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Universal Mobile Telecommunications System (UMTS);
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Service capability exposure functionality
over Nt reference point
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Contents

Foreword

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

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1 Scope

This document defines the protocol for Nt reference point. The Nt reference point includes Nt application and Nta application.

The functional requirements and the stage 2 specifications of the Nt application are contained in 3GPP TS 23.203 [2]. The Nt application of Nt reference point lies between Service Capability Exposure Function (SCEF) and Policy and Charging Rules Function (PCRF), it supports the negotiation of background data transfer policy and is documented in the main body of this document.

The functional requirements and the stage 2 specifications of the Nta application are contained in clause 5.6.4.1a of 3GPP TS 23.682 [x5]. The Nta application of Nt reference point lies between SCEF and PCRF, it supports the event monitoring configuration for a group of UEs and the corresponding event reporting. The Nta application is documented in Annex A.

NOTE: Nta is a stage 3 name of Diameter Application due to extensibility rule mentioned in IETF RFC 6733 [15].

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 23.203: "Policy and charging control architecture".

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

[4] IETF RFC 4006: "Diameter Credit Control Application".

[5] 3GPP TS 29.214: "Policy and Charging Control over Rx reference point".

[6] 3GPP TS 29.274: "3GPP Evolved Packet System. Evolved GPRS Tunnelling Protocol for EPS (GTPv2)".

[7] IETF RFC 5719: "Updated IANA Considerations for Diameter Command Code Allocations ".

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

[9] 3GPP TS 29.213: "Policy and charging control signalling flows and Quality of Service (QoS) parameter mapping".

[10] IETF RFC 7683: "Diameter Overload Indication Conveyance".

[11] 3GPP TS 29.229: "Cx and Dx interfaces based on Diameter protocol; Protocol details".

[12] IETF RFC 7944: "Diameter Routing Message Priority".

[13] 3GPP TS 29.215: "Policy and Charging Control (PCC) over S9 reference point; Stage 3".

[14] IETF RFC 8583: "Diameter Load Information Conveyance".

[15] IETF RFC 6733: "Diameter Base Protocol".

[16] 3GPP TS 29.329: "Sh Interface based on the Diameter protocol".

[17] 3GPP TS 29.336: "Home Subscriber Server (HSS) diameter interfaces for interworking with packet data networks and applications".

[18] 3GPP TS 29.061: "Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN)".

[19] 3GPP TS 29.212: "Policy and Charging Control (PCC); Reference points".

[20] 3GPP TS 23.682: "Architecture enhancements to facilitate communications with packet data networks and applications".

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 the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

3.2 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 3GPP TR 21.905 [1].

ASP	Application Service Provider
BBERF	Bearer Binding and Event Reporting Function
BTA	Background Data Transfer Answer
BTR	Background Data Transfer Request
ECA	Event Configuration Answer
ECR	Event Configuration Request
ERA	Event Reporting Answer
ERR	Event Reporting Request
DRA	Diameter Routing Agent
DRMP	Diameter Routing Message Priority
PCEF	Policy and Charging Enforcement Function
PCRF	Policy and Charging Rules Function
SCEF	Service Capability Exposure Function
SPR	Subscription Profile Repository

4 Nt application

4.1 Overview

The Nt application of Nt reference point is located between the PCRF and the SCEF. It is used for reporting the transfer policies from the PCRF to the SCEF.

The stage 2 requirements for Nt application are defined in TS 23.203 [2].

Refer to Annex G of 3GPP TS 29.213 [9] for Diameter overload control procedures for the Nt application.

Refer to Annex J of 3GPP TS 29.213 [9] for Diameter message priority mechanism procedures for the Nt application.

Refer to Annex K of 3GPP TS 29.213 [9] for Diameter load control procedures for the Nt application.

4.2 Nt Reference Model

The Nt application of Nt reference point resides between the SCEF and PCRF. The relationship between the two functional entities is depicted in figure 4.2-1. The overall PCC architecture is depicted in clause 3a of 3GPP TS 29.213 [9].

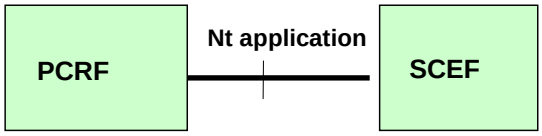

Figure 4.2-1: Reference model for Nt application of Nt interface

NOTE: For roaming case, the SCEF is always in the H-PLMN and always contact the H-PCRF.

4.3 Functional elements

4.3.1 PCRF

The PCRF is a functional element that encompasses policy control decision and flow based charging control functionalities.

The PCRF uses the information received from SCEF and other available information to determine one or more transfer policies for background data to the application service provider. The PCRF provides the selected transfer policies with a reference ID to the SPR for storage.

4.3.2 SCEF

The SCEF is a functional element which provides a means to securely expose the services and capabilities provided by 3GPP network interfaces.

The SCEF is triggered by an SCS/AS which requests for the negotiation with the PCRF for providing necessary policy to transfer background data.

4.4 Procedures over the Nt reference point

4.4.1 Negotiation for future background data transfer

Based on the SCS/AS request, the SCEF shall send the Background-Data-Transfer-Request (BTR) command to the PCRF including the Transfer-Request-Type AVP with the value TRANSFER_POLICY_REQUEST(0), it shall also include the ASP identifier within the Application-Service-Provider-Identity AVP, volume of data per UE within the CC-Output-Octets AVP for downlink volume and/or the CC-Input-Octets AVP for uplink volume, or the CC-Total-Octets AVP for total volume regardless direction, expected number of UEs within the Number-Of-UEs AVP and desired time window within the Time-Window AVP.
The Time-Window AVP shall include desired start time within the Transfer-Start-Time AVP and desired end time within the Transfer-End-Time AVP.
The SCEF may also provide network area information within Network-Area-Info-List AVP.

Once the PCRF receives the BTR command, the PCRF shall retrieve all existing transfer policies stored for any ASP from the SPR.
When all existing transfer policies are retrieved, the PCRF shall determine one or more transfer policies based on the information received from the SCEF and other available information (e.g. network policy, congestion level (if available), load status estimation for the required time window and network area, existing transfer policies) and respond with a Background-Data-Transfer-Answer (BTA) command including the possible transfer policies within Transfer-Policy AVP (s) and a reference ID within Reference-Id AVP.

The Transfer-Policy AVP(s) shall include the Transfer-Policy-Id AVP, the Time-Window AVP, the Rating-Group AVP, and may also include an Max-Requested-Bandwidth-DL AVP and/or an Max-Requested-Bandwidth-UL AVP.

If more than one transfer policies are included in the BTA command, the PCRF shall also include the PCRF Id within the PCRF-Address AVP in the BTA command.

NOTE 1: If only one Transfer-Policy AVP is included in the BTA command, the PCRF sends a request to the SPR to store the reference ID together with the transfer policy and corresponding network area information(if available).
If there is more than one Transfer-Policy AVP included in the BTA command, the PCRF waits for the transfer policy selected by the SCS/AS before communicating with the SPR.

If there is more than one transfer policy provided from the PCRF to the SCEF in the BTA command, when the SCEF receives the selected transfer policy from the SCS/AS, the SCEF shall send Background-Data-Transfer-Request (BTR) command to the PCRF including the Transfer-Request-Type AVP set to the value TRANSFER_POLICY_NOTIFICATION (1). The SCEF shall also include the reference ID in the Reference-Id AVP, the identity of the selected transfer policy within the Transfer-Policy-Id AVP and the destination PCRF Id within the Destination-Host AVP.

NOTE 2: When receiving the BTA command from the PCRF, if there is only one transfer policy included, the SCEF forwards the transfer policy to SCS/AS.
If there is more than the one transfer policy included, the SCEF forwards these transfer policies to the SCS/AS and waits for the answer including the identity of the transfer policy selected by the SCS/AS.

The PCRF shall acknowledge the BTR command by sending Background-Data-Transfer-Answer (BTA) command.

NOTE 3: The PCRF sends a request to the SPR to store the reference ID together with the transfer policy and corresponding network area information (if available).

4.5 PCRF selection

The SCEF or DRA (if deployed) may select a PCRF in the HPLMN based on operator policy (e.g. pre-configured PCRF identities or routing strategy, etc).

5 Nt protocol

5.1 Protocol support

The Diameter Base Protocol as specified in IETF RFC 6733 [15] 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 specified in IETF RFC 6733 [15] (including error handling and unrecognised information handling) shall be used unmodified.

The Nt application is defined as vendor specific Diameter application, where the vendor is 3GPP and the Application-ID for the Nt application in the present release is 16777348. The vendor identifier assigned by IANA to 3GPP (http://www.iana.org/assignments/enterprise-numbers) is 10415.

With regard to the Diameter protocol defined for the Nt application, the PCRF acts as a Diameter server, in the sense that it is the network element that handles background data transfer request. The SCEF acts as the Diameter client, in the sense that it is the network element requesting background data transfer.

5.2 Initialization, maintenance and termination of connection and session

The initialization and maintenance of the connection between each SCEF and PCRF pair is defined by the underlying protocol. Establishment and maintenance of connections between Diameter nodes is described in IETF RFC 6733 [15].After establishing the transport connection, the SCEF and the PCRF shall advertise the support of the Nt 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 Vendor-Specific-Application-Id AVP contained 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 (IETF RFC 6733 [15]).

An Nt Diameter session shall consist of a single request and answer pair. The Nt Diameter session is terminated after each request and answer pair interaction. In order to indicate that the session state is not to be maintained, the Diameter client and server shall include the Auth-Session-State AVP with the value set to NO_STATE_MAINTAINED (1), in the request and in the answer messages (see IETF RFC 6733 [15]).

5.3 Nt specific AVPs

5.3.1 General

Table 5.3.1.1 describes the Diameter AVPs defined for the Nt application, their AVP Code values, types, possible flag values, whether or not the AVP may be encrypted and which supported features the AVP is applicable to. The Vendor-Id header of all AVPs defined in the present document shall be set to 3GPP (10415).

Table 5.3.1.1: Nt specific Diameter AVPs

Attribute Name	AVP Code	Clause defined	Value Type (Note 2)	AVP Flag rules (Note 1)				Applicability
				Must	May	Should not	Must not	
Network-Area-Info-List	4201	5.3.2	OctetString	M,V	P			
Number-Of-UEs	4209	5.3.10	Unsigned32	M,V	P			
Reference-Id	4202	5.3.3	OctetString	M,V	P			
Transfer-Request-Type	4203	5.3.4	Unsigned32	M,V	P			
Time-Window	4204	5.3.5	Grouped	M,V	P			
Transfer-End-Time	4205	5.3.6	Time	M,V	P			
Transfer-Policy	4207	5.3.8	Grouped	M,V	P			
Transfer-Policy-Id	4208	5.3.9	Unsigned32	M,V	P			
Transfer-Start-Time	4206	5.3.7	Time	M,V	P			

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 [15].
NOTE 2: The value types are defined in IETF RFC 6733 [15].

5.3.2 Network-Area-Info-List AVP

The Network-Area-Info-List AVP (AVP code 4201) is of type OctetString, it contains the network area information which is coded as specified in 3GPP TS 29.274 [6] in Presence Reporting Area Action IE, starting from octet 9.

5.3.3 Reference-Id AVP

The Reference-Id AVP (AVP code 4202) is of type OctetString. It is used by the PCRF to correlate an SCS/AS request with the transfer policy retrieved from the SPR. It is assigned by the PCRF and shall be globally unique per PLMN.

NOTE: To guarantee the uniqueness of the Reference Id, the Reference Id can follow the definition of Session Id in IETF RFC 6733 [15].

5.3.4 Transfer-Request-Type AVP

The Transfer-Request-Type AVP (AVP code 4203) is of type Unsigned32, it contains the reason for sending the BT-Request message.

The following values are defined:

0 (TRANSFER_POLICY_REQUEST)

The BT-Request message is sent to initiate a transfer policy request procedure.

1 (TRANSFER_POLICY_NOTIFICATION)

The BT-Request message is sent to initiate a transfer policy notification procedure.

5.3.5 Time-Window AVP

The Time-Window AVP (AVP code 4204) is of type Grouped. It contains a Transfer-Start-Time and a Transfer-End-Time. It describes the time interval during which the SCS/AS may realize the background data transfer.

```
Time-window ::= < AVP Header: 4204 >
                  { Transfer-Start-Time }
                  { Transfer-End-Time }
                 *[ AVP ]
```

5.3.6 Transfer-End-Time AVP

The Transfer-End-Time AVP (AVP code 4205) is of type Time. It indicates the NTP time at which the SCS/AS shall stop the background data transfer.

5.3.7 Transfer-Start-Time AVP

The Transfer-Start-Time AVP (AVP code 4206) is of type Time. It indicates the NTP time when the SCS/AS may start the background data transfer.

5.3.8 Transfer-Policy AVP

The Transfer-Policy AVP (AVP code 4207) is of type Grouped. It indicates the transfer policy determined by the PCRF.

```
Transfer-Policy ::= < AVP Header: 4207 >
                   { Transfer-Policy-Id }
                   [ Time-Window ]
                   [ Rating-Group ]
                   [ Max-Requested-Bandwidth-DL ]
                   [ Max-Requested-Bandwidth-UL ]
                  *[ AVP ]
```

5.3.9 Transfer-Policy-Id AVP

The Transfer-Policy-Id AVP (AVP code 4208) is of type Unsigned32. It indicates the identity of the transfer policy. It is assigned by the PCRF and is unique per Reference-Id.

5.3.10 Number-Of-UEs AVP

The Number-Of-UEs AVP (AVP code 4209) is of type Unsigned32. It indicates the expected number of UEs.

5.4 Nt re-used AVPs

5.4.1 General

Table 5.4.1 lists the Diameter AVPs re-used by the Nt application from other existing Diameter Applications, reference to their respective specifications, short description of their usage within the Nt application. 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 5.4.1, but they are re-used for the Nt application. Unless otherwise stated, re-used AVPs shall maintain their 'M', 'P' and 'V' flag settings.

Table 5.4.1: Nt re-used Diameter AVPs

Attribute Name	Reference	Description	Applicability (NOTE)
Application-Service-Provider-Identity	3GPP TS 29.214 [5]	The identity of the application service provider that is delivering a service to an end user.	
CC-Output-Octets	IETF RFC 4006 [4]	It contains the number of requested, octets that may be sent to involved users.	
CC-Input-Octets	IETF RFC 4006 [4]	It contains the number of requested octets that may be received from the involved users.	
CC-Total-Octets	IETF RFC 4006 [4]	It contains the total number of requested octets regardless of the direction (sent or received).	
DRMP	IETF RFC 7944 [12]	Allows Diameter endpoints to indicate the relative priority of Diameter transactions.	
Load	IETF RFC 8583 [14]	The AVP used to convey load information between Diameter nodes. This AVP and all AVPs within this grouped AVP shall have the 'M' bit cleared.	
Max-Requested-Bandwidth-DL	3GPP TS 29.214 [5]	Defines the maximum aggregated authorized bandwidth for downlink by the PCRF.	
Max-Requested-Bandwidth-UL	3GPP TS 29.214 [5]	Defines the maximum aggregated authorized bandwidth for uplink by the PCRF.	
OC-OLR	IETF RFC 7683 [10]	Contains the necessary information to convey an overload report.	
OC-Supported-Features	IETF RFC 7683 [10]	Defines the support for the Diameter overload indication conveyence by the sending node.	
PCRF-Address	3GPP TS 29.215 [13]	The identity, which indicates the destination PCRF.	
Rating-Group	IETF RFC 4006 [4]	The charging key for the aggregated traffic of all involved UEs used for rating purpose.	
Supported-Features	3GPP TS 29.229 [11]	If present, this AVP informs the destination host about the features that the origin host requires to successfully complete this command exchange.	
NOTE: AVPs marked with a supported feature are applicable as described in clause 5.4.2.			

5.4.2 Use of the Supported-Features AVP for the Nt application

When new functionality is introduced for the Nt application, 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. Unless otherwise stated, the use of the Supported-Features AVP for the Nt application shall be compliant to the usage of the Supported-Features AVP on the Cx reference point and consistent with the procedures for the dynamic discovery of supported features as defined in clause 7.2 of 3GPP TS 29.229 [11].

The base functionality for the Nt application is the 3GPP Rel-13 standard and a feature is an extension to that functionality. If the origin host does not support any features beyond the base functionality, the Supported-Features AVP may be absent from the Nt commands.

As defined in clause 7.1.1 of 3GPP TS 29.229 [11], 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 [11], 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 Supported-Features AVP shall be included in every BTR and BTA commands if supported by the SCEF and PCRF respectively.

The table 5.4.2.1 defines the features applicable to the Nt application for the feature list with a Feature-List-ID of 1.

Table 5.4.2.1: Features of Feature-List-ID 1 used in Nt

Feature bit	Feature	M/O	Description

Feature bit: The order number of the bit within the Feature-List AVP where the least significant bit is assigned number "0".
Feature: A short name that can be used to refer to the bit and to the feature, e.g. "EPS".
M/O: Defines if the implementation of the feature is mandatory ("M") or optional ("O") in this 3GPP Release.
Description: A clear textual description of the feature.

NOTE: This table is a placeholder for when any supported features are added to Nt. There are no supported features in this release.

5.5 Nt specific Experimental-Result-Code AVP values

5.5.1 General

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

5.5.2 Success

Result Codes that fall into 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 protocol IETF RFC 6733 [15] are applied.

5.5.3 Permanent Failures

Errors that fall into 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 IETF RFC 6733 [15] are applied.

5.5.4 Transient Failures

Errors that fall within the Transient Failures category are used to inform a peer that the request could not be satisfied at the time it was received, but may be able to satisfy the request in the future.

The Result-Code AVP values defined in Diameter base protocol IETF RFC 6733 [15] are applied.

5.6 Nt messages

5.6.1 Command-Code Values

This clause defines the Command-Code values for the Nt application as allocated by IANA from the vendor-specific namespace defined in IETF RFC 5719 [7]. Every command is defined by means of the ABNF syntax in IETF RFC 2234 [8], and according to the rules in IETF RFC 6733 [15].

NOTE: As the commands in the present specification have originally been defined based on the former specification of the Diameter Base Protocol (IETF RFC 3588 [3]), the Vendor-Specific-Application-Id AVP is still assumed as a required AVP (an AVP indicated as {AVP}) in the command code format to avoid backward compatibility issues, even if the use of this AVP has been deprecated in the new specification of the Diameter Base Protocol (IETF RFC 6733 [15]).

The Nt application identifier shall be included in the Auth-Application-Id AVP within the Vendor-Specific-Application-Id grouped AVP contained in the BT-Request/Answer commands.

The following Command Codes are defined in this specification:

Table 5.6.1: Command-Code values for Nt

Command-Name	Abbreviation	Code	Section
Background-Data-Transfer-Request	BTR	8388723	5.6.2
Background-Data-Transfer-Answer	BTA	8388723	5.6.3

5.6.2 Background-Data-Transfer-Request (BTR) command

The BTR command, indicated by the Command-Code field set to 8388723 and the 'R' bit set in the Command Flags field, is sent by the SCEF to the PCRF as part of Negotiation for future background data transfer procedure.

Message Format:

```
<BT-Request> ::= <Diameter Header: 8388723, REQ, PXY >
                 < Session-Id >
                 [ DRMP ]
                 { Vendor-Specific-Application-Id }
                 { Auth-Session-State }
                 { Origin-Host }
                 { Origin-Realm }
                 { Destination-Realm }
                 { Transfer-Request-Type }
                 [ Destination-Host ]
                 [ OC-Supported-Features ]
                 [ Application-Service-Provider-Identity ]
                 [ CC-Output-Octets ]
                 [ CC-Input-Octets ]
                 [ CC-Total-Octets ]
                 [ Number-Of-UEs ]
                 [ Time-Window ]
                 [ Network-Area-Info-List ]
                 [ Reference-Id ]
                 [ Transfer-Policy-Id ]
                *[ Proxy-Info ]
                *[ Route-Record ]
                *[ Supported-Features ]
                *[ AVP ]
```

5.6.3 Background-Data-Transfer-Answer (BTA) command

The BTA command, indicated by the Command-Code field set to 8388723 and the 'R' bit cleared in the Command Flags field, is sent by the PCRF to the SCEF as part of Negotiation for future background data transfer procedure.

Message Format:

```
<BT-Answer> ::= <Diameter Header: 8388723, PXY >
                 < Session-Id >
                 [ DRMP ]
                 { Vendor-Specific-Application-Id }
                 { Auth-Session-State }
                 { Origin-Host }
                 { Origin-Realm}
                 [ Result-Code ]
                 [ Experimental-Result ]
                 [ Error-Message ]
                 [ Error-Reporting-Host ]
                 [ Failed-AVP ]
                *[ Redirect-Host ]
                 [ Redirect-Host-Usage ]
```

```
 [ Redirect-Max-Cache-Time ]
 [ Reference-Id ]
 [ OC-Supported-Features ]
 [ OC-OLR ]
*[ Transfer-Policy ]
 [ PCRF-Address ]
*[ Proxy-Info ]
*[ Route-Record ]
*[ Supported-Features ]
*[ Load ]
*[ AVP ]
```

Annex A (normative): Nta application

A.1 Overview

The Nta application of Nt reference point is located between the PCRF and the SCEF. It is used for configuring event monitoring for a group of UEs and reporting the event.

The stage 2 requirements for Nta application are defined in TS 23.682 [x5].

Refer to Annex G of 3GPP TS 29.213 [9] for Diameter overload control procedures for the Nta application.

Refer to Annex J of 3GPP TS 29.213 [9] for Diameter message priority mechanism procedures for the Nta application.

Refer to Annex K of 3GPP TS 29.213 [9] for Diameter load control procedures for the Nta application.

A.2 Reference Model

The Nta application of Nt reference point resides between the SCEF and PCRF. The relationship between the two functional entities is depicted in figure A.2-1. The overall PCC architecture is depicted in clause 3a of 3GPP TS 29.213 [9].

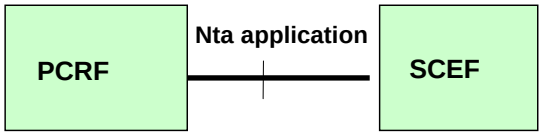

Figure A.2-1: Reference model for Nta application of Nt interface

NOTE: For roaming case, the SCEF is always in the H-PLMN and always contact the H-PCRF.

A.3 Functional elements

A.3.1 PCRF

The PCRF is a functional element that encompasses policy control decision and flow based charging control functionalities.

The PCRF receives event monitoring configuration (e.g. location request) from the SCEF and applies corresponding procedure over IP-CAN session. The PCRF reports the subscribed event to the SCEF after receiving report of the IP-CAN session.

A.3.2 SCEF

The SCEF is a functional element which provides a means to securely expose the services and capabilities provided by 3GPP network interfaces.

The SCEF receives event monitoring configuration from an SCS/AS which requests for the information (e.g. location) for a group of UEs, and reports such information to the SCS/AS.

A.4 Procedures over the Nta application

A.4.1 Event Monitoring Configuration

Based on the SCS/AS request to retrieve the location information for a group of UEs, the SCEF shall send an Event-Configuration-Request (ECR) command to the PCRF including the Event-Configuration AVP and the External-Group-Identifier AVP. The Event-Configuration AVP shall include Monitoring-Type AVP with the value LOCATION_REPORTING (2), SCEF-ID AVP, Extended-SCEF-Reference-ID AVP and MONTE-Location-Type AVP within Location-Information-Configuration AVP. The SCEF may also send the Group-Reporting-Guard-Timer AVP to indicate how often the event monitoring report shall be sent.

Once the PCRF receives the ECR command, the PCRF shall retrieve UE identities (MSISDN and optionally UE external identifier) for all UEs in the group associated with the External-Group-Identifier AVP from the SPR and respond with an Event-Configuration-Answer (ECA) command including the Event-Configuration-Status AVP. If the PCRF has at least one active IP-CAN session for received UE identities and for such IP-CAN session the PCEF/BBERF supports the NetLoc feature as defined in clause 5.4.1 of 3GPP TS 29.212 [aa], the Event-Configuration-State AVP within the Event-Configuration-Status AVP shall indicate this is not a final report with bit 0 not set. For those UEs having active IP-CAN sessions but without the support of the NetLoc feature in the PCEF/BBERF, the PCRF shall also send Event-Reports AVP with NetLoc-Access-Support AVP set to the value NETLOC_ACCESS_NOT_SUPPORTED (0).

NOTE 1: The details associated with the Sp reference point are not specified in this Release. The SPR's relation to existing subscriber databases is not specified in this Release.

For location reporting, the PCRF shall trigger an IP-CAN session modification procedure including the Access Network information report request as defined in 3GPP TS 29.212 [aa] for each UE having active IP-CAN session(s).

If a UE has multiple IP-CAN sessions established in the PCRF, only one IP-CAN session shall be selected to trigger a PCRF initiated IP-CAN session modification.

NOTE 2: If a UE has multiple IP-CAN sessions over both 3GPP and non-3GPP access, the PCRF can prioritize multi access IP-CAN session(s) or 3GPP access IP-CAN session(s) in the selection among multiple IP-CAN sessions. Then how the PCRF selects the final IP-CAN session is implementation specific and not standardized in this specification.

After receiving the ECA command, if the result indicates that it is a final report, the SCEF does not need to wait for further reporting from such PCRF.

A.4.2 Event Monitoring Reporting

For location reporting, the PCRF may wait and aggregate (according to Group-Reporting-Guard-Timer AVP received in the ECR command) the access network information reported from the PCEF/BBERF for UE(s) that were requested previously, the PCRF shall send an Event-Reporting-Request (ERR) command to the SCEF including Event-Reports AVP. The Event-Reports AVP shall include Extended-SCEF-Reference-ID AVP and the following information for each UE: MSISDN AVP or External-Identifier AVP (if available and local policy allows it) and Access-Network-Reports AVP (if available). The PCRF may send the User-Location-Info-Time AVP within the Access-Network-Reports AVP to indicate that it is the last known location for a UE. If the PCRF receives NetLoc-Access-Support AVP with the value NETLOC_ACCESS_NOT_SUPPORTED (0) from the PCEF/BBERF, it shall relay such AVP to the SCEF within the Access-Network-Reports AVP. The PCRF shall also indicate whether it is a final reporting for the group within the Event-Reporting-Results AVP within the Event-Reports AVP.

After receiving the ERR command, the SCEF shall respond with an Event-Reporting-Answer (ERA) command. If the SCEF receives the Event-Reports AVP from the PCRF with an Extended-SCEF-Reference-ID not known by the SCEF, it shall reply with DIAMETER_ERROR_SCEF_REFERENCE_ID_UNKNOWN (5515).

A.5 PCRF selection

For location reporting, the SCEF shall select all PCRFs and send ECR command to each PCRF in the same PLMN.

A.6 Nta protocol

A.6.1 Protocol support

The Diameter Base Protocol as specified in IETF RFC 6733 [15] 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 specified in IETF RFC 6733 [15] (including error handling and unrecognised information handling) shall be used unmodified.

The Nta application is defined as vendor specific Diameter application, where the vendor is 3GPP and the Application-ID for the Nta application in the present release is 16777358. The vendor identifier assigned by IANA to 3GPP (http://www.iana.org/assignments/enterprise-numbers) is 10415.

With regard to the Diameter protocol defined for the Nta application, the PCRF acts as a Diameter server, in the sense that it is the network element that handles event monitoring request. The SCEF acts as the Diameter client, in the sense that it is the network element requesting event monitoring report.

A.6.2 Initialization, maintenance and termination of connection and session

The initialization and maintenance of the connection between each SCEF and PCRF pair is defined by the underlying protocol. Establishment and maintenance of connections between Diameter nodes is described in IETF RFC 6733 [15]. After establishing the transport connection, the SCEF and the PCRF shall advertise the support of the Nta 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 Vendor-Specific-Application-Id AVP contained 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 (IETF RFC 6733 [15]).

An Nta Diameter session shall consist of a single request and answer pair. The Nta Diameter session is terminated after each request and answer pair interaction. In order to indicate that the session state is not to be maintained, the Diameter client and server shall include the Auth-Session-State AVP with the value set to NO_STATE_MAINTAINED (1), in the request and in the answer messages (see IETF RFC 6733 [15]).

A.6.3 Nta specific AVPs

A.6.3.1 General

Table A.6.3.1-1 describes the Diameter AVPs defined for the Nta application, their AVP Code values, types, possible flag values, whether or not the AVP may be encrypted and which supported features the AVP is applicable to. The Vendor-Id header of all AVPs defined in the present document shall be set to 3GPP (10415).

Table A.6.3.1-1: Nta specific Diameter AVPs

Attribute Name	AVP Code	Clause defined	Value Type (Note 2)	AVP Flag rules (Note 1)				Applicability
				Must	May	Should not	Must not	
Access-Network-Reports	4210	A.6.3.2	Grouped	M,V	P			
Event-Configuration	4211	A.6.3.3	Grouped	M,V	P			
Event-Configuration-State	4212	A.6.3.4	Unsigned32	M,V	P			
Event-Configuration-Status	4213	A.6.3.5	Grouped	M,V	P			
Event-Reporting-Results	4214	A.6.3.6	Unsigned32	M,V	P			
Event-Reports	4215	A.6.3.7	Grouped	M,V	P			
Extended-SCEF-Reference-ID	4216	A.6.3.8	Unsigned64	M,V	P			

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 [15].
NOTE 2: The value types are defined in IETF RFC 6733 [15].

A.6.3.2 Access-Network-Reports AVP

The Access-Network-Reports AVP (AVP code 4210) is of type Grouped. It indicates the access network information for a UE.

```
Access-Network-Reports ::= < AVP Header: 4210 >
                    [ MSISDN ]
                    [ External-Identifier ]
                    [ 3GPP-User-Location-Info ]
                    [ User-Location-Info-Time ]
                    [ 3GPP-SGSN-MCC-MNC ]
                    [ 3GPP-MS-TimeZone ]
                    [ UE-Local-IP-Address ]
                    [ TCP-Source-Port ]
                    [ UDP-Source-Port ]
                    [ NetLoc-Access-Support ]
                   *[ AVP ]
```

A.6.3.3 Event-Configuration

The Event-Configuration AVP (AVP code 4211) is of type Grouped, and it contains the details of the monitoring event configuration from the SCEF.

```
Event-Configuration ::= < AVP Header: 4211 >
                    { Extended-SCEF-Reference-ID }
                    { SCEF-ID }
                    { Monitoring-Type }
                    [ Location-Information-Configuration ]
                   *[ AVP ]
```

A.6.3.4 Event-Configuration-State AVP

The Event-Configuration-State AVP (AVP code 4212) is of type Unsigned32, it shall contain a bit mask. The bit 0 shall be the least significant bit. For example, to get the value of bit 0, a bit mask of 0x0001 should be used. The meaning of the bits shall be as defined below:

Table A.6.3.4-1: Event-Configuration-State

Bit	Name	Description
0	Final report	This bit, when set, indicates that this is the final report for the UE group; when not set, indicates that there are more reports pending for the UE group.

A.6.3.5 Event-Configuration-Status AVP

The Event-Configuration-Status AVP (AVP code 4213) is of type Grouped. It indicates the status for the monitoring event configuration.

```
Event-Configuration-Status ::= < AVP Header: 4213 >
                    { Event-Configuration-State }
                    { Extended-SCEF-Reference-ID }
                   *[ AVP ]
```

A.6.3.6 Event-Reporting-Results AVP

The Event-Reporting-Results AVP (AVP code 4214) is of type Unsigned32, it shall contain a bit mask. The bit 0 shall be the least significant bit. For example, to get the value of bit 0, a bit mask of 0x0001 should be used. The meaning of the bits shall be as defined below:

Table A.6.3.6-1: Event-Reporting-Results

Bit	Name	Description
0	Final report	This bit, when set, indicates that this is the final report for the UE group; when not set, indicates that there are more reports pending for the UE group.

A.6.3.7 Event-Reports AVP

The Event-Reports AVP (AVP code 4215) is of type Grouped. It indicates the event reports for a UE group.

```
Event-Reports ::= < AVP Header: 4215 >
                   { Event-Reporting-Results }
                   { Extended-SCEF-Reference-ID }
                  *[ Access-Network-Reports ]
                  *[ AVP ]
```

A.6.3.8 Extended-SCEF-Reference-ID

The Extended-SCEF-Reference-ID AVP (AVP code 4216) is of type Unsigned64 and it shall contain the identifier provided by the SCEF.

A.6.4 Nta re-used AVPs

A.6.4.1 General

Table A.6.4.1-1 lists the Diameter AVPs re-used by the Nta application from other existing Diameter Applications, reference to their respective specifications, short description of their usage within the Nta application. 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 A.6.4.1-1, but they are re-used for the Nta application. Unless otherwise stated, re-used AVPs shall maintain their 'M', 'P' and 'V' flag settings.

Table A.6.4.1-1: Nta re-used Diameter AVPs

Attribute Name	Reference	Description	Applicability (NOTE)
3GPP-MS-TimeZone	3GPP TS 29.061 [18]	Indicate the offset between universal time and local time in steps of 15 minutes of where the MS currently resides.	
3GPP-SGSN-MCC-MNC	3GPP TS 29.061 [18]	For GPRS the MCC and the MNC of the SGSN. For 3GPP/non-3GPP accesses the MCC and the MNC provided by the serving gateway (SGW, or AGW or TWAG).	
3GPP-User-Location-Info	3GPP TS 29.061 [18]	Indicates details of where the UE is currently located (e.g. SAI, CGI or eNodeB ID)	
DRMP	IETF RFC 7944 [12]	Allows Diameter endpoints to indicate the relative priority of Diameter transactions.	
External-Identifier	3GPP TS 29.336 [17]	External Identifier of the UE	
Group-Reporting-Guard-Timer	3GPP TS 29.336 [17]	It is used by the PCRF to aggregate the reports.	
Load	IETF RFC 8583 [14]	The AVP used to convey load information between Diameter nodes. This AVP and all AVPs within this grouped AVP shall have the 'M' bit cleared.	
Location-Information-Configuration	3GPP TS 29.336 [17]	Only MONTE-Location-Type AVP is applicable for the Nta application.	
Monitoring-Type	3GPP TS 29.336 [17]	Only LOCATION_REPORTING (2) is applicable for the Nta application.	
MONTE-Location-Type	3GPP TS 29.336 [17]	Indicates the current location or the last known location.	
MSISDN	3GPP TS 29.329 [16]	MSISDN of the UE	
NetLoc-Access-Support	3GPP TS 29.212 [19]	Indicates the level of support for NetLoc procedures provided by the current access network.	
OC-OLR	IETF RFC 7683 [10]	Contains the necessary information to convey an overload report.	
OC-Supported-Features	IETF RFC 7683 [10]	Defines the support for the Diameter overload indication conveyence by the sending node.	
SCEF-ID	3GPP TS 29.336 [17]	The diameter identifier provided by the SCEF which has originated the request towards the PCRF.	
Supported-Features	3GPP TS 29.229 [11]	If present, this AVP informs the destination host about the features that the origin host requires to successfully complete this command exchange.	
TCP-Source-Port	3GPP TS 29.212 [19]	TCP source port number	
UDP-Source-Port	3GPP TS 29.212 [19]	UDP source port number	
UE-Local-IP-Address	3GPP TS 29.212 [19]	Contains the UE local IP address.	
User-Location-Info-Time	3GPP TS 29.212 [19]	The time at which the UE was last known to be in the location.	
NOTE: AVPs marked with a supported feature are applicable as described in clause A.6.4.2.			

A.6.4.2 Use of the Supported-Features AVP for the Nt application

When new functionality is introduced for the Nt application, 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. Unless otherwise stated, the use of the Supported-Features AVP for the Nt application shall be compliant to the usage of the Supported-Features AVP on the Cx reference point and consistent with the procedures for the dynamic discovery of supported features as defined in clause 7.2 of 3GPP TS 29.229 [11].

The base functionality for the Nta application is the 3GPP Rel-15 standard and a feature is an extension to that functionality. If the origin host does not support any features beyond the base functionality, the Supported-Features AVP may be absent from the Nta commands.

As defined in clause 7.1.1 of 3GPP TS 29.229 [11], 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 [11], 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 Supported-Features AVP shall be included in every ECR and ECA commands if supported by the SCEF and PCRF respectively.

The table A.6.4.2-1 defines the features applicable to the Nta application for the feature list with a Feature-List-ID of 1.

Table A.6.4.2-1: Features of Feature-List-ID 1 used in Nta

Feature bit	Feature	M/O	Description

Feature bit: The order number of the bit within the Feature-List AVP where the least significant bit is assigned number "0".
Feature: A short name that can be used to refer to the bit and to the feature, e.g. "EPS".
M/O: Defines if the implementation of the feature is mandatory ("M") or optional ("O") in this 3GPP Release.
Description: A clear textual description of the feature.

NOTE: This table is a placeholder for when any supported features are added to Nta. There are no supported features in this release.

A.6.5 Nta specific Experimental-Result-Code AVP values

Clause 5.5 is applicable for Nta specific Experimental-Result-Code AVP values.

A.6.6 Nta messages

A.6.6.1 Command-Code Values

This clause defines the Command-Code values for the Nta application as allocated by IANA from the vendor-specific namespace defined in IETF RFC 5719 [7]. Every command is defined by means of the ABNF syntax in IETF RFC 2234 [8], and according to the rules in IETF RFC 6733 [15].

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 [15].

The following Command Codes are defined in this specification:

Table A.6.6-1: Command-Code values for Nta

Command-Name	Abbreviation	Code	Section
Event-Configuration-Request	ECR	8388735	A.6.6.2
Event-Configuration-Answer	ECA	8388735	A.6.6.3
Event-Reporting-Request	ERR	8388736	A.6.6.4
Event-Reporting-Answer	ERA	8388736	A.6.6.5

A.6.6.2 Event-Configuration-Request (ECR) command

The ECR command, indicated by the Command-Code field set to 8388735 and the 'R' bit set in the Command Flags field, is sent by the SCEF to the PCRF as part of event monitoring configuration procedure.

Message Format:

```
<EC-Request> ::= <Diameter Header: 8388735, REQ, PXY >
                 < Session-Id >
                 [ DRMP ]
                 { Auth-Session-State }
                 { Origin-Host }
                 { Origin-Realm }
                 { Destination-Realm }
                 [ Destination-Host ]
                 [ OC-Supported-Features ]
                 { External-Group-Identifier }
                 [ Event-Configuration ]
                 [ Group-Reporting-Guard-Timer ]
                *[ Proxy-Info ]
                *[ Route-Record ]
                *[ Supported-Features ]
                *[ AVP ]
```

A.6.6.3 Event-Configuration-Answer (ECA) command

The ECA command, indicated by the Command-Code field set to 8388735 and the 'R' bit cleared in the Command Flags field, is sent by the PCRF to the SCEF as part of event monitoring configuration procedure.

Message Format:

```
<EC-Answer> ::= <Diameter Header: 8388735, PXY >
                 < Session-Id >
                 [ DRMP ]
                 { Auth-Session-State }
                 { Origin-Host }
                 { Origin-Realm}
                 [ Result-Code ]
                 [ Experimental-Result ]
                 [ Error-Message ]
                 [ Error-Reporting-Host ]
                 [ Failed-AVP ]
                *[ Redirect-Host ]
                 [ Redirect-Host-Usage ]
                 [ Redirect-Max-Cache-Time ]
                 [ OC-Supported-Features ]
                 [ OC-OLR ]
                 [ Event-Reports ]
                 [ Event-Configuration-Status ]
                *[ Proxy-Info ]
                *[ Route-Record ]
                *[ Supported-Features ]
                *[ Load ]
                *[ AVP ]
```

A.6.6.4 Event-Reporting-Request (ERR) command

The ERR command, indicated by the Command-Code field set to 8388736 and the 'R' bit set in the Command Flags field, is sent by the PCRF to the SCEF as part of event monitoring report procedure.

Message Format:

```
<ER-Request> ::= <Diameter Header: 8388736, REQ, PXY >
```

```
                < Session-Id >
                [ DRMP ]
                { Auth-Session-State }
                { Origin-Host }
                { Origin-Realm }
                { Destination-Realm }
                { Destination-Host }
                [ OC-Supported-Features ]
                [ Event-Reports ]
               *[ Proxy-Info ]
               *[ Route-Record ]
               *[ AVP ]
```

A.6.6.5 Event-Reporting-Answer (ERA) command

The ERA command, indicated by the Command-Code field set to 8388736 and the 'R' bit cleared in the Command Flags field, is sent by the SCEF to the PCRF as part of event monitoring report procedure

Message Format:

```
<ER-Answer> ::= <Diameter Header: 8388736, PXY >
                < Session-Id >
                [ DRMP ]
                { Auth-Session-State }
                { Origin-Host }
                { Origin-Realm}
                [ Result-Code ]
                [ Experimental-Result ]
                [ Error-Message ]
                [ Error-Reporting-Host ]
                [ Failed-AVP ]
               *[ Redirect-Host ]
                [ Redirect-Host-Usage ]
                [ Redirect-Max-Cache-Time ]
                [ OC-Supported-Features ]
                [ OC-OLR ]
               *[ Proxy-Info ]
               *[ Route-Record ]
               *[ Load ]
               *[ AVP ]
```

Annex B (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2015-08					Editor's Initial Draft		0.0.0
2015-08	CT3#82	C3-153468			Initial version includes agreed documents: C3-153405, C3-153406, C3-153408,	0.0.0	0.1.0
2015-10	CT3#82bis				Initial version includes agreed documents:C3-154100, C3-154293, C3-154180, C3-154317, C3-154295, C3-154330	0.1.0	0.2.0
2015-11	CT3#83	C3-155418			Initial version includes agreed documents: C3-155110, C3-155150, C3-155277, C3-155279, C3-155281, C3-155282, C3-155332, C3-155356.	0.2.0	1.0.0
2015-11	CT#70	CP-150823			TS presented to plenary for information and approval	1.0.0	1.0.1
2015-12	CT#70	CP-150823			TS 29.154 upgraded tp 13.0.0 after approval	1.0.1	13.0.0

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New**
2016-03	CT#71	CP-160095	0001	1	F	Add command codes and AVP numbers for Nt protocol	13.1.0
2016-03	CT#71	CP-160095	0002	2	F	Missed Transfer-Request-Type AVP in the BTR/BTA commands	13.1.0
2016-03	CT#71	CP-160095	0003	2	F	Some corrections for Nt protocol	13.1.0
2016-03	CT#71	CP-160093	0004	2	B	Diameter Message Priority over Nt interface	13.1.0
2016-06	CT#72	CP-160251	0005	2	F	Some corrections to 29.154	13.2.0
2016-06	CT#72	CP-160251	0006	-	F	Correction of future background data transfer procedure	13.2.0
2016-06	CT#72	CP-160251	0007	-	F	Define Diameter application identifier for Nt reference point	13.2.0
2016-09	CT#73	CP-160444	0008	2	F	Correction of the inconsistent terminology	13.3.0
2016-09	CT#73	CP-160444	0009	2	F	Correction to PCRF addressing of transfer policy negotiation	13.3.0
2016-12	CT#74	CP-160614	0011	-	F	Change IETF drmp draft version to official RFC 7944	13.4.0
2016-12	CT#74	CP-160615	0010	1	B	Diameter Load Control Mechanism	14.0.0
2016-12	CT#74	CP-160616	0012	1	F	Diameter base protocol specification update	14.0.0
2017-03	CT#75	CP-170076	0013	-	F	Update instance number for the Failed-AVP in answer commands	14.1.0
2017-06	CT#76	CP-171119	0019	1	F	Reference update for draft-ietf-dime-load	14.2.0
2017-06	CT#76	CP-171136	0020	1	F	Vendor-Specific-Application-Id AVP handling	14.2.0
2017-06	CT#76	CP-171136	0016	2	F	Correction for Nt interface	15.0.0
2018-06	CT#80	CP-181023	0022	1	B	Support for group based event configuration and reporting	15.1.0
2018-09	CT#81	CP-182026	0023	-	F	Missing re-used AVP for Nta	15.2.0
2018-09	CT#81	CP-182026	0024	1	F	IANA codes for Nta application	15.2.0
2019-09	CT#85	CP-192154	0026	1	A	draft-ietf-dime-load published as RFC 8583	15.3.0
2020-07	SA#88e	-	-	-		Update to Rel-16 version (MCC)	16.0.0
2022-03	SA#95e	-	-	-		Update to Rel-17 version (MCC)	17.0.0
2024-03	SA#103	-	-	-		Update to Rel-18 version (MCC)	18.0.0
2025-09	SA#109	-	-	-		Update to Rel-19 version (MCC)	**19.0.0**

History

Document history		
V19.0.0	October 2025	Publication