(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 November 2007 (15.11.2007)

PCT

(10) International Publication Number
WO 2007/128343 A1

(51) International Patent Classification:
H04Q 7/22 (2006.01)

(21) International Application Number:
PCT/EP2006/061980

(22) International Filing Date: 2 May 2006 (02.05.2006)

(25) Filing Language: English

(26) Publication Language: English

(71) Applicant *(for all designated States except US)*: **TELEFONAKTIEBOLAGET L M ERICSSON (publ)** [SE/SE]; S-164 83 Stockholm (SE).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **LUNDIN, Niklas** [SE/SE]; Röds Norgård 8, S-423 34 Torslanda (SE). **HOLMSTRÖM, Tomas** [SE/SE]; Johan Åkermans väg 3, S-240 10 Dalby (SE). **PASTOR BALBÁS, J. Javier** [ES/ES]; Suecia 35, E-28022 Madrid (ES). **PETERSSON, Justus** [SE/SE]; Tegelviksgatan 38, S-116 41 Stockholm (SE). **RÖNNEKE, Hans** [SE/SE]; Stormgatan 3, S-434 34 Kungsbacka (SE).

(74) Agents: **BERGENTALL, Annika** et al.; Cegumark AB, P.O Box 53047, S-400 14 Gothenburg (SE).

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

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

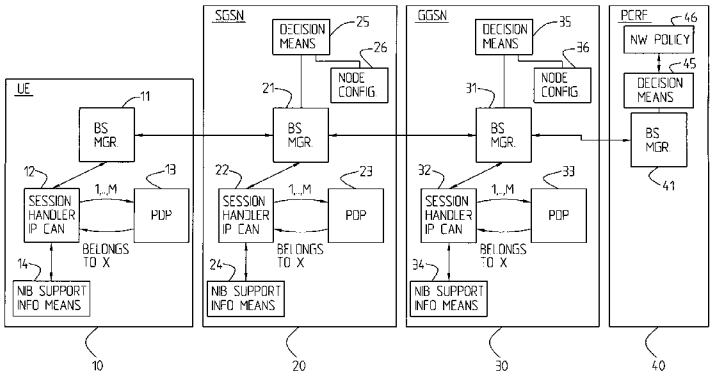
— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SYSTEM, APPARATUS AND METHOD FOR NEGOTIATING THE ESTABLISHMENT OF A NETWORK INITIATED BEARER IN A WIRELESS NETWORK



(57) Abstract: The present invention relates to a communication system supporting communication of packet data comprising a number of core network nodes (20,30) capable of communicating with policy and/or service handling nodes (40) and mobile user stations (10) over radio access networks. Said mobile user stations (10) and core network nodes (20,30) comprise respective bearer service managing means (11;21;31). Said nodes (10,20,30,40) are adapted to support network initiated bearer set-up and nodes affected by a session are adapted to, directly or indirectly, provide at least one of said other nodes with information about whether it supports network initiated bearer (NIB) set-up or not upon occurrence of a particular respective activating event. The respective bearer service managing means of the nodes affected by a new session are adapted to distribute said information about the support of NIB of the respective nodes enabling a negotiation procedure between said nodes (10,20,30,40) to determine if NIB is to be supported or not during the new session and said information is consistent in said nodes (10,20,30,40).

WO 2007/128343 A1

Title:

SYSTEM, APPARATUS AND METHOD FOR NEGOTIATING THE ESTABLISHMENT OF A NETWORK INITIATED BEARER IN A WIRELESS NETWORK

FIELD OF THE INVENTION

The present invention relates to a communication system supporting communication of packet data and which comprises a number of nodes of different categories comprising a number of core network nodes communicating with mobile user stations over one or more radio access networks and capable of communicating with policy handling nodes. Said mobile user stations and core network nodes and possibly policy and/or service handling nodes comprise respective bearer service managing means. The invention also relates to a core network packet data support node adapted to handle communication with mobile user stations over a radio access network and other core network nodes and/or other nodes, for example policy and/or service handling nodes, and it comprises bearer service managing means. Further yet the invention relates to a mobile user station supporting communication of packet data which comprises bearer service managing means adapted to communicate with core network packet data support nodes. Still further the invention relates to a policy and/or service handling node adapted to be in communication with core network nodes of a core network and comprising a bearer service managing means. Still further the invention relates to a method in a communications system supporting communication of packet data which comprises a number of core network nodes. Particularly the invention relates to establishment of a bearers with a specific QoS.

STATE OF THE ART

In GPRS (GSM Packet Radio Service) and similar systems the only way to establish bearers, particularly PDP contexts, is based on the establishment being initiated from a mobile station, particularly a user equipment (UE), towards a packet data support node acting as a gateway, for example a GGSN (Gateway GPRS Support Node). This means that primary as well as secondary bearers have to be initiated at the mobile user station. Often, however, such procedures are disadvantageous in that it deprives the operator of controlling service provisioning to a sufficient extent.

Particularly it is disadvantageous in that an operator will depend on the application in a mobile station of any type, new or old, to select the appropriate QoS. Due to the variety of mobile stations it will not function in a homogenous manner. This makes it difficult for an operator to offer services functioning homogenously, reliably and in a desired manner, and resources will be wasted. Therefore, in this respect, the operator actually has not sufficient control and can not be sure that a service functions with different mobile stations in the same manner. Today applications have to specified for each type of mobile station, i.e. the applications are to a high extent terminal dependent, i.e. depending on mobile user station type.

It has actually been suggested to allow bearers to be established from the network side, for example initiated by a GGSN, a PCRF (Policy Charging Rules Function), and AF (Application Function) etc. Such Network Initiated Bearer (NIB) would be triggered to fulfill certain QoS needs that the network may detect to render a service. Reference is herewith made to 3GPP TSG SA WG2 Architecture - SA2#50, 16-20 Jan. 2006, Budapest, Hungary (S2-060049).

However, in order to have such a NIB running in a network, it is necessary that all implicated or affected nodes actually have capability to handle it, which is not always the case, particularly since such a feature normally would be introduced gradually, which means that e.g. mobile nodes, mobile user stations which are older or just simpler and cheaper, low end-terminals, but also other network nodes may not support the NIB feature which gives rise to problems and even prevents introduction as such of NIB.

SUMMARY OF THE INVENTION

What is needed is therefore a system in which network initiated bearer set-up, in the following simply denoted NIB, can be implemented. Particularly a system is needed through which NIB can be implemented also in networks in which one or more nodes do not support NIB. Still further a system is needed through which NIB can be implemented optimally from a system point of view or a network point of view even if some node or equipment or mobile user station does not support NIB. Still further a system is needed through which an operator can introduce NIB independently of any other operator. Moreover a system is needed through which NIB dependent features can be introduced in an easy manner. Particularly a system is needed through which all nodes which are affected by a session will have knowledge of whether the NIB procedure is or can be used and about how they should behave in case it is used as well as if it is not used. Particularly a system is needed through which, with due regard to mobility, information as to whether a NIB is or can be used should be maintained, i.e. also when there is a change of for example packet data support node, for example SGSN (Service GPRS Support Node), or at Inter SGSN Routing Area Update procedures. Generally it is an object of

the invention to provide a system in which NIB can be implemented in an easy and reliable manner to the optimum extent. Particularly a system is needed in which NIB can be introduced without affecting all categories of packet data support nodes.

A packet data support node through which one or more of the above mentioned objects can be achieved, i.e. as sisting in fulfilling of one or more above mentioned objects, is also needed. Still further a mobile user station or a user equipment is needed through which one or more of the above mentioned objects can be achieved as well as a policy/server handling node, such as for example a PCRF or similar, application function or other external node, i.e. not forming part of the core network. Still further a method is needed through which one or more of the above mentioned objects can be achieved.

Therefore a communication system as initially referred to is provided in which at least a number of nodes are adapted to support network initiated bearer set-up, whereby all nodes affected by a session are adapted to, directly or indirectly, provide at least one of said other nodes affected by a particular new, also called current, session, with information about whether it supports network initiated bearer set-up or not upon occurrence of a particular respective activating event, the bearer service managing means of the respect ive nodes involved in the new, current, session being adapted to distribute information about the support of network initiated bearer set-up, thus enabling a negotiation procedure as to whether network initiated bearer set-up shall be used or not for the new or current session. An indirect indication may for example consists in no indication at all being provided which

hence indirectly indicates that the node does not support NIB, or vice versa. In other contexts in this application indirect indication means that an indication received from a node inherently indicates that also preceding nodes directly or indirectly have provided an indication to that node.

Particularly network initiated bearer set-up is only used or initiated if all nodes affected by a new or current session, at least as far as NIB is concerned, have provided an indication that network initiated bearer set-up is supported by the respective node for that session.

Particularly the core network nodes and the mobile user station node respectively comprise a session handling means comprising a data structure with a number of bearers with one or more different characteristics, for example QoS, for each of a number of IP addresses and which is in communication with said bearer service managing means. It should be clear that each session always has one IP address, even if there are several PDPs on the session; IP address is an attribute on session; QoS is a PDP attribute and all PDPs of a session have the same IP address. Particularly said session handling means are adapted to provide or generate a network initiated bearer set-up support indication. Such a support indication may comprise a specific, selected message. Such a support indication may also comprise an information element (or more information elements) adapted to be included in a data field in an existing, conventional message to be provided to another node in the messaging relating to the new or current session initial bearer set-up.

In a most advantageous implementation the NIB support indication is provided in a container information element

which is adapted to be transferred from one node to another transparently through at least one intermediate node category. This is particularly advantageous in that not all nodes are necessarily affected by the new session, at least as far as NIB is concerned, cf. SGSN nodes or similar nodes. Particularly the container information element comprises a protocol Configuration Option Field (PCO). Such an information element is generally present in all Session Management (SM) messages such as for example Create PDP Context Request/Response, Modified PDP Context Request/Response and Delete PDP Context Request/Response. In a most advantageous implementation the container information element, particularly a PCO, is additionally used to initiate or trigger bearer set-up in a network node, for example a core network node or an external node such as a PCRF or similar.

Particularly a core network node of a first category comprises a serving packet data support node, for example an SGSN, a core network node of a second category may comprise a gateway packet data support node, such as a GGSN. There are different activation events for each node or node category. Particularly the activation event for a first category core network node, for example a SGSN, comprises reception of a primary bearer activation/creation request, for example an activate PDP context request, including a network initiated bearer support indication from a mobile user station. The activation event for a second category core network node, for example a GGSN, may comprise reception of a request for creation of a primary bearer, for example a create PDP context request, including a network initiated bearer activation support indication from a first category core network node, from for example an SGSN.

In an alternative implementation, based on use of a container information element, particularly a so called PCO container, the activation event for a second category core network node comprises reception of a request for creation of a primary bearer including a network initiated bearer activation support indication in such a container element from a mobile user station, transparently transferred to it via a first category core network node, for example an SGSN. This means that the SGSN is not affected by the new or current session as far as NIB is concerned. This is extremely advantageous insofar that any SGSN related procedures will then be unaffected by the introduction of network initiated bearers. Such SGSN related procedures are for example mobility management using Inter SGSN RAU (ISRAU), SRNS Relocation, PS Handover procedures etc.

Particularly at least core network nodes of said second category and/or policy or service handling nodes comprise decision means for deciding if a bearer set-up is to be initiated by the network, e.g. by said policy and/or service handling node, or by said second category core network node, and to forward, directly or indirectly, a decision outcome or a use indication to a respective core network node affected by the new session or to the mobile user station respectively. Particularly all affected or all core network nodes comprise bearer indication decision means for determining if network initiated bearer set-up is to be implemented for a particular session or not unless a PCO container is used. Particularly said bearer initiation decision means are adapted to be initiated if a decision is received from another node indicating that the network initiated bearer is to be used as far as that other node is concerned. The outcome of the decision in said core network node is directly or indirectly

provided to another core network node or to be mobile user station if also said node decides that NIB should be used.

Particularly existing, or conventional, messages for example bearer response or acceptance messages are modified or extended to include a decision outcome. Even more particularly the decision outcome is provided in a policy or service related rule installation message modified or extended to include information about the decision outcome.

The support indication may e.g. comprise a NIB flag.

If all nodes concerned by a session initiated by a mobile user station through a request for a bearer, e.g. a PDP context (primary), have indicated directly or indirectly support for NIB and a positive decision outcome (use indication) for NIB set-up is provided in a core network node at least of a second category and eventually a policy/service handling node or some other external node as well as the mobile station, the second category core network node or the policy/service handling is adapted to initiate secondary PDP context set-ups during said session, i.e. NIB is implemented throughout the session. Unless a PCO container is used and there is a SGSN change, from an old SGSN functioning differently from a new SGSN as far as NIB support is concerned support and use information has to be updated. Thus, if a first category core network nodes, for example SGSNs, are seen as nodes affected by a new or current session for the purposes of NIB, information has to be provided from a new SGSN as to whether it supports NIB or not to the concerned GGSN, which means that the network or the system will be kept updated as far as NIB support is concerned for the session. If PCO containers are used, the SGSNs are seen as not affected.

A core network packet data support node as initially referred to is therefore also provided which is adapted to support NIB (by itself or another internal or external network node; internal is here meant a core network node). It further comprises information generating and distribution means adapted to provide a support indication as to whether, for a given session, (or in general, in which case only use indications are related to the new or current session) network initiated bearer set-up is supported, to be provided to another core network node or to an external, for example policy and/or service handling, node, and further it comprises decision and enabling means adapted to determine if, for the given session, network initiated bearer set-up is to be used and enabled.

Particularly the information generating and distribution means are comprised by or communicate with IP session handling means comprising a data structure for a number of bearers with one or more different characteristics, for example QoSs, for each IP address.

Particularly the information generating and distributing means are adapted to provide a support indication upon occurrence or reception of an activating event from a mobile user station or from another core network node, particularly of another category (unless in case of a routing area update). The support indication particularly comprises a number of parameters, for example a specific information element which for example may be provided in an existing, conventional message sent during a primary bearer set-up, or for creation of a primary bearer such as for example a primary PDP context. The information generating and distributing means may be

separate means in communication with the bearer managing means, or be comprised by said bearer managing means. The distribution may relate to a distribution to the bearer managing means for further distribution therefrom to another node or a direct distribution to another node.

The activating event particularly depends on the category of the node and it may comprise a support indication received from a mobile user station that network initiated bearer set-up is supported. The node may comprise an SGSN or similar. Alternatively the node comprises a GGSN. The activating event may then, in the latter case, comprise reception of a support indication from an SGSN or a support indication comprising a PCO container from a mobile user station.

Particularly the support indication is provided from an SGSN as an information element in an extended or modified message, e.g. a create PDP context request, or from a mobile user station as a PCO container transparently forwarded by SGSN. If the node is an SGSN, the activating event normally (unless for an inter SGSN routing area update) comprises reception of a support indication from a mobile station. The packet data support node may also comprise a CGSN (Combined GPRS Support Node).

Particularly the bearer service managing means (in an GGSNor CGSN), are adapted to provide the support indication to a policy service handling node or some other external node and to receive a use indication about use of a network initiated bearer set-up from said policy or service handling node, which for example may be a PCRF, in an extended or modified conventional message from such a node, for example a rule installation message.

Particularly the bearer service managing means of an external node or a core network node of a second category or a first category are adapted to, in communication with the decision or enabling means, include a network initiated bearer use indication in a message towards a mobile user station, e.g. as an information element in an extended or modified message to a core network packet data support node of another category, for example an SGSN. It may also be included in a PCO.

Particularly the core network packet data support node is adapted to update a decision as to use network initiated bearer set-up or not for a current session if the current session is adapted due to change from one packet data support node handling the session to another of the same category, e.g. from an old SGSN to another, new, SGSN not supporting or supporting NIB, differently from the old SGSN.

A mobile user station as initially referred to is also provided which is adapted to support network initiated bearer set-up. It comprises information generating an distributing means adapted to provide a support indication as to whether, for a given new or current session, network initiated bearer set-up is supported, and, directly or in communication with said bearer service managing means, provide a support indication to a core network packet data support node affected by the new or current session at initiation of a bearer for said session. By a bearer is here meant a primary or first bearer, such that if all nodes affected by a new or current session (at least as far as NIB is necessarily concerned) can be implemented for subsequent or secondary bearers, for example secondary PDP contexts. The expression affected by a session means all nodes affected by the session, unless the

PCO concept is used, which is extremely advantageous in that some nodes, SGSNs, will not be affected.

Particularly the information generating and distributing means are adapted to directly or via the bearer managing means, unless the same means provide the support indication, include the support indication in a bearer creation request message to be sent to a core network packet data support node. Most particularly the information generating and distributing means are adapted to generate an indication by providing an information element, for example a flag, including the information element in a conventional bearer creation request, for example an activate primary PDP context request intended for example for an SGSN or similar. Alternatively the information generating and distributing means are adapted to generate an indication by providing an information element e.g. a flag, in a container, for example a PCO container, intended for a GGSN or similar and adapted to be transparent for any intermediate SGSN.

A policy and/or service handling application node adapted to be in communication with core network nodes of a core network as initially referred to is also provided which is adapted to support network initiated bearer set-up and which comprises decision means adapted to determine whether NIB is to be used for a particular new or current session at the occurrence of an activation event and to, if it is decided that NIB is to be used, provide a use indication for the session to a core network node (and/or if NIB is not be used).

Particularly the use indication comprises a flag. The activation event may comprise reception of a support indication that NIB is supported from a core network node

indicating a new bearer. Particularly a policy and/or service control rule installation message is extended or modified to include the use indication.

A method as initially referred to is also provided which comprises the steps of: providing a support indication in a mobile user station indicating of a mobile user station supports network initiated bearer set-up (or not) at initiation of a bearer creation procedure for a session; distributing the support indication to a core network node affected by the session in communication with the mobile user station, if the received indication indicates support for NIB (or if a support indication is provided; an indication is, preferably not provided if there is no support); providing in the core network node an indication as to whether the core network node supports NIB; distributing the core network node indication to a subsequent core network node or an external node affected by the session such that all nodes affected by the session (as far as NIB is concerned) are adapted to indicate support for NIB (or not) for the session; making a decision as to whether NIB is to be used subsequently node by node towards the mobile user station for the new or current session; initiating bearer set-up in a network node only if all nodes affected by the session at least as far as NIB is concerned provide a support indication and a NIB use indication; otherwise implementing mobile user station initiated bearer set-up for the session at least until all (necessarily) affected nodes indicate support and that NIB should be used. The expression "necessarily affected" is used to include two different implementations, namely when a PCO container, in which case SGSNs are not necessarily affected and the case with an information element in a message when SGSNs necessarily are affected. Particularly the step of

providing a support indication comprises, in the mobile user station: providing information in an information element as to whether the mobile user station supports NIB in a message sent to a core network node upon initiating a bearer creation procedure for a session (SGSN necessarily affected).

Particularly the method comprises the step of, in each core network node affected by the session, at least as far as NIB is concerned; upon reception of a support indication from the mobile user station or a preceding core network node respectively that it supports NIB; providing information in an information element as to whether or if the node itself supports NIB; including the information in a respective conventional message to the subsequent core network node or to an external node if it is the subsequent node upon initiation of the primary bearer creation procedure.

Particularly the step of providing a support indication in a mobile user station comprises; forwarding information in an information container, for example a PCO container; sending the PCO container transparently through any core network packet data support node, providing or having the functionality of an SGSN, to a core network packet data node having the functionality of a gateway packet data support node, for example a GGSN, hence leaving any SGSN or similar node unaffected by the session for NIB or bearer set-up procedures. Particularly the method comprises the step of; initiating a new bearer context, for example requesting a secondary PDP context, during the new or current session in a core network node directly or according to rules received from a policy and/or service handling node or another external node by sending a PCO container containing parameters to be modified or updated, directly to the mobile user station

leaving any SGSN unaffected, i.e. transparently through any GGSN.

More particularly the method comprises the step of initiating a new bearer context, for example requesting a secondary PDP context of the session by using existing messages towards a mobile user station. BY existing messages are meant messages normally used in bearer as context creation response procedures.

The method may also comprise the steps of, upon changing from one, old, packet data support node to another, new, node of the same category, e.g. from one SGSN to another (ISRAU); providing a new support indication in the new node as to whether, or if, it supports NIB; distributing the (if any) new support indication to the nodes affected by the session subsequently; making a new decision in the respective affected nodes as to use NIB or not for the remainder of the new or current session. According to the invention an existing bearer can also be modified. It is possible to modify e.g. UL-TFT, GBR, MBR, QoS etc.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will in the following be further described, in a non-limiting manner, and with reference to the accompanying drawings, in which:

Fig. 1 is a block diagram of a system implementing the inventive concept according to a first embodiment,

Fig. 2 is a schematical block diagram of a system in which the inventive concept is implemented according to a second embodiment,

Fig. 3 is a sequence diagram illustrating the signalling sequence in a system as described with reference to Fig. 1,

Fig. 4 is a sequence diagram describing the procedure, in a system as in Fig. 1, when there is a change, or routing area update, from one SGSN to another,

Fig. 5 is a simplified sequence diagram describing the signalling in an implementation as described with reference to Fig. 2,

Fig. 6 is a flow diagram describing the procedure in an SGSN BS Manager upon occurrence of an activating event in the SGSN,

Fig. 7 is a flow diagram describing the procedure upon occurrence of an activating event in a GGSN,

Fig. 8A describes a procedure in a GGSN at reception of a rule installation message with a use indication from a PCRF,

Fig. 8B describes a procedure in an SGSN at reception of a create PDP context response with a use indication from a GGSN, and

Fig. 9 describes a procedure in a GGSN at reception of a use indication from an external node to initiate NIB.

DETAILED DESCRIPTION OF THE INVENTION

According to the invention a solution is provided allowing for NIB capability negotiation among affected nodes in a network. If a mobile user station, e.g. a UE supports the NIB capability, it should indicate so for example in the primary PDP Context Activation procedure as part of the request message. Generally also the SGSN (except for embodiments as described for example with reference to Figs. 2 and 5) should provide a support indication (if it does support and/or does not support NIB, e.g. a non-support indication) and hence also the support of the UE to a GGSN (if the UE does not support NIB, it does not have to be established, neither in an SGSN nor in a GGSN if these nodes support NIB or not). Finally, if applicable, GGSN should inform about its support to an external node, for example a PCRF as discussed above. If a GGSN provides a support indication to a PCRF, this inherently also includes information about the UE and the SGSN supporting NIB (otherwise there would be no support indication from GGSN (which has received no activating event)). If a UE has advertised that it supports NIB, it should normally get information back stating whether the rest of the affected or implicated nodes support NIB or not, or rather if NIB should be used for the current session.

Fig. 1 is a schematical block diagram describing an implementation of the inventive concept in a communication system according to a first embodiment. It should be clear that nodes that are not directly involved in the session as far as NIB is concerned as well as functions and means respective nodes that are not involved or affected, are not shown for reasons of clarity.

It is hence supposed that UE 10 comprises a bearer service manager (BS MGR) 11, for example as described in 3GPP TS

23.107. The bearer managing means 11 communicates with a session handler 12 comprising a data structure with one or more PDP contexts. There may be different PDPs for different QoSs having the same IP address here M IP addresses wherein the session here is supposed to belong to, or have, IP address X. The session handler 12 communicates with NIB support information means 14 also denoted information generating and distributing means, indicating if NIB is supported (or not) to the session handler 12 in communication with the bearer service managing means 11, wherein a NIB support indication (if NIB is supported) is included and piggy-backed onto a message to be sent to, here, SGSN 20, most particularly in an activate primary PDP context request. (NIB support information means 14 can be said to be a data holding means connected one-to-one to the session handler IP CAN "object"; an "extracted" or "clarified" attribute for the NIB support flag.) If a positive NIB support indication is provided from UE 10, to SGSN 20, also comprising a BS MGR 21, a session handler 22, PDP holding means 23 and NIB support information means 24, i.e. in SGSN 20 an activating event occurs, it is established also in SGSN 20 whether NIB is supported (or not). If yes, a NIB support indication is introduced and piggy-backed onto an existing, conventional message, particularly a create PDP context request for example as an information element which is forwarded by BS managing means 21 to BS managing means 31 of GGSN 30. Since this support indication acts as an activating event for GGSN 30, it is established in GGSN whether NIB is supported (or not) thereby by means of session handler 32, PDP holding means 33 and NIB support information means 34. If NIB is to be supported, a NIB support indication is included in, preferably, an existing message to be sent to bearer service manager 41 of, here, a PCRF 40. PCRF 40 comprises network policy holding means 46, and decision means 45 for making a

decision whether NIB can be used (or not), i.e. if NIB should be enabled or not for secondary bearers of the concerned new or current session. If yes, a NIB use indication is introduced in an existing message, here particularly a PCRF rule installation message, to be forwarded to the BS managing means 31 of GGSN 30. If a NIB use indication is received from PCRF 40, a decision is also made in GGSN decision means 35 to enable NIB based on the node configuration 26. A NIB use indication may then be forwarded to SGSN in an activate PDP context response and, in the decision means 25 of SGSN 20 it is established whether the NIB use indication should be forwarded. If yes, an activate PDP context response is provided to UE 10 including the use indication, i.e. the final decision. The decision whether to use NIB or not is now taken by all nodes in a consistent way.

In GGSN as well as in SGSN, if no NIB use indication is received from the PCRF and from the GGSN respectively, the NIB indication is removed, for example a NIB flag is cleared in an IP CAN (Connectivity Access Network) session context. The NIB negotiation is then terminated and a NIB cannot be initiated in PCRF or GGSN. It should be noted that PCRF or a similar node is optional, depending on implementation.

Fig. 2 is a block diagram similar to that of Fig. 1 describing another implementation. The UE 10_1 corresponds to UE 10 of Fig. 1, GGSN 30_1 corresponds to GGSN 30 of Fig. 1 and PCRF 40_1 corresponds to PCRF 40 of Fig. 1, therefore means and functions are denoted using the same reference numerals, but with an index 1. It is here supposed that PCO fields are used for activation and negotiation of NIB which means that SGSN is unaffected since a PCO container can be forwarded transparently by SGSN. PCO is a transparent container

forwarded by SGSN between UE and GGSN. If using the PCO concept, no mobility management procedures are affected by NIB, for example no NIB negotiation has to be done in ISRAU (Inter SGSN Routing Area Update) procedures, Relocation and PS Handover procedures which is extremely advantageous. This means that if a NIB support indication is provided from UE 10_1, from BS manager 11_1, it will be transparently forwarded to BS managing means 31_1 of GGSN 30_1 via the BS managing means 21_1 of SGSN 20_1. Generally the Protocol Configuration Option (PCO) field is an information element that is present in all SM (Session Management) messages such as Create PDP Context Request/Response, Modify PDP Context Request/Response and Delete PDP Context Request/Response. The PCO IE (Information Element) is used to exchange various information between the UE and GGSN, for example P-CSCF address (Call Session Control Function), IMS (Internet Multimedia Subsystem) signalling flag, DNS (Domain Name Server) address. If a PCO container is used as an explicit indication or information element in the SM procedure it can be used not only to indicate support for NIB but with advantage also to trigger an actual NIB in a most particular embodiment. Everything concerning NIB can be done without affecting SGSN at all, everything being handled between the UE and the GGSN normally residing in the Home PLMN (Public Land Mobile Network). Any SGSN in the home or a visited PLMN does not need to be involved at all. Therefore any MM (Mobility Management) procedures will remain unaffected if such an implementation is used. (Dec ision means 25_1 node configuration means 26_1 are not involved in this implementation and could have been omitted.)

The UE 10_1 particularly indicates NIB (SNRPCA), (Secondary Network Request for PDP Context Activation) capability in a PCO at a first (primary) PDP activation and GGSN 30_1 indicates,

also in the PCO, back to the UE 10_1 which model to use, i.e. network initiated bearers or normal UE initiated bearers. To request a secondary PDP context, the GGSN 30_1 sends an indication together with essential parameters (UL-TFT (UpLink Traffic Flow Template), DL-TFT (DownLink Traffic Flow Template), QoS (Quality of Service)) to the UE 10_1, in a PCO using a GGSN initiated PDP Modification procedure. When the UE receives such an indication, it starts a normal Activate Secondary PDP Context procedure with the parameters taken from the PCO. For SGSN 20_1 this is a normal behavior according to for example 3GPP TS 23.060, Release 6.

In order to modify an UL-TFT for an existing PDP context, the GGSN uses the PCO and the PDP modification procedure. The PCO here contains an indication of "UL-TFT update".

The maximum size of a PCO is 253 octets. If the size of the parameters in messages as discussed above would exceed that number, this can be handled in different manners. In one implementation the parameters, UL-TFT, DL-TFT, QoS can be compressed using a general scheme or a specific scheme. Alternatively a segmentation of the parameters may be done and multiple consecutive PDP context modification messages could be sent to the UE. Thus, in such embodiments any SGSN related procedures are completely unaffected by the introduction of NIB. It is an advantage that an operator can introduce NIB independently of any other operator. The NIB particulars only will be a matter between the UE, which may reside in a Visited PLMN, and the GGSN, which normally resides in the Home PLMN. This facilitates the introduction of NIB and any features dependent on NIB such as an Evolved QoS concept etc. It also makes it easier for an operator to stepwise introduce NIB in a network.

Fig. 3 is a sequence diagram illustrating the embodiment as exemplified with reference to the block diagram in Fig. 1. General for the embodiments is that the negotiation of the NIB support should be done the first time that an MS or a UE will establish a PDP context towards a GGSN for a specific APN (Access Point Name). According to 3GPP TS 23.060, the nodes will use the regular PDP Context Activation procedure.

According to Fig. 3 a modification to the conventional PDP Context Activation procedure is done in order to advertise NIB support. It is supposed that an MS or a UE sends a Primary PDP Context Request to an SGSN, which includes a NIB support indication (if NIB supported), 1. This can be done in different manners, it is possible to indicate NIB support only or NIB support or not NIB support or in some cases, however less plausible, it might be possible to only indicate that no NIB support is provided. This also applies for use indications. Particularly the NIB support indication may be piggy-backed onto, or a new IE (Information Element), in the messages used to activate the PDP contexts, Activate Primary PDP Context Request message towards SGSN according to 3GPP TS 23.060. In addition to the standard parameters a NIB support indication is provided in an information element. SGSN then creates a Create PDP Context Request message including an indication of the NIB support for both the SGSN and the UE (on condition that also SGSN supports NIB and a NIB support indication has been received from the MS), 2. This message is sent to GGSN which processes the message and realizes that it is a new (primary) PDP context establishment. If also GGSN supports NIB, it adds an indication relating to NIB support for GGSN, but inherently also for MS, and SGSN, in a new PDP context indication to PCRF, 3. In this case it is PCRF that

makes a decision as to whether NIB should be used or not and communicates a NIB use indication in e.g. a PCC (Policy Control and Charging) Rule installation to GGSN, 4. GGSN may then include (possibly after a decision also made in GGSN) the NIB use indication in a Create PDP Context Request message sent to SGSN, 5. The signalling sequences 6-9 comprise conventional messages sent for Radio Access Bearer Set-up, 6, Invoke Trace, 7, Update PDP Context Request/Response, 8,9, which will not be further discussed herein. Finally the SGSN (possibly after making a decision) includes the NIB use indication in an Activate PDP Context Accept message to be sent to the MS, hence informing the MS about the final decision, 10.

In this embodiment it is supposed that the NIB negotiation is handled by PCRF. In an alternative embodiment the NIB negotiation is handled by GGSN which means that PCRF is not involved and steps 3,4 referred to above do not need any NIB negotiation support.

In order to handle mobility insofar as an SGSN change is involved, this means that the support of NIB may change unless the PCO concept is used. In an embodiment e.g. as in Fig. 1, a new SGSN should inform other affected nodes (affected by NIB) (i.e. directly only one other affected node) whether it can support NIB (or not).

Schematically illustrated in the sequence diagram of Fig. 4 it is here supposed that an MS (or a UE) starts an ISRAU procedure, 21. This is not further described since it corresponds to known, conventional ISRAU signalling. The new SGSN then sends an update PDP Request to GGSN wherein, if NIB is supported by the new SGSN, an SGSN NIB support flag or NIB

support indication is provided in an information element included in the update PDP Request, 22. Here it is supposed that GGSN sends an update session to PCRF possibly with an indication as to NIB support, 23. It can be done in different manners, if there is a change an indication can be provided, or simply a new NIB support indication can be provided if it is supported etc., or an indication can be provided if it is not supported. In PCRF a decision is then made as to whether NIB can be used or not for remainder of the current session, after the SGSN change, 24. This means that if there is a change of NIB support, it is decided to start using NIB or to stop using NIB depending on the case. The new, updated decision is then forwarded to the rest of the nodes (subsequently, node by node) participating in the PDP context operations, namely GGSN, SGSN and MS, first as an Update Session Acknowledgment with an indication as to use or not to use NIB from PCRF to GGSN, 25, as an Update PDP Context Response with an indication as to use NIB or not from GGSN to the new SGSN, 26, and finally as an Update PDP Context Response with an indication as to use NIB or not from the new SGSN to the UE, 27, which returns an update PDP Context Response, 28 , to the new SGSN. The ISRAU procedure is then finalized or stopped, 29. This serves the purpose of keeping the network updated as to whether NIB is supported or not also when there is a change of SGSNs. It should be noted that such a procedure is not required if a PCO is used for indicating NIB support and use.

According to the invention a change procedure is thus provided amongst the nodes affected by the NIB procedure which assures a common up-to-date knowledge among the nodes as to whether NIB is supported or not.

According to the invention a NIB support indication is provided at starting a first or a primary bearer, and at e.g. ISRAU. By using it, all the affected nodes will have the knowledge of whether the NIB procedure is used all the time and then of how they should behave.

Fig. 5 is a simplified sequence diagram describing the messaging in an implementation based on the use of a PCO for support/use indication. It is here supposed that an MS sends an activate primary PDP context request with a PCO including a NIB support indication (if NIB is supported) to an SGSN, 1', which transparently forwards a create PDP context request with the PCO containing the NIB support indication to GGSN, 2'. GGSN sends a new PDP context indication with the PCO with a NIB support indication (on condition that also GGSN supports NIB) to PCRF, 3'. PCRF sends a PCC rule installation as in Fig. 3 to GGSN after having made a decision as to whether NIB should be used or not in the PCO including a NIB use indication, if it is decided to use NIB, 4'. GGSN then sends a PDP context response with a NIB use indication in the PCO, on condition that GGSN decided that NIB should be used, to SGSN, 5', which simply creates an activate PDP context accept including the PCO with the NIB use indication to the MS, 10'. Steps 6-9 are not illustrated since they correspond to the steps of Fig. 3, in order to make the transparency in the SGSN more clear.

It should be clear that in the embodiments of Fig. 3, 4, 5 it is supposed that the PCRF handles the NIB negotiation; this can alternatively be done in GGSN (or a CGSN).

The flow diagrams in Figs. 6, 7, 8A, 8B describe how the NIB indication, particularly the NIB flag, is negotiated such as

to be consistent in all nodes, namely an SGSN (Fig. 6), a GGSN (Fig. 7) and PCRF (SGSN and GGSN respectively, Fig. 8A, 8B). In Fig. 6 it is supposed that an activate PDP context request is received in SGSN from a UE, 100. It is then examined whether the request message comprises a NIB support indication, 101. If not, an IP CAN session is created and a PDP, if it does not already exist, and a create PDP context request are forwarded to GGSN. The NIB flag is set to "No" in the IP CAN session. In the message (create PDP context) NIB support is here not indicated which means that for the session NIB will not be implemented, 102A. If however a NIB support indication is included in the activate PDP context message from the UE, it is examined if NIB is enabled in the SGSN node configuration, 102. If not, it is proceeded with step 102A described above. If NIB is enabled in the node itself also, it is established if there exists an IP CAN session for the IP address/APN, 103. If not, an IP CAN session and a PDP are created and a create PDP context request including a NIB support indication is forwarded to GGSN, 103A. The NIB flag in the NIB support information means (the IP CAN session context) is set to "Yes", (it is preliminary since it is not known whether all subsequent nodes support NIB). If, on the other hand, an IP CAN session already exists for the particular IP address/APN address in the request, the activation request has to be a secondary PDP context request which should not be used in NIB negotiation, or if NIB is used, since it comes from the UE node. Therefore the incoming PDP context request is to be rejected, 104, since it is not a primary PDP context activation request and it is not the first request for the particular IP address.

Fig. 7 is a flow diagram similar to that of Fig. 6 but for a GGSN and the procedure particularly mainly takes place in the

BS managing means. Thus, it is supposed that a create PDP context request is received in GGSN from SGSN concerning a particular IP address, 200. It is then established whether there is a NIB support indication included in the message, 201. If not, an IP CAN session is created and the NIB flag in the IP CAN session is set to "No" and a PDP is created, if it does not already exist. The new PDP context indication is forwarded to PCRF. NIB support is hence not indicated in the message, 201A. If there is a NIB support indication included in the message, it is established if NIB ia enabled in the node configuration of the GGSN itself, 202. If not, it is proceeded with step 201A as described above. If however NIB is enabled in GGSN, it is established if it already exists an IP CAN session for the particular IP address or APN, 203. If not, an IP CAN session and a PDP are created and a new PDP context indication is forwarded to the PCRF; NIB support is indicated in the message and the NIB flag is set to "Yes" in the NIB support information means (IP CAN session context), 203A. If on the other hand an IP CAN session already exists for the particular IP address, the create PDP context is a secondary create PDP context request which is not used in NIB mode, cf. step 104 of Fig. 6. The incoming PDP context request is hence rejected, 204.

In the flow diagram of Fig. 8A it is supposed that a (PCC) rule installation is received in GGSN BS managing means from PCRF, 300. It is then examined if a NIB use indication was set in the message from PCRF, 301. If not, the NIB flag is cleared, i.e. set to "No" (if NIB was enabled in GGSN) in the NIB support information means, IP CAN session context, 301A. If a NIB use indication is set, the create PDP context response is forwarded to SGSN. In both cases, NIB = "Yes" or

"No", the same NIB use indication as received in the message from the PCRF is used in the response to SGSN, 302.

Fig. 8B describes the corresponding, subsequent procedure in SGSN. A create PDP context response is received from GGSN, 400. It is then examined if a NIB use indication is set, 401. If not, the NIB flag is cleared in the NIB support information means (IP CAN session context), i.e. it is set to "No" (if it was enabled in SGSN), 401A. If yes, as well as if not, i.e. in both cases an activate PDP context response is forwarded to the UE or mobile station using the same NIB indication as received in the message, 402. Thus information also has been provided to the mobile station or UE whether NIB should be implemented for the remainder of the session or not and all nodes will have the same consistent information. It should be clear that these flow diagrams do not cover the procedure when a PCO container is used, since then SGSN is unaffected, which however was more thoroughly described with reference to Fig. 5 above.

Fig. 9 is a flow diagram illustrating how a NIB indication can be used in GGSN to determine if a NIB is to be initiated. It is thus supposed that a rule installation or creation is received in GGSN from PCRF, 500. The IP CAN session is then examined to see if there is a PDP with the QoS class indicated in the rule, i.e. if there is a PDP matching the QoS class, 501. If not, it is examined if the NIB flag is set to "Yes" in the IP CAN session, 502; if yes, it is established whether a modification of existing PDP is needed, 501A; if yes, a modification of existing PDP is initiated, 501B. If on the other hand, the outcome of the examination in step 501 was "No", an initiation of a new secondary PDP context with the QoS class indicated in the rule is started, 503. This can be

done either using specific messages, a modified message from GGSN according to 3GPP TS 29.060 and SGSN to UE according to 3GPP TS 24.008, or alternatively using the PCO concept as described earlier. In the PCO case the GGSN sends an indication together with the essential parameters UL-TFT, DL-TFT and Qos to the UE in a PCO using the GGSN initiated PDP modification procedure transparently for the SGSN. As far as step 501B is concerned, if a service is to be added to an existing PDP GBR (Guaranteed Bitrate) and/or UL-TFT (the addresses in the filter) (and DL-TFT; which is locally adjusted in GGSN and hence need to be sent to UE). GBR is only changed if it is a real-time service. For non-real-time services typically only UL-TFT, and possibly MBR (Max Bitrate) is/are changed.

Thus, the PCO concept can be implemented not only for the initiation procedure but also for the actual NIB initiation procedure where a secondary PDP context is initiated within GGSN or in PCRF or an application function communicating with the PCRF comprising a Proxy Call Session Control Function (P-CSCF) in the IMS. This does however not form part of the actual negotiation procedure.

It should be clear that different messages and information elements can be used for providing support or use indications. Particularly PCO can be used which means that the procedure becomes SGSN independent as discussed earlier. It should also be clear that the support and/or indication can be provided for in different manners, for example an indication may be provided only if support (use) is provided and different indications can be provided whether support (use) is provided or not or it might also be possible to provide an indication only if NIB is not supported (to be used). Also other nodes

than those particularly described can be concerned, as well as the concept also can be implemented in other similar systems comprising nodes with similar functionalities or affected by bearer set-up . Also in other aspects the invention is not limited to the particularly described embodiments, but it can be varied in a number of ways within the scope of the appended claims.

CLAIMS

1. A communication system supporting communication of packet data and comprising at least a number of nodes of different categories comprising a number of core network nodes ($20,30;20_1,30_1$), capable of communicating with policy and/or service handling nodes ($40;40_1$) and with mobile user stations ($10;10_1$) over one or more radio access networks, at least said mobile user stations ($10;10_1$) and said core network nodes ($20,30;20_1,30_1$) comprising respective bearer service managing means ($11,21,31;11_1,21_1,31_1$) ,
characterized in
that at least a number of said nodes ($10,20,30,40;10_1,20_1,30_1,40_1$) are adapted to support network initiated bearer set-up and in that nodes ($10,20,30,40;10_1,20_1,30_1,40_1$) affected by a session are adapted to, directly or indirectly, provide at least one of said other nodes ($10,20,30,40;10_1,20_1,30_1,40_1$) with information about whether it supports network initiated bearer set-up or not upon occurrence of a particular respective activating event, and in that the respective bearer service managing means ($11,21,31;11_1,21_1,31_1$) of the nodes involved in or affected by a new or current session are adapted to distribute said information about the support of network initiated bearer set-up of the respective nodes ($10,20,30,40;10_1,20_1,30_1,40_1$) enabling a negotiation procedure between said nodes ($10,20,30,40;10_1,20_1,30_1,40_1$) to determine if network initiated bearer set-up is to be used or not during the new or current session, and in that said information is consistent in said affected nodes ($10,20,30,40;10_1,20_1,30_1,40_1$).

2. A communication system according to claim 1,
characterized in

that network initiated bearer set-up only is initiated if all nodes (10,20,30,40;10_1,20_1,30_1,40_1) affected by a new or current session have provided a support indication that network initiated bearer set-up is to be supported for said new or current session.

3. A communication system according to claim 1 or 2, characterized in that the core network nodes (20,30;20_1,30_1) and a mobile user station node (10;10_1) initiating a new or current session comprise respective session handling means (12,22,32; 12_1,22_1,32_1) comprising a data structure with a number of bearers with one or more different characteristics, e.g. QoSs, an IP-address, and that said respective session handling means (12,22,32;12_1,22_1,32_1) are in communication with said network initiated bearer set-up support information means (14,24,34;14_1,34_1) and in communication with said bearer service managing means (11,21,31;11_1,21_1,31_1).

4. A communication system according to claim 3, characterized in that said respective session handling means (12,22,32; 12_1,22_1,32_1) are adapted to provide or generate a network initiated bearer set-up support indication and to provide said support indication to said bearer service managing means (11,21,31;11_1,21_1,31_1) of a respective node (10,20,30,40; 10_1,20_1,30_1,40_1).

5. A communication system according to claim 4, characterized in that said support indication comprises a specific message.

6. A communication system according to claim 4,

c h a r a c t e r i z e d i n
that said support indication comprises (an) information element(s) adapted to be included in a data field in an existing, conventional, message to be provided to another node of another category in the messaging relating to the creation of a first, initial, bearer of the new or current session.

7. A communication system according to claim 4,
c h a r a c t e r i z e d i n
that the support indication is provided in a container information element which is adapted to be transferred to or from a node of one category, e.g. a mobile user station (10_1) from/to a node of a second core network node (30_1) category transparently through at least one intermediate node (20_1) of a first core network category.

8. A communication system according to claim 7,
c h a r a c t e r i z e d i n
that the container information element comprises a protocol Configuration Option Field (PCO).

9. A communication system according to claim 8,
c h a r a c t e r i z e d i n
that the container information element additionally is used to initiate or trigger bearer set-up in a network node, e.g. a core network gateway node ($30;30_1$).

10. A communication system according to any one of the preceding claims,
c h a r a c t e r i z e d i n
that a core network node of a first category ($20;20_1$) comprises a serving packet data support node, e.g. an SGSN, that a core

network node of a second category ($30;30_1$) comprises a gateway packet data support node, e.g. a GGSN.

11. A communication system according to claim 10, characterized in that the activation event for a first category core network node (20), e.g. a SGSN, comprises reception of a primary bearer activation/creation request, e.g. an activate PDP context request including a network initiated bearer support indication from a mobile user station (10), and in that the activation event for a second category core network node (30), e.g. a GGSN, comprises reception of a request for creation of a primary bearer, e.g. a create PDP context request, including a network initiated bearer support indication from a first category core network node (20), e.g. a SGSN.

12. A communication system according to claim 10, characterized in that the activation event for a second category core network node (30_1) comprises reception of a request for creation of a primary bearer including a network initiated bearer support indication in a container element from a mobile user station (10_1) transparently transferred via a first category core network node (20_1).

13. A communication system according to claim 10, 11 or 12, characterized in that at least a second category core network node ($30;30_1$) and/or said policy or service handling node ($40;40_1$) comprises bearer initiation decision means ($35,45;35_1,45_1$) for deciding if a bearer set-up is to be initiated by the network, e.g. by any of said respective nodes, and is/are adapted to forward,

directly or indirectly, a decision outcome comprising a use indication to another node.

14. A communication system according to any one of the preceding claims,
characterized in
that said core network nodes (20,30;20_1,30_1), e.g. said first and second category core network node, comprise bearer initiation decision means (25,35;35_1) for determining if network initiated bearer set-up is to be used for the new or current particular session or not for which support indications have been provided by each affected node, and for providing of forwarding a network initiated bearer use indication.

15. A communication system according to claim 14,
characterized in
that said bearer initiation decision means (25,35,45;35_1,45_1) are adapted to be initiated if a use indication is received from another node indicating that network initiated bearer set-up is to be used for the new or current session, and in that the outcome of the decision in said respective core network node (30,20) is directly or indirectly provided to another core network node (20) or to the mobile user station ($10;10_1$) involved in the new or current session.

16. A communication system according to claim 14 or 15,
characterized in
that existing, conventional messages sent for bearer response or acceptance messages or policy or service related rule installation messages respectively are modified or extended to include a decision outcome as a respective use indication, e.g. a flag.

17. A system according to any one of the preceding claims, characterized in that if at least all nodes involved or affected by a new or current session initiated by a mobile user station ($10;10_1$) through a request for a primary bearer, e.g. a primary PDP context for bearer set-up purposes have provided a respective support indication and a respective use indication concerning network initiated bearer set-up, a gateway core network node ($30;30_1$) or a policy and/or service handling node ($40;40_1$) is adapted to be capable of initiating secondary PDP context set-up during said new or current session.

18. A core network packet data support node ($20;30;20_1;30_1$) adapted to handle communication with mobile user stations ($10;10_1$) over a radio access network and/or communication with other core network nodes ($30;20;30_1;20_1$) and/or other nodes, e.g. policy and/or service handling nodes ($40;40_1$), and comprising bearer service managing means ($21;31;21_1;31_1$), characterized in that it is adapted to support network initiated bearer set-up that it comprises information generating or providing means or network initiated bearer support information means ($24;34;34_1$) adapted to provide a support indication as to whether, for a given new or current session, network initiated bearer set-up is supported, intended for another core network node or an external, e.g. policy or service handling node, and decision and enabling means ($25;35;35_1$) adapted to, if a support indication is received directly or indirectly via other respective nodes from all nodes ($10,30,40;10,20,40;10_1,30_1,40_1,;10_1,40_1$) affected by the session, determine if, for the given new or current session, network initiated bearer set-up is to be used and enabled, and to provide a use

indication to be provided to a respective other of said affected nodes.

19. A core network packet data support node ($20;30;20_1;30_1$) according to claim 18,
characterized in
that the information generating or providing means ($24;34;34_1$) are comprised by or communicate with IP session handling means ($22;32;32_1$) comprising a data structure for a number of bearers with one or more different characteristics, e.g. QoSs, for each of a number of IP addresses, the bearers of a session having the same IP address.

20. A core network packet data support node ($20;30;20_1;30_1$) according to claim 19,
characterized in
that the information generating or providing means ($24;34;34_1$) are adapted to generate or provide a support indication upon occurrence of an activating event.

21. A core network packet data support node ($20;30;20_1;30_1$) according to claim 20,
characterized in
that the support indication comprises a number of parameters, e.g. a specific information element, provided in an existing, conventional message involved in a first bearer activation or creation procedure.

22. A core network packet data support node ($30;30_1$) according to any one of claims 18-21,
characterized in
that the activating event comprises reception of a support indication from a mobile user station ($10;10_1$) indicating that

network initiated bearer set-up is supported by said mobile user station (10;10_1) for the new or current session.

23. A core network packet data support node according to any one of claims 18-22,
c h a r a c t e r i z e d i n
that it comprises an SGSN (20;20_1) or a node with a similar functionality.

24. A core network packet data support node according to any one of claims 18-22,
c h a r a c t e r i z e d i n
that it comprises a GGSN (30;30_1) or a node with a similar functionality.

25. A core network packet data support node (30;30_1) according to claim 24,
c h a r a c t e r i z e d i n
that the support indication is provided from an SGSN (20) as an information element in an extended or modified message, e.g. an activate PDP context request, or from a mobile user station (10) in a PCO container transparently forwarded by an SGSN (20_1).

26. A core network packet data support node (30;30_1) according to claims 24 or 25,
c h a r a c t e r i z e d i n
that the bearer server managing means (31;31_1) are adapted to provide the support indication to a policy and/or service handling node (40;40_1) and to receive a use indication of network initiated bearer set-up from said policy and/or service handling node (40;40_1), e.g. a PCRF, in an extended or

modified existing or conventional message, e.g. a rule installation message.

27. A core network packet data support node ($30;30_1$) according to claim 26,
c h a r a c t e r i z e d i n
that the bearer service managing means ($31_1;31$) of a node are adapted, to in communication with the decision or enabling means ($35_1;35$) of said node, include a network initiated bearer use indication in a message towards a mobile user station (10_1), e.g. as an information element in an extended or modified message or to a core network packet data support node (20) of another category, e.g. an SGSN.

28. A core network packet data support node ($20;30;21_1;31_1$) according to any one of claims 18-27,
c h a r a c t e r i z e d i n
that it is adapted to update a decision as to use or not use network initiated bearer set-up for a current session if the session is updated due to a change from one packet data support node handling the session to another of the same category, e.g. a change of SGSNs.

29. A mobile user station ($10;10_1$) supporting communication of packet data and comprising bearer service managing means ($11;11_1$) adapted to communicate with core network packet data support nodes,
c h a r a c t e r i z e d i n
that it is adapted to support network initiated bearer set-up, that it comprises information generating and providing means ($14;14_1$) adapted to provide a support indication as to whether, at for a given new or current session, network initiated bearer set-up is supported, and, being adapted to, in

communication with said bearer service managing means ($11;11_1$), provide such a support indication to a core network packet data support node affected by the new or current session at a first initiation or creation of a bearer for said new or current session.

30. A mobile user station according to claim 29, characterized in that the information generating and providing means ($14;14_1$) are adapted to provide the support indication for inclusion in a bearer creation request message to be sent to a core network packet data support node.

31. A mobile user station according to claim 29 or 30, characterized in that the information generating and providing means ($14;14_1$) are adapted generate a support indication as an information element, e.g. a flag, for inclusion thereof by said bearer managing means ($12;12_1$) in a conventional bearer creation request, e.g. an activate primary PDP context request intended e.g. for an SGSN affected by the new or current session.

32. A mobile user station according to claim 29 or 30, characterized in that the information generating and providing means ($14;14_1$) are adapted to provide a support indication as an information element, e.g. a flag, in a container, e.g. a PCO container intended e.g. for a GGSN affected by the new or current session and adapted to be transparent for an intermediate SGSN.

33. A policy and/or service handling node ($40;40_1$) adapted to be in communication with core network nodes of a core network and comprising a bearer service managing means ($41;41_1$), characterized in that it is adapted to support network initiated bearer set-up and in that it comprises decision means ($45;45_1$) adapted to determine if a network initiated bearer service is to be used for a particular new or current session at occurrence of an activation event, and, if the decision is yes, generate or provide a use indication and to by means of said bearer service managing means ($41;41_1$) send said use indication to a gateway core network node.

34. A policy and/or service handling node according to claim 33, characterized in that the use indication comprises a flag.

35. A policy and/or service handling node according to claim 33 or 34, characterized in that the activation event comprises reception of an indication that network initiated bearer set-up is supported from a gateway core network node indicating a new bearer.

36. A policy and/or service handling node according to claim 35, characterized in that it is adapted to extend or modify a policy and/or service control rule installation message to include the use indication.

37. A method in a communication system supporting communication of packet data and comprising a number of core network nodes (20,30;20_1,30_1) communicating with mobile user stations (10;10_1),

characterized in

that it comprises the steps of:

- providing a support indication in a mobile user station (10;10_1) indicating if or that the mobile user station supports network initiated bearer set-up at initiation of a bearer creation procedure for a new session;
- distributing the support indication to a core network node (20;30_1) affected by the session;
- providing in said core network node (20;30_1) a support indication as to whether said core network node supports network initiated bearer set-up;
- distributing the support indication to a subsequent core network node (30_1) or an external node (40_1) affected by the session such that nodes affected by the session are adapted to indicate support and/or not support for network initiated bearer set-up for the new or current session; if all affected nodes have provided a respective support indication;
- making a decision as to whether bearer network initiated bearers are to be used and generating a respective use indication node by node (40;30;20;40_1;31_1) for the new or current session;
- initiating bearer set-up in a network node (30;40;30_1;40_1) only if all nodes support and indicate that it is to be used, otherwise implementing mobile user station (10;10_1) initiated bearer set-up for the new or current session.

38. A method according to claim 36,

characterized in

that the step of providing a support indication comprises, in the mobile user station ($10;10_1$):

- providing information in an information element as to whether the mobile user station supports network initiated bearer set-up in a message;
- sending the message to a core network node ($20;30_1$) upon initiating a first bearer creation procedure for a new or current session.

39. A method according to claim 38,
c h a r a c t e r i z e d i n
that it comprises the step of, in core network nodes affected by the new or current session upon reception of a support indication from the mobile user station or a preceding core network node respectively that it supports network initiated bearer set-up;

- providing information in an information element if the node itself supports network initiated bearer set-up;
- including the information in a respective conventional message intended for the subsequent (uplinks) network node or external policy or service handling node;
- sending the information as a support indication to the subsequent (uplinks) node at the first bearer creation procedure for the new or current session.

40. A method according to claim 37,
c h a r a c t e r i z e d i n
that the step of providing a support indication in the node in a mobile user station comprises:

- forwarding information as to whether or if network initiated bearers are to be supported in an information container, e.g. a PCO container;

- sending the PCO container transparently through any core network packet data support node (20_1) comprising or having the functionality of an SGSN to a core network packet data support node (30_1) comprising or having the functionality of a GGSN, hence leaving any SGSN or similar node (20_1) unaffected by the new or current session at least for network initiated bearer negotiation purposes.

41. A method according to claim 40,
characterized in
that it comprises the step of:
- initiating a new bearer context, e.g. requesting a secondary PDP context, for the new or current session in a core network node (30_1) according to rules received from a policy and/or service handling node (40_1) by sending a PCO container containing parameters to be modified or updated, directly to the mobile user station (10_1) leaving any SGSN (20_1) unaffected, i.e. transparently through any SGSN.

42. A method according to claim 38,
characterized in
that it comprises the step of:
- initiating a new bearer context, e.g. requesting a secondary PDP context, for the new or current session by using existing messages concerning bearer set-up towards the mobile user station.

43. A method according to any one of claims 38-43,
characterized in
that it comprises the step of:
- modifying an existing bearer context, e.g. by modifying UL-TFT, GBR, MBR, QoS for an existing secondary PDP context.

44. A method according to any one of claims 37-39,
characterized in
that it comprises the steps of, upon changing from one, old, packet data support node to another, new , node of the same category, e.g. from one SGSN to another SGSN (ISRAU);

- providing a new support indication in the new node at least it supports network initiated bearer set-up;
- distributing the new support indication if any directly or indirectly to the other nodes affected by the current session;
- making a new use decision in the respective affected node as to use network initiated bearer set-up or not for the remainder of the current session.

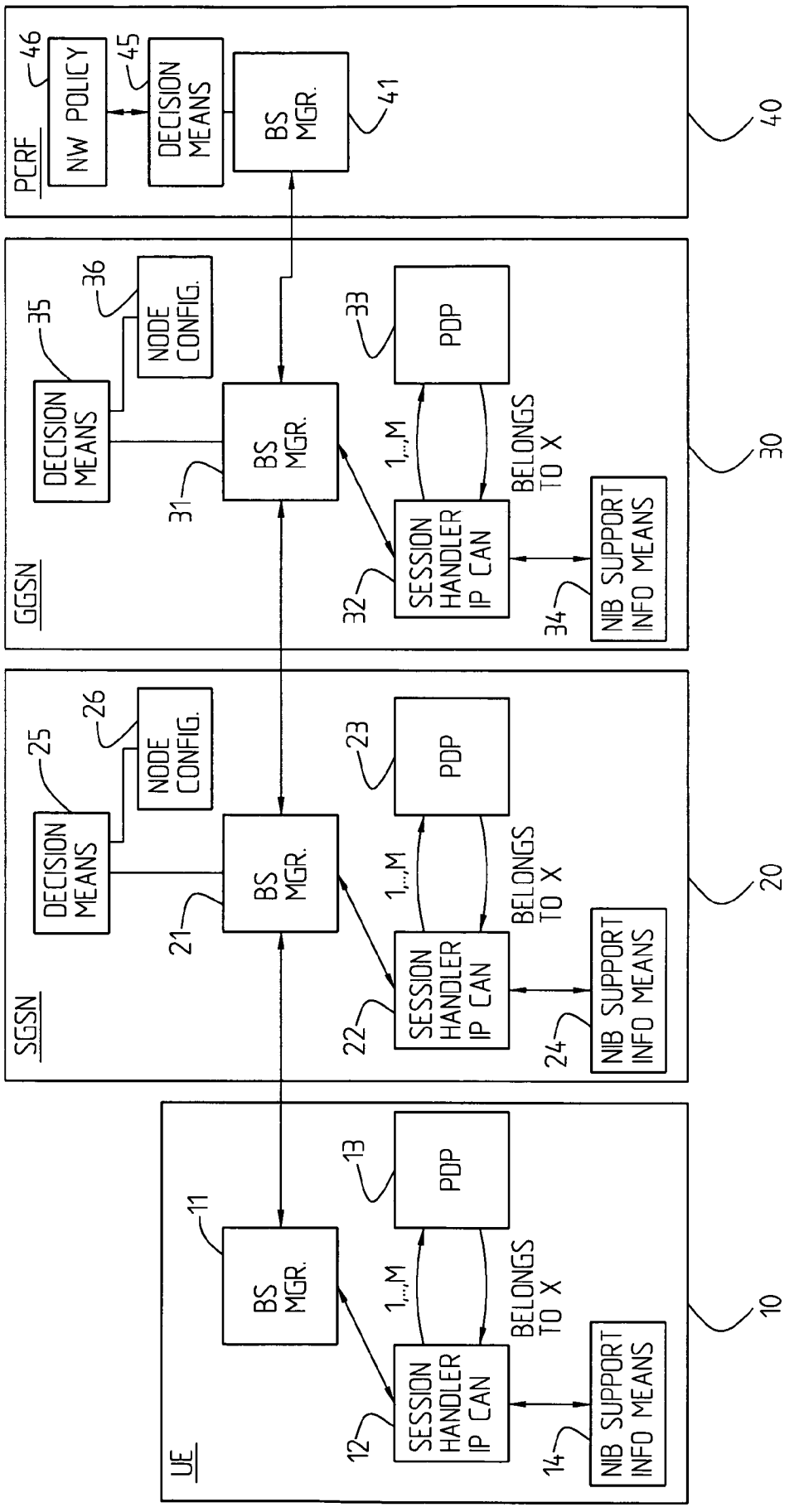

PCRF
NW POLICY
46
DECISION MEANS
45
BS MGR.
41
40
GGSN
DECISION MEANS
35
NODE CONFIG.
36
BS MGR.
31
PDP
33
1,..,M
BELONGS TO X
SESSION HANDLER IP CAN
32
NIB SUPPORT INFO MEANS
34
30
SGSN
DECISION MEANS
25
NODE CONFIG.
26
BS MGR.
21
PDP
23
1,..,M
BELONGS TO X
SESSION HANDLER IP CAN
22
NIB SUPPORT INFO MEANS
24
20
UE
BS MGR.
11
PDP
13
1,..,M
BELONGS TO X
SESSION HANDLER IP CAN
12
NIB SUPPORT INFO MEANS
14
10

Fig. 1

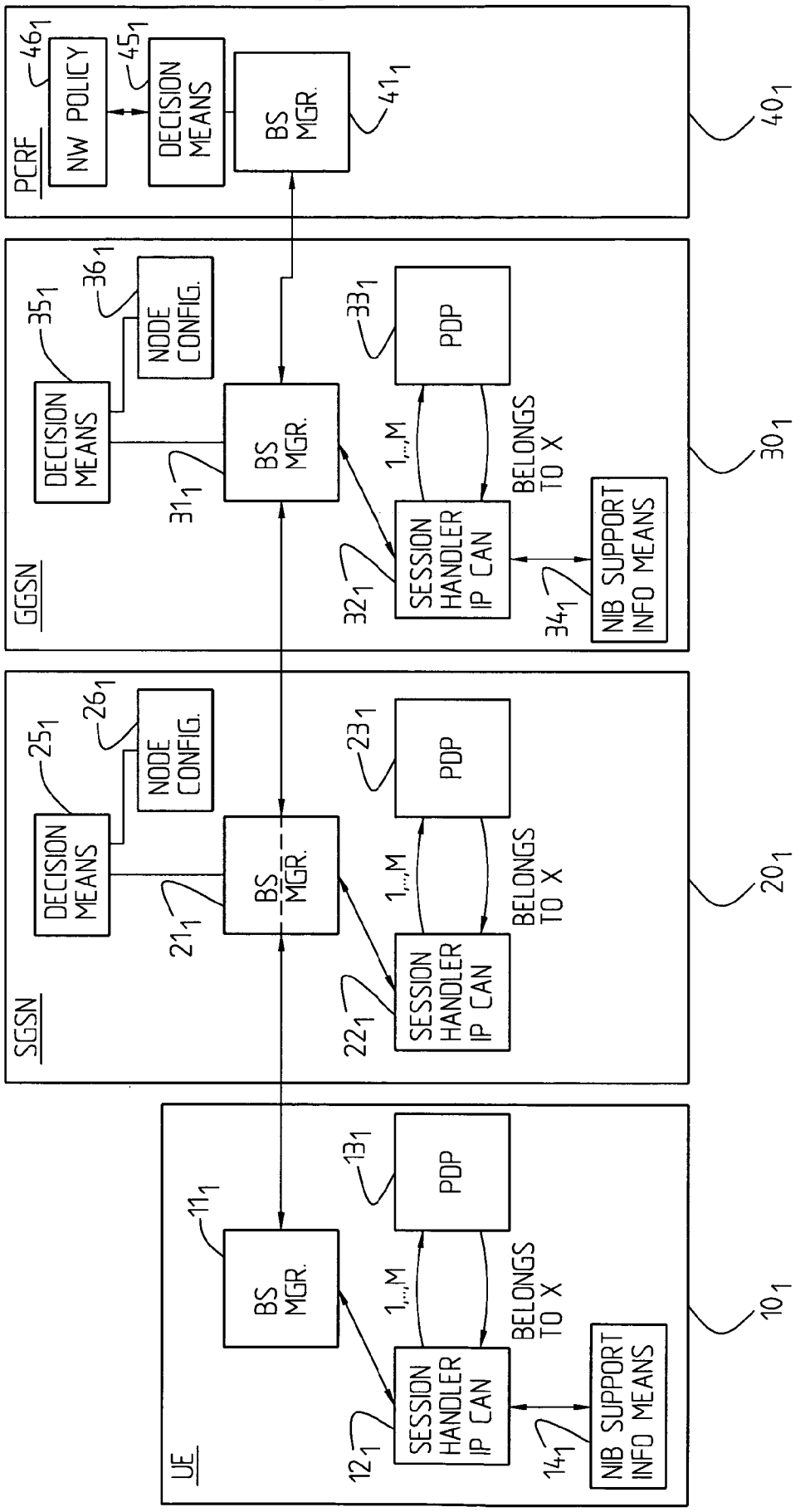

PCRF
NW POLICY
DECISION MEANS
BS MGR.
GGSN
DECISION MEANS
NODE CONFIG.
BS MGR.
PDP
1,..,M
BELONGS TO X
SESSION HANDLER IP CAN
NIB SUPPORT INFO MEANS
SGSN
DECISION MEANS
NODE CONFIG.
BS MGR.
PDP
1,..,M
BELONGS TO X
SESSION HANDLER IP CAN
UE
BS MGR.
PDP
1,..,M
BELONGS TO X
SESSION HANDLER IP CAN
NIB SUPPORT INFO MEANS

Fig. 2

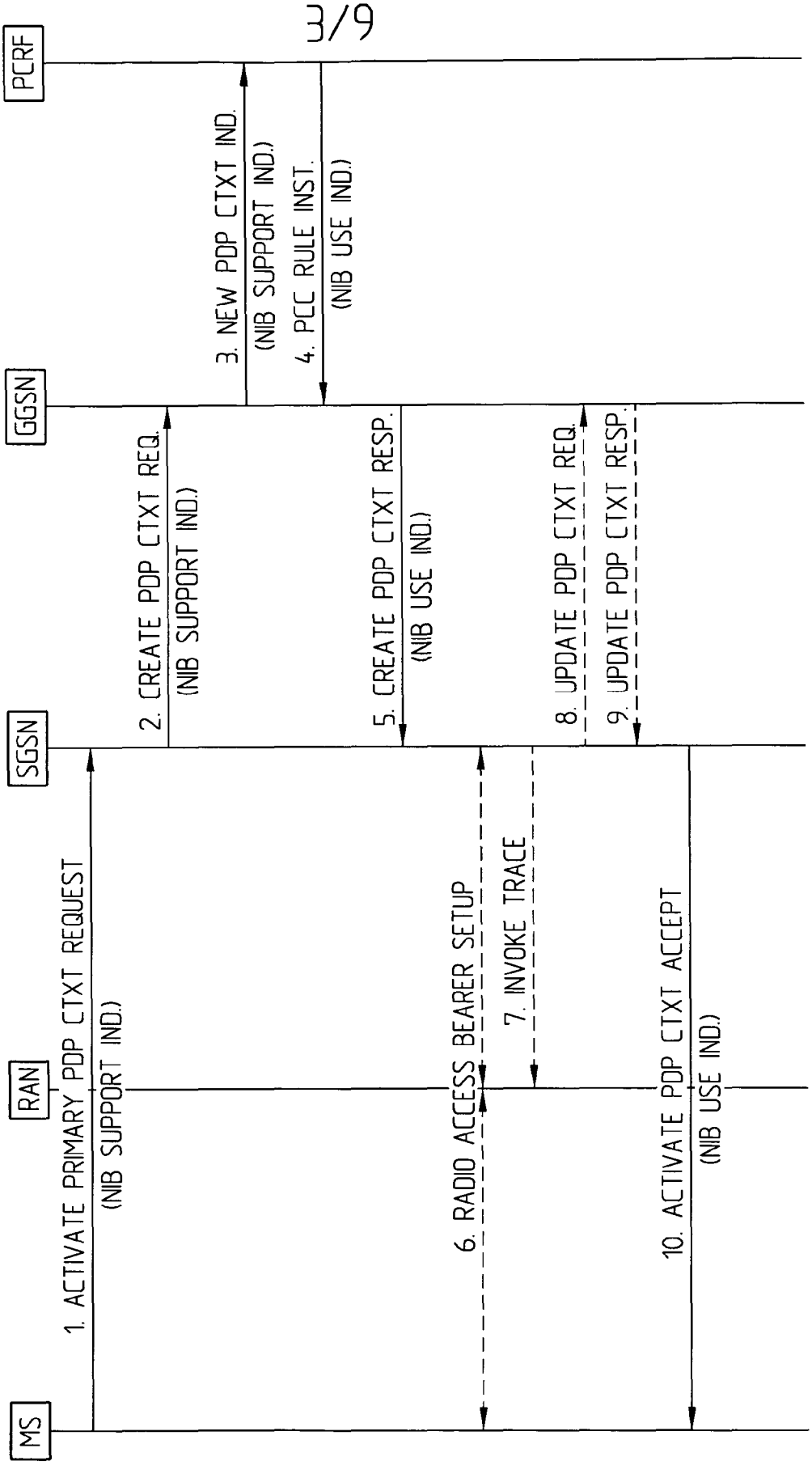

PCRF
GGSN
SGSN
RAN
MS
3. NEW PDP CTXT IND.
(NIB SUPPORT IND.)
4. PCC RULE INST.
(NIB USE IND.)
2. CREATE PDP CTXT REQ.
(NIB SUPPORT IND.)
5. CREATE PDP CTXT RESP.
(NIB USE IND.)
8. UPDATE PDP CTXT REQ.
9. UPDATE PDP CTXT RESP.
1. ACTIVATE PRIMARY PDP CTXT REQUEST
(NIB SUPPORT IND.)
6. RADIO ACCESS BEARER SETUP
7. INVOKE TRACE
10. ACTIVATE PDP CTXT ACCEPT
(NIB USE IND.)

Fig. 3

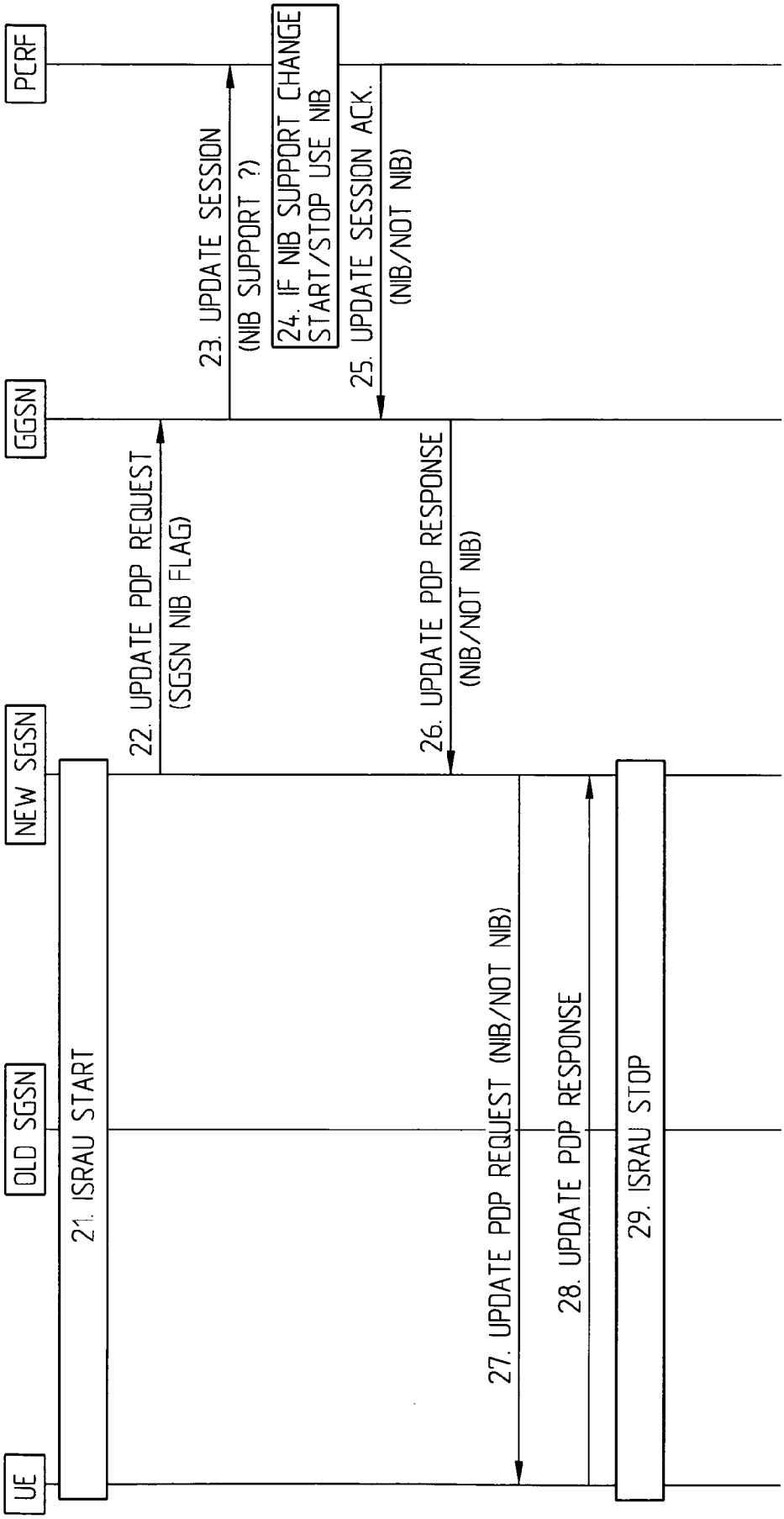

PCRF
GGSN
NEW SGSN
OLD SGSN
UE
23. UPDATE SESSION
(NIB SUPPORT ?)
24. IF NIB SUPPORT CHANGE
START/STOP USE NIB
25. UPDATE SESSION ACK.
(NIB/NOT NIB)
22. UPDATE PDP REQUEST
(SGSN NIB FLAG)
26. UPDATE PDP RESPONSE
(NIB/NOT NIB)
21. ISRAU START
27. UPDATE PDP REQUEST (NIB/NOT NIB)
28. UPDATE PDP RESPONSE
29. ISRAU STOP

Fig. 4

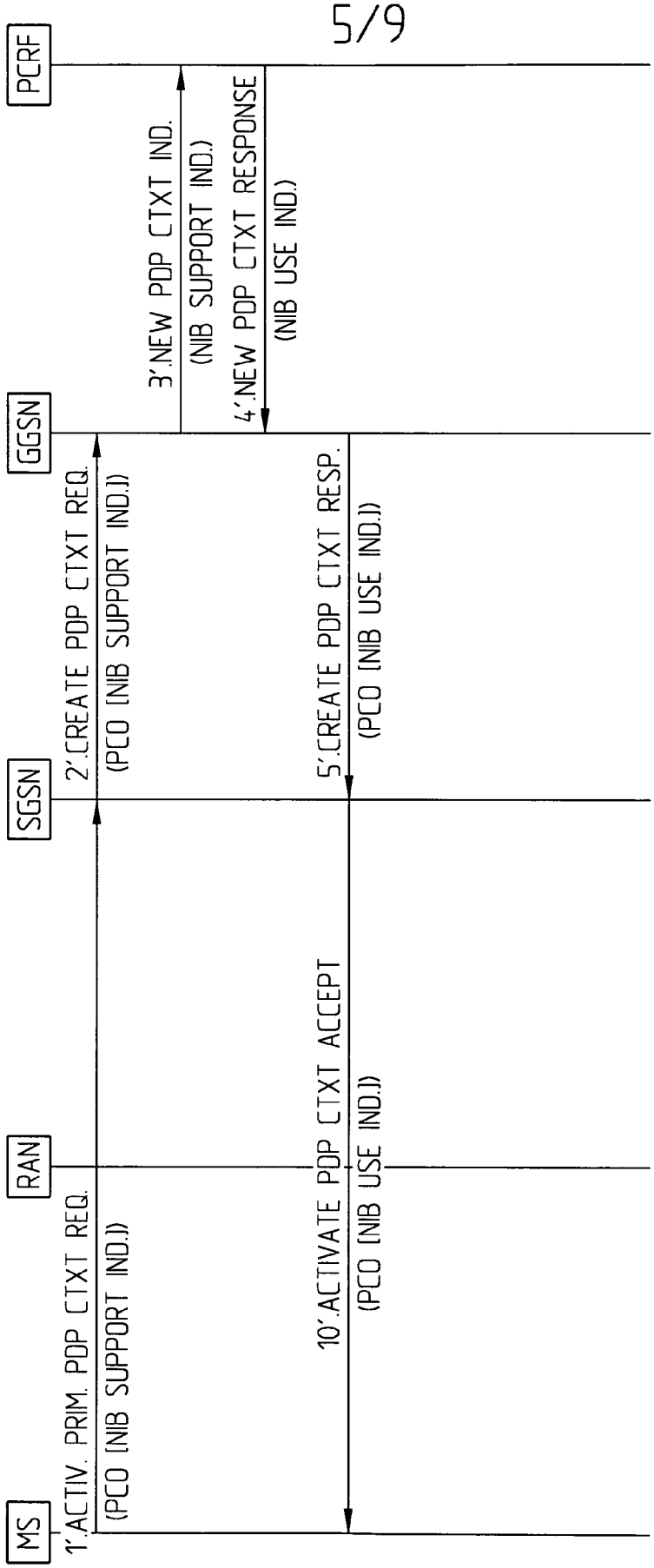

MS
RAN
SGSN
GGSN
PCRF
1'.ACTIV. PRIM. PDP CTXT REQ.
(PCO (NIB SUPPORT IND.))
2'.CREATE PDP CTXT REQ.
(PCO (NIB SUPPORT IND.))
3'.NEW PDP CTXT IND.
(NIB SUPPORT IND.)
4'.NEW PDP CTXT RESPONSE
(NIB USE IND.)
5'.CREATE PDP CTXT RESP.
(PCO (NIB USE IND.))
10'.ACTIVATE PDP CTXT ACCEPT
(PCO (NIB USE IND.))

Fig.5

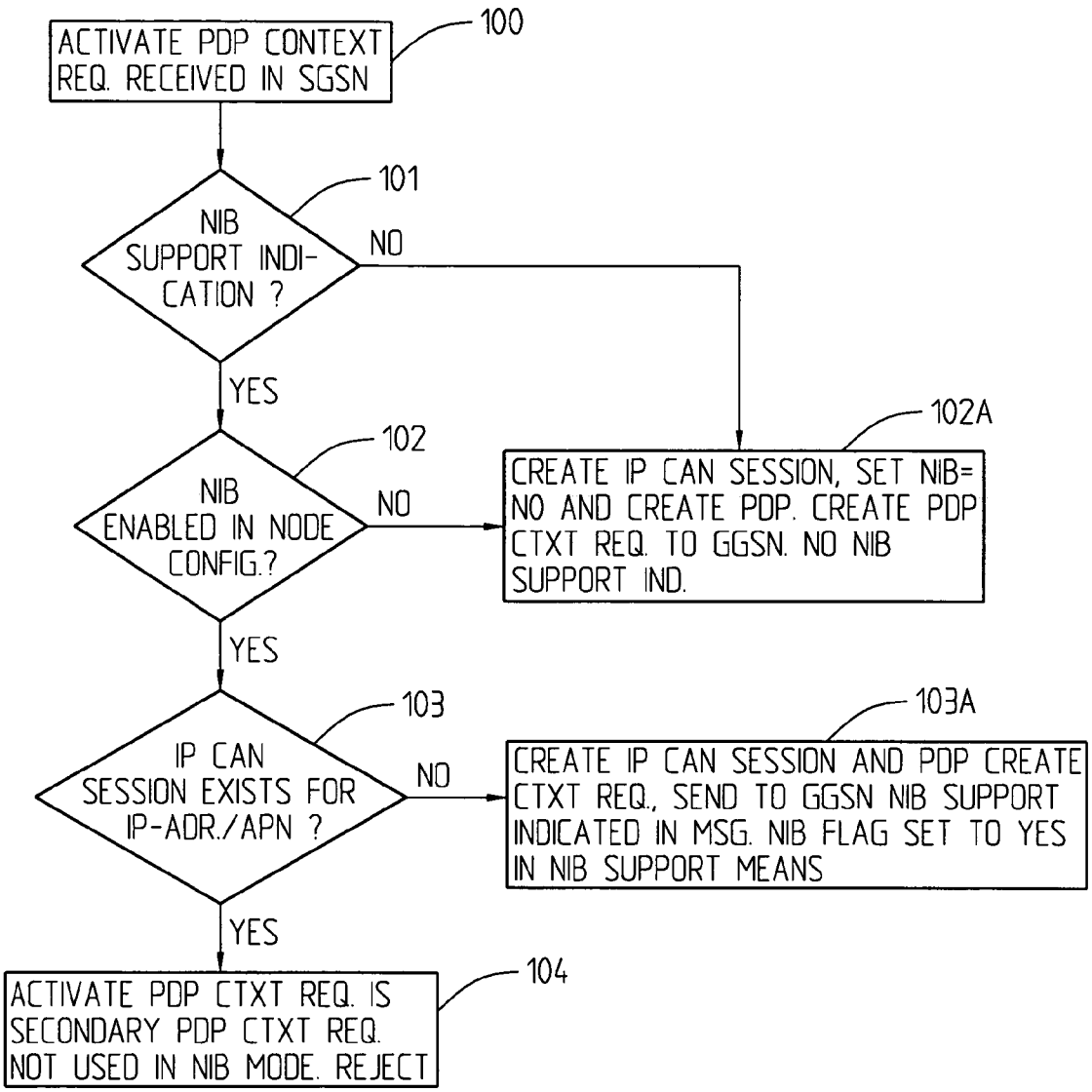

ACTIVATE PDP CONTEXT REQ. RECEIVED IN SGSN
100
NIB SUPPORT INDI-CATION ?
101
NO
YES
NIB ENABLED IN NODE CONFIG.?
102
NO
102A
CREATE IP CAN SESSION, SET NIB= NO AND CREATE PDP. CREATE PDP CTXT REQ. TO GGSN. NO NIB SUPPORT IND.
YES
IP CAN SESSION EXISTS FOR IP-ADR./APN ?
103
NO
103A
CREATE IP CAN SESSION AND PDP CREATE CTXT REQ., SEND TO GGSN NIB SUPPORT INDICATED IN MSG. NIB FLAG SET TO YES IN NIB SUPPORT MEANS
YES
ACTIVATE PDP CTXT REQ. IS SECONDARY PDP CTXT REQ. NOT USED IN NIB MODE. REJECT
104

Fig. 6

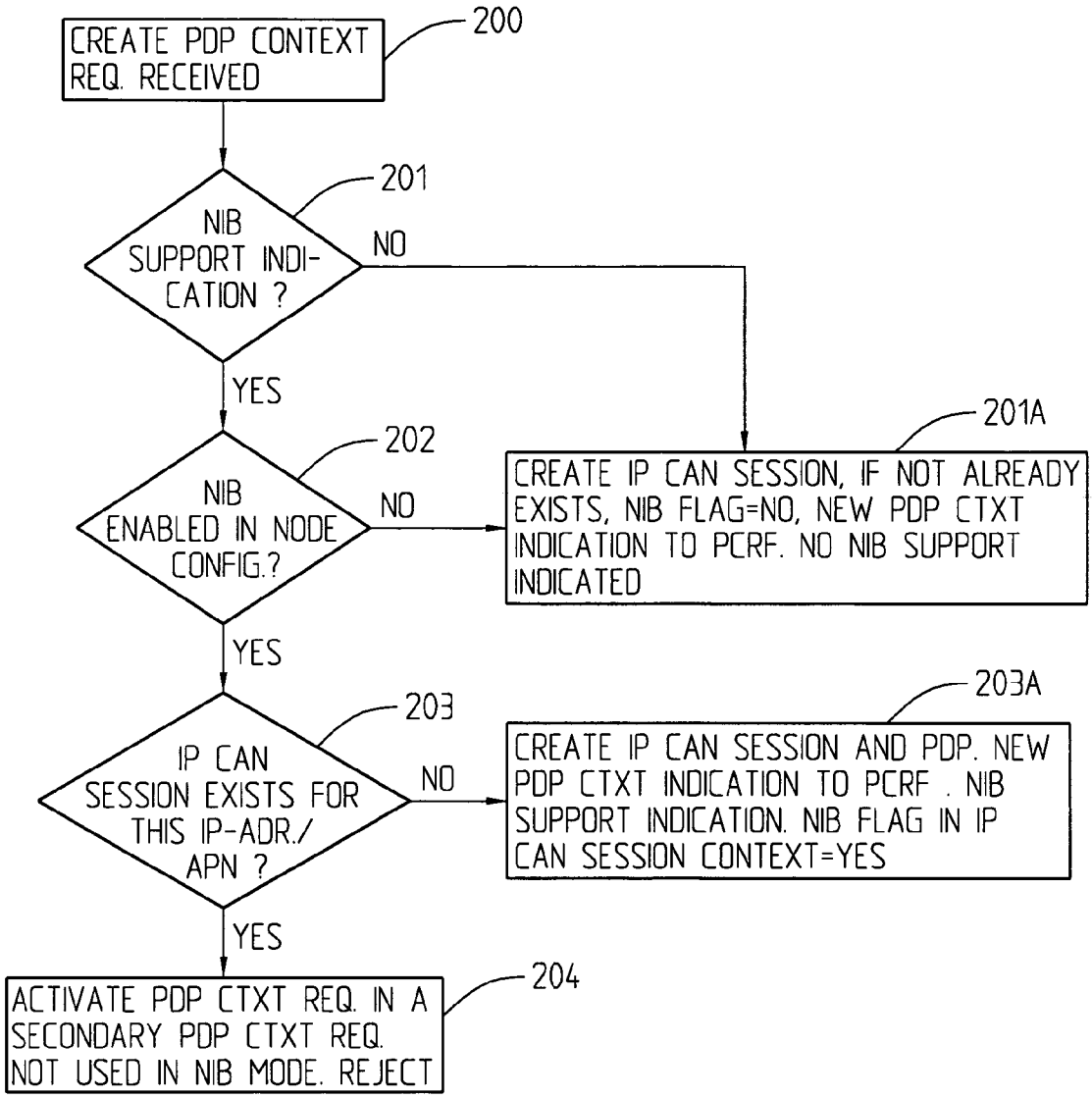

CREATE PDP CONTEXT REQ. RECEIVED
200
NIB SUPPORT INDI-CATION ?
201
NO
YES
NIB ENABLED IN NODE CONFIG.?
202
NO
201A
CREATE IP CAN SESSION, IF NOT ALREADY EXISTS, NIB FLAG=NO, NEW PDP CTXT INDICATION TO PCRF. NO NIB SUPPORT INDICATED
YES
IP CAN SESSION EXISTS FOR THIS IP-ADR./ APN ?
203
NO
203A
CREATE IP CAN SESSION AND PDP. NEW PDP CTXT INDICATION TO PCRF . NIB SUPPORT INDICATION. NIB FLAG IN IP CAN SESSION CONTEXT=YES
YES
ACTIVATE PDP CTXT REQ. IN A SECONDARY PDP CTXT REQ. NOT USED IN NIB MODE. REJECT
204

Fig. 7

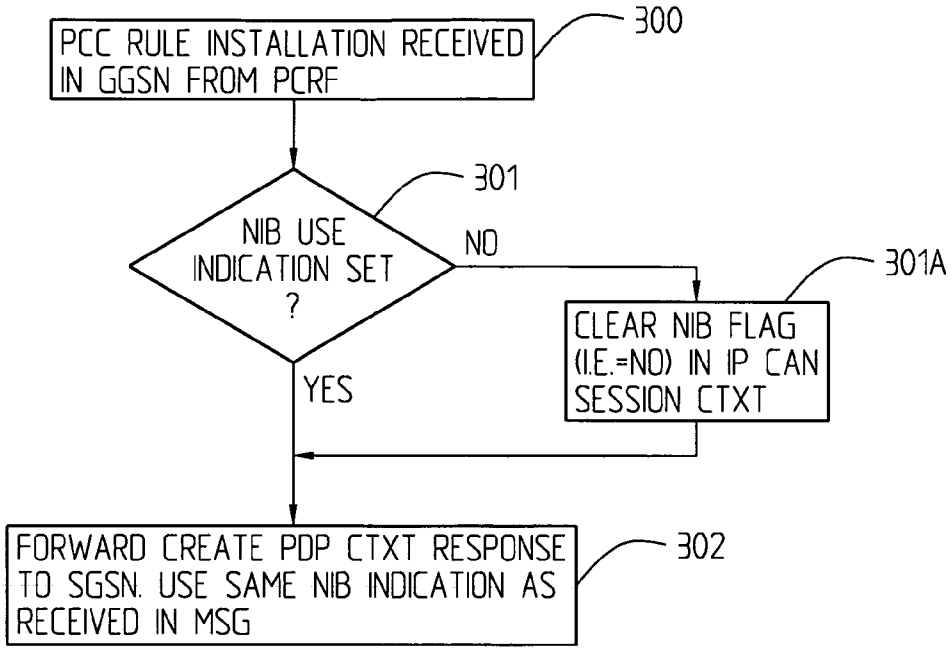

PCC RULE INSTALLATION RECEIVED IN GGSN FROM PCRF
300
NIB USE INDICATION SET ?
301
NO
YES
CLEAR NIB FLAG (I.E.=NO) IN IP CAN SESSION CTXT
301A
FORWARD CREATE PDP CTXT RESPONSE TO SGSN. USE SAME NIB INDICATION AS RECEIVED IN MSG
302

Fig. 8A

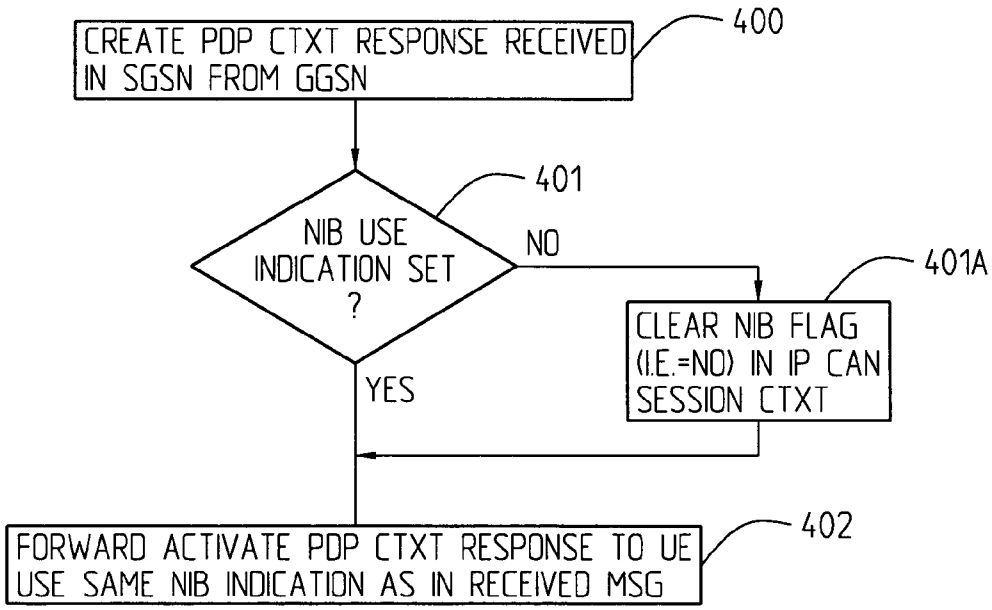

CREATE PDP CTXT RESPONSE RECEIVED IN SGSN FROM GGSN
400
NIB USE INDICATION SET ?
401
NO
YES
CLEAR NIB FLAG (I.E.=NO) IN IP CAN SESSION CTXT
401A
FORWARD ACTIVATE PDP CTXT RESPONSE TO UE USE SAME NIB INDICATION AS IN RECEIVED MSG
402

Fig. 8B

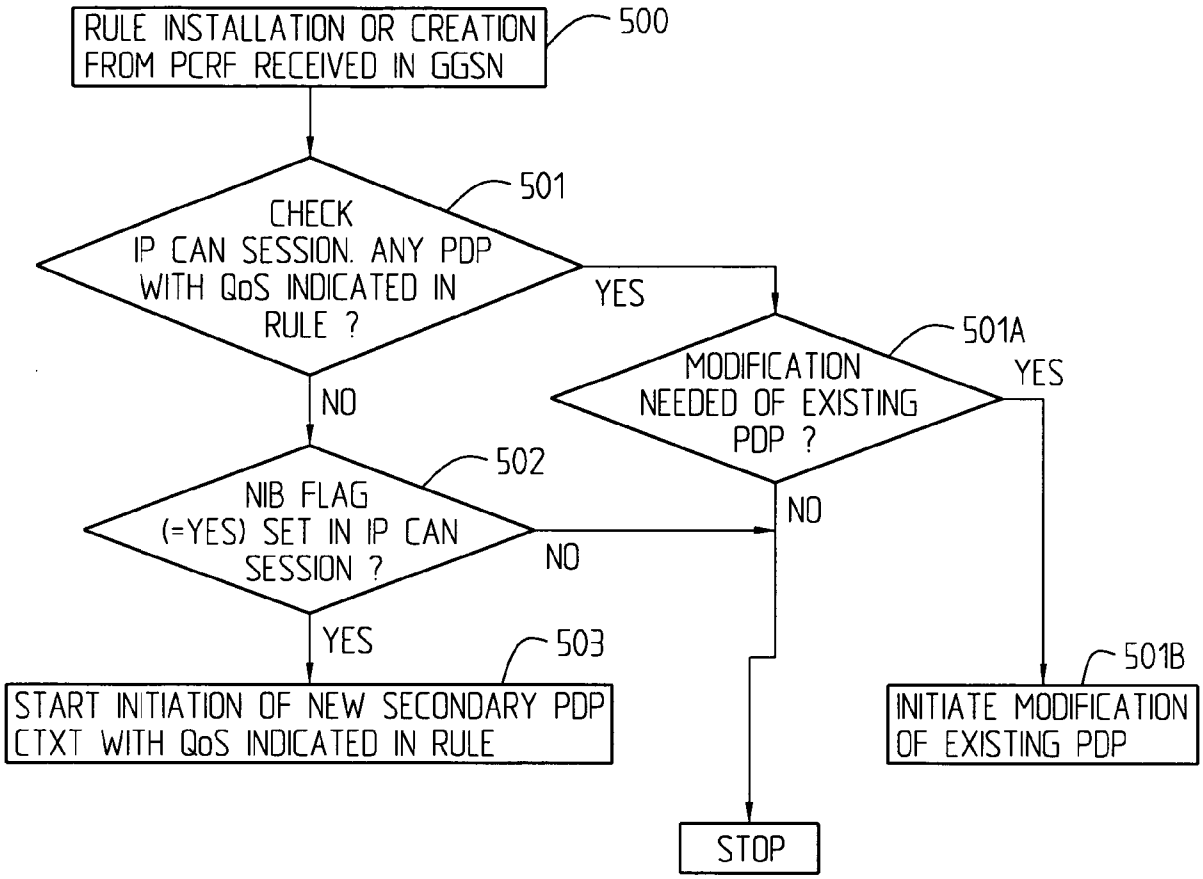

RULE INSTALLATION OR CREATION FROM PCRF RECEIVED IN GGSN
500
CHECK IP CAN SESSION. ANY PDP WITH QoS INDICATED IN RULE ?
501
YES
NO
MODIFICATION NEEDED OF EXISTING PDP ?
501A
YES
NO
NIB FLAG (=YES) SET IN IP CAN SESSION ?
502
NO
YES
START INITIATION OF NEW SECONDARY PDP CTXT WITH QoS INDICATED IN RULE
503
INITIATE MODIFICATION OF EXISTING PDP
501B
STOP

Fig. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2006/061980

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04Q7/22

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 H04Q

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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ERICSSON: "Impacts of mechanisms for operator controlled QoS in a GPRS IP-CAN" 3GPP TSG SA WG2 ARCHITECTURE - SA2#51, [Online] no. S2-060676, 13 February 2006 (2006-02-13), - 17 February 2006 (2006-02-17) pages 1-5, XP007901698 Denver, USA Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TSGS2_51_Denver/Docs/> [retrieved on 2007-02-08] paragraph [0001] paragraph [X.2.2.1] - paragraph [X.2.2.3] figure qq ----- -/--	1-44

[X] Further documents are listed in the continuation of Box C.

[X] 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 document 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	Date of mailing of the international search report
9 February 2007	15/02/2007
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Bittermann, Jörg

Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 03/030490 A2 (NOKIA CORP [FI]; KEKKI SAMI [FI]) 10 April 2003 (2003-04-10) abstract page 4, line 6 - line 10 claim 20	7-9,12, 32,40,41
A	US 2004/071126 A1 (RAMOS-ESCANO GABRIEL [ES] ET AL) 15 April 2004 (2004-04-15) abstract paragraph [0013] paragraph [0051] - paragraph [0053]	7-9,12, 32,40,41
A	ERICSSON: "Operator Controlled QoS" 3GPP TSG SA WG2 ARCHITECTURE - SA2#50, [Online] no. S2-060049, 16 January 2006 (2006-01-16), - 20 January 2006 (2006-01-20) pages 1-5, XP007901697 Budapest, Hungary Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TSGS2_50_Budapest/Docs/> [retrieved on 2007-02-08] cited in the application the whole document	1-44

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2006/061980

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 03030490 A2	10-04-2003	US 2005009501 A1	13-01-2005
US 2004071126 A1	15-04-2004	AU 2003255539 A1	04-05-2004
		CN 1689366 A	26-10-2005
		EP 1552717 A1	13-07-2005
		WO 2004036949 A1	29-04-2004