

ETSI TS 129 337 V16.0.0 (2020-07)



**Universal Mobile Telecommunications System (UMTS);
LTE;
Diameter-based T4 Interface for communications with packet
data networks and applications
(3GPP TS 29.337 version 16.0.0 Release 16)**



Reference

RTS/TSGC-0429337vg00

Keywords

LTE,UMTS

ETSI

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1 Scope

The present document describes the Diameter based interface between the Machine Type Communications-InterWorking Function (MTC-IWF) and the Short Message Service-Service Centre (SMS-SC) for communications with packet data networks and applications.

This specification defines the Diameter application for the T4 reference point between the MTC-IWF and the SMS-SC. The interactions between the MTC-IWF and the SMS-SC are specified.

MTC-IWF and SMS-SC (SMS-IW MSC) may also support the Diameter application for the SGd reference point to exchange SGd-OFr and SGd-OfA commands via T4. The stage 3 description for the SGd Diameter application is specified in 3GPP TS 29.338 [13].

The stage 2 description for communications with packet data networks and applications (architecture and functionality) is specified in the 3GPP TS 23.682 [2].

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 23.682: "Architecture enhancements to facilitate communications with packet data networks and applications".
- [3] Void.
- [4] 3GPP TS 33.210: "3G Security; Network Domain Security; IP Network Layer Security".
- [5] IETF RFC 4960: "Stream Control Transmission Protocol".
- [6] 3GPP TS 29.229: "Cx and Dx interfaces based on the Diameter protocol".
- [7] 3GPP TS 29.228: "IP multimedia (IM) Subsystem Cx and Dx Interfaces; Signalling flows and Message Elements".
- [8] 3GPP TS 23.003: "Numbering, addressing and identification".
- [9] 3GPP TS 23.040: "Technical realization of the Short Message Service (SMS)".
- [10] IETF RFC 5234: "Augmented BNF for Syntax Specifications: ABNF".
- [11] 3GPP TS 29.329: "Sh Interface based on the Diameter protocol".
- [12] 3GPP TS 29.336: "Home Subscriber Server (HSS) diameter interfaces for interworking with packet data networks and applications".
- [13] 3GPP TS 29.338: "Diameter based protocols to support SMS capable MMEs".
- [14] 3GPP TS 29.173: "Diameter-based SLh interface for Control Plane LCS".
- [15] 3GPP TS 29.368: "Tsp interface protocol between the MTC Interworking Function (MTC-IWF) and Service Capability Server (SCS)".

- [16] 3GPP TS 29.272: "Mobility Management Entity (MME) and Serving GPRS Support Node (SGSN) related interfaces based on Diameter protocol".
- [17] IETF RFC 4006: "Diameter Credit-Control Application".
- [18] IETF RFC 7944: "Diameter Routing Message Priority".
- [19] IETF RFC 6733: "Diameter Base Protocol".

3 Definitions and Abbreviations

3.1 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

ABNF	Augmented Backus-Naur Form
AVP	Attribute-Value Pair
C	Conditional
DRMP	Diameter Routing Message Priority
DSCP	Differentiated Services Code Point
IANA	Internet Assigned Numbers Authority
MTC	Machine-Type Communications
MTC-IWF	MTC Interworking Function
O	Optional
SCS	Service Capability Server

4 General Description

The T4 reference point between the MTC-IWF and the SMS-SC is an intra PLMN interface, as defined in the 3GPP TS 23.682 [7].

This document describes the T4 interface related procedures, message parameters and protocol specifications.

The T4 interface allows transfer of device trigger from MTC-IWF to SMS-SC inside HPLMN domain, along with the serving SGSN/MME/MS-C identities, and allows SMS-SC to report to MTC-IWF the submission outcome of a device trigger and the success or failure of delivering the device trigger to the UE.

5 MTC-IWF – SMS-SC (T4)

5.1 Introduction

This section describes the Diameter-based T4 interface related procedures and information elements exchanged between the MTC-IWF and the SMS-SC. For the use of SGd-OFR and SGd-OFA commands over T4 (i.e. between MTC-IWF and SMS-SC) see 3GPP TS 29.338 [13].

In the tables that describe the Information Elements transported by each Diameter command, each Information Element is marked as (M) Mandatory, (C) Conditional or (O) Optional in the "Cat." column. For the correct handling of the Information Element according to the category type, see the description detailed in section 6 of the 3GPP TS 29.228 [7].

5.2 Procedure Descriptions

5.2.1 Device Trigger Procedure

5.2.1.1 General

This procedure shall be used between the MTC-IWF and the SMS-SC for device trigger. The procedure shall be invoked by the MTC-IWF and is used:

- to transfer device trigger to SMS-SC inside HPLMN domain;
- to transfer to the SMS-SC the identities of the serving MSC or MME but not both, and/or SGSN, and/or IP-SM-GW serving the user for SMS along with device trigger.
- to transfer device trigger replace/recall message to SMS-SC inside HPLMN domain.

This procedure is mapped to the commands Device-Trigger-Request/Answer in the Diameter application specified in chapter 6. Tables 5.2.1.1/1 and 5.2.1.1/2 detail the involved information elements.

Table 5.2.1.1/1: Device Trigger Request

Information Element Name	Mapping to Diameter AVP	Cat.	Description
User Identifier (See 3GPP TS 29.336 [12])	User-Identifier	M	This information element shall contain the IMSI of the UE the trigger is to be applied, formatted according to 3GPP TS 23.003 [8], clause 2.2. This Information Element may contain the international ISDN number of the UE the device trigger was delivered, formatted according to 3GPP TS 23.003 [8], clause 3.3. The ISDN number shall be present if it is available to the MTC-IWF. This Information Element may contain the external identifier of the UE the device trigger was delivered, formatted according to 3GPP TS 23.003 [8], clause 19.7.2. The external identifier shall be present if it is available to the MTC-IWF.
SM RP SMEA (See 3GPP TS 29.338 [13])	SM-RP-SMEA	M	This Information Element shall contain the SME address of the Service Capability Server that is requesting a device trigger to the UE. It shall be encoded according to the formatting rules of the address fields described in 3GPP TS 23.040 [9].
Payload(See 3GPP TS 29.368 [15])	Payload	M	This information element shall contain the device triggering payload as received over the Tsp. For device trigger recall, this IE shall be empty.
Serving Node Identity (See 3GPP TS 29.173 [14])	Serving-Node	C	This information element shall contain the serving node identity, i.e. SGSN/MME/MSC identity serving the UE. It shall be present if it is available to the MTC-IWF, e.g. the MTC-IWF retrieved this information from the HSS.
Additional Serving Node Identity (See 3GPP TS 29.173 [14])	Additional-Serving-Node	C	This information element shall contain another serving node identity, e.g. SGSN/MME/MSC identity, if there is any serving the UE. There may be multiple instances of this information elements.
Trigger Reference Number (See 3GPP TS 29.368 [15])	Reference-Number	C	This information element shall contain the Reference Number related to the device trigger request. It shall be present if it is available to the MTC-IWF, e.g. the MTC-IWF received this information over Tsp.
Old Trigger Reference Number (See 3GPP TS 29.368 [15])	Old-Reference-Number	C	This information element shall contain the Reference Number of the device trigger to be replaced. It shall be present if it is available to the MTC-IWF, e.g. the MTC-IWF received this information over Tsp.
Validity Time (See 3GPP TS 29.368 [15])	Validity-Time	C	This information element shall contain the validity time of the device trigger request. It shall be present if it is available to the MTC-IWF, e.g. the MTC-IWF received this information over Tsp.
Priority Indication (See 3GPP TS 29.368 [15])	Priority-Indication	C	This information element shall contain the priority of the device trigger request.. It shall be present if it is available to the MTC-IWF, e.g. the MTC-IWF received this information over Tsp.
SMS Application Port ID (See 3GPP TS 29.368 [15])	SMS-Application-Port-ID	C	This information element shall contain the Application Port ID of the triggering application for the device trigger request. It shall be present if it is available to the MTC-IWF, e.g. the MTC-IWF received this information over Tsp.
Supported Features (See 3GPP TS 29.229 [6])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.
Trigger-Action (See 6.3.6)	Trigger-Action	C	This information element shall be present for device trigger action replace or recall. This information element may be present for a normal device.

Table 5.2.1.1/2: Device Trigger Answer

Information Element Name	Mapping to Diameter AVP	Cat.	Description
Result (See 7)	Result-Code / Experimental-Result	M	This IE shall contain the result of the operation. The Result-Code AVP shall be used to indicate success / errors as defined in the Diameter base protocol (see IETF RFC 6733 [19]). The Experimental-Result AVP shall be used for T4 errors. This is a grouped AVP which shall contain the 3GPP Vendor ID in the Vendor-Id AVP, and the error code in the Experimental-Result-Code AVP. The following errors are applicable: <ul style="list-style-type: none"> - Service Centre Congestion; - Invalid Short Message Entity Address; - Subscriber not Service Centre Subscriber; - SM Protocol Error; - Trigger Replace failed; - Trigger Recall failed; - Original Message not pending.
MTC-Error-Diagnostic	MTC-Error-Diagnostic	O	If the Experimental Result indicates either "DIAMETER_ERROR_TRIGGER_REPLACE_FAILURE " or "DIAMETER_ERROR_ORIGINAL_MESSAGE_NOT_PENDING", Error Diagnostic may be present to indicate the reason why the replace has failed.
Supported Features (See 3GPP TS 29.229 [6])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.
Old Trigger Reference Number (See 3GPP TS 29.368 [15])	Old-Reference-Number	C	This information element shall be included if the SMS-SC was requested to perform device trigger recall or replace. It shall contain the Reference Number of the device trigger which was intended to be replaced or recalled in the request.
Trigger-Action (see 6.3.6)	Trigger-Action	C	This information element shall be present for device trigger action replace or recall. This information element may be present for a normal device trigger.

5.2.1.2 Detailed Behaviour of the MTC-IWF

The MTC-IWF shall make use of this procedure to transfer device trigger request received over Tsp interface from SCS to the SMS-SC.

If the MTC-IWF retrieved the IMSI and serving node identities of the UE from the HSS, the MTC-IWF shall include these identities in the request to the SMS-SC.

The MTC-IWF shall include the External Identifier of the UE if received over Tsp interface from SCS.

The MTC-IWF shall include the Old Trigger Reference Number if received over Tsp interface from SCS.

5.2.1.3 Detailed Behaviour of the SMS-SC

When receiving a Device Trigger Request, the SMS-SC shall check the identity of the UE received (i.e. IMSI or MSISDN) if it serves this UE. If not, a Result Code of DIAMETER_ERROR_USER_UNKNOWN shall be returned.

If the SM-RP-SMEA AVP contains an invalid SME address, the SMS-SC shall return a Result Code of DIAMETER_ERROR_INVALID_SME_ADDRESS.

If the SMS-SC cannot fulfil the received request due to congestion, it shall return a Result Code of DIAMETER_ERROR_SC_CONGESTION.

If there are routing information (i.e. MSC or MME, SGSN, IP-SM-GW identities serving the UE for SMS) present in the request, the SMS-SC shall use the information for delivery of device trigger request for the UE. The SMS-SC shall return a Result Code of DIAMETER_SUCCESS to the MTC-IWF.

NOTE: If the IP-SM-GW address is received, the SMS-SC uses the IP-SM-GW as the serving node with highest priority for delivery of device trigger request for the UE.

If there is no routing information (i.e. MSC or MME, SGSN, IP-SM-GW identities serving the UE for SMS) present in the request, the SMS-SC shall send a Report-SM-Delivery-Status message to the HLR in order to update the MWD in the HLR (see 3GPP TS 23.040 [9]).

If Trigger-Action is received from the MTC-IWF and set to TRIGGER (0), SMS-SC shall store the new trigger message received from MTC-IWF.

If Trigger-Action is received from the MTC-IWF and set to RECALL (1), SMS-SC checks if message corresponding to Reference-Number is pending. If trigger message is pending then SMS-SC deletes the old trigger message. The SMS-SC shall return Old-Reference-Number and a Result Code of DIAMETER_SUCCESS to the MTC-IWF. For the successful scenario the SMS-SC is not required to initiate a device trigger reporting to the device trigger of Old-Reference-Number. If trigger message is not pending then SMS-SC shall return a Result Code of DIAMETER_ERROR_ORIGINAL_MESSAGE_NOT_PENDING to the MTC-IWF.

If Trigger-Action is received from the MTC-IWF and set to REPLACE (2), SMS-SC checks if message corresponding to Old-Reference-Number is pending. If trigger message is pending then SMS-SC shall delete the old trigger message and store the new trigger message received from MTC-IWF. The SMS-SC shall return OLD-Reference-Number and a Result Code of DIAMETER_SUCCESS to the MTC-IWF. For the successful scenario the SMS-SC is not required to initiate a device trigger reporting to the device trigger of Old-Reference-Number. If trigger message is not pending then SMS-SC shall return OLD-Reference-Number and a Result Code of DIAMETER_ERROR_ORIGINAL_MESSAGE_NOT_PENDING to the MTC-IWF and shall interpret the trigger replace message as a new device trigger. If the SMS-SC fails to perform deletion of the old trigger or fails to store the new trigger, it shall not delete the old trigger and shall not store the new trigger and shall return result code of DIAMETER_ERROR_TRIGGER_REPLACE_FAILURE.

The SMS SC shall use the most appropriate cause code indicating the real reason for the unsuccessful handling of the request message.

If the SMS-SC cannot fulfil the received request for reasons not stated in the above steps, e.g. due to system failure, it shall stop processing the request and set Result-Code to DIAMETER_UNABLE_TO_COMPLY.

5.2.2 Delivery Report of Device Trigger

5.2.2.1 General

This procedure shall be used between the SMS-SC and the MTC-IWF for Delivery Report of Device Trigger. The procedure shall be invoked by the SMS-SC and is used:

- to report the success or failure of delivering the device trigger to the UE.

This procedure is mapped to the commands Delivery-Report-Request/Answer in the Diameter application specified in chapter 6. Tables 5.2.2.1/1 and 5.2.2.1/2 detail the involved information elements.

Table 5.2.2.1/1: Delivery Report Request

Information Element Name	Mapping to Diameter AVP	Cat.	Description
User Identifier (See 3GPP TS 29.336 [12])	User-Identifier	M	This information element shall contain the IMSI of the UE the device trigger was delivered, formatted according to 3GPP TS 23.003 [8], clause 2.2. This Information Element may contain the international ISDN number of the UE the device trigger was delivered, formatted according to 3GPP TS 23.003 [8], clause 3.3. The ISDN number shall be present if it is available to the SMS-SC. This Information Element may contain the external identifier of the UE the device trigger was delivered, formatted according to 3GPP TS 23.003 [8], clause 19.7.2. The external identifier shall be present if it is available to the SMS-SC.
SM RP SMEA (See 3GPP TS 29.338 [13])	SM-RP-SMEA	M	This Information Element shall contain the SME address of the Service Capability Server that is requesting a device trigger to the UE as received from the MTC-IWF.
SM Delivery Outcome (See 6.3.1)	SM-Delivery-Outcome	M	This information element shall be present and indicate one of the following outcomes of the device trigger delivery: <ul style="list-style-type: none"> - Absent subscriber; - UE memory capacity exceeded; - Successful transfer.
Absent Subscriber Diagnostic SM (See 6.3.2)	Absent-Subscriber-Diagnostic-SM	C	This information element shall indicate the reason why the subscriber is absent. It shall be present if the device trigger failed to be delivered due to absent subscriber.
Trigger Reference Number (See 3GPP TS 29.368 [15])	Reference-Number	C	This information element shall contain the Trigger Reference Number as received from the MTC-IWF for the device trigger. This information element shall be present if it is available in the SMS-SC.
Supported Features (See 3GPP TS 29.229 [6])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.

Table 5.2.2.1/2: Delivery Report Answer

Information Element Name	Mapping to Diameter AVP	Cat.	Description
Result (See 7)	Result-Code / Experimental-Result	M	This IE shall contain the result of the operation. The Result-Code AVP shall be used to indicate success / errors as defined in the Diameter base protocol (see IETF RFC 6733 [19]). The Experimental-Result AVP shall be used for T4 errors. This is a grouped AVP which shall contain the 3GPP Vendor ID in the Vendor-Id AVP, and the error code in the Experimental-Result-Code AVP.
Supported Features (See 3GPP TS 29.229 [6])	Supported-Features	O	If present, this information element shall contain the list of features supported by the origin host.

5.2.2.2 Detailed Behaviour of the SMS-SC

The SMS-SC shall make use of this procedure to report the success or failure of delivering the device trigger to the UE to the MTC-IWF.

The SMS-SC shall include the IMSI of the UE and, if available, other identities of the UE, i.e. the MSISDN and the external identifier.

The SMS-SC shall include the External Identifier of the UE if the SMS-SC received it from MTC-IWF in the device trigger request message.

The SMS-SC shall include an SM-RP-SMEA AVP that contains the SME address of the Service Capability Server that requested the device trigger to the UE as received from the MTC-IWF in the device trigger request message.

The SMS-SC shall include an SM-Delivery-Outcome-T4 AVP that contains the outcome of the success or failure of delivering the device trigger to the UE.

The SMS-SC shall include an Absent-Subscriber-Diagnostic-T4 AVP that contains the reason why the subscriber is absent if the device trigger failed to be delivered due to absent subscriber.

5.2.2.3 Detailed Behaviour of the MTC-IWF

The MTC-IWF shall return a Result Code of DIAMETER_SUCCESS to the SMS-SC.

6 Protocol Specification and Implementation

6.1 General

6.1.1 Use of Diameter Base Protocol

The Diameter base protocol as specified in IETF RFC 6733 [19] shall apply except as modified by the defined support of the methods and the defined support of the commands and AVPs, result and error codes as specified in this specification. Unless otherwise specified, the procedures (including error handling and unrecognised information handling) shall be used unmodified.

6.1.2 Securing Diameter Messages

For secure transport of Diameter messages, see 3GPP TS 33.210 [4]

6.1.3 Accounting Functionality

Accounting functionality (Accounting Session State Machine, related command codes and AVPs) shall not be used on the T4 interface.

6.1.4 Use of Sessions

Between the MTC-IWF and the SMS-SC, Diameter sessions shall be implicitly terminated. An implicitly terminated session is one for which the server does not maintain state information. The client shall not send any re-authorization or session termination requests to the server.

The Diameter base protocol specified in IETF RFC 6733 [19] includes the Auth-Session-State AVP as the mechanism for the implementation of implicitly terminated sessions.

The client (server) shall include in its requests (responses) the Auth-Session-State AVP set to the value NO_STATE_MAINTAINED (1), as described in IETF RFC 6733 [19]. As a consequence, the server shall not maintain any state information about this session and the client shall not send any session termination request. Neither the Authorization-Lifetime AVP nor the Session-Timeout AVP shall be present in requests or responses.

6.1.5 Transport Protocol

Diameter messages over the T4 interface shall make use of SCTP, see IETF RFC 4960 [5].

6.1.6 Routing Considerations

This clause specifies the use of the Diameter routing AVPs Destination-Realm and Destination-Host.

The T4 reference point is defined as an intra-operator interface, and both MTC-IWF and the SMS-SC are located in the same network domain. If the MTC-IWF knows the address/name of the SMS-SC for a certain user, both the Destination-Realm and Destination-Host AVPs shall be present in the request. Otherwise, the Destination-Realm AVP shall be present and the command shall be routed to the next Diameter node. Consequently, the Destination-Host AVP is declared as optional in the ABNF for all requests initiated by the MTC-IWF.

The SMS-SC obtains the Destination-Host AVP to use in requests towards the MTC-IWF, from the Origin-Host AVP received in previous requests from the MTC-IWF. Consequently, the Destination-Host AVP is declared as mandatory in the ABNF for all requests initiated by the SMS-SC.

If the Vendor-Specific-Application-ID AVP is received in any of the commands defined in this specification, it shall be ignored by the receiving node, and it shall not be used for routing purposes.

6.1.7 Advertising Application Support

The MTC-IWF and SMS-SC shall advertise support of the Diameter T4 Application by including the value of the application identifier in the Auth-Application-Id AVP within the Vendor-Specific-Application-Id grouped AVP of the Capabilities-Exchange-Request and Capabilities-Exchange-Answer commands.

The vendor identifier value of 3GPP (10415) shall be included in the Supported-Vendor-Id AVP of the Capabilities-Exchange-Request and Capabilities-Exchange-Answer commands, and in the Vendor-Id AVP within the Vendor-Specific-Application-Id grouped AVP of the Capabilities-Exchange-Request and Capabilities-Exchange-Answer commands.

The Vendor-Id AVP included in Capabilities-Exchange-Request and Capabilities-Exchange-Answer commands that is not included in the Vendor-Specific-Application-Id AVPs as described above shall indicate the manufacturer of the Diameter node as per IETF RFC 6733 [19].

6.1.8 Diameter Application Identifier

The T4 interface protocol shall be 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.

The Diameter application identifier assigned to the T4 interface application is 16777311 (allocated by IANA).

6.1.9 Use of the Supported-Features AVP

When new functionality is introduced on the T4 interface, it should be defined as optional. If backwards incompatible changes cannot be avoided, the new functionality shall be introduced as a new feature and support advertised with the Supported-Features AVP. The usage of the Supported-Features AVP on the T4 interface is consistent with the procedures for the dynamic discovery of supported features as defined in clause 7.2 of 3GPP TS 29.229 [6].

When extending the application by adding new AVPs for a feature, the new AVPs shall have the M bit cleared and the AVP shall not be defined mandatory in the command ABNF.

As defined in 3GPP TS 29.229 [6], the Supported-Features AVP is of type grouped and contains the Vendor-Id, Feature-List-ID and Feature-List AVPs. On the all reference points as specified in this specification, the Supported-Features AVP is used to identify features that have been defined by 3GPP and hence, for features defined in this document, the Vendor-Id AVP shall contain the vendor ID of 3GPP (10415). If there are multiple feature lists defined for the reference point, the Feature-List-ID AVP shall differentiate those lists from one another.

The Table 6.3.5 defines the features applicable to the T4 reference point for the feature list with a Feature-List-ID of 1.

6.2 Commands

6.2.1 Introduction

This section defines the Command code values and related ABNF for each command described in this specification.

6.2.2 Command-Code Values

This section defines Command-Code values for the T4 interface application as allocated by IANA.

Every command is defined by means of the ABNF syntax IETF RFC 5234 [10], according to the Command Code Format (CCF) specification defined in IETF RFC 6733 [19]. In the case, the definition and use of an AVP is not specified in this document, the guidelines in IETF RFC 6733 [19] shall apply.

The Vendor-Specific-Application-Id AVP shall not be included in any command sent by Diameter nodes supporting applications defined in this specification. If the Vendor-Specific-Application-Id AVP is received in any of the commands defined in this specification, it shall be ignored by the receiving node.

NOTE: The Vendor-Specific-Application-Id is included as an optional AVP in all Command Code Format specifications defined in this specification in order to overcome potential interoperability issues with intermediate Diameter agents non-compliant with the IETF RFC 6733 [19].

The following Command Codes are defined in this specification:

Table 7.2.2/1: Command-Code values for T4

Command-Name	Abbreviation	Code	Section
Device-Trigger-Request	DTR	8388643	6.2.3
Device-Trigger-Answer	DTA	8388643	6.2.4
Delivery-Report-Request	DRR	8388644	6.2.5
Delivery-Report-Answer	DRA	8388644	6.2.6

For these commands, the Application-ID field shall be set to 16777311 (application identifier of the T4 interface application, allocated by IANA).

6.2.3 Device-Trigger-Request (DTR) Command

The Device-Trigger-Request (DTR) command, indicated by the Command-Code field set to 8388643 and the "R" bit set in the Command Flags field, is sent from the MTC-IWF to the SMS-SC.

Message Format

```

< Device-Trigger-Request > ::= < Diameter Header: 8388643, REQ, PXY, 16777311 >
    < Session-Id >
    [ DRMP ]
    { Auth-Session-State }
    { Origin-Host }
    { Origin-Realm }
    [ Destination-Host ]
    { Destination-Realm }
    { User-Identifier }
    { SM-RP-SMEA }
    { Payload }
    [ Serving-Node ]
    *[ Additional-Serving-Node ]
    [ Reference-Number ]
    [ Validity-Time ]
    [ Priority-Indication ]
    [ SMS-Application-Port-ID ]
    [ Old-Rference-Number ]
    [ Trigger-Action ]

```


*[Supported-Features]
 *[AVP]
 *[Proxy-Info]
 *[Route-Record]

6.2.4 Device-Trigger-Answer (DTA) Command

The Device-Trigger-Answer (DTA) command, indicated by the Command-Code field set to 8388643 and the "R" bit cleared in the Command Flags field, is sent from the SMS-SC to the MTC-IWF.

Message Format

```
< Device-Trigger-Answer > ::= < Diameter Header: 8388643, PXY, 16777311 >
  < Session-Id >
  [ DRMP ]
  [ Vendor-Specific-Application-Id ]
  [ Result-Code ]
  [ Experimental-Result ]
  [ MTC-Error-Diagnostic ]
  { Auth-Session-State }
  { Origin-Host }
  { Origin-Realm }
  [ Old-Reference-Number ]
  [ Trigger-Action ]
  *[ Supported-Features ]
  *[ AVP ]
  [ Failed-AVP ]
  *[ Proxy-Info ]
  *[ Route-Record ]
```

6.2.5 Delivery-Report-Request (DRR) Command

The Delivery-Report-Request (DRR) command, indicated by the Command-Code field set to 8388644 and the "R" bit set in the Command Flags field, is sent from the SMS-SC to the MTC-IWF.

Message Format

```
< Delivery-Report-Request > ::= < Diameter Header: 8388644, REQ, PXY, 16777311 >
  < Session-Id >
  [ DRMP ]
  { Auth-Session-State }
  { Origin-Host }
  { Origin-Realm }
  { Destination-Host }
  { Destination-Realm }
  { User-Identifier }
  { SM-RP-SMEA }
  { SM-Delivery-Outcome-T4 }
  [ Absent-Subscriber-Diagnostic-T4 ]
  [ Reference-Number ]
  *[ Supported-Features ]
  *[ AVP ]
  *[ Proxy-Info ]
  *[ Route-Record ]
```

6.2.6 Delivery-Report-Answer (DRA) Command

The Delivery-Report-Answer (DRA) command, indicated by the Command-Code field set to 8388644 and the "R" bit cleared in the Command Flags field, is sent from the MTC-IWF to the SMS-SC.

Message Format

```
< Delivery-Report-Answer > ::= < Diameter Header: 8388644, PXY, 16777311 >
```

< Session-Id >
 [DRMP]
 [Vendor-Specific-Application-Id]
 [Result-Code]
 [Experimental-Result]
 { Auth-Session-State }
 { Origin-Host }
 { Origin-Realm }
 *[Supported-Features]
 *[AVP]
 [Failed-AVP]
 *[Proxy-Info]
 *[Route-Record]

6.3 AVPs

The following table specifies the Diameter AVPs defined for the T4 interface protocol, 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 this specification shall be set to 3GPP (10415).

Table 6.3.1/1: T4 specific Diameter AVPs

Attribute Name	AVP Code	Section defined	Value Type	AVP Flag rules				
				Must	May	Should not	Must not	May Encr.
SM-Delivery-Outcome-T4	3200	6.3.1	Enumerated	M, V				No
Absent-Subscriber-Diagnostic-T4	3201	6.3.2	Enumerated	M, V				No
Trigger-Action	3202	6.3.6	Unsigned32	V			M	No
MTC-Error-Diagnostic	3203	6.3.7	Unsigned32	V			M	No
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 IETF RFC 6733 [19]. NOTE 2: If the M-bit is set for an AVP and the receiver does not understand the AVP, it shall return a rejection. If the M-bit is not set for an AVP, the receiver shall not return a rejection, whether or not it understands the AVP. If the receiver understands the AVP but the M-bit value does not match with the definition in this table, the receiver shall ignore the M-bit.								

The following table specifies the Diameter AVPs re-used by the T4 interface protocol from existing Diameter Applications, including a reference to their respective specifications and when needed, a short description of their use within T4.

Any other AVPs from existing Diameter Applications, except for the AVPs from Diameter base protocol specified in IETF RFC 6733 [19], do not need to be supported. The AVPs from Diameter base protocol specified in IETF RFC 6733 [19] are not included in table 6.3.1/2, but they may be re-used for the T4 protocol.

Table 6.3.1/2: T4 re-used Diameter AVPs

Attribute Name	Reference	Comments	M-bit
User-Identifier	3GPP TS 29.336 [12]		
SM-RP-SMEA	3GPP TS 29.338 [13]		
Payload	3GPP TS 29.368 [15]		
Serving-Node	3GPP TS 29.173 [14]	See 6.3.3	
Additional-Serving-Node	3GPP TS 29.173 [14]	See 6.3.4	
Reference-Number	3GPP TS 29.368 [15]		
Old-Reference-Number	3GPP TS 29.368 [15]		
Validity-Time	IETF RFC 4006 [17]		
Priority-Indication	3GPP TS 29.368 [15]		
SMS-Application-Port-ID	3GPP TS 29.368 [15]		
Supported-Features	3GPP TS 29.229 [6]		
Feature-List-ID	3GPP TS 29.229 [6]		
Feature-List	3GPP TS 29.229 [6]		
IP-SM-GW-Name	3GPP TS 29.336 [12]		
IP-SM-GW-Realm	3GPP TS 29.336 [12]		
IP-SM-GW-Number	3GPP TS 29.336 [12]		
MME-Number-for-MT-SMS	3GPP TS 29.272 [16]		
DRMP	IETF RFC 7944 [18]	see section 6.3.8	Must not set
NOTE 1: The M-bit settings for re-used AVPs override those of the defining specifications that are referenced. Values include: "Must set", "Must not set". If the M-bit setting is blank, then the defining specification applies.			
NOTE 2: If the M-bit is set for an AVP and the receiver does not understand the AVP, it shall return a rejection. If the M-bit is not set for an AVP, the receiver shall not return a rejection, whether or not it understands the AVP. If the receiver understands the AVP but the M-bit value does not match with the definition in this table, the receiver shall ignore the M-bit.			

6.3.1 SM-Delivery-Outcome-T4

The SM-Delivery-Outcome-T4 AVP is of type Enumerated and indicates the outcomes of the device trigger delivery. The following values are defined:

ABSENT_SUBSCRIBER (0)

This value is used when the device trigger delivery failed due to absent subscriber.

UE_MEMORY_CAPACITY_EXCEEDED (1)

This value is used when the device trigger delivery failed due to UE memory capacity exceeded.

SUCCESSFUL_TRANSFER (2)

This value is used when the device trigger delivery is successfully transferred to the UE.

VALIDITY_TIME_EXPIRED (3)

This value is used when the message was deleted in the SMS-SC due to expiration of the validity time.

6.3.2 Absent-Subscriber-Diagnostic-T4

The Absent-Subscriber-Diagnostic-T4 AVP is of type Enumerated and indicates the reason why the subscriber is absent if the device trigger failed to be delivered due to absent subscriber. The following values are defined:

NO_PAGING_RESPONSE (0)

This value is used when there is no paging response via some of the serving nodes.

UE_DETACHED (1)

This value is used when the UE is detached from all of the serving nodes.

UE_DEREGISTERED (2)

This value is used when the UE is deregistered in the network.

UE_PURGED (3)

This value is used when the UE is purged by some of the serving nodes.

ROAMING_RESTRICTION (4)

This value is used when the UE is roaming restricted.

UNIDENTIFIED_SUBSCRIBER (5)

This value is used when the user is unidentified in all of the serving nodes.

6.3.3 Serving-Node

The Serving-Node AVP is of type Grouped and it shall contain the name/number of the serving node to be used for T4-triggering. It is originally defined in 3GPP TS 29.173 [8].

Serving-Node ::= <AVP header: 2401 10415>

[SGSN-Name]
 [SGSN-Realm]
 [SGSN-Number]
 [MME-Name]
 [MME-Realm]
 [MME-Number-for-MT-SMS]
 [MSC-Number]
 [IP-SM-GW-Number]
 [IP-SM-GW-Name]
 [IP-SM-GW-Realm]
 *[AVP]

The following combinations are allowed:

- a) SGSN-Number
- b) SGSN-Name & SGSN-Realm & SGSN-Number
- c) MME-Name & MME-Realm & MME-Number-for-MT-SMS
- d) MSC-Number
- e) MSC-Number & MME-Name & MME-Realm
- f) IP-SM-GW-Number
- g) IP-SM-GW-Number & IP-SM-GW-Name & IP-SM-GW-Realm

6.3.4 Additional-Serving-Node

The Additional Serving-Node AVP is of type Grouped and when present it shall contain the name/number of an additional serving node to be used for T4-triggering. It is originally defined in 3GPP TS 29.173 [8],

```
Additional-Serving-Node ::= <AVP header: 2406 10415>
    [ SGSN-Name ]
    [ SGSN-Realm ]
    [ SGSN-Number ]
    [ MME-Name ]
    [ MME-Realm ]
    [ MME-Number-for-MT-SMS ]
    [ MSC-Number ]
    *[AVP]
```

The following combinations are allowed:

- a) SGSN-Number
- b) SGSN-Name & SGSN-Realm & SGSN-Number
- c) MME-Name & MME-Realm & MME-Number-for-MT-SMS
- d) MSC-Number
- e) MSC-Number & MME-Name & MME-Realm

6.3.5 Supported-Feature-List AVP for the T4 application

The syntax of this AVP is defined in 3GPP TS 29.229 [6].

For the T4 application, the meaning of the bits shall be as defined in table 6.3.5 for the Supported-Feature-List-ID of 1.

Table 6.3.5: Features of Feature-List-ID 1 used in T4

Feature bit	Feature	M/O	Description
0	Device-Trigger-Recall-Replace	O	This Feature indicates the support of the applicability to support the functionality for device trigger recall and device trigger replace. This Feature is applicable for the DTR/DTA command pair. For recall if an MTC-IWF or SMS-SC does not indicate the support of the feature the MTC-IWF shall not send device trigger recall requests to an SMS-SC and send a negative reply to the SCS. For Replace if an MTC-IWF or SMS-SC does not indicate the support of the feature the MTC-IWF shall treat the device trigger replace as a new device trigger.
Feature bit: The order number of the bit within the Supported-Features AVP, e.g. "1". Feature: A short name that can be used to refer to the bit and to the feature, e.g. " Device-Trigger-Recall-Replace ". M/O: Defines if the implementation of the feature is mandatory ("M") or optional ("O"). Description: A clear textual description of the feature.			

6.3.6 Trigger-Action

The Trigger Action AVP is of type Unsigned32 and indicates the type of the device trigger. The following values are defined:

TRIGGER (0)

This value is used when device trigger requests the storage and sending of a new device trigger.

RECALL (1)

This value is used when device trigger requests the removal of a pending device trigger.

REPLACE (2)

This value is used when device trigger requests the replacement of a pending device trigger.

6.3.7 MTC-Error-Diagnostic

The MTC-Error-Diagnostic AVP is of type Unsigned32. The following values are defined:

- ORIGINAL_MESSAGE_NOT_DELETED (0)

This cause should be sent if the replace failed due to the fact that the old message is pending but could not be deleted in the SMS-SC.

- NEW_MESSAGE_NOT_STORED (1)

This cause should be sent if the replace failed due to the fact that the new message could not be stored in the SMS-SC e.g. no resource available.

6.3.8 DRMP

The DRMP AVP is of type Enumerated and it is defined in IETF RFC 7944 [18]. This AVP allows the SMS-SC and the MTC-IWF to indicate the relative priority of Diameter messages. The DRMP AVP may be used to set the DSCP marking for transport of the associated Diameter message.

7 Result-Code and Experimental-Result Values

7.1 General

This section defines result code values that shall be supported by all Diameter implementations that conform to this specification.

7.2 Success

Result codes that fall within the Success category shall be used to inform a peer that a request has been successfully completed. The Result-Code AVP values defined in the Diameter base protocol specified in IETF RFC 6733 [19] shall be applied.

7.3 Permanent Failures

Errors that fall within the Permanent Failures category shall be used to inform the peer that the request has failed, and should not be attempted again. The Result-Code AVP values defined in Diameter base protocol specified in IETF RFC 6733 [19] shall be applied. When one of the result codes defined here is included in a response, it shall be inside an Experimental-Result AVP and the Result-Code AVP shall be absent.

7.3.1 DIAMETER_ERROR_USER_UNKNOWN (5001)

This result code shall be sent by the SMS-SC to indicate that the user identified by the IMSI or the MSISDN is unknown.

7.3.2 DIAMETER_ERROR_INVALID_SME_ADDRESS (5530)

This result code shall be sent by the SMS-SC to indicate that the SME address is invalid.

7.3.3 DIAMETER_ERROR_SC_CONGESTION (5531)

This result code shall be sent by the SMS-SC to indicate that SC is congested and unable to deliver the device trigger request.

7.3.4 Void

7.3.5 DIAMETER_ERROR_TRIGGER_REPLACE_FAILURE (5533)

This result code shall be sent by the SMS-SC to indicate that trigger replace has failed to delete the old message and/or to store the new message.

7.3.6 DIAMETER_ERROR_TRIGGER_RECALL_FAILURE (5534)

This result code shall be sent by the SMS-SC to indicate that trigger recall has failed.

7.3.7 DIAMETER_ERROR_ORIGINAL_MESSAGE_NOT_PENDING (5535)

This result code shall be sent by the SMS-SC to indicate that trigger recall or replace has failed because the original message to be recalled or replaced is not stored any more in the SMS-SC.

Annex A (normative): Diameter message priority mechanism

A.1 General

IETF RFC 7944 [18] specifies a Diameter routing message priority mechanism that allows Diameter nodes to indicate the relative priority of Diameter messages. With this information, other Diameter nodes may leverage the relative priority of Diameter messages into routing, resource allocation, set the DSCP marking for transport of the associated Diameter message, and also abatement decisions when overload control is applied.

A.2 T4 interface

A.2.1 General

The Diameter message priority mechanism is an optional feature.

A.2.2 SMS-SC and MTC-IWF behaviour

When the SMS-SC or the MTC-IWF support the Diameter message priority mechanism over the T4 interface, the SMS-SC or the MTC-IWF shall comply with IETF RFC 7944 [18].

The SMS-SC or the MTC-IWF sending a request shall determine the required priority according to its policies. When priority is required, the SMS-SC or the MTC-IWF shall include the DRMP AVP indicating the required priority level in the request it sends, and shall prioritise the request according to the required priority level.

When the SMS-SC or the MTC-IWF receives the corresponding response, it shall prioritise the received response according to the priority level received within the DRMP AVP if present in the response, otherwise according to the priority level of the corresponding request.

When the SMS-SC or the MTC-IWF receives a request, it shall handle the request according to the received DRMP AVP priority level. For the response, the SMS-SC or the MTC-IWF may modify the priority level received in the DRMP AVP according to its policies and shall handle the response according to the required priority level. If the required priority level is different from the priority level received in the request, the SMS-SC or the MTC-IWF shall include the DRMP AVP in the response.

The SMS-SC and MTC-IWF decisions for a required priority and for the priority level value are implementation specific.

If:

- SMS-SC and the MTC-IWF supports using the Diameter message priority mechanism for DSCP marking purposes,
- the transport network utilizes DSCP marking, and
- message-dependant DSCP marking is possible for the protocol stack transporting Diameter,

then the SMS-SC and the MTC-IWF shall set the DSCP marking for transport of the request or response according to the required priority level.

Diameter requests related to high priority traffic shall contain a DRMP AVP with a high priority of which the level value is operator dependent.

If the SMS-SC supporting the Diameter message priority mechanism receives a request message containing both the Priority-Indication AVP and the DRMP AVP, the SMS-SC shall prioritize the request according to priority level received within the DRMP AVP.

Annex B (informative): Change history

Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	New
2012-09	CT#57	CP-120486			TS presented for information and approval	11.0.0
2012-12	CT#58	CP-120731	0001	2	T4 Device Triggering via IMS	11.1.0
		CP-120731	0002	1	MWD update	
		CP-120731	0003	1	Add Reference for the Information Elements	
		CP-120731	0004	3	Removal of Editor's Notes	
2013-03	CT#59	CP-130028	0005	-	Application Port ID in T4	11.2.0
2013-06	CT#60	CP-130297	0006	-	Delivery-Report-Request/Answer Description	11.3.0
2013-06	CT#60	CP-130300	0007	1	T4 complements related to Diameter for SMS with SGSN	12.0.0
2014-03	CT#63	CP-140180	0008	3	Protocol enhancements for the support of device recall and replace procedure	12.1.0
2014-06	CT#64	CP-140251	0010	2	Handling of error scenarios on trigger replace	12.2.0
		CP-140251	0011	2	Error handling, MTC error diagnostic	
2014-09	CT#65	CP-140508	0012	1	Reporting of Validity period of the trigger message expired in SMS-SC	12.3.0
2014-12	CT#66	CP-140792	0014	1	Trigger action in device trigger request	12.4.0
2015-06	CT#68	CP-150247	0016	-	Payload T4 parameter	12.5.0
		CP-150247	0020	-	SCS address for SMS over T4	
		CP-150248	0018	1	IP-SM-GW-Realm	
2015-09	CT#69	CP-150429	0023	-	AVP names corrections	12.6.0
2015-12	CT#70	CP-150746	0025	2	Destination Host in the DTR command, IMSI presence	12.7.0
2015-12	CT#70				Automatic upgrade from previous Release version 12.7.0	13.0.0
2016-03	CT#71	CP-160023	0026	1	Diameter message priority over T4	13.1.0
2016-12	CT#74	CP-160664	0027	-	Correction to change IETF drmp draft version to official RFC 7944	13.2.0
2017-03	CT#75	CP-170036	0028	-	SMS-MO over T4	14.0.0
2017-03	CT#75	CP-170048	0029	-	Update of reference for the Diameter base protocol	14.0.0
2017-03	CT#75	CP-170048	0030	1	Handling of the Vendor-Specific-Application-Id AVP	14.0.0
2017-03	CT#75	CP-170048	0031	-	Cardinality of the Failed-AVP AVP in answer	14.0.0
2017-06	CT#76	CP-171018	0033	1	Support for signaling transport level packet marking	14.1.0
2017-09	CT#77	CP-172013	0035	-	Correction of DRMP Procedures	14.2.0
2018-06	CT#80	-	-	-	Update to Rel-15 version (MCC)	15.0.0
2020-07	CT#88e	-	-	-	Update to Rel-16 version (MCC)	16.0.0

History

Document history		
V16.0.0	July 2020	Publication