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TECHNICAL SPECIFICATION

Universal Mobile Telecommunications System (UMTS); LTE; Representational State Transfer (REST) reference point between Application Function (AF) and Protocol Converter (PC) (3GPP TS 29.201 version 12.0.0 Release 12)

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Contents

Foreword

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- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document describes the Representational State Transfer (REST) reference point, which is used to exchange application level session information between the Protocol Converter (PC) and the Application Function (AF). REST shall be used as an architectural style as appropriate.

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 TR 29.817: "Study on XML based access of AF to the PCRF".

[3] 3GPP TR 29.213: "Policy and Charging Control signalling flows and Quality of Service (QoS) parameter mapping".

[4] 3GPP TS 29.214: "Policy and Charging Control over Rx reference point".

[5] 3GPP TS 23.203: "Policy and Charging Control architecture".

[6] 3GPP TS 23.335: "User Data Convergence (UDC); Technical realization and information flows; Stage 2".

[7] 3GPP TS 29.335: "User Data Convergence (UDC); User Data Repository Access Protocol over the Ud interface; Stage 3".

[8] IETF RFC 793: "Transmission Control Protocol"

[9] IETF RFC 2616: "Hypertext Transfer Protocol – HTTP/1.1"

[10] IETF RFC 3986: "Uniform Resource Identifier (URI): Generic Syntax"

[11] IETF RFC 920:" Domain Requirements"

[12] IETF RFC 2131: "Dynamic Host Configuration Protocol"

[13] 3GPP TS 33.310: "Network Domain Security (NDS); Authentication Framework (AF)"

[14] IETF RFC 2818: "HTTP Over TLS"

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].

Application Function (AF): element offering application(s) that use IP bearer resources

Protocol Converter (PC): element that converts the RESTful/XML based Rx reference point to the Diameter based Rx reference point

RESTful HTTP: is an architectural style consisting of a coordinated set of architectural constraints applied to components, connectors, and data elements, within a distributed hypermedia system applied to the development of web services

REST-Rx: term that is used to indicate the Rx interface based on RESTful HTTP between the AF and the PC

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].

AAA	Authentication, Authorization, Accounting
AF	Application Function
API	Application Programming Interface
BBERF	Bearer Binding and Event Reporting Function
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
DRA	Diameter Routing Agent
HTTP	HyperText Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
IP-CAN	IP Connectivity Access Network
PC	Protocol Converter
PCC	Policy and Charging Control
PCEF	Policy and Charging Enforcement Function
PCRF	Policy and Charging Rules Function
PDN	Packet Data Network
PLMN	Public Land Mobile Network
QoS	Quality of Service
REST	Representational State Transfer
SPR	Subscription Profile Repository
UDR	User Data Repository
URL	Uniform Resource Locator
UE	User Equipment
XML	Extensible Markup Language

4 Representational State Transfer (REST) reference point based on Protocol Converter (PC) architecture

4.1 Overview

The Representational State Transfer (REST) reference point resides between the AF and the Protocol Converter (PC). The PC converts application level information received from the AF to Diameter session information and communicates with the PCRF via the Diameter based Rx reference point [4].

4.2 Reference model

The Rx reference point, which is based on Diameter, is defined between the PCRF and the AF [4]. If the AF supports RESTful HTTP and XML a Protocol Converter (PC) is needed. In this specification the interface between the AF and the PC is named REST-Rx.

The PC converts the information, received over the REST-Rx interface, into information that can be used on the Diameter based Rx interface in order to get an access to the PCC architecture and vice versa. The PC manages RESTful resources, which are an integral part of the REST-Rx interface. As defined in the stage 2 specifications

(3GPP TS 23.203 [5]), information from the AF is part of the input used by the PCRF for Policy and Charging Control (PCC) decisions. Signalling flows are specified in Annex A.

The relationships between the different functional entities involved for non-roaming scenario are depicted in figure 4.2.1 and 4.2.2.

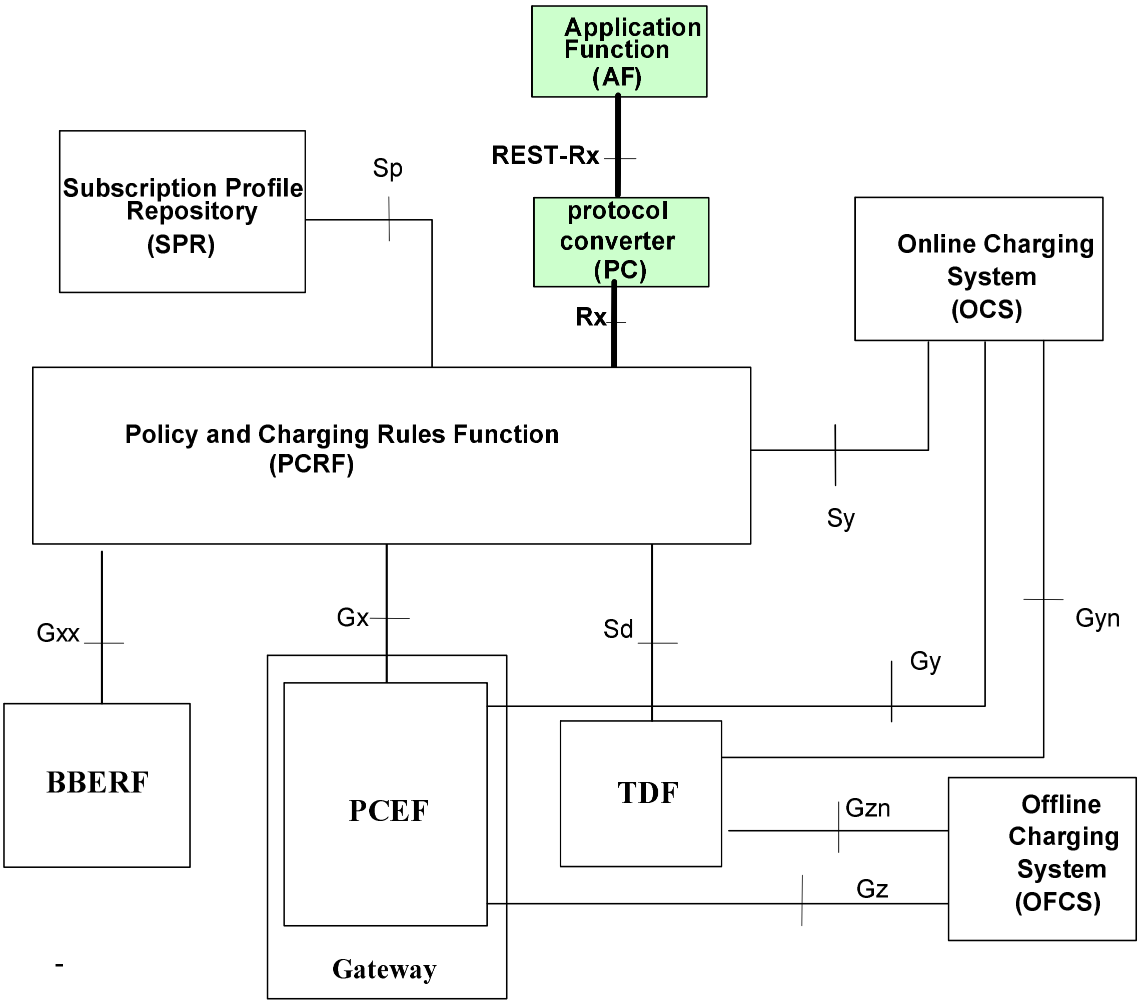

Figure 4.2.1: The PCC architecture with the PC for non-roaming scenario with SPR

With the UDC-based architecture, as defined in 3GPP TS 23.335 [6] and applied in 3GPP TS 23.203 [5], the UDR replaces SPR and the Ud reference point provides access to the subscription data in the UDR. The Ud interface as defined in 3GPP TS 29.335 [7] is the interface between the PCRF and the UDR. When the UDC architecture is used, SPR and Sp, whenever mentioned in this document, are replaced by UDR and Ud.

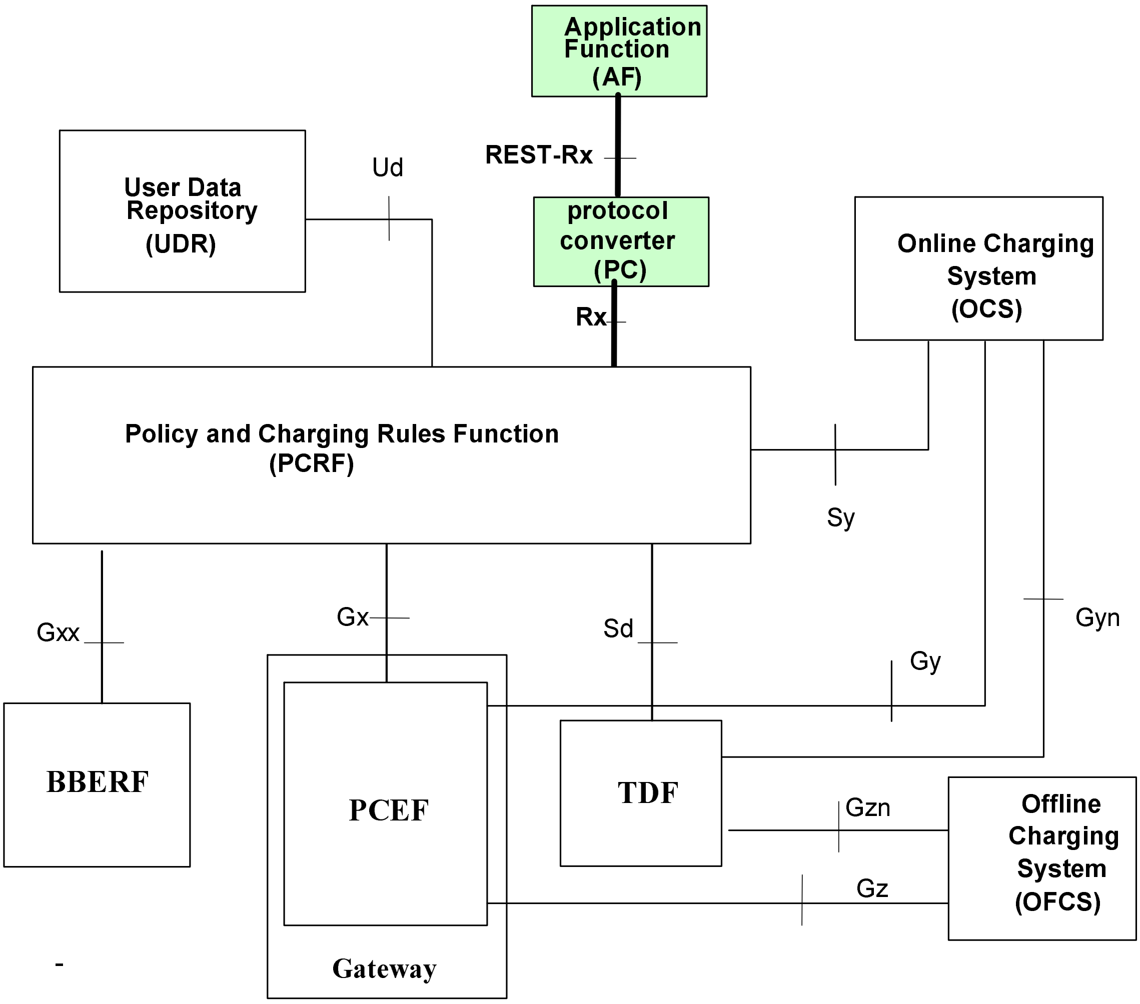

Figure 4.2.2: The PCC architecture with the PC for non-roaming scenario with UDR

The relationships between the different functional entities involved for home routed scenario are depicted in figure 4.2.3 and 4.2.4.

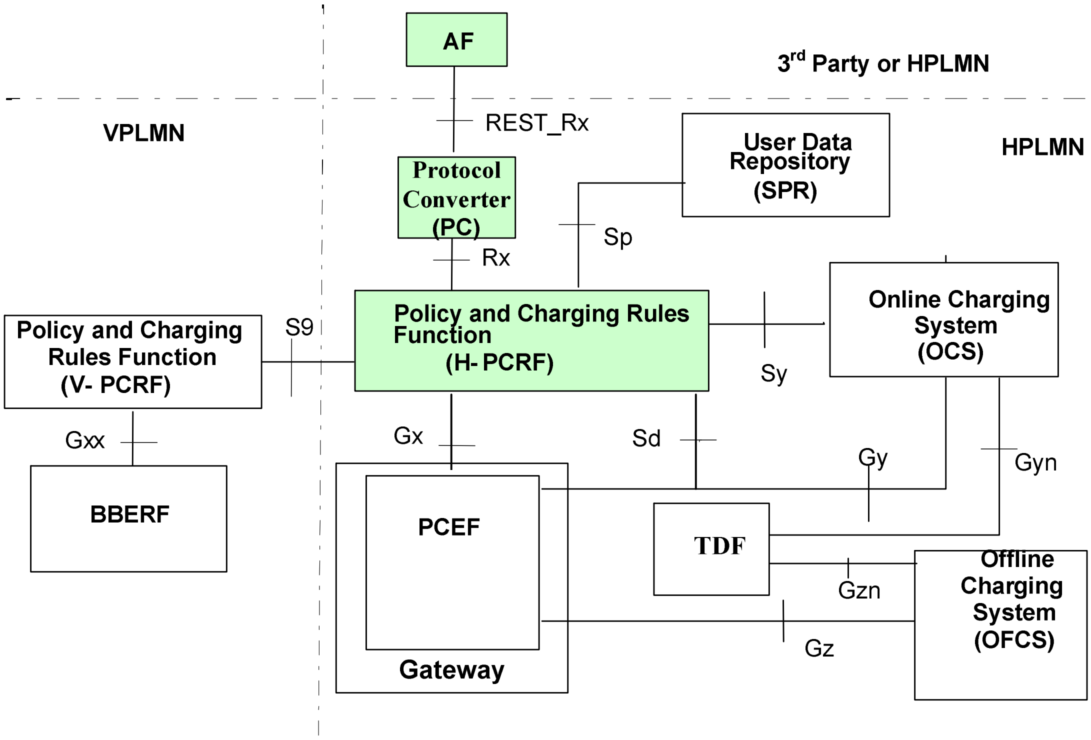

Figure 4.2.3: The PCC architecture with the PC for home routed scenario with SPR

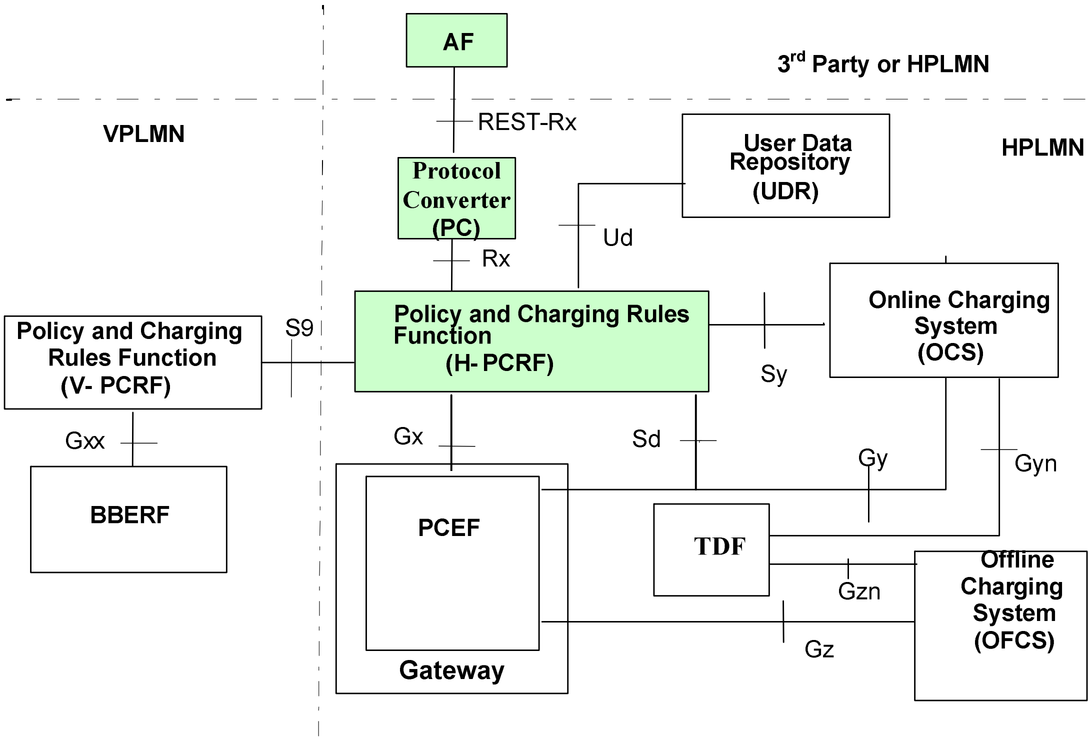

Figure 4.2.4: The PCC architecture with the PC for home routed scenario with UDR

The relationships between the different functional entities involved for local breakout scenario are depicted in figure 4.2.5 and 4.2.6.

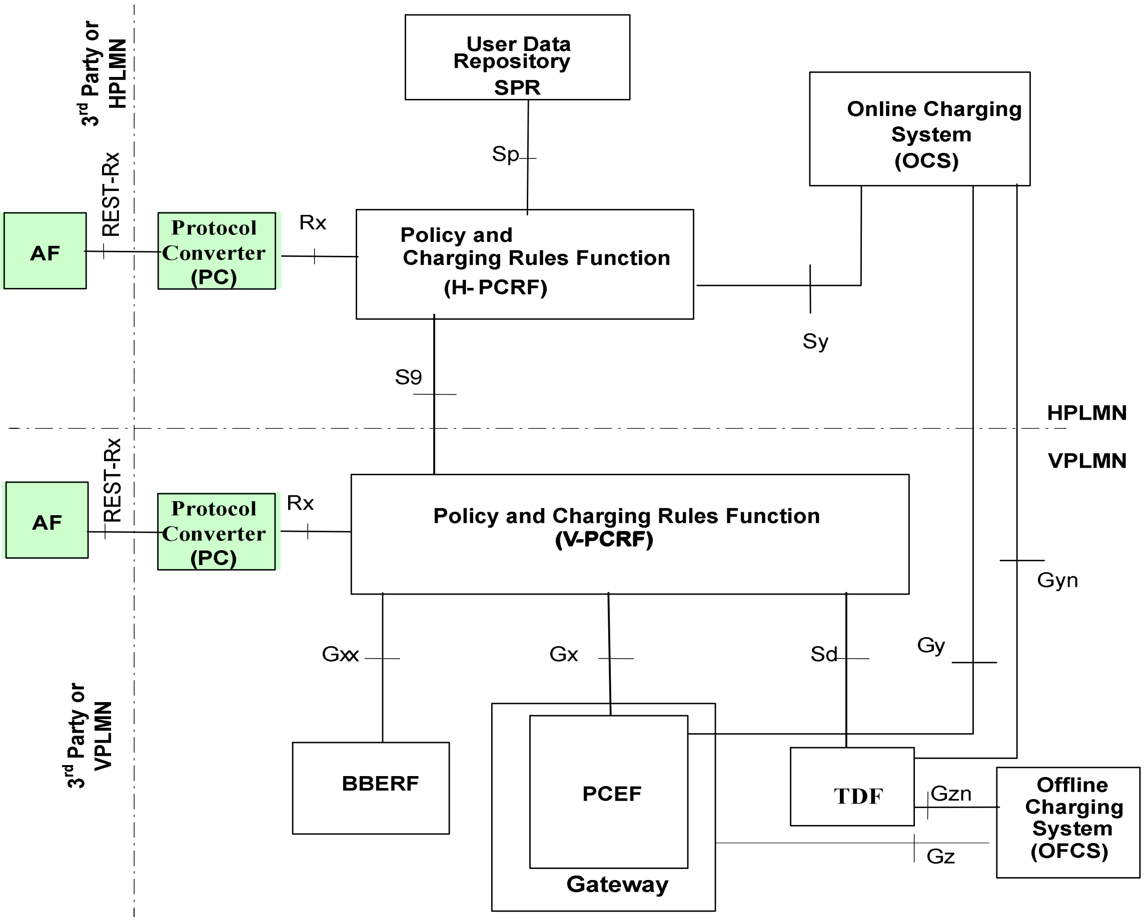

Figure 4.2.5: The PCC architecture with the PC for visited access scenario with SPR

With the UDC-based architecture, as defined in 3GPP TS 23.335 [6] and applied in 3GPP TS 23.203 [5], the UDR replaces SPR and the Ud reference point provides access to the subscription data in the UDR. The Ud interface as defined in 3GPP TS 29.335 [7] is the interface between the PCRF and the UDR. When the UDC architecture is used, SPR and Sp, whenever mentioned in this document, are replaced by UDR and Ud.

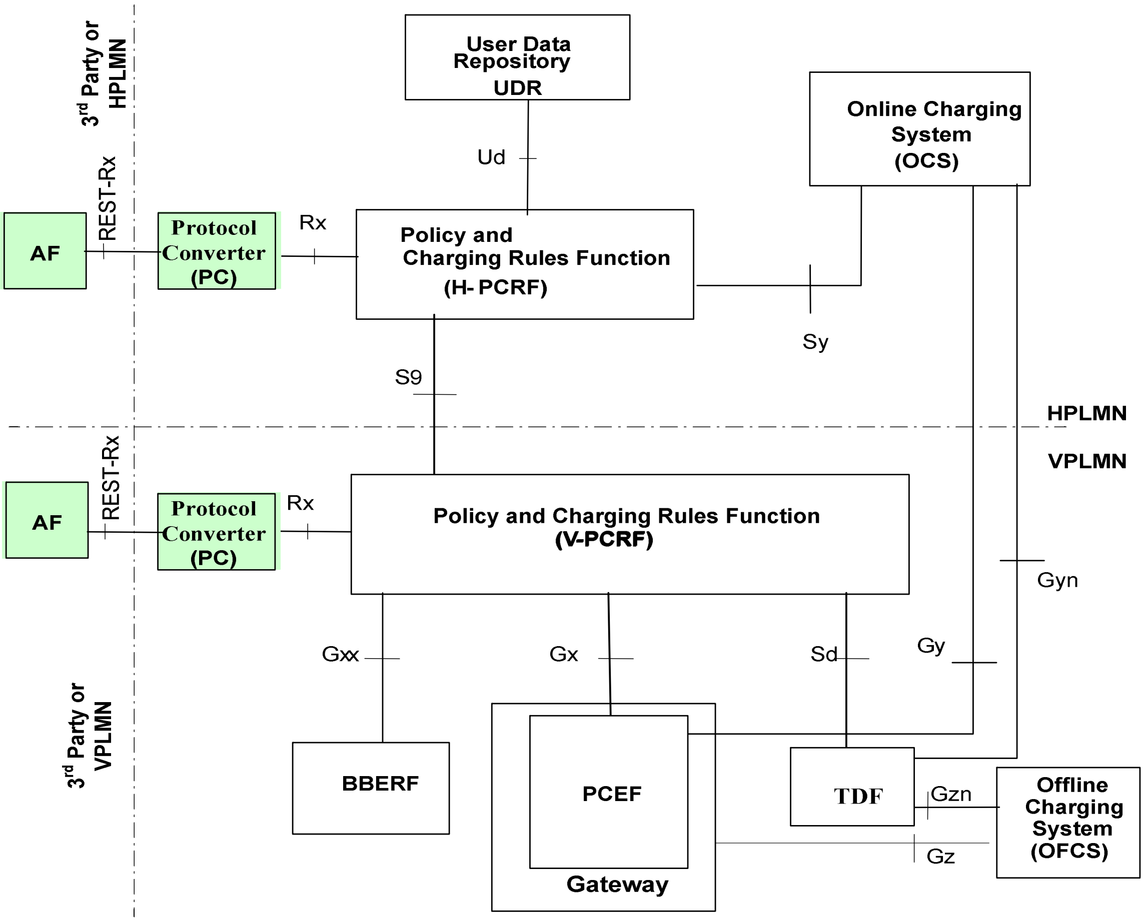

Figure 4.2.6: The PCC architecture with the PC for visited access scenario with UDR

4.3 Functional elements

4.3.1 Application function

The AF is an element offering applications that require the Policy and Charging Control of traffic plane resources (e.g. UMTS PS domain/GPRS domain resources). The AF shall use the Rx reference point to provide session information to the PCRF.

NOTE: The AFs may be deployed by the same operator offering the IP-CAN or may be provided by external third party service provider.

4.3.2 Protocol converter

If the AF only supports RESTful HTTP and XML a protocol converter is needed between the AF and the PCRF.

The Protocol converter (PC) is an element converting information carried over RESTful HTTP and XML to information carried over Diameter in order to get an access to the PCC architecture.

4.4 Location of the PC within the PLMN

4.4.1 General

The protocol converter can be located:

(1) In the PLMN but outside of the PCRF realm;

(2) In the PCRF realm.

There is only one logical protocol converter in both above cases.

4.4.2 Protocol converter located in the PLMN but outside of the PCRF

In this scenario the protocol converter is in the PLMN but outside of the PCRF realm, as shown in figure 4.4.2.1. There is one logical protocol converter within a PLMN.

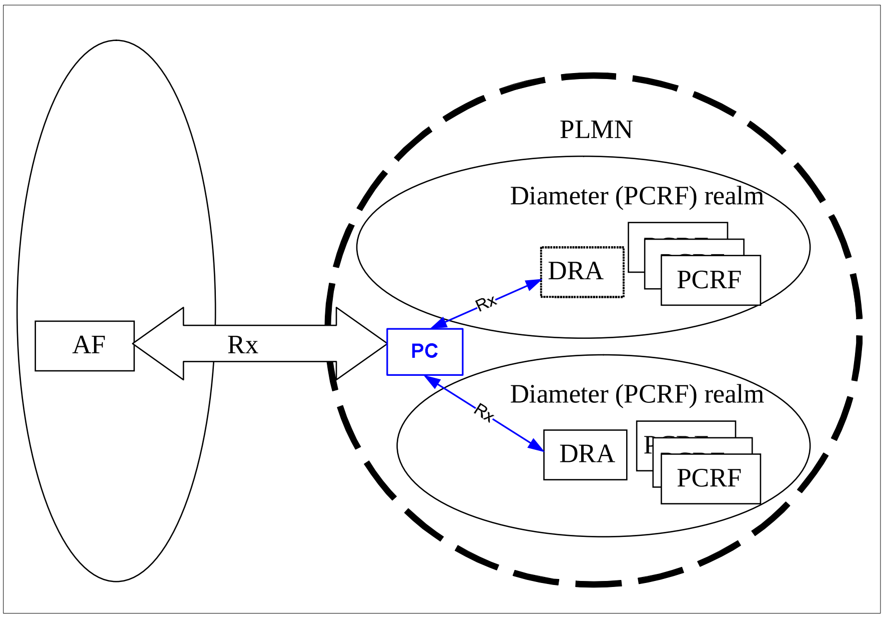

Figure 4.4.2.1: Protocol converter placed within PLMN but outside of the Diameter (PCRF) realm

NOTE: A DRA is needed if more than one PCRF is present in a Diameter (PCRF) realm.

4.4.3 Protocol converter located in the PCRF realm

In this scenario the protocol converter is in the PCRF realm, as shown in figure 4.4.3.1. There is one logical protocol converter per Diameter (PCRF) realm.

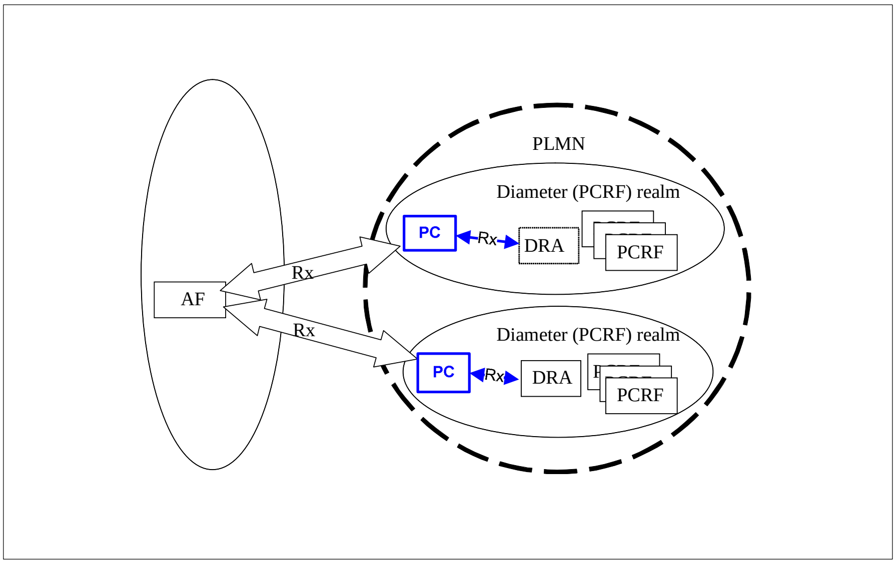

Figure 4.4.3.1: Protocol converter placed within the Diameter (PCRF) realm

NOTE: A DRA is needed if more than one PCRF is present in a Diameter (PCRF) realm.

4.5 PCC Procedures over the RESTful reference point

Editor's note: The PCC procedures can be described in this clause.

4.5.1 General

Editor's note 1: It''s a CT3 working assumption that the procedures in this sub-clause are all for non-IMS scenarios.

Editor's note 2: It''s FFS how the session establishment, modification, termination and other procedures included in this sub-clause are handled over this interface.

Editor's note 3: Handling of result codes on the interface is FFS.

4.5.2 Initial Provisioning of Session Information

When a new AF session is being established and media information for this AF session is available at the AF and the related media require PCC supervision, the AF shall open an Rx Restful session with the PC for the AF session using an AF session establishment command, unless an Rx session has already been established for the AF session. If an Rx Restful session already exists for the AF session, the AF uses the existing Rx Restful session. The AF shall provide the full IP address of the UE using either UEIP element or UEIPv6 element, and the corresponding Service Information within MCD element(s). The AF shall not include circuit-switched bearer related media in the service information sent to the PC. The AF shall indicate to the PC as part of the MCD element whether the media IP flow(s) should be enabled or disabled with the FlowStatus element.

The AF may include the AFAppId element into the AF session establishment in order to indicate the particular service that the AF session belongs to. This element can be provided at both AF session level, and media component description level. When provided at both levels, the AFAppId element provided within the MCD element will have precedence.

The AF may include the AFChargingId element into the AF session establishment for charging correlation purposes. The AF may also include the SpecificAction element to request notification for certain user plane events, e.g. bearer termination.

The AF may include the SvcURN element in order to indicate that the new AF session relates to emergency traffic.

The AF may include the MPSId element in order to indicate that the new AF session relates to an MPS session.

If the AF provides service information that has been fully negotiated, the AF may include the SvcInfoStatus element set to FINAL_SERVICE_INFORMATION as specified in 3GPP TS 29.214 [4].

The AF may additionally provide preliminary service information not fully negotiated yet at an earlier stage. To do so, the AF shall include the SvcInfoStatus element with the value set to PRELIMINARY SERVICE INFORMATION as specified in 3GPP TS 29.214 [4].

For sponsored data connectivity, the AF shall provide the application service provider identity and the sponsor identity to the PCRF via the PC by including the ASPId element and the SponsId element in the SpConnData element in the AF session establishment request.

NOTE 1: The relationship between the AF and sponsor is out of scope of this specification. A single AF can serve multiple sponsors.

To support the usage monitoring of sponsored data connectivity, the AF may also include the GSU element in the SpConnData element and the SpecificAction element set to the value USAGE_REPORT as specified in 3GPP TS 29.214 [4] to request notification when the usage threshold has been reached.

NOTE 2: If the AF is in the user plane, the AF can handle the usage monitoring and therefore it is not required to provide a usage threshold to the PCRF as part of the sponsored data connectivity information.

To allow the PCRF and PCEF to perform PCC rule authorization and bearer binding for the described service IP flows, the AF may supply both source and destination IP addresses and port numbers within the FlowDesc element, if such information is available.

The AF may specify the ResPrio element at request level in the AF session establishment request in order to assign a priority to the AF session as well as specify the ResPrio element at the media component description level to assign a priority to the IP flow. The presence of the ResPrio in both levels does not constitute a conflict as they each represent different types of priority. Specifically the ResPrio at the AF session establishment request level provides the relative priority for a session while the ResPrio at the media component description level provides the relative priority for an IP flow within a session. If the ResPrio element is not specified the requested priority is DEFAULT (0) as specified in 3GPP TS 29.214 [4].

The AF may request notifications of specific IP-CAN session events through the usage of the SpecificAction element in the AF session establishment request command.

The AF may include the RxqType element set to INITIAL_REQUEST as specified in 3GPP TS 29.214 [4].

The behaviour when the AF does not receive the AF session establishment response, or when it arrives after the internal timer waiting for it has expired, are outside the scope of this specification and based on operator policy.

4.5.3 Modification of Session Information

The AF may modify the session information at any time (e.g. due to an AF session modification or internal AF trigger) by sending an AF session modification request command to the PCRF via the PC containing the MCD element(s) with the SessionId element and updated Service Information. The AF shall send an AF session modification request command to the PCRF via the PC, only after the previous AF session modification request has been acknowledged.

If the AF provides service information that has been fully negotiated, the AF may include the SvcInfoStatus element set to FINAL_SERVICE_INFORMATION as specified in 3GPP TS 29.214 [4].

The AF may additionally provide preliminary service information not fully negotiated yet at an earlier stage. To do so, the AF shall include the SvcInfoStatus element with the value set to PRELIMINARY SERVICE INFORMATION as specified in 3GPP TS 29.214 [4].

The AF may include the RxqType element set to UPDATE_REQUEST as specified in 3GPP TS 29.214 [4] in the AF SESSION MODIFICATION REQUEST.

The AF may include the MPSId element in order to indicate that the modified AF session relates to an MPS session.

For sponsored data connectivity, the AF shall provide the application service provider identity and the sponsor identity to the PCRF via the PC by including ASPId element and the SponsId element in the SpConnData element in the AF session modification request.

To support the usage monitoring of sponsored data connectivity, the AF may also include the GSU element in the SpConnData element in the AF session modification request.

NOTE: If the AF is in the user plane, the AF can handle the usage monitoring and therefore it is not required to provide a usage threshold to the PCRF via the PC as part of the sponsored data connectivity information.

4.5.4 AF Session Termination

When an AF session is terminated, the AF shall send an HTTP DELETE including the AF SessionId to the PC.

If the AF requires access network information at this step, the AF shall include the ReqAccInfo element within the AF session termination request, indicating the required information.

4.5.5 Gate Related Procedures

Depending on the application, in the Service Information provision, the AF may instruct the PCRF via the PC by sending an HTTP PUT when the IP flow(s) are to be enabled or disabled to pass through the IP-CAN. The AF does this by sending the gate status request message containing the MCD element(s) that contains the flow status information (in the FlowStatus element) for the flows to be enabled or disabled.

The behaviour when the AF does not receive the gate status response from the PC, or when it arrives after the internal timer waiting for it has expired, or when it arrives with an indication different than SUCCESS, are outside the scope of this specification and based on operator policy.

4.5.6 Subscription to Notification of Signalling Path Status

An AF may subscribe to notifications of the status of the AF signalling transmission path. To do so, the AF shall send an HTTP POST to establish an AF session with the PC (as per sub-clause 5.3.4). The AF shall provide the UE's IP address (using either the UEIP element or the UEIPv6 element) and the SpecificAction element requesting the subscription to "INDICATION_OF_LOSS_OF BEARER" and/or "INDICATION_OF_RELEASE_OF_BEARER". The AF shall additionally provide a MCD element including a single MSC element with the FlowUsage element set to the value "AF_SIGNALLING". The MCD element shall contain the MCN element set to '0'.

If the AF Session is only used for subscription to Notification of Signalling Path Status, the AF may cancel the subscription to notifications of the status of the AF Signalling transmission path. In that case, the AF shall use an AF session termination request to the PC, which shall be acknowledged with an AF session termination response.

NOTE: The Rx session created for the AF signalling can also be used when the AF requests notifications of IP-CAN type change and/or when the AF provisions AF Signalling Flow Information.

4.5.7 Traffic Plane Events

If the PC receives a Diameter RAR command for traffic plane events reporting as defined in subclause 4.4.6 of 3GPP TS 29.214 [4], the PC converts the RAR command to HTTP POST message to indicate to the AF the traffic plane events including the parameters described in sub-clause 5.4.1.3. After receives the HTTP 200 OK from the AF, the PC converts the response to Diameter RAA command and sends the Diameter RAA command to the PCRF as specified in 3GPP TS 29.214 [4].

Editor's note: The contents of the reporting message need to be further defined.

5 Protocol

5.1 Introduction

The following layers of the protocol stack for the Rx reference point between AF and PC are described in sub-clauses:

- TCP [8] provides the communication service at the transport layer.

- An optional communication security layer can be added between the transport and the application delivery layer (see sub-clause 7).
- The application delivery layer provides the transport of the specific application communication data using HTTP [9].
- The specific application communication layer constitutes the transport of the XML documents. The XML schema describes the data structure, which is accepted by the Rx software applications.

Figure 5.1.1 illustrates the protocol stack of the RESTful Rx reference point.

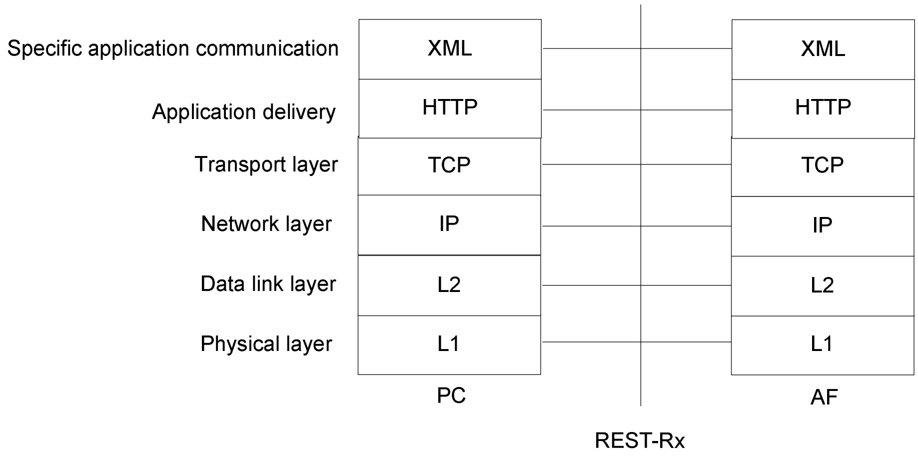

Figure 5.1.1: Protocol stack of the RESTful Rx reference point

5.2 Transport layer

HTTP is layered over TCP, which provides a reliable transport.

PC and the AF act as HTTP client and HTTP server both. As a result the PC and the AF establish a TCP connection for each direction. This permits bidirectional communication.

AF and PC should use persistent connections. If the AF or PC has not already initiated a persistent TCP connection at the time sending a HTTP message, AF or PC shall initiate a TCP connection before sending the HTTP message; otherwise the AF or PC shall use the persistent connection.

5.3 Application delivery layer

Editor's note: The text, which does not have the normative style, has to be transferred to a normative style.

The application delivery layer uses RESTful HTTP.

The application delivery layer provides the following services:

- session establishment including creation of resources, which are addressable in the path element of an URL, and setup of notification URLs
- session modification, termination and gate related procedures by HTTP request/response dialogs
- subscription to notifications
- notification dialog by HTTP request/response messages
- transport of the specific application communication included in the HTTP message body

The creation of resources is a part of the AF session establishment. The AF session ID is assigned by the PC and is used to identify the session resource at the PC. This also sets-up the notification URL, which is used to address the resource for notifications from the PC to the AF.

NOTE: The AF session ID is allocated by the PC (in the session dialogue the AF session ID will be used as a resource later on) as a resource. If it is allocated by the PC, the client will be informed about the AF session ID within the HTTP response 201 Created. This means that the session related URI (see sub-clause 5.3.4 ...sessions/afsessionid) is dynamically discovered and not defined by the client.

Editor's note: The format of the AF session Id needs to be defined. It is used within the URI design, in order to access the resources (see e.g. the clause session dialogues). Therefore, the AF session ID should be key, which is constant over the complete lifetime of the AF session.

The Rx application requires that the PC can notify the AF about traffic plane events. The AF normally acts as the HTTP client, but the requirement for notifications result in a reversal role of the client and server. Therefore, PC and AF act as HTTP client and HTTP server both.

If the AF establishes an AF session (i.e. initiates the initial provisioning of session information), the AF will send an HTTP POST to the PC including all session information required. The AF includes its own URL so that the PC can find the AF when the PC reports traffic plane events corresponding to the AF session. The PC allocates a new AF session ID for the AF session and initiates an Rx Diameter session. The PC shall keep the mapping between the AF session ID and the URL and the mapping between the AF session ID and the Rx Diameter session ID. The PC sends an HTTP response to the AF including the allocated AF session ID once it receives a response from the PCRF.

If the AF modifies an AF session (i.e. initiates modification of session information), the AF will send an HTTP PUT, which includes the AF session ID as a path element of the URI. The PC sends an HTTP response to the AF and after update of the corresponding Rx Diameter session.

If the AF terminates an AF session, the AF will send an HTTP DELETE including the AF session ID as a path element of the URI. The PC sends a HTTP response to the AF after termination of the corresponding Rx Diameter session.

If the AF initializes a gate related procedure, the AF will send an HTTP PUT to the PC including all information required. The PC sends a HTTP response to the AF after update of the corresponding Rx Diameter session.

If the AF subscribes to notifications of the status of the signalling transmission path, the AF will send an HTTP POST to the PC including event information for the subscription. The subscription to notifications is performed as a separate session. The PC sends a HTTP response to the AF after update of the corresponding Rx Diameter session.

When the PC reports traffic plane events corresponding to the AF session, the PC sends an HTTP POST to the AF using the notification URL. The request includes the AF session ID as a path element of the notification URL. The AF uses the information for appropriate actions and sends an HTTP 200 OK to the PC.

Every HTTP message contains the specific communication information required for this case in its body.

Annex A provides call flows for all procedures.

5.3.1 Methods

Methods indicate the server what action has to be performed. Every HTTP request message has a method. The following HTTP methods can be used [9]:

- POST: Used to create a resource state. The URI defines the address responsible for the creation of the resource.
- PUT: Used to modify a resource state. The URI defines the resource which will be modified.
- DELETE: Used to delete a resource state

Every HTTP request results in a response message that comes back with a status code and further information in its body, if required. The AF waits for this response before initiating a further request for the same AF session.

5.3.2 Content type

An HTTP message is allowed to transport different content types. The content type represents the Rx application between AF and PC.

5.3.3 Resources and URI design

REST claims that the server state is held by the client or it is transferred into a resource status by the server, in order to allow a stateless communication. The concept of the resource status avoids the transfer of the complete server state to the client. Therefore, resources shall be an integral part of the REST-Rx interface. Resources are identifiable and have state representation.

NOTE 1: Stateless communication reduces the coupling of client and server. E.g., two requests that follow each other may not be processed by the same server instance.

NOTE 2: Resources may have one or more representations. JSON may be another representation [2]. It is possibility to use different representations of resources for different requirements. In this release XML will be used as a representation only.

Resources are identified by URIs. The URI design shall be based on the structure defined in IETF RFC 3986 [10]:

scheme ":" hier-part ["?" query] ["#" fragment]
hier-part = "//" authority path-abempty
/ path-absolute
/ path-rootless
/ path-empty

The URI design for the REST-Rx interface shall be based on the characteristics and requirements of the reference point between AF and PC and shall have a hierarchical structure.

The scheme may be HTTP or HTTPS for the REST-Rx reference point. Within a scheme the definition of names follows the rules of HTTP URIs. Host and port are the main parts of the authority. The path element identifies the resources. The URIs, which are allowed on the REST-Rx reference point and build out of the obligatory parts, shall have the structure:

Scheme://Host/Mainapplication/Mainresources

The obligatory parts have the meaning:

- Scheme: The application delivery layer protocol HTTP or HTTPS.
- Host: This part of the URI represents the server address including the port.
- Mainapplication: The application which will be accessed by the request. This release only provides the Rx application.

NOTE 3: The application level makes possible defining different applications as resources at the same entity. This release only provides the Rx application.

- Mainresources: Sessions are the core concepts of the REST-Rx interface and can be defined as the main resources by URIs. Main resources can be split into sub-resources further (e.g. individual sessions may be identified by AF session IDs).

The URI addressing of the main resource sessions may look like:

- http://pcserver/rxapplication/sessions

5.3.4 HTTP request/response dialogues

The HTTP request/response dialogue may consist out of different dialogues providing the functionalities for session establishment, modification, termination, gate related procedures, subscription to notifications and notifications. These dialogues include the required content translated from the Diameter messages as defined in 3GPP TS 29.214 [4] and represented by the specific application communication language as defined in sub-clause 5.4. Sessions are addressed as resources in the path of the URI.

The HTTP request message, which is related to a session establishment procedure, shall use the POST method and includes the notification URL in addition to the required content translated from an AAR message. The message addresses a resource, which is responsible for resource creation and session establishment, and has the general structure:

```
HTTP POST https://pcserver/rxapplication/sessions/establishment
```

```
      <settings>
         <notificationURL>https://afresponsehost/path</notificationURL>
      </settings>
      <RxMessage>
         <xs:annotation>
            <xs:documentation>========================</xs:documentation>
            <xs:documentation>Rx specific information/xs:documentation>
            <xs:documentation>========================</xs:documentation>
         </xs:annotation>
      </RxMessage>
```

This HTTP POST message instructs the PC to create a resource state with a notification URL and to establish an AF session between the PC and the PCRF. An AAA message, received by the PC, results in an HTTP response message 201 Created, which includes the required content to be translated from the Diameter AAA answer message. The response message includes one resource in the Location header field, which represents the AF session ID and can be used as a resource address by the AF.

The HTTP request message, which is related to a session with an AF session ID, has the general structure:

```
   HTTP METHOD https://pcserver/rxapplication/sessions/afsessionid
      <RxMessage>
         <xs:annotation>
            <xs:documentation>=============================</xs:documentation>
            <xs:documentation>Rx specific information/xs:documentation>
            <xs:documentation>=============================</xs:documentation>
         </xs:annotation>
      </RxMessage>
```

It is answered by an HTTP response message (200 OK) that includes the correct Diameter answer message as a representation. The definition of sessions as resources makes it possible to use HTTP methods to retrieve information about the sessions and control their state.

Table 5.3.4.1: Rx methods and their result

Method	Result
POST .../sessions/establishment	Creates a resource for a session and initiates an AF session establishment procedure and notifies the AF about events
PUT ...sessions/afsessionid	Modifies a session/resource state
DELETE ...sessions/afsessionid	Deletes a session/resource state

5.4 Specific application communication

5.4.0 General

Specific application communication represents the presentation of application data structures by transforming data into the form that the application accepts. It establishes the context between application-layer entities.

Note: This release only supports the content type XML.

5.4.1 Content type XML

The content of the HTTP message is an XML document.

5.4.1.1 XML schema

The XML schema is given in annex B.

5.4.1.2 Data types and methods

Editor's note: List of data types allowed for every method.

5.4.1.3 Mapping between Diameter AVP and XML element and group

The mapping between the Diameter AVP names and XML element and group names is defined in table 5.4.1.3.1.

Table 5.4.1.3.1: Mapping between Diameter AVP and XML element or group

Diameter AVP	XML element or group
3GPP-MS-TimeZone	MSTimeZone
3GPP-SGSN-MCC-MNC	SgsnMccMnc
3GPP-User-Location-Info	ULI
Acceptable-Service-Info	AcceptableSvcInfo
Access-Network-Charging-Address	ANCAddr
AF-Application-Identifier	AFAppId
AF-Charging-Identifier	AFChargingId
Application-Service-Provider-Identity	ASPId
Called-Station-ID	APN
CC-Input-Octets	CCIO
CC-Output-Octets	CCOO
CC-Total-Octets	CCTO
Codec-Data	CodecData
Experimental-Result-Code	ExperiResCode
Feature-List	FeatList
Feature-List-ID	FeatListId
Flow-Description	FlowDesc
Flow-Number	FlowNum
Flow-Status	FlowStatus
Flow-Usage	FlowUsage
Flows	Flows
Framed-IP-Address	UEIP
Framed-IPv6-Address	UEIPv6
Granted-Service-Unit	GSU
IP-CAN-Type	IPCANType
IP-Domain-ID	IPDomainId
Max-Requested-Bandwidth-DL	MaxBwDL
Max-Requested-Bandwidth-UL	MaxBwUL
Media-Component-Number	MCN
Media-Component-Description	MCD
Media-Sub-Component	MSC
Media-Type	MediaType
Min-Requested-Bandwidth-DL	MinBWDL
Min-Requested-Bandwidth-UL	MinBWUL
MPS-Identifier	MPSId
Origin-State-ID	OrigStateId
RAT-Type	RATType
Required-Access-Info	ReqAccInfo
Reservation-Priority	ResPrio
Result-Code	ResCode
RR-Bandwidth	RRBw
RS-Bandwidth	RSBw
Rx-Request-Type	ReqType
Service-Info-Status	SvcInfoStatus
Service-URN	SvcURN
Session-ID	SessionId
Specific-Action	SpecificAction
Sponsor-Identity	SponsId
Sponsored-Connectivity-Data	SpConnData
Subscription-ID	SubId
Subscription-ID-Data	SubIdVal
Subscription-ID-Type	SubIdType
Supported-Features	SuppFeatures
TWAN-Identifier	TWANId
Used-Service-Unit	USU
User-Location-Info-Time	ULITime

Editor's note: The mapping of other Diameter AVPs and error handling should also be analyzed.

5.5 PC discovery

The Dynamic Host Configuration Protocol (DHCP) [12] and Domain Name System (DNS) [11] interfaces are typically not included in architecture diagrams or described as reference points. For the PC discovery, DHCP and DNS interactions can take place between the AF and the PC. If the AF does not have PC address information (i.e. provided by preconfiguration or other protocol configuration options), DHCP and DNS queries can be carried out before the creation of resources by the AF. The input paramenters could be the UE IP address, User identity, IP domain Id and PDN Id.

6 Routing

6.1 PC located in the PLMN but outside of the PCRF realm

The AF may have following parameters: UE IP address (i.e. IPv4 or IPv6 address), PDN information, user identity and domain Identity.

The AF may use above parameters to construct the HTTP request URL to the protocol converter.

The above available parameters shall also be included in the AF session establishment requests to the protocol converter.

For the routing between the protocol converter and PCRF, if the PC can extract the realm information from the user identification and/or other information from the AF, the PC can send the Diameter message to the correct PCRF realm. Otherwise, if the PC can"t extract the realm information from the user identification and/or other information from the AF, the PC may use pre-configured information to find the PCRF realm. The parameters provided by the PC may include the UE"s IPv4 address, the UE"s IPv6 address, PDN information, user identity and domain identity.

NOTE: The DRA procedure for the PC to find the PCRF is defined in subclause 7.3.2 of 3GPP TS 29.213 [3].

6.2 PC located in the PCRF realm

The AF may have following parameters: UE IP address (i.e. IPv4 or IPv6 address), PDN information, user identity and domain Identity.

The AF may use above parameters to construct the HTTP request URL to the protocol converter.

The above available parameters shall also be included in the AF session establishment requests to the protocol converter.

For the routing between the protocol converter and PCRF, the protocol converter shall provide the PCRF or the DRA of the PCRF realm with the parameters translated from the HTTP request. The parameters provided by the PC may include the UE"s IPv4 address, the UE"s IPv6 address, PDN information, user identity and domain identity.

NOTE: The DRA procedure for the PC to find the PCRF is defined in subclause 7.3.2 of 3GPP TS 29.213 [3].

7 Secure communication

3GPP TS 33.310 [13] provides a highly scalable entity authentication framework for 3GPP network nodes.

The unsecured HTTP protocol may be combined with TLS [14] in order to provide confidentiality and integrity protection. HTTP/TLS is differentiated from HTTP URIs by using the "HTTPS" scheme in place of the "HTTP" scheme. Mutual authentication shall be enabled in TLS for authenticating and allowing only an authorized 3rd party AF to access the PC

NOTE: In case a client knows the application level protocol (HTTP) and the format of the representation (XML), it is able to communicate with every resource around the world, for which a representation is retrievable in this format. Since HTTP and XML are extensively used in the internet community it is highly desirable to use the option for secure communication.

Annex A (informative): Call Flows

Editor's note: This section includes the call flows for session establishment, session modification, and so on based on 3GPP TR 29.817, section 6.2.2 [2]

A.1 General

This annex describes the procedures which use the two TCP connections to implement the interactions between the AF and the protocol converter. The AF in the annex A.2, A.3 and A.4 uses one TCP connection initiated by the AF to send the HTTP request message and the protocol converter in the annex A.5 and A.6 uses one TCP connection initiated by the PC to send the HTTP request message.

Editor's note: The command names (e.g. HTTP request/response) of the call flows below should be replaced by specific names in the later version of this specification.

A.2 AF session establishment

This sub-clause describes the signalling flow for the AF session establishment procedure through the PC.

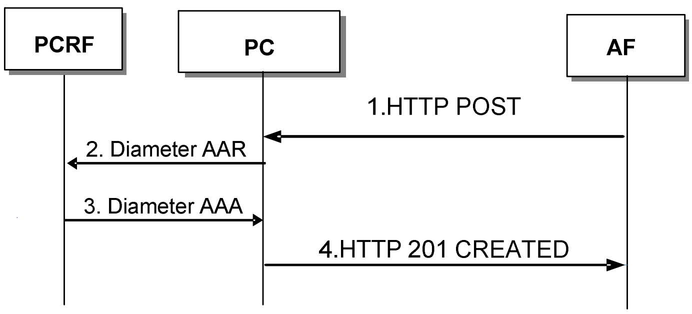

Figure A.2.1: Initial AF session request

1. The AF sends the HTTP POST to the PC to initiate the creation of a resource state, to inform the PC about the notification URL and to initate an AF session establishment including the parameters defined in sub-clause 4.5.2.
2. The PC converts the request to Diameter AAR command. The PC provides the Service Information to the PCRF by sending a Diameter AAR command as specified in 3GPP TS 29.214 [4] for a new Rx Diameter session.
3. The PCRF sends a Diameter AAA command to the PC as specified in 3GPP TS 29.214 [4].
4. The PC converts the required content of the Diameter AAA command and provides it in the HTTP 201 CREATED response to the AF including the parameters defined in sub-clause 4.5.2. The response message includes one resource in the Location header field, which represent the AF session ID.

A.3 AF Session Modification Initiated by AF

This sub-clause describes the signalling flow for the AF session modification procedure through PC.

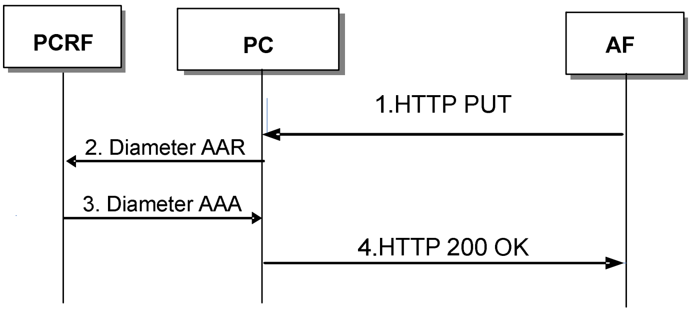

Figure A.3.1: AF session modification initiated by AF

1. The AF sends the HTTP PUT to the PC to initiate the AF session modification procedure including the parameters defined in sub-clause 4.5.3.

2. The PC converts the AF session modification request to a Diameter AAR command and sends the Diameter AAR command to the PCRF as specified in 3GPP TS 29.214 [4].

3. The PCRF sends a Diameter AAA command to the PC as specified in 3GPP TS 29.214 [4].

4. The PC converts the required content of the the Diameter AAA command and provides it in the HTTP 200 OK to the AF including the parameters defined in sub-clause 4.5.3.

A.4 AF Session Termination

This sub-clause describes the signalling flow for the AF session termination procedures through PC.

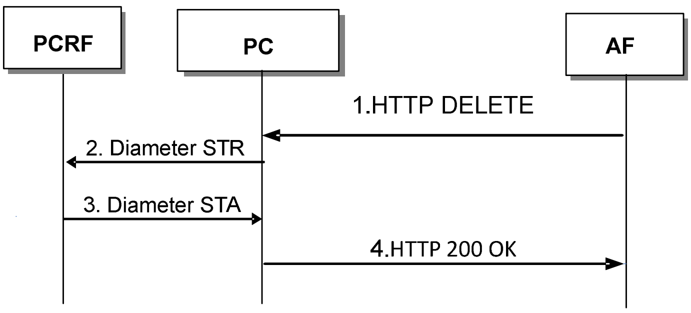

Figure A.4.1: AF session termination Procedures

1. The AF sends the HTTP DELETE to the PC to initiate the AF session termination procedure including the parameters defined in sub-clause 4.5.4.

2. The PC converts the AF session termination request to Diameter STR command do the session binding as defined in sub-clause 4.5.4, and sends the Diameter STR command to the PCRF as specified in 3GPP TS 29.214 [4].

3. The PCRF sends a Diameter STA command to the PC as specified in 3GPP TS 29.214 [4].

4. The PC converts the Diameter STA command and provides the HTTP 200 OK to the AF including the parameters defined in sub-clause 4.5.4.

A.5 Gate Related Procedures

This sub-clause describes the signalling flow for the gate related procedures through PC.

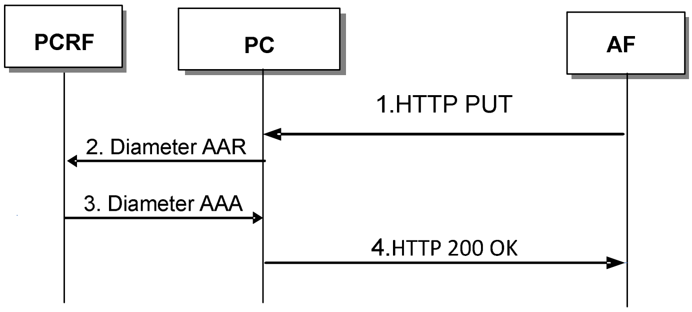

Figure A.5.1: Gate Related Procedures

1. The AF sends the HTTP PUT to the PC to indicate gate status including the parameters defined in sub-clause 4.5.5.
2. The PC converts the gate status request to Diameter AAR command and sends the Diameter AAR command to the PCRF as specified in 3GPP TS 29.214 [4].
3. The PCRF sends a Diameter AAA command to the PC as specified in 3GPP TS 29.214 [4].
4. The PC converts the Diameter AAA command and provides the HTTP 200 OK to the AF including the parameters defined in sub-clause 4.5.5.

A.6 Subscription to Notification of Signalling Path Status

This sub-clause describes the signalling flow for the subscription to notification of signalling path status through PC.

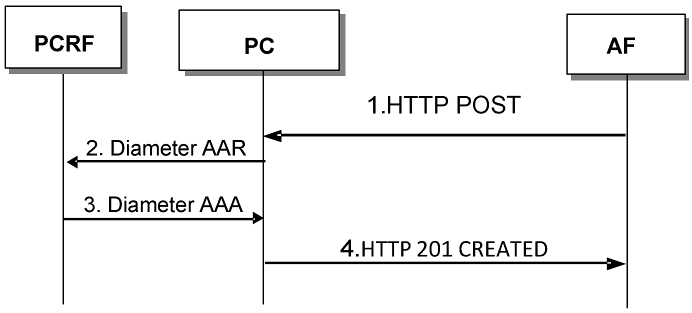

Figure A.6.1: Subscription to Notification of Signalling Path Status

1. The AF sends the HTTP POST to the PC to subscribe to notification of signalling path status including the parameters defined in sub-clause 4.5.6.
2. The PC converts the subscription request to Diameter AAR command and sends the Diameter AAR command to the PCRF as specified in 3GPP TS 29.214 [4].
3. The PCRF sends a Diameter AAA command to the PC as specified in 3GPP TS 29.214 [4].
4. The PC converts the Diameter AAA command and provides the HTTP 201 CREATED to the AF including the parameters defined in sub-clause 4.5.6.

A.7 Notification of Traffic Plane Events

This sub-clause describes the signalling flow for the notification of traffic plane events through PC.

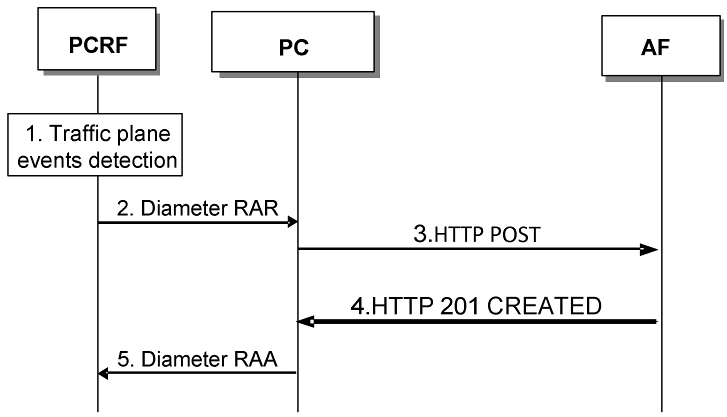

Figure A.7.1: Notification of Traffic Plane Events

1. The PCRF detects the occurrence of the traffic plane events.
2. When the traffic plane events occur, the PCRF notifies the corresponding events to the PC via a Diameter RAR command as specified in 3GPP TS 29.214 [4].
3. The PC converts the Diameter RAR command to HTTP POST to indicate the traffic plane events including the parameters defined in sub-clause 4.5.7.
4. The AF sends the HTTP 201 CREATED to the PC including the parameters defined in sub-clause 4.5.7.
5. The PC converts the HTTP 201 CREATED to Diameter RAA command and sends the Diameter RAA command to the PCRF as specified in 3GPP TS 29.214 [4].

Annex B (informative): XML Schema

Editor's note: The parameters included in the XML schema are only related to the initial provisioning and modification procedures. The parameters related to the other procedures are FFS. The XML schema introduced in this clause as the first step, showing the element and group definition, and will be completed and revised based on further analysis.

B.1 XML elements and groups

```
<xs:annotation>
  <xs:documentation>=============================</xs:documentation>
  <xs:documentation>Definition of Simple Elements</xs:documentation>
  <xs:documentation>=============================</xs:documentation>
</xs:annotation>
<xs:element name="SessionId" type="xs:string" />
<xs:element name="IPDomainId" type="xs:string" />
<xs:element name="AFAppId" type="xs:string" />
<xs:element name="FlowNum" type="xs:string" />
<xs:element name="FlowDesc" type="xs:string" />
<xs:element name="FlowStatus" type="xs:string" />
<xs:element name="FlowUsage" type="xs:string" />
<xs:element name="MaxBwUL" type="xs:unsignedInt" />
<xs:element name="MaxBwDL" type="xs:unsignedInt" />
<xs:element name="MinBwDL" type="xs:unsignedInt" />
<xs:element name="MinBwUL" type="xs:unsignedInt" />
<xs:element name="MediaType" type="xs:int" />
<xs:element name="ResPrio" type="xs:int" />
<xs:element name="RSBw" type="xs:string" />
<xs:element name="RRBw" type="xs:string" />
<xs:element name="SvcInfoStatus" type="xs:int" />
<xs:element name="AFChargingId" type="xs:string" />
<xs:element name="SpecificAction" type="xs:int" />
<xs:element name="MCN" type="xs:unsignedInt" />
<xs:element name="CodecData" type="xs:string" />
<xs:element name="SubIdType" type="xs:int" />
<xs:element name="SubIdVal" type="xs:string" />
<xs:element name="FeatListId" type="xs:unsignedInt" />
<xs:element name="FeatList" type="xs:unsignedInt" />
<xs:element name="UEIP" type="xs:string" />
<xs:element name="UEIPv6" type="xs:string" />
<xs:element name="APN" type="xs:string" />
<xs:element name="SvcURN" type="xs:string" />
<xs:element name="SponsId" type="xs:string" />
<xs:element name="ASPId" type="xs:string" />
<xs:element name="CCTO" type="xs:unsignedInt" />
<xs:element name="CCIO" type="xs:unsignedInt" />
<xs:element name="CCOO" type="xs:unsignedInt" />
<xs:element name="MPSId" type="xs:string" />
<xs:element name="RxqType" type="xs:int" />
<xs:element name="ReqAccInfo" type="xs:int" />
<xs:element name="OrigStateId" type="xs:unsignedInt" />
<xs:annotation>
  <xs:documentation>====================</xs:documentation>
  <xs:documentation>Definition of Groups</xs:documentation>
  <xs:documentation>====================</xs:documentation>
</xs:annotation>
<xs:group name="MCD">
  <xs:sequence>
    <xs:element minOccurs="0" ref="MCN" />
    <xs:element minOccurs="0" ref="AFAppId" />
    <xs:element minOccurs="0" ref="MediaType" />
    <xs:element minOccurs="0" ref="MaxBwDL" />
    <xs:element minOccurs="0" ref="MaxBwUL" />
    <xs:element minOccurs="0" ref="MinBwDL" />
    <xs:element minOccurs="0" ref="MinBwUL" />
    <xs:element minOccurs="0" ref="FlowStatus" />
    <xs:element minOccurs="0" ref="ResPrio" />
```

```
    <xs:element minOccurs="0" ref="RSBw" />
    <xs:element minOccurs="0" ref="RRBw" />
    <xs:element minOccurs="0" ref="CodecData" />
    <xs:element minOccurs="0" maxOccurs="unbounded" name="MSC">
      <xs:complexType>
        <xs:group ref="MSC" />
      </xs:complexType>
    </xs:element>
  </xs:sequence>
</xs:group>
<xs:group name="MSC">
  <xs:sequence>
    <xs:element minOccurs="0" ref="FlowNum" />
    <xs:element minOccurs="0" ref="FlowDesc" />
    <xs:element minOccurs="0" ref="FlowStatus" />
    <xs:element minOccurs="0" ref="FlowUsage" />
    <xs:element minOccurs="0" ref="MaxBwUL" />
    <xs:element minOccurs="0" ref="MaxBwDL" />
  </xs:sequence>
</xs:group>
<xs:group name="SubId">
  <xs:sequence>
    <xs:element minOccurs="0" ref="SubIdType" />
    <xs:element minOccurs="0" ref="SubIdVal" />
  </xs:sequence>
</xs:group>
<xs:group name="SuppFeatures">
  <xs:sequence>
    <xs:element minOccurs="0" ref="FeatListId" />
    <xs:element minOccurs="0" ref="FeatList" />
  </xs:sequence>
</xs:group>
<xs:group name="SpConnData">
  <xs:sequence>
    <xs:element minOccurs="0" ref="SponsId" />
    <xs:element minOccurs="0" ref="ASPId" />
    <xs:element minOccurs="0" maxOccurs="unbounded" name="GSU">
      <xs:complexType>
        <xs:group ref="GSU" />
      </xs:complexType>
    </xs:element>
    <xs:element minOccurs="0" maxOccurs="unbounded" name="USU">
      <xs:complexType>
        <xs:group ref="USU" />
  <xs:sequence>
    <xs:element minOccurs="0" ref="CCTO" />
    <xs:element minOccurs="0" ref="CCIO" />
    <xs:element minOccurs="0" ref="CCOO" />
  </xs:sequence>
</xs:group>
<xs:group name="UsedServiceUnit">
  <xs:sequence>
    <xs:element minOccurs="0" ref="CCTO" />
    <xs:element minOccurs="0" ref="CCIO" />
    <xs:element minOccurs="0" ref="CCOO" />
  </xs:sequence>
</xs:group>
```

Annex C (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2014-03					TS skeleton		0.0.0
2014-04					Includes the following TDOCs agreed at CT3#76bis: C3-141231 (clean version of agreed skeleton), C3-141232, C3-141234, C3-141392, C3-141420	0.0.0	0.1.0
2014-05					Includes the following TDOCs agreed at CT3#77: C3-142234, C3-142308, C3-142309, C3-142324, C3-142325, C3-142326, C3-142327, C3-142329, C3-142344	0.1.0	0.2.0
2014-06	CT#64	CP-140406			Clean-up for presentation for information to CT#64	0.2.0	1.0.0
2014-07					Includes the following TDOCs agreed at CT3#78: C3-143098, C3-143201, C3-143202, C3-143208, C3-143212, C3-143215, C3-143333, C3-143334, C3-143335, C3-143336, C3-143339, C3-143340, C3-143341, C3-143342, C3-143362, C3-143363, C3-143364	1.0.1	1.1.0
2014-09	CT#65	CP-140567	-	-	MCC clean-up for presentation for approval to CT#65	1.1.0	2.0.0
2014-09	CT#65	CP-140567			Raised to v.12.0.0 following CT#65 approval	2.0.0	12.0.0

History

Document history		
V12.0.0	October 2014	Publication