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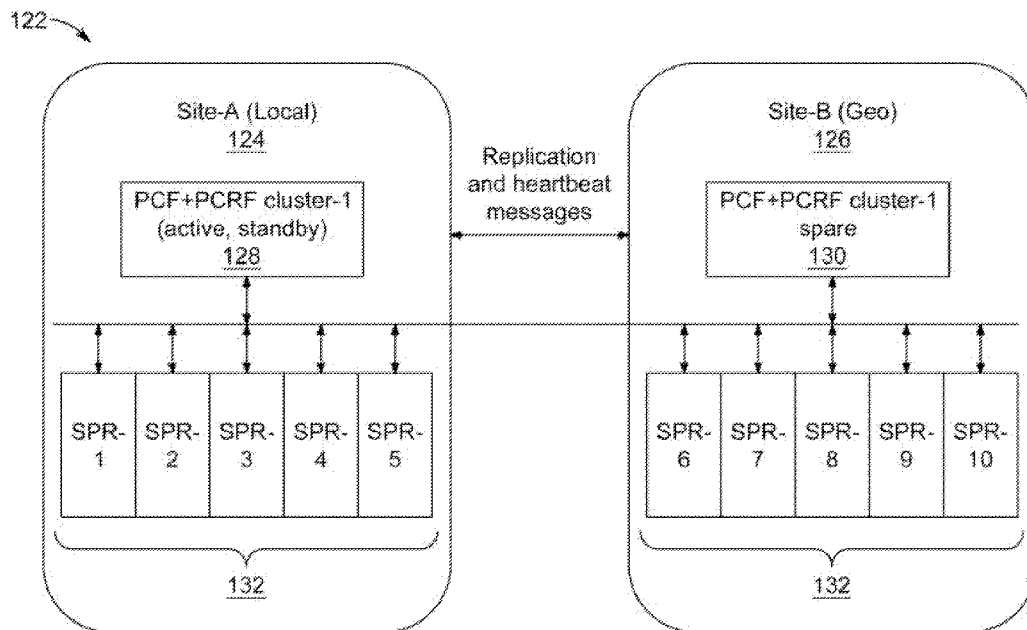


FIG. 1C

(57) Abstract: The present disclosure discloses a method (400) for managing a plurality of subscriber profiles in a network (108), including establishing a connection of a network policy function (202) with SPR nodes (132) deployed at a first data centre and a second data centre, wherein the first data centre is deployed at a local site (124) and the second data centre is deployed at a geo-site (126); enabling the network policy function (202) to transmit a request of subscriber profile information to the SPR nodes (132) of the first data centre based on a first predefined criteria; enabling at least one SPR node (132) of the first data centre to serve the request based on a second predefined criteria; redirecting the request to the SPR nodes (132) deployed at the second data centre, when the SPR nodes (132) of the first data centre fails to meet the second predefined criteria.

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SYSTEM AND METHOD FOR MANAGING SUBSCRIBER PROFILES IN A NETWORK

5 **RESERVATION OF RIGHTS**

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15 **TECHNICAL FIELD**

[002] The present disclosure relates to a field of telecommunication networks and specifically to a system and a method for managing subscriber profiles based on subscriber profile repository (SPR) selection.

20

BACKGROUND

[003] The following description of related art is intended to provide background information pertaining to the field of the disclosure. This section may
25 include certain aspects of the art that may be related to various features of the present disclosure. However, it should be appreciated that this section be used only to enhance the understanding of the reader with respect to the present disclosure, and not as admissions of prior art.

30 [004] In modern telecom networks, network policy functions such as, a policy charging rule function (PCRF) and a policy control function (PCF) are pivotal components responsible for managing policy decisions and charging rules based on subscriber profiles. These components rely heavily on timely and reliable access to subscriber data stored in a subscriber profile repository (SPR). With
35 increasing subscriber bases and need for enhanced services, ensuring fast, reliable and resilient access to the subscriber data has become crucial.

[005] The PCF is connected with a SPR cluster, which may be deployed in either a distributed architecture or a single-site deployment. In a case of the distributed architecture, subscriber profile information may be retrieved from SPR nodes deployed at all local sites as well as geo-sites. In the distributed SPR architecture, the subscriber profile is available at local nodes as well as geo nodes. Response for queries at the local site is typically faster as compared to the geo site, as at the geo site, a data packet needs to travel through a large number of devices, such as routers (also referred to as “high routing hop count”) as compared to the local site.

[006] In an event of network fluctuation, natural disaster, or a fiber-cut between the local sites and the geo sites, a delay in responding to the query increases. In such cases, an application needs to open a processing thread to wait for the response from the SPR, which also introduces Gx/N7 reference point initial message response delays and if this situation persists for longer duration, then the application suffers with a poor performance.

[007] Thus, there is a need of a system and a method that can overcome disadvantages of the prior art by providing a robust, efficient and reliable mechanism for the PCF to interact with the SPR nodes.

OBJECTS OF THE PRESENT DISCLOSURE

[008] Some of the objects of the present disclosure, which at least one embodiment herein satisfies are as listed herein below.

[009] An object of the present disclosure is to provide a system and a method for managing subscriber profiles in a network.

[0010] Another object of the present disclosure is to improve a policy control function (PCF) response time in a network.

[0011] Another object of the present disclosure is to prevent an application from getting damaged during message queue overload situations.

[0012] Another object of the present disclosure is to provide a system and a
5 method that is economical and easy to implement.

DEFINITION

As used in the present disclosure, the following terms are generally intended to have the meaning as set forth below, except to the extent that the context in which they
10 are used to indicate otherwise.

The term PCF as used herein, refers to a Policy Control Function that is a functional element for policy control decision and flows-based charging control functionalities. The PCF provides functions such as, Policy rules for application and service data flow detection, gating, Quality of Service (QoS), and flow-based
15 charging to Session Management Function (SMF).

The term PCRF as used herein, refers to a Policy and Charging Rules Function that is a component of the network core in telecommunications networks, particularly in the Evolved Packet Core (EPC) of 4G LTE networks. It plays a central role in defining quality policy rules and ensuring the competent application of real-time
20 charging for user data.

The term SPR as used herein, refers to a Subscriber Profile Repository (logical database) which contains subscriber related information related to policy and charging control. The SPR may be a subset of the HSS (Home Subscriber Server), providing information such as subscriber allowed services, permitted QoS and
25 charging related information.

SUMMARY

[0013] In an exemplary embodiment, the present invention discloses a method for managing a plurality of subscriber profiles in a network. The method includes a step of establishing, by a connection management unit, a connection of a network policy function with a plurality of Subscriber Profile Repository (SPR) nodes deployed at a first data centre and a second data centre. The first data centre is deployed at a local site and the second data centre is deployed at a geo-site. The method includes a step of enabling, by a processing unit, the network policy function to transmit at least one request of subscriber profile information to the plurality of SPR nodes deployed at the first data centre based on a first predefined criteria. The method includes a step of enabling, by the processing unit, at least one SPR node of the plurality of SPR nodes of the first data centre to serve the at least one request of the subscriber profile information based on a second predefined criteria. The method includes a step of redirecting, by the processing unit, the at least one request of the subscriber profile information to the plurality of SPR nodes deployed at the second data centre, when the plurality of SPR nodes of the first data centre fails to meet the second predefined criteria.

[0014] In some embodiments, the network policy function is selected from a list of a Policy Control Function (PCF), a Policy and Charging Rule Function (PCRF), or a combination thereof.

[0015] In some embodiments, the first predefined criteria comprises priorities of the plurality of SPR nodes in both the first data centre and the second data centre.

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[0016] In some embodiments, the second predefined criteria comprises a minimum threshold of the plurality of SPR nodes required to be operational in the first data centre.

[0017] In some embodiments, the method includes a step of enabling, by the processing unit, the at least one SPR node of the plurality of SPR nodes of the

30

first data centre to serve one or more requests of the subscriber profile information once the plurality of SPR nodes of the first data centre meet the second predefined criteria.

- 5 **[0018]** In some embodiments, the method includes a step of defining, by the processing unit, one or more configuration parameters for the plurality of SPR nodes deployed at the first data centre and the second data centre.

- 10 **[0019]** In another exemplary embodiment, the present invention discloses a system for managing a plurality of subscriber profiles in a network. The system includes a connection management unit configured to establish a connection of a network policy function with a plurality of Subscriber Profile Repository (SPR) nodes deployed at a first data centre and a second data centre. The first data centre is deployed at a local site and the second data centre is deployed at a geo-site. The
15 connection management unit is further configured to receive at least one request of subscriber profile information from the network policy function. The system further includes a processing unit. The processing unit is configured to: transmit the at least one received request of the subscriber profile information to the plurality of SPR nodes deployed at the first data centre based on a first predefined criteria; enable at
20 least one SPR node of the plurality of SPR nodes of the first data centre to serve the at least one request of the subscriber profile information based on a second predefined criteria; and redirect the at least one request of the subscriber profile information to the plurality of SPR nodes deployed at the second data centre, when the plurality of SPR nodes of the first data centre fails to meet the second predefined
25 criteria.

- 30 **[0020]** In some embodiments, the network policy function is selected from a list of a Policy Control Function (PCF), a Policy and Charging Rule Function (PCRF), or a combination thereof.

[0021] In some embodiments, the first predefined criteria comprises priorities of the plurality of SPR nodes in both the first data centre and the second data centre.

- 5 [0022] In some embodiments, the second predefined criteria comprises a minimum threshold of the plurality of SPR nodes required to be operational in the first data centre.

- [0023] In some embodiments, the processing unit is configured to enable
10 the at least one SPR node of the plurality of SPR nodes of the first data centre to serve one or more requests of the subscriber profile information once the plurality of SPR nodes of the first data centre meet the second predefined criteria.

- [0024] In some embodiments, the processing unit is configured to define
15 one or more configuration parameters for the plurality of SPR nodes at the first data centre and the second data centre.

- [0025] In an exemplary embodiment, the present invention discloses a user equipment communicatively coupled with a network. The coupling includes steps
20 of receiving, by the network, a connection request from the user equipment (UE); sending, by the network, an acknowledgment of the connection request to the user equipment (UE); and transmitting a plurality of signals in response to the connection request. The network is configured for performing a method for managing a plurality of subscriber profiles in the network. The method includes
25 step of establishing, by a connection management unit, a connection of a network policy function with a plurality of Subscriber Profile Repository (SPR) nodes deployed at a first data centre and a second data centre. The first data centre is deployed at a local site and the second data centre is deployed at a geo-site. The method includes a step of enabling, by a processing unit, the network policy
30 function to transmit at least one request of subscriber profile information to the plurality of SPR nodes deployed at the first data centre based on a first predefined

criteria. The method includes a step of enabling, by the processing unit, at least one SPR node of the plurality of SPR nodes of the first data centre to serve the at least one request of the subscriber profile information based on a second predefined criteria. The method includes a step of redirecting, by the processing unit, the at least one request of the subscriber profile information to the plurality of SPR nodes deployed at the second data centre, when the plurality of SPR nodes of the first data centre fails to meet the second predefined criteria.

[0026] In an exemplary embodiment, the present invention discloses a computer program product comprising a non-transitory computer-readable medium including instructions that, when executed by one or more processors, cause the one or more processors to perform a method for managing a plurality of subscriber profiles in a network. The method includes a step of establishing, by a connection management unit, a connection of a network policy function with a plurality of Subscriber Profile Repository (SPR) nodes deployed at a first data centre and a second data centre. The first data centre is deployed at a local site and the second data centre is deployed at a geo-site. The method includes a step of enabling, by a processing unit, the network policy function to transmit at least one request of subscriber profile information to the plurality of SPR nodes deployed at the first data centre based on a first predefined criteria. The method includes a step of enabling, by the processing unit, at least one SPR node of the plurality of SPR nodes of the first data centre to serve the at least one request of the subscriber profile information based on a second predefined criteria. The method includes a step of redirecting, by the processing unit, the at least one request of the subscriber profile information to the plurality of SPR nodes deployed at the second data centre, when the plurality of SPR nodes of the first data centre fails to meet the second predefined criteria.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] In the figures, similar components and/or features may have the same reference label. Further, various components of the same type may be

distinguished by following the reference label with a second label that distinguishes among the similar components. If only the first reference label is used in the specification, the description is applicable to any one of the similar components having the same first reference label irrespective of the second reference label.

5

[0028] The diagrams are for illustration only, which thus is not a limitation of the present disclosure, and wherein:

[0029] FIG. 1A illustrates an exemplary network architecture in which or
10 with which embodiments of the present disclosure may be implemented;

[0030] FIG. 1B illustrates an exemplary block diagram of a system, in accordance with an embodiment of the present disclosure;

15 **[0031]** FIG. 1C illustrates an exemplary distributed architecture depicting configuration of a local site and a geo-site, in accordance with an embodiment of the present disclosure;

[0032] FIG. 2 illustrates an exemplary diagram representing an interaction
20 system for enabling interaction between network policy functions through corresponding interfaces, in accordance with an embodiment of the present disclosure;

[0033] FIG. 3 illustrates an exemplary computer system in which or with
25 which embodiments of the present disclosure may be implemented; and

[0034] FIG. 4 illustrates a flowchart of a method for managing a plurality
of subscriber profiles in a network, in accordance with an embodiment of present disclosure.

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LIST OF REFERENCE NUMERALS

100 – Network architecture

102-1, 102-2...102-N – User Equipment

- 104-1, 104-2...104-N – Users
- 106 – System
- 108 – Network
- 110 – Connection Management Unit
- 5 112 – Memory
- 114 – Interfacing Unit
- 116 – Processing Unit
- 118 – Database(s)
- 120 – Node Prioritization Module
- 10 122 – Distributed Architecture
- 124 – Local Site
- 126 – Geo-Site
- 128 – Active Cluster
- 130 – Spare Cluster
- 15 132 – SPR nodes
- 200 – Interaction system
- 202 – Network Policy Function
- 204 – Deep Packet Inspection (DPI) Function
- 206 – Session Management Function (SMF)
- 20 208 – Charging Function (CHF)
- 210 – Binding Support Function (BSF)
- 212 – Network Repository Function (NRF)
- 214 - Access and Mobility Management Function (AMF)
- 216 – Application Function (AF)
- 25 218 – Online Charging System (OCS)
- 220 – Packet Data Network Gateway (PGW)
- 222 – Network Management System (NMS)
- 300 – Computer system
- 310 – External storage device
- 30 320 – Bus
- 330 – Main memory

- 340 – Read only memory
- 350 – Mass storage device
- 360 – Communication port(s)
- 370 – Processor
- 5 400 – Method

DETAILED DESCRIPTION

[0035] In the following description, for the purposes of explanation, various specific details are set forth in order to provide a thorough understanding of
10 embodiments of the present disclosure. It will be apparent, however, that embodiments of the present disclosure may be practiced without these specific details. Several features described hereafter can each be used independently of one another or with any combination of other features. An individual feature may not address all of the problems discussed above or might address only some of the
15 problems discussed above. Some of the problems discussed above might not be fully addressed by any of the features described herein.

[0036] The ensuing description provides exemplary embodiments only, and is not intended to limit the scope, applicability, or configuration of the disclosure.
20 Rather, the ensuing description of the exemplary embodiments will provide those skilled in the art with an enabling description for implementing an exemplary embodiment. It should be understood that various changes may be made in the function and arrangement of elements without departing from the spirit and scope of the disclosure as set forth.

25 [0037] Specific details are given in the following description to provide a thorough understanding of the embodiments. However, it will be understood by one of ordinary skill in the art that the embodiments may be practiced without these specific details. For example, circuits, systems, networks, processes, and other
30 components may be shown as components in block diagram form in order not to obscure the embodiments in unnecessary detail. In other instances, well-known

circuits, processes, algorithms, structures, and techniques may be shown without unnecessary detail in order to avoid obscuring the embodiments.

[0038] Also, it is noted that individual embodiments may be described as a process which is depicted as a flowchart, a flow diagram, a data flow diagram, a structure diagram, or a block diagram. Although a flowchart may describe the operations as a sequential process, many of the operations can be performed in parallel or concurrently. In addition, the order of the operations may be re-arranged. A process is terminated when its operations are completed but could have additional steps not included in a figure. A process may correspond to a method, a function, a procedure, a subroutine, a subprogram, etc. When a process corresponds to a function, its termination can correspond to a return of the function to the calling function or the main function.

[0039] The word “exemplary” and/or “demonstrative” is used herein to mean serving as an example, instance, or illustration. For the avoidance of doubt, the subject matter disclosed herein is not limited by such examples. In addition, any aspect or design described herein as “exemplary” and/or “demonstrative” is not necessarily to be construed as preferred or advantageous over other aspects or designs, nor is it meant to preclude equivalent exemplary structures and techniques known to those of ordinary skill in the art. Furthermore, to the extent that the terms “includes,” “has,” “contains,” and other similar words are used in either the detailed description or the claims, such terms are intended to be inclusive—in a manner similar to the term “comprising” as an open transition word—without precluding any additional or other elements.

[0040] Reference throughout this specification to “one embodiment” or “an embodiment” or “an instance” or “one instance” means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present disclosure. Thus, the appearances of the phrases “in one embodiment” or “in an embodiment” or “in some embodiments” in various places throughout this specification are not necessarily all referring to the

same embodiment. Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

5 **[0041]** The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the disclosure. As used herein, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises” and/or “comprising,” when used in this
10 specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. As used herein, the term “and/or” includes any and all combinations of one or more of the associated listed items.

15 **[0042]** Embodiments herein relate to systems and methods for managing subscriber profiles in a network. In particular, a priority is set between a first data centre (DC) and a second data centre (DC), where the first data centre is a local data centre and prioritized over the second data centre. Upon prioritizing the first data
20 centre, a network policy function transmits subscriber profile information request to subscriber profile repository (SPR) nodes present in the first data centre as a first priority. In case, when the first data centre is not available to provide the subscriber profile information, the network policy function transmits the subscriber profile information request to the SPR nodes present in the second data centre as a second
25 priority.

[0043] Various embodiments of the present disclosure will be explained in detail with reference to FIGs. 1 to 4.

30 **[0044]** FIG. 1A illustrates an exemplary network architecture (100) in which or with which embodiments of the present disclosure may be implemented.

[0045] Referring to the FIG. 1A, the network architecture (100) may include one or more computing devices or user equipment (102-1, 102-2...102-N) that may be associated with one or more users (104-1, 104-2...104-N) and a system (106) in an environment. In an embodiment, the one or more user equipment (102-1, 102-2...102-N) may be communicated to the system (106) through a network (108). A person of ordinary skill in the art will understand that the one or more user equipment (102-1, 102-2...102-N) may be individually referred to as the user equipment (102) and collectively referred to as the user equipment (102). A person of ordinary skill in the art will appreciate that the terms “computing device(s)” and “user equipment” may be used interchangeably throughout the disclosure. Although three user equipment (102) are depicted in the FIG. 1A, however any number of the user equipment (102) may be included without departing from the scope of the ongoing description. Similarly. A person of ordinary skill in the art will understand that the one or more users (104-1, 104-2...104-N) may be individually referred to as the user (104) and collectively referred to as the users (104).

[0046] In an embodiment, the user equipment (102) may include smart devices operating in a smart environment, for example, an Internet of Things (IoT) system. In such an embodiment, the user equipment (102) may include, but not limited to, smart phones, smart watches, smart sensors (e.g., mechanical, thermal, electrical, magnetic, etc.), networked appliances, networked peripheral devices, networked lighting system, communication devices, networked vehicle accessories, networked vehicular devices, smart accessories, tablets, smart television (TV), computers, a smart security system, a smart home system, other devices for monitoring or interacting with or for the users (104) and/or entities, or any combination thereof. A person of ordinary skill in the art will appreciate that the user equipment (102) may include, but not limited to, intelligent multi-sensing, network-connected devices, that can integrate seamlessly with each other and/or with a central server or a cloud-computing system or any other device that is network-connected.

[0047] In an embodiment, the user equipment (102) may include, but not limited to, a handheld wireless communication device (e.g., a mobile phone, a smart phone, a phablet device, and so on), a wearable computer device (e.g., a head-mounted display computer device, a head-mounted camera device, a wristwatch computer device, and so on), a Global Positioning System (GPS) device, a laptop, a tablet computer, or another type of portable computer, a media playing device, a portable gaming system, and/or any other type of computer device with wireless communication capabilities, and the like.

10 [0048] In an embodiment, the user equipment (102) may include, but is not limited to, any electrical, electronic, electro-mechanical, or an equipment, or a combination of one or more of the above devices such as virtual reality (VR) devices, augmented reality (AR) devices, a general-purpose computer, a desktop, a personal digital assistant, a mainframe computer, or any other computing device. In
15 another embodiment, the user equipment (102) may include one or more in-built or externally coupled accessories including, but not limited to, a visual aid device such as a camera, an audio aid, a microphone, a keyboard, and input devices for receiving input from the user (104) or the entity such as a touch pad, a touch enabled screen, an electronic pen, and the like. A person of ordinary skill in the art will appreciate
20 that the user equipment (102) may not be restricted to the mentioned devices and various other devices may be used.

[0049] Referring to the FIG. 1A, the user equipment (102) may communicate with the system (106), for example, the system (106) for managing a
25 plurality of subscriber profiles in the network (108).

[0050] In an embodiment, the system (106) may be configured to enhance a network policy function (202) (as shown in FIG. 2) for prioritizing requests for subscriber profile information. In an embodiment, the network policy function
30 (202) may be, but not limited to, a PCF, a PCRF, or a combination thereof. The system (106) may be configured to distinguish between SPR nodes (132) (as shown in FIG. 1C) deployed at a first data centre and a second data centre using predefined

configuration parameters, in an embodiment. The first data centre may be a centre that may be deployed at a local site (124) (as shown in FIG. 1C) and the second data centre may be a centre that may be deployed at a geo-site (126) (as shown in FIG. 1C). As used herein, the term “local site” (124) may be a site that may be geographically close to a primary service area. Also, as used herein, the “geo-site” (126) may be a site that may be geographically dispersed from the local site (124). Further, in an embodiment, the system (106) may be configured to prioritize the SPR nodes (132) of the first data centre to ensure faster response times, and dynamically switches to the SPR nodes (132) of the second data centre when the SPR nodes (132) of the first data centre fails to meet requirements.

[0051] In an embodiment, the network (108) may include at least one of a 5G network, 6G network, or the like. The network (108) may enable the user equipment (102) to communicate with other devices in the network architecture (100) and/or with the system (106). The network (108) may include a wireless card or some other transceiver connection to facilitate this communication. In another embodiment, the network (108) may be implemented as, or include any of a variety of different communication technologies such as a Wide Area Network (WAN), a Local Area Network (LAN), a wireless network, a mobile network, a Virtual Private Network (VPN), the Internet, a Public Switched Telephone Network (PSTN), or the like.

[0052] Although the FIG. 1A shows exemplary components of the network architecture (100); however, in other embodiments, the network architecture (100) may include fewer components, different components, differently arranged components, or additional functional components than depicted in the FIG. 1A. Additionally, or alternatively, one or more components of the network architecture (100) may perform functions described as being performed by one or more other components of the network architecture (100).

[0053] FIG. 1B illustrates an exemplary block diagram of the system (106), in accordance with an embodiment of the present disclosure.

[0054] In an embodiment, the system (106) may include a connection management unit (110), a memory (112), an interfacing unit (114), a processing unit (116) and the database (118). In an embodiment, the processing unit (116) may
5 include a node prioritization module (120).

[0055] In an embodiment, the connection management unit (110) may be configured to define the configuration parameters for the SPR nodes (132) (as shown in the FIG. 1C) of both the first data centre and the second data centre. In
10 such embodiment, the network policy function (202) (as shown in the FIG. 2) may be configured with the configuration parameters during an initial setup to establish an identity and characteristics of each of the SPR nodes (132) of both the first data centre and the second data centre. In an exemplary embodiment, the configuration parameters may be used to identify and classify each of the SPR nodes (132) as
15 either part of the first data centre or the second data centre.

[0056] The connection management unit (110) may be configured to establish a connection of the network policy function (202) with the SPR nodes (132) deployed at the first data centre and the second data centre, so that the network
20 policy function (202) may quickly switch to an alternative SPR node (132) without requiring additional connection setup time. In an exemplary embodiment, the connection management unit (110) may be configured to establish the connection of the network policy function (202) with the SPR nodes (132) deployed at the first data centre based on the configuration parameters defined for the corresponding
25 SPR nodes (132) of the first data centre. In another exemplary embodiment, the connection management unit (110) may be configured to establish the connection of the network policy function (202) with the SPR nodes (132) deployed at the second data centre based on the configuration parameters defined for the corresponding SPR nodes (132) of the second data centre.

30 [0057] In an embodiment, the connection management unit (110) may be configured to receive at least one request of a subscriber profile information from

the network policy function (202) upon establishing the connection of the network policy function (202) with the SPR nodes (132) of both the first data centre and the second data centre. In an exemplary embodiment, the at least one request of the subscriber profile information may first be received by the network policy function
5 (202) from other network elements and may further be transmitted by the network policy function (202) to the connection management unit (110).

[0058] The memory (112) may be configured to store computer-readable instructions or routines in a non-transitory computer readable storage medium. In
10 an aspect, the memory (112) may be configured to store program instructions that may be executed to perform tasks associated with the system (106). The memory (112) may include any non-transitory storage device including, for example, but not limited to, a volatile memory such as a Random-Access Memory (RAM), or a non-volatile memory such as an Erasable Programmable Read Only Memory (EPROM),
15 a flash memory, and the like. Embodiments of the present invention are intended to include or otherwise type of the memory (112) including known related art and/or later developed technologies.

[0059] In an embodiment, the interfacing unit (114) may comprise a variety
20 of interfaces, for example, interfaces for data input and output devices (I/O), storage devices, and the like. The interfacing unit (114) may facilitate communication through the system (106). The interfacing unit (114) may also provide a communication pathway for various other units/modules of the system (106).

[0060] In an embodiment, the database(s) (118) may be SPR(s) that offers
25 functionality to manage, capture, storage, and retrieval of data. In an embodiment, the database(s) (118) is configured for serving as a centralized repository for storing the subscriber profile information. The database(s) (118) is designed to interact seamlessly with other components of the system (106), such as the node prioritization module (120), to support a functionality of the system (106)
30 effectively. The database(s) (118) may store the data that may be either stored or generated as a result of functionalities implemented by any of the components of

the processing unit (116). In an embodiment, the database(s) (118) may be separate from the system (106).

[0061] The modules are controlled by the processing unit (116) which
5 execute the computer-readable instructions retrieved from the memory (112). The processing unit (116) further interact with the interfacing unit (114) to facilitate a user interaction and to provide options for managing and configuring the system (106). The processing unit (116) may be implemented as one or more microprocessors, microcomputers, microcontrollers, digital signal processors,
10 central processing units, logic circuitries, and/or any devices that process data based on operational instructions.

[0062] In an embodiment, the node prioritization module (120) may be configured to prioritize and transmit the at least one received request of the
15 subscriber profile information to at least one SPR node (132) of the first data centre based on a first predefined criteria. The first predefined criteria may include priorities that may be set for the SPR nodes (132) of both the first data centre and the second data centre. In an embodiment, the SPR nodes (132) of the first data centre of the local site (124) (as shown in the FIG. 1C) may be having a first priority
20 and the SPR nodes (132) of the second data centre of the geo-site (126) (as shown in the FIG. 1C) may be having a second priority, to ensure faster response times under normal conditions.

[0063] The node prioritization module (120) may be configured to enable
25 the at least one SPR node (132) of the first data centre to serve the at least one request of the subscriber profile information based on a second predefined criteria. In an embodiment, the second predefined criteria may include a minimum threshold of the SPR nodes (132) required to be operational in the first data centre. In an example, the minimum threshold of the operational SPR nodes (132) may be at least
30 50% of the total SPR nodes (132) on the first data centre. In an exemplary embodiment, the first data centre may act as a primary serving centre for the at least

one received request until more than 50% of the SPR nodes (132) in the first data centre fails to operate.

[0064] In an embodiment, the node prioritization module (120) may be configured to detect whether the SPR nodes (132) on the first data centre meets the second predefined criteria or not. The node prioritization module (120) may be configured to redirect the at least one request of the subscriber profile information to the SPR nodes (132) deployed at the second data centre, when the SPR nodes (132) of the first data centre fails to meet the second predefined criteria. In an exemplary embodiment, if more than 50% SPR nodes (132) (i.e. three SPR nodes out of five SPR nodes) in the first data centre fails, then the request may be redirected to the SPR nodes (132) of the second data centre.

[0065] Further, in an embodiment, the node prioritization module (120) may be configured to enable the at least one SPR node (132) of the first data centre to serve one or more requests of the subscriber profile information once the SPR nodes (132) of the first data centre meet the second predefined criteria. In an exemplary embodiment, if more than 50% SPR nodes (132) of the first data centre recovers from failure, then the one or more requests of the subscriber profile information may be served again by the SPR nodes (132) of the first data centre.

[0066] In an alternative embodiment, if the network policy functions (202) are deployed at the local site (124) and the at least one request of the subscriber profile information is received from the network policy functions (202) that are deployed at the local site (124), then the node prioritization module (120) may be configured to transmit the at least one request of the subscriber profile information to the SPR nodes (132) of the first data centre located at the local site (124). In such embodiment, the SPR nodes (132) of the local site (124) may be having a higher priority as compared to the SPR nodes (132) of the geo-site (126).

[0067] Similarly, in another embodiment, if the network policy functions (202) are deployed at the geo-site (126) and the at least one request of the subscriber

profile information is received from the network policy functions (202) that are deployed at the geo-site (126), then the node prioritization module (120) may be configured to transmit the at least one request of the subscriber profile information to the SPR nodes (132) of the second data centre located at the geo-site (126). In
5 such embodiment, the SPR nodes (132) of the geo-site (126) may be having the higher priority as compared to the SPR nodes (132) of the local site (124).

[0068] Although the FIG. 1B shows an exemplary block diagram of the system (106); however, in other embodiments, the system (106) may include fewer
10 components, different components, differently arranged components, or additional functional components than depicted in the FIG. 1B. Additionally, or alternatively, one or more components of the system (106) may perform functions described as being performed by one or more other components of the system (106).

15 [0069] FIG. 1C illustrates an exemplary distributed architecture (122) depicting configuration of the local site (124) and the geo-site (126), in accordance with an embodiment of the present disclosure. The distributed architecture (122) shows an active cluster (128) and a spare cluster (130), ensuring high availability and disaster recovery.

20 [0070] In an embodiment, the active cluster (128) may be a primary cluster located on the local site (124) and responsible for handling all the network policy functions (202) (as shown in the FIG. 2). The SPR nodes (132) located on the local site (124) may be primarily used by the active cluster (128) for faster response time.
25 In an embodiment, the active cluster (128) may interact with the SPR nodes (132) of the local site (124) for getting the subscriber profile information.

[0071] In another embodiment, the spare cluster (130) may be a secondary cluster that remains on standby and ready to take over if the active cluster (128)
30 fails or becomes overloaded. The SPR nodes (132) located on the geo-site (126) may act as backups and used by the spare cluster (130).

[0072] In an exemplary embodiment, at each of the local site (124) and the geo-site (126), the SPR nodes (132) are configured to serve the request associated with the subscriber profile information. A priority may be set between the first data centre of the local site (124) and the second data centre of the geo-site (126) where the first data centre of the local site (124) is prioritized over the second data centre of the geo-site (126). Accordingly, the network policy function (202) transmits the request to the SPR nodes (132) present in first data centre of the local site (124) as the first priority. In case, when the first data centre of the local site (124) is not available to provide the subscriber profile information, the network policy function (202) transmits the request to the SPR nodes (132) present in second data centre of the geo-site (126) as the second priority.

[0073] FIG. 2 illustrates an exemplary diagram representing an interaction system (200) for enabling interaction between network policy functions through corresponding interfaces, in accordance with an embodiment of the present disclosure.

[0074] The network policy function (202) such as, the PCF and the PCRF may interact with various network functions through the interfaces to ensure seamless service delivery.

[0075] The network policy function (202) may communicate with a Deep packet inspection (DPI) function (204) using a Sd interface. The DPI function (204) may be utilized to analyze network traffic at a granular level, enabling detailed traffic management and policy enforcement based on content and nature of data packets.

[0076] The network policy function (202) may communicate with a Session Management Function (SMF) (206) through N7 Interface. The network policy function (202) may provide policy rules to the SMF (206), which manages session establishment, modification, and termination.

[0077] The network policy function (202) may communicate with a Charging Function (CHF) (208) through N28 Interface. The network policy function (202) interacts with the CHF (208) to provide charging-related information and enforce policies that impact charging decisions.

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[0078] The network policy function (202) may communicate with a Binding Support Function (BSF) (210) through Nbsf Interface. The BSF (210) helps in binding application functions and their requests to the appropriate policy rules and sessions managed by the network policy function (202).

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[0079] The network policy function (202) may communicate with a Network Repository Function (NRF) (212) through a Nnrf Interface. The network policy function (202) queries the NRF (212) to discover other network functions and their capabilities, ensuring that it can interact with the appropriate functions to enforce the policies and manage sessions.

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[0080] The network policy function (202) may communicate with an Access and Mobility Management Function (AMF) (214) through N15 Interface. The network policy function (202) provides the AMF (214) with policy decisions that affect user mobility, access management, and session continuity, ensuring consistent policy enforcement as the users (104) (as shown in the FIG. 1A) move across the network (108) (as shown in the FIG. 1A).

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[0081] The network policy function (202) may communicate with an Application Function (AF) (216) through Rx Interface. The network policy function (202) receives application-level requests and requirements through the Rx interface, enabling it to apply appropriate QoS policies and resource allocations to support applications.

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[0082] The network policy function (202) may communicate with an Online Charging System (OCS) (218) through Sy Interface. The network policy function (202) exchanges charging-related information with the OCS (218) to support real-

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time charging and apply the policies that affect how subscribers are billed for their usage.

5 [0083] The network policy function (202) may communicate with a Packet Data Network Gateway (PGW) (220) through Gx Interface. The network policy function (202) provides policy and charging control rules to the PGW (220), which enforces these rules for data sessions, managing the QoS, and applying the charging rules.

10 [0084] The network policy function (202) may communicate with a Network Management System (NMS) (222) and the database such as, the Subscriber Profile Repository (SPR) (118). The network policy function (202) interacts with the NMS (222) for overall network management, monitoring, and configuration.

15 [0085] The network policy function (202) communicates with the SPR (118) to retrieve and update the subscriber profile information, ensuring that the policy decisions are based on most current subscriber information.

20 [0086] FIG. 3 illustrates an exemplary computer system (300) in which or with which embodiments of the present disclosure may be implemented. As shown in the FIG. 3, the computer system (300) may include an external storage device (310), a bus (320), a main memory (330), a read only memory (340), a mass storage device (350), a communication port (360), and a processor (370). A person skilled
25 in the art will appreciate that the computer system (300) may include more than one processor (370) and the communication ports (360). The processor (370) may include various modules associated with embodiments of the present disclosure.

[0087] In an embodiment, the external storage device (310) may be any
30 device that is commonly known in the art such as, but not limited to, a memory card, a memory stick, a solid-state drive, a hard disk drive (HDD), and so forth.

[0088] In an embodiment, the bus (320) may be communicatively coupled with the processor(s) (370) with the other memory, storage, and communication blocks. The bus (320) may be, e.g., a Peripheral Component Interconnect (PCI)/PCI Extended (PCI-X) bus, a Small Computer System Interface (SCSI), a Universal
5 Serial Bus (USB) or the like, for connecting expansion cards, drives and other subsystems as well as other buses, such a front side bus (FSB), which connects the processor (370) to the computer system (300).

[0089] In an embodiment, the main memory (330) may be a Random Access
10 Memory (RAM), or any other dynamic storage device commonly known in the art. The Read-only memory (340) may be any static storage device(s) e.g., but not limited to, a Programmable Read Only Memory (PROM) chips for storing static information e.g., start-up or Basic Input/Output System (BIOS) instructions for the processor (370).

15 [0090] In an embodiment, the mass storage device (350) may be any current or future mass storage solution, which may be used to store information and/or instructions. Exemplary mass storage solutions include, but are not limited to, a Parallel Advanced Technology Attachment (PATA) or a Serial Advanced
20 Technology Attachment (SATA) hard disk drives or solid-state drives (internal or external, e.g., having Universal Serial Bus (USB) and/or Firewire interfaces), one or more optical discs, Redundant Array of Independent Disks (RAID) storage, e.g., an array of disks (e.g., SATA arrays).

25 [0091] Further, the communication port (360) may be any of an RS-232 port for use with a modem-based dialup connection, a 10/100 Ethernet port, a Gigabit or 10 Gigabit port using copper or fiber, a serial port, a parallel port, or other existing or future ports. The communication port (360) may be chosen depending on the network (108), such a Local Area Network (LAN), Wide Area Network
30 (WAN), or any network to which the computer system (300) connects.

[0092] Optionally, operator and administrative interfaces, e.g., a display, a keyboard, a joystick, and a cursor control device, may also be coupled to the bus (320) to support a direct operator interaction with the computer system (300). Other operator and administrative interfaces may be provided through network connections connected through the communication port (360). Components described above are meant only to exemplify various possibilities. In no way should the aforementioned exemplary computer system (300) limit the scope of the present disclosure.

10 **[0093]** FIG. 4 illustrates a flowchart of a method (400) for managing a plurality of subscriber profiles in a network (108), in accordance with an embodiment of present disclosure.

[0094] Step (402) includes a step of establishing a connection of a network policy function (202) with a plurality of Subscriber Profile Repository (SPR) nodes (132) deployed at a first data centre and a second data centre. The first data centre is deployed at a local site (124) and the second data centre is deployed at a geographical site (126).

20 **[0095]** Step (404) includes a step of enabling the network policy function (202) to transmit at least one request of subscriber profile information to the plurality of SPR nodes (132) deployed at the first data centre based on a first predefined criteria.

25 **[0096]** Step (406) includes a step of enabling at least one SPR node of the plurality of SPR nodes (132) of the first data centre to serve the at least one request of the subscriber profile information based on a second predefined criteria.

[0097] Step (408) includes a step of redirecting the at least one request of the subscriber profile information to the plurality of SPR nodes (132) deployed at the second data centre, when the plurality of SPR nodes (132) of the first data centre fails to meet the second predefined criteria.

[0098] In an embodiment, the network policy function (202) is selected from a list of a Policy Control Function (PCF), a Policy and Charging Rule Function (PCRF), or a combination thereof.

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[0099] In some embodiments, the first predefined criteria includes priorities of the plurality of SPR nodes (132) in both the first data centre and the second data centre.

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[00100] In some embodiments, the second predefined criteria includes a minimum threshold of the plurality of SPR nodes (132) required to be operational in the first data centre.

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[00101] In some embodiments, the method (400) includes a step of enabling the at least one SPR node of the plurality of SPR nodes (132) of the first data centre to serve one or more requests of the subscriber profile information once the plurality of SPR nodes (132) of the first data centre meet the second predefined criteria.

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[00102] In some embodiments, the method (400) includes a step of defining one or more configuration parameters for the plurality of SPR nodes (132) deployed at the first data centre and the second data centre.

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[00103] In an embodiment, the present disclosure discloses a user equipment (UE) communicatively coupled with a network. The coupling including a step of receiving, by the network, a connection request from the user equipment (UE). The coupling including a step of sending, by the network, an acknowledgment of the connection request to the UE. The coupling including a step of transmitting a plurality of signals in response to the connection request. The network is configured for implementing the method for managing a plurality of subscriber profiles in the

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network.

[00104] While the foregoing describes various embodiments of the present disclosure, other and further embodiments of the present disclosure may be devised without departing from the basic scope thereof. The scope of the present disclosure is determined by the claims that follow. The present disclosure is not limited to the
5 described embodiments, versions or examples, which are included to enable a person having ordinary skill in the art to make and use the present disclosure when combined with information and knowledge available to the person having ordinary skill in the art.

10 [00105] While considerable emphasis has been placed herein on the preferred embodiments, it will be appreciated that many embodiments can be made and that many changes can be made in the preferred embodiments without departing from the principles of the disclosure. These and other changes in the preferred
15 embodiments of the disclosure will be apparent to those skilled in the art from the disclosure herein, whereby it is to be distinctly understood that the foregoing descriptive matter is to be implemented merely as illustrative of the disclosure and not as a limitation.

ADVANTAGES OF THE PRESENT DISCLOSURE

20 [00106] The present disclosure provides a system and a method for managing subscriber profiles in a network.

[00107] The present invention improves a policy control function (PCF) response time in a network.

25 [00108] The present invention prevents an application from getting damaged during message queue overload situations.

[00109] The present invention provides a system and a method that is
30 economical and easy to implement.

CLAIMS

1. A method (400) for managing a plurality of subscriber profiles in a network (108), wherein the method (400) comprising steps of:
 - 5 establishing, by a connection management unit (110), a connection of a network policy function (202) with a plurality of Subscriber Profile Repository (SPR) nodes (132) deployed at a first data centre and a second data centre, wherein the first data centre is deployed at a local site (124) and the second data centre is deployed at a geo-site (126);
 - 10 enabling, by a processing unit (116), the network policy function (202) to transmit at least one request of subscriber profile information to the plurality of SPR nodes (132) deployed at the first data centre based on a first predefined criteria;
 - enabling, by the processing unit (116), at least one SPR node of the
 - 15 plurality of SPR nodes (132) of the first data centre to serve the at least one request of the subscriber profile information based on a second predefined criteria; and
 - redirecting, by the processing unit (116), the at least one request of the subscriber profile information to the plurality of SPR nodes (132) deployed at
 - 20 the second data centre, when the plurality of SPR nodes (132) of the first data centre fails to meet the second predefined criteria.
2. The method (400) as claimed in claim 1, wherein the network policy function (202) is selected from a list of a Policy Control Function (PCF), a Policy and
- 25 Charging Rule Function (PCRF), or a combination thereof.
3. The method (400) as claimed in claim 1, wherein the first predefined criteria comprises priorities of the plurality of SPR nodes (132) of both the first data centre and the second data centre.

4. The method (400) as claimed in claim 1, wherein the second predefined criteria comprises a minimum threshold of the plurality of SPR nodes (132) required to be operational in the first data centre.
5. The method (400) as claimed in claim 1, comprising a step of enabling, by the processing unit (116), the at least one SPR node of the plurality of SPR nodes (132) of the first data centre to serve one or more requests of the subscriber profile information once the plurality of SPR nodes (132) of the first data centre meet the second predefined criteria.
6. The method (400) as claimed in claim 1, comprising a step of defining, by the processing unit (116), one or more configuration parameters for the plurality of SPR nodes (132) deployed at the first data centre and the second data centre.
7. A system (106) for managing a plurality of subscriber profiles in a network (108), wherein the system (106) comprising:
- a connection management unit (110) configured to:
 - establish a connection of a network policy function (202) with a plurality of Subscriber Profile Repository (SPR) nodes (132) deployed at a first data centre and a second data centre, wherein the first data centre is deployed at a local site (124) and the second data centre is deployed at a geo-site (126); and
 - receive at least one request of subscriber profile information from the network policy function (202);
 - a processing unit (116) configured to:
 - transmit the at least one received request of the subscriber profile information to the plurality of SPR nodes (132) deployed at the first data centre based on a first predefined criteria;
 - enable at least one SPR node of the plurality of SPR nodes (132) of the first data centre to serve the at least one request of the subscriber profile information based on a second predefined criteria;
 - and

redirect the at least one request of the subscriber profile information to the plurality of SPR nodes (132) deployed at the second data centre, when the plurality of SPR nodes (132) of the first data centre fails to meet the second predefined criteria.

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8. The system (106) as claimed in claim 7, wherein the network policy function (202) is selected from a list of a Policy Control Function (PCF), a Policy and Charging Rule Function (PCRF), or a combination thereof.

10 9. The system (106) as claimed in claim 7, wherein the first predefined criteria comprise priorities of the plurality of SPR nodes (132) of both the first data centre and the second data centre.

15 10. The system (106) as claimed in claim 7, wherein the second predefined criteria comprise a minimum threshold of the plurality of SPR nodes (132) required to be operational in the first data centre.

20 11. The system (106) as claimed in claim 7, wherein the processing unit (116) is configured to enable the at least one SPR node of the plurality of SPR nodes (132) of the first data centre to serve one or more requests of the subscriber profile information once the plurality of SPR nodes (132) of the first data centre meet the second predefined criteria.

25 12. The system (106) as claimed in claim 7, wherein the processing unit (116) is configured to define one or more configuration parameters for the plurality of SPR nodes (132) at the first data centre and the second data centre.

30 13. A user equipment (UE) (102) communicatively coupled with a network (108), the coupling comprises steps of:
receiving, by the network (108), a connection request from the user equipment (UE) (102);

sending, by the network (108), an acknowledgment of the connection request to the user equipment (UE) (102); and

transmitting a plurality of signals in response to the connection request, wherein the network (108) is configured for performing a method (400) for managing a plurality of subscriber profiles in the network (108) as claimed in claim 1.

14. A computer program product comprising a non-transitory computer-readable medium comprising instructions that, when executed by one or more processors, cause the one or more processors to perform a method (400) for managing a plurality of subscriber profiles in a network (108), the method (400) comprising steps of:

establishing, by a connection management unit (110), a connection of a network policy function (202) with a plurality of Subscriber Profile Repository (SPR) nodes (132) deployed at a first data centre and a second data centre, wherein the first data centre is deployed at a local site (124) and the second data centre is deployed at a geo-site (126);

enabling, by a processing unit (116), the network policy function (202) to transmit at least one request of subscriber profile information to the plurality of SPR nodes (132) deployed at the first data centre based on a first predefined criteria;

enabling, by the processing unit (116), at least one SPR node of the plurality of SPR nodes (132) of the first data centre to serve the at least one request of the subscriber profile information based on a second predefined criteria; and

redirecting, by the processing unit (116), the at least one request of the subscriber profile information to the plurality of SPR nodes (132) deployed at the second data centre, when the plurality of SPR nodes (132) of the first data centre fails to meet the second predefined criteria.

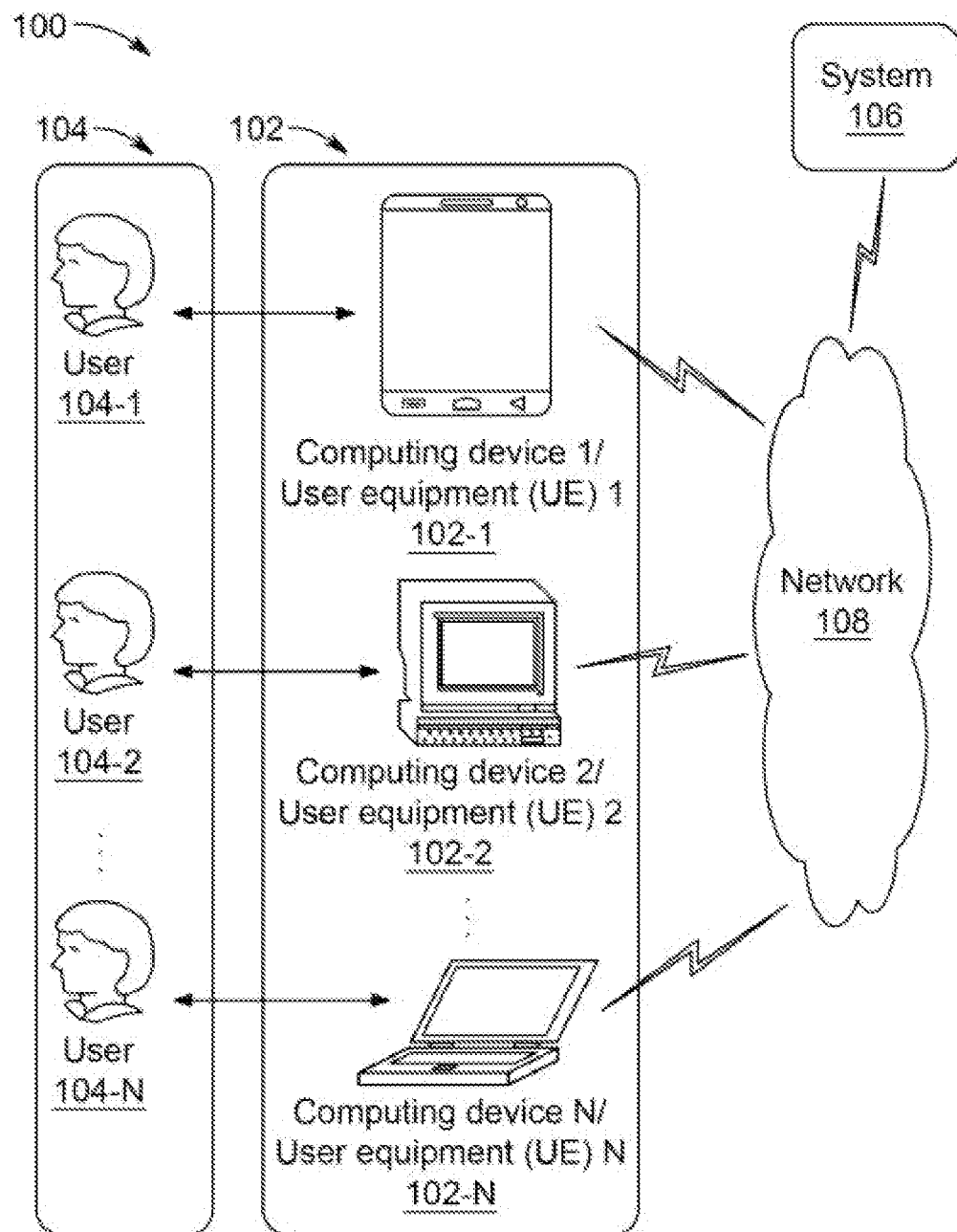


FIG. 1A

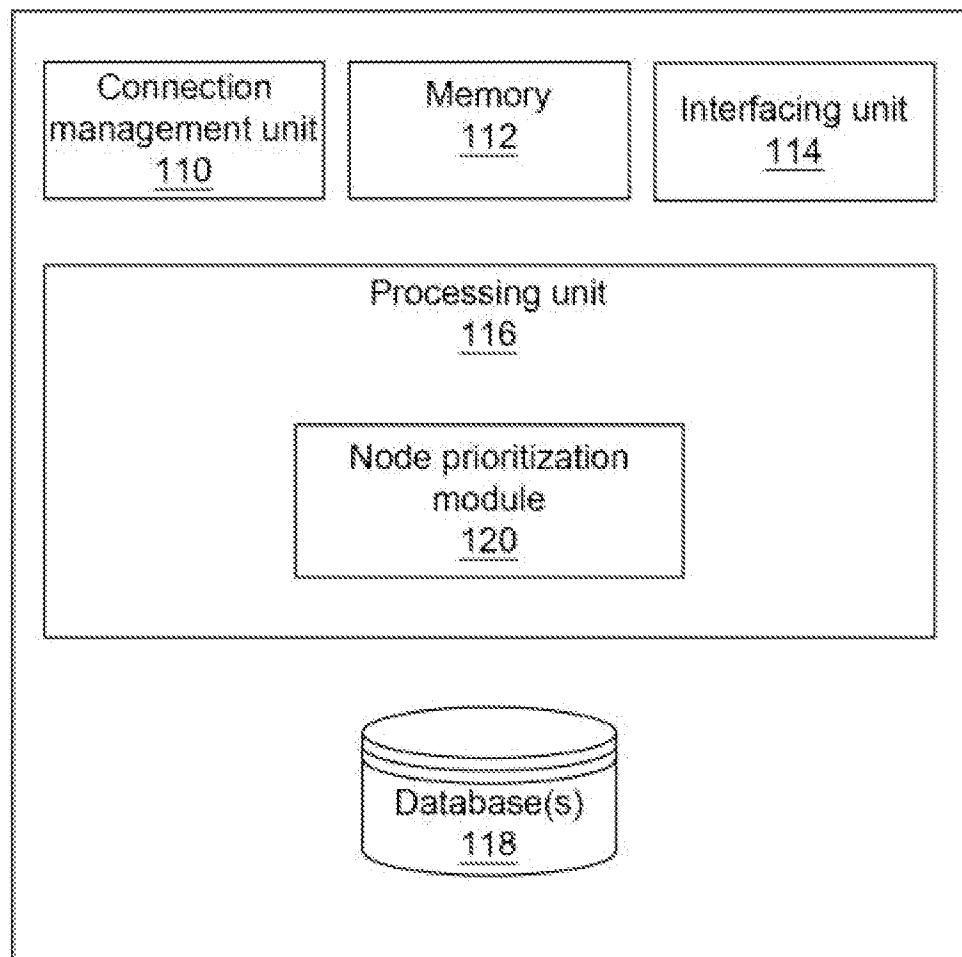
106 

FIG. 1B

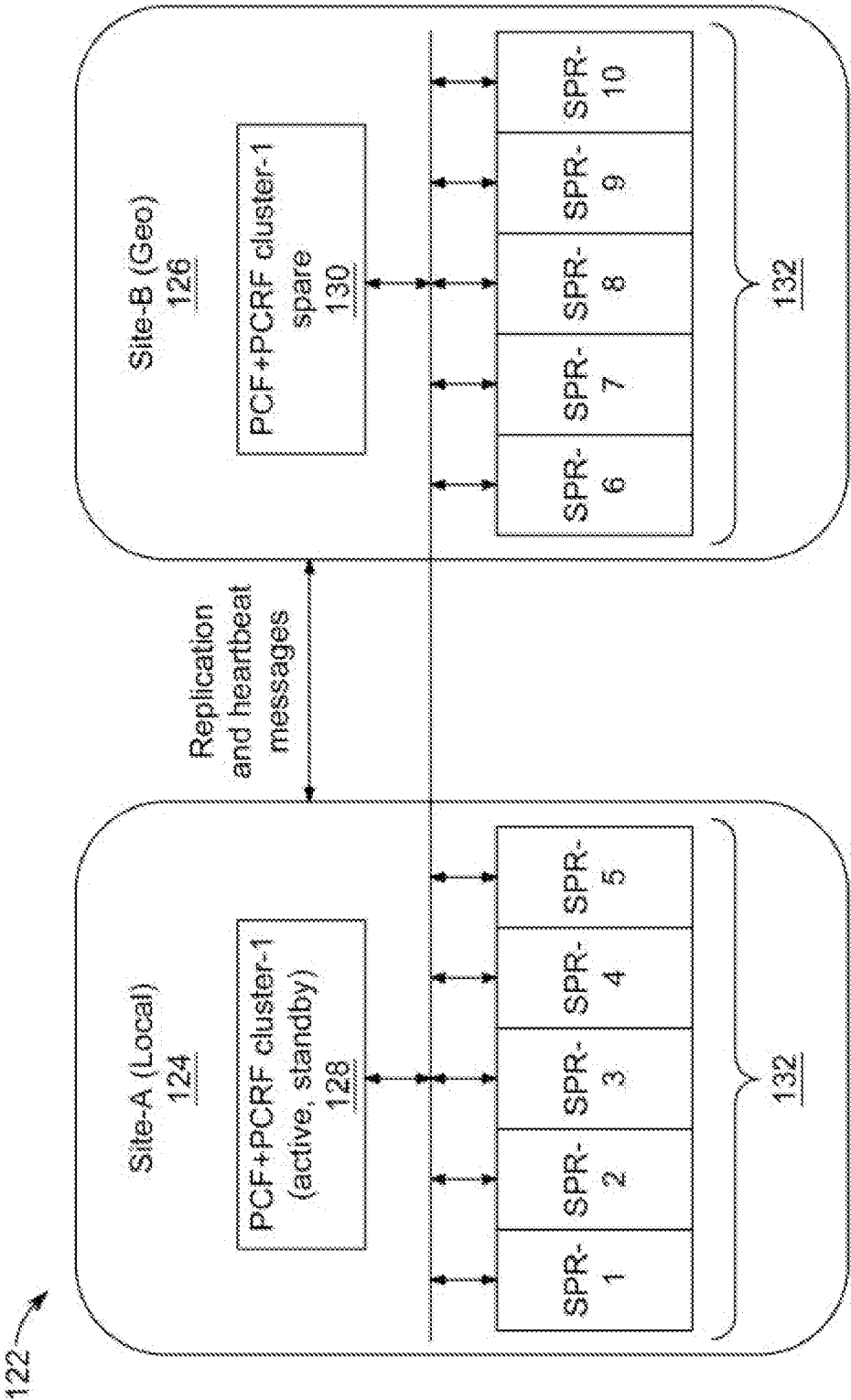


FIG. 1C

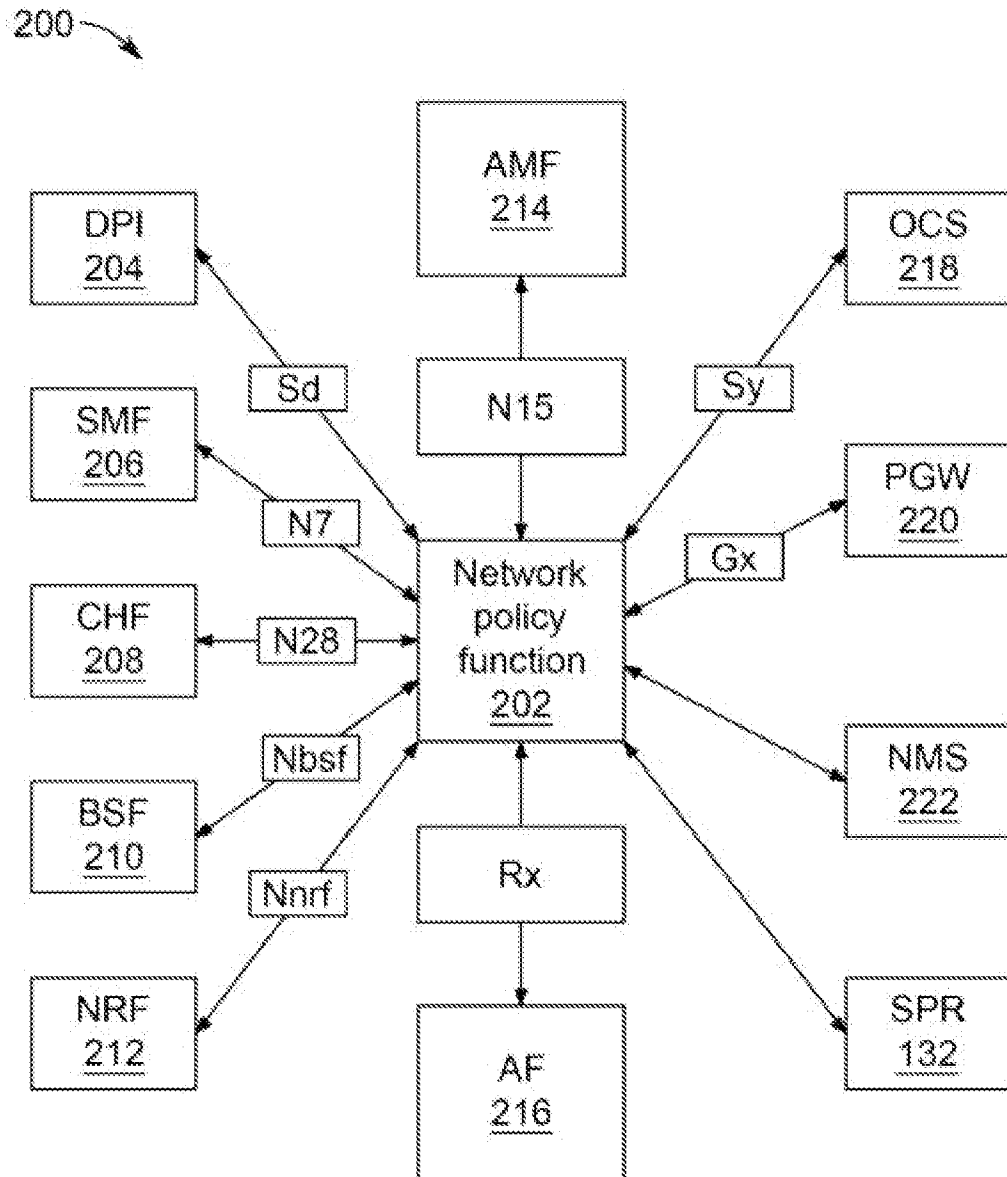


FIG. 2

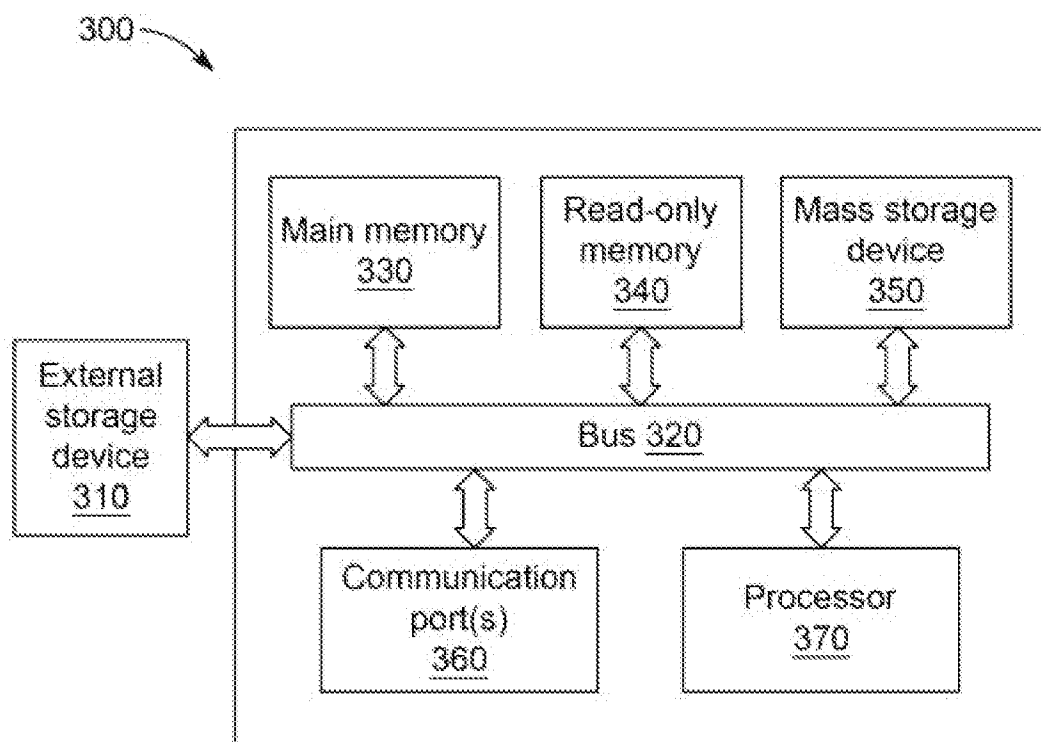


FIG. 3

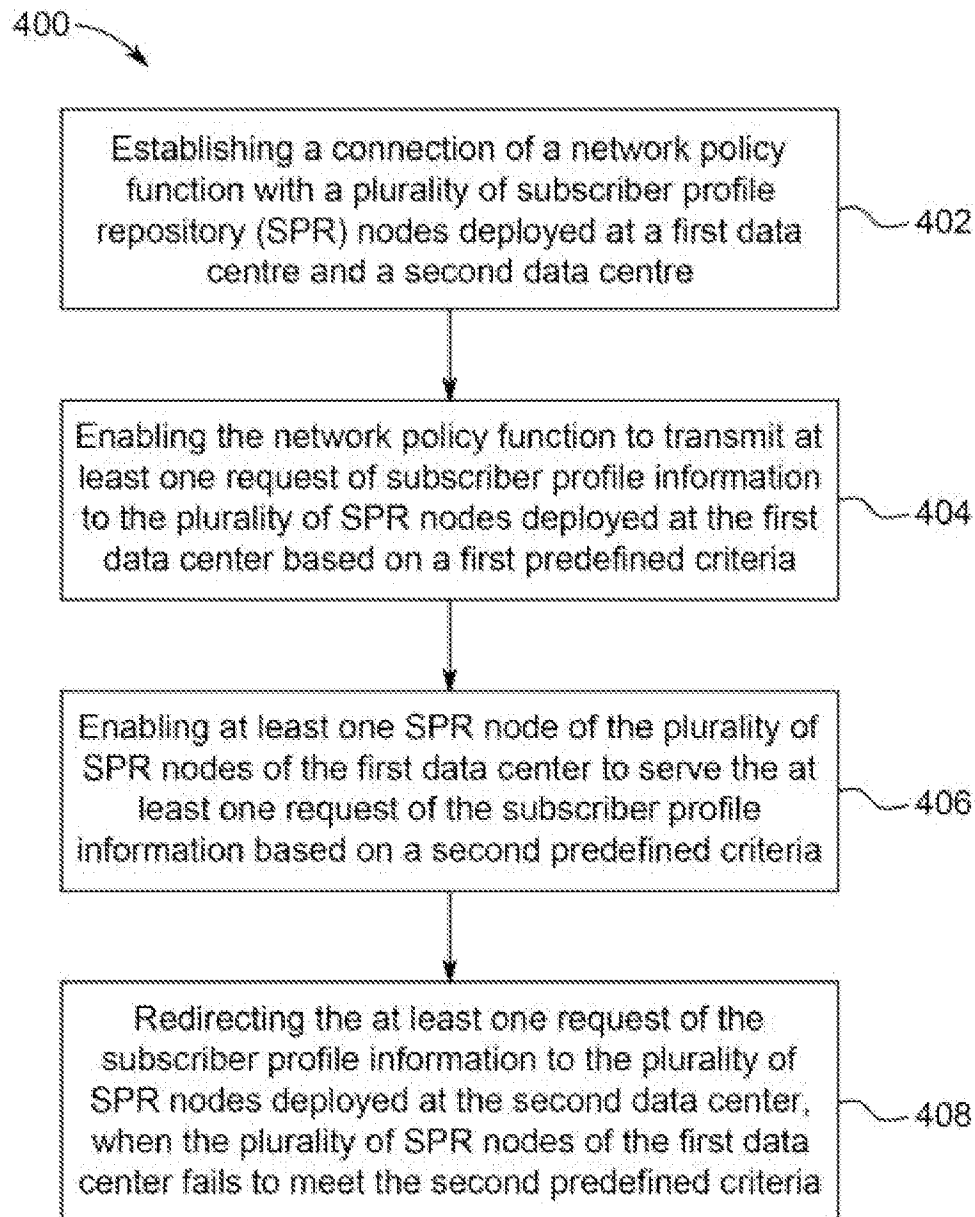


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IN2024/051104

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 14
because they relate to subject matter not required to be searched by this Authority, namely:
The subject matter of claim 14 relates to computer program product, which does not require an international search by the International Searching Authority in accordance with PCT Article 17(2)(a)(i) and [Rule 39.1(vi)].
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2024/051104

A. CLASSIFICATION OF SUBJECT MATTER

H04M15/00, H04W8/18, H04L41/0894, H04W4/24 Version=2024.01

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)

H04M, H04W, H04L

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

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

Databases: Google Patents, PatSeer, IPO Internal Database

Keywords: subscriber profile repository, local site, geo-site

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2013003529 A1 (Telefonaktiebolaget LM Ericsson AB) 03 January 2013 (03/01/2013) Whole Document	1-13
A	US 2022201462 A1 (T MOBILE USA INC) 23 June 2022 (23/06/2022) Whole Document	1-13

☐ 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

"D" document cited by the applicant in the international application

"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

"I" 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

30-10-2024

Date of mailing of the international search report

30-10-2024

Name and mailing address of the ISA/

Indian Patent Office

Plot No.32, Sector 14, Dwarka, New Delhi-110075

Facsimile No.

Authorized officer

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IN2024/051104

Citation	Pub.Date	Family	Pub.Date
US 20130003529 A1	03-01-2013	WO 2011107813 A1	09-09-2011
		EP 2543159 B1	11-05-2016
		AR 080367 A1	04-04-2012
US 2022201462 A1	23-06-2022	US 20220400369 A1	15-12-2022