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TECHNICAL SPECIFICATION

Universal Mobile Telecommunications System (UMTS);
LTE;
Service exposure functionality
between SCEF and RCAF reference point
(3GPP TS 29.153 version 13.0.0 Release 13)

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Contents

Foreword

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

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

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where:

x   the first digit:

1   presented to TSG for information;

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y   the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

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1 Scope

This document defines the protocol for Ns reference point between the Service Capability Exposure Function (SCEF) and RAN Congestion Awareness Function (RCAF).

The Ns reference point and related stage 2 procedures are defined in 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] IETF RFC 3588: "Diameter Base Protocol".

[4] 3GPP TS 29.217: "Congestion reporting over Np reference point".

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

[6] 3GPP TS 29.229: "Cx and Dx interfaces based on Diameter protocol; Protocol details".

[7] 3GPP TS 29.336: "Home Subscriber Server (HSS) diameter interfaces for interworking with packet data networks and applications Diameter Base Protocol".

[8] 3GPP TS 29.154: "Service Capability Exposure Functionality over Nt reference point".

[9] 3GPP TS 29.274: "3GPP Evolved Packet System. Evolved GPRS Tunnelling Protocol for EPS (GTPv2)".

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

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

[12] 3GPP TS 29.213: "Policy and charging control signalling flows and Quality of Service (QoS) parameter mapping".

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].

NCA   Network Status Continuous Report Answer
NCR   Network Status Continuous Report Request
NSA   Network Status Answer
NSR   Network Status Request
RCAF   RAN Congestion Awareness Function
SCEF   Service Capability Exposure Function

4 Architectural Overview

4.0 Overview

The Ns reference point is located between the RCAF and SCEF. The Ns reference point is used for network status reporting.

The stage 2 level requirements for the Ns reference point are defined in 3GPP TS 23.682 [2].

Refer to Annex G of 3GPP TS 29.213 [12] for Diameter overload control procedures over the Ns reference point.

4.1 Reference Model

The Ns reference point is defined between the RCAF and the SCEF to transfer the network status. The relationship between the two functional entities is depicted in figure 4.1.1. The complete 3GPP architecture for service capability exposure is defined in 3GPP TS 23.682 [2].
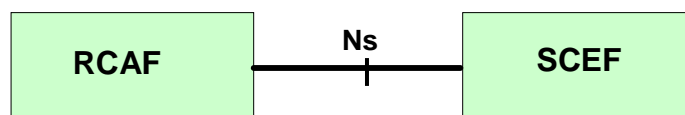
Figure 4.1.1: Ns reference model

4.2 Functional elements

4.2.1 RCAF

The RCAF is a functional element which reports network status to the SCEF to enable the SCEF to take the RAN user plane congestion status into account. The network status includes the following information;

-   Congestion level or an indication of the "no congestion" state;

-   ECGI, or eNB-ID, or SAI for which the congestion level is being provided.

4.2.2 SCEF

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

Based on the geographical area provided by the SCS/AS and the configuration data, the SCEF determines from which RCAF(s) to request congestion reporting.

NOTE: The procedures in 3GPP TS 23.682 [2], subclause 5.8, describe the interaction between the SCEF and SCS/AS and the information elements exchanged in the relevant steps of each procedure. When the SCEF receives the network status information from one or more RCAF(s) in both the one-time or continuous reporting cases, it determines the Network Status Indication (NSI) of the geographical area based on the Congestion–Level-Value AVP in the Network-Congestion-Area-Report AVP it receives from the RCAF(s). The NSI value (e.g. High, Medium, Low, No-Congestion) is determined per Service Provider policies.

4.3 Procedures over the Ns reference point

4.3.1 Network status reporting procedures

4.3.1.1 General

This clause contains the detailed procedures for requesting one-time or continuous network status report, and network status report and the removal of the continuous network status report.

4.3.1.2 Request of one-time or continuous reporting of network status

This procedure shall be used by the SCEF to request one-time or continuous network status report.

This procedure is mapped to Network-Status-Request /Answer commands specified in subclause 5.6.

After the SCEF authorized a SCS/AS request for notification about the network status, the SCEF shall assign an SCEF Reference ID and identify the RCAF(s) responsible for requesting of the network status report. The identity of the RCAF is found by the SCEF based on the RCAF selection procedure defined in subclause 4.3.2. If multiple RCAFs have been found, the procedure shall be invoked multiple times, for each RCAF responsible for the network status report.

The SCEF shall send a Network-Status-Request (NSR) command to the targeted RCAF. The NSR shall include the Ns-Request-Type AVP with the value 0 (initial request), the SCEF reference ID within SCEF-Reference-Id AVP and the location area in the Network-Area-Info-List AVP, the location area is either a 3GPP location area (e.g. list of TA/RAs, list of cell(s), list of eNBs etc) according to operator configuration or a 3GPP location area (e.g. list of TA/RAs, list of cell(s), list of eNBs etc) as provided by the SCS/AS.
The SCEF may also include duration in the Monitoring-Duration AVP and the threshold value(s) in Congestion-Level-Range AVP if the SCS/AS requested reporting for specific threshold(s). The duration indicates the time for which a continuous reporting is requested.
The SCEF, based on operator policies, may choose a different threshold value than the one received from the SCS/AS. The SCEF shall not include the Congestion-Level-Range AVP in the request to the RCAF if no threshold was requested by the SCS/AS.

NOTE: The SCS/AS can be notified when the SCEF changes the threshold provided by the SCS/AS.

Upon reception of a Network-Status-Request (NSR) command including the Ns-Request-Type AVP with the value 0 (initial request), the RCAF shall send the Network-Status-Answer (NSA) command to the SCEF including the SCEF-Reference-ID AVP and one or more congestion status(es) within Network-Congestion-Area-Report AVP(s). If the Monitoring-Duration AVP is present in the NSR, the RCAF shall store the SCEF instruction and start to monitor the location area for a change in the congestion status.

When receiving NSA from the RCAF, the SCEF shall store the report if the SCS/AS request identified via the SCEF reference ID is valid and active.

4.3.1.3 Continuous reporting of network status

This procedure shall be used by the RCAF to continuously notify the SCEF of the congestion status list for the location area requested by the SCEF when at least one of the following conditions applies:

- a threshold is not provided by the SCEF and the congestion level(s) is changed;

- one or more thresholds are provided by the SCEF and the congestion level(s) is changed which corresponds to a threshold(s) provided.

This procedure is mapped to Network-Status-Continuous-Report-Request/Answer commands specified in subclause 5.6.

If one or more thresholds was provided to the RCAF by the SCEF, and when the RCAF detects a change in the congestion level(s) and this congestion level(s) corresponds to congestion threshold(s) for the location area (e.g. set of cells or eNodeBs) requested by the SCEF, the RCAF shall send Network-Status-Continuous-Report-Request (NCR) command to report this to the SCEF.
  The NCR command shall include SCEF reference ID within the SCEF Reference-Id AVP and congestion status within one or more Network-Congestion-Area-Report AVP(s).

If no threshold was provided to the RCAF by the SCEF, see subclause 4.3.1.2, and when the RCAF detects a change in the congestion level(s) for   the location area (e.g. set of cells or eNodeBs) requested by the SCEF, the RCAF shall report the change of congestion level value(s) to the SCEF by sending a NCR command including SCEF reference ID within SCEF Reference-Id AVP and one or more congestion level value(s) within Network-Congestion-Area-Report AVP(s).

The RCAF shall include one Network-Congestion-Area-Report AVP per congestion level value reported. Within the Network-Congestion-Area-Report AVP the congestion level value shall be included in the Congestion-Level-Value AVP and the affected location area in the Network-Area-Info-List AVP.

The SCEF shall acknowledge the NCR command by sending Network-Status-Continuous-Report-Answer (NCA) command.

4.3.1.4 Cancellation of continuous reporting of network status

This procedure shall be used by the SCEF to request the cancellation of the continuous network status report.

This procedure is mapped to Network-Status-Request (NSR)/Network-Status-Answer (NSA) commands specified in subclause 5.6.

When the SCEF detects that the duration for ongoing continuous reporting of network status is over or is requested to terminate ongoing continuous reporting of network status by the SCS/AS, the SCEF shall identify the RCAF(s) involved in the continuous reporting represented by the SCEF reference ID and send a Network-Status-Request (NSR) command to the identified RCAF(s) including the SCEF reference ID in SCEF-Reference-Id AVP and the Ns-Request-Type AVP with the value 1 (cancellation request).

Upon reception of a NSR command including the Ns-Request-Type AVP with the value 1 (cancellation request), the RCAF shall remove the related SCEF instructions associated with the SCEF reference ID such that the RCAF will no longer notify the SCEF of the change of the network status and send a Network-Status-Answer (NSA) command including the corresponding SCEF reference ID in the SCEF-Reference-Id AVP to acknowledge the cancellation.

4.3.2 RCAF selection

To discover the RCAF(s) responsible for reporting of network status, the SCEF may use the following information:

- Geographical area provided by SCS/AS;

- Pre-configured RCAF address for the geographical area the RCAF is responsible for;

5 Ns protocol

5.1 Protocol support

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

NOTE: A route entry can have a different destination based on the application identification AVP of the message. Therefore, Diameter agents (relay, proxy, redirection, translation agents) must be configured appropriately to identify the 3GPP Ns application within the Auth-Application-Id AVP in order to create suitable routing tables.

With regard to the Diameter protocol defined over the Ns interface, the RCAF acts as a Diameter server, in the sense that it is the network element that handles network status reporting requests for a particular location. The SCEF acts as the Diameter client, in the sense that is the network element requesting reporting of network status.

5.2 Initialization, maintenance and termination of connection and session

The initialization and maintenance of the connection between each SCEF and RCAF 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 RCAF shall advertise the support of the Ns 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]).

The Ns Diameter session shall consist of a single request and answer pair. The Ns 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 Ns specific AVPs

5.3.1 General

Table 5.3.1.1 describes the Diameter AVPs defined for the Ns 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: Ns specific Diameter AVPs

| Attribute Name | AVP Code | Clause defined | Value Type (NOTE 2) | AVP Flag rules (NOTE 1) | | | | May Encr. | Applicability (NOTE 3) |
				Must	May	Should not	Must not		
Network-Congestion-Area-Report	mmmm	5.3.2	Grouped	M,V	P			Y	
Ns-Request-Type	nnnn	5.3.x	Unsigned32	M,V	P			Y	
NOTE 1: The AVP header bit denoted as 'M', indicates whether support of the AVP is required. The AVP header bit denoted as 'V', indicates whether the optional Vendor-ID field is present in the AVP header. For further details, see IETF RFC 3588 [3].									
NOTE 2: The value types are defined in IETF RFC 3588 [3].									
NOTE 3: AVPs marked with a supported feature are applicable as described in subclause 5.4.1.									

5.3.2 Network-Congestion-Area-Report AVP

The Network-Congestion-Area-Report AVP (AVP code mmmm) is of type Grouped, and includes the Network-Area-Info-List AVP and the Congestion-Level-Value-AVP.

AVP Format:

```
Network-Congestion-Area-Report ::=    < AVP Header: jjjj >
                            { Network-Area-Info-List }
                            [ Congestion-Level-Value ]
                           *[ AVP ]
```

5.3.3 Ns-Request-Type AVP

The Ns-Request-Type AVP (AVP code nnnn) is of type Unsigned32, and contains the reason for sending a Request message.

The following values are defined:

0 (initial request)

An initial request is used to initiate a one time or continuous reporting and contains information that is relevant to initiation.

1 (cancellation request)

A cancellation request is used to cancel an ongoing continuous reporting.

5.4 Ns re-used AVPs

5.4.1 General

Table 5.4.1.1 lists the Diameter AVPs re-used by the Ns reference point from other existing Diameter Applications, reference to their respective specifications, short description of their usage within the Ns reference point and which supported features the AVP is applicable to. AVPs from existing Diameter Applications, except for the AVPs from Diameter base protocol, do not need to be supported. Unless otherwise stated, re-used AVPs shall maintain their 'M', 'P' and 'V' flag settings.

Table 5.4.1.1: Ns re-used Diameter AVPs

Attribute Name	Reference	Description	Applicablity (NOTE)
OC-OLR	IETF RFC 7683 [5]	Contains the necessary information to convey an overload report.	
OC-Supported-Features	IETF RFC 7683 [5]	Defines the support for the Diameter overload indication conveyence by the sending node.	
Supported-Features	3GPP TS 29.229 [6]	If present, this AVP informs the destination host about the features that the origin host requires to successfully complete this command exchange.	
Monitoring-Duration	3GPP TS 29.336 [7]	It shall contain the number of seconds for which network status reporting shall be performed.	
Congestion-Level-Value	3GPP TS 29.217 [4]	Indicates the congestion level of a location.	
Congestion-Level-Range	3GPP TS 29.217 [4]	It indicates the list of congestion level(s).	
SCEF-Reference-ID	3GPP TS 29.336 [7]	It contains the identifier provided by the SCEF.	
Network-Area-Info-List	3GPP TS 29.154 [8]	It contains the network area information which is coded as specified in 3GPP TS 29.274 [9] in Presence Reporting Area Action IE, starting from octet 9.	
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 Ns reference point

When new functionality is introduced on the Ns 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 Ns

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 [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 Supported-Features AVP shall be included in every NSR and NSA command if supported by the RCAF and SCEF respectively.

The Table 5.4.2.1 defines the features applicable to the Ns 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 Ns

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 Ns. There are no supported features in this release.

5.5   Ns 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 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. The Result-Code AVP values defined in Diameter Base Protocol IETF RFC 3588 [3] are applied.

Editor's note: It is FFS whether Ns specific permanent failures are required

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 applicable.

Editor's note: It is FFS whether Ns specific transient failures are required.

5.6 Ns messages

5.6.1 Command-Code Values

This clause defines the Command-Code values for the Ns interface application as allocated by IANA from the vendor-specific namespace defined in IETF RFC 5719 [10]. Every command is defined by means of the ABNF syntax in IETF RFC 2234 [11], and according to the rules in IETF RFC 3588 [3].

The following Command Codes are defined in this specification:

Table 5.6.1: Command-Code values for Ns

Command-Name	Abbreviation	Code	Section
Network-Status-Request	NSR	xxxxxxx	5.6.2
Network-Status-Answer	NSA	xxxxxxx	5.6.3
Network-status-continuous-Report-Request	NCR	xxxxxxx	5.6.4
Network- status-Continuous-report-Answer	NCA	xxxxxxx	5.6.5

Editor´s Note: The Diameter Ns Command Codes needs to be requested from IANA by MCC.

5.6.2 Network-Status-Request (NSR) command

The NSR command, indicated by the Command-Code field set to xxxxxx and the 'R' bit set in the Command Flags field, is sent by the SCEF to the RCAF as part of the onetime or continuous network status reporting procedure and as part of the cancellation of continuous reporting of network status procedure.

Message Format:

```
<NS-Request> ::= <Diameter Header: xxxxxx, REQ, PXY >
                < Session-Id >
                { Vendor-Specific-Application-Id }
                { Auth-Session-State }
                { Origin-Host }
                { Origin-Realm }
                { Destination-Realm }
                [ Destination-Host ]
                [ Origin-State-Id ]
                [ OC-Supported-Features ]
                { Ns-Request-Type }
                [ SCEF-Reference-ID]
                [ Network-Area-Info-List ]
                [ Congestion-Level-Range]
                [ Monitoring-Duration]
               *[ Proxy-Info ]
               *[ Route-Record ]
               *[ Supported-Features ]
               *[ AVP ]
```

5.6.3 Network-Status-Answer (NSA) command

The NSA command, indicated by the Command-Code field set to xxxxxx and the 'R' bit cleared in the Command Flags field, is sent by the RCAF to the SCEF as part of the as part of the onetime or continuous network status reporting request procedure and as part of the cancellation of continuous reporting of network status procedure.

Message Format:

```
<NS-Answer> ::=  < Diameter Header: xxxxxx, 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 ]
                [ OC-Supported-Features ]
                [ OC-OLR ]
                [ SCEF-Reference-ID]
```

```
              [ Origin-State-Id ]
             *[ Network-Congestion-Area-Report ]
             *[ Redirect-Host ]
              [ Redirect-Host-Usage ]
              [ Redirect-Max-Cache-Time ]
             *[ Proxy-Info ]
             *[ Supported-Features ]
             *[ AVP ]
```

5.6.4   Network-Status-Continuous-Report (NCR) command

The NCR command, indicated by the Command-Code field set to xxxxxx and the 'R' bit set in the Command Flags field, is sent by the RCAF to the SCEF as part of the continuous network status reporting procedure.

Message Format:

```
<NC-Report> ::= <Diameter Header: xxxxxx, REQ, PXY >
                < Session-Id >
                { Vendor-Specific-Application-Id }
                { Auth-Session-State }
                { Origin-Host }
                { Origin-Realm }
                { Destination-Realm }
                [ Destination-Host ]
                [ Origin-State-Id ]
                [ OC-Supported-Features ]
                [ OC-OLR ]
                [ SCEF-Reference-ID]
                [ Network-Congestion-Area-Report]
               *[ Proxy-Info ]
               *[ Route-Record ]
               *[ Supported-Features ]
               *[ AVP ]
```

5.6.5   Network-Status-Continuous-Report-Answer (NCA) command

The NCA command, indicated by the Command-Code field set to xxxxxx and the 'R' bit cleared in the Command Flags field, is sent by the SCEF to the RCAF as part of the as part of the continuous network status reporting procedure.

Message Format:

```
<NC-Answer> ::=  < Diameter Header: xxxxxx, 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 ]
                [ OC-Supported-Features ]
                [ OC-OLR ]
               *[ Redirect-Host ]
                [ Redirect-Host-Usage ]
                [ Redirect-Max-Cache-Time ]
               *[ Proxy-Info ]
               *[ 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	C3-153466			Initial version includes agreed documents: C3-153407, C3-153431, C3-153433	0.0.0	0.1.0
2015-10-21	CT3#82 bis				Initial version includes agreed documents:C3-154183, C3-154298, C3-154332, C3-154333, C3-154318, C3-154334, C-154347	0.1.0	0.2.0
2015-11-24	CT3#83	C3-155416			Initial version includes agreed documents:C3-155240, C3-155241, C3-155331, C3-155347, C3-155364	0.2.0	1.0.0
2015-11-30	CT#70	CP-150822			TS 29.153 sent to plenary CT#70 for information and approval	1.0.0	1.0.1
2015-12	CT#70	CP-150822			TS 29.153 upgraded to 13.0.0 after approval	1.0.1	13.0.0

History

Document history		
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