



(51) International Patent Classification:

H04L 12/24 (2006.01) H04L 12/14 (2006.01)
H04W 4/24 (2009.01) G06Q 30/02 (2012.01)

(21) International Application Number:

PCT/EP2017/050274

(22) International Filing Date:

6 January 2017 (06.01.2017)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

16305015.6 8 January 2016 (08.01.2016) EP

(71) Applicant: ALCATEL LUCENT [FR/FR]; 148/152
Route de la Reine, 92100 Boulogne-Billancourt (FR).

(72) Inventors: THIEBAUT, Laurent; Alcatel-Lucent Interna-
tional, Centre de Villarcieux, Route de Villejust, 91620
Nozay (FR). MULEY, Praveen; Alcatel-Lucent USA Inc,
805 East Middlefield road, Mountain View, California
94043-4025 (US).

(74) Agent: EL MANOUNI, Josiane; Alcatel-Lucent Interna-
tional, 148/152 Route de la Reine, 92100 Boulogne-Billan-
court (FR).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN,
KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA,
MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG,
NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS,
RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY,
TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN,
ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,

[Continued on next page]

(54) Title: DYNAMIC PROVISION OF APPLICATION RELATED SPONSORED DATA CONNECTIVITY

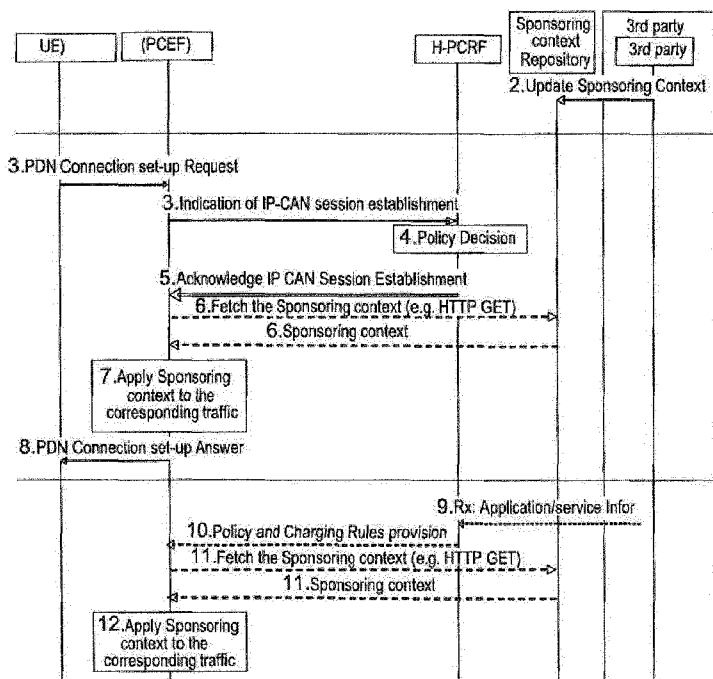


Fig. 5

(57) Abstract: An embodiment of the invention is a Policy Enforcement Function such as PCEF or TDF, configured to: receive from a Policy Controller such as PCRF, over an interface such as Gx or Sd interface, a command related to a User Equipment UE, said command referring to a Sponsoring Context Identifier, Sponsoring Context ID, said Sponsoring Context ID serving as an identifier of a Sponsoring Context to be applied to application-related data traffic to be sponsored for said UE, said Sponsoring Context providing a list of data flows to be sponsored.

WO 2017/118737 A1



SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, **Published:**
GW, KM, ML, MR, NE, SN, TD, TG).

— *with international search report (Art. 21(3))*

DYNAMIC PROVISION OF APPLICATION RELATED SPONSORED DATA CONNECTIVITY

The present invention generally relates to communication networks and
5 systems, in particular mobile communication networks and systems.

Descriptions of mobile networks and systems can be found in the literature, such as in particular in Technical Specifications published by standardization bodies such as for example 3GPP (3rd Generation Partnership Project).

In general, in a mobile communication system, a terminal (also called User
10 Equipment UE) has access to various application services via a mobile network (PMN). In particular, a terminal has access to IP-based application services via an IP-Connectivity Access Network (IP-CAN). An example of IP-CAN is EPS (Evolved Packet System) network, specified in particular in 3GPP TS 23.401 and TS 23.402 . An EPS network comprises EPC (Evolved Packet Core) that can be accessed by different Radio
15 Access Networks (such as for example E-UTRAN).

Policy and Charging Control (PCC) functionality is specified in particular in 3GPP TS 23.203. PCC functions include in particular: PCRF (Policy and Charging Rules Function), PCEF (Policy and Charging Enforcement Function), TDF (Traffic Detection Function), AF (Application Function), SPR (Subscriber Profile Repository).
20 Interfaces within PCC architecture include in particular: Gx interface between PCRF and PCEF, Rx interface between AF and PCRF, Sd interface between PCRF and TDF. An example of PCC architecture is recalled in figure 1 taken from 3GPP TS 23.203.

A feature called Sponsored Data Connectivity has been introduced in such systems. In particular, PCC usage for Sponsored Data Connectivity has been
25 specified in 3GPP TS 23.203. As defined in particular in 3GPP TS 23.203, with sponsored data connectivity, the Sponsor has a business relationship with the operator and the Sponsor reimburses the operator for the user's data connectivity in order to allow the user access to an associated Application Service Provider's (ASP) services. An example of deployment for Sponsored Data Connectivity is recalled in
30 figure 2 taken from 3GPP TS 23.203.

As recognized by the inventors and as will be described with more details later, there is a need to improve PCC usage for Sponsored Data Connectivity.

Embodiments of the present invention in particular address such needs.

These and other objects are achieved, in one aspect, by a Policy Enforcement Function such as PCEF or TDF, configured to:

- receive from a Policy Controller such as PCRF, over an interface such as Gx or Sd interface, a command related to a User Equipment UE, said command referring to a Sponsoring Context Identifier, Sponsoring Context ID, said Sponsoring Context ID serving as an identifier of a Sponsoring Context to be applied to application-related data traffic to be sponsored for said UE, said Sponsoring Context providing a list of data flows to be sponsored.

10

These and other objects are achieved, in another aspect, by a Policy Controller, such as PCRF, configured to:

- send to a Policy Enforcement Function such as PCEF or TDF, over an interface such as Gx or Sd interface, a command related to a User Equipment UE, said command referring to a Sponsoring Context Identifier, Sponsoring Context ID, said Sponsoring Context ID serving as an identifier of a Sponsoring Context to be applied to application-related data traffic to be sponsored for said UE, said Sponsoring Context providing a list of data flows to be sponsored.

20

These and other objects are achieved, in another aspect, by an application-related entity such as AF interfacing with a Policy Controller such as PCRF, over an interface such as Rx interface, said application-related entity configured to:

- send to said Policy Controller a Sponsoring Context Identifier, Sponsoring Context ID, for a user, said Sponsoring Context ID serving as an identifier of a Sponsoring Context to be applied to application-related data traffic to be sponsored for said user, said Sponsoring Context providing a list of data flows to be sponsored.

These and other objects are achieved, in another aspect, by a Content Server, referred to as Sponsoring Context Repository, configured to:

- provide a Sponsoring Context to be applied to application-related data traffic to be sponsored for a User Equipment UE, upon reception of a request including a Sponsoring Context Identifier, Sponsoring Context ID, said Sponsoring Context ID serving as a pointer to said Sponsoring Context stored in said Sponsoring

Context Repository, said Sponsoring Context providing a list of data flows to be sponsored.

These and other objects are achieved, in another aspect, by a OAM
5 equipment of a mobile network, configured to:
- create in a content server, referred to as Sponsoring Context Repository, a Sponsoring Context document, identified by a Sponsoring Context Identifier, Sponsoring Context ID, said Sponsoring Context ID serving as information to build an identifier of a Sponsoring Context stored in said Sponsoring Context document.

10

These and other objects are achieved, in another aspect, by method for dynamic provision of application related sponsored data connectivity, said method comprising at least one step performed by at least one of a thus configured: Policy Enforcement Function such as PCEF or TDF, Policy Controller such as PCRF,
15 application-related entity such as AF, content server referred to as Sponsoring Context Repository, OAM entity of a mobile network.

20 Some embodiments of apparatus and/or methods in accordance with embodiments of the present invention are now described, by way of example only, and with reference to the accompanying drawings, in which:

- Figure 1 is intended to recall an example of PCC architecture,
- Figure 2 is intended to recall an example of deployment for Sponsored Data
25 Connectivity,
- Figure 3 is intended to recall a signaling flow for IP-CAN session establishment,
- Figure 4 is intended to recall a signaling flow for IP-CAN session modification (PCRF initiated),
- 30 - Figure 5 is intended to illustrate an example of signaling flow, according to embodiments of the invention.

Abbreviations

	ADC	Application Detection and Control
	AF	Application Function
	APN	Access Point Name
5	EPC	Evolved Packet Core
	EPS	Evolved Packet System
	HTTP	HyperText Transfer Protocol
	IP-CAN	IP- Connectivity Access Network
	MNO	Mobile Network Operator
10	OAM	Operation And Maintenance
	PCC	Policy and Charging Control
	PCEF	Policy and Charging Enforcement Function
	PCRF	Policy and Charging Rules Function
	PGW	PDN Gateway
15	SPR	Subscription Profile Repository
	TDF	Traffic Detection Function
	UE	User Equipment
	URL	Uniform Resource Locator

20

Description of various aspects and/or embodiments of the invention

Following description of various aspects and/or embodiments of the invention will be made by way of example for the case of the usage of the Sponsoring Context ID in the case of a PGW (PCEF). However, as understood by the skilled person, embodiments of the invention are not limited to such case.

3GPP as part of a Study on sponsored data connectivity improvements (FS-SDCI, whose WID is in document SP-150627) is working on improvements of the Sponsored data connectivity topic. This study especially addresses the following: "This key issue shall study:

1. How to support a dynamic provisioning of Sponsored data flow beyond layers 3 and 4 (e.g. URLs) from 3rd-party service providers to operator networks. "
- The Sponsored data connectivity feature has been specified as part of 3gpp Rel10 and is documented in 3GPP TS 23.203 (for example Annex N)
Note: in all this document the Third party may also correspond to an internal application of the operator.

40

One of the usages of sponsored data connectivity is the possibility for a Third party to sponsor advertisement. This kind of sponsoring would apply to a collection of users (possibly to all users).

The FS-SDCI study has thus following facets:

- Allowing a 3rd party to define the sponsored data flows not only by specifying 5 T-uples¹ (as defined in current 3GPP TS 23.203) but by giving higher layer information such as a list of sponsored URL
- 5 • Avoiding overloading the Rx and Gx interfaces by repeating the same list of sponsored URL over a Rx and a Gx Diameter session set-up for each user (as defined in current 3GPP TS 23.203, the list of sponsored data flows is explicitly provided over a Rx and a Gx Diameter session set-up for each user)
- 10 • Provide flexibility for the Third part capability to change the list of sponsored flows
- Allow the operator to control the feature.

¹ IP address and ports

In some embodiments:

- The QoS requirements sent by the policy controller (e.g. PCRF in EPC architecture defined in 3GPP TS 23.203) to the Policy enforcement Function (e.g. PCEF located in the PGW or in the BNG as defined in 3GPP TS 23.203 or TDF as defined in 3GPP TS 23.203) does not contain the list of flows to be sponsored but a pointer (actually an HTTP URL) to this list: the Sponsoring Context Id.

In some embodiments:

- When the PCEF (PGW) or TDF receives a PCC/ADC rule referring to a Sponsoring context Id, it fetches the Sponsoring Context i.e. the list of flows that are sponsored (HTTP GET on the URL in the Sponsoring Context Id). As HTTP is used, caching techniques ensure that the PCEF/TDF does not need to fetch the list of flows that are sponsored for each user (Gx) session associated with an already known Sponsoring Context Id. The caching time may control how long the list of sponsored flows is valid

In some embodiments:

The Sponsoring Context may correspond to a list of

- URL that are sponsored
- Server name indication (SNI) as specified in IETF RFC 6066
 - SNI is an extension to the TLS protocol by which a client indicates which hostname it is attempting to connect to at the start of the TLS handshaking process. This allows a server to present multiple certificates on the same IP address and TCP port number and hence allows multiple secure (HTTPS) websites (or any other Service over TLS) to be served off the same IP address without requiring all those sites to use the same certificate
-

In some embodiments:

- The Sponsoring context Id may be dynamically passed from the 3rd party to the operator via Rx (in this case the 3rd party selects which UE will benefit from the sponsoring context) or statically configured in the PCRF (policy rules)(in that case the Sponsoring context Id applies to a collection of users, for example to the traffic of all users on a given APN or to the traffic of some user categories on an APN). Based on policy rules (and/or on information received on Rx) the PCRF decides whether to put a Sponsoring Context Id in the Gx(/Sd) commands sent to a PCEF(/TDF) about an UE and decides on the value of this Sponsoring Context Id.

In some embodiments:

- The Content server (Sponsoring context Repository) that stores the Sponsoring Context (e.g. list of sponsored URL) belongs to the operator so is under control of the operator but the Third party may modify the list of sponsored flows as often as it desires based on its own business needs. This is to be controlled by business agreements between the operator and the Third party

Figure 5 depicts an example of signaling flow for the case of the usage of the Sponsoring Context Id in the case of a PGW (PCEF).

In figure 5, the dotted lines correspond to optional interactions.

Following operations may be distinguished:

- 5 Off line operations (operations not related with an user activity)
 In some embodiments, part or all of following steps may be provided:
0. The Third party and the operator (MNO) negotiate a sponsoring agreement that
 10 is identified by a Sponsoring Context Id which is an unique identifier (e.g. URL)
 that refers to the Sponsoring Context i.e. to the actual list of Flows that the Third
 party is ready to sponsor (i.e. the Sponsoring context).
 The Sponsoring Context Id refers to a content server that is hosted by
 the (OAM of the) operator. This allows the operator to control the list of flows
 that Third party may sponsor.
- 15 1. The operator
- a. Creates in the Sponsoring context Repository a Sponsoring Context
 document identified by the Sponsoring Context Id.
- b. May modify PCRF policies accordingly, e.g. may create policy rules that
 20 associate an APN, an user category, a subscription type, etc... with one
 or more Sponsoring Context Id.
2. The Third party updates the list of flows it is ready to sponsor by e.g. adding /
 modifying / removing entries (URL, , ..) in the Sponsoring Context stored in the
 25 Sponsoring context Repository. These operations are controlled by the operator
 OAM.
- 30 "on-line" operations (operations related with an user activity): actions at an
 IP-CAN Session Establishment
 In some embodiments, part or all of following steps may be provided:
3. An UE sets up a PDN connection as described in Figure 3 corresponding to
 3GPP TS 23.203 Figure 7.2-1: "IP-CAN Session Establishment".
 35 The PCEF/TDF request policies from the PCRF.
 This is done via an indication of IP-CAN session establishment . Steps 2 to 5
 of Figure 3 take place without modification
4. (as part of step 7 of Figure 3 in case of PCEF) Based on policy rules the PCRF
 40 decides whether to put a Sponsoring Context Id in the Gx(/Sd) commands to be
 sent to the PCEF(/TDF) about an UE and decides on the value of this
 Sponsoring Context Id. For example for this decision, the PCRF may use:
- The APN of the target IPCAN session (in that case all UE are associated
 with the same sponsoring context, e.g. corresponding to ads).
- 45 • An user category received from the SPR (Subscriber Policy repository) as
 defined in 3GPP TS 23.203
- Or any combination of these parameters
- Or any other parameter
- 50 5. The PCRF provides the PCEF/TDF with PCC/ADC rules.

In case of a PCEF as part of the PCRF acknowledgement of the IP-CAN session establishment (step 14 of Figure 3) the PCRF may send PCC rules related with Sponsoring Context.

5 In case of a TDF as part of the TDF Session establishment request (step 8 of Figure 3) the PCRF may send ADC rules related with Sponsoring Context

10 The Sponsoring Context Id may be provided in a PCC/ADC rule instead of an application ID. This allows associating flows identified by the Sponsoring Context Id with existing PCC information such as Rating Groups (charging), QoS , Usage monitoring, etc....

6. When the PCEF or TDF receives a PCC/ADC rule referring to an unknown Sponsoring context Id (i.e. a Sponsoring context Id that it has not yet resolved), it fetches from the Sponsoring context Repository the Sponsoring Context i.e. the list of flows that are sponsored (HTTP GET on the URL in the Sponsoring Context Id). As HTTP is used, caching techniques ensure that the PCEF/TDF does not need to fetch the list of flows that are sponsored for each user (Gx/Sd) session associated with an already known/resolved Sponsoring Context Id. The caching time may control how long the list of sponsored flows is valid.

20 7. The PCEF/TDF starts applying the PCC/ADC rule (charging, QoS control, usage monitoring, etc...) to the flows identified by the Sponsoring context Id (whose identifiers have been received in the Sponsoring Context).

25 8. The IP-CAN Session Establishment is further processed as in steps 15 to 19 of Figure 3:

30 “on-line” operations (operations related with an user activity): actions at an Rx request from the Third party application

In some embodiments, part or all of following steps may be provided:

35 9. The Third party application may decide to apply Sponsoring only for some users. In that case it may provide the sponsoring context Id to the PCRF over an Rx session (invoking step1a of Figure 4 corresponding to 3GPP TS 23.203 Figure 7.5: IP-CAN Session Modification; PCRF initiated). Steps 2 to 11 of Figure 4 may take place

40 10. The PCRF provides the PCEF/TDF with updated PCC/ADC rules
The PCRF may send to the PCEF the Policy and Charging Rules Provision as in Step12 of Figure 4. As part of this step the PCRF may provide Sponsoring context Id as part of the PCC rule information sent over Gx.
The PCRF may send to the TDF updated ADC rules as part of a Sd session modification (as in step 5 of Figure 4). As part of this step the PCRF may
45 provide Sponsoring context Id as part of the ADC rule information sent over Sd

11. The PCEF/TDF action is similar to that described at step 6

50 12. The PCEF/TDF action is similar to that described at step 7

Such mechanism in particular avoids the PCC chain (Rx, Gx/Sd) to have to pass long lists of URL that a Third party provider is ready to sponsor.

- NOTE: The Sponsoring context Id passed over Gx/Sd does not need to correspond to the full URL that the PCEF/TDF uses in step 6 / 11 to fetch the sponsoring Context.: The Sponsoring Context ID may
- either include a HTTP URL pointing to the Sponsoring Context
 - or include information to be used to build a HTTP URL pointing to the Sponsoring Context. For example, the sponsoring context Id is "OTT-x/sponsor-Ad" and the PCEF/TDF adds a fixed URL part like "https://www.operator.com/sponsor-context/" to build the final target "https://www.operator.com/sponsor-context/OTT-x/sponsor-Ad"

Various aspects of the invention include (though not being limited to) following aspects.

One aspect of the invention is a Policy Enforcement Function such as PCEF or TDF

Various embodiments may be provided, including (though not being limited to) following embodiments, which may be taken alone or in combination, according to various combinations.

In an embodiment, said Policy Enforcement Function is configured to:

- receive from a Policy Controller such as PCRF, over an interface such as Gx or Sd interface, a command related to a User Equipment UE, said command referring to a Sponsoring Context Identifier, Sponsoring Context ID, said Sponsoring Context ID serving as an identifier of a Sponsoring Context to be applied to application-related data traffic to be sponsored for said UE, said Sponsoring Context providing a list of data flows to be sponsored.

In an embodiment, said Policy Enforcement Function is configured to:

- fetch said Sponsoring Context from a content server referred to as Sponsoring Context Repository, using said Sponsoring Context ID as a pointer to said Sponsoring Context stored in said Sponsoring Context Repository.

In an embodiment, said Policy Enforcement Function is configured to:

- fetch said Sponsoring Context from a content server referred to as Sponsoring Context Repository by sending to said content server a HTTP request, such as HTTP GET, on an HTTP URL corresponding to the content of said Sponsoring Context ID or built using the content of said Sponsoring Context ID.

- 5 In an embodiment, said Policy Enforcement Function is configured to:
- receive said Sponsoring Context ID with an associated policy rule such as PCC or ADC rule.

- In an embodiment, said Policy Enforcement Function is configured to:
- receive said Sponsoring Context ID in a command acknowledging
- 10 establishment of an IP-CAN session establishment for said UE, such as Acknowledge IP-CAN Session Establishment.

Another aspect of the invention is a Policy Controller, such as PCRF.

- Various embodiments may be provided, including (though not being limited
- 15 to) following embodiments, which may be taken alone or in combination, according to various combinations.

- In an embodiment, said Policy Controller is configured to:
- send to a Policy Enforcement Function such as PCEF or TDF, over an interface such as Gx or Sd interface, a command related to a User Equipment UE,
- 20 said command referring to a Sponsoring Context Identifier, Sponsoring Context ID, said Sponsoring Context ID serving as an identifier of a Sponsoring Context to be applied to application-related data traffic to be sponsored for said UE, said Sponsoring Context providing a list of data flows to be sponsored.

- In an embodiment, said Policy Controller is configured to:
- 25 - associate said Sponsoring Context ID with said UE, based on at least one, or a combination of, parameters related to said UE including:

- An APN of an IP-CAN session,
- A user category,
- A subscription type.

- 30 In an embodiment, said Policy Controller is configured to:
- store policy rules associating said APN and/or user category and/or subscription Type with one or more Sponsoring Context ID.

In an embodiment, said Policy Controller is configured to:

- send said Sponsoring Context ID to said Policy Enforcement Function in a command acknowledging establishment of an IP-CAN session for said UE, such as Acknowledge IP-CAN Session Establishment.

In an embodiment, said Policy Controller is configured to:

- 5 - receive said Sponsoring Context ID from an application-related entity such as an AF, over an interface such as a Rx interface.

In an embodiment, said Policy Controller is configured to:

- send said Sponsoring Context ID to said Policy Enforcement Function in a command such as Policy and Charging Rules Provision.

- 10 In an embodiment, said Policy Controller is configured to:

- send said Sponsoring Context ID to said Policy Enforcement Function in a command such as Sd session modification.

In an embodiment, said Policy Controller is configured to:

- 15 - send said Sponsoring Context ID to said Policy Enforcement Function with an associated policy rule such as PCC or ADC rule.

In an embodiment:

- said Sponsoring Context ID includes a HTTP URL pointing to said Sponsoring Context or includes information to be used to build a HTTP URL pointing to said Sponsoring Context.

20

Another aspect of the invention is an application-related entity such as AF interfacing with a Policy Controller such as PCRF, over an interface such as Rx interface.

- 25 Various embodiments may be provided, including (though not being limited to) following embodiments, which may be taken alone or in combination, according to various combinations.

In an embodiment, said application-related entity is configured to:

- 30 - send to said Policy Controller a Sponsoring Context Identifier, Sponsoring Context ID, for a user, said Sponsoring Context ID serving as an identifier of a Sponsoring Context to be applied to application-related data traffic to be sponsored for said user, said Sponsoring Context providing a list of data flows to be sponsored.

In an embodiment, said application-related entity is configured to:

- invoke a session such as Rx session over said interface such as Rx interface, for sending said Sponsoring Context ID to said Policy Controller.

In an embodiment:

- said Sponsoring Context ID includes a HTTP URL pointing to said Sponsoring Context or includes information to be used to build a HTTP URL pointing to said Sponsoring Context.

In an embodiment, said application-related entity is configured to:

- update the content of the Sponsoring Context under control of the OAM of the operator.

10

Another aspect of the invention is a Content Server, referred to as Sponsoring Context Repository.

Various embodiments may be provided, including (though not being limited to) following embodiments, which may be taken alone or in combination, according

15 to various combinations.

In an embodiment, said Content Server is configured to:

- provide a Sponsoring Context to be applied to application-related data traffic to be sponsored for a User Equipment UE, upon reception of a request including a Sponsoring Context Identifier, Sponsoring Context ID, said Sponsoring Context ID serving as a pointer to said Sponsoring Context stored in said Sponsoring Context Repository, said Sponsoring Context providing a list of data flows to be sponsored.

20 In an embodiment, said Content Server is configured to:

- receive said request from a Policy Enforcement Function such as PCEF or

25 TDF.

In an embodiment, said Content Server is configured to:

- said Sponsoring Context ID including information to build a HTTP URL pointing to said Sponsoring Context, provide said Sponsoring Context upon reception of a HTTP request, such as HTTP GET, on said HTTP URL.

30

Another aspect of the invention is a OAM equipment of a mobile network.

Various embodiments may be provided, including (though not being limited to) following embodiment.

In an embodiment, said OAM equipment is configured to:

- create in a content server, referred to as Sponsoring Context Repository, a Sponsoring Context document, identified by a Sponsoring Context Identifier, Sponsoring Context ID, said Sponsoring Context ID serving as information to build an identifier of a Sponsoring Context stored in said Sponsoring Context document.

Another aspect of the invention is a method for dynamic provision of application related sponsored data connectivity, said method comprising at least one step performed by at least one of a thus configured: Policy Enforcement Function such as PCEF or TDF, Policy Controller such as PCRF, application-related entity such as AF, content server referred to as Sponsoring Context Repository, OAM entity of a mobile network.

Other possible embodiments than described above are also possible, e.g. where the Policy Controller is another entity than the PCRF of 4G-EPC such as the function of the 5G Core Network determining policies for the network or where the Policy Enforcement Function may be any entity enforcing policies to user plane traffic such as the PDN-GW-U and TDF-U defined in 3GPP TR 23.714 or the entity enforcing policies to user plane traffic in a 5G Core Network.

A person of skill in the art would readily recognize that steps of various above-described methods can be performed by programmed computers. Herein, some embodiments are also intended to cover program storage devices, e.g., digital data storage media, which are machine or computer readable and encode machine-executable or computer-executable programs of instructions, wherein said instructions perform some or all of the steps of said above-described methods. The program storage devices may be, e.g., digital memories, magnetic storage media such as a magnetic disks and magnetic tapes, hard drives, or optically readable digital data storage media. The embodiments are also intended to cover computers programmed to perform said steps of the above-described methods.

CLAIMS

1. A Policy Enforcement Function such as PCEF or TDF, configured to:
 - receive from a Policy Controller such as PCRF, over an interface such as Gx
 - 5 or Sd interface, a command related to a User Equipment UE, said command referring to a Sponsoring Context Identifier, Sponsoring Context ID, said Sponsoring Context ID serving as an identifier of a Sponsoring Context to be applied to application-related data traffic to be sponsored for said UE, said Sponsoring Context providing a list of data flows to be sponsored.
 - 10
2. A Policy Enforcement Function according to claim 1, configured to:
 - fetch said Sponsoring Context from a content server referred to as Sponsoring Context Repository, using said Sponsoring Context ID as a pointer to said Sponsoring Context stored in said Sponsoring Context Repository.
 - 15
3. A Policy Enforcement Function according to claim 1 or 2, configured to:
 - fetch said Sponsoring Context from a content server referred to as Sponsoring Context Repository by sending to said content server a HTTP request, such as HTTP GET, on an HTTP URL corresponding to the content of said Sponsoring
 - 20 Context ID or built using the content of said Sponsoring Context ID.
4. A Policy Enforcement Function according to any of claims 1 to 3, configured to:
 - receive said Sponsoring Context ID with an associated policy rule such as
 - 25 PCC or ADC rule.
5. A Policy Enforcement Function according to any of claims 1 to 4, configured to:
 - receive said Sponsoring Context ID in a command acknowledging
 - 30 establishment of an IP-CAN session establishment for said UE, such as Acknowledge IP-CAN Session Establishment.
6. A Policy Controller, such as PCRF, configured to:

- send to a Policy Enforcement Function such as PCEF or TDF, over an interface such as Gx or Sd interface, a command related to a User Equipment UE, said command referring to a Sponsoring Context Identifier, Sponsoring Context ID, said Sponsoring Context ID serving as an identifier of a Sponsoring Context to be
5 applied to application-related data traffic to be sponsored for said UE, said Sponsoring Context providing a list of data flows to be sponsored.

7. A Policy Controller according to claim 6, configured to:

- associate said Sponsoring Context ID with said UE, based on at least one,
10 or a combination of, parameters related to said UE including:

- An APN of an IP-CAN session,
- A user category,
- A subscription type.

15 8. A policy Controller according to claim 6 or 7, configured to:

- store policy rules associating said APN and/or user category and/or subscription Type with one or more Sponsoring Context ID.

9. A Policy Controller according to any of claims 6 to 8, configured to:

20 - send said Sponsoring Context ID to said Policy Enforcement Function in a command acknowledging establishment of an IP-CAN session for said UE, such as Acknowledge IP-CAN Session Establishment.

10. A Policy Controller according to claim 6, configured to:

25 - receive said Sponsoring Context ID from an application-related entity such as an AF, over an interface such as a Rx interface.

11. A Policy Controller according to claim 9 or 10, configured to perform at least one of following actions:

30 - send said Sponsoring Context ID to said Policy Enforcement Function in a command such as Policy and Charging Rules Provision,
- send said Sponsoring Context ID to said Policy Enforcement Function in a command such as Sd session modification.

12. A Policy Controller according to any of claims 6 to 11, configured to:

- send said Sponsoring Context ID to said Policy Enforcement Function with
5 an associated policy rule such as PCC or ADC rule.

13. A Policy Controller according to any of claims 6 to 12, wherein:

- said Sponsoring Context ID includes a HTTP URL pointing to said
Sponsoring Context or includes information to be used to build a HTTP URL pointing
10 to said Sponsoring Context

14. An application-related entity such as AF interfacing with a Policy
Controller such as PCRF, over an interface such as Rx interface, said application-
related entity configured to:

- 15 - send to said Policy Controller a Sponsoring Context Identifier, Sponsoring
Context ID, for a user, said Sponsoring Context ID serving as an identifier of a
Sponsoring Context to be applied to application-related data traffic to be sponsored
for said user, said Sponsoring Context providing a list of data flows to be sponsored.

20 15. An application-related entity according to claim 14, configured to:

- invoke a session such as Rx session over said interface such as Rx interface,
for sending said Sponsoring Context ID to said Policy Controller.

16. An application-related entity according to claim 14 or 15, wherein:

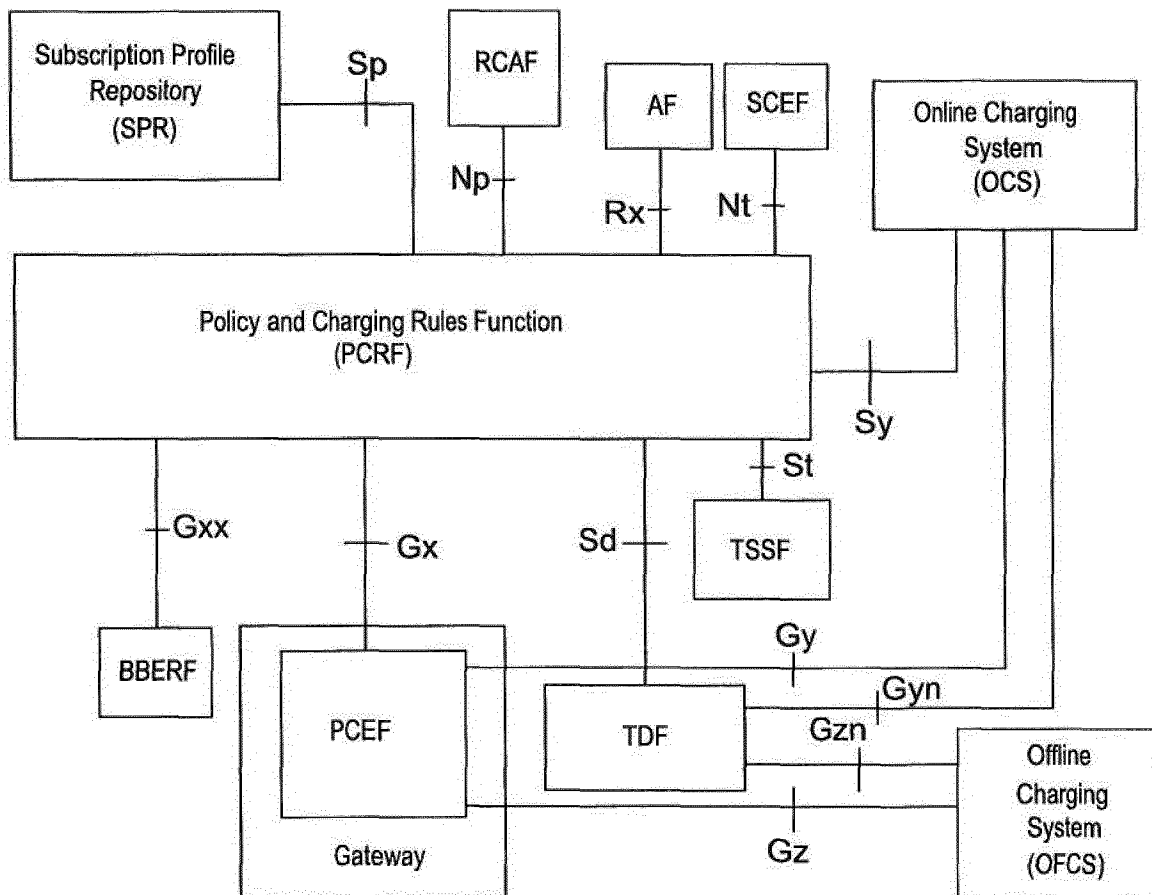
- 25 - said Sponsoring Context ID includes a HTTP URL pointing to said
Sponsoring Context or includes information to be used to build a HTTP URL pointing
to said Sponsoring Context.

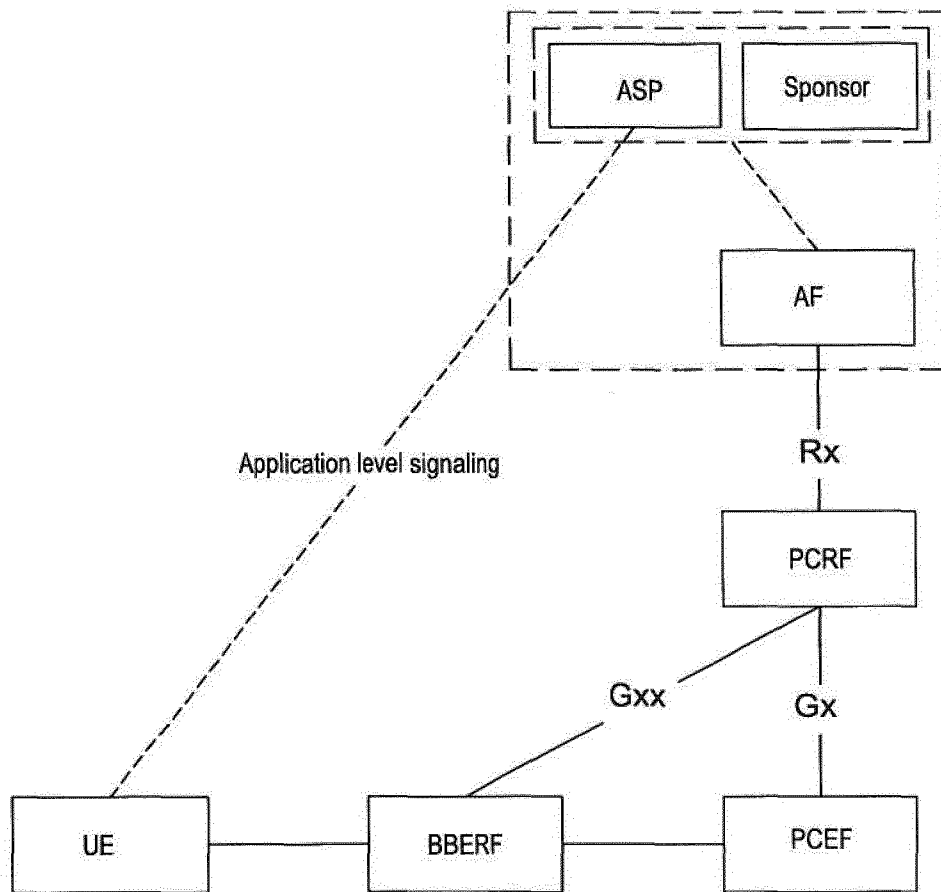
17. An application-related entity according to any claim 14 to 16 ,

30 configured to:

- update the content of the Sponsoring Context under control of the OAM of
the operator.

18. A Content server, referred to as Sponsoring Context Repository,
configured to:
- provide a Sponsoring Context to be applied to application-related data traffic to be sponsored for a User Equipment UE, upon reception of a request
- 5 including a Sponsoring Context Identifier, Sponsoring Context ID, said Sponsoring Context ID serving as a pointer to said Sponsoring Context stored in said Sponsoring Context Repository, said Sponsoring Context providing a list of data flows to be sponsored.
- 10 19. A Content server according to claim 17, configured to:
- receive said request from a Policy Enforcement Function such as PCEF or TDF.
20. A Content server according to claim 17 or 18, configured to:
- 15 - said Sponsoring Context ID including information to build a HTTP URL pointing to said Sponsoring Context, provide said Sponsoring Context upon reception of a HTTP request, such as HTTP GET, on said HTTP URL.
21. An OAM equipment of a mobile network, configured to:
- 20 - create in a content server, referred to as Sponsoring Context Repository, a Sponsoring Context document, identified by a Sponsoring Context Identifier, Sponsoring Context ID, said Sponsoring Context ID serving as information to build an identifier of a Sponsoring Context stored in said Sponsoring Context document.
- 25 22. A method for dynamic provision of application related sponsored data connectivity, said method comprising at least one step performed by at least one of a Policy Enforcement Function such as PCEF or TDF, a Policy Controller such as PCRF, an application-related entity such as AF, a content server referred to as Sponsoring Context Repository, an OAM entity of a mobile network, configured according to any
- 30 of claims 1 to 21.

**Fig. 1**

**Fig. 2**

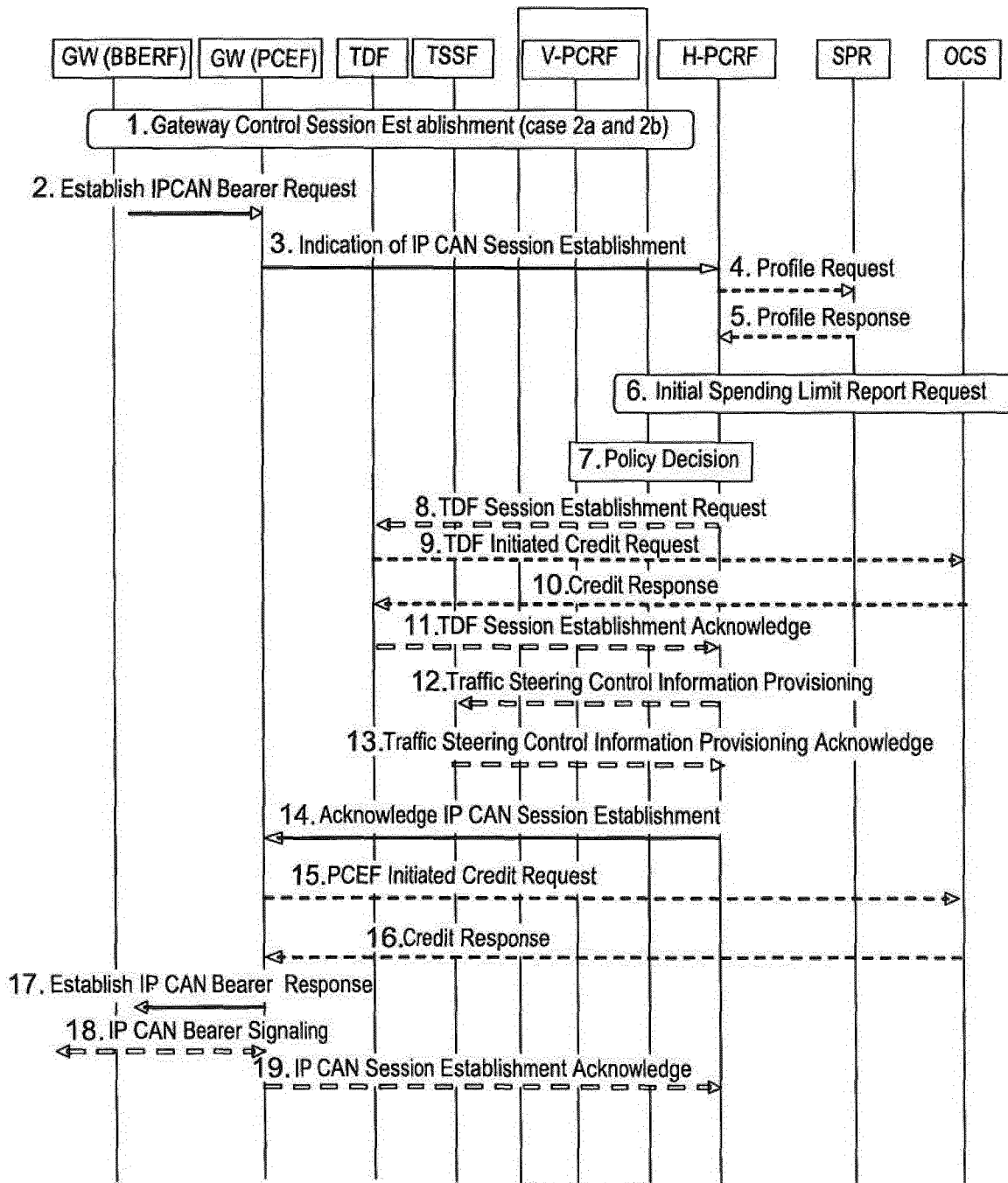


Fig. 3

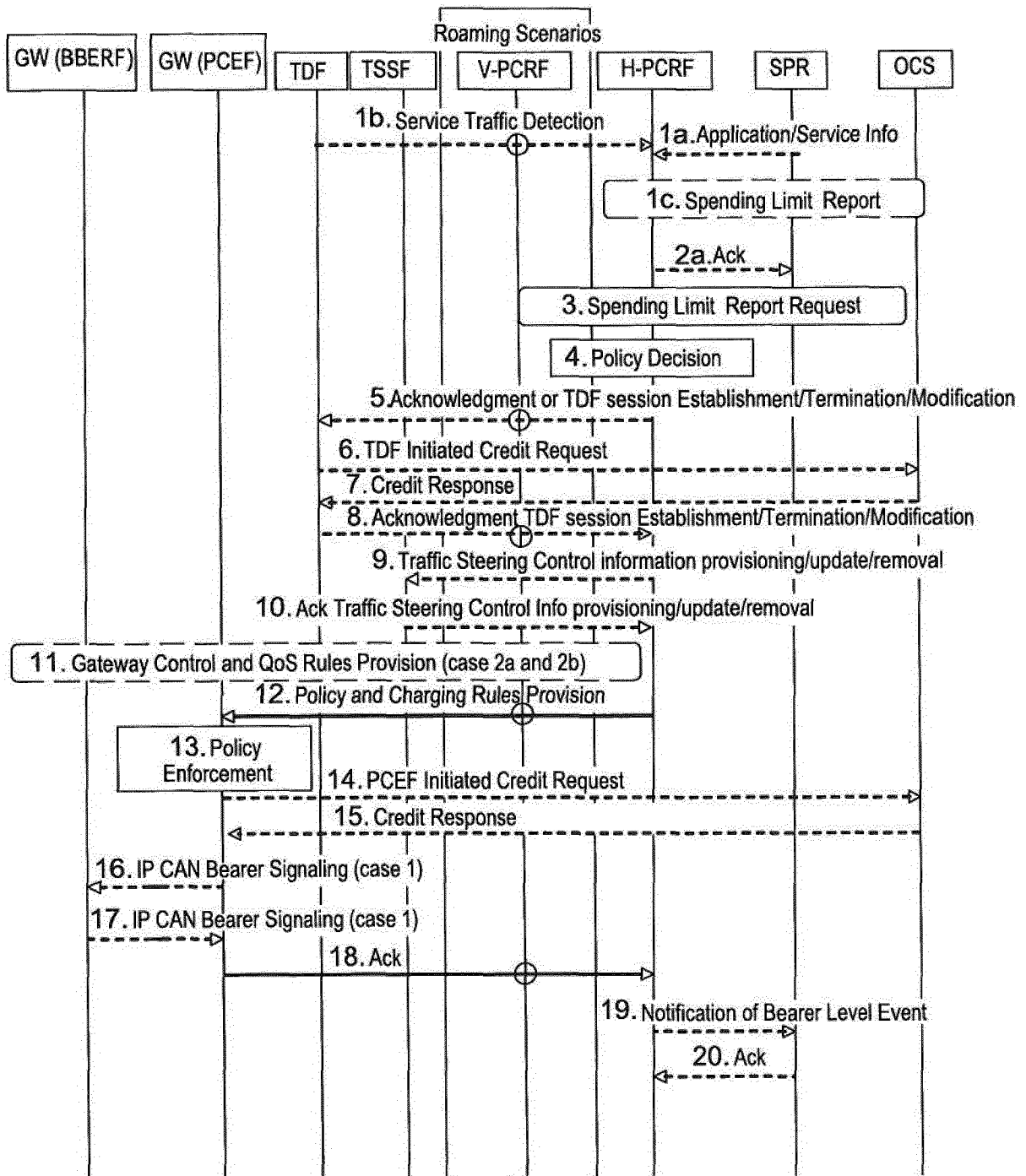


Fig. 4

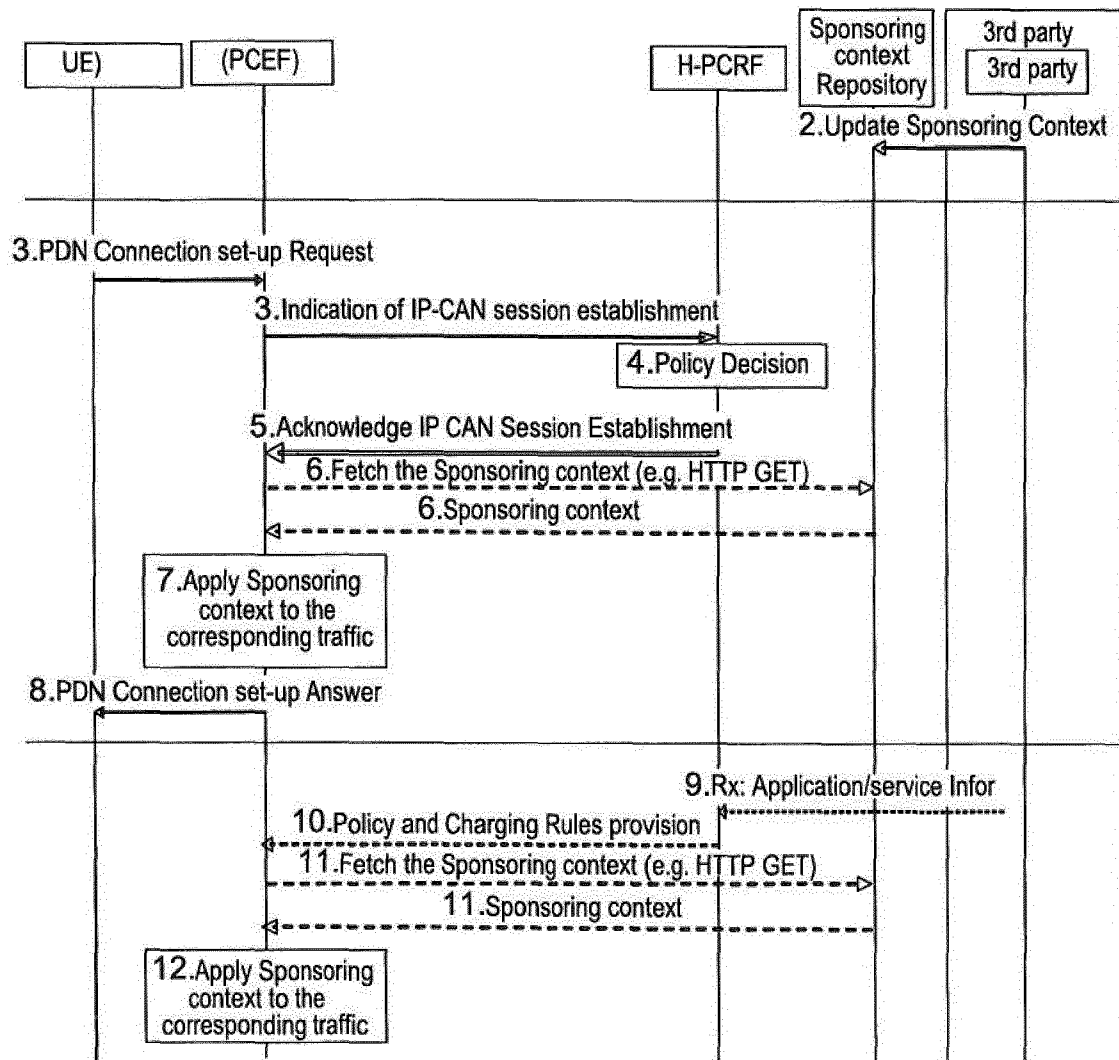


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/050274

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L12/24 H04W4/24 H04L12/14 G06Q30/02
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04L H04W G06Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	QUALCOMM INCORPORATED ET AL: "Support for sponsored data connectivity: Impacts to current stage 2", 3GPP DRAFT; S2-102096-POLICY-SPONSORED-IMPACTS, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. SA WG2, no. Kyoto, Japan; 20100510 - 20100514, 4 May 2010 (2010-05-04), XP050630753, the whole document	1-22
A	US 2015/172899 A1 (SHARMA MANISH [US] ET AL) 18 June 2015 (2015-06-18) the whole document ----- -/-	1-22



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

9 February 2017

Date of mailing of the international search report

17/02/2017

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

García Bolós, Ruth

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2017/050274

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	"3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Study on Sponsored Data Connectivity Improvements (Release 14)", 3GPP DRAFT; 23721-011-RM, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , 30 December 2015 (2015-12-30), XP051071830, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg_sa/WG2_Arch/Latest_SA2_Specs/Latest_draft_S2_Specs/ [retrieved on 2015-12-30] the whole document -----	1-22
X,P	ALCATEL-LUCENT ET AL: "New Solution: Usage of a sponsoring context Identifier", 3GPP DRAFT; S2-160074 SDCI- SPONSORING CONTEXT ID-V0.1, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. SA WG2, no. Saint Kitts, KN; 20160125 - 20160129 17 January 2016 (2016-01-17), XP051059732, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Meetings_3GPP_SYNC/SA2/Docs/ [retrieved on 2016-01-17] the whole document -----	1-22

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/050274

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2015172899	A1	18-06-2015	NONE
