receives a notification of a bearer recovery via the Gx interface, and an AF with IP flow(s) bound to that bearer has requested a notification at the recovery of a bearer, the CRF shall send a RA-Request with the value for the Specific-Action AVP set to INDICATION_OF_RECOVERY_OF_BEARER to this AF and shall indicate the affected IP flows with the Flows AVP(s) if not all IP flows within an AF session are affected.

NOTE: If an IP flow is bound to several bearers, the AF may receive several of such notifications.

5.2 AF

5.2.1 Provision of Service Information at session establishment

When receiving an AF session signalling message initiating a new AF session, the AF shall send the Service Information to the network by sending the AA-Request message. The AF shall include the corresponding Media-Component-Description AVP(s) into the message if the information is already available at the AF. The AF may include the Flow-Grouping AVP(s) to indicate a particular way on how the Packet flows described within the service description are distributed to several bearers at the bearer establishment. The AF may also include the Specific-Action-Report AVP to request notification for certain bearer events, e.g., bearer termination or bearer establishment. To allow the CRF to match the described service IP flows in an unambiguous manner with TFT filter information, the AF should supply both source and destination IP addresses and port numbers within the Flow-Description AVP, if such information is available.

5.2.2 Session modification

During the AF session modification, the AF shall send an update for the session description information to the CRF. The AF does this by sending the AA-Request message containing the Media-Component-Description AVP(s) containing the updated Service Information.

5.2.32 FBC Gate function

The AF shall indicate to the network as part of the Media-Component-Description whether the media Packet flow(s) should be enabled or disabled at the bearer level. Depending on the application, the AF may instruct the CRF also during the session when the Packet flow(s) are to be enabled or disabled to pass through the access network. The AF does this by sending the AA-Request message containing the Media-Component- Description AVP(s) that contains the flow status information for the flows to be enabled or disabled.

5.2.43 Session modification

During the AF session modification, the AF shall send an update for the session description information to the CRF. The AF does this by sending the AA-Request message containing the Media-Component-Description AVP(s) containing the updated Service Information.

5.2.54 AF Session Termination

When an AF session is terminated, the AF shall send Session-Termination-Request message to the CRF.

5.2.65 Bearer Release

Upon the reception of a Re-Auth-Request including an Abort-Cause AVP indicating that some of the Packet Flows (included in the Flows AVP) of the AF session are being discontinued (typically PDP_CONTEXT_RELEASE cause), the AF will issue a Re-Auth-Answer as a response to the CRF.

5.2.7 Other Bearer Events

Upon the reception of a Re-Auth-Request including an Specific Action AVP indicating bearer establishment, loss of bearer or recovery of bearer, the AF will issue a Re-Auth-Answer as a response to the CRF.

6 Binding the AF Session Information ~~and~~ to the Bearer Sessions

Binding refers to the CRF process of associating IP flows described in the AF ~~Service Data Flows~~ Service Information and Bearer Sessions with bearers means binding the Rx and Gx Diameter session. An IP flow described in the AF session information can be bound to multiple bearers, as the CRF does not necessarily know which bearer is transporting this IP flow.

NOTE: IP flows described in many AF sessions may share the same bearer(s). Separate IP flows of a single AF session may be transported over different bearers.

~~The relationship may be many to many (i.e for GPRS one AF Service Data Flow carried in several PDP contexts or several AF Service Data Flows carried in the same PDP context).~~

If an IP flow described in the AF Service Information is bound to a bearer, the CRF shall install a Charging Rule for this bearer with a Service Data Flow Filter matching this IP flow.

The following mechanisms shall be used:

- For all bearer types, the UE IP Address shall be used for binding purposes. For IPv6, if the CRF is only notified about the address prefix at the Gx interface, it shall compare this prefix with the prefix of the UE IP address provided at the Rx interface.

- In particular, for GPRS, it is also recommended to use TFT filters (from TPF via Gx) and IP Flow Filters (from AF via Rx) ~~are used~~ to select the Charging Rules matching to a PDP context. [The flow grouping AVP\(s\) of the Service Information may be used for further analysis.](#)

Also for GPRS, the QoS information (QoS negotiated from the TPF and Requested Bandwidth from the AF) may be used for further analysis. ~~Note: needs a mapping table. If QoS comparison is required, it would be beneficial to send the bandwidth information from TPF to the CRF, i.e., to add it to the Gx reference point.~~

The GPRS binding mechanism does not necessarily identify a single PDP context, therefore the same Charging Rule for an AF Session IP Flow may be installed over several PDP contexts.

7 Rx Protocol

7.1 Protocol Support

The Rx reference point shall be based on Gq protocol as specified in 3GPP TS 29.209 [4]. Most of the the AVPs from the Gq protocol are reused as specified in sub-clause 7.2.

Editor's note: The new application id needs to be allocated for Rx Protocol from IANA.

The Rx application is defined as an IETF vendor specific Diameter application, where the vendor is 3GPP. The vendor identifier assigned by IANA to 3GPP (<http://www.iana.org/assignments/enterprise-numbers>) is 10415.

With regard to the Diameter protocol defined over the Rx reference point, the CRF acts as a Diameter server, in the sense that it is the network element that handles Charging Rule control for a particular realm. The AF acts as the Diameter Client, in the sense that it is the network element requesting FBC control in the bearer path network resources.

The support of Diameter agents between the CRF and the AF, is optional for the IMS, where the Rx is intra operator i.e. for GPRS: TPF, CRF and P-CSCF are all in the same network.

7.1.1 Advertising application support

The AF and the CRF shall advertise the support of the Rx specific Application by including the value of the application identifier in the Auth-Application-Id AVP and the value of the 3GPP (10415) in the Vendor-Id AVP of the Capabilities-Exchange-Request and Capabilities-Exchange-Answer commands. The Capabilities-Exchange-Request and Capabilities-Exchange-Answer commands are specified in the Diameter Base Protocol.

7.2 Securing Diameter messages

[For secure transport of Diameter messages, see 3GPP TS 33.210 \[6\].](#)

7.3 Rx messages

[Existing Diameter command codes from the Diameter base protocol RFC 3588 \[5\] and the NASREQ Diameter application \(draft-ietf-aaa-diameter-nasreq-17 \[7\]\) are used with the Rx specific AVPs. An Rx specific Auth-Application id is used together with the command code to identify the Rx messages.](#)

NOTE: The notion of NAS (Network Access Server) is not used here, NASREQ is just used for protocol purposes, not for its functional meaning.

NOTE: Some of the AVPs included in the messages formats below are in bold to highlight that these AVPs are used by this specific protocol and do not belong to the original Diameter Base Protocol RFC 3588 [5].

7.3.1 AA-Request (AAR) command

The AAR command, indicated by the Command-Code field set to 265 and the 'R' bit set in the Command Flags field, is sent by an AF to the CRF in order to provide it with the Session Information.

Message Format:

```
<AA-Request> ::= < Diameter Header: 265, REQ, PXY >
< Session-Id >
{ Auth-Application-Id }
{ Origin-Host }
{ Origin-Realm }
{ Destination-Realm }
*[ Media-Component-Description ]
*[ Flow-Grouping ]
[ AF-Charging-Identifier ]
[ SIP-Forking-Indication ]
*[ Specific-Action ]
*[ Subscription-ID ]
*[ Proxy-Info ]
*[ Route-Record ]
*[ AVP ]
```

7.3.2 AA-Answer (AAA) command

The AAA command, indicated by the Command-Code field set to 265 and the 'R' bit cleared in the Command Flags field, is sent by the CRF to the AF in response to the AAR command.

Message Format:

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
< Session-Id >
{ Auth-Application-Id }
{ Origin-Host }
{ Origin-Realm }
[ Result-Code ]
[ Experimental-Result ]
[ Error-Message ]
[ Error-Reporting-Host ]
*[ Failed-AVP ]
*[ Proxy-Info ]
*[ AVP ]
```

7.3.3 Re-Auth-Request (RAR) command

The RAR command, indicated by the Command-Code field set to 258 and the 'R' bit set in the Command Flags field, is sent by the CRF to the AF in order to indicate an Rx specific action.

The values INDICATION_OF_ESTABLISHMENT_OF_BEARER and INDICATION_OF_RELEASE_OF_BEARER of the Specific-Action AVP are the only ones used in for Rx.

Message Format:

```
<RA-Request> ::= < Diameter Header: 258, REQ, PXY >
< Session-Id >
{ Origin-Host }
{ Origin-Realm }
{ Destination-Realm }
{ Destination-Host }
{ Auth-Application-Id }
*[ Specific-Action ]
*[ Flows ]
*[ Subscription-ID ]
[ Abort-Cause ]
[ Origin-State-Id ]
*[ Proxy-Info ]
*[ Route-Record ]
*[ AVP ]
```


7.3.4 Re-Auth-Answer (RAA) command

The RAA command, indicated by the Command-Code field set to 258 and the 'R' bit cleared in the Command Flags field, is sent by the AF to the CRF in response to the RAR command.

Message Format:

```
<RA-Answer> ::= < Diameter Header: 258, PXY >
< Session-Id >
{ Auth-Application-Id }
{ Origin-Host }
{ Origin-Realm }
[ Result-Code ]
[ Experimental-Result ]
*[ Media-Component-Description ]
*[ Flow-Grouping ]
[ Origin-State-Id ]
[ Error-Message ]
[ Error-Reporting-Host ]
*[ Failed-AVP ]
*[ Proxy-Info ]
*[ AVP ]
```

7.3.5 Session-Termination-Request (STR) command

The STR command, indicated by the Command-Code field set to 275 and the 'R' bit set in the Command Flags field, is sent by the AF to inform the CRF that an established session shall be terminated.

Message Format:

```
<ST-Request> ::= < Diameter Header: 275, REQ, PXY >
< Session-Id >
{ Origin-Host }
{ Origin-Realm }
{ Destination-Realm }
{ Auth-Application-Id }
{ Termination-Cause }
[ Destination-Host ]
*[ Class ]
[ Origin-State-Id ]
*[ Proxy-Info ]
*[ Route-Record ]
*[ AVP ]
```

7.3.6 Session-Termination-Answer (STA) command

The STA command, indicated by the Command-Code field set to 275 and the 'R' bit cleared in the Command Flags field, is sent by the CRF to the AF in response to the STR command.

Message Format:

```
<ST-Answer> ::= < Diameter Header: 275, PXY >
< Session-Id >
{ Origin-Host }
{ Origin-Realm }
{ Auth-Application-Id }
[ Result-Code ]
[ Experimental-Result ]
[ Error-Message ]
[ Error-Reporting-Host ]
*[ Failed-AVP ]
[ Origin-State-Id ]
*[ Redirect-Host ]
[ Redirect-Host-Usage ]
[ Redirect-Max-Cache-Time ]
*[ Proxy-Info ]
[ AVP ]
```

7.3.7 Abort-Session-Request (ASR) command

The ASR command, indicated by the Command-Code field set to 274 and the 'R' bit set in the Command Flags field, is sent by the CRF to inform the AF that bearer for the established session is no longer available.

Message Format:

```
<AS-Request> ::= < Diameter Header: 274, REQ, PXY >
< Session-Id >
{ Origin-Host }
{ Origin-Realm }
{ Destination-Realm }
{ Destination-Host }
{ Auth-Application-Id }
{ Abort-Cause }
[ Origin-State-Id ]
*[ Proxy-Info ]
*[ Route-Record ]
[ AVP ]
```

7.3.8 Abort-Session-Answer (ASA) command

The ASA command, indicated by the Command-Code field set to 274 and the 'R' bit cleared in the Command Flags field, is sent by the AF to the CRF in response to the ASR command.

Message Format:

```
<AS-Answer> ::= < Diameter Header: 274, PXY >
< Session-Id >
{ Origin-Host }
{ Origin-Realm }
[ Result-Code ]
[ Experimental-Result ]
[ Origin-State-Id ]
[ Error-Message ]
[ Error-Reporting-Host ]
*[ Failed-AVP ]
*[ Redirected-Host ]
[ Redirected-Host-Usage ]
[ Redirected-Max-Cache-Time ]
*[ Proxy-Info ]
*[ AVP ]
```

7.42 Gq+Re-used AVPs for Rx Protocol

The table 7.3.1 lists the Diameter AVPs re-used by the Rx reference point from existing Diameter Applications, including a reference to their respective specifications and when needed, a short description of their usage within the Rx reference point. Other AVPs from existing Diameter Applications, except for the AVPs from Diameter Base Protocol, do not need to be supported. The AVPs from Diameter Base Protocol are not included in table 7.3.1, but they are re-used for the Rx protocol. ~~Table 7.3.1 lists the re-used Application specific AVPs, defined in the Gq protocol specification, see ref [4].~~

The Vendor-Id header of all AVPs defined in the present document shall be set to 3GPP (10415).

Table 7.3.1: Rx re-used Diameter AVPs

Attribute Name	Reference	Comments
Abort-Cause	3GPP TS 29.209 [4]	
AF-Application-Identifier	3GPP TS 29.209 [4]	
AF-Charging-Identifier	3GPP TS 29.209 [4]	
Flow-Description	3GPP TS 29.209 [4]	
Flow-Number	3GPP TS 29.209 [4]	

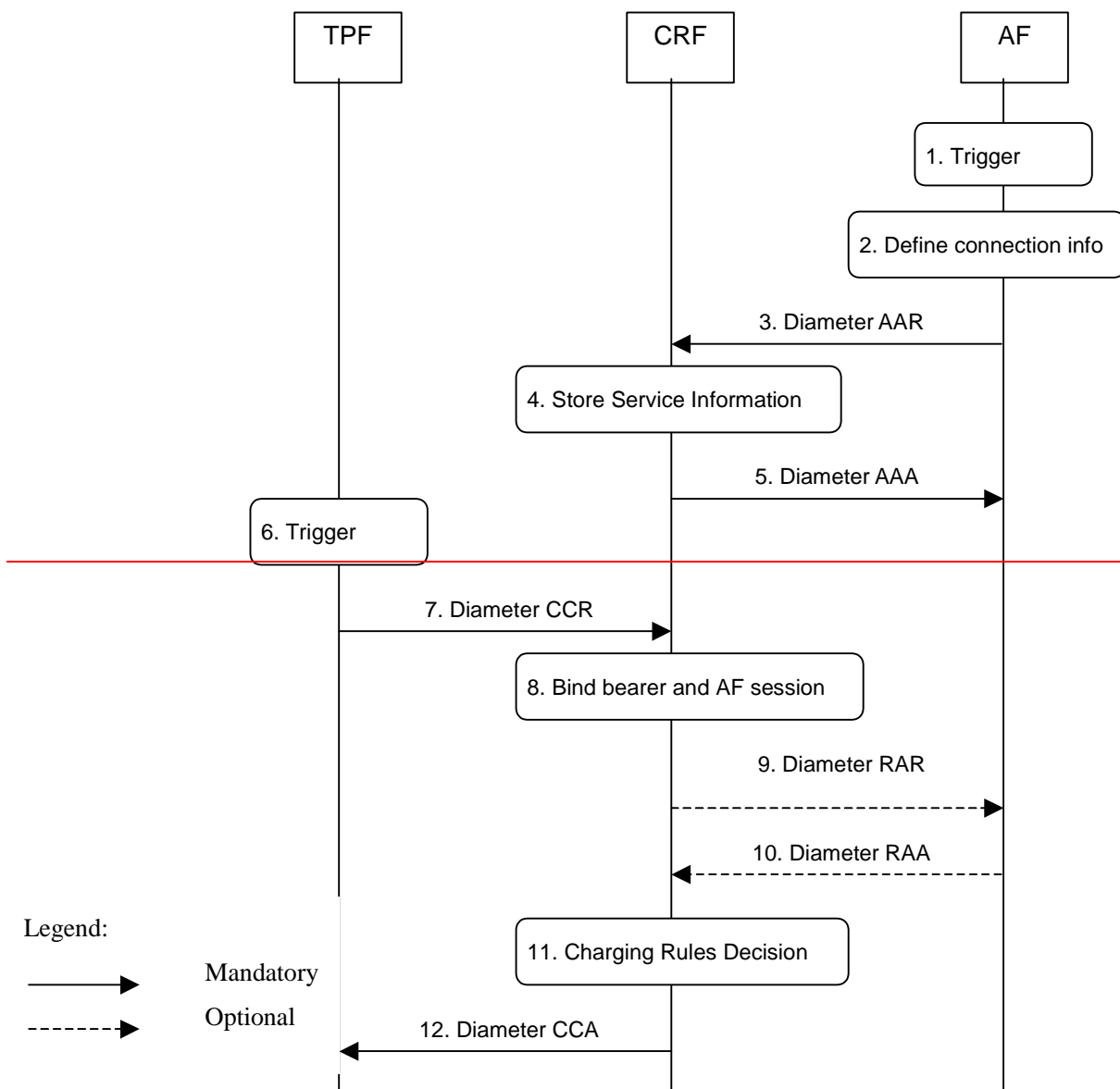
Attribute Name	Reference	Comments
Flows	3GPP TS 29.209 [4]	
Flow-Status	3GPP TS 29.209 [4]	
Flow-Usage	3GPP TS 29.209 [4]	FFS
Flow-Grouping Max-Requested-Bandwidth	3GPP TS 29.209 [4]	
Max-Requested-Bandwidth-DL	3GPP TS 29.209 [4]	
Max-Requested-Bandwidth-UL	3GPP TS 29.209 [4]	
Media-Component-Description	3GPP TS 29.209 [4]	
Media-Component-Number	3GPP TS 29.209 [4]	
Media-Sub-Component AVP	3GPP TS 29.209 [4]	
Media-Type	3GPP TS 29.209 [4]	
RR-Bandwidth	3GPP TS 29.209 [4]	
RS-Bandwidth	3GPP TS 29.209 [4]	
SIP-Forking-Indication	3GPP TS 29.209 [4]	FFS
Specific-Action	3GPP TS 29.209 [4]	<p>Editor's Note:</p> <p>The value 1 is not used for Rx?</p> <p>Editors note: what about 0?</p> <p>FFS if new values needed for:</p> <p><u>Allowed values:</u></p> <p><u>INDICATION OF LOSS OF BEARER(2)</u></p> <p><u>INDICATION OF RECOVERY OF BEARER(3)</u></p> <p><u>INDICATION OF TERMINATION OF BEARER(4)</u></p> <p>INDICATION_OF_ESTABLISHMENT OF BEARER (5)</p> <p>INDICATION_OF_QOS_CHANGE_OF BEARER (6)</p>
<u>Subscription-Id</u>	<u>draft-ietf-aaa-diameter-cc-06.txt [8]</u>	<u>The identification of the subscription (IMSI, MSISDN, etc.)</u>

8 Rx/Gx Signalling Flows

[The signaling flows in this Clause are examples.](#)

8.1 ~~AF session establishment or modification in case of no bearer~~

~~This clause covers the provision of service information and related Charging Rules when an AF session is being established or modified and the CRF is not aware of any bearer being established. For GPRS, the AF session modification in case of no existing bearer may be an IMS session for which a new media components is added and it is to be transported in a new secondary PDP context.~~



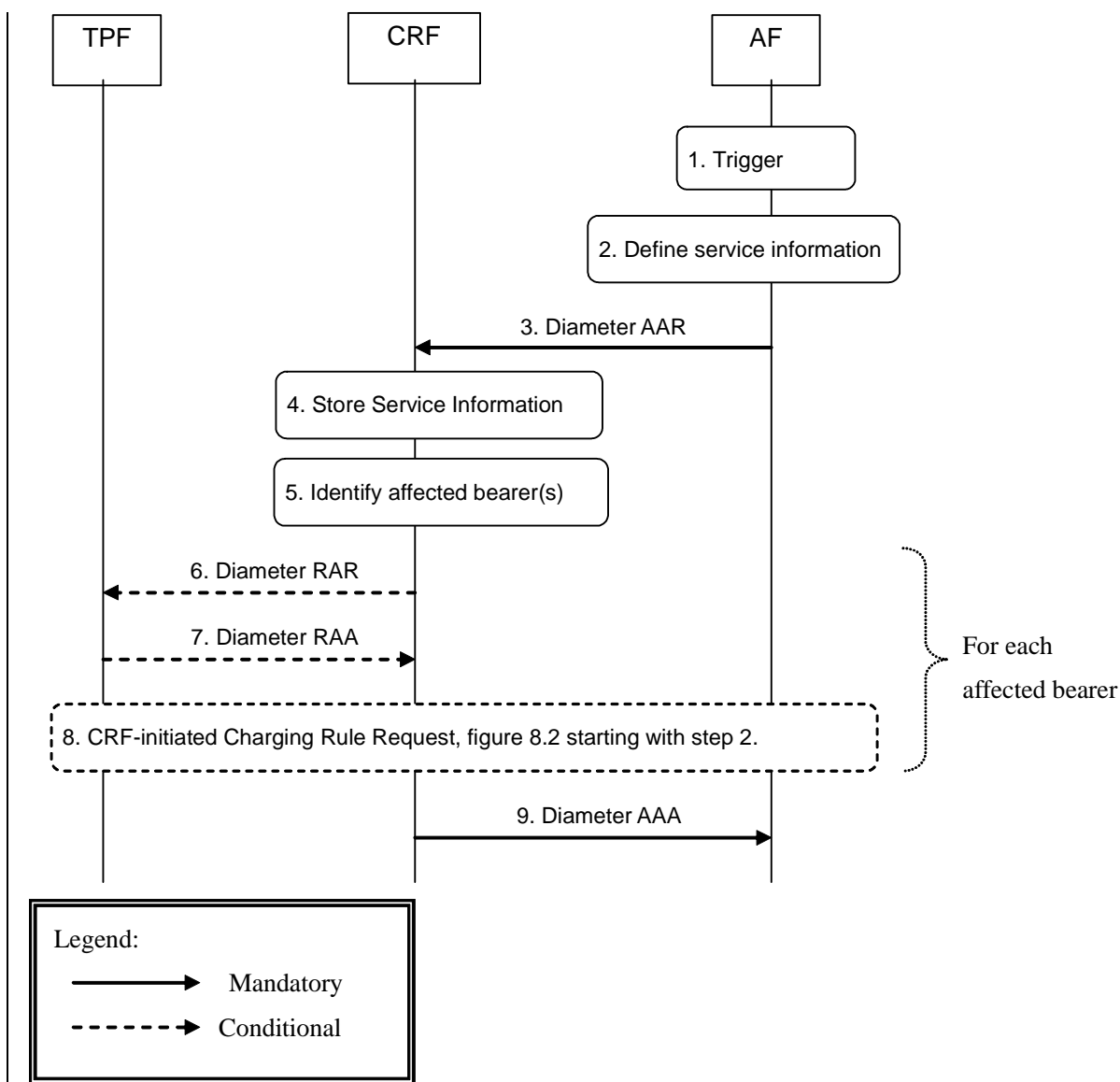
1. ~~The AF receives an internal or external trigger to provide service information, at a set up of a new AF session or at a modification of an existing AF session.~~
2. ~~The AF identifies the connection information needed (e.g. IP address of the IP flow(s), port numbers to be used etc...).~~
3. ~~The AF provides the service information to the CRF by sending a Diameter AAR for a new, or in case of AF session modification for the existing Diameter session. The AF may instruct the CRF to request the full service information from the AF at resource reservation. The AF may also forward part of or the entire service information at this stage.~~
4. ~~The CRF shall store the received service information.~~
5. ~~An ACK is sent to the AF by sending a Diameter AAA~~
6. ~~A bearer set up triggers the request of Charging Rules. For GPRS, this is the PDP Context Activation.~~
7. ~~The Charging Rules are requested by the TPF, using the Diameter CCR.~~
7. ~~The Charging Rules are requested by the TPF, using the Diameter CCR.~~
8. ~~The CRF binds the bearer session to the AF session using the bearer information received from the TPF and the service information received from the AF. Refer to chapter xxx~~
9. ~~The CRF sends a Diameter RAR to that AF to request the full service information or to report the establishment of a bearer, if instructed by the AF in step 3.~~
10. ~~If step 9 happens, the AF sends an Diameter RAA message including the service information to the CRF.~~
11. ~~The CRF identifies the Charging Rules to be installed.~~
12. ~~The Charging Rules are provisioned to the TPF using Diameter CCA.~~

Figure 8.1: AF session establishment or modification in case of no bearer.

8.12 AF session establishment or modification ~~in case of bearer established~~

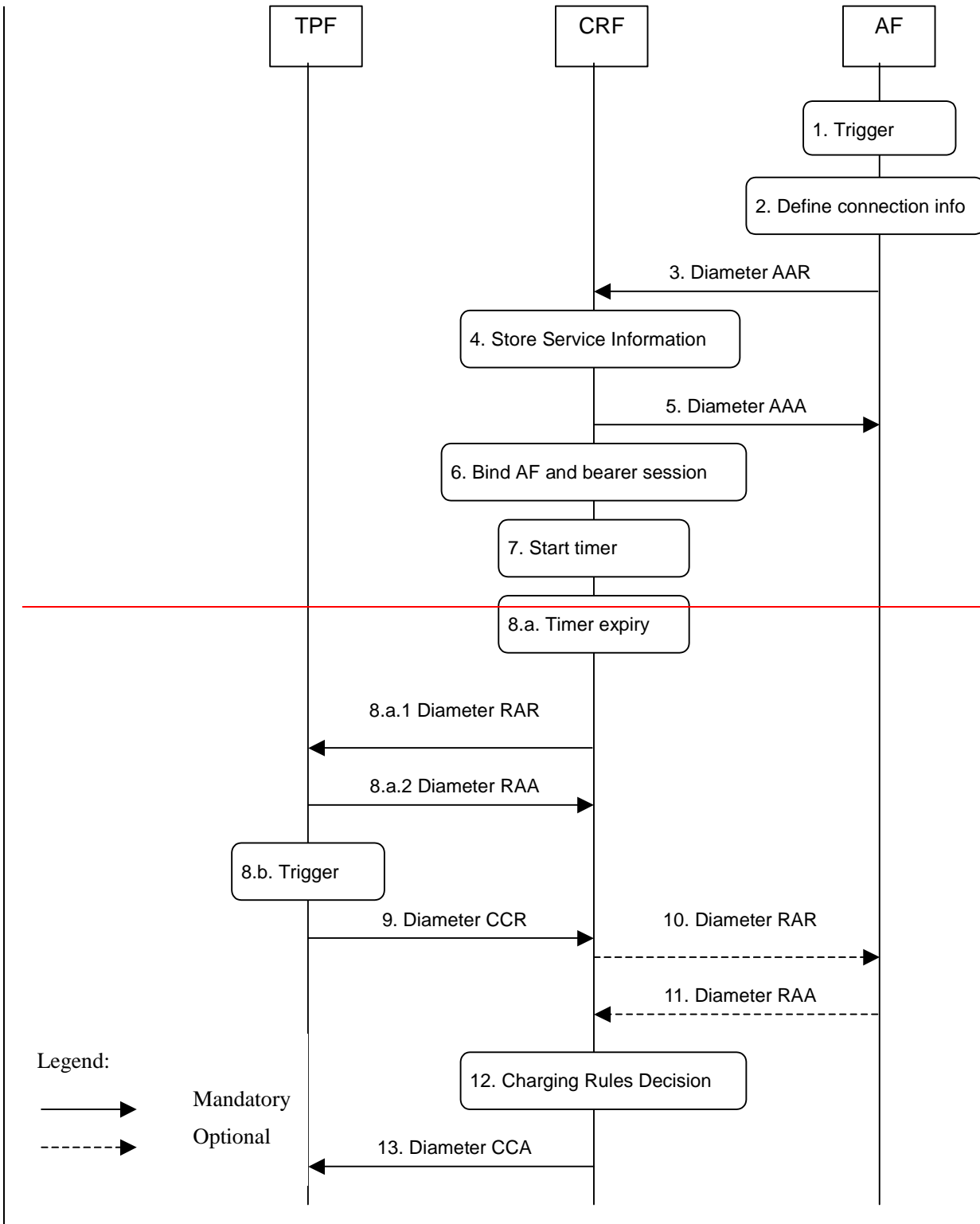
This clause covers the provision of Service Information and related Charging Rules when an AF session is being established or modified, ~~and a bearer is already established. This clause does not consider a case where the AF session modification leads to bearer removal, e.g. removing an IMS media component from an IMS session being the last media flow in an PDP context~~

~~The timer mechanism shown in the signalling flow is optional. The CRF may either start a timer or provide the Charging Rule update immediately to the TPF. If the timer expires before a Charging Rule request for the TPF has been received, the CRF shall initiate an unsolicited Charging Rule provisioning.~~



1. The AF receives an internal or external trigger to provide Service Information, at a set-up of a new AF session or at a modification of an existing AF session.
 2. The AF identifies the Service Information needed (e.g. IP address of the IP flow(s), port numbers to be used etc...).
 3. The AF provides the Service Information to the CRF by sending a Diameter AAR for a new Rx Diameter session at set-up of a new AF session, or for the existing Rx Diameter session in case of AF session modification.
 4. The CRF shall store the received Service Information
 5. The CRF identifies any affected established bearer(s) by binding new or modified IP flows described in the AF Service Information to bearer(s) using the bearer information previously received from the TPF and the Service Information received from the AF.
- If any affected bearer(s) are identified in step 5, steps 6, 7 and 8 are performed separately for each of these bearer(s). If there are no bearer(s) affected, steps 6, 7 and 8 are not executed.
6. The CRF sends Diameter RAR to trigger the TPF to request Charging Rules.
 7. The TPF sends RAA to acknowledge the RAR.
 8. The TPF will request Charging Rules for the bearer identified in step 7, as described in Figure 8.2 starting with step 2.
 9. As soon as the CRF completes the provisioning of Charging Rules for the bearer(s) identified in step 5, the CRF sends a Diameter AAA to the AF.

Figure 8.1: AF session establishment or modification



1. ~~The AF receives an internal or external trigger to provide service information, at a set up of a new AF session or at a modification of an existing AF session.~~
2. ~~The AF identifies the connection information needed (e.g. IP address of the IP flow(s), port numbers to be used etc...).~~
3. ~~The AF provides the service information to the CRF by sending a Diameter AAR for a new, or in case of AF session modification for the existing Diameter session. The AF may instruct the CRF to request the full service information from the AF at resource reservation. The AF may also forward the part of or the entire service information at this stage.~~
4. ~~The CRF shall store the received service information~~
5. ~~An ACK is sent to the AF by sending a Diameter AAA.~~
6. ~~The CRF identifies established bearer session(s) by binding the AF session to bearer session(s) using the bearer information previously received from the TPF and the service information received from the AF.~~
7. ~~A timer is started.~~
- 8.a ~~If the timer expires:~~
 - 8.a.1 ~~The timer expires but the TPF has not requested Charging Rules from the CRF. The CRF sends Diameter RAR to trigger the TPF to request Charging Rules.~~
 - 8.a.2 ~~The TPF sends RAA to acknowledge the RAR.~~
- 8.b ~~If the timer does not expire. I.e. the TPF is triggered to request Charging Rules before the timer expires. For GPRS, this is the PDP Context Modification.~~
9. ~~The Charging Rules are requested by the TPF, using the Diameter CCR.~~
10. ~~The CRF sends a Diameter RAR to that AF to request the full service information, if instructed by the AF in step 3.~~
11. ~~If step 10 happens, the AF sends an Diameter RAA message including the service information to the CRF.~~
12. ~~The CRF identifies the Charging Rules to be installed.~~
13. ~~The Charging Rules are provisioned to the TPF using Diameter CCA.~~

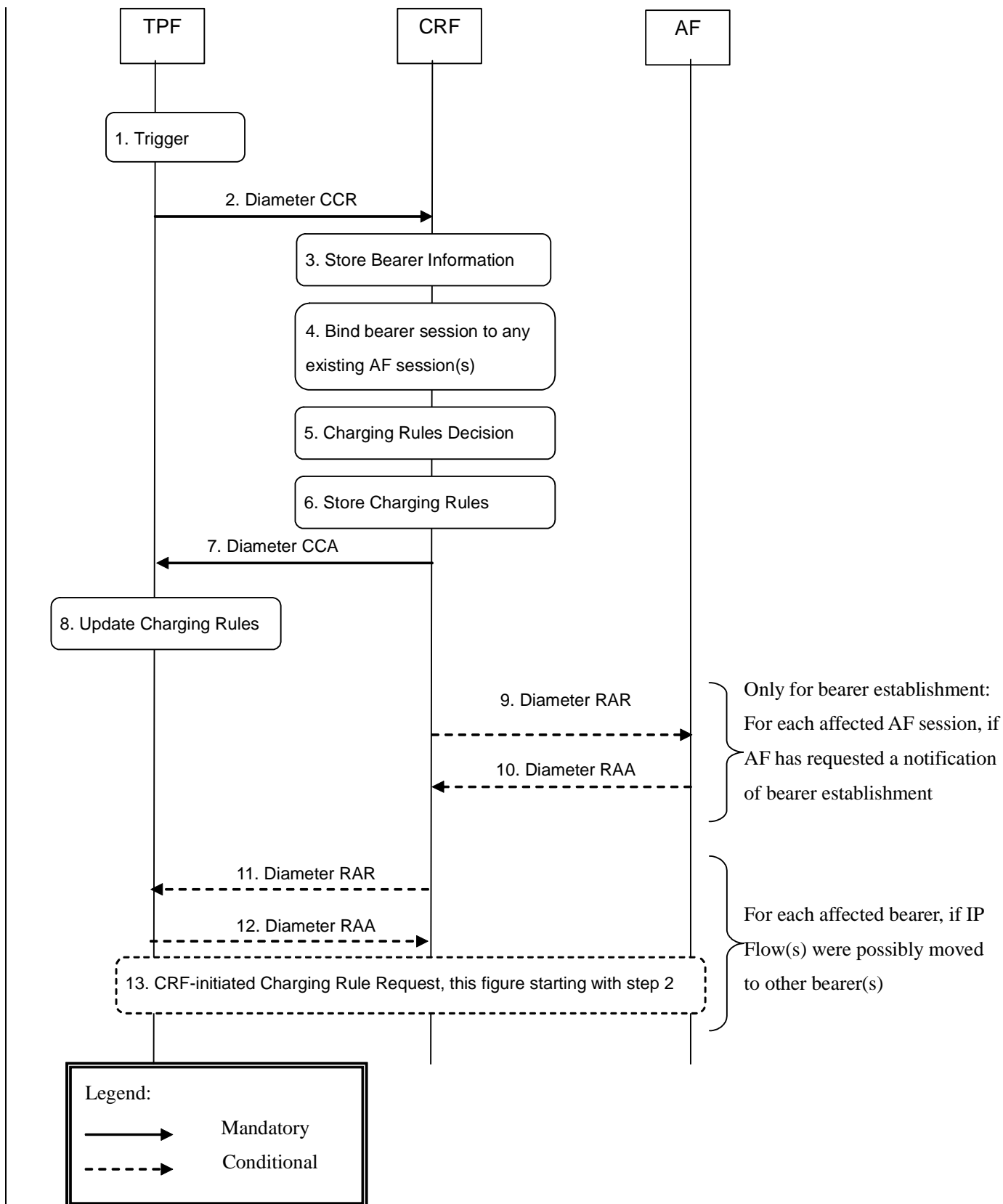
Figure 8.2: AF session establishment or modification in case of bearer already established.

8.2 Request of Charging Rule

This clause covers both the CRF-initiated and bearer-event-initiated Request of Charging Rules by the TPF.

A bearer-event-initiated Request of Charging Rules occurs when a new bearer is established or when an existing bearer is modified. For GPRS, these are PDP Context Activation(s) or Modification(s). A bearer modification triggers a Charging Rule request only if the CRF has previously requested a Charging Rule Request for the given bearer modification event.

A CRF-initiated Request of Charging Rules is triggered by an Diameter RAR sent from the CRF.



- [1. The TPF receives a trigger for a Charging Rule Request, such as the establishment or modification of a bearer or an RAR from the CRF.](#)
- [2. The Charging Rules are requested by the TPF, using the Diameter CCR. The TPF also provides information about the bearer within the request.](#)

3. The CRF stores the received bearer information in the Diameter CCR, e.g. TFT filters and UE IP address (prefix).
4. The CRF binds the bearer to all matching IP flow(s) of existing of AF session(s) using the bearer information received from the TPF and the Service Information received from the AF(s).
5. The CRF defines new Charging Rule(s) to be installed for the identified bearer. For a modified bearer, the CRF can also identify existing Charging Rules that need to be modified or removed. The Charging Rules may relate to any of the matching AF sessions identified in step 4 or that may exist in the CRF without matching to any AF session.
6. The CRF stores the selected Charging Rules for the bearer.
7. The Charging Rules are provisioned by the CRF to the TPF using Diameter CCA. The CRF may also provide event triggers listing bearer events for which the CRF desires Charging Rule Requests.
8. The TPF installs the received Charging Rules. For a modified bearer the TPF may also have to modify or remove previously installed Charging Rules.

If the trigger in step 1 was a bearer establishment, steps 9 and 10 are executed separately for each affected AF session for which the AF has requested notification of bearer establishment.

9. The CRF sends a Diameter RAR to the AF to inform it about the bearer establishment.
10. The CRF sends RAA to acknowledge the RAR.

If IP Flow(s) were possibly moved to other bearer(s), other bearer(s) may need to be modified. The following steps are performed for each of these bearers. For GPRS, an IP flow may be possibly moved if a higher priority TFT filter in the modified PDP context was removed and a lower priority TFT filter in another PDP context matches the IP flow.

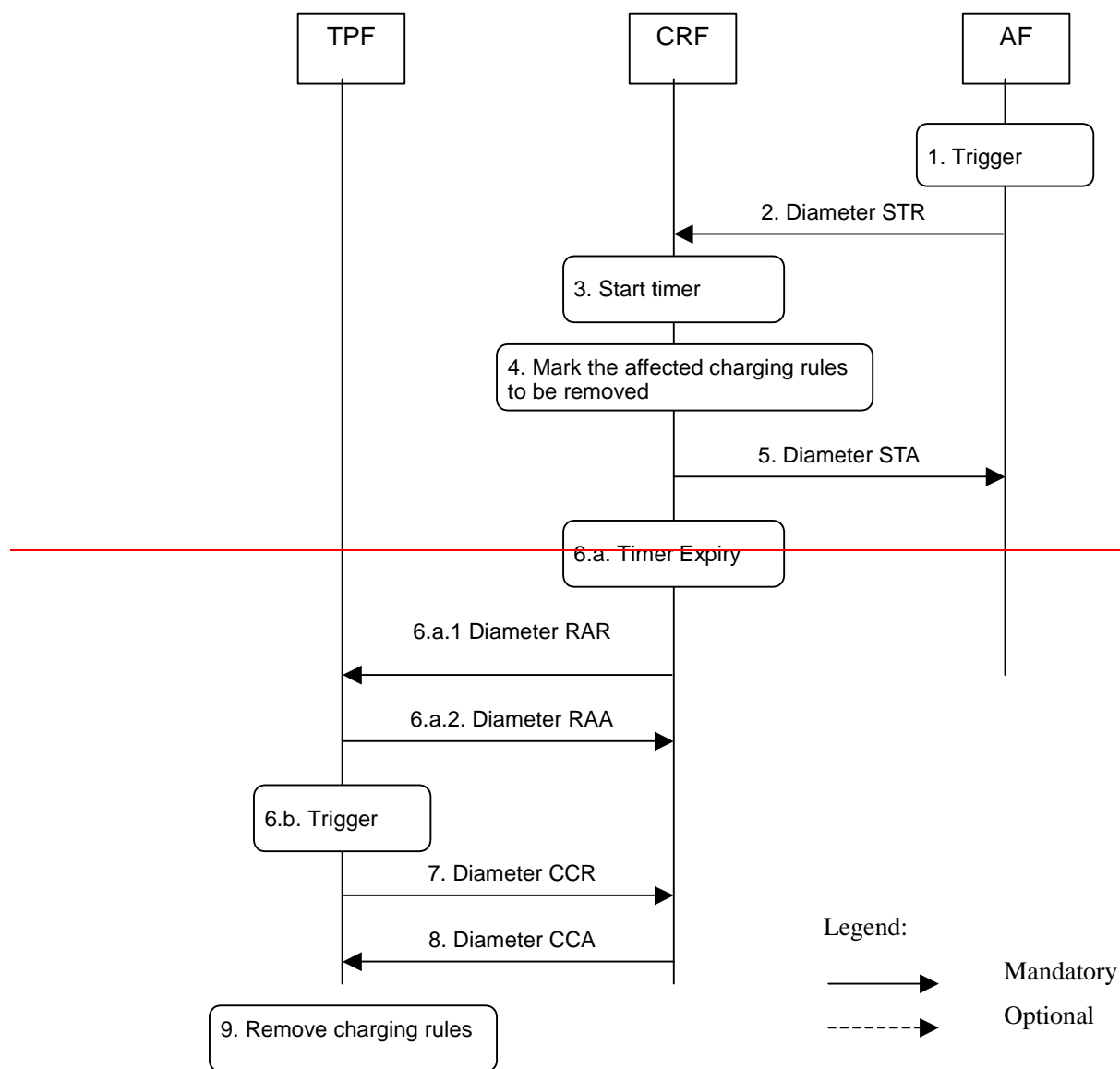
11. The CRF sends Diameter RAR to trigger the TPF to request Charging Rules for the other bearer.
12. The TPF sends RAA to acknowledge the RAR.
13. The TPF will request Charging Rules for the bearer identified in step 11, as described in the present figure starting with step 2.

Figure 8.2: Charging Rule Request.

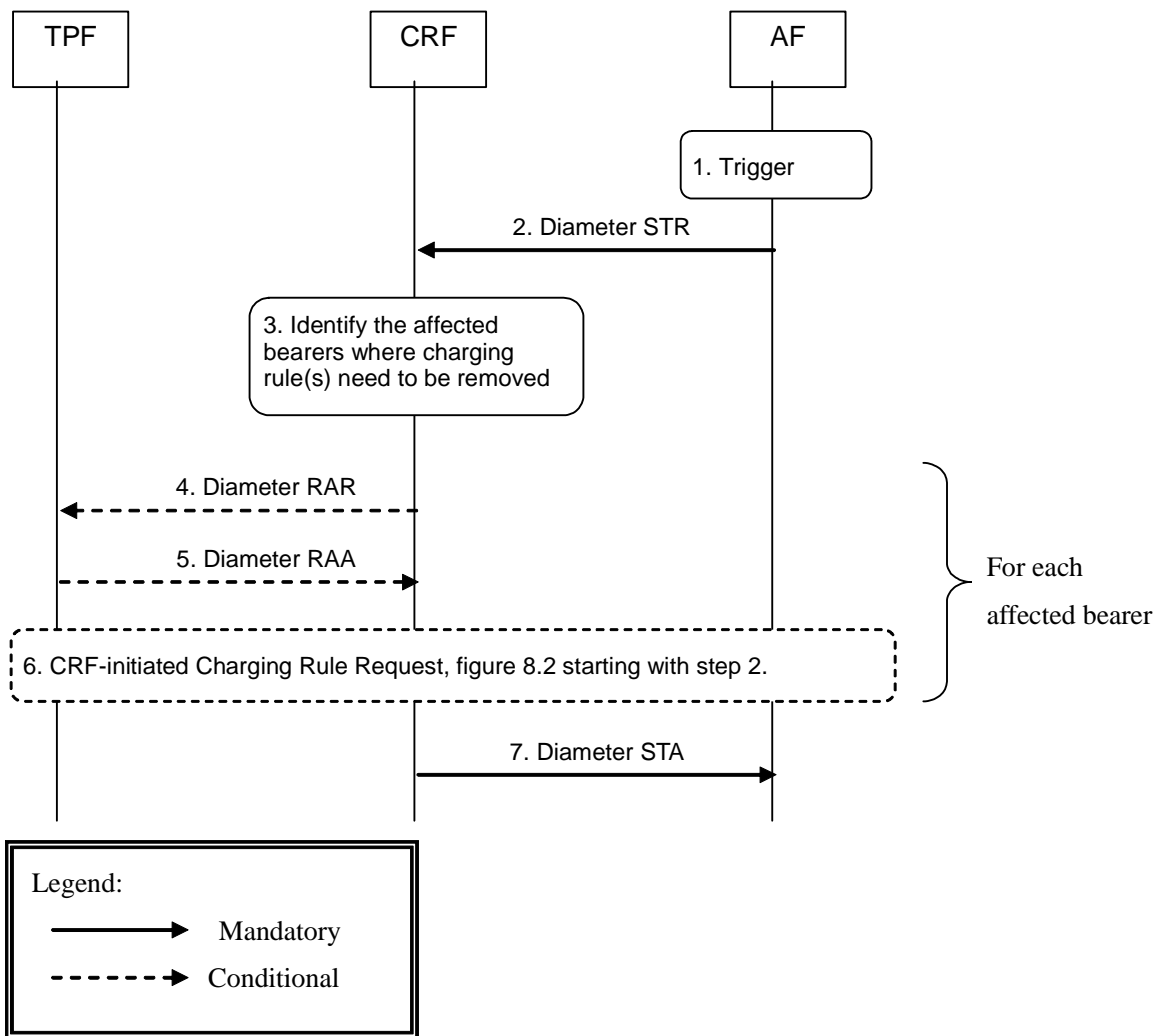
8.3 Removal of Charging Rules at AF session release

This clause covers the removal of Charging Rules at the AF session release, ~~when the related bearer sessions are not released. For AF session release followed by a bearer session(s) release, see clause 4.4.~~

~~The timer mechanism shown in the signalling flow is optional. The CRF may either start a timer or remove the Charging Rules from the TPF. If the timer expires before a Charging Rule request for the TPF has been received, the CRF shall initiate an unsolicited Charging Rule provisioning~~



- 1. The AF receives an internal or external trigger for a session release.
- 2. The AF sends session termination request, Diameter STR, to the CRF to indicate the removal of the session.
- 3. The CRF starts timer.
- 4. The CRF marks the Charging Rules for the affected IP flow(s) of this AF session to be removed.
- 5. The CRF sends Diameter STA , session termination answer, to the AF.
- 6.a If the timer expires:
 - 6.a.1 The timer expires but the CRF has not been notified that the affected bearer(s), for GPRS the PDP context(s), have been modified. The CRF sends Diameter RAR to trigger the TPF to request Charging Rules.
 - 6.a.2. The TPF sends Diameter RAA to acknowledge the RAR.
- 6.b If the timer does not expire. I.e. the TPF is triggered to request Charging Rules before the timer expires. For GPRS, this is the PDP Context Modification.
- 7. The Charging Rules are requested by the TPF, using the Diameter CCR.
- 8. The CRF removes the affected Charging Rules by using Diameter CCA.
- 9. The TPF removes the indicated Charging Rules.



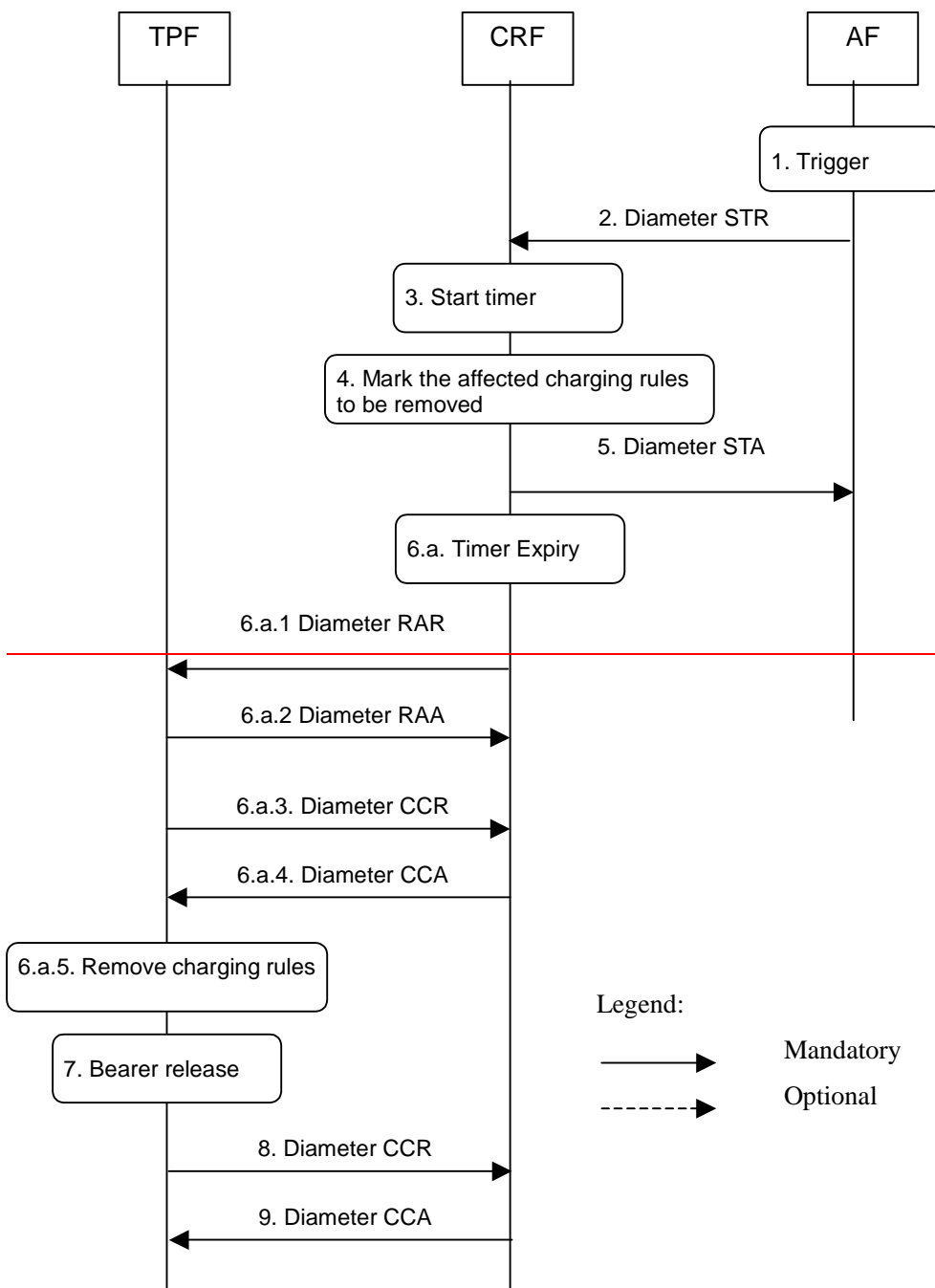
1. The AF receives an internal or external trigger for a session release.
 2. The AF sends a session termination request, Diameter STR, to the CRF to request the removal of the session.
 3. The CRF identifies the affected bearers where Charging Rules for the IP flow(s) of this AF session are installed. These Charging Rules need to be removed.
- If any affected bearer(s) are identified, steps 4, 5 and 6 are performed separately for each of these bearer(s).
4. The CRF sends a Diameter RAR to trigger the TPF to request Charging Rules.
 5. The TPF sends a Diameter RAA to acknowledge the RAR.
 6. The TPF will request Charging Rules for the bearer identified in step 7, as described in Figure 8.2 starting with step 2. The CRF will request the TPF to remove the Charging Rules for the released AF session.
 7. As soon as the CRF has requested the TPF to remove the Charging Rules for all the bearer(s) identified in step 3, The CRF sends Diameter STA, session termination answer, to the AF.

Figure 8.3: Removal of Charging Rules at AF session release

8.4 ~~Bearer release at AF session release~~

This clause covers the AF session release, which is followed by the release of the bearer that carries the IP flow(s) for that AF session.

~~The timer mechanism shown in the signalling flow is optional. The CRF may either start a timer or remove the Charging Rules from the TPF. If the timer expires before a Charging Rule request for the TPF has been received, the CRF shall initiate an unsolicited Charging Rule provisioning~~



Legend:
 —————> Mandatory
 - - - - -> Optional

- 1. — The AF receives an internal or external trigger for a session release.
- 2. — The AF sends session termination request, Diameter STR, to the CRF to indicate the removal of the session.
- 3. — The CRF starts timer.
- 4. — The CRF marks the Charging Rules for the affected IP flow(s) of this AF session to be removed.
- 5. — The CRF sends Diameter STA , session termination answer, to the AF.

- 6.a — If the timer expires:
- 6.a.1 — The timer expires but the CRF has not been notified that the affected bearer(s), for GPRS the PDP context(s), have been terminated. The CRF sends Diameter RAR to trigger the TPF to request Charging Rules.
- 6.a.2. — The TPF sends Diameter RAA to acknowledge the RAR.
- 6.a.3 — The Charging Rules are requested by the TPF, using the Diameter CCR.
- 6.a.4 — The CRF removes the affected Charging Rules by using Diameter CCA.
- 6.a.5 — The TPF removes the indicated Charging Rules.

- 7. — The bearer is deactivated.

8. The TPF sends a Diameter CCR message to the CRF, indicating bearer termination.
9. The CRF acknowledges the bearer termination by sending a Diameter CCA message.

Figure 8.4: Bearer release at AF session release

8.5 Bearer release at AF session modification

This clause covers the AF session modification, which is followed by the release of the bearer that carries the IP flow(s) for that AF session. The AF session modification disables the IP flow(s) for the released bearer.

1. The AF receives an internal or external trigger to provide service information. In this case the session is modified by disabling IP flow(s).
2. The AF provides the new service information to the CRF by sending a Diameter AAR.
3. The CRF starts timer.
4. The CRF stores the new session information marks the Charging Rules for the affected IP flow(s) of this AF session to be removed.
5. An ACK is sent to the AF by sending a Diameter AAA.

The following steps shall be performed separately for each bearer session that is affected by the AF session release. For GPRS these are the PDP contexts where the Charging Rule(s) to be removed are provisioned.

- 6.a If the timer expires:
 - 6.a.1 The timer expires but the CRF has not been notified that the affected bearer(s), for GPRS the PDP context(s), have been terminated. The CRF sends Diameter RAR to trigger the TPF to request Charging Rules.
 - 6.a.2 The TPF sends Diameter RAA to acknowledge the RAR.
 - 6.a.3 The Charging Rules are requested by the TPF, using the Diameter CCR.
 - 6.a.4 The CRF removes the affected Charging Rules by using Diameter CCA.
 - 6.a.5 The TPF removes the indicated Charging Rules.
7. The bearer is deactivated.
8. The TPF sends a Diameter CCR message to the CRF, indicating bearer termination.
9. The CRF acknowledges the bearer termination by sending a Diameter CCA message.

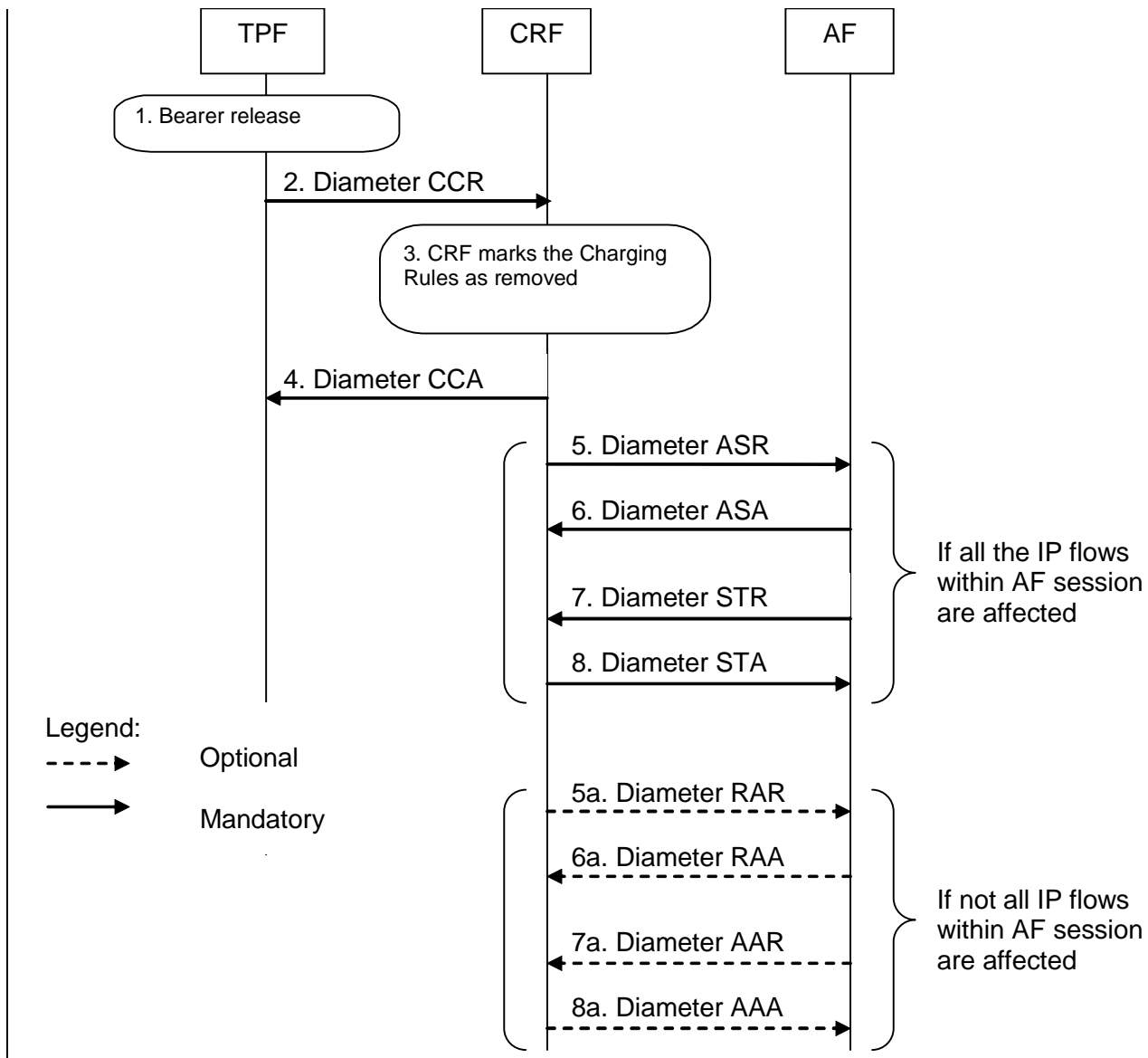
Figure 8.5: Bearer release at AF session modification

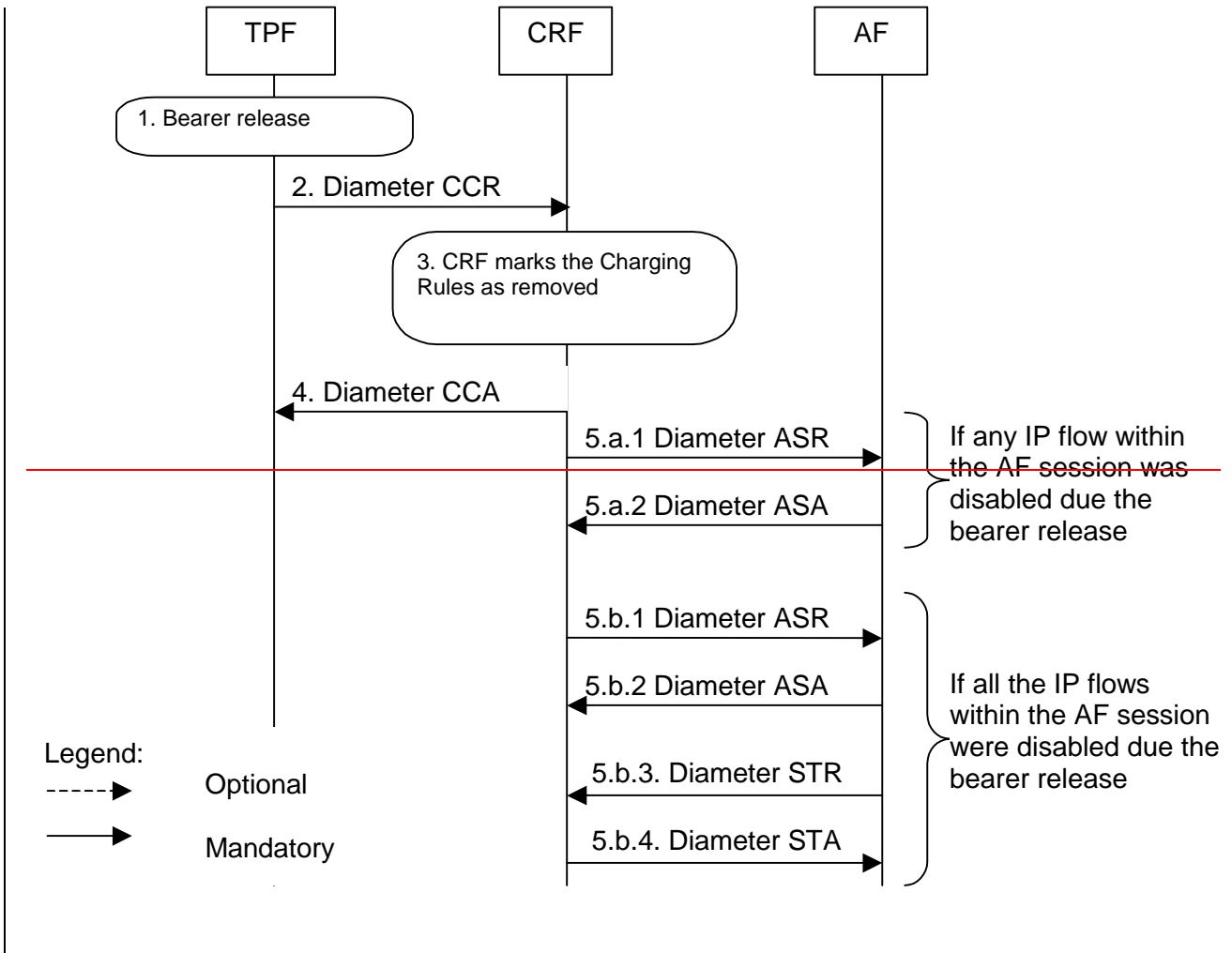
8.46 Bearer Release

This clause covers the bearer release, which may be indicated to the AF. Three cases are covered:

- bearer release that does not cause IP flow(s) within an AF session to be disabled; ~~for certain;~~
- bearer release that causes at least one but not all the IP flow(s) within an AF session to be disabled; and
- bearer release that causes all the IP flows within an AF session to be disabled.

Bearer release may not cause an IP flow within an AF session to be disabled if the IP flow is bound to more than one bearer. ~~The case were the bearer release that does not cause IP flow(s) within an AF session to be disabled for certain is the one were Charging Rule(s) for the affected IP flow(s) are provisioned to more than one bearers.~~ For GPRS, ~~those are the secondary bearers may be~~ PDP context(s) within an PDP session. The CRF does not necessary know ~~for sure in which~~ PDP context(s) carries the IP flow(s) ~~are possibly carried,~~ thus a release of a PDP context does not necessarily mean that the IP flow(s) ~~are~~ is disabled.





1. A bearer is deactivated. For GPRS ~~and IMS~~, the SGSN deactivates the PDP context carrying IP flow(s) of ~~IMS media component(s)~~ by sending the Delete PDP Context Request message to the GGSN.
2. The TPF sends a Diameter CCR message to the CRF, indicating bearer termination.
3. The CRF marks the Charging Rules for the terminated bearer as removed. ~~For GPRS, this is the corresponding PDP context.~~
4. The CRF acknowledges the bearer termination by sending a Diameter CCA message.

—The following steps apply for the case where at least one IP Flow within an AF session is being disabled. They apply only if the affected IP Flow is not bound to any other bearer that is still established. The steps shall be performed separately for each ongoing AF session that is affected by the bearer release as explained below. ~~For IMS and GPRS, these are the IMS session(s) for which the IMS media component(s) were carried within the terminated PDP Context.~~

~~5.a — If at least one but not all of the IP flow(s) within the AF session are discontinued by the bearer release:~~

~~5.a.1 — The CRF indicates the release of the bearer by sending a Diameter RAR to the AF.~~

~~5.a.2 — The AF responds by sending a Diameter RAA to the CRF.~~

~~5.b — If all IP flow(s) within the AF session are discontinued by the bearer release:~~

~~5.b.1 — The CRF indicates the session abort to the AF by sending a Diameter ASR message to the AF.~~

~~6.5.b.2 — The AF responds by sending a Diameter ASA message to the CRF.~~

~~7.5.b.3 — The AF sends a Diameter STR message to the CRF to indicate that the session has been terminated.~~

~~8.5.b.4 — The CRF responds by sending a Diameter STA message to the AF.~~

If at least one but not all of the IP flow(s) within the AF session are discontinued by the bearer release, and the AF has requested notification of bearer removal:

5a. — The CRF indicates the release of the bearer by sending a Diameter RAR to the AF.

6a. — The AF responds by sending a Diameter RAA to the CRF.

7a. — The AF may send an AAR to the CRF to update the session information.

8a. — If step 7a occurs, the CRF responds by sending a AAA to the AF.

Figure 8.6: Bearer Release

Annex A (normative): Support for SIP forking

The P-CSCF shall be able to handle forking when FBC is applied. Forking can occur as specified in 3GPP TS 23.228 [6].

A.1 Resources for early media for forked responses

When a SIP session has been originated by a connected UE, the P-CSCF may receive provisional responses associated with different early dialogues due to forking before the first final answer is received. Multiple early media session may be established during this process.

The UE and the P-CSCF become aware of the forking only when a subsequent provisional response arrives for a new early dialogue. After the first early media session is established, for each subsequent provisional response establishing an additional early media session, the P-CSCF shall use an AA-Request within the existing Diameter session containing the SIP-Forking-Indication AVP with value SEVERAL_DIALOGUES and include the Service Information derived from each corresponding provisional response.

When receiving an AA-Request containing the SIP-Forking-Indication AVP with value SEVERAL_DIALOGUES, the CRF shall identify the existing Service Information for the corresponding AF session. The CRF shall send additional Charging Rules as required by the Flow Description AVPs within the session information to the TPF. The CRF can also use the highest QoS requested for an IP flow by any of the forked responses as the required QoS for that IP flow.

A.2 Updating the Charging Rules information at the final answer

The P-CSCF shall store the SDP information for each early dialogue separately until the first final SIP answer is received. Then the corresponding early dialogue is progressed to an established dialogue to establish the final SIP session. All the other early dialogues are terminated. The Service Information for the SIP session is updated to match the requirements of the remaining early dialogue only.

When receiving the first final SIP response, the P-CSCF shall send an AA-Request without the SIP-Forking-Indication AVP and include the Service Information derived from the SDP corresponding to the dialogue of the final response.

When receiving an AA-Request with no SIP-Forking-Indication AVP or with a SIP-Forking-Indication AVP with value SINGLE_DIALOGUE, the CRF shall update the installed Charging Rules information to match only the requirements of the Service Information within this AA-Request. The CRF should immediately remove Charging Rule(s) not matching IP flow(s) in the updated Service Information, to reduce the risk for initial clipping of the media stream, and to minimize possible misuse of resources.

Annex **AB** (informative): Change history

Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
12-2004	CN#26				Presented to CN#26 for information	-	1.0.0
03-2005	CN#27				Presented to CN#27 for approval	1.0.0	2.0.0
03-2005	CN#27	NP-050118			Keyword in second page corrected and the format of Annex A changed.	2.0.0	2.0.1

3GPP TS 29.211 V2.0.1 (2005-02)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Core Network; Rx Interface and Rx/Gx signalling flows (Release 6)



The present document has been developed within the 3rd Generation Partnership Project (3GPPTM) and may be further elaborated for the purposes of 3GPP.

The present document has not been subject to any approval process by the 3GPP Organizational Partners and shall not be implemented. This Specification is provided for future development work within 3GPP only. The Organizational Partners accept no liability for any use of this Specification. Specifications and reports for implementation of the 3GPPTM system should be obtained via the 3GPP Organizational Partners' Publications Offices.

Keywords

UMTS, Flow Based Charging, Gx, Rx, Signalling
Flows

3GPP

Postal address

3GPP support office address

650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet

<http://www.3gpp.org>

Copyright Notification

No part may be reproduced except as authorized by written permission.
The copyright and the foregoing restriction extend to reproduction in all media.

© 2005, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TTA, TTC).
All rights reserved.

Contents

Foreword.....	5
1 Scope	6
2 References	6
3 Definitions and abbreviations	6
3.1 Definitions.....	6
3.2 Abbreviations	7
4 Rx reference point	7
4.1 Overview	7
4.2 Rx reference model	8
4.3 Functional elements and capabilities.....	9
4.3.1 Charging Rules Function (CRF).....	9
4.3.2 Application Function (AF)	9
5 FBC Procedures over Rx	9
5.1 CRF.....	9
5.1.1 Initial Provision of Session Information.....	9
5.1.2 Modification of Session Information.....	9
5.1.3 FBC Gate function.....	10
5.1.4 AF Session Termination	10
5.1.5 Bearer Release	10
5.1.6 Other Bearer Events.....	10
5.2 AF	11
5.2.1 Provision of Service Information at session establishment	11
5.2.2 Session modification.....	11
5.2.3 FBC Gate function.....	11
5.2.4 Session modification.....	11
5.2.5 AF Session Termination	11
5.2.6 Bearer Release	11
5.2.7 Other Bearer Events.....	11
6 Binding the AF Session Information to the Bearers.....	12
7 Rx Protocol.....	12
7.1 Protocol Support.....	12
7.1.1 Advertising application support.....	12
7.2 Securing Diameter messages.....	12
7.3 Rx messages	13
7.3.1 AA-Request (AAR) command	13
7.3.2 AA-Answer (AAA) command.....	13
7.3.3 Re-Auth-Request (RAR) command.....	13
7.3.4 Re-Auth-Answer (RAA) command.....	14
7.3.5 Session-Termination-Request (STR) command	14
7.3.6 Session-Termination-Answer (STA) command	14
7.3.7 Abort-Session-Request (ASR) command	15
7.3.8 Abort-Session-Answer (ASA) command	15
7.4 Re-used AVPs for Rx Protocol	15
8 Rx/Gx Signalling Flows	17
8.1 AF session establishment or modification.....	17
8.2 Request of Charging Rule	18
8.3 Removal of Charging Rules at AF session release.....	20
8.4 Bearer Release.....	22
Annex A (normative): Support for SIP forking	23
A.1 Resources for early media for forked responses.....	23
A.2 Updating the Charging Rules information at the final answer	23

Annex B (informative): Change history 24

Foreword

This Technical Specification 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:

Version x.y.z

where:

- x the first digit:
 - 1 presented to TSG for information;
 - 2 presented to TSG for approval;
 - 3 or greater indicates TSG approved document under change control.
- 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 provides the stage 3 specification of the Rx reference point interface.

The functional requirements and the stage 2 specifications of the Rx reference point are contained in 3GPP TS 23.125 [2]. The Rx reference point is used to exchange Flow Based Charging information between the Charging Rules Function (CRF) and the Application Function (AF).

Whenever it is possible the present document specifies the protocol by reference to specifications produced by the IETF within the scope of Diameter and to the Gq specification 3GPP TS 29.209 [4].

The present specification also provides detailed signalling flows for FBC procedures over the interfaces that correspond to Rx and Gx reference points.

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 and/or edition number or version number) 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 23.125: "Overall high level functionality and architecture impacts of flow based charging; Stage 2".
- [3] 3GPP TS 29.210: "Charging rule provisioning over Gx interface".
- [4] 3GPP TS 29.209: "Policy control over Gq interface".
- [5] IETF RFC 3588: "Diameter Base Protocol".
- [6] 3GPP TS 33.210: "3G Security; Network Domain Security (NDS); IP network layer security".
- [7] draft-ietf-aaa-diameter-nasreq-17.txt: "Diameter Network Access Server Application".
- [8] draft-ietf-aaa-diameter-cc-06.txt: "Diameter Credit Control Application".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and 3GPP TS 23.125 [2] and the following apply:

Application Function (AF): element offering application(s) that uses IP bearer resources. The AF is capable of communicating with the CRF to transfer dynamic Charging Rules application information

NOTE: One example of an AF is the P-CSCF of the IM CN subsystem.

AF Session: an application level session established by an application level signalling protocol offered by the AF that requires a session set-up with explicit session description before the use of the service.

NOTE: One example of an application session is an IMS session.

Attribute-Value Pair (AVP): See RFC 3588 [5], corresponds to an Information Element in a Diameter message.

Binding: the CRF process of associating IP flows described in AF Service Information with bearers.

IP flow: a unidirectional flow of IP packets with the same source IP address and port number and the same destination IP address and port number and the same transport protocol. Port numbers are only applicable if used by the transport protocol.

Packet Flow: a specific user data flow carried through the Traffic Plane Function. A Packet Flow can be an IP flow.

Service Information: The set of information conveyed from the AF to the CRF over the Rx interface to be used as a basis for Flow Based Charging decisions at the CRF, including information about the AF session (e.g. application identifier, type of media, bandwidth, IP address and port number) and parameters controlling the CRF behavior. The encoding of the Service Information is provided in 3GPP TS 29.209 [4].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply:

AAA	AA-Answer
AAR	AA-Request
AF	Application Function
ASA	Abort-Session-Answer
ASR	Abort-Session-Request
AVP	Attribute-Value Pair
CRF	Charging Rule Function
CSCF	Call Session Control Function
DCC	Diameter Credit Control
FBC	Flow Based Charging
IANA	Internet Assigned Numbers Authority
IM	IP Multimedia
IMS	IP Multimedia CN Subsystem
OCS	Online Charging System
P-CSCF	Proxy-CSCF
QoS	Quality of Service
SDI	Session Description Information
STA	Session-Termination-Answer
STR	Session-Termination-Request
TPF	Traffic Plane Function

4 Rx reference point

4.1 Overview

The Rx interface is used to exchange Flow Based Charging control information between the Charging Rules Function (CRF) and the Application Function (AF). As defined in the stage 2 specifications (3GPP TS 23.125 [2]), this

information is used by the CRF for the Flow Based Charging (FBC) decisions. The CRF exchanges the Flow Based Charging control information with the Traffic Plane Function (TPF) as specified in 3GPP TS 29.210 [3].

The Rx interface may be an intra- or inter-domain interface. One CRF shall be able to serve more than one AF and one given AF may interact with a number of CRFs, although on an AF session basis, it shall interact with only a single CRF.

Signalling flows related to the both Rx and Gx interfaces are specified in clause 8 in this specification.

4.2 Rx reference model

The Rx interface is defined between the CRF and the AF. The CRF is in the same PLMN as the TPF. The relationships between the different functional entities involved are depicted in figure 4.1a and 4.1b..

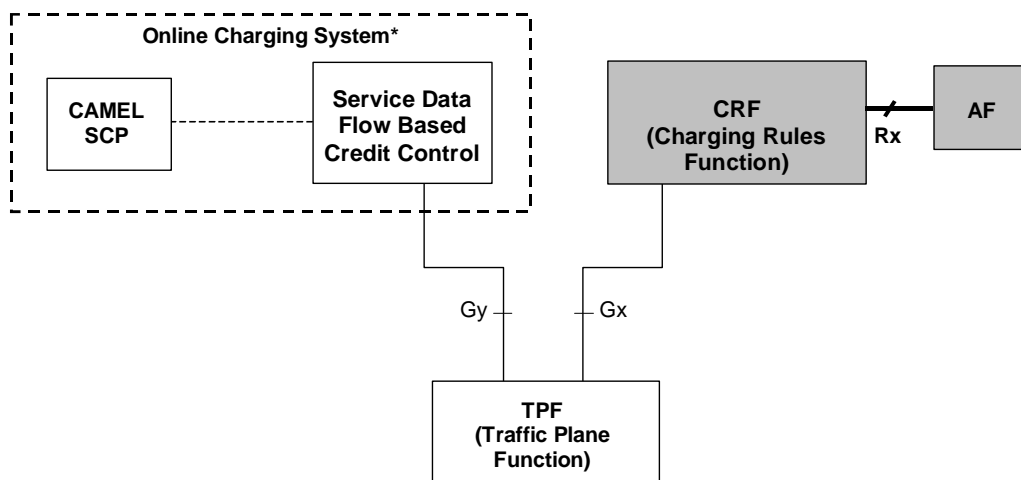


Figure 4.1a: Rx interface architecture model for service data flow based online bearer charging

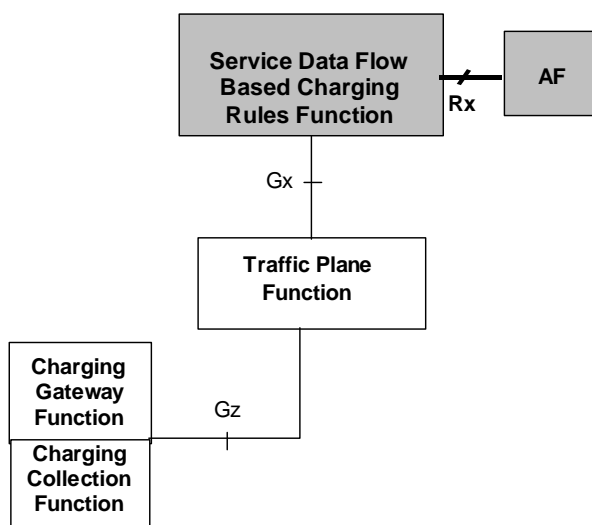


Figure 4.1b: Rx interface architecture model for service data flow based offline bearer charging

4.3 Functional elements and capabilities

4.3.1 Charging Rules Function (CRF)

The Charging Rules Function provides Service Data Flow level Charging Rules to the TPF and informs AF about bearer session events. The CRF makes the Charging Rule decisions which may be based on the session and media related information obtained from the AF via the Rx reference point, the bearer and subscriber related information obtained from the TPF over the Gx reference point, and subscriber and service related data the CRF may be aware of. The CRF shall provision Charging Rules to the TPF via the Gx reference point. The CRF may also provide policy control like functions based on Charging Rules provisioning to the TPF.

The CRF reports, via the Rx reference point, bearer events from the TPF to the AF, e.g. bearer release and bearer establishment.

4.3.2 Application Function (AF)

The AF is an element offering applications that require the Flow Based Charging of IP bearer resources (e.g. UMTS PS domain/GPRS domain resources). One example of an application function is the P-CSCF. The AF shall use the Rx reference point to provide session information to the CRF.

5 FBC Procedures over Rx

5.1 CRF

5.1.1 Initial Provision of Session Information

When receiving an initial AA-Request from the AF, the CRF shall check if it contains the Media-Component-Description Attribute-Value Pair(s) (AVP(s)) and if so, the CRF shall store the received Service Information.

If the Specific Action AVP is present in the AAR command the CRF shall take into account the requested notification for the related bearers.

After storing the received Service Information, the CRF shall send back an AA-Answer to the AF. The CRF shall check whether the received Service Information requires Charging Rules to be provisioned towards existing bearer(s). The CRF identifies suitable bearers using the binding mechanisms described in clause 6.

If the CRF identifies that Charging Rules need to be provisioned, the CRF shall immediately send a Diameter RA-Request to the TPF for each of the affected bearer(s) to trigger the TPF to request Charging Rules using a Diameter CC-Request. The CRF shall provide the Charging Rules to the TPF within the CC-Answer.

5.1.2 Modification of Session Information

If the AA-Request from the CRF is received for a Diameter session already active (due to an AF session modification), the CRF shall update the Service Information with the new information received. Due to the updated Service Information, the CRF may send a Diameter RA-Request to the TPF for each of the affected bearer(s) to trigger the CRF to request Charging Rules using a Diameter CC-Request. The CRF shall use the CC-Answer to install new Charging Rules and/or, to modify or remove the currently installed Charging Rules as required due to the updated Service Information.

5.1.3 FBC Gate function

The AF may indicate to the CRF as part of the Media-Component-Description AVP(s) whether the Packet Flows should be enabled or disabled at the bearer level. The CRF may receive a separate AA-Request message(s) from the AF to enable or disable Packet Flows Based on the received Service Information, the CRF may decide to install or remove the corresponding Charging Rule(s).

5.1.4 AF Session Termination

The CRF may receive a ST-Request from the AF, indicating an AF session termination. If any Charging Rules have been provisioned for the corresponding Service Data Flow(s), the CRF shall immediately send a Diameter RA-Request to the TPF for each of the affected bearer(s) to trigger the CRF to request Charging Rules using Diameter CC-Request. The CRF shall use the CC-Answer to remove those Charging Rules from the TPF.

5.1.5 Bearer Release

If the CRF receives a CC-Request from the TPF with an indication of bearer termination, the CRF shall check for each of the IP flows from AF Service Information bound to this bearer, if it needs to notify the corresponding AF. The CRF shall notify the AF if, and only if, the IP flow is no longer bound to any existing bearer. The CRF shall use the following procedures to notify the AF:

- If the CRF needs to notify the AF for all IP flows of an AF session, the CRF shall send an Diameter AS-Request. The AF will terminate the corresponding Diameter session at the Rx interface using a Diameter ST-Request.
- If the CRF needs to notify the AF for some, but not all, IP flows of an AF session, the CRF shall send an Diameter RA-Request. Within the RA-Request, the CRF shall set the value for the Specific-Action AVP to INDICATION_OF_TERMINATION_OF_BEARER, shall indicate the affected PacketIP flows with the Flows AVP(s) and shall provide the appropriate Abort-Cause AVP value.

5.1.6 Other Bearer Events

If CRF receives a notification that a bearer is being established via the Gx interface and the CRF binds IP flow(s) described in the Service Information of an AF session to this bearer, and if the corresponding AF has requested a notification of bearer establishment from the CRF, the CRF shall send a RA-Request including the Specific Action AVP with the value set to INDICATION_OF_ESTABLISHMENT_OF_BEARER and shall indicate the affected IP flows with the Flows AVP(s) if not all IP flows within an AF session are affected.

NOTE: If the IP flow is being bound to several bearers, the AF will receive several of such notifications.

If the CRF receives a notification that a bearer is modified to the bandwidth of 0 kbit via the Gx interface, and an AF with IP flow(s) bound to that bearer has requested a notification at the loss of a bearer, the CRF shall send a RA-Request with the value for the Specific-Action AVP set to INDICATION_OF_LOSS_OF_BEARER to this AF and shall indicate the affected IP flows with the Flows AVP(s) if not all IP flows within an AF session are affected.

NOTE: If an IP flow is bound to several bearers, the AF may receive several of such notifications.

If the CRF receives a notification of a bearer recovery via the Gx interface, and an AF with IP flow(s) bound to that bearer has requested a notification at the recovery of a bearer, the CRF shall send a RA-Request with the value for the Specific-Action AVP set to INDICATION_OF_RECOVERY_OF_BEARER to this AF and shall indicate the affected IP flows with the Flows AVP(s) if not all IP flows within an AF session are affected.

NOTE: If an IP flow is bound to several bearers, the AF may receive several of such notifications.

5.2 AF

5.2.1 Provision of Service Information at session establishment

When receiving an AF session signalling message initiating a new AF session, the AF shall send the Service Information to the network by sending the AA-Request message. The AF shall include the corresponding Media-Component-Description AVP(s) into the message if the information is already available at the AF. The AF may include the Flow-Grouping AVP(s) to indicate a particular way on how the Packet flows described within the service description are distributed to several bearers at the bearer establishment. The AF may also include the Specific-Action AVP to request notification for certain bearer events, e.g., bearer termination or bearer establishment. To allow the CRF to match the described service IP flows in an unambiguous manner with TFT filter information, the AF should supply both source and destination IP addresses and port numbers within the Flow-Description AVP, if such information is available.

5.2.2 Session modification

During the AF session modification, the AF shall send an update for the session description information to the CRF. The AF does this by sending the AA-Request message containing the Media-Component-Description AVP(s) containing the updated Service Information.

5.2.3 FBC Gate function

The AF shall indicate to the network as part of the Media-Component-Description whether the media Packet flow(s) should be enabled or disabled at the bearer level. Depending on the application, the AF may instruct the CRF also during the session when the Packet flow(s) are to be enabled or disabled to pass through the access network. The AF does this by sending the AA-Request message containing the Media-Component-Description AVP(s) that contains the flow status information for the flows to be enabled or disabled.

5.2.4 Session modification

During the AF session modification, the AF shall send an update for the session description information to the CRF. The AF does this by sending the AA-Request message containing the Media-Component-Description AVP(s) containing the updated Service Information.

5.2.5 AF Session Termination

When an AF session is terminated, the AF shall send Session-Termination-Request message to the CRF.

5.2.6 Bearer Release

Upon the reception of a Re-Auth-Request including an Abort-Cause AVP indicating that some of the Packet Flows (included in the Flows AVP) of the AF session are being discontinued (typically PDP_CONTEXT_RELEASE cause), the AF will issue a Re-Auth-Answer as a response to the CRF.

5.2.7 Other Bearer Events

Upon the reception of a Re-Auth-Request including an Specific Action AVP indicating bearer establishment, loss of bearer or recovery of bearer, the AF will issue a Re-Auth-Answer as a response to the CRF.

6 Binding the AF Session Information to the Bearers

Binding refers to the CRF process of associating IP flows described in AF Service Information with bearers. An IP flow described in the AF session information can be bound to multiple bearers, as the CRF does not necessarily know which bearer is transporting this IP flow.

NOTE: IP flows described in many AF sessions may share the same bearer(s). Separate IP flows of a single AF session may be transported over different bearers.

If an IP flow described in the AF Service Information is bound to a bearer, the CRF shall install a Charging Rule for this bearer with a Service Data Flow Filter matching this IP flow.

The following mechanisms shall be used:

- For all bearer types, the UE IP Address shall be used for binding purposes. For IPv6, if the CRF is only notified about the address prefix at the Gx interface, it shall compare this prefix with the prefix of the UE IP address provided at the Rx interface.
- In particular, for GPRS, it is also recommended to use TFT filters (from TPF via Gx) and IP Flow Filters (from AF via Rx) to select the Charging Rules matching to a PDP context. The flow grouping AVP(s) of the Service Information may be used for further analysis.

Also for GPRS, the QoS information (QoS negotiated from the TPF and Requested Bandwidth from the AF) may be used for further analysis

The GPRS binding mechanism does not necessarily identify a single PDP context, therefore the same Charging Rule for an AF Session IP Flow may be installed over several PDP contexts.

7 Rx Protocol

7.1 Protocol Support

The Rx reference point shall be based on Gq protocol as specified in 3GPP TS 29.209 [4]. Most of the the AVPs from the Gq protocol are reused as specified in sub-clause 7.2.

Editor's note: The new application id needs to be allocated for Rx Protocol from IANA.

The Rx application is defined as an IETF vendor specific Diameter application, where the vendor is 3GPP. The vendor identifier assigned by IANA to 3GPP (<http://www.iana.org/assignments/enterprise-numbers>) is 10415.

With regard to the Diameter protocol defined over the Rx reference point, the CRF acts as a Diameter server, in the sense that it is the network element that handles Charging Rule control for a particular realm. The AF acts as the Diameter Client, in the sense that is the network element requesting FBC control in the bearer path network resources.

The support of Diameter agents between the CRF and the AF, is optional for the IMS, where the Rx is intra operator i.e. for GPRS: TPF, CRF and P-CSCF are all in the same network.

7.1.1 Advertising application support

The AF and the CRF shall advertise the support of the Rx specific Application by including the value of the application identifier in the Auth-Application-Id AVP and the value of the 3GPP (10415) in the Vendor-Id AVP of the Capabilities-Exchange-Request and Capabilities-Exchange-Answer commands. The Capabilities-Exchange-Request and Capabilities-Exchange-Answer commands are specified in the Diameter Base Protocol.

7.2 Securing Diameter messages

For secure transport of Diameter messages, see 3GPP TS 33.210 [6].

7.3 Rx messages

Existing Diameter command codes from the Diameter base protocol RFC 3588 [5] and the NASREQ Diameter application (draft-ietf-aaa-diameter-nasreq-17 [7]) are used with the Rx specific AVPs. An Rx specific Auth-Application id is used together with the command code to identify the Rx messages.

NOTE: The notion of NAS (Network Access Server) is not used here, NASREQ is just used for protocol purposes, not for its functional meaning.

NOTE: Some of the AVPs included in the messages formats below are in bold to highlight that these AVPs are used by this specific protocol and do not belong to the original Diameter Base Protocol RFC 3588 [5].

7.3.1 AA-Request (AAR) command

The AAR command, indicated by the Command-Code field set to 265 and the 'R' bit set in the Command Flags field, is sent by an AF to the CRF in order to provide it with the Session Information.

Message Format:

```
<AA-Request> ::= < Diameter Header: 265, REQ, PXY >
  < Session-Id >
  { Auth-Application-Id }
  { Origin-Host }
  { Origin-Realm }
  { Destination-Realm }
  * [ Media-Component-Description ]
  * [ Flow-Grouping ]
  [ AF-Charging-Identifier ]
  [ SIP-Forking-Indication ]
  * [ Specific-Action ]
  * [ Subscription-ID ]
  * [ Proxy-Info ]
  * [ Route-Record ]
  * [ AVP ]
```

7.3.2 AA-Answer (AAA) command

The AAA command, indicated by the Command-Code field set to 265 and the 'R' bit cleared in the Command Flags field, is sent by the CRF to the AF in response to the AAR command.

Message Format:

```
<AA-Answer> ::= < Diameter Header: 265, PXY >
  < Session-Id >
  { Auth-Application-Id }
  { Origin-Host }
  { Origin-Realm }
  [ Result-Code ]
  [ Experimental-Result ]
  [ Error-Message ]
  [ Error-Reporting-Host ]
  * [ Failed-AVP ]
  * [ Proxy-Info ]
  * [ AVP ]
```

7.3.3 Re-Auth-Request (RAR) command

The RAR command, indicated by the Command-Code field set to 258 and the 'R' bit set in the Command Flags field, is sent by the CRF to the AF in order to indicate an Rx specific action.

The values INDICATION_OF_ESTABLISHMENT_OF_BEARER and INDICATION_OF_RELEASE_OF_BEARER of the Specific-Action AVP are the only ones used in for Rx.

Message Format:

```
<RA-Request> ::= < Diameter Header: 258, REQ, PXY >
  < Session-Id >
  { Origin-Host }
```

```

    { Origin-Realm }
    { Destination-Realm }
    { Destination-Host }
    { Auth-Application-Id }
  *{ Specific-Action }
  *{ Flows }
  *{ Subscription-ID }
  [ Abort-Cause ]
  [ Origin-State-Id ]
  *{ Proxy-Info }
  *{ Route-Record }
  *{ AVP }

```

7.3.4 Re-Auth-Answer (RAA) command

The RAA command, indicated by the Command-Code field set to 258 and the 'R' bit cleared in the Command Flags field, is sent by the AF to the CRF in response to the RAR command.

Message Format:

```

<RA-Answer> ::= < Diameter Header: 258, PXY >
    < Session-Id >
    { Auth-Application-Id }
    { Origin-Host }
    { Origin-Realm }
    [ Result-Code ]
    [ Experimental-Result ]
  *{ Media-Component-Description }
  *{ Flow-Grouping }
  [ Origin-State-Id ]
  [ Error-Message ]
  [ Error-Reporting-Host ]
  *{ Failed-AVP }
  *{ Proxy-Info }
  *{ AVP }

```

7.3.5 Session-Termination-Request (STR) command

The STR command, indicated by the Command-Code field set to 275 and the 'R' bit set in the Command Flags field, is sent by the AF to inform the CRF that an established session shall be terminated.

Message Format:

```

<ST-Request> ::= < Diameter Header: 275, REQ, PXY >
    < Session-Id >
    { Origin-Host }
    { Origin-Realm }
    { Destination-Realm }
    { Auth-Application-Id }
    { Termination-Cause }
    [ Destination-Host ]
  *{ Class }
  [ Origin-State-Id ]
  *{ Proxy-Info }
  *{ Route-Record }
  *{ AVP }

```

7.3.6 Session-Termination-Answer (STA) command

The STA command, indicated by the Command-Code field set to 275 and the 'R' bit cleared in the Command Flags field, is sent by the CRF to the AF in response to the STR command.

Message Format:

```

<ST-Answer> ::= < Diameter Header: 275, PXY >
    < Session-Id >
    { Origin-Host }
    { Origin-Realm }
    { Auth-Application-Id }
    [ Result-Code ]
    [ Experimental-Result ]
    [ Error-Message ]

```

```

[ Error-Reporting-Host ]
*[ Failed-AVP ]
[ Origin-State-Id ]
*[ Redirect-Host ]
[ Redirect-Host-Usage ]
[ Redirect-Max-Cache-Time ]
*[ Proxy-Info ]
[ AVP ]

```

7.3.7 Abort-Session-Request (ASR) command

The ASR command, indicated by the Command-Code field set to 274 and the 'R' bit set in the Command Flags field, is sent by the CRF to inform the AF that bearer for the established session is no longer available.

Message Format:

```

<AS-Request> ::= < Diameter Header: 274, REQ, PXY >
                < Session-Id >
                { Origin-Host }
                { Origin-Realm }
                { Destination-Realm }
                { Destination-Host }
                { Auth-Application-Id }
                { Abort-Cause }
                [ Origin-State-Id ]
                *[ Proxy-Info ]
                *[ Route-Record ]
                [ AVP ]

```

7.3.8 Abort-Session-Answer (ASA) command

The ASA command, indicated by the Command-Code field set to 274 and the 'R' bit cleared in the Command Flags field, is sent by the AF to the CRF in response to the ASR command.

Message Format:

```

<AS-Answer> ::= < Diameter Header: 274, PXY >
                < Session-Id >
                { Origin-Host }
                { Origin-Realm }
                [ Result-Code ]
                [ Experimental-Result ]
                [ Origin-State-Id ]
                [ Error-Message ]
                [ Error-Reporting-Host ]
                *[ Failed-AVP ]
                *[ Redirected-Host ]
                [ Redirected-Host-Usage ]
                [ Redirected-Max-Cache-Time ]
                *[ Proxy-Info ]
                *[ AVP ]

```

7.4 Re-used AVPs for Rx Protocol

The table 7.3.1 lists the Diameter AVPs re-used by the Rx reference point from existing Diameter Applications, including a reference to their respective specifications and when needed, a short description of their usage within the Rx reference point. Other AVPs from existing Diameter Applications, except for the AVPs from Diameter Base Protocol, do not need to be supported. The AVPs from Diameter Base Protocol are not included in table 7.3.1, but they are re-used for the Rx protocol

The Vendor-Id header of all AVPs defined in the present document shall be set to 3GPP (10415).

Table 7.3.1: Rx re-used Diameter AVPs

Attribute Name	Reference	Comments
Abort-Cause	3GPP TS 29.209 [4]	
AF-Application-Identifier	3GPP TS 29.209 [4]	

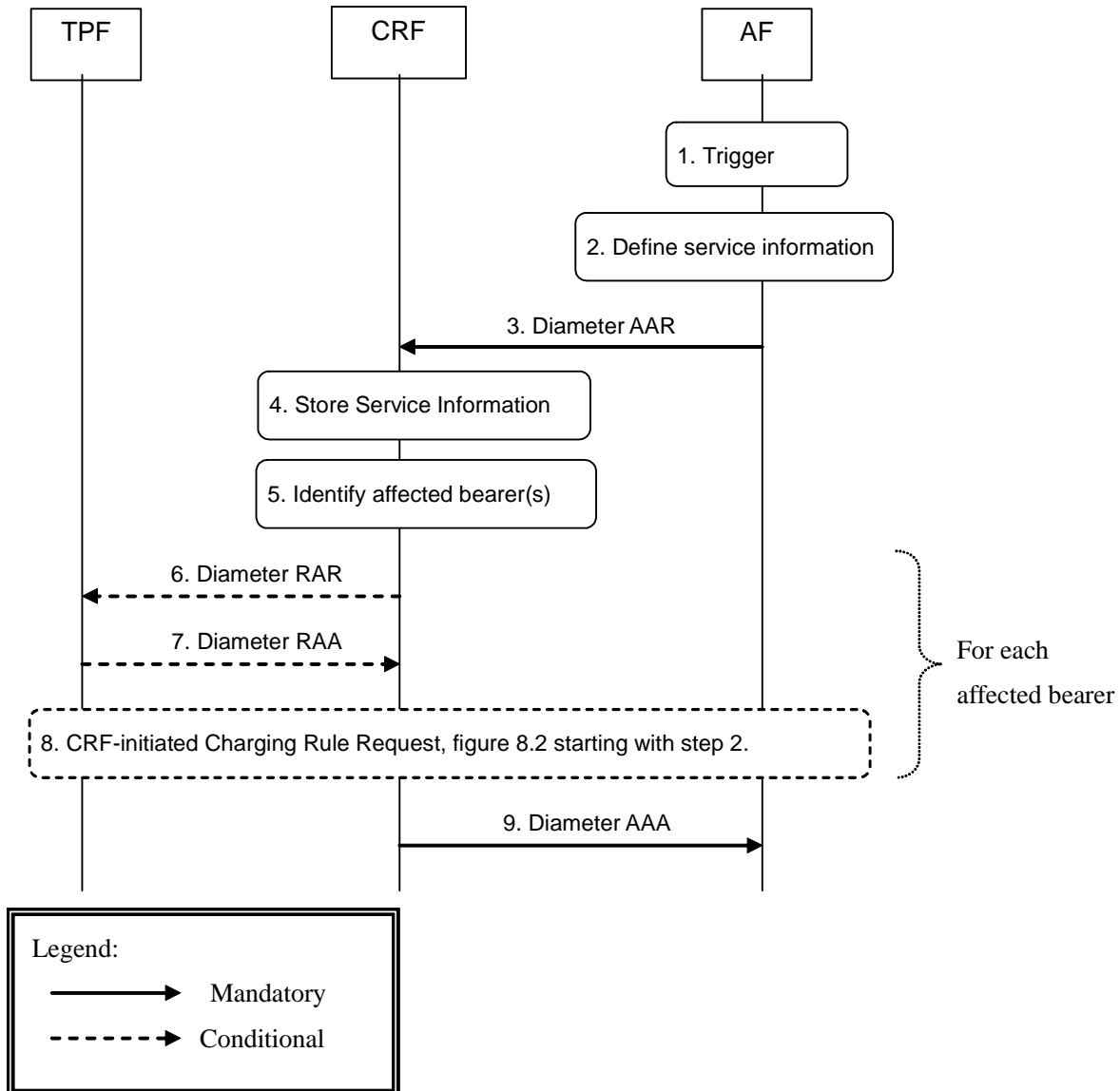
Attribute Name	Reference	Comments
AF-Charging-Identifier	3GPP TS 29.209 [4]	
Flow-Description	3GPP TS 29.209 [4]	
Flow-Number	3GPP TS 29.209 [4]	
Flows	3GPP TS 29.209 [4]	
Flow-Status	3GPP TS 29.209 [4]	
Flow-Usage	3GPP TS 29.209 [4]	
Flow-Grouping	3GPP TS 29.209 [4]	
Max-Requested-Bandwidth-DL	3GPP TS 29.209 [4]	
Max-Requested-Bandwidth-UL	3GPP TS 29.209 [4]	
Media-Component-Description	3GPP TS 29.209 [4]	
Media-Component-Number	3GPP TS 29.209 [4]	
Media-Sub-Component AVP	3GPP TS 29.209 [4]	
Media-Type	3GPP TS 29.209 [4]	
RR-Bandwidth	3GPP TS 29.209 [4]	
RS-Bandwidth	3GPP TS 29.209 [4]	
SIP-Forking-Indication	3GPP TS 29.209 [4]	
Specific-Action	3GPP TS 29.209 [4]	<p>Allowed values:</p> <p>INDICATION_OF_LOSS_OF_BEARER(2)</p> <p>INDICATION_OF_RECOVERY_OF_BEARER(3)</p> <p>INDICATION_OF_TERMINATION_OF_BEARER(4)</p> <p>INDICATION_OF_ESTABLISHMENT OF BEARER (5)</p>
Subscription-Id	draft-ietf-aaa-diameter-cc-06.txt [8]	The identification of the subscription (IMSI, MSISDN, etc.)

8 Rx/Gx Signalling Flows

The signalling flows in this Clause are examples.

8.1 AF session establishment or modification

This clause covers the provision of Service Information and related Charging Rules when an AF session is being established or modified.



1. The AF receives an internal or external trigger to provide Service Information, at a set-up of a new AF session or at a modification of an existing AF session.
2. The AF identifies the Service Information needed (e.g. IP address of the IP flow(s), port numbers to be used etc...).
3. The AF provides the Service Information to the CRF by sending a Diameter AAR for a new Rx Diameter session at set-up of a new AF session, or for the existing Rx Diameter session in case of AF session modification.
4. The CRF shall store the received Service Information
5. The CRF identifies any affected established bearer(s) by binding new or modified IP flows described in the AF Service Information to bearer(s) using the bearer information previously received from the TPF and the Service Information received from the AF.

If any affected bearer(s) are identified in step 5, steps 6, 7 and 8 are performed separately for each of these bearer(s). If there are no bearer(s) affected, steps 6, 7 and 8 are not executed.

6. The CRF sends Diameter RAR to trigger the TPF to request Charging Rules.
 7. The TPF sends RAA to acknowledge the RAR.
 8. The TPF will request Charging Rules for the bearer identified in step 7, as described in Figure 8.2 starting with step 2.
9. As soon as the CRF completes the provisioning of Charging Rules for the bearer(s) identified in step 5, the CRF sends a Diameter AAA to the AF.

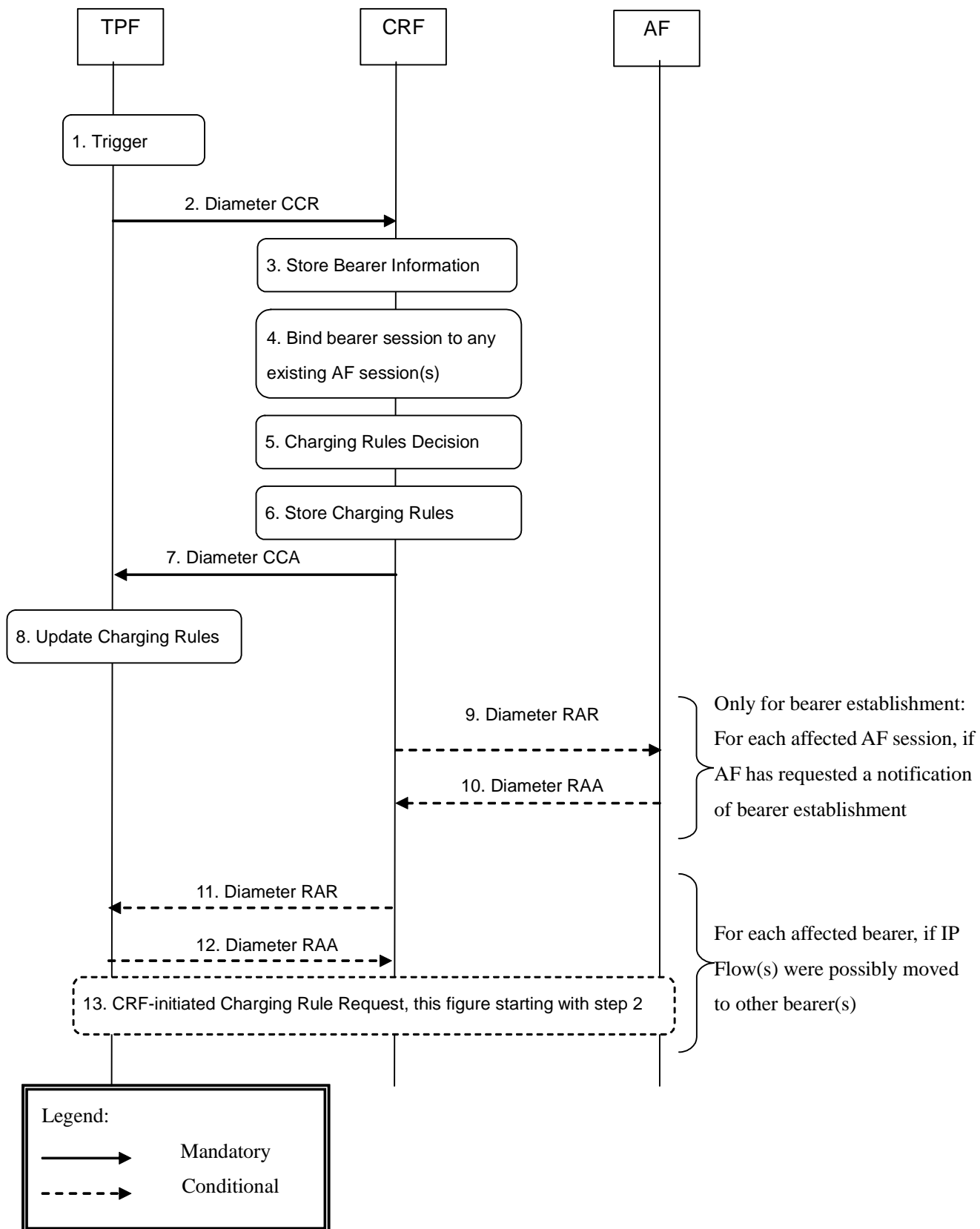
Figure 8.1: AF session establishment or modification

8.2 Request of Charging Rule

This clause covers both the CRF-initiated and bearer-event-initiated Request of Charging Rules by the TPF.

A bearer-event-initiated Request of Charging Rules occurs when a new bearer is established or when an existing bearer is modified. For GPRS, these are PDP Context Activation(s) or Modification(s). A bearer modification triggers a Charging Rule request only if the CRF has previously requested a Charging Rule Request for the given bearer modification event.

A CRF-initiated Request of Charging Rules is triggered by a Diameter RAR sent from the CRF.



1. The TPF receives a trigger for a Charging Rule Request, such as the establishment or modification of a bearer or an RAR from the CRF.
2. The Charging Rules are requested by the TPF, using the Diameter CCR. The TPF also provides information about the bearer within the request.

3. The CRF stores the received bearer information in the Diameter CCR, e.g. TFT filters and UE IP address (prefix).
4. The CRF binds the bearer to all matching IP flow(s) of existing of AF session(s) using the bearer information received from the TPF and the Service Information received from the AF(s).
5. The CRF defines new Charging Rule(s) to be installed for the identified bearer. For a modified bearer, the CRF can also identify existing Charging Rules that need to be modified or removed. The Charging Rules may relate to any of the matching AF sessions identified in step 4 or that may exist in the CRF without matching to any AF session.
6. The CRF stores the selected Charging Rules for the bearer.
7. The Charging Rules are provisioned by the CRF to the TPF using Diameter CCA. The CRF may also provide event triggers listing bearer events for which the CRF desires Charging Rule Requests.
8. The TPF installs the received Charging Rules. For a modified bearer the TPF may also have to modify or remove previously installed Charging Rules.

If the trigger in step 1 was a bearer establishment, steps 9 and 10 are executed separately for each affected AF session for which the AF has requested notification of bearer establishment.

9. The CRF sends a Diameter RAR to the AF to inform it about the bearer establishment.
10. The CRF sends RAA to acknowledge the RAR.

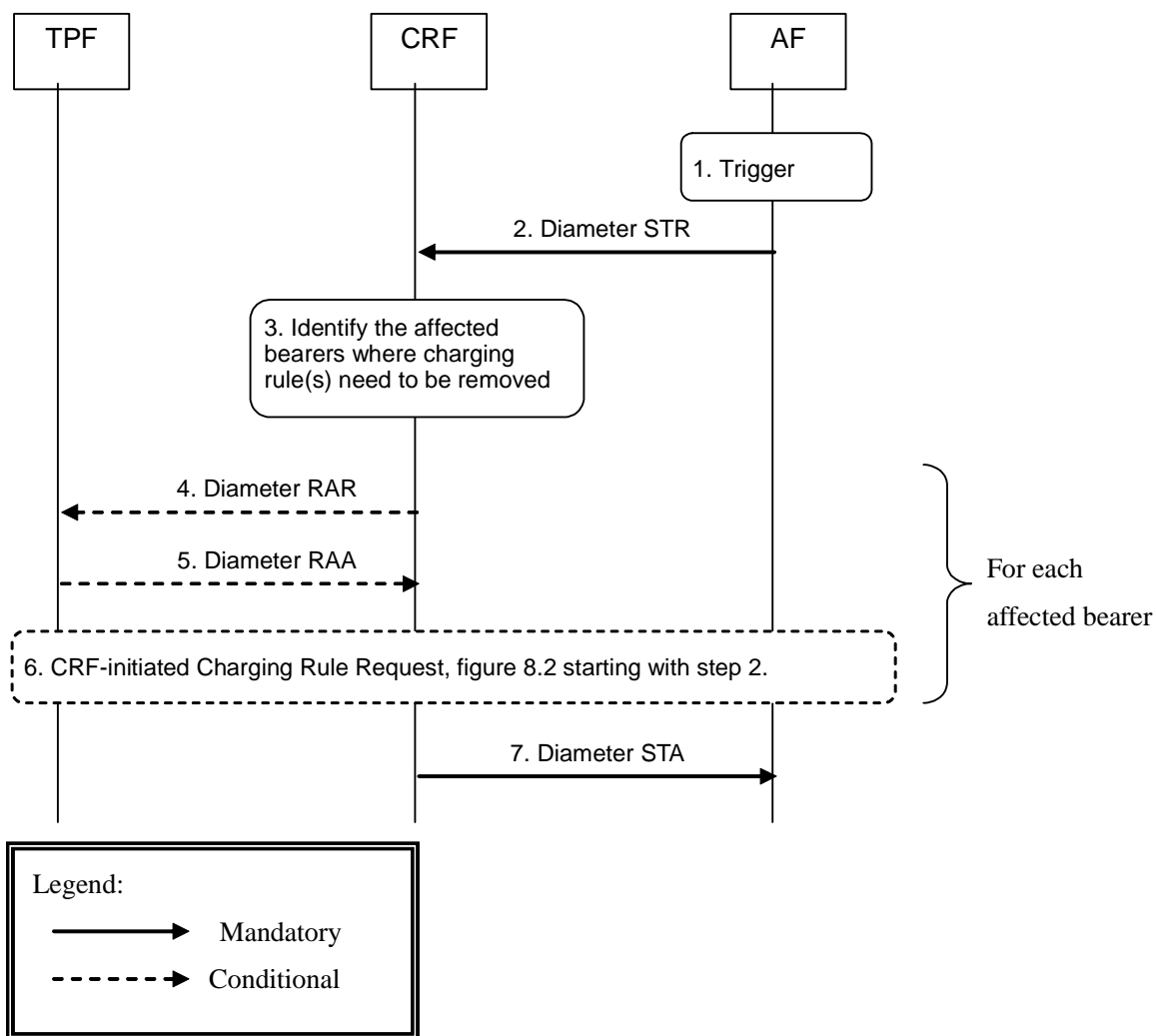
If IP Flow(s) were possibly moved to other bearer(s), other bearer(s) may need to be modified. The following steps are performed for each of these bearers. For GPRS, an IP flow may be possibly moved if a higher priority TFT filter in the modified PDP context was removed and a lower priority TFT filter in another PDP context matches the IP flow.

11. The CRF sends Diameter RAR to trigger the TPF to request Charging Rules for the other bearer.
12. The TPF sends RAA to acknowledge the RAR.
13. The TPF will request Charging Rules for the bearer identified in step 11, as described in the present figure starting with step 2.

Figure 8.2: Charging Rule Request.

8.3 Removal of Charging Rules at AF session release

This clause covers the removal of Charging Rules at the AF session release.



1. The AF receives an internal or external trigger for a session release.
2. The AF sends a session termination request, Diameter STR, to the CRF to request the removal of the session.
3. The CRF identifies the affected bearers where Charging Rules for the IP flow(s) of this AF session are installed. These Charging Rules need to be removed.

If any affected bearer(s) are identified, steps 4, 5 and 6 are performed separately for each of these bearer(s).

4. The CRF sends a Diameter RAR to trigger the TPF to request Charging Rules.
5. The TPF sends a Diameter RAA to acknowledge the RAR.
6. The TPF will request Charging Rules for the bearer identified in step 7, as described in Figure 8.2 starting with step 2. The CRF will request the TPF to remove the Charging Rules for the released AF session.
7. As soon as the CRF has requested the TPF to remove the Charging Rules for all the bearer(s) identified in step 3, The CRF sends Diameter STA, session termination answer, to the AF.

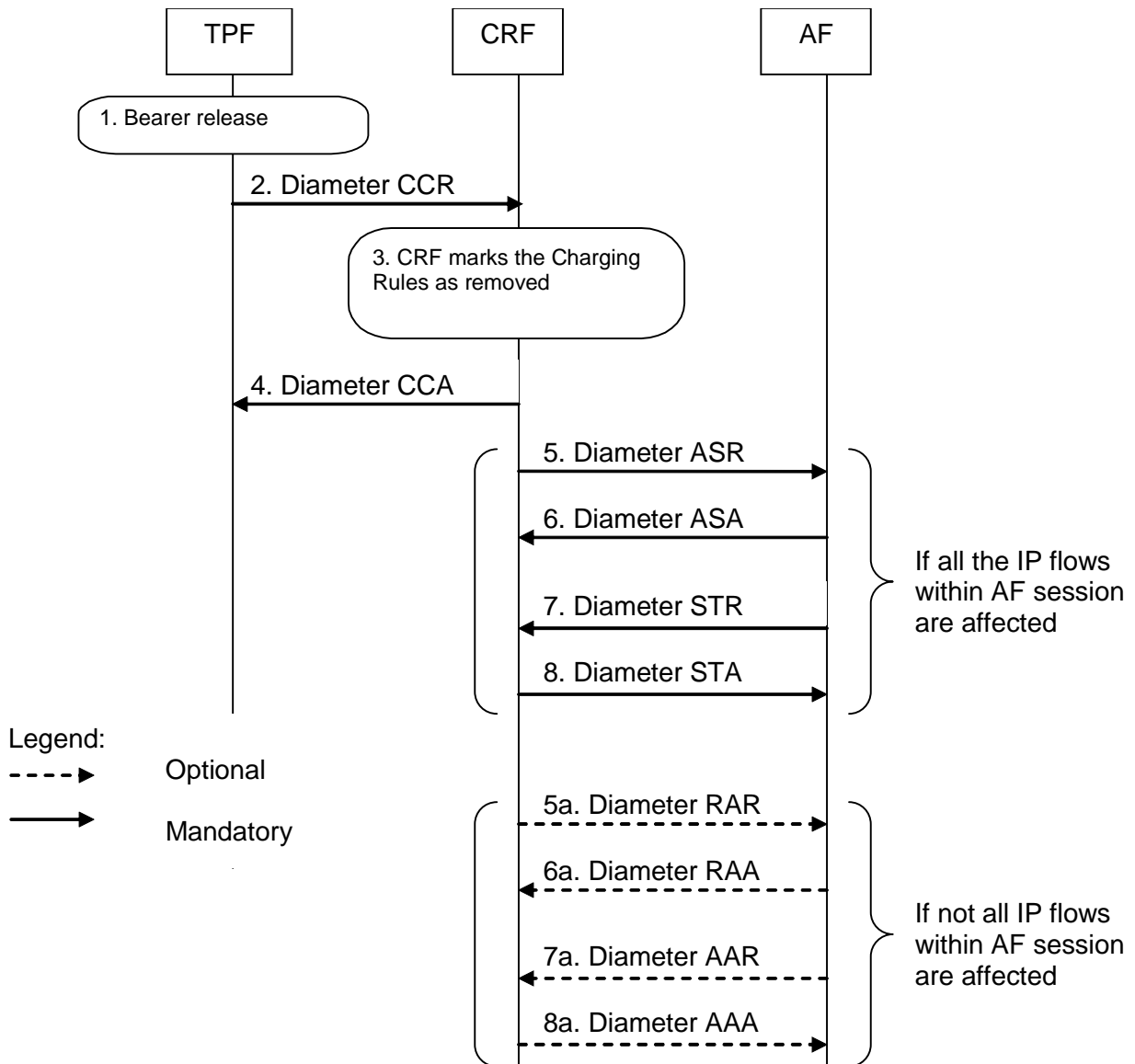
Figure 8.3: Removal of Charging Rules at AF session release

8.4 Bearer Release

This clause covers the bearer release, which may be indicated to the AF. Three cases are covered:

- bearer release that does not cause IP flow(s) within an AF session to be disabled;
- bearer release that causes at least one but not all the IP flow(s) within an AF session to be disabled and
- bearer release that causes all the IP flows within an AF session to be disabled.

Bearer release may not cause an IP flow within an AF session to be disabled if the IP flow is bound to more than one bearer. For GPRS, those bearers may be PDP context(s) within a PDP session. The CRF does not necessarily know which PDP context carries the IP flow, thus a release of a PDP context does not necessarily mean that the IP flow is disabled.



1. A bearer is deactivated. For GPRS, the SGSN deactivates the PDP context carrying IP flow(s) of by sending the Delete PDP Context Request message to the GGSN.
2. The TPF sends a Diameter CCR message to the CRF, indicating bearer termination.
3. The CRF marks the Charging Rules for the terminated bearer as removed.
4. The CRF acknowledges the bearer termination by sending a Diameter CCA message.

The following steps apply for the case where at least one IP Flow within an AF session is being disabled. They apply only if the affected IP Flow is not bound to any other bearer that is still established. The steps shall be performed separately for each ongoing AF session that is affected by the bearer release as explained below.

If all IP flow(s) within the AF session are discontinued by the bearer release:

5. The CRF indicates the session abort to the AF by sending a Diameter ASR message to the AF.
6. The AF responds by sending a Diameter ASA message to the CRF.
7. The AF sends a Diameter STR message to the CRF to indicate that the session has been terminated.
8. The CRF responds by sending a Diameter STA message to the AF.

If at least one but not all of the IP flow(s) within the AF session are discontinued by the bearer release, and the AF has requested notification of bearer removal:

- 5a. The CRF indicates the release of the bearer by sending a Diameter RAR to the AF.
 - 6a. The AF responds by sending a Diameter RAA to the CRF.
 - 7a. The AF may send an AAR to the CRF to update the session information.
- 8a. If step 7a occurs, the CRF responds by sending a AAA to the AF.

Figure 8.6: Bearer Release

Annex A (normative): Support for SIP forking

The P-CSCF shall be able to handle forking when FBC is applied. Forking can occur as specified in 3GPP TS 23.228 [6].

A.1 Resources for early media for forked responses

When a SIP session has been originated by a connected UE, the P-CSCF may receive provisional responses associated with different early dialogues due to forking before the first final answer is received. Multiple early media session may be established during this process.

The UE and the P-CSCF become aware of the forking only when a subsequent provisional response arrives for a new early dialogue. After the first early media session is established, for each subsequent provisional response establishing an additional early media session, the P-CSCF shall use an AA-Request within the existing Diameter session containing the SIP-Forking-Indication AVP with value SEVERAL_DIALOGUES and include the Service Information derived from each corresponding provisional response.

When receiving an AA-Request containing the SIP-Forking-Indication AVP with value SEVERAL_DIALOGUES, the CRF shall identify the existing Service Information for the corresponding AF session. The CRF shall send additional Charging Rules as required by the Flow Description AVPs within the session information to the TPF. The CRF can also use the highest QoS requested for an IP flow by any of the forked responses as the required QoS for that IP flow.

A.2 Updating the Charging Rules information at the final answer

The P-CSCF shall store the SDP information for each early dialogue separately until the first final SIP answer is received. Then the corresponding early dialogue is progressed to an established dialogue to establish the final SIP session. All the other early dialogues are terminated. The Service Information for the SIP session is updated to match the requirements of the remaining early dialogue only.

When receiving the first final SIP response, the P-CSCF shall send an AA-Request without the SIP-Forking-Indication AVP and include the Service Information derived from the SDP corresponding to the dialogue of the final response.

When receiving an AA-Request with no SIP-Forking-Indication AVP or with a SIP-Forking-Indication AVP with value SINGLE_DIALOGUE, the CRF shall update the installed Charging Rules information to match only the requirements of the Service Information within this AA-Request. The CRF should immediately remove Charging Rule(s) not matching IP flow(s) in the updated Service Information, to reduce the risk for initial clipping of the media stream, and to minimize possible misuse of resources.

Annex B (informative): Change history

Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
12-2004	CN#26				Presented to CN#26 for information	-	1.0.0
03-2005	CN#27				Presented to CN#27 for approval	1.0.0	2.0.0
03-2005	CN#27	NP-050118			Keyword in second page corrected and the format of Annex A changed.	2.0.0	2.0.1