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Technical Report

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Stage-2
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Contents

Foreword

This Technical Report 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:

Version x.y.z

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.

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

1 Scope

Editor's note: This clause will describe the scope of the feasibility study for P4C.

This Technical Report addresses stage 2 study for the Evolved Packet System (EPS) to facilitate policy and charging control in the fixed broadband access network in the convergent scenario where a single operator is deploying both the fixed broadband access network and the Evolved Packet Core (EPC).

The scope of this TR is to consider the convergent scenario where the PCRF controls directly the network element(s) in the fixed broadband access without the mediation of a different policy server, such as the BPCF defined in TS 23.139 [20].

The work in this TR takes the fixed broadband accesses as specified by BroadBand Forum as a reference. This does not preclude the applicability of the solutions described in this TR to other types of fixed broadband accesses.

This TR will address policy and charging control for:

- Traffic to/from fixed devices connected to the fixed broadband access network (e.g. PC, IPTV Set top Box).

- Traffic exchanged by 3GPP UEs connected via WLAN or H(e)NB when both the fixed broadband access network and the EPC are under the control of the EPS operator.

The work is organized in the building blocks and this TR address the Building block listed below, for an outline of the content of each building block refers to clause 4:

- BB1: Policy and Charging Control for supporting traffic from fixed terminals and NSWO traffic from 3GPP UEs in fixed broadband access networks (P4C-F).

- BB3: Policy and Charging Control for 3GPP UEs connected to fixed broadband access network via S2b and S2c reference points for EPC routed traffic (P4C-S2bc).

- BB4: Policy and Charging Control for EPC routed traffic over fixed broadband access networks of 3GPP UEs connected via H(e)NB in convergent scenarios (P4C-HeNB).

- BB5: Policy and Charging Control for supporting Layer 2 traffic in fixed broadband access network (P4C-FL2).

- BB6: Policy and Charging Control for 3GPP UEs connected to fixed broadband forum access networks as Trusted network in Convergence scenario (P4C-TC).

NOTE: The Building Block 2 P4C-TI is addressed in TR 23.839 [28].

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 23.401: "GPRS Enhancements for E-UTRAN Access".

[3] 3GPP TS 23.402: "Architecture enhancements for Non-3GPP Accesses ".

[4] 3GPP TS 23.203: "Policy and charging control architecture".

[5]   3GPP TS 22.278: "Service requirements for the Evolved Packet System (EPS)".

[6]   Broadband Forum WT-203: "Interworking between Next Generation Fixed and 3GPP Wireless Access" (work in progress).

[7]   Broadband Forum TR-058: "Multi-service Architecture and Framework Requirements" September 2003.

[8]   Broadband Forum TR-101 "Migration to Ethernet-based DSL Aggregation" April 2006.

[9]   Broadband Forum WT-145: "Multi-service Broadband Network Functional Modules and Architecture" work in progress.

[10]   Broadband Forum WT-134: "Policy Control Framework" work in progress.

[11]   3GPP TS 29.274: "General Packet Radio Service (GPRS); Evolved GPRS Tunnelling Protocol (eGTP) for EPS".

[12]   BBF TR-092: "Broadband Remote Access Server (BRAS) Requirements".

[13]   BBF TR-124: Issues 2 "Functional Requirements for Broadband RG Devices".

[14]   3GPP TS 23.234: "3GPP system to Wireless Local Area Network (WLAN) interworking".

[15]   Broadband Forum WT-146: "Subscriber sessions" work in progress.

[16]   Broadband Forum WT-178: "Multi-service Broadband Network Architecture and Nodal Requirements " work in progress.

[17]   Broadband Forum WT-300: "Converged Policy Management" work in progress.

[18]   Broadband Forum WT-291: "Nodal Requirements for Interworking between Next Generation Fixed and 3GPP Wireless Access" work in progress.

[19]   3GPP TS 33.402: "3GPP System Architecture Evolution (SAE); Security aspects of non-3GPP accesses".

[20]   3GPP TS 23.139: "3GPP system - fixed broadband access network interworking; Stage 2".

[21]   3GPP TS 23.335: "User Data Convergence (UDC); Technical realization and information flows; Stage 2".

[22]   Broadband Forum WT-144: "Broadband Multi-Service Architecture & Framework Requirements".

[23]   3GPP TS 32.251: "Telecommunication management; Charging management; Packet Switched (PS) domain charging".

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

[25]   3GPP TS 32.240: "Telecommunication management; Charging management; Charging architecture and principles".

[26]   3GPP TS 32.296: "Telecommunication management; Charging management; Online Charging System (OCS): Applications and interfaces.

[27]   3GPP TR 23.800: "Study on Application Based Charging; Stage 2".

[28]   3GPP TR 23.839: "Support for BBF Accesses Interworking".

[29]   3GPP TS 23.228: "IP Multimedia Subsystem (IMS); Stage 2".

3 Definitions, symbols 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].

UE local IP address is defined as: either the public IP address assigned to the UE by the BBF domain in the no-NAT case, or the public IP address assigned by the BBF domain to the NATed RG that is used for this UE.

Non-seamless WLAN offload (NSWO) is a capability of a UE supporting routing specific IP flows over the WLAN access without traversing the EPC as defined in clause 4.1.5 of TS 23.402 [3].

EPC-routed: User plane traffic that is routed via a PDN GW in EPC as part of a PDN Connection. EPC-routed applies to non-roaming, roaming with traffic home-routed and roaming with traffic local break-out cases.

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].

ANDSF	Access Network Discovery and Selection Function
BBF	Broadband Forum
BRAS	Broadband Remote Access Server
BNG	Broadband Network Gateway
BPCF	Broadband Policy Control Function
DSMIPv6	Dual-Stack MIPv6
EPC	Evolved Packet Core
ePDG	Evolved Packet Data Gateway
EPS	Evolved Packet System
H-ANDSF	Home-ANDSF
MME	Mobility Management Entity
NSWO	Non-Seamless Wireless Offload
P-GW	PDN Gateway
PMIP/PMIPv6	Proxy Mobile IP version 6
RG	Residential Gateway
S-GW	Serving GW
V-ANDSF	Visited-ANDSF

4 Building blocks

Editor's note: This clause describes the organisation of work in building blocks with the corresponding description.

The architecture study for convergence scenario is planned to be performed within five Building Blocks, with the scope for each BB described in the following.

NOTE: The Building Block 2 P4C-TI is address in TR 23.839 [28].

4.1 Building Block 1 PCC for supporting traffic from fixed terminals and NSWO traffic from 3GPP UEs

Editor's note: The text below is copied from the Work Item Description of P4C-F.

This BB will focus on policy and charging control for:

- Traffic to/from fixed devices.

- NSWO traffic exchanged by 3GPP UEs connected to the fixed broadband access via WLAN.

NOTE 1: Determining the definition of fixed device is within the scope of this BB.

Specific objectives of this BB are to study and define:

- The reference architecture for policy and charging control in the convergent scenario.

- Any required enhancements for 3GPP PCC to provide policies for IP traffic exchanged by fixed devices in the fixed broadband access.

- Any required enhancements to 3GPP PCC to provide policies NSWO traffic exchanged by 3GPP UEs connected to the fixed broadband access via WLAN.

- Architecture and requirements to provide charging for traffic exchanged by fixed devices and NSWO traffic to/from 3GPP UEs in the following scenarios:

  - 3GPP PCC- Gy/Gz based charging with PCEF located in the fixed broadband access network;

  - Traffic Detection Function (TDF)-based charging;

  - AAA-based charging as already specified for interworking scenario.

NOTE 2: All the above solutions will be studied and standardized as alternative solutions for providing charging.

- The subscription information for fixed devices (e.g. identifiers, maximum subscribed bit rate, etc.) required for policy and charging control.

- The usage of the SPR or UDR to store policy related subscription information for fixed devices.

In this BB only policy and charging control for IP sessions will be considered, while policy control and charging for Layer 2 VPNs will be considered in P4C-FL2.

Policy control will address both dynamic and pre-provisioned policies in the BNG.

NOTE 3: The identification of fixed device and/or fixed access session between the RG and the BNG for the purpose of policy and charging control of the fixed broadband access in the PCC architecture is an input expected from BBF to be assessed considering the existing 3GPP system identifiers.

4.2 Building Block 3 PCC for 3GPP UE connected to fixed broadband access networks via S2b and S2c reference points for EPC routed traffic

Editor's note: The text below is copied from the Work Item Description of P4C-s2bc.

This Building Block will focus to provide stage 2 specifications for converged policy management and charging for the convergent scenarios with traffic routed to EPC for operators providing both 3GPP and fixed broadband access network for following scenarios:

- WLAN S2b: UE connects to WLAN/BBF with traffic routed to ePDG/PDN GW.

- WLAN S2c (trusted): UE connects to WLAN/BBF with traffic routed to PDN GW via s2c.

- WLAN S2c (untrusted): UE connects to WLAN/BBF with traffic routed to PDN GW through ePDG via S2c.

This BB will study and define any possible enhancement of 3GPP PCC for supporting policy management for the resource allocation and the QoS enforcement at the BBF access network for a 3GPP UE.

The traffic is EPC routed so accounting and charging is performed in 3GPP EPC network.

The solution defined in BB 3 shall be compatible with the solution defined in BB 1 (P4C-F) to ensure the consistent policy enforcement for the 3GPP UE connecting to the EPC via S2b or S2c with the consideration that the NSWO may have been be activated for the same UE as specified in BB 1.

4.3 Building Block 4 PCC for EPC routed traffic over fixed broadband access networks of 3GPP UEs connected via H(e)NB

Editor's note: The text below is copied from the Work Item Description of P4C-HeNB.

This Building Block will focus to provide stage 2 specifications for converged policy management and charging for the scenarios with traffic routed to EPC for operators providing both 3GPP and BBF accesses for the following scenario:

- 3GPP UE connects to a H(e)NB, which is connected to the EPC via a fixed broadband access network.

This BB will study and define any possible enhancement of 3GPP PCC for supporting policy management for the resource allocation and the QoS enforcement in the BBF access network for a 3GPP UE connected to a H(e)NB.

The traffic is EPC routed so accounting and charging is performed in 3GPP EPC network.

4.4 Building Block 5 PCC for supporting Layer 2 traffic in fixed broadband access networks

Editor's note: The text below is copied from the Work Item Description of P4C-FL.

This Building Block will focus to provide stage 2 specifications to enhance 3GPP PCC for supporting policy and charging control in fixed broadband access in the convergent scenario when single operator is deploying both fixed broadband access and the Evolved Packet Core (EPC).

The scope is to support dynamic QoS for fixed access session associated with layer 2 based sessions(, i.e. session identified by layer 2 identity, e.g. VLAN Tag)

Specific objectives of this BB are to study and define:

- Enhancements of the reference architecture, if needed, for policy and charging control in the convergent scenario.

- Any required enhancements to 3GPP PCC to provide policies for L2 traffic exchanged in the fixed broadband access.

- Enhancements of solutions to support AAA-based accounting for traffic exchanged by fixed devices. The support of 3GPP PCC charging is not considered in this release within the scope of this BB.

The activities performed under this BB will consider the result of other BBs that are part of the P4C features if needed.

4.5 Building Block 6 PCC for 3GPP UE connected to fixed broadband access networks via S2a reference point for EPC routed traffic

Editor's note: The text below is copied from the Work Item Description of P4C-TC.

This Building Block will focus to provide stage 2 specifications for converged policy management and charging for the scenarios with traffic routed to EPC for operators providing both 3GPP and fixed broadband access network for 3GPP UE connecting to Trusted WLAN access network supporting S2a towards PDN GW.

This BB will consider the architecture defined in TS 23.402 [3] clause 16. Both GTP and PMIP protocol variants for S2a will be considered.

This BB will study and define any possible enhancement of 3GPP PCC for supporting policy management for the resource allocation and the QoS enforcement for a 3GPP UE.

The work in this BB will be carried out taking the fixed broadband accesses as specified by BroadBand Forum as a reference. This BB will identify additional deployment scenarios. However, the architecture will be designed in a way to be also applicable to these deployment scenarios.

The traffic is EPC routed so accounting and charging is performed in 3GPP EPC network.

The solution defined in BB 4 shall be compatible with the solution defined in BB 4 (P4C-F) to ensure the consistent policy enforcement for the 3GPP UE connecting to the EPC via S2a with the consideration that the NSWO may have been be activated for the same UE as specified in BB 4.

As S2a traffic is EPC routed, charging is performed in 3GPP EPC. The support of accounting by the TWAN is out of scope of this WID.

The charging aspects for EPC access via TWAN are thus about to define:

- whether any user charging related information is missing that needs to be transferred to PDN GW/OCS/OFCS;

- a solution to provide the EPC (i.e. PDN GW) with the necessary user charging related information.

5 Building Block 1: PCC for supporting traffic from fixed terminals and NSWO traffic from 3GPP UEs

Editor's note: This clause will contain items being part of Building Block I P4C_F.

5.1 Key issues

Editor's note: This clause will identify the key issues for Building Block I.

5.1.1 Key Issue #1: Relation between IP-CAN session over Gxd and fixed subscriber session/NSWO

Considering QoS control for fixed subscriber session and NSWO traffic of 3GPP UE in bridge mode and routed mode (with and without NAT) RG configuration following questions need to be addressed:

- The number of IP-CAN sessions associated with a given fixed subscriber session.

- Whether different PCRFs or a single PCRF are in control of IP-CAN session(s).

- The mapping between IP-CAN session and fixed subscriber session traffic and/or NSWO traffic from 3GPP UE.

5.1.1.1 Solution Alternative 1

This clause describes single IP-CAN session over Gxd reference point for fixed subscriber session and NSWO traffic for 3GPP UEs.
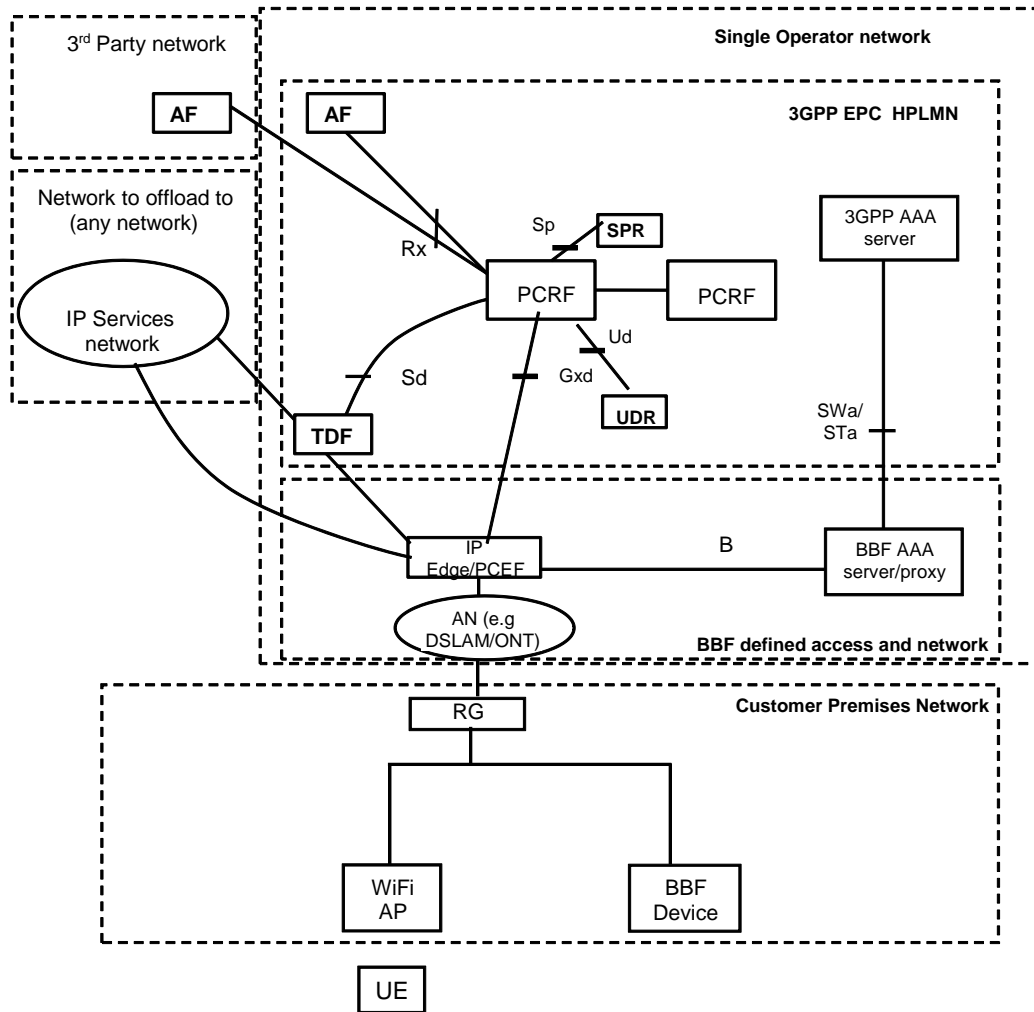
Figure 5.1.1.1-1: Architecture of single IP-CAN session over Gxd reference point

In the routed RG mode, there are typically multiple 3GPP UEs associated with a single fixed subscriber session in the BBF network. The fixed subscriber session is per RG in the BBF network and the relationship between fixed subscriber session and RG is one-to-one, while the relationship between such fixed subscriber session and UEs behind the RG is one-to-multiple. All the traffic from 3GPP UEs are transported within the same fixed subscriber session. The IP address can be assigned to the 3GPP UE by the IP Edge or by the RG.

The successful establishment of an fixed subscriber session shall trigger and indication of IP-CAN session establishment over Gxd to request PCC rules. For 3GPP UEs, the same IP-CAN session shall be used for provisioning PCC rules in the IP Edge.

Editor's note: How the IP Edge identifies the 3GPP UE behind the RG is FFS.

Different PCRFs will be selected to control the same IP-CAN session for the RG and 3GPP UEs. For fixed subscriber session, PCRF will be selected based on the Line ID. For 3GPP UE, the PCRF will be selected based on Subscriber id and ID of NSWO-APN by the PCRF handling the fixed subscriber session. As illustrated in Figure 5.1.1.1-1, the PCRF terminating on Gxd reference point will be selected for fixed subscriber session and the other one will be selected for NSWO traffic of 3GPP UE. The PCRF handling fixed subscriber session and the PCRF handling 3GPP UE need to interact with each other to provision PCC rules for the 3GPP UE. When the PCC rules for 3GPP UE changed (e.g. triggered by AF or TDF), the PCC rules for fixed subscriber session may also need to be updated.

Editor's note: How the PCRF handling the fixed subscriber session identifies and interacts with the PCRF handling NSWO traffic of 3GPP UE is FFS.

In the bridge RG mode, different IP addresses will be assigned to 3GPP UEs and Fixed Devices by IP Edge, and separate IP-CAN sessions shall be established for fixed subscriber session and NSWO traffic for 3GPP UEs.

5.1.1.2 Alternative Solution 2: One to one relation: IP-CAN session and IP Subscriber session

5.1.1.2.1 General

This solution alternative proposes to provide policy and charging control for the UE IP address that is known at the PCEF, i.e. all UEs behind a NAT have the same IP-CAN session in the PCEF. In addition, for those services that request resource reservation over Rx, policy and charging control in the PCEF is possible for a given service using PCC Rules provisioned by PCRF in PCEF.

In this solution a UE may be either a 3GPP UE or a fixed device.

For fixed devices, the PCEF is located in the IP Edge. For 3GPP UE in NSWO the PCEF is located in the IP Edge.

The IP Edge has an IP-CAN session per UE behind the RG in both bridge and routed mode with no NAT. The IP Edge has an IP-CAN session for the RG in routed mode with NAT.

5.1.1.2.2 Definition of an IP-CAN Session in the BBF domain

A "Fixed Broadband Access IP-CAN" is a fixed access broadband network that provides IP connectivity. The Fixed Broadband Access IP-CAN reuses the definition of an IP-CAN session in TS 23.203 [4].

NOTE: In the context of Fixed Broadband Access, the term UE is device (i.e. fixed device or 3GPP UE or the RG) that allows the user to access the IP connectivity services provided by the network.

In a Fixed Broadband Access an IP-CAN session corresponds to an IP subscriber session defined in WT-146 [15].

As defined in TS 23.203 [4], the association between the UE and an IP network is identified by an IP address(es), UE identity information (if available) and a PDN represented by a PDN-id. For those accesses that support IP-CAN bearers, there may be multiple IP-CAN bearers. For Fixed Broadband Access, the IP-CAN session can also be identified primarily by an IP address(es). The term UE corresponds to the device that access the services provided by the network (i.e. either RG, or 3GPP UE or fixed end-device), the PDN identifies the IP network where the device gets connectivity and the UE identity information may be the circuit-id (if available) although other identities may be used.

Editor's note: The definition and applicability of PDN ID for fixed subscriber session is FFS.

DSCP marking provides QoS support on transport network layer so that it can be assumed that there is support for multiple IP-CAN bearers for the purpose to provide QoS and charging.

5.1.1.2.3 IP-CAN Session in the PCEF

This solution proposes that there is an IP-CAN session per IP address known in the PCEF only. This means that there is:

- an IP-CAN session for the IP address assigned to the RG in the routed mode with NAT and

- an IP-CAN session for the IP address assigned to the end device (i.e. fixed device or 3GPP UE) in the bridge mode and routed mode with no NAT.

For the purpose to provide policy and charging control, PCC Rules contains SDF templates that include the IP address known in the PCEF.

For services (AF) that request resource reservation over Rx, this information is dynamically provided using Rx interface and allows providing both policy control and charging for the traffic generated by that UE. This solution is under the condition that:

a) The AF supports an Rx interface and

b) The AF can provide the NATed IP address and ports used by the UE (for IMS, according to TS 23.228 [29]).

NOTE: When the above conditions are not met, there are no standardized means as for now to identify a UE behind a NATed-RG.

5.1.1.2.3.1 Policy and Charging Control for the IP-CAN session in the PCEF.

Over Gxd, the PCEF announce the IP-CAN session establishment to the PCRF including, the IP address known by the PCEF, the identity of the UE associated in the PCEF with this IP address and a PDN-id, if available. There is a 1:1 relation between the IP-CAN session in the PCEF and in the PCRF. There is also a single subscriber in SPR/UDR per IP-CAN session, this is either the UE identity that identities the RG or the end device.

5.1.1.2.4 Procedures

Editor's note: This clause will identify the procedures for Policy and QoS in TS 23.402 [3] and/or TS 23.203 [4] style for Building Block 1.

Editor's note: Charging/accounting interactions for all scenarios are FFS.

Editor's note: For all scenarios in this alternative solution, roaming interaction has to be added to the flows (only update to the subscription information scenario includes it for now).

5.1.1.2.4.1 General Assumptions

For the dynamic QoS for the IP-CAN session the following requirements shall be supported:

- interaction between PCRF and PCEF at IP-CAN session establishment.

- policy change requests originated from Applications Function after IP-CAN session establishment.

- policies apply to individual IP-CAN session.

- policy evaluation may be triggered by the change in state of an IP-CAN session.

In the RG NATed/routed mode there is a single RG IP subscriber session for all devices connected to the RG (NAT case, routed mode) and thus a single Gxd IP-CAN session

In the case without NAT between the UE and the PCEF (e.g. RG in bridge mode) the IP Edge/PCEF binds a UE IP subscriber session connected to the RG (no NAT/bridged mode) with a Gxd IP-CAN session.

Editor's note: 3GPP AAA interactions for 3GPP UE authentication are not shown in the message flows.

5.1.1.2.4.2 IP-CAN Session Establishment

This clause describes the signalling flow for Gxd IP CAN Session establishment. The session is initiated after that the IP Edge becomes aware of an IPv4 address and/or an IPv6 prefix has been assigned to the fixed device and/or 3GPP UE.

NOTE 1: In bridge mode, the session is initiated after the device has been authenticated according to BBF specifications (i.e. out of scope of 3GPP) or after that 3GPP UE performs 3GPP EAP-based authentication and has been assigned an IPv4 address and/or IPv6 Prefix.

NOTE 2: In route mode configuration with NATed RG, the session is initiated after the RG has been connected to the network and has been assigned an IPv4 address and/or IPv6 Prefix. The IPv4 address and/or IPv6 Prefix is assigned according to BBF specifications and it is out of scope of 3GPP.
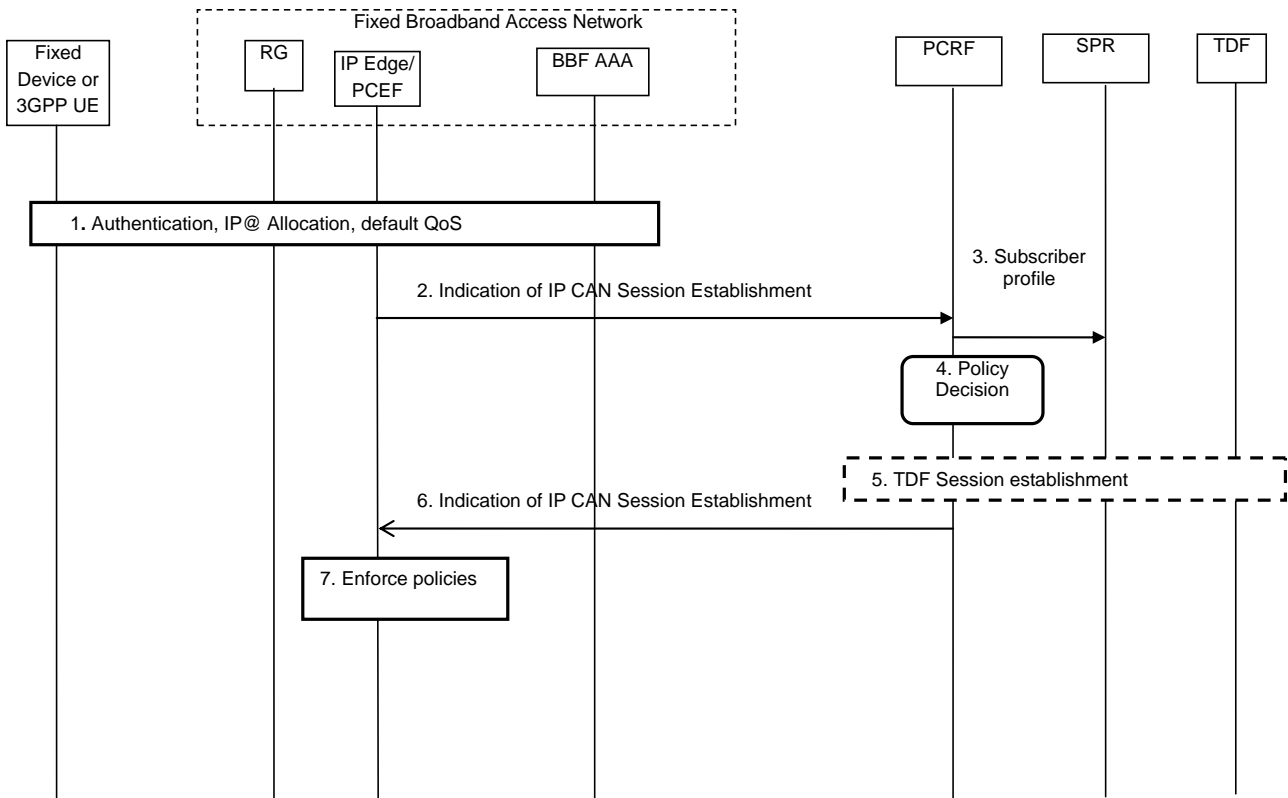
Figure 5.1.1.2.4.2: Initial Attach

1. A Fixed Broadband subscriber session is initiated by the device, (e.g. a RG switches on, a 3GPP UE starts a session, etc.). When the device is not acting as a 3GPP device, the BBF (e.g. access line) authentication is performed as specified by BBF. Otherwise if the device is 3GPP UE the authentication is performed as described in TS 23.402 [3]. As part of this step, the BBF AAA may provide Default QoS to the IP Edge/PCEF. The IP Edge/PCEF assigns an IP address (and/or an IPv6 prefix) for the Fixed Broadband subscriber session. This step is BBF specific and as such out of scope of this specification.

NOTE 1: In routed mode configuration with NAT, the authentication of any fixed device or 3GPP UE in step 1 does not trigger any IP-CAN session establishment procedure, since the IP-CAN session has been already established after RG connected to the network.

2. The IP Edge/PCEF sends an indication of the IP-CAN session establishment to the PCRF. The message includes the subscription-ID if available , the Access Line Identifier (physical and logical circuit ID), default QoS, if available, the IP-CAN type, the IPv4 address and/or the IPv6 network prefix and subscriber priority according to WT-134 [10] and WT-146 [15] requirements.

NOTE 2: For 3GPP UE the establishment indication of the IP-CAN session establishment with the PCRF QoS may include the APN (i.e. NSWO-APN).

3. The PCRF obtains the subscriber's profile related to the UE.

4. The PCRF makes policy decision and derives PCC and ADC Rules. The PCRF may change the default QoS of the subscriber it received from the PCEF. In this step the PCRF sends the decision(s) to the IP Edge/PCEF. The PCRF may include the following information: Default QoS, the PCC Rules and the Event Triggers to report. The Event Triggers indicate to the IP Edge/PCEF what events must be reported to the PCRF.

NOTE 3: The PCRF may override the default QoS received from the IP Edge/PCEF.

5 For the solicited application reporting, the PCRF establishes the session with the TDF and provides ADC rules to the TDF.

Editor's note: Whether additional parameters in the PCC Rule are required for the IP-CAN session is FFS.

6. The PCRF provisions the PCC rules at the IP Edge/PCEF:

7. This step is BBF specific. The IP Edge/PCEF may communicate with other network elements in the BBF access network according to BBF specifications.

5.1.1.2.4.3 PCRF Initiated IP-CAN Session Modification

This clause is related to IP-CAN session modification for IP session initiated by PCRF. The AF can be involved.
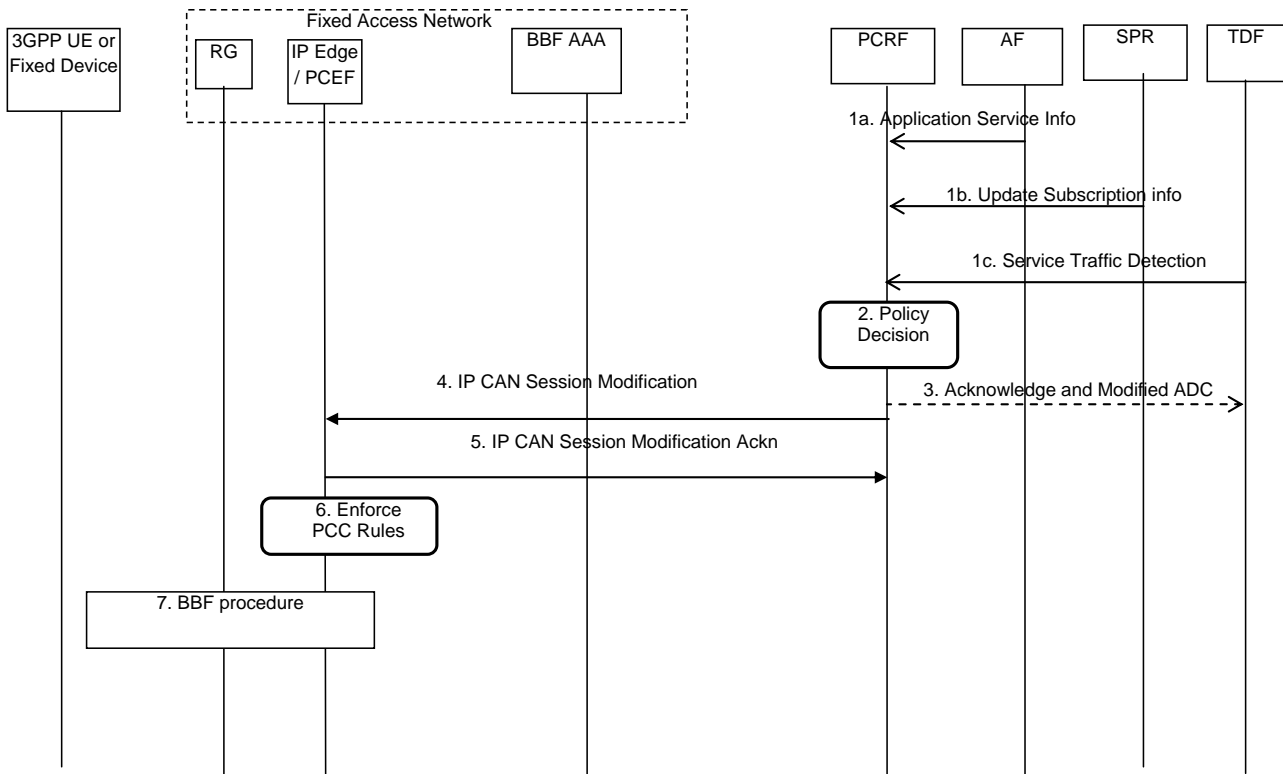
Figure 5.1.1.2.4.3: PCRF initiated IP-CAN Session Modification

1a. The AF requests QoS resource authorization. The request includes the bandwidth requirements, media type, session priority and other information according to TS 23.203 [4].

NOTE 1: In routed mode with NAT this procedure is applicable when AF request QoS and charging for RG or for single device connected behind the NATed RG for which the AF is providing the NATed IP address and ports used by the single device (e.g. for IMS, according to TS 23.228 [29]).

1b. The SPR notifies the PCRF when the user's profile changes.

NOTE 2: In routed mode configuration with NAT the PCRF can be triggered by step 1b only when user subscriber information for RG is updated.

1c. The same step as step 1b in TS 23.203 [4] procedure in clause 7.5.

NOTE 3: In routed mode with NAT the PCRF can be triggered by step 1c only when TDF detects application exchanged with RG.

Alternatively, the PCRF may initiate this procedure based on PCRF internal logic.

2. The PCRF makes policy decisions and determines the QoS, ADC and PCC Rules (e.g. QCI, UL/DL max/minimum or guaranteed Bitrate and priority for the service) and the Event Triggers to report. The Event Triggers indicate to the IP Edge/PCEF what events must be reported to the PCRF.

3. The PCRF modifies the TDF session by sending the new/updated ADC Rules to the TDF as step 5 in TS 23.203 [4] procedure in clause 7.5.

4. The PCRF provisions the PCC rules at the IP Edge/PCEF.

5. The IP Edge/PCEF responds with an acknowledgment.

6. The IP Edge/PCEF enforces the PCC rules.

NOTE 1: How the IP Edge/PCEF performs QoS enforcement in the BBF is out of the scope of 3GPP.

NOTE 2: The IP Edge/PCEF performs the mapping between the PCC rules and the parameters specific in BBF network.

7. BBF specific procedures may applies, e.g. the IP Edge/PCEF may communicate with other entities in BBF access according to BBF specifications.

5.1.1.2.4.4 IP Edge/PCEF Initiated IP-CAN Session Modification

This clause is related to IP-CAN session modification initiated by IP Edge/PCEF for IP session. The procedure is applicable when the IP Edge/PCEF makes a decision to request a modification of PCC rules. The trigger to start the modification procedure by IP Edge/PCEF can be a provisioned event-trigger by the PCRF or a BBF specific trigger.

In routed mode with NAT, this procedure can be triggered when new device connects to the LAN, for example when UE requests a local IP address to the RG or when a UE disconnects from WLAN.
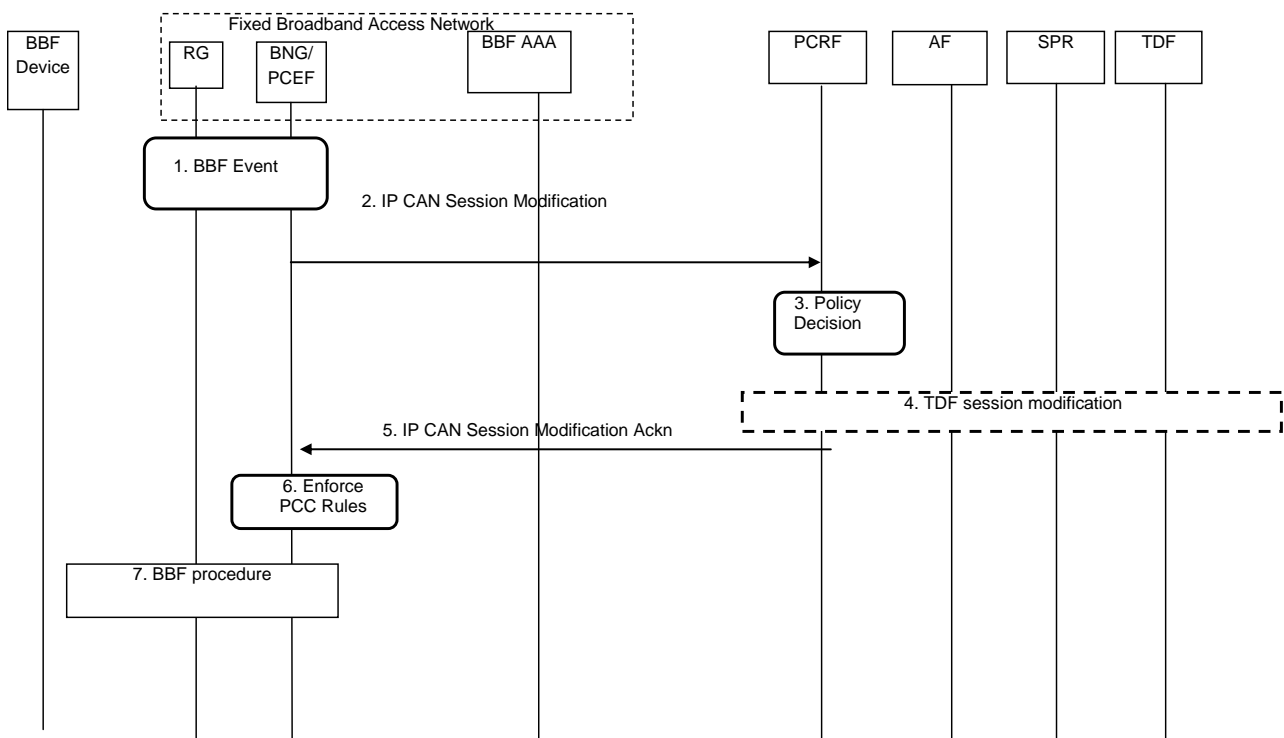
Figure 5.1.1.2.4.4: IP Edge/PCEF Initiated IP-CAN Session Modification

1. The IP Edge/PCEF receives a trigger (e.g. from RG) or decides to modify an IP-CAN session due e.g. to partial network failure, failure to enforce a PCC rule or other BBF specific triggers according to BBF specification that are out of scope of 3GPP.

NOTE: The triggers can be different in bridge mode configuration and in routed mode configuration.

2. The IP Edge/PCEF may initiate the session modification procedure based on internal triggers or when event-triggers provisioned by the PCRF are detected. The message includes the Event Report and affected PCC Rules.

3. The PCRF makes policy decisions and may derive new or modified PCC rules.

Editor's note: Whether additional parameters in the PCC Rule are required for the IP-CAN session is FFS.

4. The PCRF provisions new/updated ADC Rules at the TDF as defined in steps 11 and 12 of TS 23.203 [4] procedure in clause 7.3.2.

5 The PCRF provisions PCC rules at the IP Edge/PCEF.

6.	The IP Edge/PCEF enforces the PCC rules.

7.	BBF specific procedures may apply, e.g. the IP Edge/PCEF may communicate with other entities in BBF access according to BBF specifications.

NOTE 1:	How the IP Edge/PCEF performs PCC rules enforcement in the BBF is out of the scope of 3GPP.

NOTE 2:	The IP Edge/PCEF performs the mapping between the PCC rules and the parameters specific in BBF network. This mapping is out of scope of 3GPP.

### 5.1.1.2.4.5	IP Edge/PCEF initiated IP-CAN Termination

This clause is related to termination of the IP-CAN session by IP Edge/PCEF. The procedure is applicable when IP session is terminated. The trigger to start the termination by IP Edge/PCEF is BBF specific (e.g. RG switch off, PPPoE session termination, etc) and out of the scope of 3GPP.

In routed mode configuration with NAT this procedure is applicable only when IP session from RG is terminated, e.g. when RG switches off or when IP address assigned to WLAN IP interface is released, etc. The termination of connection from a device in LAN, e.g when device releases the local IP address or it disconnects from WLAN does not trigger the IP-CAN session termination for IP session from RG.
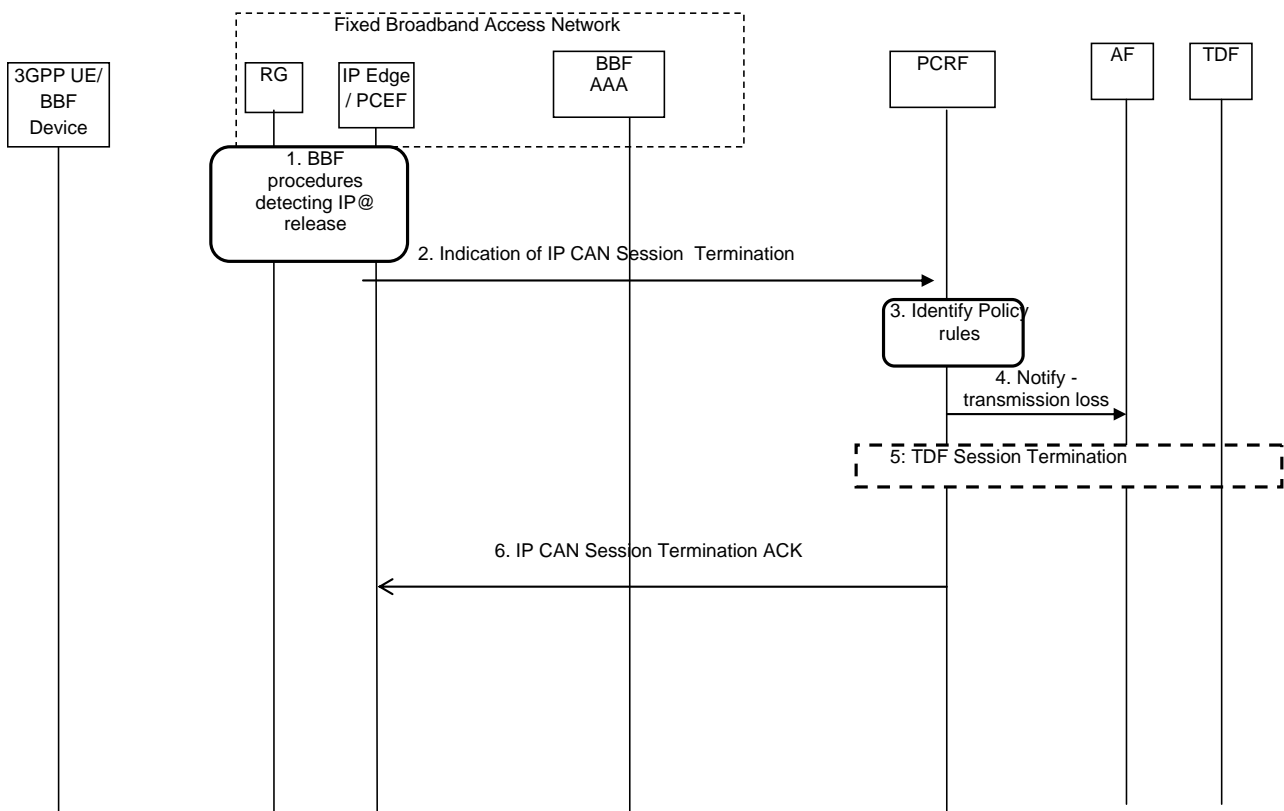
Figure 5.1.1.2.5: IP Edge/PCEF Initiated IP-CAN Session Termination

1.	The IP Edge/PCEF receives a request to terminate the session with the PCRF based on BBF triggers (both either external and internal to the IP Edge/PCEF) for example due to termination of session, power off of RG, etc as defined by BBF specifications.

NOTE:	How the IP Edge/PCEF detects or is informed that BBF access session is terminated is BBF specific and is out of the scope of 3GPP.

2.	The IP Edge/PCEF initiate the indication of IP-CAN Session termination procedure.

3.	The PCRF identifies the affected PCC rules.

4.	The PCRF notifies the AF about loss of transmission.

5 The PCRF terminates the session with the TDF as defined in steps 10 and 11 of TS 23.203 [4] procedure in clause 7.3.1.

6. The PCRF acknowledges the termination of the session.

5.1.1.2.4.6 Update of the subscription information in the PCRF

In routed mode with NAT this procedure is applicable only if profile information related to RG has been changed.
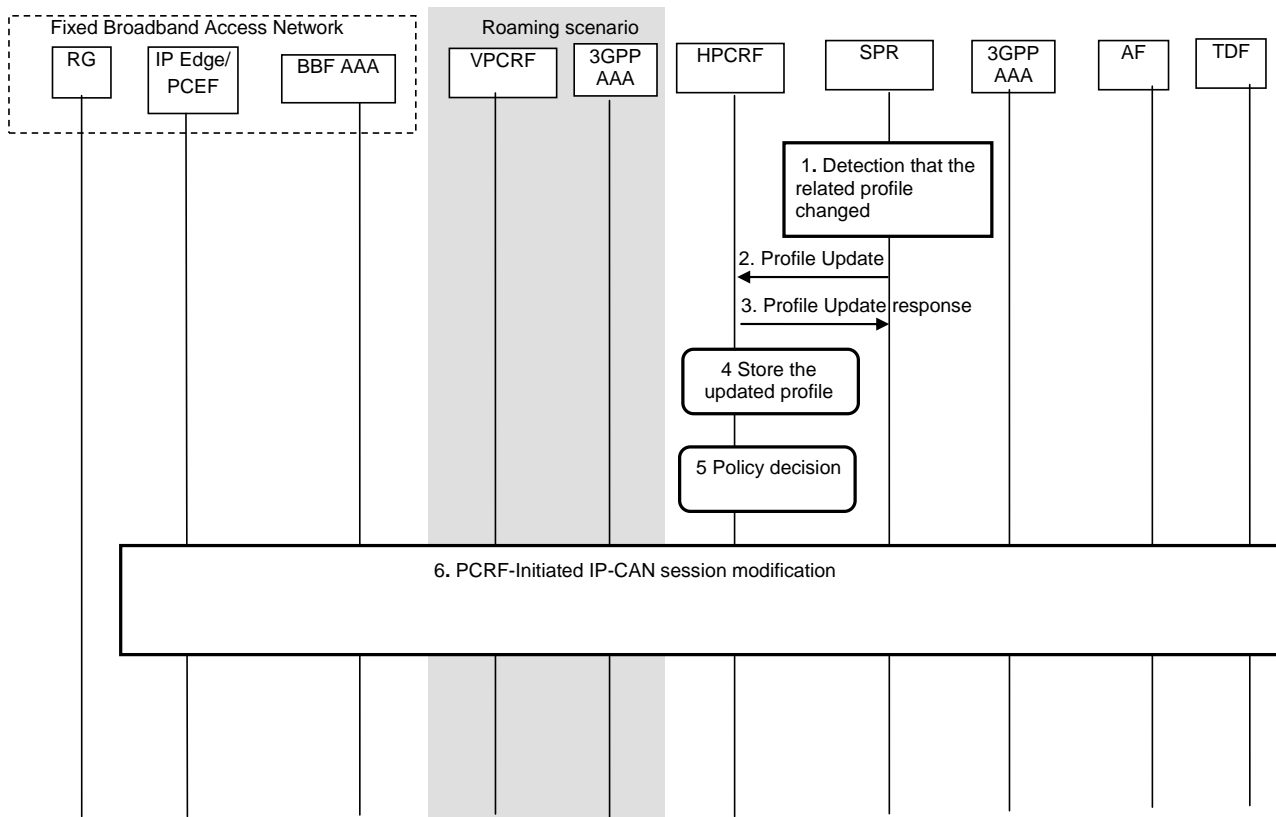
Figure 5.1.1.2.4.6: Update of the subscription information in the PCRF

1 The SPR detects that the subscriber's profile changed.

Editor's note: Enhancements to the subscriber profile for BBF access is FFS.

2 The SPR notifies the PCRF of the profile change provided if the PCRF has subscribed to such notification event(s).

3 The PCRF responds to the SPR notification message.

4 The PCRF stores the updated profile.

5 The PCRF identifies the rules affected and derives new/modified ones.

6 The PCRF initiates the IP-CAN Session Modification procedure according to clause 5.1.1.2.4.3 if the BBF access or 3GPP UEs are affected.

5.1.1.3 Alternative 3: Multiple IP-CAN session for Fixed Subscriber Session and NWSO 3GPP UE

Editor's note: This clause will identify the requirements and assumptions for convergent Policy QoS and charging for Fixed Subscriber Session and WLAN UE NSWO.

5.1.1.3.1 General

The PCEF located in the IP Edge binds the Fixed Subscriber Session with the IP-CAN session on Gxd reference point.

For Routed mode RG without NAT, an IP-CAN session shall be established for the fixed subscriber session. The IP-CAN session is established by the IP Edge when the RG accesses the fixed broadband network. The IP Edge sends the IP address of RG to the PCRF, as well as the access line ID as identification information of the RG. For each 3GPP UE using NSWO to access the fixed access network, IP-CAN session will also be established. The IP Edge obtains the 3GGP UE IMSI via successful 3GPP-based access authentication procedure. When the IP address is allocated by the RG, there shouldn't be overlap between the address pools of the RGs connecting to the same IP Edge. The IP Edge sends the IMSI, which is learnt via authentication, and the IP address of the UE to the PCRF. It is assumed that IP Edge is the AAA proxy or AAA client for EAP-based authentication support as defined in BBF WT-146 [15].

In case of RG configured in routed mode with or without NAT there is a single Fixed Subscriber Session for all N3GPP User Equipments connected to the RG. In this scenario there is an IP-CAN session for the Fixed subscriber session and one separate IP-CAN session for NSWO traffic for each 3GPP UE which performs 3GPP EAP-based authentication.

This alternative assumes that for fixed device connected behind a RG in routed mode a single IP-CAN session is used for all devices.

> Editor's note: How the IP-CAN session for 3GPP UE relates to the IP-CAN session for fixed subscriber session is FFS.

> Editor's note: Whether the IP-CAN session definition needs to be enhanced for this scenario is FFS.

For Bridge mode RG, there is one IP-CAN session for each single IP session, i.e. one per fixed subscriber session and one per each 3GPP UE performing NSWO. Fixed devices and 3GPP UEs behind the RG can be recognized and allocated an IP address by the IP Edge. The IP Edge establishes IP-CAN session when a fixed device/3GPP UE accesses to the fixed broadband network. The IP address information sent to PCRF is the IP address allocated by the IP Edge. The identification information for 3GPP UE is IMSI. The multiple IP-CAN sessions are independent from each other.

> Editor's note: It is FFS what kind of identification information is used for fixed subscriber session.

> NOTE: In the case of a routed mode RG behind a bridge RG, it's the same as Routed RG case in the perspective of QoS control over Gxd.

> Editor's note: It is FFS how the IP edge can identify flow belonging to the NSWO UE in NATed RG.

5.1.1.3.2 IP-CAN Session Establishment

This clause describes the signalling flow for IP-CAN Session establishment over Gxd. The session is initiated after the fixed subscriber session is established and the IP address has been assigned as defined in BBF specifications for BBF defined network. The procedure for authentication of fixed subscriber session is out of 3GPP scope.

The roaming scenario is not applicable for the Fixed subscriber session.

> Editor's note: The steps related to accounting and charging data collection for AAA-based, PCC-based and TDF-based are FFS and not shown in the diagram flow.

5.1.1.3.2.1 Bridged RG with fixed device or 3GPP UE attachment

This clause describes the signalling flow for Gxd IP-CAN Session establishment in the case of RG acting as bridge mode. The session is initiated after the N3GPP device or 3GPP UE has been authenticated and assigned a Local IP Address. The authentication procedure for the N3GPP device is based on BBF specifications that out of scope in 3GPP.
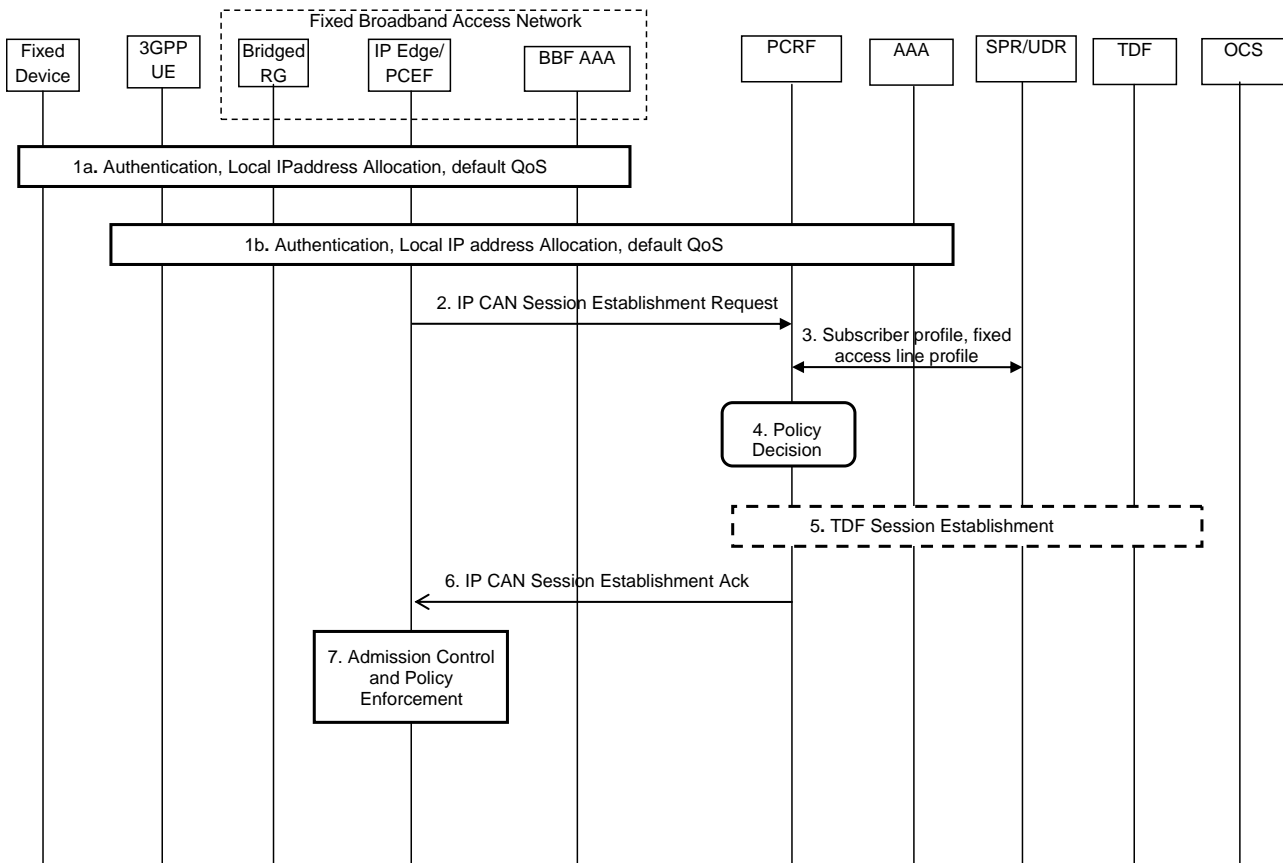
Figure 5.1.1.3.2-1: IP-CAN session establishment procedure for RG operating in Bridge mode

1. The Fixed Device (e.g. PC, IPTV) or the 3GPP UE accesses to the network.

   1a. The Fixed Device accesses to the network and performs authentication. The access authentication is performed as specified by BBF. As part of this step, the BBF AAA may provide Default QoS to the IP Edge. The IP Edge assigns a Local IP address to the N3GPP Device. This step is BBF specific and as such out of scope of this specification.

   1b. the 3GPP UE accesses to the network and performs authentication. The default QoS of the 3GPP UE is returned during the authentication. The IP Edge assigns a Local IP address to the 3GPP UE.

2. The IP Edge/PCEF triggers the establishment of the IP-CAN session over Gxd for the Fixed Subscriber Session or for the NSWO traffic of the 3GPP UE with the PCRF. The message includes the Subscriber-ID (e.g. the Fixed device ID, 3GPP UE IMSI, circuit ID), the Local IP address, default QoS, the IP-CAN type.

3. The PCRF obtains the subscriber's profile related to the fixed subscriber session and 3GPP UE from the SPR/UDR.

Editor's note: Enhancement to the subscriber profile in SPR/UDR for fixed subscriber session is FFS.

4. The PCRF makes policy decision and derives PCC rules. The PCRF may change the default QoS of the fixed subscriber session or of 3GPP UE which is received from the IP Edge/PCEF.

5. For the solicited application reporting, the PCRF requests the TDF to establish the relevant session towards PCRF and provides ADC rules to the TDF.

6. The PCRF provides the PCC rules to the IP Edge/PCEF. In this step the PCRF may include the following information: Default QoS, the PCC Rules and the Event Triggers to report. The Event Triggers indicate to the IP Edge/PCEF what events must be reported to the PCRF.

7. The IP Edge/PCEF performs admission control and resource allocation based on PCC rules. The IP Edge may also communicate with other network elements in the BBF access network according to BBF specifications and is out of scope of 3GPP.

Editor's note: Whether additional parameters are required for BBF access session is FFS.

5.1.1.3.2.2 Routed RG

This clause describes the signalling flow for Gxd IP-CAN Session establishment in the case of RG operating as routed mode. The session is initiated when RG attaches to the network. The authentication procedure for fixed subscriber session is based on BBF specifications that out of scope in 3GPP.
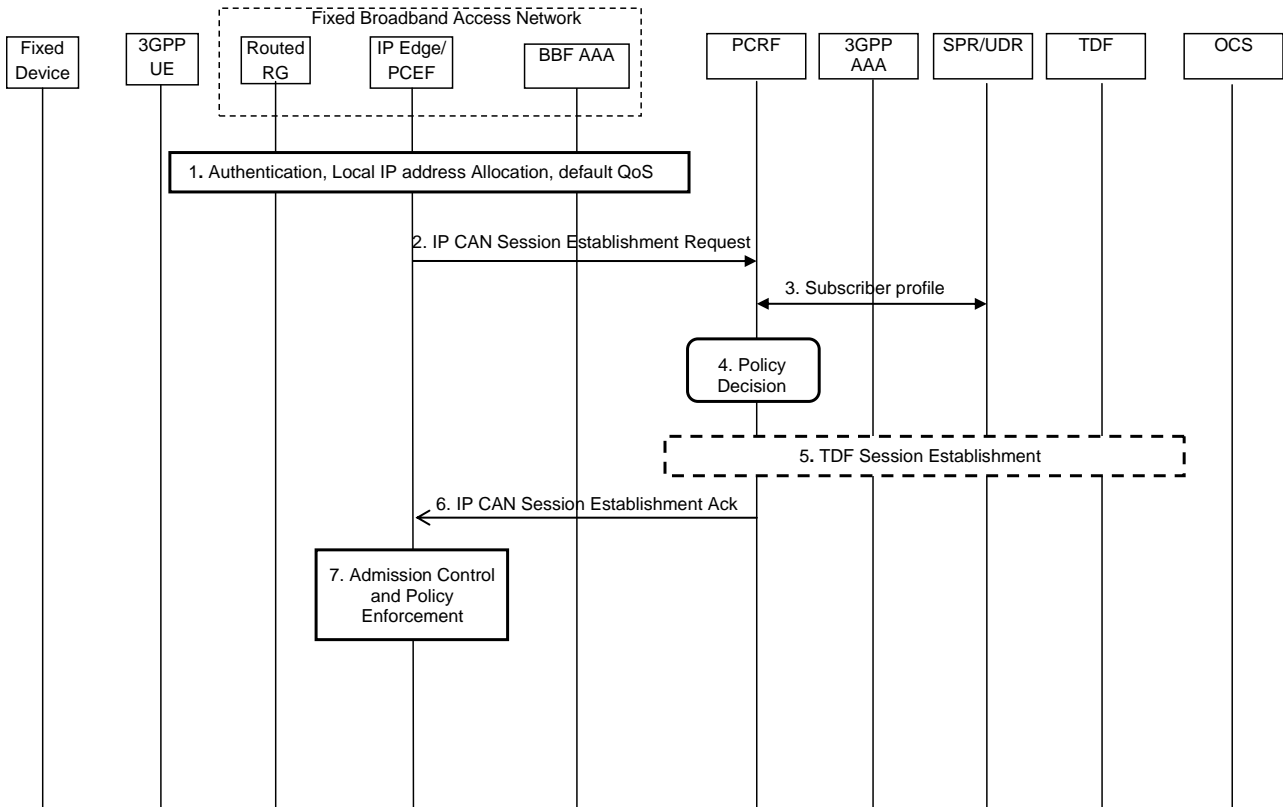
Figure 5.1.1.3.2-2: IP-CAN session establishment procedure for RG operating in Routed mode

1. The Routed RG accesses to the network and performs BBF access authentication. The BBF AAA returns the default QoS for the Fixed Subscriber Session of the Routed-RG to the IP Edge. The IP Edge assigns a Local IP address to the RG. This step is BBF specific and as such out of scope of this specification.

2. The IP Edge/PCEF triggers the establishment of the IP-CAN session over Gxd for the Fixed Subscriber Session of the Routed-RG with the PCRF. The message includes Subscriber-ID (e.g. Circuit ID), the RG Local IP address, default QoS for the fixed access session.

Editor's note: The specific Subscriber ID information used is FFS.

3. The PCRF obtains the subscriber's profile related to the RG from the SPR/UDR.

Editor's note: Enhancement to the subscriber profile in SPR/UDR for fixed devices and fixed access line is FFS.

4. The PCRF makes policy decision and derives PCC rules. The PCRF may change the default QoS of the subscriber which is received from the IP Edge/PCEF.

5. For the solicited application reporting, the PCRF requests the TDF to establish the relevant session towards PCRF and provides ADC rules to the TDF.

6. The PCRF provides the PCC rules at the IP Edge/PCEF. In this step the PCRF may include the following information: Default QoS, the PCC Rules and the Event Triggers to report. The Event Triggers indicate to the IP Edge/PCEF what events must be reported to the PCRF.

7. The IP Edge/PCEF performs admission control and resource allocation based on the PCC rules.

Editor's note: Whether additional parameters are required for BBF access session is FFS.

5.1.1.3.2.3 Routed RG with 3GPP UE performs 3GPP-based authentication

This clause describes the signalling flow for Gxd IP-CAN Session establishment in the case of RG acting as routed mode and 3GPP UE performs 3GPP-based authentication. The session is initiated when RG and 3GPP UE accesses to the network.
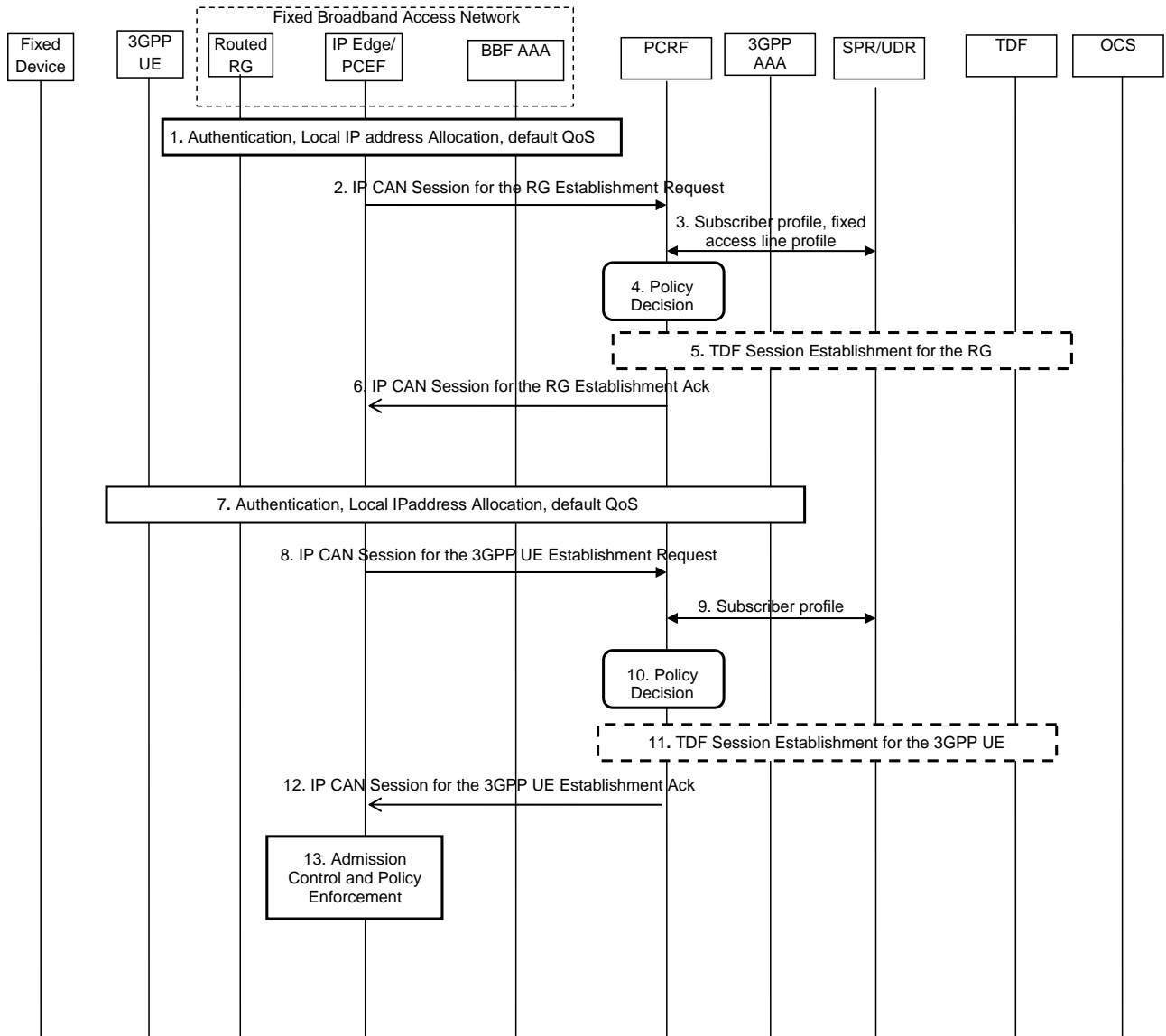
Figure 5.1.1.3.2-3: IP-CAN session establishment procedure RG operating in routed with 3GPP UE performing authentication

1. The Routed RG accesses to the network and performs access authentication. The BBF AAA returns the default QoS for the Fixed Subscriber Session of the Routed-RG to the IP Edge. The IP Edge assigns a Local IP address to the RG. This step is BBF specific and as such out of scope of this specification.

2. The IP Edge/PCEF triggers the establishment of the IP-CAN session over Gxd for the Fixed Subscriber Session of the Routed-RG with the PCRF. The message includes Subscriber-ID(e.g. the RG ID, Circuit ID), the RG Local IP address, default QoS for the fixed access session.

3. The PCRF obtains the subscriber's profile related to the RG from the SPR/UDR.

Editor's note: Enhancement to the subscriber profile in SPR/UDR for fixed devices and fixed access line is FFS.

4. The PCRF makes policy decision and derives PCC rules. The PCRF may change the default QoS of the subscriber which is received from the IP Edge/PCEF.

5. For the solicited application reporting, the PCRF requests the TDF to establish the relevant session for the RG towards PCRF and provides ADC rules to the TDF.

6. The PCRF provides the PCC rules at the IP Edge/PCEF. In this step the PCRF may include the following information: Default QoS, the PCC Rules and the Event Triggers to report. The Event Triggers indicate to the IP Edge/PCEF what events must be reported to the PCRF.

The following steps 8-16 are IP-CAN session establishment for the 3GPP UE in case that RG acts as Routed mode and the BBF device supports 3GPP-based authentication.

7. When 3GPP UE access to the network via the Routed-RG, if the RG supports 3GPP-based authentication, the authentication procedure is performed in 3GPP UE, RG, IP Edge, BBF AAA and 3GPP AAA.. After successful authentication, default QoS for the 3GPP UE is returned to the IP Edge.

8. The IP Edge/PCEF triggers the establishment of the IP-CAN session over Gxd for the NSWO traffic of the 3GPP UE with the PCRF. The message includes the Subscriber-ID (e.g. 3GPP UE IMSI, Circuit ID) , the UE Local IP address, the UDP port for RG in routed mode with NAT, default QoS, the IP-CAN type.

9. The PCRF obtains the subscriber's profile related to the 3GPP UE from the SPR/UDR.

10. The PCRF makes policy decision and derives PCC rules for the NSWO traffic based on the subscription of the 3GPP UE. The PCRF may change the default QoS of the subscriber which is received from the IP Edge/PCEF.

11. For the solicited application reporting, the PCRF requests the TDF to establish the relevant session for the 3GPP UE towards PCRF and provides ADC rules to the TDF.

12. The PCRF provides the PCC rules at the IP Edge/PCEF. In this step the PCRF may include the following information: Default QoS, the PCC Rules and the Event Triggers to report. The Event Triggers indicate to the IP Edge/PCEF what events must be reported to the PCRF.

13. The IP Edge shall bind the IP-CAN session for the NSWO traffic of 3GPP UE to the Subscriber Session of Routed-RG based on the UE Local IP address. The IP Edge/PCEF performs admission control and resource allocation based on the default QoS of RG when PCRF provides the PCC rules for the Fixed Devices and/or NSWO traffic of 3GPP UE to the IP Edge/PCEF. The IP Edge may also communicate with other network elements in the BBF access network according to BBF specifications and is out of scope of 3GPP.

Editor's note: Whether additional parameters are required for BBF access session is FFS.

NOTE 1: How the IP Edge performs QoS enforcement in fixed broadband network is out of the scope of 3GPP and in case of BBF defined network is specified by BBF.

NOTE 2: The IP Edge performs the mapping between the QoS rules and the parameters specific in BBF network.

5.1.1.3.3 PCRF Initiated IP-CAN Session Modification

This procedure is applicable when the PCRF initiated an IP-CAN session modification initiated by PCRF for Fixed Subscriber Session for N3GPP User equipment to provision new PCC/ADC Rules or modify PCC/ADC rules over Gxd/Sd interfaces for traffic from N3GPP User Equipment in the Fixed Broadband Access. The AF can be involved.

The roaming scenario is not applicable for the Fixed Subscriber Session.

Editor's note: The steps related to accounting and charging data collection for AAA-based, PCC-based and TDF-based are FFS and not shown in the diagram flow.

Figure 5.1.1.3.3-1: PCRF initiated IP-CAN Session Modification

1a. The AF requests QoS resource authorization. The request includes the bandwidth requirements, media type, session priority and other information according to TS 23.203 [4].

1b. The SPR notifies the PCRF when the user's profile changes.

1c The same step as step 1b in TS 23.203 [4] procedure in clause 7.5

Alternatively, the PCRF may initiate this procedure based on PCRF internal logic.

2a, 2b. The PCRF for non-roaming cases or the V-PCRF for roaming cases makes the authorization and policy decision.

3. The PCRF modifies the TDF session by sending the new/updated ADC Rules to the TDF as step 5 in TS 23.203 [4] procedure in clause 7.5.

4 the PCRF sends the Policy and Charging Rules provision to the PCEF located in the IP edge. The PCRF may include the following information: the QoS Rules and the Event Triggers to report. The Event Triggers indicate to the IP Edge(PCEF) what events must be reported to the PCRF.

Editor's note: Whether additional information is required in IP-CAN session modification message, it is FFS.

5. The IP edge enforces the PCC rules in the fixed broadband network.

NOTE 1: How the IP Edge performs QoS enforcement in fixed broadband network is out of the scope of 3GPP and in case of BBF defined network is specified by BBF.

NOTE 2: The IP Edge performs the mapping between the QoS rules and the parameters specific in BBF network.

6. PCEF responds with an acknowledgment.

7.a. If the AF requested it, the PCRF notifies the AF (e.g. transmission resources are established/released/lost).

7.b. The AF acknowledges the notification from the PCRF.

5.1.1.3.4 PCEF Initiated IP-CAN Session Modification

The procedure is applicable for N3GPP User Equipment when the IP Edge(PCEF) makes a decision to request a modification of QoS rules. The trigger to start the modification procedure by PCEF can be a provisioned event-trigger by the PCRF or a BBF specific trigger. This procedure is applicable for the cases in Bridged RG, Routed RG and Routed RG 3GPP UE performs 3GPP-based authentication.

The roaming scenario is not applicable for the Fixed subscriber session.

Editor's note: The steps related to accounting and charging data collection for AAA-based, PCC-based and TDF-based are FFS and not shown in the diagram flow.
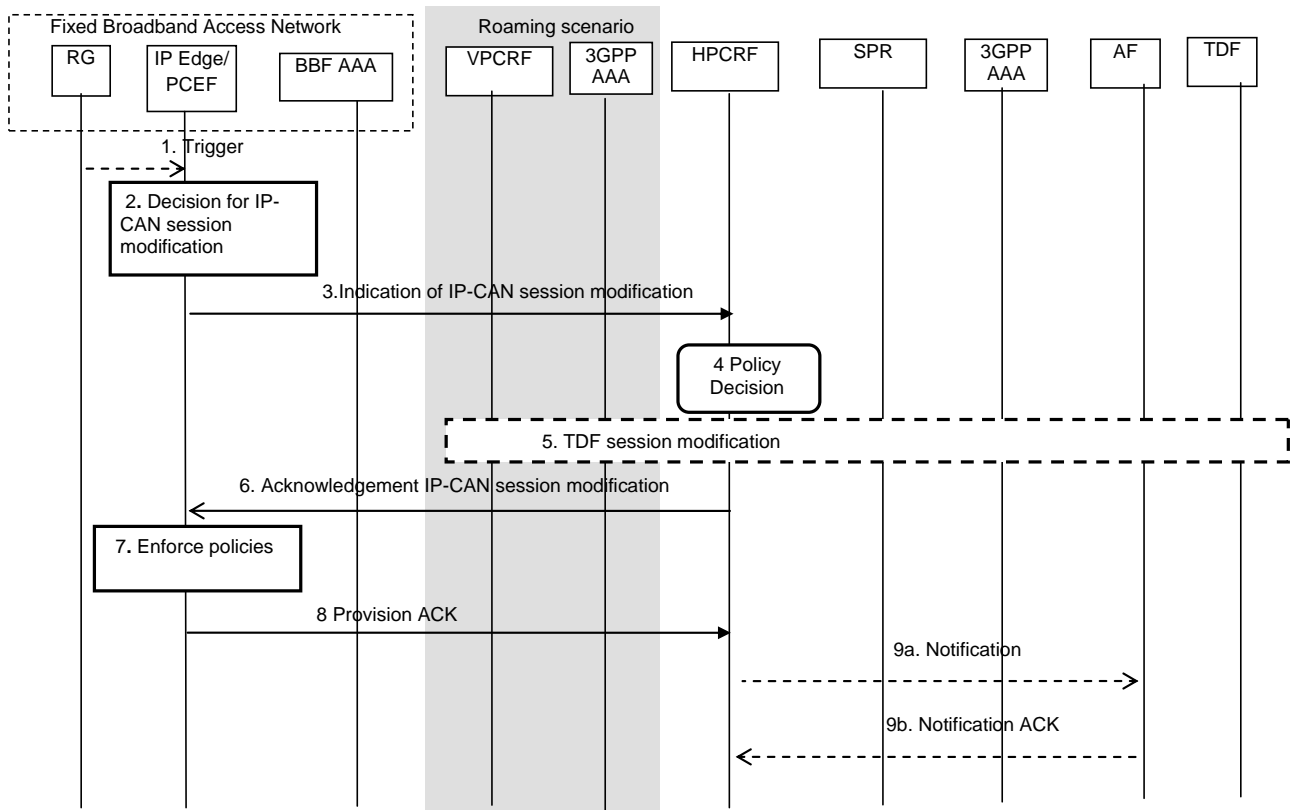
Figure 5.1.1.3.4-1: PCEF-initiated IP-CAN Session Modification

The IP Edge(PCEF) may receive a trigger to modify an QoS for Fixed Subscriber session, for example due to partial network failure or other specific triggers.

Editor's note: The list of applicable even triggers from TS 23.203 [4] plus additional BBF specific event-triggers is FFS.

2. The IP Edge(PCEF) initiates the session modification procedure either caused by previous step or based on internal decision.

3 The PCEF send the Indication of IP-CAN session modification to the PCRF. The message includes the Event Report, affected QoS Rules, Subscription ID.

Editor's note: The detailed list of parameters applicable to Fixed Subscriber session and to NSWO included in the message request is FFS.

4. The PCRF makes policy decisions and derives new or modified PCC rules.

5. The PCRF provisions new/updated ADC Rules at the TDF as defined in steps 11 and 12 of TS 23.203 [4] procedure in clause 7.3.2.

6. The PCRF provisions QoS rules at the PCEF.

Editor's note: The detailed list of parameters applicable to Fixed Subscriber session and to NSWO included in the message request is FFS.

7. The IP edge enforces the PCC rules on the fixed broadband network.

NOTE 1: How the IP Edge performs QoS enforcement in fixed broadband network is out of the scope of 3GPP and in case of BBF defined network is specified by BBF.

NOTE 2: The IP Edge performs the mapping between the QoS rules and the parameters specific in BBF network.

8. The PCEF may respond to the session modification trigger according to BBF specification.

9.a. If the AF requested it, the PCRF notifies the AF (e.g. transmission resources are established/released/lost).

9.b. The AF acknowledges the notification from the PCRF.

5.1.1.3.5 PCEF initiated IP-CAN Termination

The procedure is applicable when PCEF initiated the termination of the IP-CAN session. The detection of session termination by IP Edge/PECF is BBF specific (e.g. RG switch off, PPPoE session termination, etc). This procedure is applicable for the cases in Bridged RG, Routed RG and Routed RG 3GPP UE performs 3GPP-based authentication.

The roaming scenario is not applicable for the Fixed subscriber session.

Editor's note: The steps related to accounting and charging data collection for AAA-based, PCC-based and TDF-based are FFS and not shown in the diagram flow.
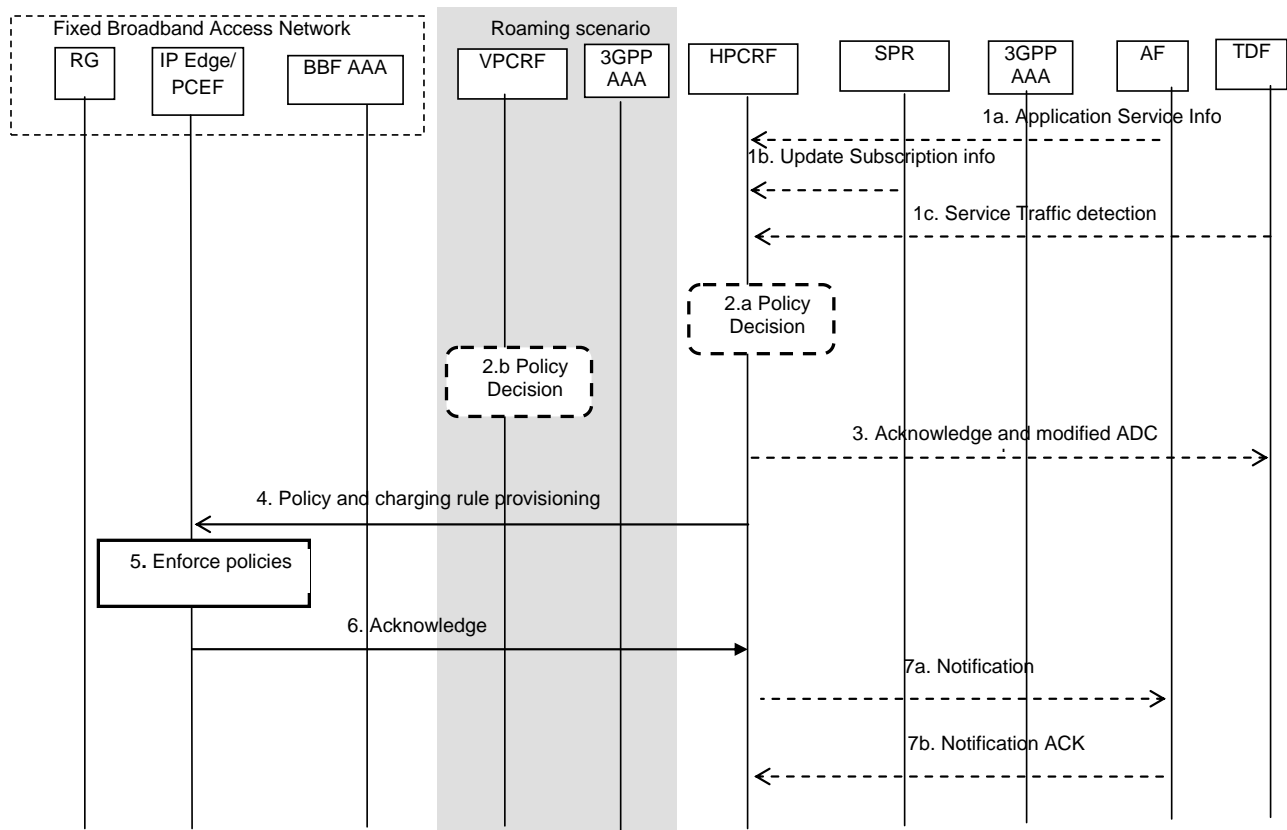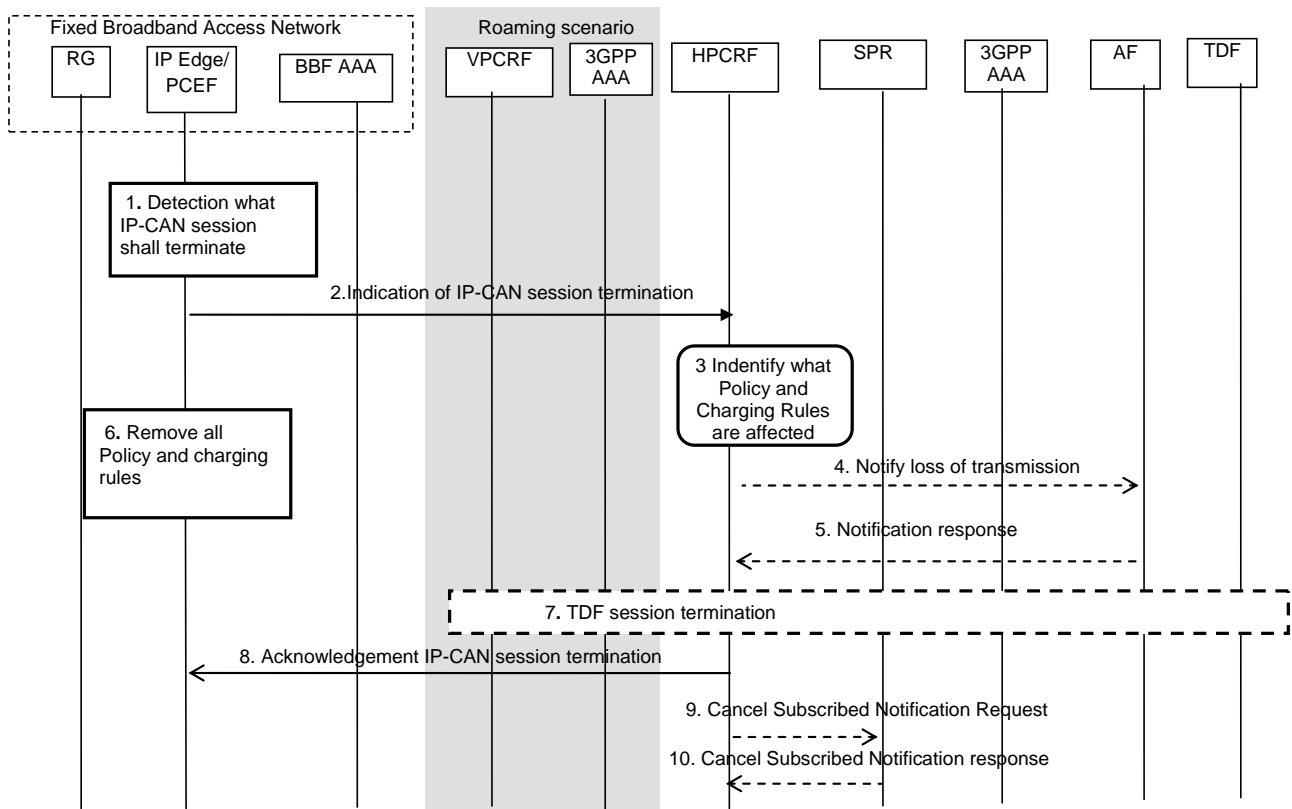

Figure 5.1.1.3.5-1: PCEF Initiated IP-CAN Session Termination

1. The PCEF may receive a request to terminate the IP-CAN session with the PCRF based on triggers specific of the fixed broadband network (both external and internal to the IP Edge) for example due to termination of fixed subscriber session, power off of RG, etc.

Editor's note: The list of applicable even triggers from TS 23.203 [4] plus additional BBF specific event-triggers is FFS.

NOTE 1: How the IP Edge detects or is informed that fixed subscriber session and/or 3GPP UE connection is terminated is BBF specific and is out of the scope of 3GPP.

2. The IP Edge (PCEF) initiates the IP-CAN Session termination procedure and provides the relevant information to the PCRF.

Editor's note: The detailed list of parameters applicable to Fixed Subscriber session and to NSWO included in the message request is FFS.

3. The PCRF identifies the affected rules.

4. The PCRF notify the AF that there are no transmission resources for the service, if this is requested by the AF.

5. The AF acknowledges the notification of loss of transmission.

6. The IP Edge(PCEF) removes the PCC rules associated with the IP-CAN session.

7. The PCRF terminates the session with the TDF as defined in steps 10 and 11 of TS 23.203 [4] procedure in clause 7.3.1.

8. The PCRF acknowledges IP-CAN session termination.

9. The PCRF sends a cancellation notification request to the SPR if it has subscribed such notification.

NOTE 2: Step 7 may be initiated any time after step 5.

10. The SPR sends a response to the PCRF.

5.1.1.3.6 Update of the subscription information in the PCRF

The procedure is applicable when subscriber profile information are modified in SPR

The roaming scenario is not applicable for the Fixed subscriber session.
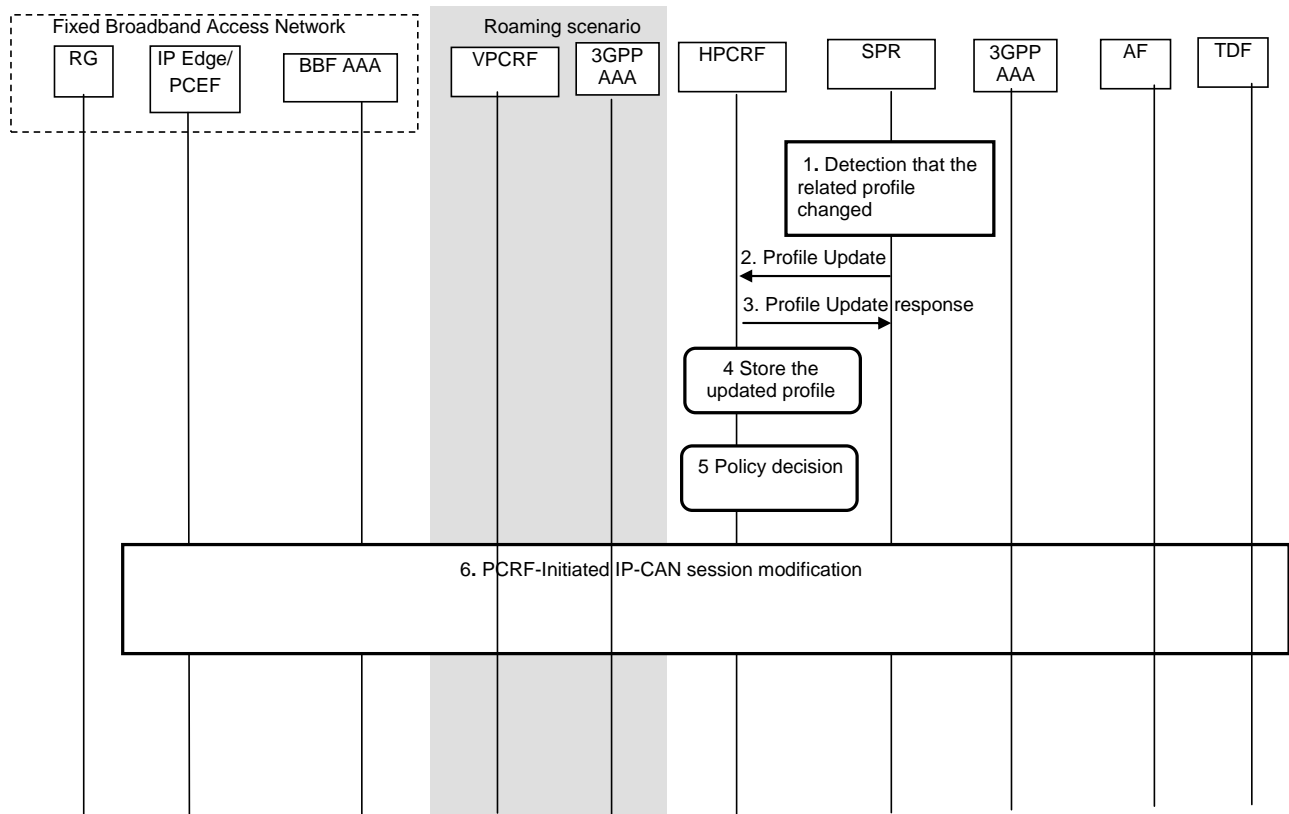
Figure 5.1.1.3.6-1: Update of the subscription information in the PCRF

1) The SPR detects that the subscriber's profile changed.

Editor's note: Enhancements to the subscriber profile for BBF access is FFS.

2) The SPR notifies the PCRF of the profile change provided the PCRF subscribes to notification event(s).

3) The PCRF responds to the SPR notification message.

4) The PCRF stores the updated profile.

5) The PCRF indentifies the rules affected and derives new/modified ones.

6) The PCRF initiates the IP-CAN Session Modification procedure as defined in clause 5.1.1.y.2.

5.1.2 Evaluation of solutions for Key Issue #1

Three different solutions for key issue #1 are captured above. Two of the solutions (solution 1 and solution 3) require that the IP Edge can identify traffic from devices (3GPP UEs or fixed devices) behind a routed mode RG with NAT. Although a solution for this requirement is being discussed in BBF and IETF, it is not clear when such a solution may become available. Furthermore, solutions 1 and 3 will have impact to fundamental PCC concepts (e.g. the IP-CAN session definition).

Solution 2 assumes that only the Subscriber IP Session in the IP Edge is identified. The solution does not rely on means for the IP Edge to identify devices behind a routed mode RG with NAT. However, the solution 2 supports limited QoS control for fixed devices and for offloaded traffic from 3GPP UEs behind the RG. In particular, subscriber based PCC policies for devices behind a NAT cannot be provided. Policy control for dynamic services (Rx based) can however be provided in certain scenarios also for the devices behind the NAT, e.g. using similar techniques as in IMS.

5.1.3 Conclusion on Key Issue #1

Solution Alternative 2 to key issue #1 is chosen as the basis for the solutions to progress the study work in this Building Block.

5.2 Architectural requirements and assumptions

General assumptions:

- The definition of AAA functionality for authentication of the fixed access line (access line authentication) or fixed access session (e.g. PPPoE or IP Session) is out of scope of 3GPP.

- The authentication procedure of the Fixed Devices in a BBF access network is performed according to BroadBand Forum specifications and is therefore considered out of the scope of 3GPP.

- The authentication procedure of a 3GPP UE connected to a fixed broadband access network is defined by TS 33.402 [19].

General requirements:

- PCRF shall control directly the IP Edge in the fixed broadband access without the mediation of the BPCF defined in TS 23.139 [20].

- 3GPP PCC shall support the enforcement of QoS policies for IP traffic exchanged by fixed devices in the fixed broadband access.

- 3GPP PCC shall support the enforcement of QoS policies of NSWO traffic exchanged by 3GPP UEs connected to the fixed broadband access via WLAN.

- Only policy and charging control for Subscriber IP sessions will be considered, while policy control and charging for Layer 2 sessions is out of the scope of BB1.

- More than one fixed access Subscriber IP session (e.g. a PPPoE session) can be supported per fixed access line (e.g. RG).

- A device connected to the RG (e.g. VoIP phones) may also initiate a Subscriber IP session when the RG is configured in bridge mode or when the PPP pass-through feature is enabled on the Routing RG (see requirement R-10 in TR-124 Issue 3 [13]).

- The subscription information included in the user profile shall enable the support of fixed devices (e.g. identifiers, maximum subscribed bit rate, etc.) required for policy and charging control purposes.

- The SPR or UDR stores subscription information related to policy control for fixed devices and fixed access line for QoS and charging purposes.

- Policy control will address both dynamic and pre-provisioned policies in the IP Edge.

General architectural assumptions:

- There is a direct interface between PCRF and IP Edge.

- The IP Edge is the policy enforcement point for QoS in the fixed access network.

NOTE 1: How the IP Edge performs policy enforcement and binding if Gxd sessions with PPPoE or IP sessions in the BBF access is out of scope of 3GPP.

- The IP-CAN session definition from TS 23.203 [4] apply also to Fixed Broadband Access IP-CAN. In particular this implies:

- There is an IP-CAN session with a corresponding Subscriber IP session on the IP Edge per IPv4 address and/or IPv6 address or IPv6 prefix known in the PCEF.

NOTE 2: For routed mode RG with NAT, there is one IP-CAN session with a corresponding Subscriber IP session on the IP Edge for the IPv4 address and/or IPv6 address or IPv6 prefix assigned to the RG

NOTE 3: In case of routed mode RG when the PPP pass-through feature is enabled (see requirement R-10 in TR-124 Issue 3 [13]) there is an IP-CAN session for the single fixed device starting the PPP session. In this case the 3GPP UE does not have Subscriber IP session in IP Edge

NOTE 4: For bridged mode RG, there is one IP-CAN session with a corresponding Subscriber IP session on the IP Edge for each IPv4 address and/or IPv6 address or IPv6 prefix assigned to the fixed device or 3GPP UE which established a Subscriber IP session in fixed broadband network.

NOTE 5: For routed mode RG with IPv6 when stateless IPv6 address autoconfiguration is used by the end-device behind the RG, there is one IP-CAN session with a corresponding Subscriber IP session on the IP Edge for the IPv6 prefix assigned to the RG. When stateful IPv6 address configuration is used by the end-devices, there may be scenarios for one IP-CAN session per end-device. There may be scenarios for one Subscriber IP session on the IP Edge with a corresponding IP-CAN session per end-device.

- Per IP-CAN session there is a single subscriber in SPR/UDR. This is the UE identity that identifies the RG, the 3GPP UE or the fixed device.

NOTE 6: The identification information for 3GPP UE is the IMSI.

NOTE 7: For routed mode RG, the successful completion of 3GPP-based access authentication and assignment of IP address to the 3GPP UE does not result in any IP-CAN session establishment if the IP address assignment does not result in a new Subscriber IP Session in the IP Edge. In this case the pre-existent IP-CAN session for the RG is used. More considerations with respect to a routed mode RG can be referred to Annex A.

Editor's note: It is FFS whether there will be support in this Building Block to identify, in the PCC framework, end-user devices behind a routed mode RG.

- The IP Edge shall be able to enforce policies and to perform the appropriate mapping from QoS parameters it receives from the PCRF to BBF specific parameters.

- It shall be possible to apply QoS control on a per service data flow basis in the PCEF located in IP Edge according to TS 23.203 [4] requirements

- The PCEF located in IP Edge shall be able to detect event triggers provisioned by the PCRF.

- Upon detection of an event, the PCEF located in IP Edge shall request policy rules re-authorisation from the PCRF.

Editor's note: The list of applicable even triggers from TS 23.203 [4] plus additional BBF specific event-triggers is FFS.

Architectural assumptions for "Default QoS policy".

- The BBF AAA may provide a default Access Profile QoS for the subscriber IP session that may contain QoS information. If TDF is deployed in the network for application detection and control, then the 3GPP and BBF AAA shall be configured in such a way that a default Access Profile QoS does not conflict with the policies enforced by the TDF (e.g. bandwidth limitation which is part of Access Profile QoS would be higher than any possible bandwidth limitation value provided by the PCRF to the TDF for application detection and control).

- The PCRF may provide the default QoS for the IP subscriber session. . If TDF is deployed in the network for application detection and control, then the PCRF shall configure policies in such a way that default QoS does not conflict with the policies enforced by the TDF (e.g. the bandwidth limitation which is part of default QoS would be higher than any possible bandwidth limitation value provided by the PCRF to the TDF for application detection and control). The default QoS consists of a QCI and MBR. The PCEF located in the IP Edge shall be able to convert default QoS into Fixed Broadband Access QoS attribute values. The PCRF may provide a default QoS profile name if the default QoS profile is provisioned in the IP Edge/PCEF. In the IP Edge, the QCI is mapped into a DSCP code value or other transport specific information element and the MBR is used for bandwidth limitation for the DSCP code value.

- The PCEF located in the IP Edge shall enforce the default QoS, as specified above for both DSCP marking and bandwidth limitation, for all downlink and uplink traffic for the IP subscriber session unless the packets match a service data flow template in an active policy rule for which specific QoS enforcement actions are provided.

Editor´s note: Whether or not dynamic prioritization of resource requests as represented by the ARP will be performed by the PCEF and whether or not PCRF will provisioned the ARP as part of the default QoS is under discussion in the BBF.

Editor´s note: Whether Fixed Broadband parameters are also included as part of the default QoS is FFS.

- The architecture shall provide charging for traffic exchanged by fixed devices and NSWO traffic to/from 3GPP UEs in the following scenarios:

  - 3GPP PCC- Gy/Gz based charging with PCEF located in the fixed broadband access network;

  - Traffic Detection Function (TDF)-based charging;

  - AAA-based charging.

In this release of the specification, these charging options are mutually exclusive i.e. for a given deployment only one of these charging options applies. Exception is when PCEF and TDF perform both enforcement and charging for the same subscriber session, see also NOTE 14 for the clarification when this may be applicable.

NOTE 8: The charging option applicable in a given deployment is transparent for the UE.

NOTE 9: No charging interaction between the HPLMN and the Fixed Broadband Service Providers is possible when there is no IP-CAN session dedicated to a 3GPP UE in NSWO (e.g. the 3GPP UE is served by a RGW providing NAT).

NOTE 10: Inter operator settlements are assumed to ensure support of the case of an UE receiving NSWO over a Fixed Broadband Access (FBA), when the HPLMN and the FBA Service Provider are different.

For 3GPP PCC Gy/Gz- based and TDF-based charging there is one charging session per IP-CAN session.

NOTE 11: The relationship between an IP-CAN session and a terminal served by a Fixed Broadband access is detailed in NOTE 2 to NOTE 4.

NOTE 12: In case of AAA-based accounting the charging information send by PCRF over Gxd are not taken into consideration for accounting purposes.

NOTE 13: The AAA-based accounting for fixed device is not applicable in roaming scenario.

In this release in case of AAA-based charging the BBF AAA server is used for performing accounting of fixed device as defined by BBF specifications TR-101 [8], WT-146 [15] .

For the charging session, the user identifier is the same that is issued over the Gxd session

For any given UE IP-CAN session, either the IP Edge PCEF or the TDF shall be performing charging and policy enforcement, but not both.

NOTE 14: An operator may also apply this solution with both PCEF and TDF performing enforcement and charging for a single IP-CAN session as long as the network is configured in such a way that the traffic charged and enforced in the IP Edge PCEF does not overlap with the traffic charged and enforced by the TDF. In addition, the DL APN-AMBR and any UL maximum bit rate enforcement for the TDF session need to be configured with such high values that they don't result in discarded packets.

Charging for SDFs belonging to real time services shall be performed at the IP Edge PCEF.

NOTE 15: The definition of requirements for real time services in fixed broadband network are defined in BBF TR-126 [x].

In case of TDF performing charging and policy enforcement, the functionality supported over Gxd interface shall only include TDF address transfer to the PCRF, usage monitoring control functionality, BBF IP-CAN Type reporting, event triggers support for those event triggers which can be detected by the IP Edge/PCEF.

In case of PCEF performing charging and policy enforcement, the functionality supported over Sd interface shall only include application detection following the rules received from the PCRF (without policy enforcement and charging actions), usage monitoring control functionality for the detected applications, Application START/STOP event triggers support with the corresponding detected application information provided to the PCRF.

5.3   Reference architecture

Editor's Note: This clause describes common reference architecture for Policy control and charging solution for Building Block 1.

This architecture supports the scenario of a single network operator deploying both the 3GPP EPC and the BBF access network. Furthermore the architecture supports the roaming scenario between two PLMN operators.

The architectures in the following figures show only entities and interfaces that are in scope of the work and/or are impacted by BB 1.

In this release the BBF AAA server is used for fixed access session authentication as defined by BBF specifications TR-101 [8], WT-146 [15] and it out of the 3GPP scope. The SWa/STa reference points are not applicable for authentication of fixed devices.

The fixed device is only supported in non-roaming scenario.

The reference points internal to the Fixed Broadband access network are defined or are under definition by Broadband Forum and are out of the scope of this specification.

In non-roaming architecture shown in figures 5.3.1-1, 5.3.2-1 AND 5.3.3-1:

-    PCRF provisions PCC Rules to the PCEF located in the IP edge;

-    both a 3GPP UE and a fixed device may access IP services network, e.g. internet, AF, etc.;

-    the AF may be located in the 3GPP HPLMN or in the 3rd Party IP network that has agreements with HPLMN;

-    multiple TDFs may be deployed.

NOTE 1:   The reference point between the IP Edge to the TDF in EPC does not imply that the NSWO and Fixed traffic is EPC routed.

The following assumptions are made for non-roaming architecture regarding functionality in the BBF Access Network:

-    the BBF network routes the offloaded traffic subject to packet inspection and the offloaded traffic not subject to packet inspection via the same TDF; or

- the BBF network may be configured in such a way that the traffic determined to be subject to packet inspection is routed via the TDF. Traffic that is not subject to for packet inspection may physically bypass the TDF.

Editor's note: The support of differentiating routing handling for the traffic is subjected for packet inspection and the traffic not subjected for packet inspection by BBF access network requires further study in Broadband Forum.

In roaming architecture shown in figures 5.3.1-2, 5.3.2-2 and 5.3.3-2:

- V-PCRF provisions PCC Rules to the PCEF located in the IP edge;

- the AF may be located in the 3GPP HPLMN or external IP network;

- both a 3GPP UE and a fixed device may access IP services network, e.g. internet, AF etc.;

- the TDF function, if present, is located in the 3GPP VPLMN;

- multiple TDFs may be deployed.

NOTE 2: The reference point between the IP Edge and the TDF in EPC does not imply that the NSWO and Fixed traffic are EPC routed.

The following assumptions are made for roaming scenario regarding functionality in the BBF Access Network:

- the BBF network routes the offloaded traffic subject to packet inspection and the offloaded traffic not subject to packet inspection via the same TDF located in VPLMN; or

- the BBF network may be configured in such a way that the traffic determined to be subject to packet inspection is routed via the TDF in VPLMN. Traffic that is not subject to for packet inspection may physically bypass the TDF.

Editor's note: The support of differentiating routing handling for the traffic is subjected for packet inspection and the traffic not subjected for packet inspection by BBF access network requires further study in Broadband Forum.

5.3.1 Reference architecture for Policy Control and TDF based charging

Editor's note: This clause describes reference architecture which includes both QoS handling and TDF based charging solution.
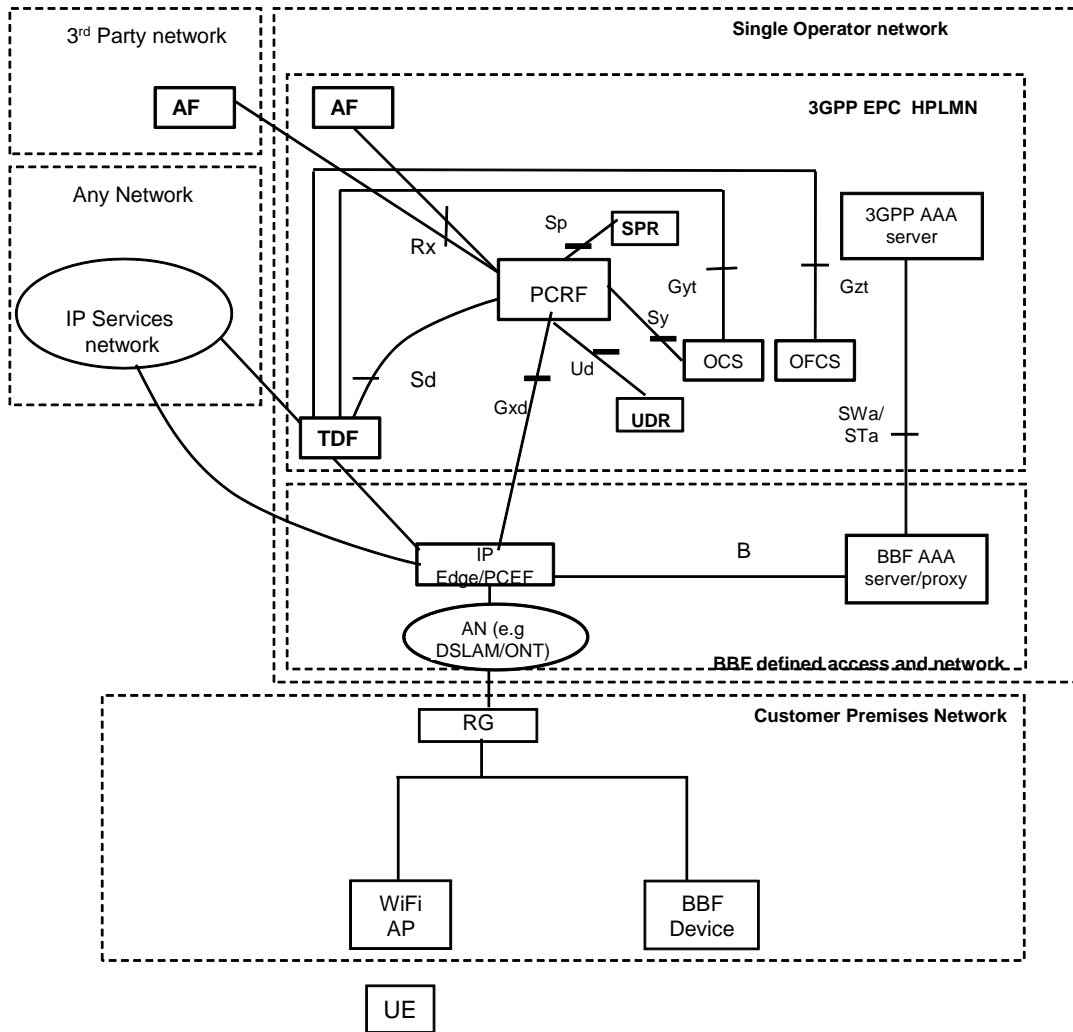
Figure 5.3.1.-1: Non-roaming architecture for policy Control and TDF based charging for traffic exchanged by fixed devices and NSWO traffic to/from 3GPP UEs

In this architecture:

- PCRF provisions ADC rules to the TDF over Sd interface or to the enhanced IP Edge PCEF over Gxd for application detection and control and charging control of 3GPP UEs' offloaded traffic and of fixed device traffic.

Editor's note: The assumption that IP Edge PCEF can be enhanced with ADC must be verified with BBF.
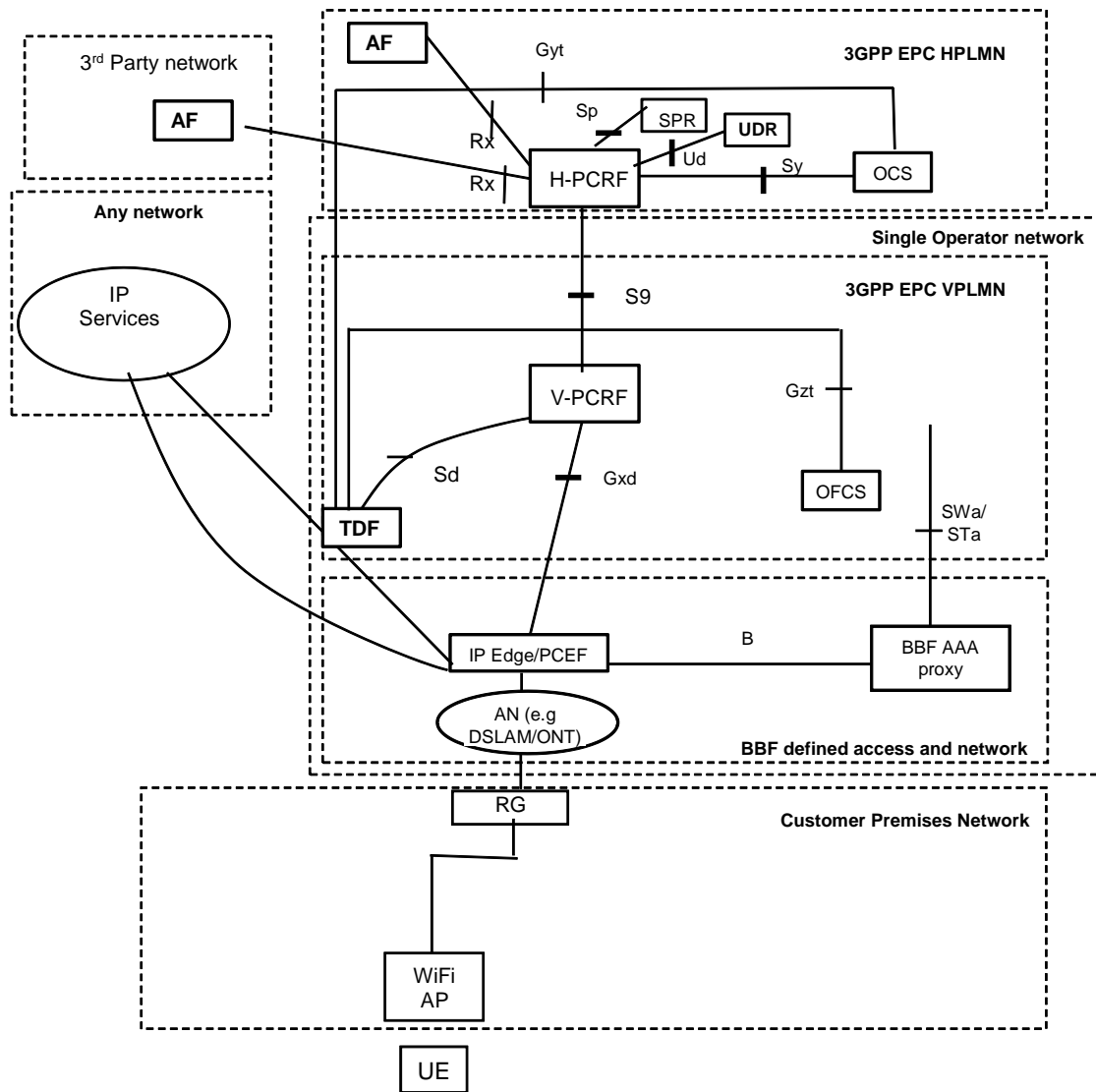
Figure 5.3.1.-2: Roaming architecture for policy control and TDF based charging for NSWO traffic to/from 3GPP UEs

In this architecture:

- V-PCRF provisions ADC rules to the TDF over Sd interface or to the enhanced IP Edge PCEF over Gxd for application detection and control and charging control of 3GPP UEs' offloaded traffic.

- When UDC architecture is used, SPR and Sp, wherever mentioned in this document, can be replaced by UDR and Ud.

NOTE: Either SPR or UDR is used in this architecture.

Editor's note: The assumption that IP Edge PCEF can be enhanced with ADC must be verified with BBF.

5.3.2 Reference architecture for policy control and 3GPP PCC- Gy/Gz based charging with PCEF located in the fixed broadband access network

Editor's note: This clause describes reference architecture which includes both QoS and Gy/Gz based charging solution with PCEF located in the fixed broadband access network.
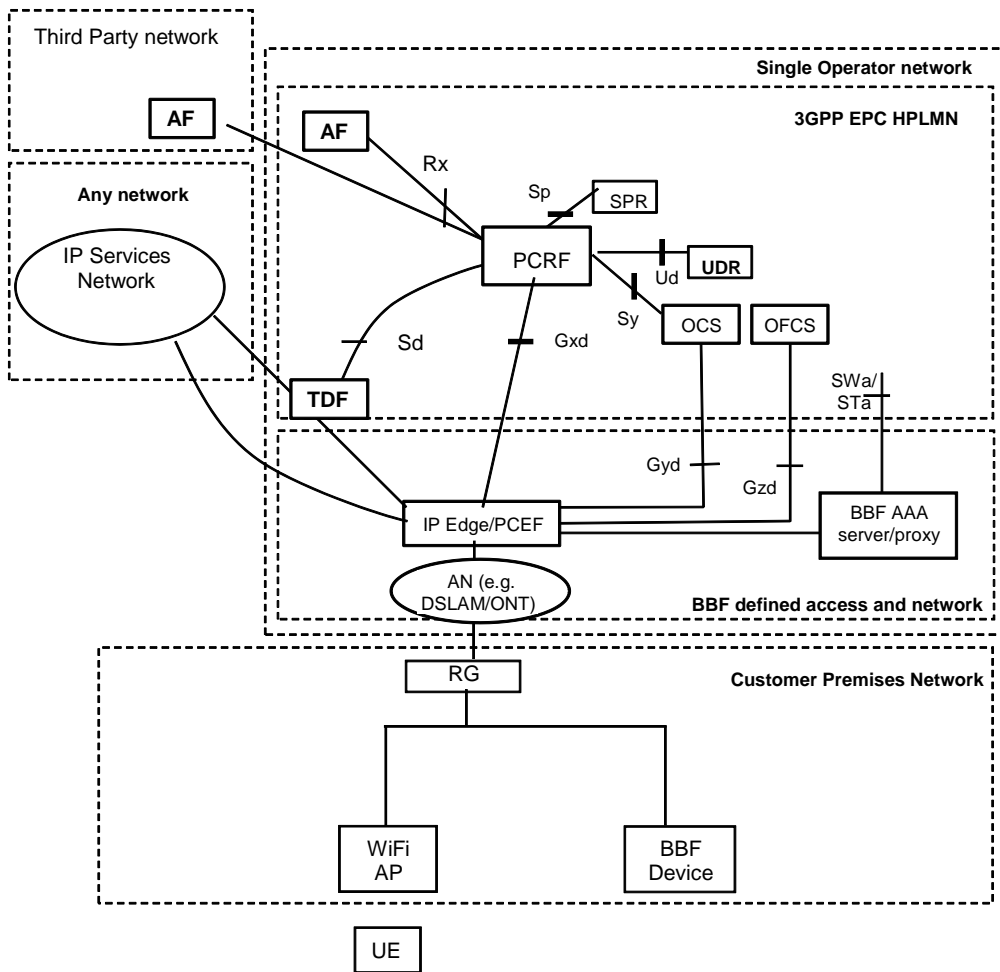
Figure 5.3.2-1: Non-roaming architecture for policy control and with 3GPP PCC- Gy/Gz based charging with PCEF located in the fixed broadband access network

In this architecture:

- PCRF provisions PCC rules to the PCEF in the IP Edge over Gxd interface for policy and charging control of 3GPP UEs' offloaded traffic and of fixed device traffic.
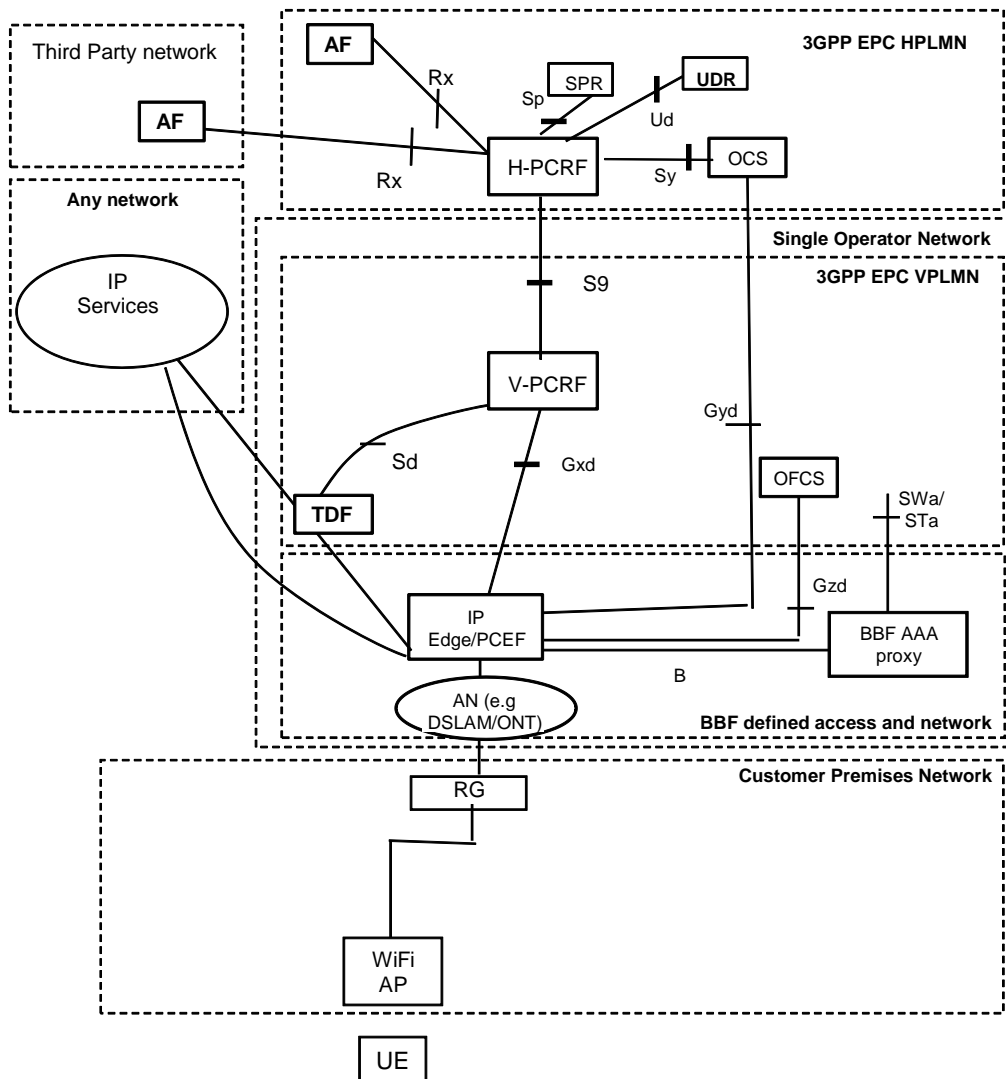
Figure 5.3.2-2: Roaming architecture for policy control and 3GPP PCC- Gy/Gz based charging with PCEF located in the fixed broadband access network

In this architecture:

- V-PCRF provisions PCC rules to PCEF in the IP Edge over Gxd interface for policy and charging control of 3GPP UEs' offloaded traffic.

5.3.3 Reference architecture for policy control and AAA based charging for traffic exchanged by fixed devices and NSWO traffic to/from 3GPP UEs

This clause describes reference architecture which includes both Policy Control and AAA based charging solution.
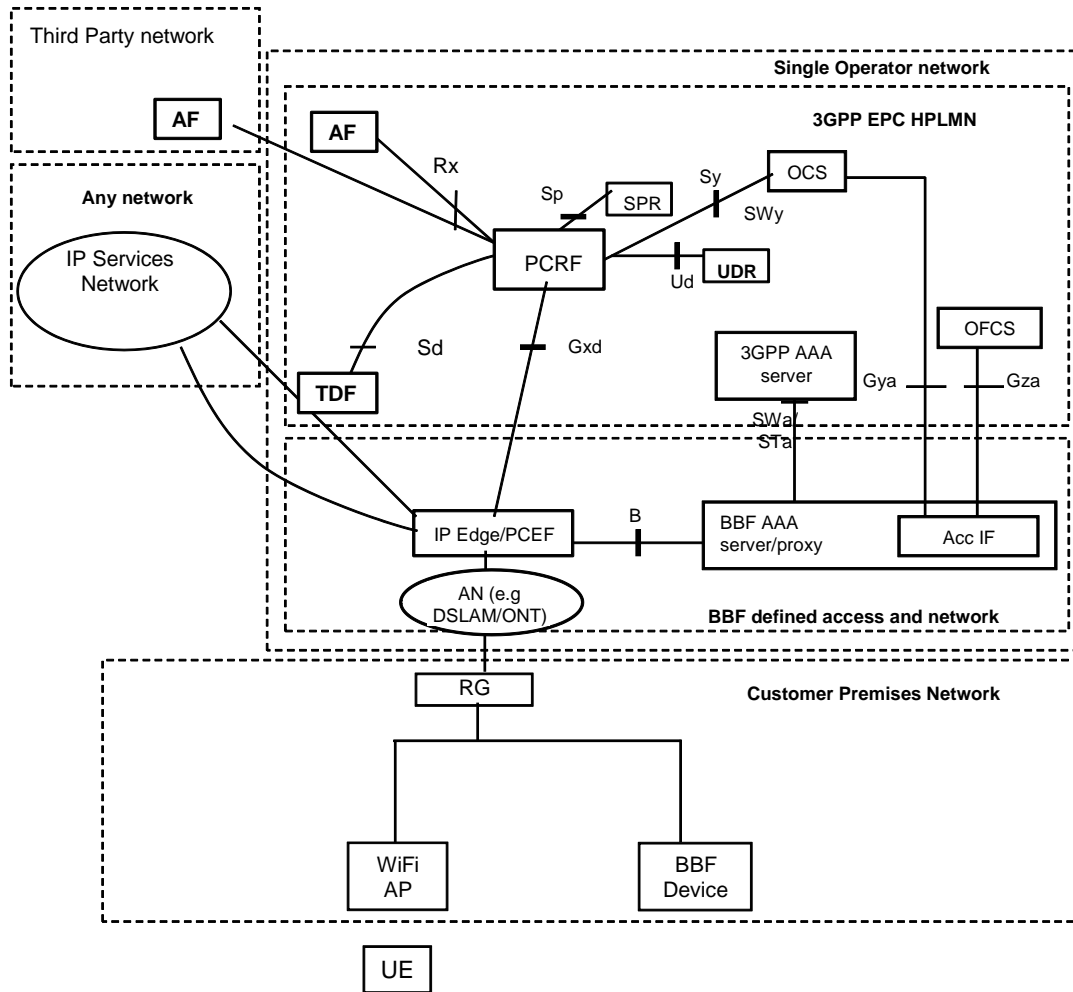
Figure 5.3.3-1: Non roaming architecture for policy control and AAA based charging using RADIUS/Diameter Accounting signalling for traffic exchanged by fixed devices and NSWO traffic to/from 3GPP UEs
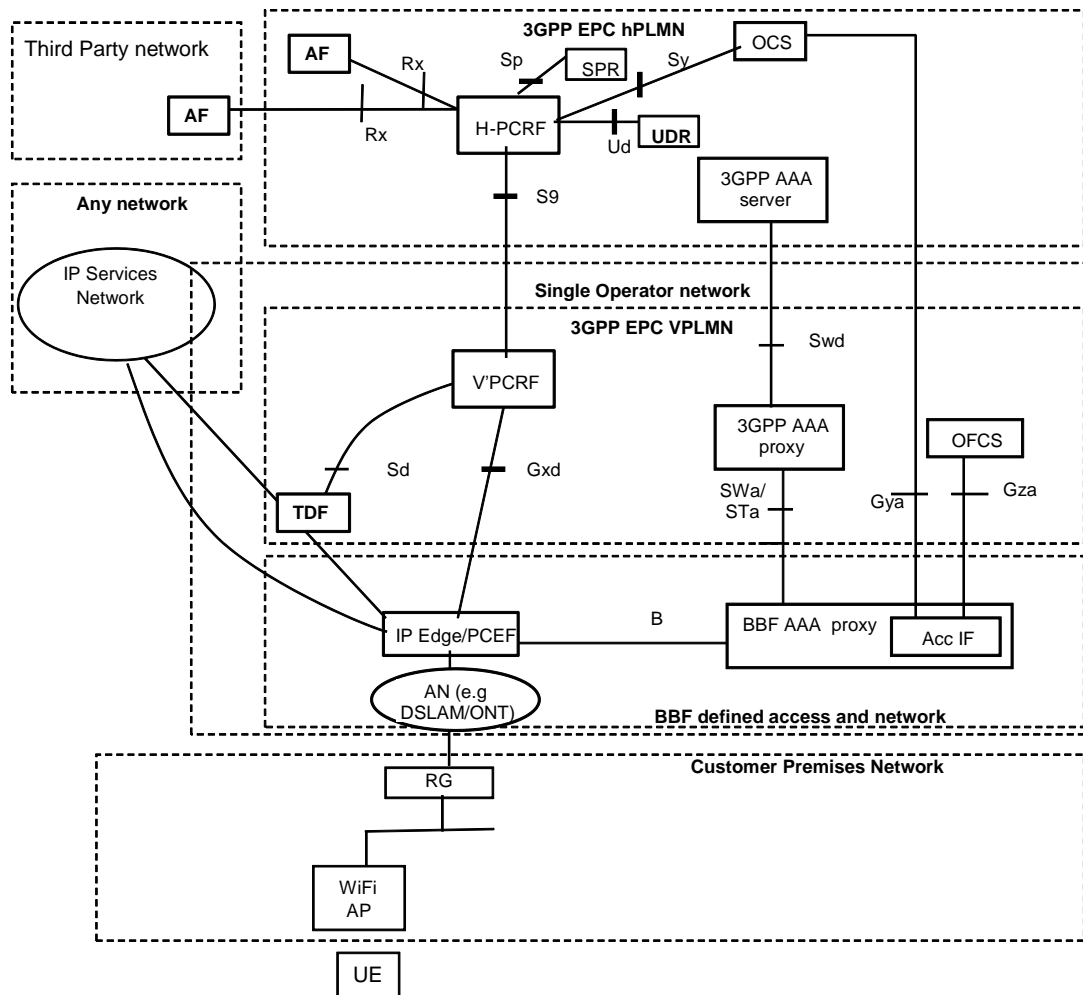
Figure 5.3.3-2: Roaming architecture for policy control and AAA based charging using RADIUS/Diameter Accounting signalling for NSWO traffic to/from 3GPP UEs

In this architecture:

- the B reference point transfers accounting information related to the Fixed device and to the NSWO 3GPP UE from the IP Edge to the BBF AAA server.

- the accounting for Fixed device is not applicable in roaming scenario.

- the Accounting Interworking Function collocated or not with the BBF AAA interacts with both the OCS and/or the OFCS.

5.4 Reference points

The reference point Rx, SWd are defined in TS 23.203 [4].

Gxd For the purpose of convergence between 3GPP and BBF network it transfers PCC rules and usage monitoring from the Home PCRF to the PCEF in the IP Edge in non-roaming scenario and from the Visited PCRF to the IP Edge in roaming scenario.

Sd The functionality is defined in TS 23.203 [4], including usage monitoring support over Sd. For the TDF based charging outlined in the clause 5.3.1.2.1, the Sd reference point additionally enables transfer of the charging policies from the H-PCRF and the V-PCRF to the TDF.

SWa For the purpose of convergence between 3GPP and BBF network it transports the authentication, authorisation n for the 3GPP UE in a secure manner.

STa   For the purpose of convergence between 3GPP and BBF network it transports the authentication, authorisation for the 3GPP UE in a secure manner.

Sp   For the purpose of convergence between 3GPP and BBF network it transfers User profile information from SPR to PCRF.

Ud   For the purpose of convergence between 3GPP and BBF network it transfers User profile information from UDR to PCRF.

Gyd   For the purpose of convergence between 3GPP and BBF network it transfers Charging information from the PCEF in IP Edge to the OCS in Home network

Gzd   For the purpose of convergence between 3GPP and BBF network it transfers charging information from the PCEF in IP Edge to the OFCS in Home network in non-roaming scenario and in Visited network in roaming scenario

Gyt   For the purpose of convergence between 3GPP and BBF network it transfers Charging information from the TDF to the OCS in Home network in non-roaming scenario and in Visited network in roaming scenario

Gzt   For the purpose of convergence between 3GPP and BBF network it transfers Charging information from the TDF to the OFCS in Home network in non-roaming scenario and in Visited network in roaming scenario

S9   For the purpose of convergence between 3GPP and BBF for 3GPP UE roaming it transfers PCC rules from the Home PCRF to the V-PCRF. This reference point if not applicable for Fixed device.

B   For the purpose of convergence between 3GPP and BBF network it transports the authentication, authorisation and accounting information for the Fixed device and for the Non-Seamless WLAN offloaded traffic. The definition of this reference point is out of the scope of 3GPP.

Gya   For the purpose of convergence between 3GPP and BBF network it transfers Charging information from the Accounting Interworking function in the BBF defined network to the OCS in Home network.

Gza   For the purpose of convergence between 3GPP and BBF network it transfers charging information from the Accounting Interworking function in the BBF defined network to the OFCS in Home network in non-roaming scenario and in the Visited network in roaming scenario.

Sy   It enables the transfers of policy counters and its status from OCS to PCRF for the purpose of policy decisions. The functionality is defined in TS 23.203 [4]. Policy counters and its status may be defined for both 3GPP UEs and fixed devices.

The Reference points within the BBF access network are defined in BBF TR-058 [7], BBF TR-101 [8], BBF WT-145 [9] and BBF WT-134 [10] and they are considered out of the scope of 3GPP. Any enhancement of reference points within the BBF access network for supporting convergence scenario is out of the scope of 3GPP.

Editor's note: It is FFS whether S9 requires enhancements for supporting BBF convergent scenario.

5.4.1   Gxd Reference Point

The Gxd reference point resides between the PCEF in the IP edge and the PCRF.

The Gxd reference point enables a PCRF to have dynamic control over the PCC behaviour at a PCEF in the IP Edge.

The Gxd reference point enables the transfer of QoS policies from the Home PCRF to the PCEF in IP Edge in non-roaming scenario for fixed device and for NSWO offload traffic, and from the Visited PCRF to the PCEF in roaming scenario for the NSWO traffic

The Gxd interface supports both the PUSH and PULL model.

The Gxd reference point enables the signalling of PCC decision and it supports the following functions:

-   Request for PCC decision from PCEF in the IP Edge to PCRF.

-   Provision of PCC decision from PCRF to PCEF in the IP Edge.

- Termination of Gxd session by PCEF in the IP Edge or PCRF.

- Install events triggers at the PCEF in the IP Edge and notify the PCRF when the PCEF detects an event.

A PCC decision consists of zero or more PCC rule(s) and IP CAN attributes.

For the 3GPP PCC Gyd/Gzd based charging with PCEF located in the fixed broadband access network described in clause 5.3.2 the Gxd reference point enables the transfer of charging policies from the Home PCRF and V-PCRF in roaming to the PCEF in IP Edge.

5.4.2 SWa Reference Point

The same extensions defined in TS 23.139 [20], clause 5.2 for NSWO are applicable. The reference point is not applicable for authentication of fixed device and fixed session.

5.4.3 STa Reference Point

The same extensions defined in TS 23.139 [20], clause 5.2 for NSWO are applicable. The reference point is not applicable for authentication of fixed device and fixed session.

5.4.4 Sp Reference Point

The Sp reference point is defined in TS 23.203 [4].

The Sp reference point lies between the SPR and the PCRF and is defined in TS 23.203 [4], clause 5.2.3.1.

The Sp reference point allows the PCRF to request subscription information related to the IP CAN transport level policies from the SPR based on a subscriber ID of the RG, fixed BBF device and the 3GPP WLAN UE NSWO.

Editor's note: The enhancement of Sp for supporting fixed device for QoS purpose (e.g. subscriber information related to fixed device or line) is FFS.

5.4.5 Ud Reference Point

The Ud reference point is defined in TS 23.203 [4], clause 5.2.3.2 and provides the same functionality as the Sp described in clause 5.4.4 in this TR..

5.4.6 Gza Reference Point

This reference point is applicable in case of supporting the AAA-based charging solution.

The Gza reference point is located between Accounting Interworking function in the BBF defined network and the 3GPP offline charging system OFCS located in the VPLMN (roaming scenario) or HPLMN (non-roaming scenario) and it transports charging information for 3GPP UE.

The Gza reference point is located between the Accounting Interworking function in the BBF defined network BBF AAA Server and the 3GPP offline charging system located in the HPLMN (non-roaming scenario) and it transports charging information for fixed device.

NOTE 1: Gza is not applicable to roaming scenario for fixed device

NOTE 2: The study and definition of Gza reference point and diagram flows for supporting AAA-based charging is outside the scope of this TR and left to SA5 for further consideration.

5.4.7 B Reference Point

The B reference point supports authentication and authorisation for fixed device as define in BBF TR-101 [8], BBF TR-144 [22] and BBF WT-146 [15]. The Reference point and the procedure for authentication of fixed device and fixed session are out of the scope of 3GPP.

In cased of AAA-based charging solution this reference interface supports accounting for fixed devices and for NSWO 3GPP UE. The requirements for accounting for fixed device are defined in BBF TR-101 [8], BBF TR-144 [22] and BBF WT-146 [15].

The support of charging management on B reference point is outside the scope of this Release and the enhancement of B Reference point is outside the 3GPP scope. Limited online charging is supported based on accounting capability on B reference point (e.g. support of RADIUS protocol).

NOTE: The definition of this reference point is out of the scope of 3GPP.

Editor's note: Whether this reference point needs to be enhanced for supporting specific information for 3GPP UE scenario is outside the scope of this TR.

5.4.8   Gyd/Gzd Reference Point

These reference points are applicable in case of supporting the alternative for 3GPP PCC- Gy/Gz based charging from the PCEF located in IP Edge as defined in the clause 5.3.2.

In this case the following requirements are applicable:

- The Gyd reference point resides between the OCS and the PCEF located in IP Edge.

- The Gyd reference point allows online credit control for service data flow based charging for both NSWO from 3GPP UE and Fixed device.

- The Gzd reference point resides between the PCEF located in IP Edge and the OFCS.

- The Gzd reference point enables transport of service data flow based offline charging information for both NSWO from 3GPP UE and Fixed device.

The functionalities required across the Gyd reference point are similar to Gy as defined in TS 32.251 [9].

The functionalities required across the Gzd reference point are similar to Gz as defined in TS 32.251 [9].

NOTE: The detailed specification of Gyd and Gzd interfaces is outside the scope of this TR and it is left for consideration to 3GPP SA WG5.

5.4.9   Gyt/Gzt Reference Point

These reference points are applicable in case of supporting the alternative for TDF based charging from the TDF as defined in the clause 5.3.1.

In this case the following requirements are applicable:

- The Gyt reference point resides between the OCS and the TDF.

- The Gyt reference point allows online credit control for TDF based charging for both NSWO from 3GPP UE and Fixed device.

- The Gzt reference point resides between the TDF and the OFCS.

- The Gzt reference point enables transport of offline charging information for both NSWO from 3GPP UE and Fixed device.

NOTE   The detailed specification of Gyt and Gzt interfaces is outside the scope of this TR and it is left for consideration to 3GPP SA5.

5.4.10   S9 Reference Point

The S9 reference point resides between the PCRF in Visited network and in Home network PCRF. The details of the S9 reference point are described as describe in TS 23.203 [4].

5.4.11   Gya Reference Point

This reference point is applicable in case of supporting the AAA-based charging solution.

The Gya reference point is located between the Accounting Interworking function in the BBF defined Access Network and the 3GPP online charging system OCS located in the HPLMN and it transports charging information for 3GPP UE.

The Gya reference point is located between the Accounting Interworking function in the BBF defined Access Network and the 3GPP online charging system located in the HPLMN and it transports charging information for fixed device.

NOTE 1:   Gya is not applicable to roaming scenario for fixed device.

NOTE 2:   The study and definition of Gya reference point and diagram flows for supporting AAA-based charging is outside the scope of this TR and left to SA5 for further consideration.

5.5   Network elements

The 3GPP network elements are defined in details in TS 23.401 [2], TS 23.402 [3] and TS 23.203 [4].

5.5.1   PCRF

The PCRF functionality defined in TS 23.203 [4] shall apply for Fixed device and for non-seamless WLAN offloaded traffic from 3GPPP UE connected via Broadband Fixed Access network with the following modifications:

- PCRF shall interact with the PCEF in the IP Edge over Gxd interface for PCC control in the Fixed Broadband Access Network.

- PCRF shall be able to modify and send back to PCEF the Default-QoS received by IP Edge during IP-CAN session establishment

Additionally, to support TDF based charging as described in clause 5.3.1, the PCRF shall:

- Send ADC Rules including charging parameters to the TDF over Sd interface for TDF based charging control of offloaded 3GPP UEs' traffic and/or of fixed access session's traffic.

5.5.2   IP Edge

The IP Edge is network element in the fixed broadband access network controlled by network operator capable of hosting an IP Session. This can be a BNG in the context of BBF TR-101 [8] or a BRAS in the context of BBF TR-59 [X].

The IP Edge implements the PCEF functionalities defined in TS 23.203 [4] as specified in BBF WT-300 [17].

Specifically, the IP Edge for convergence purpose:

- Receives from the PCRF the PCC rules for QoS control in the Fixed Broadband Access network.

- Requests the PCC rules to the PCRF for QoS control in the Fixed Broadband Access network.

- Enforces the PCC rules in the Fixed Broadband Access network and performs the appropriate mapping between 3GPP QoS parameters and BBF specific QoS parameters.

Editor's note: The usage of ARP is still under discussion in BBF.

Editor's note: Additional QoS specific parameters for fixed line use cases may be further provided by BBF.

- Provides provide the Default QoS rules when initiating the IP-CAN session establishment over Gxd for the 3GPP UE with NSWO traffic or fixed device,

- Provides the Subscription ID defined in clause 5.8 when initiating the IP-CAN session establishment over Gxd or the 3GPP UE with NSWO or fixed device.

- Perform admission control in fixed access or delegates admission control decision to other BBF nodes. Based on the admission control, the IP Edge accepts or rejects the request received over Gxd.

NOTE 1:   The definition of Admission Control functionality in BBF network is out of the scope of 3GPP.

NOTE 2:   How the IP Edge performs QoS enforcement in the BBF access and mapping between 3GPP QoS parameters and BBF specific parameters is out of scope of 3GPP.

- Performs the appropriate mapping between the BBF specific QoS parameters included in the Default-Access profile received by the IP Edge and the 3GPP QoS parameters included in the Default-QoS.

NOTE 3:   Which BBE NE provides the access-default entity and how the default-access profile is delivered to IP Edge is out of scope.

- Sends and receives the Default-QoS to/from the PCRF during the IP-CAN session establishment procedure.

NOTE 4:   How the IP Edge performs the mapping between the BBF specific QoS parameters included in the Default-Access profile and the 3GPP QoS parameters included in the Default-QoS is out of scope of 3GPP.

For AAA-based accounting, the charging information send by PCRF over Gxd are not taken into consideration for accounting purposes by IP Edge.

5.5.3   TDF

The TDF functionality defined in TS 23.203 [4] shall apply.

Additionally, in case of receiving charging control parameters within the ADC Rules from the PCRF, the TDF:

- Initiates, maintains and terminates the session with OCS/OFCS according to the charging control parameters received within the rules.

5.5.4   OFCS

The Offline Charging System (OFCS) performs offline charging functions as specified in TS 32.240 [25].

NOTE: The enhancements of OCFS for supporting offline charging for NSWO and fixed devices in convergent scenario is considered outside the scope of this TR and left for consideration in 3GPP SA WG5.

5.5.5   OCS

The Online Charging System (OCS) performs online credit control as specified in TS 32.240 [3].

NOTE: The enhancements of OCS for supporting online charging for NSWO and fixed devices in convergent scenario is considered outside the scope of this TR and left for consideration in 3GPP SA WG5.

5.5.6   AAA

The 3GPP AAA Server and 3GPP AAA Proxy are described in TS 23.402 [3]. In this Release it is assumed that the accounting information for 3GPP UE and fixed device is collected in BBF AAA Accounting Interworking Function.

The Accounting Interworking Function that performs translation of the accounting signalling and parameters that are understood by the IP Edge into the credit management signalling and parameters that are understood by the OCS and the OFCS.

The Accounting Interworking Function triggers the establishment of the credit management session with OCS after successful authentication, stores the quota for the subscriber identified by the subscriber id received in the authentication. When the Accounting Interworking Function detects that the quota (e.g. time or volume) is exhausted (thanks to Accounting-Interim-Report that reports the accumulated usage), the Accounting Interworking Function requests a new quota and provides the accumulated usage to the OCS. When the IP-CAN session in the IP Edge is terminated the Accounting Interworking Function provides the remaining quota to the OCS and the credit management session is terminated.

5.5.7 SPR

The SPR is a functional entity that stores the subscriber's QoS profile and is defined in TS 23.203 [4].

In a converged network the SPR requirements may include:

- The QoS profile for the RG is identified by the Subscription ID assigned to the RG.

- The RG QoS profile may include the uplink and down link rate limit assigned to the RG line and QCI.

Individual QoS profile for each 3GPP UE and BBF fixed device identified by the subscription-ID assigned to the devices.

The individual QoS profile for each 3GPP UE and fixed BBF device may include:

- Allowed QoS, including the Subscribed Guaranteed Bandwidth QoS;

- Indication whether application detection and control can be enabled for the BBF fixed device and 3GPP UE.

Editor's note: Whether additional information may be provided by SPR for supporting convergent scenario is FFS.

5.5.8 UDR

The UDR is a functional entity that acts as a single logical repository storing user data and is defined in TS 23.203 [4].

5.6 TDF discovery

For the solicited application reporting, the TDF address is either configured in the PCRF or the PCRF may also receive it as part of Gxd signalling.

5.7 Charging

5.7.1 TDF based charging

5.7.1.1 Architectural requirements

Architectural requirements shall be as defined in the TR 23.800 [27], clause 4.

5.7.1.2 Application Detection and Control Rules extension to support charging

ADC Rules extension to support charging shall be as defined in the TR 23.800 [27], clause 6.1.1.3.

5.7.1.3 Credit Management

Credit Management shall be as defined in the TR 23.800 [27], clause 6.1.1.4.

5.7.1.4 Termination action

Termination action shall be as defined in the TR 23.800 [27], clause 6.1.1.5.

5.7.1.5 Reporting

Reporting shall be as defined in the TR 23.800 [27], clause 6.1.1.5a.

5.7.1.6   TDF session information related to charging

The purpose of the TDF session related information is to provide information that is applicable to the whole TDF session. The PCRF provides the TDF session related information to the TDF (if applicable) using ADC rule provision procedure. The Downlink maximum bit rate per TDF session may be provided together with ADC rules or separately.

Table 6.4a lists the TDF session related policy information.

Table 6.4a: TDF session related policy information

Attribute	Description	PCRF permitted to modify the attribute
Charging information	Defines the containing OFCS and/or OCS addresses.	No
Default charging method	Defines the default charging method for the TDF session.	No
Event trigger	Defines the event(s) that shall cause a re-request of ADC rules for the TDF session.	Yes
Maximum downlink bit rate	Defines the maximum downlink bit rate per TDF session.	Yes
ADC Revalidation time limit	Defines the time period within which the TDF shall perform an ADC rules request.	Yes

Upon the initial interaction with the TDF, the PCRF may provide Charging information containing OFCS and/or OCS addresses to the TDF defining the offline and online charging system addresses respectively. These shall override any possible predefined addresses at the TDF. If received by the TDF, it supersedes the Primary OFCS/OCS address and Secondary OFCS/OCS address predefined at the TDF.

Upon the initial interaction with the TDF, the PCRF may provide Default charging method indicating what charging method shall be used in the TDF session for every ADC rule where the charging method identifier is omitted. If received by the TDF, it supersedes the defined Default charging method.

Upon every interaction with the TDF, the PCRF may provide Maximum downlink bit rate for the TDF session.

  NOTE: To avoid down-link packets being discarded in PCEF when TDF performs charging, the PCRF should set the Maximum downlink bit rate to the DL APN-AMBR.

  Editor's note: It is FFS whether Maximum uplink bit rate should also be supported.

Upon every interaction with the TDF, the PCRF may provide event triggers for the TDF session. Event triggers are used to determine which event causes the TDF to re-request ADC rules. The triggers applicable for the TDF are listed in clause 6.1.4.

The ADC Revalidation time limit defines the time period within which the TDF shall trigger a request for ADC rules for an established TDF session.

5.7.2   AAA based Charging

The charging support for NSWO traffic for 3GPP UE and fixed devices can be provided when the BBF network reports per-user accounting data via B and reference points.

Offline and online charging may be supported by the 3GPP and BBF domain. In this Release, in case of AAA-based Charging, the Online charging is supported based on existing capability supported by B reference point and IP edge with limitation based on AAA RADIUS/Diameter accounting in the BBF network (e.g. BNG capability, usage of RADIUS over B reference point).

For RG in routed mode configuration with NAT, the single devices (i.e. fixed device and 3GPP UE) connected behind a RG can not be recognised, so the accounting is performed only for the RG.

In case of RG bridge mode configuration and in routed mode configuration without NAT the AAA based charging is performed per single devices having a Subscriber IP session.

In order to allow performing charging for fixed devices, the following assumptions are made about functionality in the Fixed Broadband Network:

- The BBF network is able to collect per user accounting data for fixed devices and periodically report this data via the B reference points.

NOTE: The study and definition of enhancements of AAA for supporting charging for NSWO traffic from 3GPP UE and for fixed device is outside the scope of this TR.

5.7.3 IP Edge based charging

5.7.3.1 Architectural requirements

The architecture shall be as described in clause 5.3.2

5.7.3.2 Credit re-authorization Triggers

The IP Edge shall support the credit re-authorization triggers according to table 5.7.X.2.

Table 5.7.X-2: IP Edge Credit re-authorization triggers

Credit re-authorization trigger	Description
Credit authorisation lifetime expiry	The OCS has limited the validity of the credit to expire at a certain time.
Idle timeout	The service data flow has been empty for a certain time.
QoS changes	The QoS of the IP-CAN session has changed. Editor's Note: Whether a BBF access supports this (QoS changes) trigger in the IP Edge needs to be cross-checked with BBF

5.8 Subscription ID

For the 3GPP UE the Subscription-ID is the IMSI.

For the RG and BBF fixed device, the Subscription-ID is defined in BBF TR-134 [10], clause 4.1.4.1 as follows:

- **Parameter:** Subscriber ID.

- **Category:** User identification.

- Type: Octet String.

- **Description: Identity of the attached user.** The Subscriber ID is stored permanently in the user profile data base and is stored temporarily in the AAA function connected to the PDP.

NOTE: *"and is stored temporarily in the AAA function connected to the PDP"* reflects the policy management architecture of BBF WT-134 [10] and has no significance for the PCC based architecture.

The Subscription-ID used by fixed device at establishment of Subscriber IP session in fixed broadband access network can be the Access Line Identifier (physical and logical circuit ID) or the username, for example when the Subscriber IP session is a PPP Session.

5.9 PCRF discovery

Following information is available for PCRF discovery: the Subscription-ID, as specified in sub-clause 5.8, and the fixed device/3GPP UE local IPv4/v6 address or IPv6 prefix. For a 3GPP UE, the NSWO-APN is also available.

Editor's note: Using the Access Line Identifier IE defined in BBF WT-134 [10] for PCRF discovery is FFS.

The AF has the same information available for PCRF discovery as defined in TS 23.203 [4], clause 7.6.

The TDF for unsolicited application reporting has the same information available for PCRF discovery as defined in TS 23.203 [4], clause 7.6.

PCRF discovery and selection follows the principles defined in TS 23.203 [4], clause 7.6.

5.10 Policy for QoS and charging

Editor's note: This clause will identify the requirements and assumptions for Policy for QoS and charging for Building Block 1.

5.10.1 Policy and charging control rule

For convergent policies the definition of PCC rules in clause 6.3 of TS 23.203 [4] are applicable with the modification described in this clause.

NOTE: The procedure for provisioning predefined PCC rules at the IP Edge is out of scope of 3GPP.

Table 5.10-1 lists the QoS information contained in a PCC rule applicable to the convergent scenario on Gxd reference point. The definition of information contained in PCC rules in clause 6.3 of TS 23.203 [4] shall apply to the convergent scenario.

Editor's note: Whether additional IEs are required is FFS.

Editor's note: The list of QoS IEs will be verified with BBF.

Table 5.10.1-1: QoS rule information elements of PCC rule

Information name	Description	Category	PCRF permitted to modify for a dynamic PCC rule in the IP Edge PCEF	Applicable for NSWO WLAN, fixed BBF ,All
Rule identifier	See table 6.3 TS 23.203 [4]	Mandatory	No	All
Service data flow detection	This clause defines the method for detecting packets belonging to a service data flow.			All
Precedence	See table 6.3 TS 23.203 [4].	Mandatory	Yes	All
Service data flow template	See table 6.3 TS 23.203 [4]	Mandatory	Yes	All
Policy control	This clause defines how the BNG shall apply policy control for the service data flow.			All
Gate status	See table 6.3 TS 23.203 [4]		Yes	All
QoS class identifier	See table 6.3 TS 23.203 [4]	Mandatory	Yes	All
UL-maximum bitrate	See table 6.3 TS 23.203 [4]	Conditional (NOTE 1)	Yes	All
DL-maximum bitrate	See table 6.3 TS 23.203 [4]	Conditional (NOTE 1)	Yes	All
UL-guaranteed bitrate	See table 6.3 TS 23.203 [4]		Yes	All
DL-guaranteed bitrate	See table 6.3 TS 23.203 [4]		Yes	All
ARP	See table 6.3 TS 23.203 [4]	Conditional (NOTE 2)	Yes	All
NOTE 1: Mandatory when policy control on SDF level applies. NOTE 2: Applicable according to BBF WT-134 [10] requirements.				

5.10.2   Charging control information elements for PCEF based charging

Table 5.10.2-1 includes the charging IEs over Gxd for the PCEF based charging solution.

Table 5.10.2-1: Charging rule information elements

Information name	Description	Category	PCRF permitted to modify for a dynamic PCC rule in the IP Edge PCEF	Applicable for NSWO WLAN, fixed BBF ,All
Charging	See table 6.3 TS 23.203 [4]			
Charging Key	See table 6.3 TS 23.203 [4]		Yes	All
Service identifier	See table 6.3 TS 23.203 [4]		Yes	All
Application Service Provider Identifier	See table 6.3 TS 23.203 [4]	Conditional	Yes	All
Charging method	See table 6.3 TS 23.203 [4]	Conditional	Yes	All
Gate status	See table 6.3 TS 23.203 [4]		Yes	All

5.10.3   Charging control information elements for TDF based Changing

Table 5.10.3-1 includes the charging IEs over Sd for the TDF based charging solution.

Table 5.10.3-1: Charging rule information elements

Information name	Description	Category	PCRF permitted to modify for a dynamic ADC rule	Applicable for NSWO WLAN, fixed BBF ,All
Charging	Defines identities and instructions for charging and accounting that is required for an access point where application usage charging is configured			
Charging Key	The charging system (OCS or OFCS) uses the charging key to determine the tariff to apply for the application..	Optional	Yes	All
Charging Method	Indicates the required charging method for the ADC rule. Values: online, offline or neither.	Conditional (Mandatory if there is no default charging method for the TDF session).	No	All
Measurement method	Indicates whether the application data volume, duration, combined volume/duration or event shall be measured. This is applicable for reporting, if the charging method is online or offline.	Optional	Yes	All
Service identifier	Identifies one or more applications to the charging system.	Optional	Yes	All
Service Identifier level reporting	Indicates that separate usage reports shall be generated for this Service identifier. Values: mandated or not required.	Optional	Yes	All

5.10.4 Charging control information elements for AAA based Changing

In case of AAA-based accounting the charging information over Gxd are not considered for accounting purposes.

5.11 Event Triggers

The IP Edge shall support the event triggers according to table 5.11-1.

Table 5.11-1: IP Edge specific event triggers

Event trigger	Description	Reported from	Condition for reporting
QoS change	The QoS of the access session has changed (Note 2)(Note 7)	PCEF	PCRF
Loss of transmission resources	The IP-CAN transmission resources are no longer / again usable.(Note 7) .	PCEF	PCRF
Out of Credit	Credit is no longer available (Note 5)	PCEF	PCRF
Usage Report	The IP CAN session or the monitoring key specific resource consumed by the UE or fixed device either reached the threshold or need to be reported for other reasons.	PCEF	PCRF
Enforced PCC rule request	The PCEF is performing a PCC rules request as instructed by the PCRF. (See table 6.2 of TS 23.203)	PCEF	PCRF
Start of application traffic detection and Stop of application traffic detection (Note 4)	The start or the stop of application traffic has been detected	PCEF	PCRF
Device IP address change (Note 4)(Note 6) (Note 7)	The local IP address / Prefix of the 3GPP UE or of the fixed device has been allocated/released	PCEF	Always set
NOTE 1: All these events are defined in Table 6-2 of TS 23.203 NOTE 2: The PCEF generates the request because an event occurred that may affect resources requirements and require re-authorization of PCC rules NOTE 3: This event may e.g. take place when a local IP address / IPv6 Prefix has been allocated / released for an IPCAN session where the IP Edge is providing both an IPv4 and an IPv6 service (when the IPCAN session toggles between the support of 1 and 2 IP versions). It may also take place when the fixed device gets via DHCPv6 IPv6 addresses / Prefixes with different life times.In IPv6 case when SLAAC is used, the IP Edge can only report the IPv6 Prefix, as it is unaware of the IP address built by the device. If TDF for solicited application reporting is applicable, upon receiving this event report from PCEF, PCRF always update the TDF NOTE 4: This applies only to an IP Edge with ADC capabilities. The start and stop of application traffic detection are separate event triggers, but received under the same subscription from the PCRF. For unsolicited application reporting, the IP Edge uses these event triggers to notify the PCRF. NOTE 5: This event may apply only when Gyd is deployed NOTE 6: This event trigger shall be reported when the corresponding event occurs, even if the event trigger has not been provisioned by the PCRF. NOTE 7: Editor's note: Whether a BBF access supports this Event trigger in the IP Edge needs to be cross-checked with BBF			

The QoS change event trigger shall trigger the PCRF interaction for all changes of the Subscriber IP session QoS.

The Device IP address change event trigger applies shall trigger a PCEF interaction with the PCRF in case an IP address /Prefix is allocated to the UE or released during the lifetime of the IP-CAN session.

5.12 Usage Monitoring Control

5.12.1 General

Usage Monitoring Control provides a mechanism to monitor usage of services that share a common volume and/or time allowance as defined in TS 23.203 [4].

In the routed RG with NAT mode, the fixed subscriber session (i.e. IP-CAN session) is per RG, the PCRF retrieves the usage monitoring related information (e.g. total allowed usage for the fixed subscriber session and/or per MK) from the SPR using the subscriber-id provided over Gxd reference point. The PCRF decides how to allocate a usage threshold to each existing IP-CAN session and/or MK.

In the bridge RG mode and in routed RG mode without NAT there may be a separate fixed subscriber session (i.e. IP-CAN session) for the each device behind the RG. The PCRF retrieves usage monitoring related information (e.g. the total allowed usage for the fixed subscriber session and/or per MK) from the SPR using the subscriber-id and, if the request is for a 3GPP UE, the NSWO APN provided over Gxd reference point. The PCRF decides how to allocate a

usage threshold to each existing IP-CAN session and/or MK. The total allowed usage stored in SPR is per PDN and UE as defined in TS 23.203 [4].

The PCRF requests the PCEF to monitor the usage per IP-CAN session or for a given Monitoring Key using the Usage Report Event Trigger and the usage threshold upon which the PCEF shall report to the PCRF.

The PCEF monitors both the usage threshold for the fixed subscriber session and the usage threshold for the NSWO traffic of the 3GPP UE. When the usage threshold is reached, the PCRF performs policy decisions (e.g. block access to services for a 3GPP UE).

Table 6.6 in TS 23.203 [4] defines Usage Monitoring Control Information.

5.13 Procedures

Editor's note: This clause will identify the procedures for Policy and QoS in TS 23.402 [3] and/or TS 23.203 [4] style for Building Block 1.

Editor's note: For all charging options in this clause, roaming interaction has to be added to the flows (only update to the subscription information scenario includes it for now).

5.12.1 Overview of the procedures

NOTE 1: As the architecture considers 3 possible charging options for traffic exchanged by fixed devices and NSWO traffic to/from 3GPP UE, the procedures are described as follows:

- For each high level procedure (IP-CAN Session Establishment, PCRF Initiated IP-CAN Session Modification, IP Edge/PCEF initiated IP-CAN Termination, etc.) the charging flows are not documented in the description of the procedure but a reference is made to the clause dedicated to "Accounting and charging".

- Nevertheless if, due to the different charging options, there are, within a procedure (IP-CAN Session Establishment, etc.), some differences in non charging related flows/steps, these differences are captured in these steps.

- From stage 2 point of view some charging parameters that may be included in PCC interactions (e.g. Charging rules sent over Gxd) are applicable only for a specific charging deployment. This does not preclude the stage 3 from defining protocols (e.g. Gxd) that contain parameters applicable to the 3 possible charging options.

- The PCRF is assumed to be aware of the charging option that applies in a given deployment and to thus make sure to provide the other PCC entities (IP Edge, TDF) with the parameters that are needed by the charging option that applies in this deployment.

NOTE 2: In all the procedures, the IP Edge/PCEF performs the mapping between the PCC rules received from the PCRF and the parameters specific for BBF networks. This mapping is out of scope of 3GPP.

5.13.2 IP-CAN related procedures

This clause depicts the procedures over Gxd reference point: session establishment, modification and termination. Each of the procedures may result in interactions with the charging system and those are referred to in these flows but described in clause 5.13.3.

For the dynamic QoS for the IP-CAN session the following requirements shall be supported:

- interaction between PCRF and PCEF at IP-CAN session establishment.

- policy change requests originated from Applications Function after IP-CAN session establishment.

- policies apply to individual IP-CAN session.

- policy evaluation may be triggered by the change in state of an IP-CAN session.

In the RG NATed/routed mode there is a single RG IP subscriber session for all devices connected to the RG (NAT case, routed mode) and thus a single Gxd IP CAN session.

In the case without NAT between the UE and the PCEF (e.g. RG in bridge mode) the IP Edge/PCEF binds a UE IP subscriber session connected to the RG (no NAT/bridged mode) with a Gxd IP-CAN session.

Editor's note: 3GPP AAA interactions for 3GPP UE authentication are not shown in the message flows.

NOTE: In all the procedures how the IP Edge/PCEF performs QoS enforcement in the BBF is out of the scope of 3GPP. The IP Edge/PCEF performs the mapping between the PCC rules and the parameters specific to a Fixed Broadband Access network.

Editor's note: The impact on Gy interface with regard to Information Elements and re-authorization triggers is FFS.

5.13.2.1 IP-CAN Session Establishment

This clause describes the signalling flow for Gxd IP CAN Session establishment. The session is initiated after that the IP Edge becomes aware of an IPv4 address and/or an IPv6 prefix has been assigned to the fixed device and/or 3GPP UE.

NOTE 1: In bridge mode, the session is initiated after the device has been authenticated per BBF specifications (i.e. out of scope of 3GPP) or after that 3GPP UE performs 3GPP EAP-based authentication and has been assigned an IPv4 address and/or IPv6 Prefix.

NOTE 2: In routed mode configuration with NATed RG, the session is initiated after the RG has been connected to the network and has been assigned an IPv4 address and/or IPv6 Prefix. The IPv4 address and/or IPv6 Prefix is assigned as per BBF specifications and it is out of scope of 3GPP.
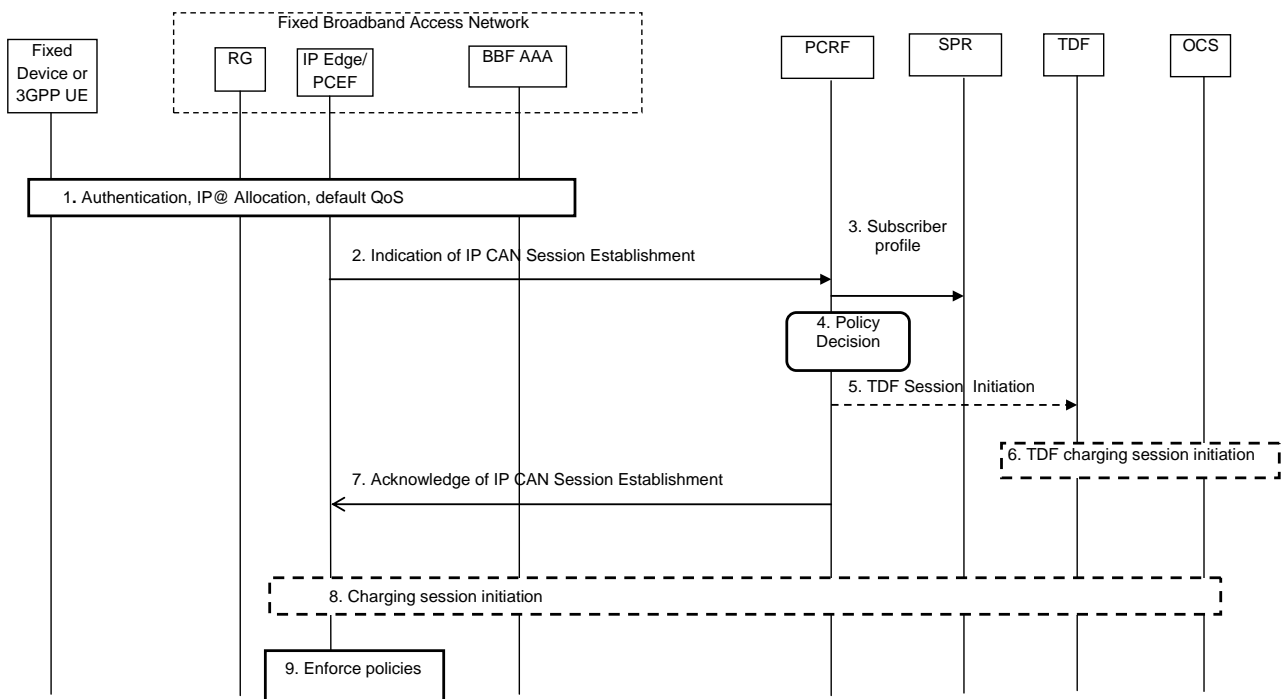

Figure 5.13.2.1-1: Session Establishment

1. A Fixed Broadband subscriber session is initiated by the device, (e.g. a RG switches on, a 3GPP UE starts a session, etc.). When the device is not acting as a 3GPP device, implicit authentication (e.g. access line authentication) or explicit authentication (i.e. user name and credentials) is performed as specified by BBF. Otherwise if the device is 3GPP UE, the authentication is performed as described in TS 23.402 [3]. As part of this step, the BBF AAA may provide Default QoS to the IP Edge/PCEF. The IP Edge/PCEF assigns an IP address (and/or an IPv6 prefix) or IP Edge learns the IP address if already assigned for the Fixed Broadband subscriber session. This step is BBF specific and as such out of scope of this TR.

2.   The IP Edge/PCEF sends an indication of the IP-CAN session establishment to the PCRF. The message includes the Subscription-ID if available, the Access Line Identifier (physical and logical circuit ID), default QoS, if available, the IP-CAN type, the IPv4 address and/or the IPv6 network prefix.

NOTE 3:   For 3GPP UE, the indication of the IP-CAN session establishment with the PCRF may include the APN (i.e. NSWO-APN).

3.   The PCRF obtains the subscriber's profile related to the UE.

4.   The PCRF makes policy decision and derives PCC and possibly ADC Rules. The PCRF may change the default QoS of the subscriber it received from the PCEF. The PCRF may include the following information: Default QoS, the PCC Rules and the Event Triggers to report. The Event Triggers indicate to the IP Edge/PCEF what events must be reported to the PCRF. The PCC and ADC rules may contain charging information needed by the charging option used in the deployment.

NOTE 4:   The PCRF may override the default QoS received from the IP Edge/PCEF.

5.   When the solicited application reporting from the TDF applies, the PCRF establishes a session with the TDF and provides ADC rules to the TDF.

6.   If TDF based charging is applicable for this deployment, interaction with the charging systems is performed. This is further detailed in clause 5.13.3.

Editor's note: Whether additional parameters in the PCC Rule are required for the IP-CAN session is FFS.

7.   The PCRF provisions the PCC rules at the IP Edge/PCEF. It may also provision ADC rules when the IP Edge is enhanced with support of ADC rules. The IP Edge/PCEF enforces the rules received from the PCRF.

8.   If IP Edge/PCEF or AAA based charging applies for this deployment, interaction with the charging systems is performed. This is further detailed in clause 5.13.3.

9.   This step is BBF specific. The IP Edge/PCEF may communicate with other network elements in the BBF access network per BBF specifications.

5.13.2.2   PCRF Initiated IP-CAN Session Modification

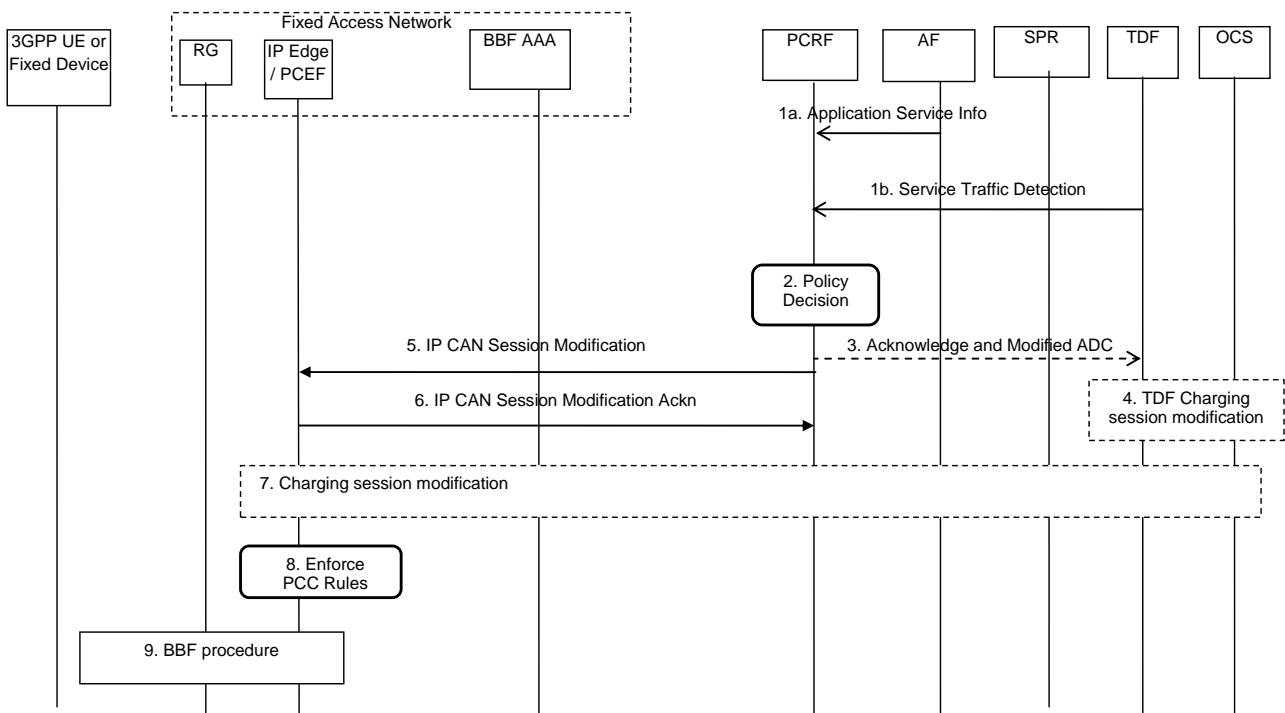This clause is related to IP-CAN session modification for IP session initiated by PCRF. The AF can be involved.

Figure 5.13.2.2-1: PCRF initiated IP-CAN Session Modification

1a. The AF requests QoS resource authorization. The request includes the bandwidth requirements, media type, session priority and other information according to TS 23.203 [4].

NOTE 1: In routed mode with NAT this procedure is applicable when AF request QoS and charging for RG or for single device connected behind the NATed RG for which the AF is providing the NATed IP address and ports used by the single device (e.g. for IMS, according to TS 23.228 [29]).

1b. The same step as step 1b in TS 23.203 [4] procedure in clause 7.5.

NOTE 2: In routed mode with NAT the TDF is unaware of which device supports the application that has been detected and so the trigger cannot be correlated to a fixed or NSWO device.

Alternatively, the PCRF may initiate this procedure based on PCRF internal logic.

2. The PCRF makes policy decisions and determines the ADC and PCC Rules (e.g. QCI, UL/DL max/minimum or guaranteed Bitrate and priority for the service) and the Event Triggers to report. The Event Triggers indicate to the IP Edge/PCEF what events must be reported to the PCRF. The PCC and ADC rules may contain charging information needed by the charging option used in the deployment.

3. When a TDF session exists for this IP-CAN session and new ADC rules have been determined at step 2, the PCRF modifies the TDF session by sending the new/updated ADC Rules to the TDF as step 5 in TS 23.203 [4] procedure in clause 7.5.

4. If TDF based charging is applicable for this deployment, interaction with the charging systems is performed. This is further detailed in clause 5.13.3.

5. When new rules and/or Events Triggers impacting the IP Edge have been determined at step 2, the PCRF provisions them at the IP Edge/PCEF. The PCRF may also provision ADC rules when the IP Edge is enhanced with support of ADC rules.

6. The IP Edge/PCEF responds with an acknowledgment.

7. If IP Edge/PCEF or AAA based charging applies for this deployment, interaction with the charging systems is performed. This is further detailed in clause 5.13.3.

8. The IP Edge/PCEF enforces the PCC rules.

9. BBF specific procedures may apply, e.g. the IP Edge/PCEF may communicate with other entities in BBF access as per BBF specifications.

5.13.2.3 IP Edge/PCEF Initiated IP-CAN Session Modification

This clause is related to IP-CAN session modification initiated by IP Edge/PCEF for IP session. The procedure is applicable when the IP Edge/PCEF makes a decision to request a modification of PCC rules. The trigger to start the modification procedure by IP Edge/PCEF can be a provisioned event-trigger by the PCRF or a BBF specific trigger.

For the IP Edge/PCEF enhanced with ADC, the reason for such a modification may be that a start or stop of application traffic that matches with one of the activated ADC Rules is detected.
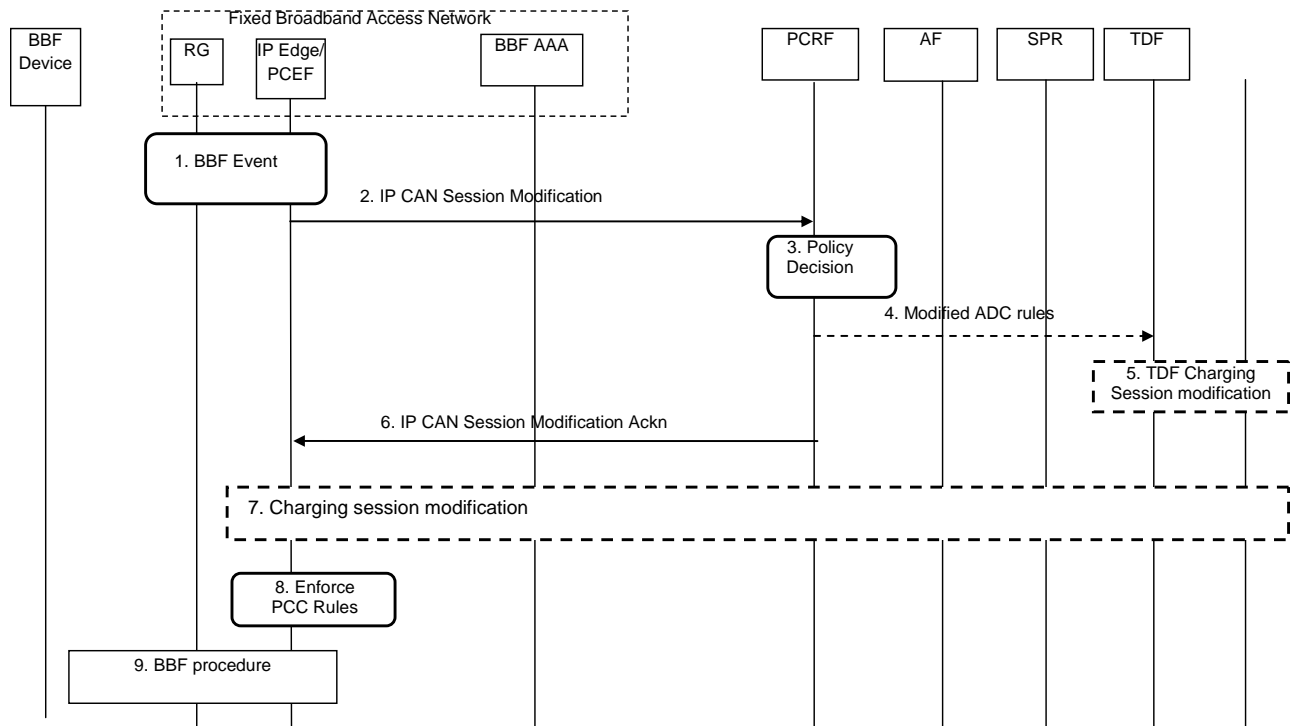
Figure 5.13.2.3-1: IP Edge/PCEF Initiated IP-CAN Session Modification

1. The IP Edge/PCEF receives a trigger (e.g. from RG) or decides to modify an IP-CAN session.

NOTE 1: The triggers can be different in bridge mode configuration and in routed mode configuration.

Editor's note: Applicable event-triggers are FFS.

2. The IP Edge/PCEF may initiate the session modification procedure based on internal triggers or when event-triggers provisioned by the PCRF are detected. The message includes the Event Report and affected PCC Rules.

3. The PCRF makes policy decisions and may determine new/modified ADC and PCC Rules (e.g. QCI, UL/DL max/minimum or guaranteed Bitrate and priority for the service) and the Event Triggers to report. The modified PCC or ADC rules may contain Charging related information that is needed by the charging option used in the deployment.

Editor's note: Whether additional parameters in the PCC Rule are required for the IP-CAN session is FFS.

4. When a TDF session exists for this IPCAN session and new ADC rules have been determined at step 2, The PCRF provisions new/updated ADC Rules at the TDF as defined in steps 11 and 12 of TS 23.203 [4] procedure in clause 7.3.2.

5. The modified ADC rules may contain Charging related information that is relevant in case TDF based charging is applicable to this deployment; In such a case, interaction with the charging systems is performed. This is further detailed in clause 5.13.3.

6. When new rules and/or Events Triggers impacting the IP Edge have been determined at step 2, the PCRF provisions them at the IP Edge/PCEF. It may also provision ADC rules when the IP Edge is enhanced with support of ADC rules.

7. If IP Edge/PCEF or AAA based charging applies for this deployment, interaction with the charging systems is performed. This is further detailed in clause 5.13.3.

8. The IP Edge/PCEF enforces the PCC rules.

9. BBF specific procedures may apply, e.g. the IP Edge/PCEF may communicate with other entities in BBF access per BBF specifications.

5.13.2.4 IP Edge/PCEF initiated IP-CAN Termination

This clause is related to termination of the IP-CAN session by IP Edge/PCEF. The procedure is applicable when IP session is terminated. The trigger to start the termination by IP Edge/PCEF is BBF specific (e.g. RG switch off, PPPoE session termination, etc.) and out of the scope of 3GPP.

In routed mode configuration with NAT this procedure is applicable only when IP session from RG is terminated, e.g. when RG switches off, etc. The termination of connection from a device in LAN, e.g. when a device releases the local IP address or disconnects from WLAN does not trigger the IP-CAN session termination for IP session from RG.
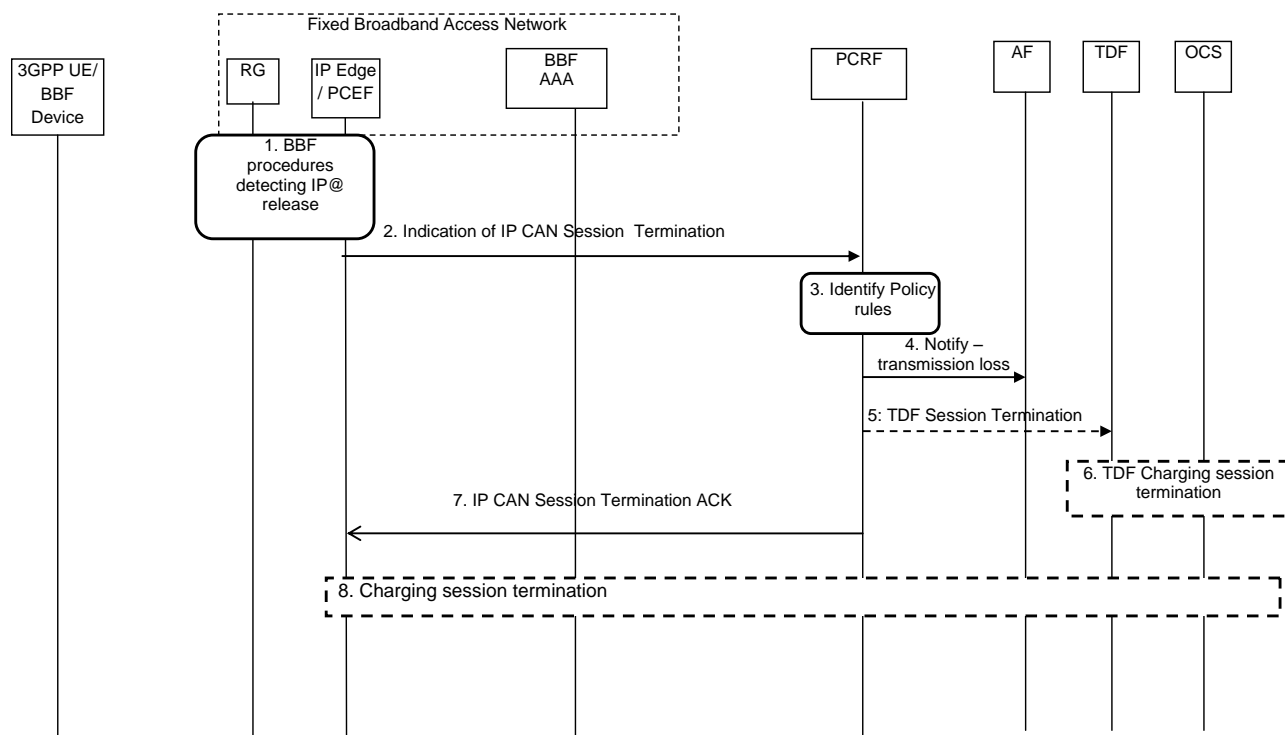

Figure 5.13.2.4-1: IP Edge/PCEF Initiated IP-CAN Session Termination

1. The IP Edge/PCEF receives a request to terminate the session with the PCRF based on BBF triggers (for example due to termination of session, power off of RG, etc as defined by BBF specifications.

NOTE: How the IP Edge/PCEF detects or is informed that BBF access session is terminated is BBF specific and is out of the scope of 3GPP.

2. The IP Edge/PCEF initiates the indication of IP-CAN Session termination procedure.

3. The PCRF identifies the affected PCC rules.

4. The PCRF notifies the AF about loss of transmission.

5. When a TDF session exists for this IP-CAN session, the PCRF terminates the session with the TDF as defined in steps 10 and 11 of TS 23.203 [4] procedure in clause 7.3.1.

6. If TDF based charging had applied for this particular deployment, interaction with the charging systems is performed. This is further detailed in clause 5.13.3.

7. The PCRF acknowledges the termination of the session.

8. If IP Edge/PCEF or AAA based charging applies for this deployment, interaction with the charging systems is performed. This is further detailed in clause 5.13.3.

5.13.2.5 Update of the subscription information in the PCRF

In routed mode with NAT this procedure is applicable only if profile information related to RG has been changed.
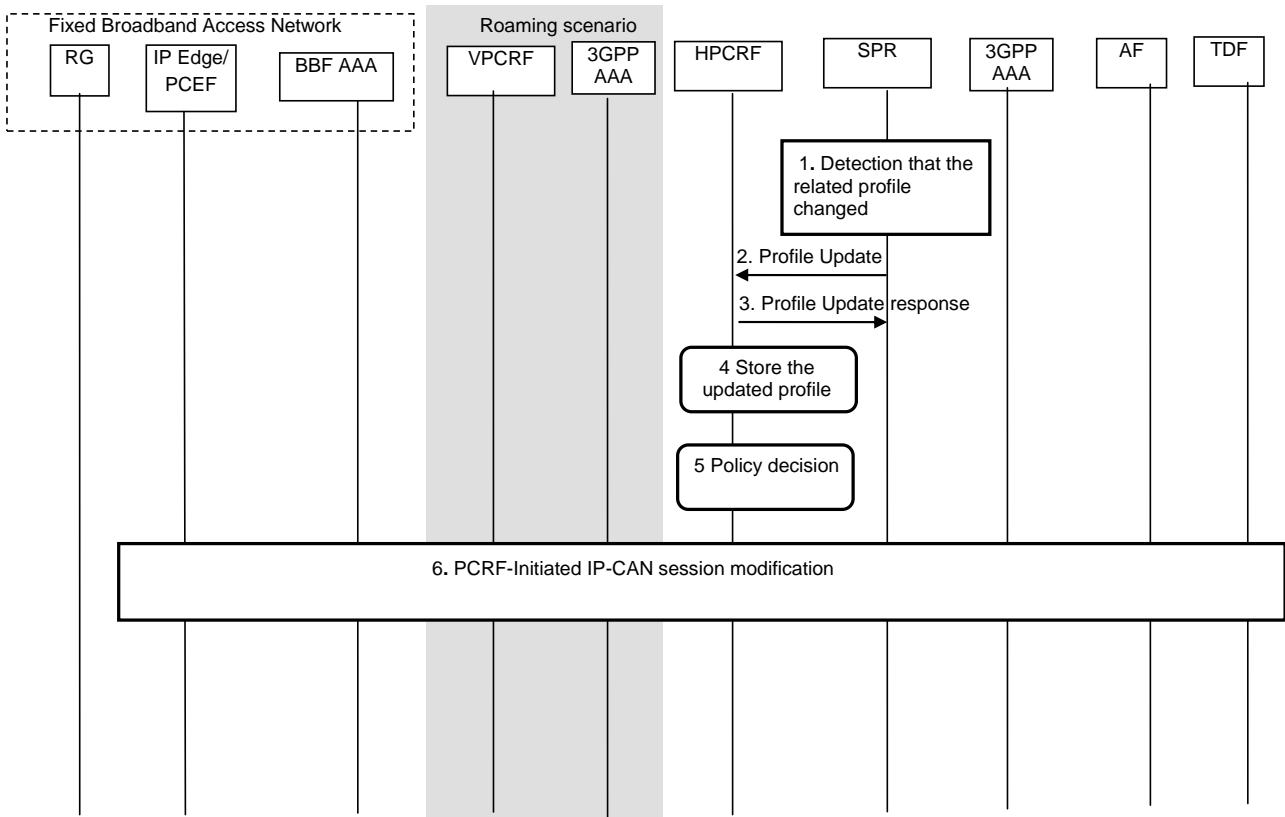
Figure 5.13.2.5-1: Update of the subscription information in the PCRF

1 The SPR detects that the subscriber's profile changed. The change many include indication whether application detection and control can be enabled.

Editor's note: Enhancements to the subscriber profile for BBF access is FFS.

2 The SPR notifies the PCRF of the profile change provided if the PCRF has subscribed to such notification event(s).

3 The PCRF responds to the SPR notification message.

4 The PCRF stores the updated profile.

5 The PCRF identifies the rules affected and derives new/modified ones.

6 The PCRF initiates the IP-CAN Session Modification procedure as according to clause 5.13.2.2 if the BBF access or 3GPP UEs are affected. The PCRF may also provide ADC rules to the PCEF enhanced with the ADC.

5.13.3 Charging related procedures

5.13.3.1 PCEF based charging (PCEF located at IP Edge)
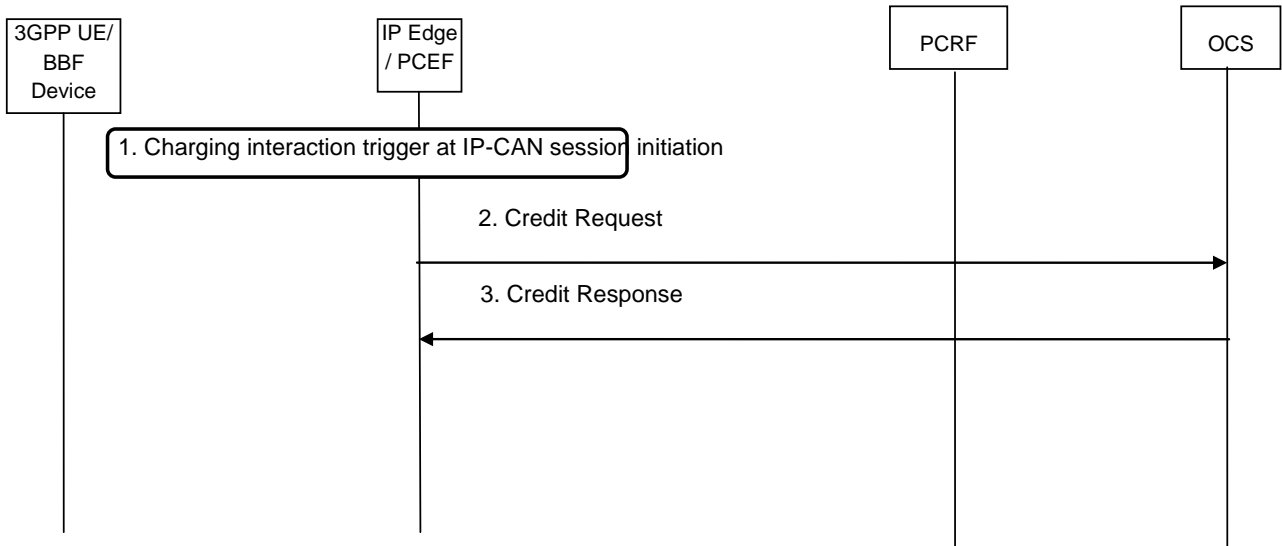
Charging Session initiation

Figure 5.13.3.1-1: PCEF based Charging Session Initiation

1. Initiation of charging session takes place at IP-CAN session initiation, see clause 5.13.2.1, if online charging is applicable for the IP-CAN session, and at least one PCC rule is activated.

2. The IP Edge /PCEF shall activate the online charging session, and provide relevant input information for the OCS decision. Depending on operator configuration IP Edge / PCEF may request credit from OCS for each charging key of the activated PCC rules.

3. If online charging is applicable, the OCS provides the possible credit information to the IP Edge / PCEF and may provide re-authorisation triggers for each of the credits.
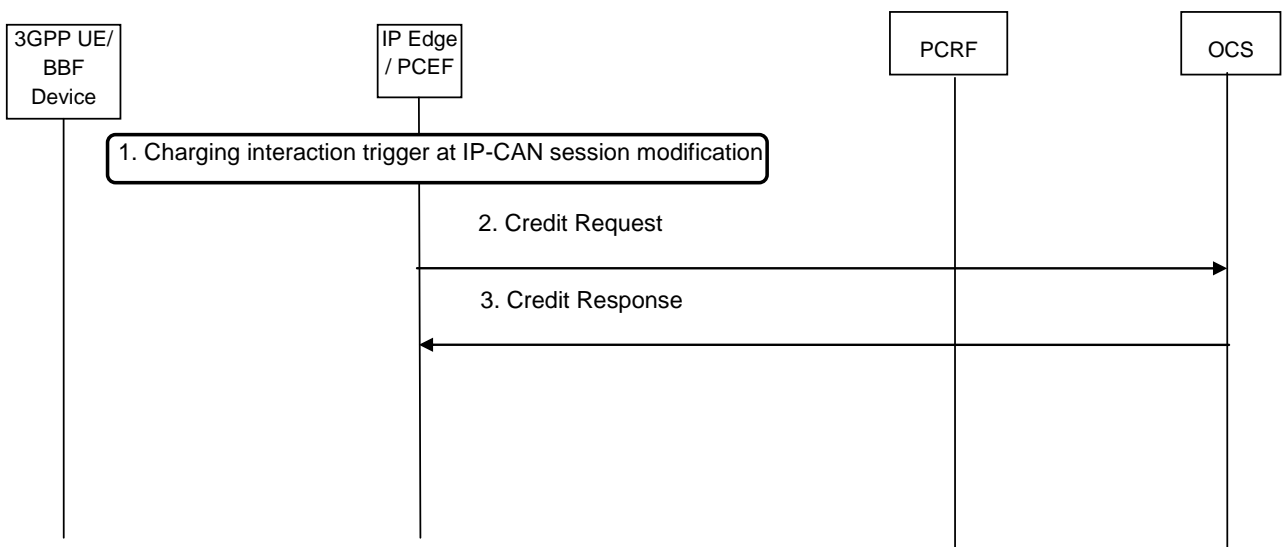
Charging Session Modification

Figure 5.12.3.1-2: PCEF based Charging Session Modification

1. Update of charging session takes place at IP-CAN session modification, see clause 5.13.2.3, if online charging is applicable for the IP-CAN session, and at least one PCC rule is activated, updated or removed.

2. The IP Edge/PCEF may contact the OCS to request credit for new charging keys and/or to issue final report and return remaining credit for charging keys no longer active.

   Editor's Note: the list of events that may trigger credit re-authorization request is FFS.

3. The OCS may instruct the IP Edge / PCEF on the further handling of the IP-CAN session (terminate, continue, reroute, etc), provide credit information to the IP Edge / PCEF (possibly with re-authorisation trigger), and/or acknowledge the credit report.

Charging Session Termination

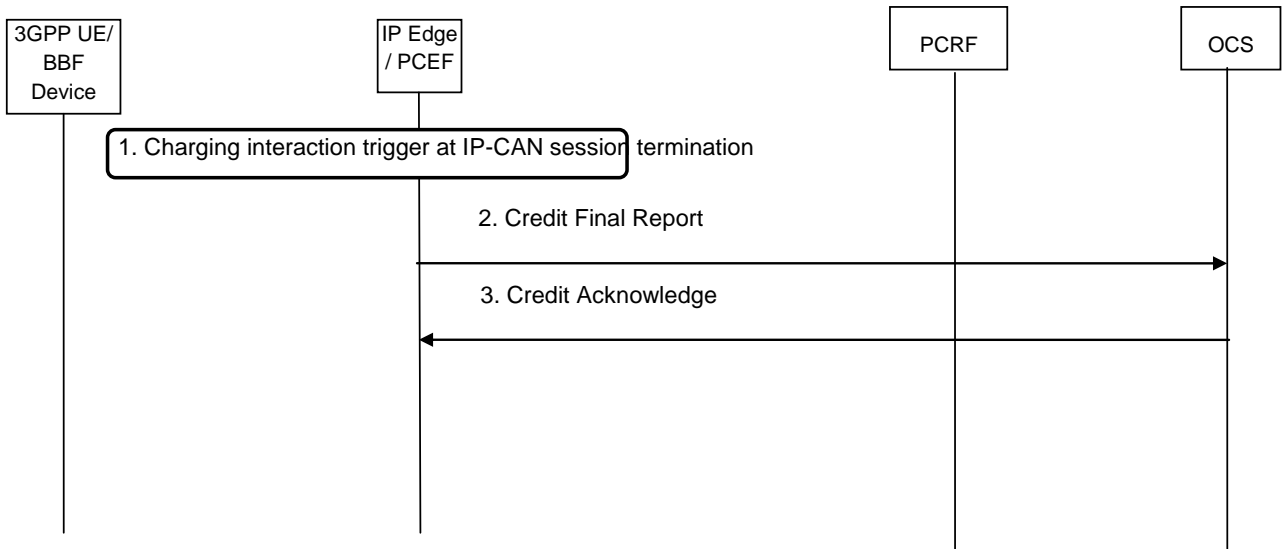**Figure 5.12.3.1-1: PCEF based Charging Session Termination**

1. Termination of charging session takes place at IP-CAN session termination, see clause 5.13.2.4, if online charging was applicable for the IP-CAN session.

2. The IP Edge / PCEF shall issue the final reports and return the remaining credit to the OCS.

3. The OCS acknowledges the credit report and terminates the online charging session.

5.13.3.2 TDF based charging
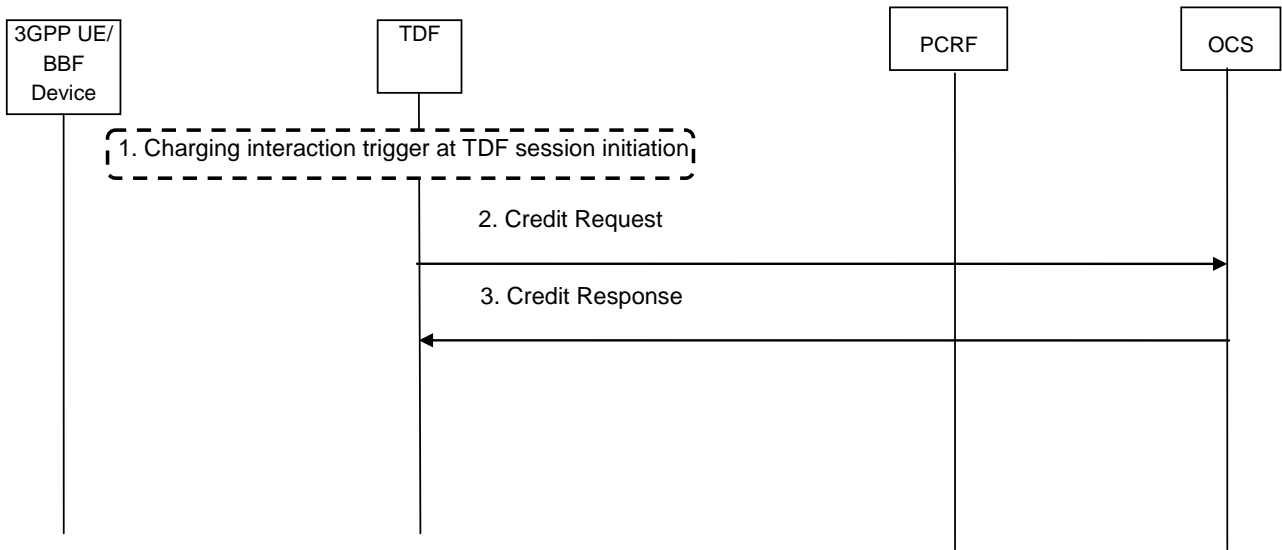
Charging Session Initiation

Figure 11.3.2-1: TDF based Charging Session Initiation

1. Initiation of online/offline charging session takes place at IP-CAN session initiation in case of TDF session establishment, see clause 5.13.2.1, if at least one ADC Rule with charging parameters is activated.

NOTE: Establishment of online/offline charging session for TDF may also occur during IP-CAN session, if TDF session is established during an on-going IP-CAN session and/or if at least one ADC Rule is received from the PCRF which includes charging parameters.

2. If online charging is applicable, the TDF activates the online charging session, and provide relevant input information for the OCS decision. Depending on operator configuration, the TDF may request credit from the OCS.

3. If online charging is applicable, the OCS provides the possible credit information to the TDF and may provide re-authorisation triggers for each one of the credits.
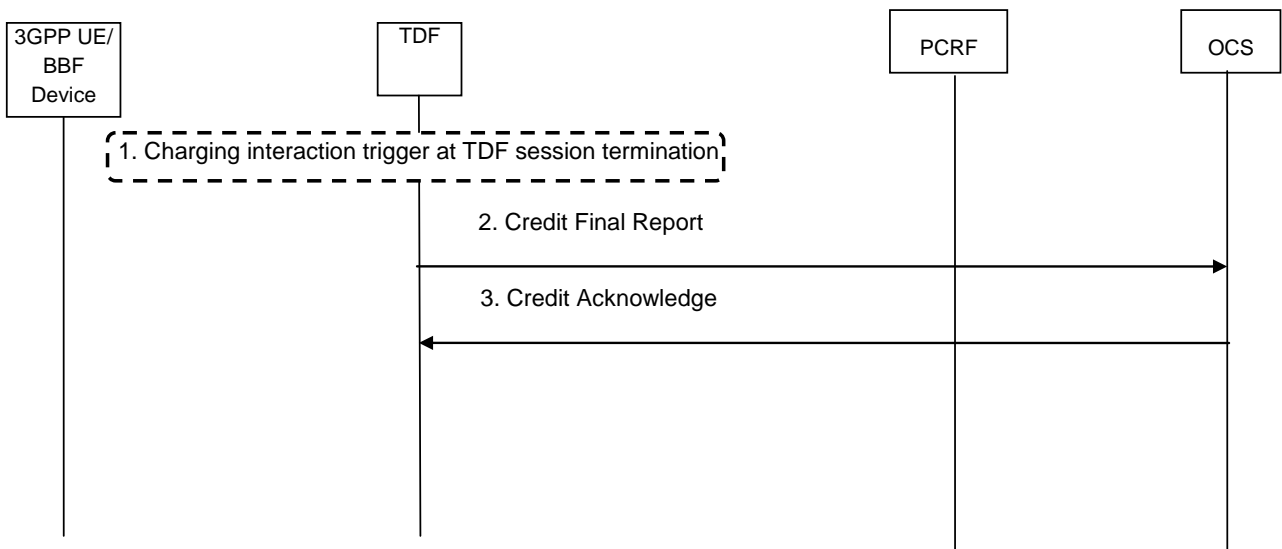
Charging Session Termination

Figure 5.13.3.2-2: TDF based Charging Session Termination

1. Termination of online/offline charging session takes place at IP-CAN session termination in case of active TDF session, see clause 5.13.2.4, if at least one ADC Rule with charging parameters was activated.

NOTE: Termination of online/offline charging session for TDF may also occur during IP-CAN session, if TDF session is terminated during an on-going IP-CAN session and/or if the last ADC Rule with charging parameters was deactivated by the PCRF.

2. If online charging is applicable, The TDF shall issue the final reports and returns the remaining credit to the OCS.

3. The OCS acknowledges the credit report and terminates the online charging session.

Charging Session Modification
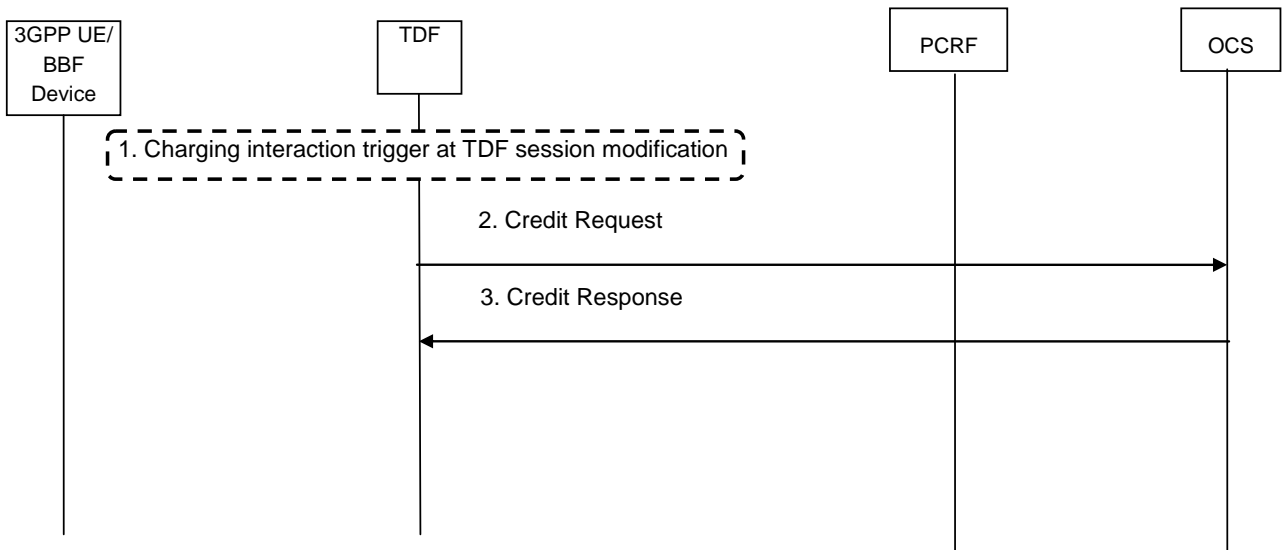
Figure 5.13.3.2-3: TDF based Charging Session Modification

1. Modification of online charging session takes place at IP-CAN session modification in case of active TDF session, see clauses 5.13.2.3 and 5.13.2.4.

2. If online charging is applicable, the TDF may request credit for new charging keys from the OCS, and/or inform OCS about re-authorization trigger if the event occurs, and/or issue final reports and return remaining credit for charging keys no longer active to the OCS.

3. If OCS was contacted, the OCS provides the credit information to the TDF, and/or acknowledges the credit report.

5.13.3.3 AAA-based charging using accounting signalling

In this clause, we describe the AAA-based charging. The basic assumption is that B interface is not modified.

Charging Session Initiation
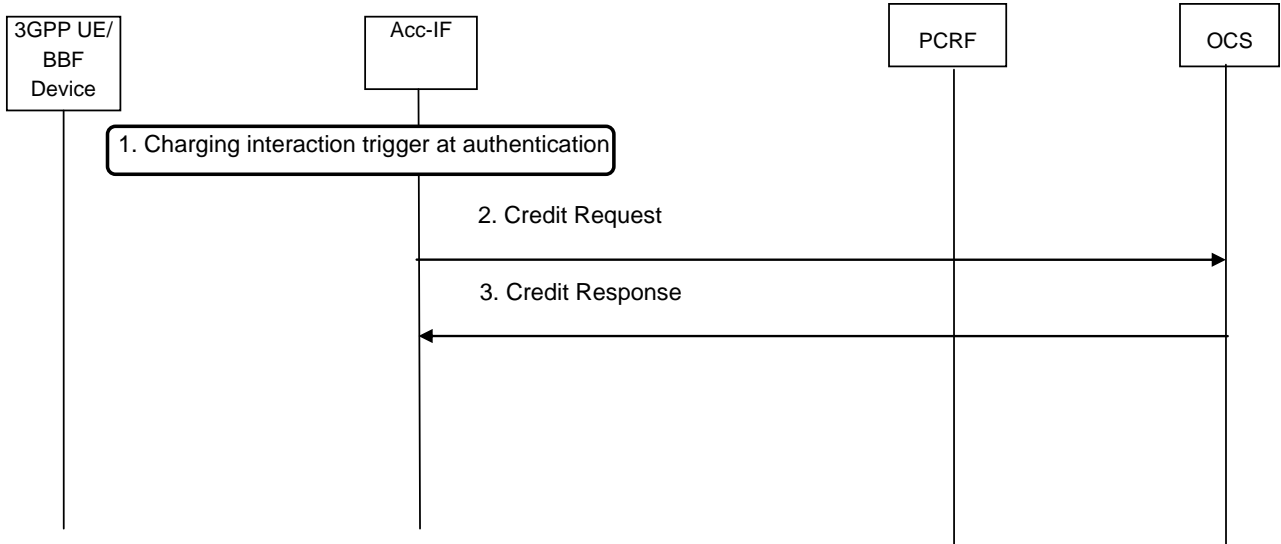
Figure 5.13.3.3-1: AAA-based Charging Session Initiation

1. The 3GPP UE/BBF device is successfully authenticated.

2. The Accounting Interworking Function that will activate the online-charging session, and provide relevant input information for the OCS decision. i.e. subscriber identifier and charging keys.

3. If online charging is applicable, the OCS provides the possible credit information to the Accounting Interworking Function and may provide re-authorisation triggers for each of the credits.

NOTE: Credit Reauthorization triggers that can be reported are Credit Reauthorization time expired.

Charging Session Modification

Figure 5.13.3.3-2: AAA-based Charging Session modification

1. Update or termination of accounting information takes place at the Accounting Interworking Function which triggers an interaction with the OCS.

2. The Accounting Interworking Function may contact the OCS to request credit for new charging keys and/or to issue final report and return remaining credit for charging keys no longer active, i.e. when the accounting session is terminated.

3. The OCS may instruct the Accounting Interworking Function on the further handling of the session (terminate, continue, etc), provide credit information (possibly with re-authorisation trigger), and/or acknowledge the credit report.
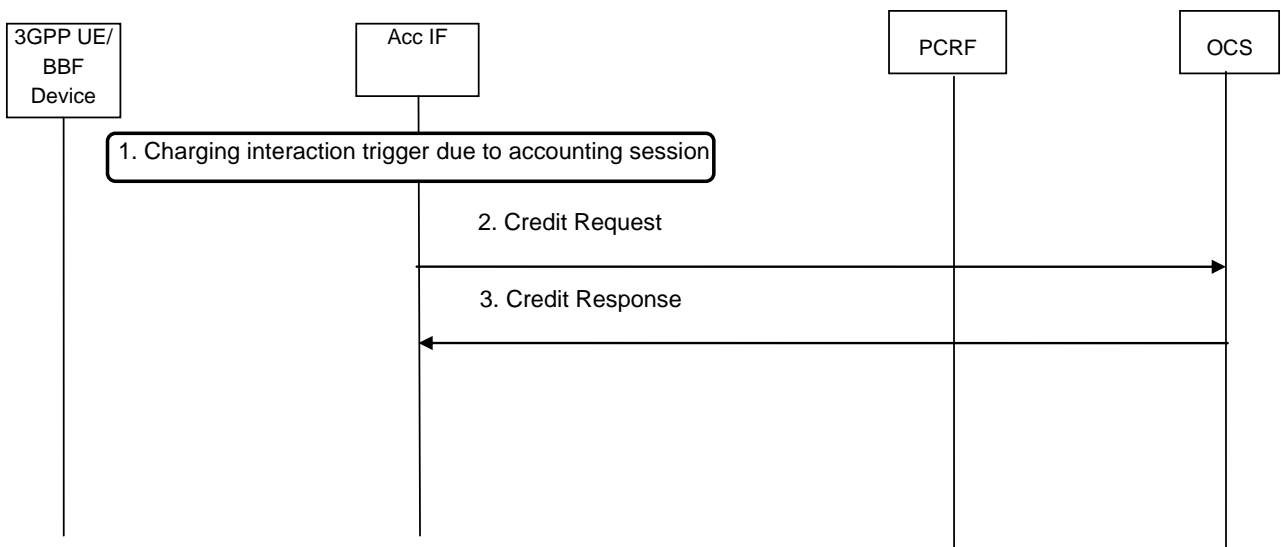
Charging Session Termination
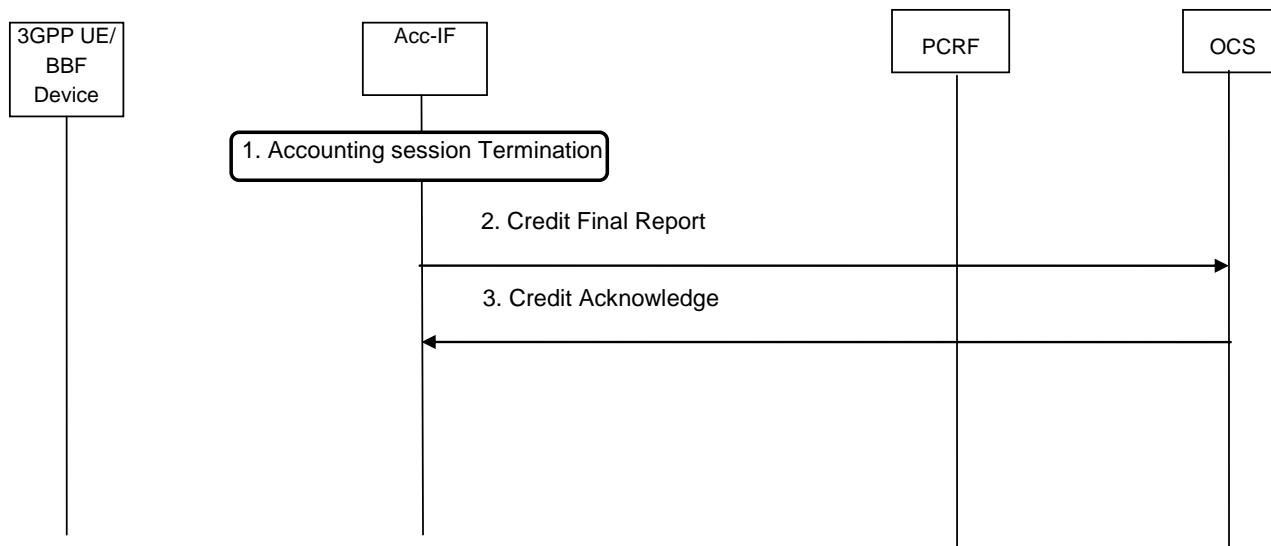
Figure 5.13.3.3-3: AAA-based Charging Session Termination

1. The Accounting Session terminates.

2. The Accounting Interworking Function shall issue the final reports and return the remaining credit to the OCS.

3. The OCS acknowledges the credit report and terminates the online charging session.

5.14 Binding Mechanism

The binding mechanism includes two steps:

1. Session binding.

2. PCC rule authorization.

   Session binding of AF session and TDF session (in unsolicited mode) to an IP-CAN session is performed by the PCRF, as defined in clause 6.1.1 of TS 23.203 [4].

The PCRF derives and authorises PCC rules as described in clause 6.1.1 of TS 23.203 [4].

5.15 Conclusion on BB1

5.15.1 Enhancements to PCC architecture

The study for support QoS, IP Edge/PCEF-based and TDF-based charging has been concluded with the assumptions and requirements described in clauses 5.2 to 5.12 for the support of convergence scenario for 3GPP UE and of fixed device.

This clause lists the identified enhancements to PCC architecture to support policy and charging control for fixed devices and for 3GPP UEs in a non-seam WLAN offload scenario,

In case of BBF-defined Fixed Broadband Access, the PCEF located in the IP Edge is defined in WT-300 [17]. The PCEF in the IP Edge supports both Gxd, Gyd and Gzd reference points and credit management, reporting, termination action, policy control functions, standardized QoS characteristics, application detection and redirection functionalities as defined in the TS 23.203 [4] with the following considerations:

- For Policy control and standardized QoS characteristics, the authorized QoS for a service data flow or for an application is provided by PCRF to the PCEF; the assumption is that the PCEF uses QCI for traffic prioritization, GBR for admission control and MBR for bandwidth limitation.

    Editor's note: Verification of the usage of ARP for pre-emption of existing IP Sessions or prioritization of new requests to establish an IP Session and verification of event triggers applicable to BBF architecture is ongoing.

- For credit management, there is one credit management session with the OCS for each IP-CAN session subject of online charging.

    Editor's note: Verification of credit reauthorization triggers detected by IP Edge/PCEF applicable to BBF architecture is ongoing.

The BBF confirms that WT-300 scope includes the support of the following charging options:

- Gy/Gz-based charging in IP Edge

- TDF-based charging

Alternatively, the TDF supports Sd, Gyt and Gzt for credit management, reporting, termination action functions policy control and redirection as defined in the TS 23.203 [4].

    Editor's note: BBF has been informed about configuration needed in the BBF-defined Fixed Broadband Access in order to achieve QoS and charging support in the TDF.

In case of Fixed Broadband Access, the SPR stores subscriber data for fixed devices.

In case of BBF-defined Fixed Broadband Access the following areas of enhancements are identified for the PCRF thus far: identification of fixed devices, or the access specific information sent from PCEF as defined in WT-300 to PCRF, i.e. logical and physical circuit ID of the fixed device. No required enhancements have been identified for the AF so far. Additional requirements on PCRF may be received from BBF at a later time.

5.15.2   Enhancements to AAA architecture

The study for the support of AAA-based charging has been concluded with the assumptions that the Accounting Interworking Function located in the BBF domain performs interworking between accounting received over B reference point in BBF domain and charging performs over Gya and Gza towards OCS/OFCS in 3GPP domain.

    NOTE: Whether the Accounting Interworking function resides in the BBF AAA proxy or is a stand-alone function is outside the 3GPP scope.

    Editor's note: Verification above assumptions is ongoing with BBF.

6   Building block 3: PCC for 3GPP UE connected to fixed broadband access networks via S2b and S2c reference points for EPC routed traffic

    Editor's note: This clause will contain items being part of Building Block 3 P4C-s2bc.

6.1   Key issues

    Editor's note: This clause will identify the key issues for Building Block 3.

6.2 Architectural requirements and assumptions

Editor's note: This clause will identify the architectural requirements and assumptions as well as architecture common for Building Block 3.

6.3 Alternative Solutions

Editor's note: This clause will describe the alternative solutions for Building Block 3, if more than 1 will be proposed.

6.3.1 Alternative X

6.3.1.1 General principles

Editor's note: This clause will describe the general principles for alternative X for Building Block 3.

6.3.1.2 Reference architecture

Editor's note: This clause will describe the reference architecture for Non-roaming and for roaming scenario for alternative X for Building Block 3.

6.3.1.3 Reference points

Editor's note: This clause will describe the reference points of architecture for roaming for alternative X for Building Block 3.

6.3.1.4 Policy forQoS and charging

Editor's note: This clause will identify the requirements and assumptions for Policy for QoS and charging for Building Block 3.

6.3.1.5 Procedures

Editor's note: This clause will identify the procedures for Policy and QoS in TS 23.402 [3] and/or TS 23.203 [4] style for Building Block 3.

6.4 Evaluation of alternatives

Editor's note: This clause contains the evaluation of solutions for Building Block 3 based on the objectives.

6.5 Conclusions

Editor's note: This clause contains the conclusions for the Building Block 3.

7 Building block 4: PCC for EPC routed traffic over fixed broadband access networks of 3GPP UEs connected via H(e)NB

Editor's note: This clause will contain items being part of Building Block 4 P4C-HeNB.

7.1 Key issues

Editor's note: This clause will identify the key issues for Building Block 4.

7.2 Architectural requirements and assumptions

Editor's note: This clause will identify the architectural requirements and assumptions as well as architecture common for Building Block 4.

7.3 Alternative Solutions

Editor's note: This clause will describe the alternative solutions for Building Block 4, if more than 1 will be proposed.

7.3.1 Alternative X

7.3.1.1 General principles

Editor's note: This clause will describe the general principles for alternative X for Building Block 4.

7.3.1.2 Reference architecture

Editor's note: This clause will describe the reference architecture for Non-roaming and for roaming scenario for alternative X for Building Block 4.

7.3.1.3 Reference points

Editor's note: This clause will describe the reference points of architecture for roaming for alternative X for Building Block 4.

7.3.1.4 Policy for QoS and charging

Editor's note: This clause will identify the requirements and assumptions for Policy for QoS and charging for Building Block 4.

7.3.1.5 Procedures

Editor's note: This clause will identify the procedures for Policy and QoS in TS 23.402 [3] and/or TS 23.203 [4] style for Building Block 4.

7.4 Evaluation of alternatives

Editor's note: This clause contains the evaluation of solutions for Building Block 4 based on the objectives.

7.5 Conclusions

Editor's note: This clause contains the conclusions for the Building Block 4.

8 Building block 5: PCC for supporting Layer 2 traffic in fixed broadband access networks

Editor's note: This clause will contain items being part of Building Block 5 P4C-FL2.

8.1 Key issues

Editor's note: This clause will identify the key issues for Building Block 5.

8.2 Architectural requirements and assumptions

Editor's note: This clause will identify the architectural requirements and assumptions as well as architecture common for Building Block 5.

8.3 Alternative Solutions

Editor's note: This clause will describe the alternative solutions for Building Block 5, if more than 1 will be proposed.

8.3.1 Alternative X

8.3.1.1 General principles

Editor's note: This clause will describe the general principles for alternative X for Building Block 5.

8.3.1.2 Reference architecture

Editor's note: This clause will describe the reference architecture for Non-roaming and for roaming scenario for alternative X for Building Block 5.

8.3.1.3 Reference points

Editor's note: This clause will describe the reference points of architecture for roaming for alternative X for Building Block 5.

8.3.1.4 Policy for QoS and charging

Editor's note: This clause will identify the requirements and assumptions for Policy for QoS and charging for Building Block 5.

8.3.1.5 Procedures

Editor's note: This clause will identify the procedures for Policy and QoS in TS 23.402 [3] and/or TS 23.203 [4] style for Building Block 5.

8.4 Evaluation of alternatives

Editor's note: This clause contains the evaluation of solutions for Building Block 5 based on the objectives.

8.5 Conclusions

Editor's note: This clause contains the conclusions for the Building Block 5.

9 Building block 6 : PCC for 3GPP UE connected to fixed broadband access networks via S2a reference point for EPC routed traffic

Editor's note: This clause will contain items being part of Building Block 6 P4C-TC.

9.1 Key issues

Editor's note: This clause will identify the key issues for Building Block 6.

9.2 Architectural requirements and assumptions

Editor's note: This clause will identify the architectural requirements and assumptions as well as architecture common for Building Block 6.

9.3 Alternative Solutions

Editor's note: This clause will describe the alternative solutions for Building Block 6, if more than 1 will be proposed.

9.3.1 Alternative 1: Policy and QoS control over Gxd

9.3.1.1 General principles

Editor's note: This clause will describe the general principles for alternative X for Building Block 6.

General architectural assumptions:

- There is a direct Gxd interface between PCRF and IP Edge.

- PCRF provides QoS rules via Gxd interface to IP Edge for both S2a-GTP and S2a-PMIP cases.

- The IP Edge is the policy enforcement point for QoS rules in the fixed access network.

- The IP Edge shall be able to perform the appropriate mapping from QoS parameters it receives from the PCRF to BBF specific parameters.

  NOTE 1: For which entity internal to TWAN to process the QoS rules received from PCRF over Gxd is outside the scope of 3GPP.

  NOTE 2: Additional policy session (i.e. IP-CAN session) associated with the same UE may be established for attaching UE to the fixed device and to enable the NSWO over the same Gxd interface.

9.3.1.2 Reference architecture

Editor's note: This clause will describe the reference architecture for Non-roaming and for roaming scenario for alternative X for Building Block 6.

The converged network architecture for BB 6 is shown in the following figures.

This architecture supports the scenario of a single network operator deploying both the 3GPP EPC and the BBF access network. Furthermore the architecture supports the roaming scenario between two PLMN operators.

The architectures in the following figures show only entities and interfaces that are in scope of the work and/or are impacted by BB 6.

The reference points internal to the Fixed Broadband access network are defined or are under definition by Broadband Forum and are out of the scope of this TR.
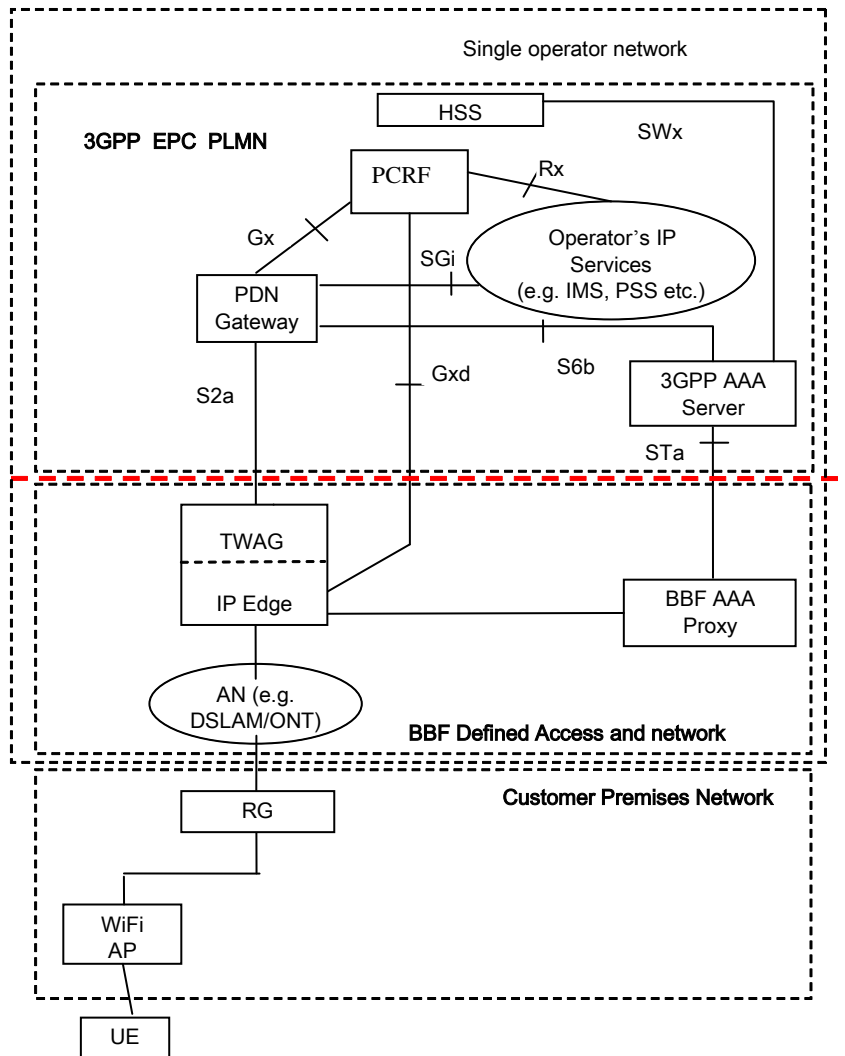
Figure 9.3.1.2-1: Non-Roaming Architecture for policy and control over Gxd for fixed broadband access network connected via s2a
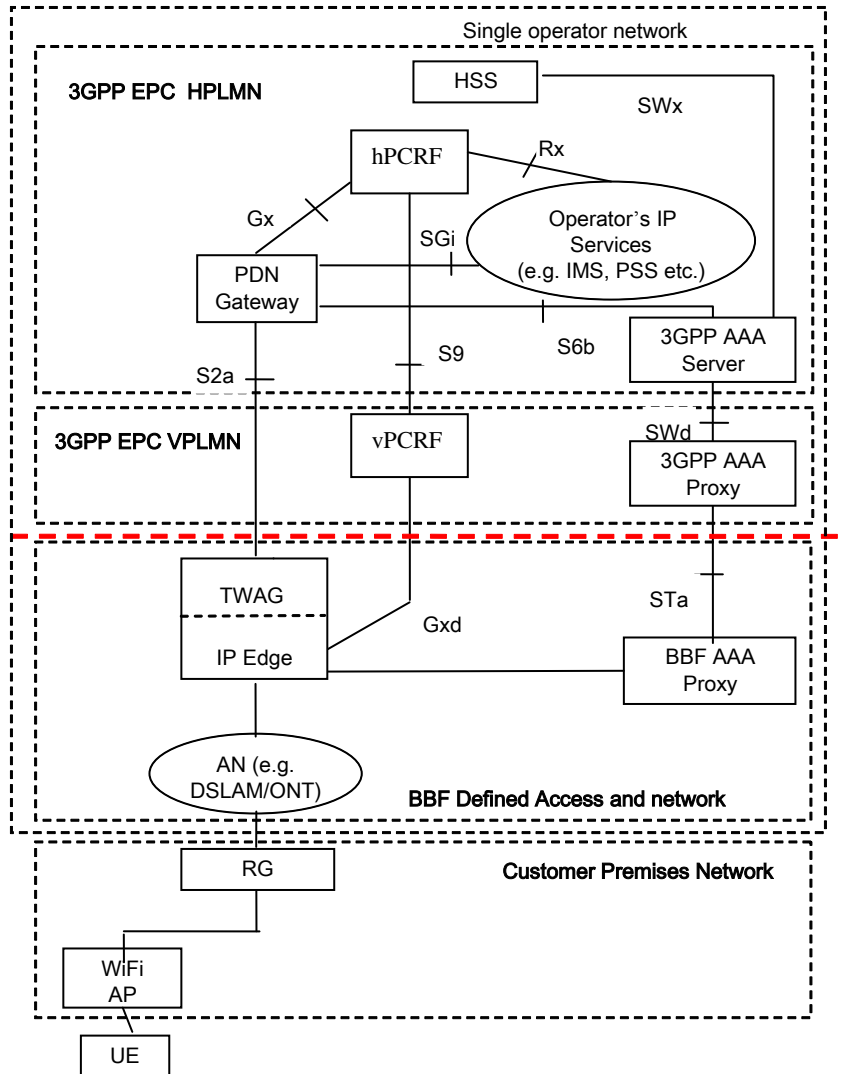
Figure 9.3.1-2-2: Roaming Architecture for policy and control over Gxd for fixed broadband access network connected via s2a - Home Routed
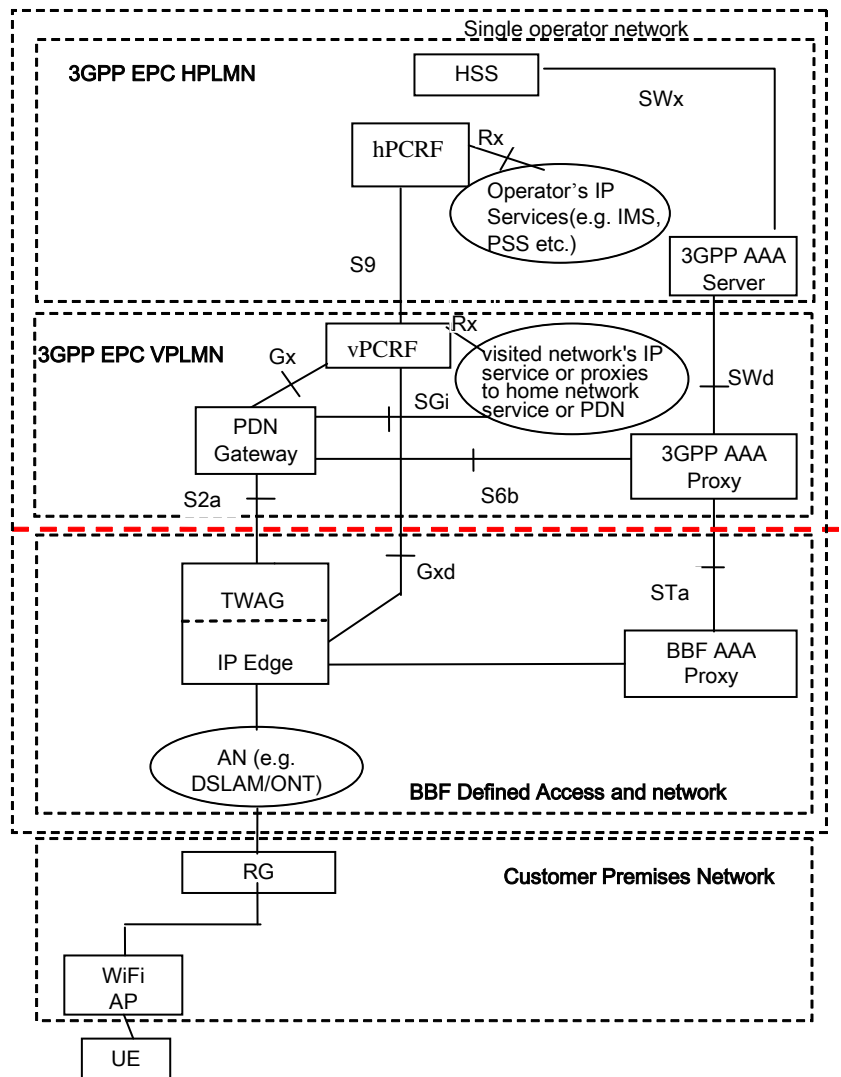
Figure 9.3.1.2-3: Roaming Architecture for policy and control over Gxd for fixed broadband access network connected via s2a - Local Break Out

NOTE 1: Whether the TWAG and IP Edge is integrated or standalone is defined in BBF and is out of 3GPP scope.

9.3.1.3   Reference points

Editor's note: This clause will describe the reference points of architecture for roaming for alternative X for Building Block 6.

Gxd   For the purpose of convergence between 3GPP and BBF network it transfers QoS control policies from the Home PCRF to the IP Edge in non-roaming scenario and from the Visited PCRF to the BNGIP Edge in roaming scenario.

Editor's note: It is FFS whether Gxd is Gx or an enhancement of Gx.

Editor's note: It is FFS whether S9 requires enhancements.

Gxd Reference Point:

-    The Gxd reference point enables a PCRF to have dynamic control over the QoS behaviour at a BBF network.

-    The Gxd reference point enables the signalling of PCC decision and it supports the following functions:

     -    Request for QoS rules from IP Edge to PCRF.

     -    Provision of QoS rules from PCRF to IP Edge.

- Termination of Gateway control session over Gxd interface by IP Edge or PCRF.

Editor's note: Whether the Gateway control session over Gxd for the EPC-routed traffic is initiated by PCRF or IP Edge is FFS.

9.3.1.4 Policy for QoS and charging

Editor's note: This clause will identify the requirements and assumptions for Policy for QoS and charging for Building Block 6.

In this alternative solution, Policy and QoS are sent over Gxd signalling, i.e. no additional requirement are imposed to FBB/BBF to define a signalling path to support either S2a-GTP or S2a-Gxa to provision QoS rules at the IP Edge.

Assumptions for policy and QoS control in alternative solution #1: Policy and QoS via S9aGxd:

- A common policy control interface is defined to support converged policy for the co-existence deployment for the fixed, NSWO and EPC-routed.

- The policy control interface described above is agnostic to the deployment of S2a-GTP or S2a-PMIP.

- The policy control interface described above is agnostic to the internal configuration of TWAN (e.g. standalone or integrated TWAN and IP Edge configurations).

- The QoS parameters that are in-band to S2a-GTP will be ignored by TWAN as Gxd is the common policy control interface to support policy control interworking for S2a over trusted WLAN access.

9.3.1.5 Procedures

Editor's note: This clause will identify the procedures for Policy and QoS in TS 23.402 [3] and/or TS 23.203 [4] style for Building Block 6.

9.4 Evaluation of alternatives

Editor's note: This clause contains the evaluation of solutions for Building Block 6 based on the objectives.

9.5 Conclusions

Editor's note: This clause contains the conclusions for the Building Block 6.

10 Conclusions

Editor's note: This clause contains the conclusions and the output of the study. This clause will be also filled based with common part for the BBS when 1 or more BBs are mature enough. The indication included this clause will be used for normative work.

10.1 Reference architecture

Editor's note: This clause contains the results and the common architecture for the building block for which the work has been completed.

10.2 Policy for QoS and charging

Editor's note: This clause contains the results and the common definition of policy for QoS and charging for the building block for which the work has been completed.

10.3 Procedure

Editor's note: This clause contains the results and the common procedure for the building block for which the work has been completed.

Annex A:
3GPP EAP-based access authentication with respect to routed RG

For the case when the 3GPP UE performs the 3GPP-based authentication, there are two considerations with respect to the Routed mode RG with or without NAT:

- Routed mode RG with NAT

    - RG with NAT is operating with IPv4 addressing. The RG obtains a public IPv4 address from the IP Edge after the RG powers on and performs the authentication.

- Routed mode RG without NAT

    - RG without NAT is operating in either IPv6 or/and IPv4. For IPv6, the RG obtains an IPv6 prefix from the IP Edge after the RG powers on and performs the authentication.

    - For IPv4, the RG obtains a public IPv4 address from the IP Edge after the RG powers on and performs the authentication. The RG or IP Edge assigns another public IPv4 address to the 3GPP UE once the UE has performed 3GPP-based authentication. When the IPv4 addresses are allocated by the RG, there shouldn't be any overlapping between the address pools of the RGs connecting to the same IP Edge.

Annex B:
Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
July 2012	SA2#92				First draft including the follow ing doc S2-122131, S2-123333, S2-123201, S"-12349, S2-123384, S2-123320		0.1.0
October 2012	SA2#93				Included follow ing document: S2-123976, S2-123985, S2-123988, S2-123989, S2-124097, S2-124160, S2-124176	0.1.0	0.2.0
October 2012	SA2#93				Erroneous implementation of document S2-123988 (missing approved revisions) with consequent impact on technical specification included in version 0.2.0	0.2.0	0.3.0
November 2012	SA2#94				Included follow ing document:S2-4673, S2-124674, S2-124681, S2-124855, S2-124899, S2-124906	0.3.0	0.4.0
January 2013	SA2#95				Included follow ing documents:S2-130116, S2-130606, S2-130607, S2-130496, S2-130497	0.4.0	0.5.0
02-2013	SP#59	SP-130096	-	-	MCC Update for presentation to TSG SA for information	0.5.0	1.0.0
04-2013	SA2#96	-	-	-	MCC Correction to include Erroneous implementation of document S2-120606 in clause 5.2 left out of v1.0.0. Included follow ing documents: S2-131331, S2-131334, S2-131338, S2-131349, S2-131439, S2-131440, S2-131442, S2-131443, S2-131444, S2-131546, S2-131548	1.0.0	1.1.0
04-2013	-	-	-	-	History Box correction	1.1.0	1.1.1
05-2013					Included follow ing documents:s2-132046, S2-132208, S2-132213, S2-132314	1.1.1	1.2.0
07-2013					Included document:S2-132753	1.2.0	1.3.0
09-2013	SP#61	SP-130386	-	-	MCC Update for presentation to TSG SA for information	1.3.0	1.3.1