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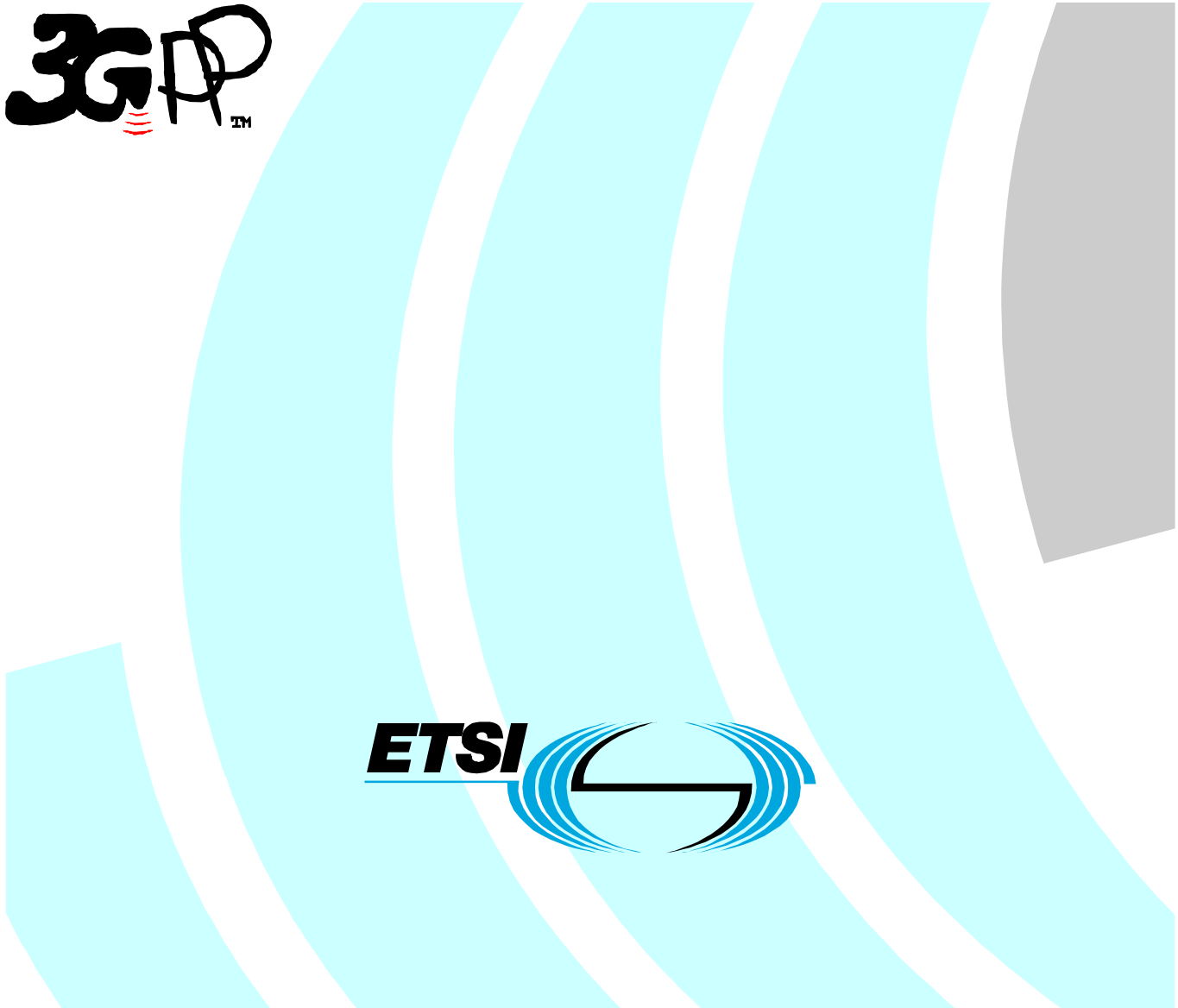
Technical Specification

Universal Mobile Telecommunications System (UMTS); Charging rule provisioning over Gx interface (3GPP TS 29.210 version 6.1.0 Release 6)



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650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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Foreword

This Technical Specification (TS) has been produced by ETSI 3rd Generation Partnership Project (3GPP).

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Contents

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

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- x the first digit:
  - 1 presented to TSG for information;
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1 Scope

The present document provides the stage 3 specification of the Gx reference point. The functional requirements and the stage 2 specifications of the Gx reference point are contained in 3GPP TS 23.125 [3]. The Gx reference point is for provisioning service data flow based charging rules between the Traffic Plane Function (TPF) and the Charging Rules Function (CRF), also known as Service Data Flow Based Charging Rules Function.

The present document defines:

- the protocol to be used between TPF and CRF over the Gx reference point;
- the information to be exchanged between TPF and CRF over the Gx reference point.

Whenever it is possible the present document specifies the requirements for this protocol by reference to specifications produced by the IETF within the scope of Diameter. Where this is not possible, extensions to Diameter are defined within the present document.

3GPP TS 29.211 [15] provides callflows for Flow Based Charging, covering the signalling on the Gx reference point.

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

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

[2] 3GPP TS 23.002: "Network architecture".

[3] 3GPP TS 23.125: "Overall high level functionality and architecture impacts of flow based charging; Stage 2".

[4] IETF RFC 3588: "Diameter Base Protocol".

[5] IETF RFC 2234: "Augmented BNF for syntax specifications: ABNF".

[6] 3GPP TS 33.210: "3G security; Network Domain Security (NDS); IP network layer security".

[7] 3GPP TS 29.207: "Policy control over Go interface".

[8] draft-ietf-aaa-diameter-cc-06.txt: "Diameter Credit-Control Application".

[9] 3GPP TS 32.299: "Telecommunication management; Charging management; Diameter charging applications".

[10] 3GPP TS 29.209: "Policy control over Gq interface".

[11] 3GPP TS 29.061: "Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN)".

[12] draft-ietf-aaa-diameter-nasreq-17.txt: "Diameter Network Access Server Application", work in progress.

[13] 3GPP TS 32.251: "Packet Switched (PS) domain charging".

[14] 3GPP TS 24.008: "Mobile radio interface Layer 3 specification; Core network protocols; Stage 3".

[15] 3GPP TS 29.211: "Rx Interface and Rx/Gx signalling flows".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

Application Function (AF): element offering applications that use IP bearer resources
The AF is capable of communicating with the CRF to transfer dynamic charging rules related service information. One example of an AF is the P-CSCF of the IM CN subsystem.

Attribute-Value Pair: See IETF RFC 3588 [4], corresponds to an Information Element in a Diameter message.

PDP Session: unique association of a subscriber with a network access service given by the combination of MSISDN, APN and IP address. A PDP session can consist of one or more PDP contexts (one primary and zero or more secondary)

3.3 Abbreviations

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

AF	Application Function
AVP	Attribute-Value Pair
CCF	Charging Collection Function
CGF	Charging Gateway Function
CRF	Charging Rules Function
CSCF	Call Session Control Function
DCC	Diameter Credit Control
GCID	GPRS Charging ID
ICID	IMS Charging IDentifier
IM	IP Multimedia
IMS	IP Multimedia core network Subsystem
IMSI	International Mobile Subscriber Identity
OCS	Online Charging System
P-CSCF	Proxy-CSCF
PDGw	Packet Data Gateway
PLMN	Public Land Mobile Network
QoS	Quality of Service
SBLP	Service Based Local Policy
S-CSCF	Serving-CSCF
SDF	Service Data Flow
SGSN	Serving GPRS Support Node
SIP	Session Initiation Protocol
TPF	Traffic Plane Function
UE	User Equipment
WAP	Wireless Application Protocol
WLAN	Wireless LAN

4 Gx reference point

4.1 Overview

The Gx reference point is used for provisioning service data flow based charging rules. The reference point is located between the Traffic Plane Function (TPF) and the Charging Rules Function (CRF), also known as Service Data Flow Based Charging Rules Function. The stage 2 level requirements for the Gx reference point are defined in 3GPP TS 23.125 [3].

4.2 Charging Rules

Charging rules determine how service data flows are identified and charged. The TPF shall apply charging rules by evaluating received packets against service data flow filters. When a packet matches a service data flow filter, the packet matching process for that packet is complete, and the charging rule for that filter shall be applied.

Charging rules may be:

- Pre-defined and active within the TPF (e.g. default rules that are configured within the TPF).
- Pre-defined within the TPF but not active (e.g. charging rules that are activated dynamically via provisioning over the Gx reference point).
- Pre-defined within the CRF and provided by the CRF (charging rules that are provisioned dynamically over the Gx reference point).
- Dynamically defined and provided by the CRF (e.g. dynamic charging rules for example for IMS peer to peer service data flows, where both the service data flow filter and the charging rule are identified dynamically).

NOTE: Whether the charging rule is pre-defined or dynamically defined by the CRF does not impact the procedures at the Gx reference point

- Pre-defined rules within the TPF may be grouped allowing CRF to dynamically activate a set of rules over the Gx reference point.

A charging rule shall consist of a charging rule name, charging key (i.e. rating group), service identifier, service flow filter and other charging parameters. The charging rule name shall be used to reference to a charging rule in the communication between the TPF and the CRF. The service identifier shall be used to identify the service or the service component the service data flow relates to. The service flow filter shall be used to select the traffic for which the charging rule applies. The charging parameters define whether online and offline charging interfaces are used, what is to be metered in offline charging, what is the precedence of the charging rule in case of overlapping charging rules, on what level the TPF shall report the usage related to the charging rule, etc. Charging rule also includes Application Function record information for enabling charging correlation between the application and bearer layer if the Application Function has provided this information via the Rx interface. For IMS this includes the IMS Charging Identifier (ICID) and flow identifiers. See the AVPs in clauses 5.2 and 5.3.

4.3 Functionality of the Gx reference point

4.3.1 Initialization and maintenance of connection

The initialization and maintenance of the connection between each interworking CRF and TPF pair is defined by the underlying protocol. Establishment and maintenance of connections between Diameter nodes is described in IETF RFC 3588 [4].

4.3.2 Request for charging rules from the TPF

The TPF shall indicate, via the Gx reference point, a request for charging rules in the following instances.

1) At bearer establishment:

   The TPF shall supply user identification and other attributes to allow the CRF to identify the charging rules to be applied. The other attributes shall include the type of the radio access technology (e.g UTRAN, GERAN, WLAN) and the UE IP address. For GPRS, information about the user equipment (e.g. IMEISV), QoS negotiated, SGSN Address, SGSN country and network codes, APN, TFT and indication if the bearer is used as IMS signalling PDP context shall be provided.

2) At bearer modification if an Event trigger is met:

   The TPF shall supply those attributes that have changed within the charging rule request. The bearer attributes that have been modified since the last request are required items.

3) When the specific event of the Event trigger is detected:

   The TPF shall supply those attributes that have changed within the charging rule request. The attributes that have been modified since the last request are required items.

NOTE: For GPRS the same procedures are applied to both primary and secondary PDP contexts.

4.3.3 Provision of charging rules from the CRF

The CRF shall indicate, via the Gx reference point, charging rules to be applied at the TPF. This may be:

- in response to a request for charging rules., i.e. to a request made as described in the preceding section; or
- unsolicited by the TPF, e.g. in response to information provided to the CRF via the Rx or Ry reference points, or in response to an internal trigger within the CRF.

For each request from the TPF and upon the unsolicited provision the CRF shall provision zero or more charging rules. The CRF may provide a single charging rule by one of the following means:

- Reference to a charging rule predefined at the TPF and the required action, i.e. activation or deactivation of charging rule, or
- Reference to a charging rule previously provided by the CRF to the TPF and the required action and possibly modified information, e.g. modification or removal of charging rule, or
- 'Fully formed' charging rule and the required action, i.e. installation of a charging rule

As an alternative to providing a single sharging rule, the CRF may provide a reference to a group of charging rules predefined at the TPF and the required action, i.e. activation or deactivation of the group.

The CRF may combine multiple of the above charging rule provisionings in a single command.

To activate a predefined charging rule at the TPF, charging rule name shall be used as a reference to the predefined charging rule. To activate a group of predefined charging rules within the TPF (e.g. gold users or gaming services) charging rule base name shall be used as a reference to the group of predefined charging rules. The same references shall be used for deactivating predefined and removing CRF-provided charging rules from a bearer, which for GPRS is a PDP context. See the AVP definitions in clause 5.2.

To provision or modify a CRF defined charging rule, the Charging-Rule-Definition AVP shall be used. If a charging rule with the same charging rule name already exists at the TPF, the new charging rule shall update the currently installed charging rule. If the existing charging rule already has charging attributes also included in the new charging rule definition, the existing attributes shall be overwritten. Any charging attribute in the existing charging rule not included in the new charging rule definition shall remain valid.

4.3.4 Provision of event triggers from the CRF

The CRF may provide event triggers to the TPF using the charging rule provision procedure. Event triggers are used to determine which bearer modification or specific event causes the TPF to re-request charging rules. Event triggers apply for a bearer and may be included to the initial or subsequent charging rule provision.

4.3.5 Provision of charging addresses from the CRF

Within the initial charging rule provisioning only, the CRF may provide CCF and/or OCS addresses to the TPF defining the offline and online charging system addresses respectively. These shall overwrite any predefined addresses at the TPF. Both primary and secondary addresses for CCF and/or OCS shall be provided simultaneously. Provisioning CCF or OCS addresses without charging rules for offline or online charged service data flows, respectively, shall not be considered as an error since such charging rules may be provided in later provisioning.

4.3.6 Indication of bearer termination (from TPF to CRF)

The TPF indicates to the CRF, via the Gx reference point, that a bearer is terminated via the release of the corresponding DCC (sub)session. TheTPF shall send a CC-Request with CC-Request-Type AVP set to the value TERMINATION_REQUEST. The bearer termination indication identifies the bearer being removed by the usage of the corresponding DCC (sub)session.

Upon the bearer termination, the CRF may provision charging rules for any remaining bearers. In case of GPRS, these are the remaining PDP context(s) in a PDP session for which a PDP context is terminated. The CRF provisions the charging rules for any remaining bearer using the unsolicited provision procedure.

5. Gx Protocol

5.1 Protocol support

The Gx reference point shall be based on Diameter as specified in RFC 3588 [4] and Diameter Credit Control Application (draft-ietf-aaa-diameter-cc-06.txt) [8] except as modified by the defined Gx specific procedures and AVPs. Unless otherwise specified, the procedures (including error handling and unrecognized information handling) are unmodified. In addition to the AVPs defined within the clause 5.2, the existing Diameter AVPs are reused as specified in sub-clause 5.3. Diameter messages from the Diameter base application (RFC 3588 [4]) and DCC (draft-ietf-aaa-diameter-cc-06.txt [8]) are reused as specified in clause 6.

With regard to the Diameter protocol defined over the Gx reference point, the CRF acts as a Diameter server, in the sense that it is the network element that handles charging rule requests for a particular realm. The TPF acts as the Diameter Client, in the sense that it is the network element requesting charging rules.

5.2 Gx specific AVPs

Table 5.2 describes the Diameter AVPs defined for the Gx reference point, their AVP Code values, types, possible flag values and whether or not the AVP may be encrypted. The Vendor-Id header of all AVPs defined in the present document shall be set to 3GPP (10415).

Table 5.2: Gx specific Diameter AVPs

Attribute Name	AVP Code	Clause defined	Value Type (note 2)	AVP Flag rules (note 1)				May Encr.
				Must	May	Should not	Must not	
Bearer-Usage	1000	5.2.1	Enumerated	M,V	P			Y
Charging-Rule-Install	1001	5.2.2	Grouped	M,V	P			Y
Charging-Rule-Remove	1002	5.2.3	Grouped	M,V	P			Y
Charging-Rule-Definition	1003	5.2.4	Grouped	M,V	P			Y
Charging-Rule-Base-Name	1004	5.2.5	OctetString	M,V	P			Y
Charging-Rule-Name	1005	5.2.6	OctetString	M,V	P			Y
Event-Trigger	1006	5.2.7	Enumerated	M,V	P			Y
Metering-Method	1007	5.2.8	Enumerated	M,V	P			Y
Offline	1008	5.2.9	Enumerated	M,V	P			Y
Online	1009	5.2.10	Enumerated	M,V	P			Y
Precedence	1010	5.2.11	Unsigned32	M,V	P			Y
Primary-CCF-Address	1011	5.2.12	DiameterURI	M,V	P			Y
Primary-OCS-Address	1012	5.2.13	DiameterURI	M,V	P			Y
Reporting-Level	1014	5.2.15	Enumerated	M,V	P			Y
Secondary-CCF-Address	1015	5.2.16	DiameterURI	M,V	P			Y
Secondary-OCS-Address	1016	5.2.17	DiameterURI	M,V	P			Y
TFT-Filter	1017	5.2.18	IPFilterRule	M,V	P			Y
TFT-Packet-Filter-Information	1018	5.2.19	Grouped	M,V	P			Y
ToS-Traffic-Class	1019	5.2.20	OctetString	M,V	P			Y
NOTE 1: The AVP header bit denoted as 'M', indicates whether support of the AVP is required. The AVP header bit denoted as 'V', indicates whether the optional Vendor-ID field is present in the AVP header. For further details, see RFC 3588 [4].								
NOTE 2: The value types are defined in RFC 3588 [4].								

5.2.1 Bearer-Usage AVP

The Bearer-Usage AVP (AVP code 1000) is of type Enumerated, and it shall indicate how the bearer is being used. If the Bearer-Usage AVP has not been previously provided, its absence shall indicate that no specific information is available. If the Bearer-Usage AVP has been provided, its value shall remain valid until it is provided the next time. The following values are defined:

GENERAL (0)

This value shall indicate no specific bearer usage information is available.

IMS_SIGNALLING (1)

This value shall indicate that the bearer is used for IMS signalling only.

5.2.2 Charging-Rule-Install AVP

The Charging-Rule-Install AVP (AVP code 1001) is of type Grouped, and it is used for installing or modifying charging rules for a bearer as instructed from the CRF to the TPF. Charging-Rule-Name AVP is a reference for activating a specific charging rule predefined at the TPF. The Charging-Rule-Base-Name AVP is a reference for activating a group of charging rules predefined at the TPF. The Charging-Rule-Definition AVP is used for installing or modifying charging rules provisioned over the Gx interface.

AVP Format:

```
Charging-Rule-Install ::= < AVP Header: 1001 >
                          *[ Charging-Rule-Definition ]
                          *[ Charging-Rule-Name ]
                          *[ Charging-Rule-Base-Name ]
                          *[ AVP ]
```

5.2.3 Charging-Rule-Remove AVP

The Charging-Rule-Remove AVP (AVP code 1002) is of type Grouped, and it is used for removing charging rules from a bearer. Charging-Rule-Name AVP is a reference for a specific charging rule at the TPF to be removed or for a specific

charging rule predefined at the TPF to be deactivated.. The Charging-Rule-Base-Name AVP is a reference for a group of charging rules predefined at the TPF to be deactivated.

AVP Format:

```
Charging-Rule-Remove ::= < AVP Header: 1002 >
                          *[ Charging-Rule-Name ]
                          *[ Charging-Rule-Base-Name ]
                          *[ AVP ]
```

5.2.4 Charging-Rule-Definition AVP

The Charging-Rule-Definition AVP (AVP code 1003) is of type Grouped, and it defines the charging rule for a service flow sent by the CRF to the TPF. The Charging-Rule-Name AVP uniquely identifies the charging rule for a bearer and it is used to reference to a charging rule in communication between the TPF and the CRF. The Flow-Description AVP(s) determines the traffic that belongs to the service flow.

If optional AVP(s) within a Charging-Rule-Definition AVP are omitted, but corresponding information has been provided in previous Gx messages, the previous information remains valid. If Flow-Description AVP(s) are supplied, they replace all previous Flow-Description AVP(s). If Flows AVP(s) are supplied, they replace all previous Flows AVP(s),

AVP Format:

```
Charging-Rule-Definition ::= < AVP Header: 1003 >
                              { Charging-Rule-Name }
                              [ Service-Identifier ]
                              [ Rating-Group ]
                             *[ Flow-Description ]
                              [ Reporting-Level ]
                              [ Online ]
                              [ Offline ]
                              [ Metering-Method ]
                              [ Precedence ]
                              [ AF-Charging-Identifier ]
                             *[ Flows ]
                             *[ AVP ]
```

5.2.5 Charging-Rule-Base-Name AVP

The Charging-Rule-Base-Name AVP (AVP code 1004) is of type OctetString, and it indicates the name of a pre-defined group of charging rules residing at the TPF.

5.2.6 Charging-Rule-Name AVP

The Charging-Rule-Name AVP (AVP code 1005) is of type OctetString. For charging rules provided by the CRF it uniquely identifies a charging rule for a bearer. For charging rules pre-defined at the TPF it uniquely identifies a charging rule within the TPF.

5.2.7 Event-Trigger AVP

The Event-Trigger AVP (AVP code 1006) is of type Enumerated, and it indicates an event that shall cause a re-request of charging rules. The following values are defined:

SGSN_CHANGE (0)

This value shall be used to indicate that upon the change of the serving SGSN charging rules shall be requested.

QOS_CHANGE (1)

This value shall be used to indicate that the upon QoS change charging rules shall be requested.

RAT_CHANGE (2)

This value shall be used to indicate that the upon RAT change charging rules shall be requested.

TFT_CHANGE (3)

This value shall be used to indicate that the upon TFT change charging rules shall be requested.

5.2.8 Metering-Method AVP

The Metering-Method AVP (AVP code 1007) is of type Enumerated, and it defines what parameters shall be metered for offline charging. The following values are defined:

DURATION (0)

This value shall be used to indicate that the duration of the service flow shall be metered.

VOLUME (1)

This value shall be used to indicate that volume of the service flow traffic shall be metered.

DURATION_VOLUME (2)

This value shall be used to indicate that the duration and the volume of the service flow traffic shall be metered.

5.2.9 Offline AVP

The Offline AVP (AVP code 1008) is of type Enumerated, and it defines whether the offline charging interface from the TPF for the associated charging rule shall be enabled. The absence of this AVP indicates that the default configuration shall be used. The following values are defined:

DISABLE_OFFLINE (0)

This value shall be used to indicate that the offline charging interface for the associated charging rule shall be disabled.

ENABLE_OFFLINE (1)

This value shall be used to indicate that the offline charging interface for the associated charging rule shall be enabled.

5.2.10 Online AVP

The Online AVP (AVP code 1009) is of type Enumerated, and it defines whether the online charging interface from the TPF for the associated charging rule shall be enabled. The absence of this AVP indicates that the default configuration shall be used. The following values are defined:

DISABLE_ONLINE (0)

This value shall be used to indicate that the online charging interface for the associated charging rule shall be disabled.

ENABLE_ONLINE (1)

This value shall be used to indicate that the online charging interface for the associated charging rule shall be enabled.

5.2.11 Precedence AVP

The Precedence AVP (AVP code 1010) is of type Unsigned32, and it defines the precedence of a charging rule in case of overlapping charging rules. A charging rule with the Precedence AVP with lower value shall take the priority over a charging rule with the Precedence AVP with higher value. The Precedence AVP is also used to indicate the evaluation precedence of the TFT packet filters.

5.2.12 Primary-CCF-Address AVP

The Primary-CCF-Address AVP (AVP code 1011) is of type DiameterURI, and it defines the address of the primary offline charging system for the bearer. The absence of the protocol definition in the DiameterURI shall indicate the default protocol defined for the Gz interface.

5.2.13 Primary-OCS-Address AVP

The Primary-OCS-Address AVP (AVP code 1012) is of type DiameterURI, and it defines the address of the primary online charging system for the bearer. The absence of the protocol definition in the DiameterURI shall indicate the default protocol defined for the Gy interface.

5.2.14 Void

5.2.15 Reporting-Level AVP

The Reporting-Level AVP (AVP code 1014) is of type Enumerated, and it defines on what level the TPF reports the usage for the related charging rule. The following values are defined:

CHARGING_RULE_LEVEL (0)

This value shall be used to indicate that the usage shall be reported on charging rule level.

RATING_GROUP_LEVEL (1)

This value shall be used to indicate that the usage shall be reported on rating group level.

5.2.16 Secondary-CCF-Address AVP

The Secondary-CCF-Address AVP (AVP code 1015) is of type DiameterURI, and it defines the address of the secondary offline charging system for the bearer. The absence of the protocol definition in the DiameterURI shall indicate the default protocol defined for the Gz interface.

5.2.17 Secondary-OCS-Address AVP

The Secondary-OCS-Address AVP (AVP code 1016) is of type DiameterURI, and it defines the address of the secondary online charging system for the bearer. The absence of the protocol definition in the DiameterURI shall indicate the default protocol defined for the Gy interface.

5.2.18 TFT-Filter AVP

The TFT-Filter AVP (AVP code 1017) is of type IPFilterRule, and it contains the flow filter for one TFT packet filter. The TFT-Filter AVP is derived from the Traffic Flow Template (TFT) defined in 3GPP TS 24.008 [14]. The following information shall be sent:

- Action shall be set to "permit".
- Direction shall be set to "out".
- Protocol shall be set to the value provided within the TFT packet filter parameter "Protocol Identifier/Next Header Type". If the TFT packet filter parameter "Protocol Identifier/Next Header Type" is not provided within the TFT packet filter, Protocol shall be set to "IP".
- Source IP address (possibly masked). The source IP address shall be derived from TFT packet filter parameters "Source address" and "Subnet Mask". The source IP address shall be set to "any", if no such information is provided in the TFT packet filter.
- Source and destination port (single value, list or ranges). The information shall be derived from the corresponding TFT packet filter parameters. Source and/or destination port(s) shall be omitted if such information is not provided in the TFT packet filter.
- The Destination IP address shall be set to "assigned".

The IPFilterRule type shall be used with the following restrictions:

- No options shall be used
- Destination IP address shall be wildcarded

- The invert modifier "!" for addresses shall not be used.

The direction "out" refers to downlink direction.

5.2.19 TFT-Packet-Filter-Information AVP

The TFT-Packet-Filter-Information AVP (AVP code 1018) is of type Grouped, and it contains the information from a single TFT packet filter including the evaluation precedence, the filter and the Type-of-Service/Traffic Class sent from the TPF to the CRF. The TPF shall include one TFT-Packet-Filter-Information AVP for each TFT packet filters applicable at a PDP context in separate TFT-Packet-Filter-Information AVPs within each charging rule request. corresponding to that PDP context. TFT-Packet-Filter-Information AVPs are derived from the Traffic Flow Template (TFT) defined in 3GPP TS 24.008 [14]. When SBLP is used the packet filters shall be omitted.

AVP Format:

```
TFT-Packet-Filter-Information ::= < AVP Header: 1018 >
                              [ Precedence ]
                              [ TFT-Filter ]
                              [ ToS-Traffic-Class ]
```

5.2.20 ToS-Traffic-Class AVP

The ToS-Traffic-Class AVP (AVP code 1019) is of type OctetString, and it contains the Type-of-Service/Traffic-Class of a TFT packet filter as defined in 3GPP TS 24.008 [14].

5.3 Gx re-used AVPs

The table 5.3 lists the Diameter AVPs re-used by the Gx reference point from existing Diameter Applications, reference to their respective specifications and short description of their usage within the Gx 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 5.3, but they are re-used for the Gx reference point. Where 3GPP Radius VSAs are re-used, they shall be translated to Diameter AVPs as described in draft-ietf-aaa-diameter-nasreq-17.txt [12] with the exception that the 'M' flag shall be set and the "P' flag may be set.

Table 5.3: Gx re-used Diameter AVPs

Attribute Name	Reference	Description
3GPP-GPRS-Negotiated-QoS-Profile	3GPP TS 29.061 [11]	For GPRS the QoS of the PDP context
3GPP-SGSN-Address	3GPP TS 29.061 [11]	For GPRS the IPv4 address of the SGSN
3GPP-SGSN-IPv6-Address	3GPP TS 29.061 [11]	For GPRS the IPv6 address of the SGSN
3GPP-SGSN-MCC-MNC	3GPP TS 29.061 [11]	For GPRS the MCC and the MNC of the SGSN
AF-Charging-Identifier	3GPP TS 29.209 [10]	The AF charging identifier that may be used in charging correlation. For IMS the ICID.
Called-Station-ID	draft-ietf-aaa-diameter-nasreq-17.txt [12]	The address the user is connected to. For GPRS the APN.
CC-Request-Number	draft-ietf-aaa-diameter-cc-06.txt [8]	The number of the request for mapping requests and answers
CC-Request-Type	draft-ietf-aaa-diameter-cc-06.txt [8]	The type of the request (initial, update, termination)
CC-Sub-Session-Id	draft-ietf-aaa-diameter-cc-06.txt [8]	For GPRS each PDP context maps to a CC-Sub-Session-Id as specified in clause 6.
Flow-Description	3GPP TS 29.209 [10]	Defines the service flow filter parameters for a charging rule
Flows	3GPP TS 29.209 [10]	The flow identifiers of the IP flows related to a charging rule as provided by the AF. May be used in charging correlation together with AF-Charging-Identifier AVP.
Framed-IP-Address	draft-ietf-aaa-diameter-nasreq-17.txt [12]	The IPv4 address allocated for the user.
Framed-IPv6-Prefix	draft-ietf-aaa-diameter-nasreq-17.txt [12]	The IPv6 address prefix allocated for the user
Rating-Group	draft-ietf-aaa-diameter-cc-06.txt [8]	The charging key for the charging rule used for rating purposes
Service-Identifier	draft-ietf-aaa-diameter-cc-06.txt [8]	The identity of the service or service component the service data flow in a charging rule relates to.
Subscription-Id	draft-ietf-aaa-diameter-cc-06.txt [8]	The identification of the subscription (IMSI, MSISDN, etc)
User-Equipment-Info	draft-ietf-aaa-diameter-cc-06.txt [8]	The identification and capabilities of the terminal (IMEISV, etc.)
3GPP-RAT-Type	3GPP TS 29.061 [11]	Indicate which Radio Access Technology is currently serving the UE.

5.4 Gx specific Experimental-Result-Code AVP values

There are two different types of errors in Diameter; protocol and application errors. A protocol error is one that occurs at the base protocol level, those are covered in the Diameter BASE RFC 3588 [4] specific procedures. Application errors, on the other hand, generally occur due to a problem with a function specified in a Diameter application.

Diameter BASE RFC 3588 [4] defines a number of Result-Code AVP values that are used to report protocol errors and how those are used. Those procedures and values shall apply for the present specification.

Due to the Gx specific AVPs, new applications errors can occur. The Gx specific errors are described by the Experimental-Result-Code AVP in this clause, below. According to RFC 3588 [4], the diameter node reports only the first error encountered and only either one Result-Code AVP or one Experimental-Result AVP is included in the Diameter answer.

5.4.1 Success

Result Codes that fall within the Success category are used to inform a peer that a request has been successfully completed.

The Result-Code AVP values defined in Diameter BASE RFC 3588 [4] shall be applied.

5.4.2 Permanent Failures

Errors that fall within the Permanent Failures category shall be used to inform the peer that the request failed, and should not be attempted again.

The Result-Code AVP values defined in Diameter BASE RFC 3588 [4] are applicable. Also the following specific Gx Experimental-Result-Codes values are defined:

DIAMETER_ERROR_INITIAL_PARAMETERS (5140)

This error shall be used when the set of bearer information needed in the CRF for rule selection is incomplete or erroneous for the decision to be made. (e.g. QoS, SGSN address, RAT type, TFT…)

DIAMETER_ERROR_TRIGGER_EVENT (5141)

This error shall be used when the set of bearer information sent in a CCR originated due to a trigger event been met is incoherent with the previous set of bearer information for the same bearer. (e.g event trigger met was RAT changed, and the RAT notified is the same as before)

6 Gx Messages

Gx Messages are carried within the Diameter Application(s) described in the sub-clauses below. These Applications are defined as vendor specific Diameter applications, where the vendor is 3GPP. The vendor identifier assigned by IANA to 3GPP (http://www.iana.org/assignments/enterprise-numbers) is 10415.

The TPF and the CRF shall advertise the support of the 3GPP vendor specific Diameter Application for the Gx Application and/or the Gx over Gy Application by including the value of the appropriate application identifier(s) in 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.

Existing Diameter command codes from the Diameter base protocol RFC 2588 [4] and the Diameter Credit Control Application (draft-ietf-aaa-diameter-cc-06.txt) [8] are used with the Gx specific AVPs specified in clause 5.2. The Diameter Credit Control Application AVPs and AVPs from other Diameter applications that are re-used are defined in clause 5.3.

In the GPRS case, the association between the PDP sessions and the Diameter Credit Control sessions shall be done in a one-to-one basis (i.e. 1 PDP session = 1 DCC session), and each PDP context (one primary and zero or more secondary PDP contexts) shall map to a Diameter sub-session (i.e. 1 PDP context = 1 DCC sub-session). The release of the last PDP Context shall be indicated by the release of the whole DCC session, whereas release of a single PDP Context, with others remaining, shall be indicated by the release of the sub-session corresponding to that PDP Context.

6.1 Gx Application

Gx reference point shall use Diameter Gx Application as described in this chapter when the CRF functionality is implemented in a standalone device. The Auth-Application-Id for the Gx Application is xxx as allocated by IANA.

Editor's note: The application id needs to be allocated from IANA.

A Gx Application specific Auth-Application-Id is used together with the command code to identify the Gx Application messages.

6.1.1 CC-Request (CCR) Command

The CCR command, indicated by the Command-Code field set to xxx (IETF suggested value 272) and the 'R' bit set in the Command Flags field, is sent by the TPF to the CRF in order to request charging rules for a bearer. The CCR command is also sent by the TPF to the CRF in order to indicate the termination of the bearer.

Message Format:

```
<CC-Request> ::= < Diameter Header: xxx (272), REQ, PXY >
                 < Session-Id >
```

```
                 { Auth-Application-Id }
                 { Origin-Host }
                 { Origin-Realm }
                 { Destination-Realm }
                 { CC-Request-Type }
                 { CC-Request-Number }
                 [ Destination-Host ]
                 [ CC-Sub-Session-Id ]
                 [ Origin-State-Id ]
                *[ Subscription-Id ]
                 [ Framed-IP-Address ]
                 [ Framed-IPv6-Prefix ]
                 [ 3GPP-RAT-Type ]
                 [ Termination-Cause ]
                 [ User-Equipment-Info ]
                 [ 3GPP-GPRS-Negotiated-QoS-Profile ]
                 [ 3GPP-SGSN-MCC-MNC ]
                 [ 3GPP-SGSN-Address ]
                 [ 3GPP-SGSN-IPv6-Address ]
                 [ Called-Station-ID ]
                 [ Bearer-Usage ]
                *[ TFT-Packet-Filter-Information ]
                *[ Proxy-Info ]
                *[ Route-Record ]
                *[ AVP ]
```

6.1.2 CC-Answer (CCA) Command

The CCA command, indicated by the Command-Code field set to xxx (IETF suggested value 272) and the 'R' bit cleared in the Command Flags field, is sent by the CRF to the TPF in response to the CCR command. It is used to provision charging rules and event triggers for the bearer. The primary and secondary CCF and/or primary and secondary OSC addresses may be included in the initial provisioning.

Message Format:

```
<CC-Answer> ::=  < Diameter Header: (272), PXY >
                 < Session-Id >
                 { Auth-Application-Id }
                 { Origin-Host }
                 { Origin-Realm }
                 [ Result-Code ]
                 [ Experimental-Result ]
                 { CC-Request-Type }
                 { CC-Request-Number }
                 [ CC-Sub-Session-Id ]
                *[ Event-Trigger ]
                 [ Origin-State-Id ]
                *[ Charging-Rule-Remove ]
                *[ Charging-Rule-Install ]
                 [ Primary-CCF-Address ]
                 [ Secondary-CCF-Address ]
                 [ Primary-OCS-Address ]
                 [ Secondary-OCS-Address ]
                 [ Error-Message ]
                 [ Error-Reporting-Host ]
                *[ Failed-AVP ]
                *[ Proxy-Info ]
                *[ Route-Record ]
                *[ AVP ]
```

6.1.3 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 TPF in order to initiate the provision of unsolicited charging rules for an existing bearer. The RAR command shall be followed by a CCR command from the TPF requesting charging rules for the bearer in question.

Message Format:

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

```
                { Origin-Realm }
                { Destination-Realm }
                { Destination-Host }
                { Re-Auth-Request-Type }
                [ CC-Sub-Session-Id ]
                [ Origin-State-Id ]
               *[ Proxy-Info ]
               *[ Route-Record ]
               *[ AVP]
```

6.1.4 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 TPF 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 ]
                 [ CC-Sub-Session-Id ]
                 [ Origin-State-Id ]
                 [ Error-Message ]
                 [ Error-Reporting-Host ]
                *[ Failed-AVP ]
                *[ Proxy-Info ]
                *[ AVP ]
```

6.2 Gx over Gy Application

The Gy protocol is specified as online charging application in in 3GPP TS 32.299 [9] and TS 32.251 [13]

The Gx over Gy Application allows to combine in a single message exchange (e.g. CCR-CCA) the Gx functionality of charging rule provisioning, and the Gy functionality of credit control for service data flow based online charging. This allows creating synergies and signalling savings in case the CRF and the OCS are collocated.

The Diameter Gx over Gy Application as described in this Clause should be used when the CRF functionality is co-located with the Online Charging System (OCS) and both are connected to the TPF via a single interface that comprises the Gx and Gy reference points. The Auth-Application-Id for the Gx over Gy Application is xxx as allocated by IANA.

Editor's note: The application id needs to be allocated from IANA.

A Gx over Gy Application specific Auth-Application-Id is used together with the command code to identify the Gx over Gy Application messages.

The Gx over Gy Application is based on the Diameter Credit Control Application. The Gx over Gy Application shall use Gx specific AVPs to fulfil the Gx specific requirements (charging rule provision) and, over the same message, Gy functionalities (credit authorization), as follows:

- When only charging rule provision is required the procedures and message content for Gx Application as specified in clause 6.1 shall apply.
- When only credit authorization is required the procedures and message content for Gy as specified as online charging application in 3GPP TS 32.299 [9] and TS 32.251 [13] shall apply.
- When credit authorization and charging rule provision are required simultaneously, these should be requested and provided with a single CCR-CCA message pair (e.g. credit authorization and request for charging rules). The AVPs defined in Gy interface to satisfy the credit authorization requirements and the Gx specific and Gx re-used AVPs shall be both included in the Diameter messages as needed. The common AVPs shall be included only once within the same message.

If during a Gx over Gy session, the Gy server indicates DIAMETER_CREDIT_CONTROL_NOT_APPLICABLE as defined in 3GPP TS 32.299 [9], then the session shall be maintained using the original Gx over Gy Application-id, i.e. shall not switch over to the Gx Application-id.

The Experimental-Result-Code AVP specific values of both the Gy protocol and Gx protocol apply for the Gx over Gy application.

All AVPs mandated for the Gx protocol or for the Gy protocol are also mandated for the Gx over Gy application.

Both the procedures defined for the Gx protocol and the procedures defined for the Gy protocol shall be applied for the Gx over Gy application as clarified in the subsequent Clause.

6.2.1 Simultaneous charging rule provision and credit authorization

When the CRF uses the charging rule install AVP to install new charging rule(s) or to activate predefined charging rule(s) at the TPF, the collocated OCS should simultaneously provide new quota for the related service data flows if they are online charged and no previously allocated quota are used. The OCS shall link the new service data flows matching the new charging rules to allocated quota. Therefore, for predefined charging rules, that are activated by the CRF, the collocated OCS/CRF needs configured knowledge if they will be online charged and how they are rated.

For the predefined charging rules that are always active at the TPF and online charged, the TPF requests credit using normal Gy procedures. This request should be combined with the request for charging rules at bearer establishment.

If the TPF receives an reauthorization request message, it shall request both charging rules and credit re-authorization. The TPF should combine both requests in a single CC-request.

If during bearer modification both event and re-authorization triggers apply at the same time, the TPF shall request both charging rules and credit re-authorization. The TPF should combine both requests in a single CC-request.

Annex A (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2004-03					Presented to CN3#31bis for information	-	0.0.1
2004-04					Updated to be used as a basis for email work	0.0.1	0.1.0
2004-04					Submitted for email work	0.2.0	0.1.0
2004-05					Submitted for CN3 meeting	0.2.0	0.3.0
2004-05					TS number 29.910 reserved, version for email discussion after CN3#32	0.3.0	0.4.0
2004-08					Erroneous TS number corrected to 29.210. Tdocs N3-040458, N3-040597, N3-040566, N3-040504, N3-040605 are agreed at CN3#33 and incorporated. To be presented to NP#25 for information	0.4.0	1.0.0
2004-08					Editorial Corrctions made by MCC to align with 3GPP drafting rules	1.0.0	1.0.1
2004-10					Several Tdocs agreed at CN3#33Bis incorporated	1.0.1	1.1.0
2004-11					Several Tdocs agreed at CN3#34 incorporated. To be presented to NP#26 for approval	1.1.0	2.0.0
2004-12	CN#26				Upgraded to Release 6	2.0.0	6.0.0
2005-03	CN#27	NP-050109	1	3	Extend the Rule Name uniqueness to the TPF for static rules	6.0.0	6.1.0
2005-03	CN#27	NP-050109	3	2	Missing description of the behaviour of the application-ids on NOT_APPLICABLE notifications	6.0.0	6.1.0
2005-03	CN#27	NP-050109	5	1	Indication of Bearer Termination	6.0.0	6.1.0
2005-03	CN#27	NP-050109	6	4	TFT filter usage	6.0.0	6.1.0
2005-03	CN#27	NP-050109	7	2	Correction of AF and Bearer Session Definitions	6.0.0	6.1.0
2005-03	CN#27	NP-050109	9	2	RAT-Type AVP definition	6.0.0	6.1.0

History

Document history		
V6.0.0	December 2004	Publication
V6.1.0	March 2005	Publication