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Universal Mobile Telecommunications System (UMTS);
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over Nt reference point
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Foreword

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Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Contents

Foreword

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

This document defines the protocol for Nt reference point. The functional requirements and the stage 2 specifications of the Nt reference point are contained in 3GPP TS 23.203 [2]. The Nt reference point lies between Service Capability Exposure Function (SCEF) and Policy and Charging Rules Function (PCRF).

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".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 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 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 TR 21.905 [1].

ASP	Application Service Provider
BTA	Background Data Transfer Answer
BTR	Background Data Transfer Request
PCRF	Policy and Charging Rules Function
SCEF	Service Capability Exposure Function
SPR	Subscription Profile Repository

4 Nt reference point

4.1 Overview

The Nt reference point is located between the PCRF and the SCEF. The Nt reference point is used for:

- Reporting the transfer policies from the PCRF to the SCEF;

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

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

4.2 Nt Reference Model

The 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 subclause 3a of 3GPP TS 29.213 [9].

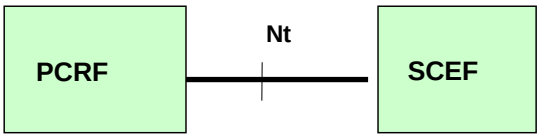

Figure 4.2-1: Nt reference model

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 shall use 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 shall provide the transfer policies to SCEF together with a reference ID. The PCRF receives the selected transfer policy from the SCEF and stores it in the SPR together with the reference ID.

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 AF 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 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-Information-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 Time-Window AVP, the Rating-Group AVP, it may also include an Max-Requested-Bandwidth-DL AVP and/or an Max-Requested-Bandwidth-UL AVP.

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 are more than one Transfer-Policy AVPs 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 the 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 and the identity of the selected transfer policy within the Transfer-Policy-ID 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 3588 [3] 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 3588 [3] (including error handling and unrecognised information handling) shall be used unmodified. With regard to the Diameter protocol defined over the Nt interface, 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 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 RFC 3588 [3].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 (RFC 3588 [3]).

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 3588 [3]).

5.3 Nt specific AVPs

5.3.1 General

Table 5.3.1.1 describes the Diameter AVPs defined for the Nt reference point, 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	aaaa	5.3.2	OctetString	M,V	P			
Reference-Id	bbbb	5.3.3	OctetString	M,V	P			
Transfer-Request-Type	cccc	5.3.4	Unsigned32	M,V	P			
Time-Window	dddd	5.3.5	Grouped	M,V	P			
Transfer-End-Time	xxxx	5.3.6	Unsigned64	M,V	P			
Transfer-Start-Time	yyyy	5.3.7	Unsigned64	M,V	P			
Transfer-Policy	eeee	5.3.8	Grouped	M,V	P			
Transfer-Policy-Id	zzzz	5.3.9	Unsigned32	M,V	P			
Number-Of-UEs	ffff	5.3.10	Unsigned32	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 3588 [3].
NOTE 2: The value types are defined in IETF RFC 3588 [3].

5.3.2 Network-Area-Info-List

The Network-Area-Info-List AVP (AVP code aaaa) 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 bbbb) 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 3588[3].

5.3.4 Transfer-Request-Type

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

The following values are defined:

0 (TRANSFER_POLICY_REQUEST)

The SCEF-Transfer-Request message is sent to initiate a transfer policy negotiation procedure.

1 (TRANSFER_POLICY_NOTIFICATION)

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

5.3.5 Time-Window

The Time-Window AVP (AVP code dddd) 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: dddd >
                  { Transfer-Start-Time }
                  { Transfer-End-Time }
                  *[ AVP ]
```

5.3.6 Transfer-End-Time

The Transfer-End-Time AVP (AVP code xxxx) 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

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

5.3.8 Transfer-Policy

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

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

5.3.9 Transfer-Policy-Id

The Transfer-Policy-Id AVP (AVP code zzzz) 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

The Number-Of-UEs AVP (AVP code ffff) 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 reference point from other existing Diameter Applications, reference to their respective specifications, short description of their usage within the Nt reference point. Other AVPs from existing Diameter Applications, except for the AVPs from Diameter base protocol, do not need to be supported. The AVPs from Diameter base protocol are not included in table 5.4.1, but they are re-used for the Nt reference point. 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).	
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.	
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 subclause 5.4.2.			

5.4.2 Use of the Supported-Features AVP on the Nt reference point

When new functionality is introduced on the Nt reference point, 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 on the Nt reference point 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 subclause 7.2 of 3GPP TS 29.229 [11].

The base functionality for the Nt reference point 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 subclause 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.

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 [y], 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 command if supported by the SCEF and PCRF respectively.

The table 5.4.2.1 defines the features applicable to the Nt reference point 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 subclause 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 3588 [3] are applied.

5.5.3 Permanent Failures

Errors that fall into the 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 3588 [3] 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 3588 [3] are applied.

5.6 Nt messages

5.6.1 Command-Code Values

This subclause defines the Command-Code values for the Nt interface 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 3588 [3].

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	xxxxxxx	5.6.2
Background-Data-Transfer-Answer	BTA	xxxxxxx	5.6.3

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

The BTR command, indicated by the Command-Code field set to xxxxxxx 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: xxxxxxx, REQ, PXY >
                 < Session-Id >
                 { Vendor-Specific-Application-Id }
                 { Auth-Session-State }
                 { Origin-Host }
                 { Origin-Realm }
                 { Destination-Realm }
                 [ 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 xxxxxxx 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: xxxxxxx, PXY >
                 < Session-Id >
                 { 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 ]
*[ Proxy-Info ]
*[ Route-Record ]
*[ Supported-Features ]
*[ AVP ]
```

Annex A (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2015-08					Editor's Initial Draft		0.0.0
2015-08-25	CT3#82	C3-153468			Initial version includes agreed documents: C3-153405, C3-153406, C3-153408,	0.0.0	0.1.0
2015-10-21	CT3#82 bis				Initial version includes agreed documents:C3-154100, C3-154293, C3-154180, C3-154317, C3-154295, C3-154330	0.1.0	0.2.0
2015-11-24	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
2015-11-30	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

History

Document history		
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