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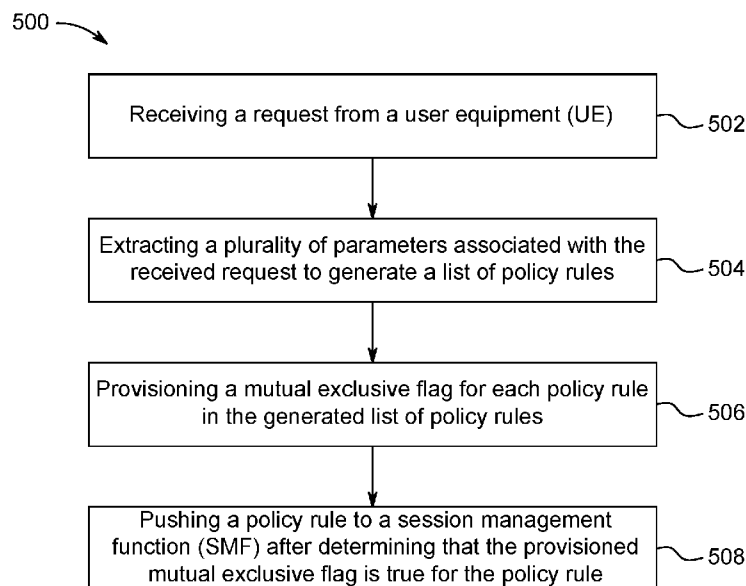


FIG. 5

(57) Abstract: The present disclosure a method (500) for changing policy rules in a communication network (106) The method (500) comprising receiving (502) a request from a user equipment (UE) (102). The method comprising extracting (504) a plurality of parameters associated with the received request to generate a list of policy rules. The method comprising provisioning (506) at least one mutual exclusive flag for each policy rule in the generated list of policy rules and pushing (508) a policy rule to a session management function (SMF) (110) after determining that the provisioned mutual exclusive flag is true for the policy rule.

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SYSTEM AND METHOD FOR POLICY RULE CHANGE IN A COMMUNICATION NETWORK

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FIELD OF DISCLOSURE

[0002] The embodiments of the present disclosure generally relate to a communication network. In particular, the present disclosure relates to a system and method for a policy rule change in a communication network.

15 BACKGROUND OF DISCLOSURE

[0003] The following description of related art is intended to provide background information pertaining to the field of the disclosure. This section may 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
20 to enhance the understanding of the reader with respect to the present disclosure, and not as admissions of prior art.

[0004] Wireless communication technology has rapidly evolved over the past few decades. The first generation of wireless communication technology was based on analog technology that offered only voice services. Further, when the
25 second-generation (2G) technology was introduced, text messaging and data services became possible. The 3G technology marked the introduction of high-speed internet access, mobile video calling, and location-based services. The fourth generation (4G) technology revolutionized the wireless communication with faster

data speeds, improved network coverage, and security. Currently, the fifth generation (5G) technology is being deployed, with even faster data speeds, low latency, and the ability to connect multiple devices simultaneously.

[0005] As wireless technologies are advancing, there is a need to cope with the 5G requirements and deliver a high level of service to the subscribers. Communications networks provide network services to numerous subscribers. With a lot of new features provided by communication networks, the number of subscribers accessing a network may easily reach into the millions. In order to cater to a larger number of subscribers, a network service provider needs to have the capability to manage the network to meet service agreements with each subscriber, maintain security, manage network resources, and correctly charge each subscriber.

[0006] For effective network management, a set of rules needs to be specified. The specified rules may be managed by a policy rule engine. The policy rule engine may include capabilities for handling new rules, new subscribers, modifications of rules for existing subscriber, etc.

[0007] There is, therefore, a need in the art to provide a method and a system that can overcome the shortcomings of the existing prior arts.

OBJECTS OF THE PRESENT DISCLOSURE

[0008] Some of the objects of the present disclosure, which at least one embodiment herein satisfies are as listed herein below.

[0009] An object of the present disclosure is to provide the policy rule engine with the capability to remove the previously installed rules on its own if the already installed rule's condition doesn't match.

[0010] An object of the present disclosure is to provide exclusive flags to enable a specific rule to be pushed to a session management function (SMF) and ignore other rules that match the condition.

[0011] An object of the present disclosure is to provide different left terms and operator choices for different interfaces.

[0012] An object of the present disclosure is to enable the policy control function (PCF) not to send a remove rules command to the SMF if rules are not

installed for the subscriber, and if policy rule removal is configured in the policy engine.

5 [0013] An object of the present disclosure is to provide network operators to create new policy with action removal to avoid policy modification of existing rule.

 [0014] An object of the present disclosure is to evaluate two policies having matching conditions.

 [0015] An object of the present disclosure is to send a delta change to the SMF when the delta changes in the dynamic rule definition.

10 **DEFINITION**

 [0016] 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 are used to indicate otherwise.

15 [0017] The term PCF as used herein, refers to Policy Control Function. The PCF is a key component of the 5G architecture and plays a crucial role in enforcing policy decisions related to Quality of Service (QoS), traffic management, and network resource allocation.

20 [0018] The term SMF as used herein, refers to Session Management Function. The SMF plays a crucial role in establishing, managing, and terminating communication sessions between User Equipment (UE) and 5G network services.

 [0019] The term AMF as used herein, refers to Access and Mobility Management Function. The AMF is responsible for managing access to the 5G network and handling mobility-related functions for UE devices.

SUMMARY

25 [0020] In an exemplary embodiment, the present invention discloses a system for changing policy rules in a communication network. The system comprises a receiving unit configured for receiving a request from a user equipment

- (UE). The system comprises a database configured for storing the request. The system comprises a processing unit coupled with the receiving unit and the database and configured for receiving the request from the database. The processing unit is configured for extracting a plurality of parameters associated with the received request to generate a list of policy rules. The processing unit is configured for provisioning a mutual exclusive flag for each policy rule in the generated list of policy rules and pushing a policy rule to a session management function (SMF) after determining that the provisioned mutual exclusive flag is true for the policy rule.
- 5
- 10 [0021] In an embodiment, the system is further configured to establish an SMF session for the policy rule on receiving the request.
- [0022] In an embodiment, the plurality of parameters includes one or more of a rule name, an assumption, and an action.
- [0023] In an embodiment, the rule name and the assumption form a
- 15 condition associated with the policy rule.
- [0024] In an embodiment, the action is executed when the condition is met for the policy rule.
- [0025] In an embodiment, the request includes an addition, a removal, or an updatation of a policy rule in a policy rule engine.
- 20 [0026] In an embodiment, the removal of the policy rule is communicated from a policy control function (PCF) to the SMF when the policy rule is successfully installed for a subscriber in the SMF session.
- [0027] In an embodiment, a precedence for each policy rule in the list of policy rules is defined by a user.
- 25 [0028] In an embodiment, the PCF is configured to remove an installed policy rule when the condition associated with the installed policy rule is not met.
- [0029] In an embodiment, the policy rule engine is configured to evaluate a set of policies with the plurality of parameters associated with the request during the SMF session.
- 30 [0030] In an embodiment, the policy rule engine is configured to evaluate at least two policies having similar matching conditions.

[0031] In an exemplary embodiment, the present invention discloses a method for changing policy rules in a communication network. The method comprises receiving a request from a user equipment (UE). The method comprises extracting a plurality of parameters associated with the received request to generate
5 a list of policy rules. The method comprises provisioning a mutual exclusive flag for each policy rule in the generated list of policy rules and pushing a policy rule to a session management function (SMF) after determining that the provisioned mutual exclusive flag is true for the policy rule.

[0032] In an embodiment, the method further comprises establishing an
10 SMF session for the policy rule on receiving the request.

[0033] In an embodiment, the plurality of parameters includes one or more of a rule name, an assumption, and an action.

[0034] In an embodiment, the rule name and the assumption form a condition associated with the policy rule.

15 [0035] In an embodiment, the action is executed when the condition is met for the policy rule.

[0036] In an embodiment, the request includes an addition, a removal, or an updation of a policy rule in a policy rule engine.

[0037] In an embodiment, the removal of the policy rule is communicated
20 from a policy control function (PCF) to the SMF when the policy rule is successfully installed for a subscriber in the SMF session.

[0038] In an embodiment, a precedence for each policy rule in the list of policy rules is defined by a user.

[0039] In an embodiment, the PCF is configured to remove an installed
25 policy rule when the condition associated with the installed policy rule is not met.

[0040] In an embodiment, the policy rule engine is configured to evaluate a set of policies with the plurality of parameters associated with the request during the SMF session.

[0041] In an embodiment, the policy rule engine is configured to evaluate
30 at least two policies having similar matching conditions.

[0042] In an exemplary embodiment, the present invention discloses a user equipment (UE) communicatively coupled with a communication network. The coupling comprises steps of receiving, by the communication network, a connection request from the UE, sending, by the communication network, an acknowledgment of the connection request to the UE and transmitting a plurality of signals in response to the connection request. The policy rules in the communication network are changed by a system. The system comprises a receiving unit configured for receiving a request from the UE. The system comprises a database configured for storing the request. The system comprises a processing unit coupled with the receiving unit and the database and is configured for receiving the request from the database. The processing unit is configured for extracting a plurality of parameters associated with the received request to generate a list of policy rules. The processing unit is configured for provisioning a mutual exclusive flag for each policy rule in the generated list of policy rules and pushing a policy rule to a session management function (SMF) after determining that the provisioned mutual exclusive flag is true for the policy rule.

BRIEF DESCRIPTION OF DRAWINGS

[0043] The accompanying drawings, which are incorporated herein, and constitute a part of this disclosure, illustrate exemplary embodiments of the disclosed methods and systems in which like reference numerals refer to the same parts throughout the different drawings. Components in the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the present disclosure. Some drawings may indicate the components using block diagrams and may not represent the internal circuitry of each component. It will be appreciated by those skilled in the art that disclosure of such drawings includes the disclosure of electrical components, electronic components or circuitry commonly used to implement such components.

[0044] FIG. 1 illustrates an exemplary network architecture in which or with which a system for changing a plurality of policy rules in a communication network is implemented, in accordance with embodiments of the present disclosure.

[0045] FIG. 2 illustrates an exemplary block diagram representation of a system for performing policy rule change, in accordance with embodiments of the present disclosure.

[0046] FIG. 3 illustrates an architecture of a rule engine, in accordance with
5 embodiments of the present disclosure.

[0047] FIG. 4 illustrates is an illustration of a non-limiting example of details of computing hardware used in the system, in accordance with an embodiment of the present disclosure.

[0048] FIG. 5 illustrates an exemplary flow diagram for a method for
10 changing policy rules in a communication network, in accordance with an embodiment of the present disclosure.

[0049] The foregoing shall be more apparent from the following more detailed description of the disclosure.

LIST OF REFERENCE NUMERALS

- 15 100 – Network Architecture
- 102 – User Equipment (UE)
- 104 – Access Point or gNodeB (gNB)
- 106 – Network
- 108 – Access and Mobility Management Function (AMF)
- 20 110 – Session Management Function (SMF)
- 112 – Policy Control Function (PCF)
- 114 – System
- 200 - Block diagram
- 202 – Receiving unit
- 25 204 – Memory
- 206 – Interfacing unit
- 208 – Processing unit
- 210 – Database
- 212 – Acquisition Unit
- 30 214 – Policy Rule Engine

- 216 – Other Engines/Units
- 300- Rule engine architecture
- 400- A computer system
- 410 – External Storage Device
- 5 420 – Bus
- 430 – Main Memory
- 440 – Read Only Memory
- 450 – Mass Storage Device
- 460 – Communication Port
- 10 470 – Processor
- 500- Flow diagram

DETAILED DESCRIPTION OF THE INVENTION

[0050] In the following description, for the purposes of explanation, various specific details are set forth in order to provide a thorough understanding of
15 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 any of the problems discussed above or might address only some of the
20 problems discussed above. Some of the problems discussed above might not be fully addressed by any of the features described herein. Example embodiments of the present disclosure are described below, as illustrated in various drawings in which like reference numerals refer to the same parts throughout the different drawings.

25 [0051] The ensuing description provides exemplary embodiments only, and is not intended to limit the scope, applicability, or configuration of the disclosure. 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.

[0052] 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 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.

[0053] Also, it is noted that individual embodiments may be described as a process that 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.

[0054] 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 like the term “comprising” as an open transition word without precluding any additional or other elements.

[0055] 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
5 phrases “in one embodiment” or “in an embodiment” 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.

[0056] The terminology used herein is to describe particular embodiments
10 only and is not intended to be limiting the disclosure. As used herein, the singular forms “a”, “an”, and “the” are intended to include the plural forms as well, unless the context indicates otherwise. It will be further understood that the terms “comprises” and/or “comprising,” when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or
15 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 combinations of one or more of the associated listed items. It should be noted that the terms “mobile device”, “user equipment”, “user device”, “communication device”, “device” and similar terms
20 are used interchangeably for the purpose of describing the invention. These terms are not intended to limit the scope of the invention or imply any specific functionality or limitations on the described embodiments. The use of these terms is solely for convenience and clarity of description. The invention is not limited to any particular type of device or equipment, and it should be understood that other
25 equivalent terms or variations thereof may be used interchangeably without departing from the scope of the invention as defined herein.

[0057] As used herein, an “electronic device”, or “portable electronic device”, or “user device” or “communication device” or “user equipment” or
30 “device” refers to any electrical, electronic, electromechanical, and computing device. The user device is capable of receiving and/or transmitting one or parameters, performing function/s, communicating with other user devices, and

transmitting data to the other user devices. The user equipment may have a processor, a display, a memory, a battery, and an input-means such as a hard keypad and/or a soft keypad. The user equipment may be capable of operating on any radio access technology including but not limited to IP-enabled communication, Zig Bee, Bluetooth, Bluetooth Low Energy, Near Field Communication, Z-Wave, Wi-Fi, Wi-Fi direct, etc. For instance, the user equipment may include, but not limited to, a mobile phone, smartphone, virtual reality (VR) devices, augmented reality (AR) devices, laptop, a general-purpose computer, desktop, personal digital assistant, tablet computer, mainframe computer, or any other device as may be obvious to a person skilled in the art for implementation of the features of the present disclosure.

[0058] Further, the user device may also comprise a “processor” or “processing unit” includes processing engine, wherein processor refers to any logic circuitry for processing instructions. The processor may be a general-purpose processor, a special purpose processor, a conventional processor, a digital signal processor, a plurality of microprocessors, one or more microprocessors in association with a DSP core, a controller, a microcontroller, Application Specific Integrated Circuits, Field Programmable Gate Array circuits, any other type of integrated circuits, etc. The processor may perform signal coding data processing, input/output processing, and/or any other functionality that enables the working of the system according to the present disclosure. More specifically, the processor is a hardware processor.

[0059] As portable electronic devices and wireless technologies continue to improve and grow in popularity, the advancing wireless technologies for data transfer are also expected to evolve and replace the older generations of technologies. In the field of wireless data communications, the dynamic advancement of various generations of cellular technology are also seen. The development, in this respect, has been incremental in the order of second generation (2G), third generation (3G), fourth generation (4G), fifth generation (5G), sixth generation (6G) and more such advanced generations are expected to continue in the forthcoming time.

[0060] While considerable emphasis has been placed herein on the components and component parts of 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 embodiment, as well as other 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 interpreted merely as illustrative of the disclosure and not as a limitation.

10 [0061] At present, there has been a surge in users subscribing to fifth generation (5G) network services, emphasizing the importance of delivering optimal services and a high-quality experience. As the subscription information, location, time, or other relevant parameters change on a user equipment (UE), the Policy Control Function (PCF) may need to update the policy rules to reflect these changes accurately. For example, if the UE moves to a different location, the PCF may update the policy rules to ensure optimal network performance and resource utilization based on the new location. The PCF and Session Management Function (SMF) are key components in the 5G core network. The PCF is responsible for policy control and enforcement, while the SMF manages the session establishment, modification, and termination. The PCF can make rules based on the session information provided by the SMF. These rules are defined to control and manage the policy aspects of a user's session. However, it is a cumbersome task to amend these rules during an active session. The present disclosure simplifies the network architecture by disclosing a method and a system for changing a plurality of policy rules in a communication network automatically such that policy rules can be updated in the production environment for 5G network in order to comply with regulatory requirements.

25 [0062] The present disclosure relates to a PCF capable of removing previously installed rules on its own if the already installed rules condition doesn't match. Further, in some embodiments, the rules are provisioned with mutual exclusive flag true if a specific rule needs to be pushed to SMF and ignore other

rules which match the condition. If rules are not installed for the subscriber, and if policy rule removal is configured in the policy engine, PCF will not send a remove rules command to the SMF.

[0063] In some embodiments, if two policies have matching conditions, the policy engine evaluates both policies. Operators can create new policies with action removal to avoid policy modification of existing rules. In an embodiment, when a request (Rx trigger) is received, and no delta change is determined by the present system, then the system is configured to send an update notification then no update is sent towards SMF, and success response (acknowledgment) is sent to the receiver. If delta change is determined by the present system, then the system is configured to send only the delta part towards SMF.

[0064] The various embodiments throughout the disclosure will be explained in more detail with reference to FIG. 1- FIG. 5.

[0065] FIG. 1 illustrates an exemplary network architecture in which or with which a system for changing a plurality of policy rules in a communication network is implemented, in accordance with embodiments of the present disclosure. In an embodiment, the plurality of policy rules is selected from a group consisting of media-based rules, session management (SM) policy rules, access and mobility (AM) policy rules, and application detection and control (ADC) rules.

[0066] For example, the system may be embedded in the policy control function (PCF) (112). In another example, the system may be embedded in a policy rule engine (PCF server).

[0067] Referring to FIG. 1, the network architecture (100) includes a plurality of access points or gNodeBs (gNB) (104) serving a user equipment (UEs) (102). The UE (102) is connected to a system (114) through a communication network (106).

[0068] In an embodiment, the UE (102) may be referred to as a user device or computing device. A person of ordinary skill in the art will appreciate that the terms “user device(s),” “computing device(s),” and “UE” may be used interchangeably throughout the disclosure. In an example, the user may be a subscriber or a network operator.

[0069] In an embodiment, the UEs (102) may include, but are not limited to, a handheld wireless communication device (e.g., a mobile phone, a smartphone, 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 computer, a tablet computer, or another type of portable computer, a media playing device, a portable gaming system, and/or any other type of device with wireless communication capabilities, and the like. In an embodiment, the UEs (102) may include, but are 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, laptop, a general-purpose computer, desktop, personal digital assistant, tablet computer, mainframe computer, or any other computing device, wherein the user device (102) may include one or more in-built or externally coupled accessories including, but not limited to, a visual aid device such as camera, audio aid, a microphone, a keyboard, and input devices for receiving input from a user such as touchpad, touch enabled screen, electronic pen, and the like.

[0070] A person of ordinary skill in the art will appreciate that the user devices or UEs (102) may not be restricted to the mentioned devices and various other devices may be used.

[0071] Referring to FIG. 1, the UEs (102) may communicate with the system (114) through the network (106). In an embodiment, the network (106) may include at least one of a non-standalone (NSA) 5G network, a standalone 5G network, or the like. The network (106) may enable the UEs (102) to communicate between devices and/or with the system (114). As such, the network (106) may enable the UEs (102) to communicate with other UEs (102) via a wired or wireless network. The network (106) may include a wireless card or some other transceiver connection to facilitate this communication. The UE (102) may be communicatively coupled with the network (106). The communicative coupling comprises receiving, from the UE (102), a connection request by the network (106),

sending an acknowledgment of the connection request to the UE (102), and transmitting a plurality of signals in response to the connection request.

[0072] In an exemplary embodiment, the network (106) may incorporate one or more of a plurality of standard or proprietary protocols including, but not limited to, Wi-Fi, Zigbee, or the like. In another embodiment, the network (106) 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, the Public Switched Telephone Network (PSTN), or the like.

[0073] Referring to FIG. 1, the network (106) may include one or more network slices enabling the connection of the UE (102) with the system (114). The network slice may include one or more modules for enabling session establishment between the UE (102) and the system (114). The modules include an AMF (108), a SMF (110), and the PCF (112). The PCF (112) performs a policy control function.

[0074] The system (114) is configured to receive a request from the UE (102). In an example, the request includes addition, removal, updation of a specific policy rule selected from the plurality of policy rules. The system (114) is configured to extract a plurality of parameters associated with the received request to generate a list of rules. For example, the plurality of parameters includes an assumption part having a left term, an operator, a right term, and an action part. For example, the left term includes values obtained from the request or fetched from a cache memory associated with the established session. In an embodiment, the system (114) is configured to add the left term values in a memory and employ forward chaining logic in which the left term and the right term are extracted, parsed, and validated to take action accordingly.

[0075] The system (114) is configured to determine a mutual exclusive flag for each rule of the generated list with a set of previously installed rules. If the determined mutual exclusive flag is true for the specific policy rule, then the system (114) is configured to push the rule to the SMF. In an aspect, the mutual exclusive flag for each rule ensures that only one rule is pushed or applied at a time to the SMF. The mutual exclusive flag for each rule prevents conflicting rules from being

simultaneously enforced in the SMF by ignoring the other rules having similar policy rule matching conditions.

[0076] Although FIG. 1 shows exemplary components of the network architecture (100), in other embodiments, the network architecture (100) may include fewer components, different components, differently arranged components, or additional functional components than depicted in FIG. 1. 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).

10 [0077] FIG. 2 illustrates an exemplary block diagram representation (200) of a system (114) for performing policy rule change, in accordance with embodiments of the present disclosure.

[0078] Referring to FIG. 2, the PCF system or system (114) include a receiving unit (202), a memory (204), an interfacing unit (206), a processing unit (208), and a database (210). The processing unit (208) comprises an acquisition unit (212), a policy rule engine (214), and other units (216). The receiving unit is configured for receiving a request from UE. The database (210) is configured for storing the request. The processing unit (208) is coupled with the receiving unit (202) and the database (210) and is configured for receiving the request from the database. The acquisition unit (212) is configured for extracting a plurality of parameters associated with the received request to generate a list of policy rules. The policy rule engine (214) is configured for provisioning a mutual exclusive flag for each policy rule in the generated list of policy rules and pushing a policy rule to a session management function (SMF) after determining that the provisioned mutual exclusive flag is true for the policy rule.

25 [0079] The processing unit (208) may be implemented as one or more microprocessors, microcomputers, microcontrollers, edge or fog microcontrollers, digital signal processors, central processing units, logic circuitries, and/or any devices that process data based on operational instructions. Among other capabilities, the processing unit (208) is configured to fetch and execute computer-readable instructions stored in a memory (204) of the system (114). The memory

30

(204) is configured to store one or more computer-readable instructions or routines in a non-transitory computer readable storage medium, which is fetched and executed to create or share data packets over a network service. The memory (204) may comprise any non-transitory storage device including, for example, volatile
5 memory such as Random-Access Memory (RAM), or non-volatile memory such as Electrically Erasable Programmable Read-only Memory (EPROM), flash memory, and the like.

[0080] In an embodiment, the interfacing unit (206) may comprise a variety of interfaces, for example, interfaces for data input and output devices, referred to
10 as input/output (I/O) devices, storage devices, and the like. The interfacing unit (206) may facilitate communication for the system (114). The interfacing unit (206) may also provide a communication pathway for one or more components of the system (114). Examples of such components include, but are not limited to, the processing unit (208) and the database (210).

[0081] The processing unit (208) is implemented as a combination of hardware and programming (for example, programmable instructions) to
15 implement one or more functionalities of the processing unit (208). In examples described herein, such combinations of hardware and programming is implemented in several different ways. For example, the programming for the processing unit (208) is processor-executable instructions stored on a non-transitory machine-
20 readable storage medium and the hardware for the processing unit (208) may comprise a processing resource (for example, one or more processors), to execute such instructions. In the present examples, the machine-readable storage medium may store instructions that, when executed by the processing resource, implement
25 the processing unit (208). In such examples, the system (114) may include the machine-readable storage medium storing the instructions and the processing resource to execute the instructions, or the machine-readable storage medium is separate but accessible to the system (114) and the processing resource. In other examples, the processing unit (208) is implemented by electronic circuitry. In an
30 aspect, the database (210) may comprise data that is either stored or generated as a

result of functionalities implemented by any of the components of the processing engine (208).

[0082] Referring to FIG. 2, the database (210) may store one or more policies and rules associated with the communication network.

5 [0083] A person of ordinary skill in the art will appreciate that the exemplary block diagram (200) is modular and flexible to accommodate any kind of changes in the system (114).

[0084] In an embodiment, the system (114) is configured to establish a session on receiving the request.

10 [0085] In an embodiment, the system (114) is configured to dismiss the received request of removal for the specific rule if the specific rule is not installed for a subscriber. In an aspect, the system (114) is configured to evaluate at least two policies if the at least two policies have similar matching conditions.

[0086] In an embodiment, the system (114) is configured to employ a
15 command line interface (CLI) or a simple mail protocol (SMP).

[0087] FIG. 3 illustrates an architecture (300) of a rule engine (inference rule engine) (policy control function (PCF) server), in accordance with embodiments of the present disclosure.

[0088] In one embodiment, a rule engine is viewed as a sophisticated
20 interpreter of if-then statements. The if-then statements are the rules. A rule is composed of the three parts, a rule Name, an assumption, and an action. When the condition is met, the action is executed. The inputs to a rule engine are a collection of rules called a rule execution set and data objects.

[0089] Referring to FIG. 3, in some embodiments, when Inference rules are
25 provisioned then the content received in provisioning request are converted into RulePojoList (shown by step 302) which contains IfPojo and ThenPojo. IfPojo is used for the Assumptions part and ThenPojo is used for Action part. Left Term, Operator and Right term are set in Assumption from IfPojos, same for the method (Rule Type) and action are set in Action from ThenPojo. Further, in an embodiment,
30 after getting rule names, assumptions, and actions from the Pojos, these are added in RuleImplList (rule implementation list).

[0090] The values of the left term are either obtained from request or sessionCachePojos and are set in working Memory of RuleInputPojo (shown by step 304).

[0091] After adding the left Term values in working Memory, the rules are
5 executed by executing the assumptions using a Forward Chaining logic (shown by step 306).

[0092] When a request is received, stateless session is created for the each ruleExecutionSet (shown by step 308). Each rule execution set is executed using Forward Chaining logic (shown by step 310).

10 [0093] In Forward Chaining, left term and right term are extracted and parsed, as well as assumptions are validated. After the validation of assumptions, action is taken on the basis of those validated assumptions.

[0094] Rule Execution is done, and Result set is obtained (step 312), which is basically an array list of strings in which each string is an action part of the
15 assumption, each action can have different meaning where it can be either Policy and Charging Control (PCC) rule name or event trigger or diameter result code and it all depends on parsing of string in action.

[0095] In an embodiment, while provisioning Business rules, Assumptions are sorted based on operator priority, and finally, rules are stored in the Rule Cache.
20 Sorting on operators provides an efficient way of evaluating the assumptions, e.g., evaluate the least expensive operator (equals to, not equals to) first only if that Assumption evaluates to true, then move to the next Assumption; otherwise, terminate further evaluation and return the result. Further rules can be provisioned by CLI and SMP both. To provision rules, some conditions are needed on which
25 rules can be executed when they meet that condition. Further, there are different parts in provision of a business rule such as a Rule name, Assumptions, and an Action.

[0096] In an aspect, the Rule Name is a unique rule id which is given to every rule while provisioning. The Assumption is made by a combination of Left
30 Term, operator, and Right Term. In an aspect, the Left Terms are the parameters that are received in the request on which condition can be written. For example, the

left term may comprise of a type of radio access technology i.e., 'RAT-TYPE', and a data network name 'DNN'. The RAT-TYPE refers to a specific technology or standard used for wireless communication between user devices (such as smartphones, tablets, IoT devices) and the cellular network infrastructure. Further, each RAT-TYPE represents a different generation or type of technology used for wireless communication. The DNN refers to the name assigned to a specific data network used for identification and organizational purposes.

[0097] In an aspect, there are different types of operators used in rule engine. The operators are added to efficiently support regulatory barring requirements in the network.

[0098] In an aspect, the right term is the value part of the left term that is used in assumptions. For example, the right term may comprise of a new radio 'NR' corresponding to the left term 'RAT-TYPE' and 'EMERGENCY', 'NETWIFI', and 'AIRFIBER' corresponding to the left term 'DNN'.

[0099] In some embodiments, action is performed after the assumptions are evaluated and consists of a rule format, an argument list (rule type) and values. In an aspect the argument list defines as which type of Rule is to be evaluated. In an aspect, the action determines whether the rules are installed, removed, or a result code is added in it. In an aspect, the values include a value of the rule type mentioned in the Argument List.

[00100] In some embodiments, implicit removal of rules are done if conditions are not matched. For example, without limitations, the rule engine may evaluate policy during the lifetime of the SMF session with the request parameters and session information saved locally. At any point, if newly evaluated policies and already installed policies set are not common, then the delta policies are automatically sent for removal to SMF. Further, the rule engine works with microseconds latency even with large execution sets with hundreds of rules.

[00101] In some embodiments, the rules may include mutual exclusive flag true if a specific rule needs to be pushed to SMF and ignore other rules which match the condition. Along with mutual exclusive, users can also define precedence for each rule; when two mutual exclusive policies are evaluated, then a rule with higher

precedence is selected. If rules are not installed for the subscriber, and if policy rule removal is configured in the policy engine, PCF will not send a remove rules command to the SMF. Rules are sent for removal only if the rules are successfully installed in SMF session.

5 **[00102]** In some embodiments, when two policies are evaluated and only one is required to be sent to SMF, then the user can configure one of the policies with rule action removed. Policy defined with action remove will not be sent to SMF.

10 **[00103]** In an embodiment, when a subsequent trigger (Rx trigger) is received, and the same set of policies are evaluated, which are already sent to SMF, then an update notification will not be sent. All attributes of dynamic rules are compared, and if any delta is found, only then an update notification is sent to SMF with delta changes only. Further, for ease of operation and to make the execution fast, business rules are divided into four modules, namely Media Based Rules (Rx), SM policy, AM policy, and ADC rules (Sd).

15 **[00104]** FIG. 4 is an illustration (400) of a non-limiting example of details of computing hardware used in the system (114), in accordance with an embodiment of the present disclosure. As shown in FIG. 4, the system (114) may include an external storage device (410), a bus (420), a main memory (430), a read only memory (440), a mass storage device (450), a communication port (460), and a
20 processor (470). A person skilled in the art will appreciate that the system (114) may include more than one processor (470) and communication ports (460). Processor (470) may include various modules associated with embodiments of the present disclosure.

25 **[00105]** In an embodiment, the communication port (460) is 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 (460) is chosen depending on a network, such a Local Area Network (LAN), Wide Area Network (WAN), or any network to which the system (114) connects.

30 **[00106]** In an embodiment, the memory (430) is Random Access Memory (RAM), or any other dynamic storage device commonly known in the art. Read-

only memory (440) is 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 (470).

5 **[00107]** In an embodiment, the mass storage (450) is any current or future mass storage solution, which is used to store information and/or instructions. Exemplary mass storage solutions include, but are not limited to, Parallel Advanced Technology Attachment (PATA) or Serial Advanced Technology Attachment (SATA) hard disk drives or solid-state drives (internal or external, e.g., having
10 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).

[00108] In an embodiment, the bus (420) communicatively couples the processor(s) (470) with the other memory, storage, and communication blocks. The
15 bus (420) is, e.g., a Peripheral Component Interconnect (PCI)/PCI Extended (PCI-X) bus, Small Computer System Interface (SCSI), Universal 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 (470) to the computer system (400).

20 **[00109]** Optionally, operator and administrative interfaces, e.g., a display, keyboard, joystick, and a cursor control device, may also be coupled to the bus (420) to support direct operator interaction with the computer system (400). Other operator and administrative interfaces are provided through network connections connected through the communication port (460). Components described above are
25 meant only to exemplify various possibilities. In no way should the aforementioned exemplary illustration (400) limit the scope of the present disclosure.

[00110] FIG. 5 illustrates an exemplary flow diagram for a method (500) for changing policy rules in a communication network (106).

30 **[00111]** At step 502, the method (500) comprises receiving a request from a user equipment (UE) (102).

[00112] At step 504, the method (500) comprises extracting a plurality of parameters associated with the received request to generate a list of policy rules.

[00113] At step 506, the method (500) comprises provisioning of a mutual exclusive flag for each policy rule in the generated list of policy rules.

5 [00114] At step 508, the method (500) comprising pushing a policy rule to a session management function (SMF) (110) after determining that the provisioned mutual exclusive flag is true for the policy rule.

[00115] In an exemplary embodiment, the present invention discloses a system (114) for changing policy rules in a communication network (106). The system (114) comprises a receiving unit (202) configured for receiving a request
10 from a user equipment (UE) (102). The system (114) comprising a database (210) configured for storing the request. The system (114) comprises a processing unit (208) coupled with the receiving unit (202) and the database (210) and is configured for receiving the request from the database (210). The processing unit (208) is
15 configured for extracting a plurality of parameters associated with the received request to generate a list of policy rules. The processing unit (208) is configured for provisioning a mutual exclusive flag for each policy rule in the generated list of policy rules and pushing a policy rule to a session management function (SMF) (110) after determining that the provisioned mutual exclusive flag is true for the
20 policy rule.

[00116] In an embodiment, the system (114) is further configured to establish an SMF session for the policy rule on receiving the request.

[00117] In an embodiment, the plurality of parameters includes one or more of a rule name, an assumption, and an action.

25 [00118] In an embodiment, the rule name and the assumption forms a condition associated with the policy rule.

[00119] In an embodiment, the action is executed when the condition is met for the policy rule.

[00120] In an embodiment, the request includes an addition, a removal, or an
30 updation of a policy rule in a policy rule engine (214).

[00121] In an embodiment, the removal of the policy rule is communicated from a policy control function (PCF) (112) to the SMF (110) when the policy rule is successfully installed for a subscriber in the SMF session.

5 [00122] In an embodiment, a precedence for each policy rule in the list of policy rules is defined by a user.

[00123] In an embodiment, the PCF (112) is configured to remove an installed policy rule when the condition associated with the installed policy rule is not met.

10 [00124] In an embodiment, the policy rule engine (214) is configured to evaluate a set of policies with the plurality of parameters associated with the request during the SMF session.

[00125] In an embodiment, the policy rule engine (214) is configured to evaluate at least two policies having similar matching conditions.

15 [00126] In an exemplary embodiment, the present invention discloses a method for changing policy rules in a communication network (106). The method comprises receiving a request from a user equipment (UE) (102). The method comprises extracting a plurality of parameters associated with the received request to generate a list of policy rules. The method comprises provisioning a mutual exclusive flag for each policy rule in the generated list of policy rules and pushing
20 a policy rule to a session management function (SMF) (110) after determining that the provisioned mutual exclusive flag is true for the policy rule.

[00127] In an embodiment, the method further comprising establishing a SMF session for the policy rule on receiving the request.

25 [00128] In an embodiment, the plurality of parameters includes one or more of a rule name, an assumption, and an action.

[00129] In an embodiment, the rule name and the assumption forms a condition associated with the policy rule.

[00130] In an embodiment, the action is executed when the condition is met for the policy rule.

30 [00131] In an embodiment, the request includes an addition, a removal, or an updation of a policy rule in a policy rule engine (214).

[00132] In an embodiment, the removal of the policy rule is communicated from a policy control function (PCF) (112) to the SMF (110) when the policy rule is successfully installed for a subscriber in the SMF session.

5 [00133] In an embodiment, a precedence for each policy rule in the list of policy rules is defined by a user.

[00134] In an embodiment, the PCF (112) is configured to remove an installed policy rule when the condition associated with the installed policy rule is not met.

10 [00135] In an embodiment, the policy rule engine (214) is configured to evaluate a set of policies with the plurality of parameters associated with the request during the SMF session.

[00136] In an embodiment, the policy rule engine (214) is configured to evaluate at least two policies having similar matching conditions.

15 [00137] In an exemplary embodiment, the present invention discloses a user equipment (UE) (102) communicatively coupled with a communication network (106). The coupling comprises steps of receiving, by the communication network (106), a connection request from the UE (102), sending, by the communication network (106), an acknowledgment of the connection request to the UE (102) and transmitting a plurality of signals in response to the connection request. The policy
20 rules in the communication network (106) are changed by a system (114). The system (114) comprises a receiving unit (202) configured for receiving a request from the UE (102). The system (114) comprises a database (210) configured for storing the request. The system (114) comprises a processing unit (208) coupled with the receiving unit (202) and the database (210) and is configured for receiving
25 the request from the database (210). The processing unit (208) is configured for extracting a plurality of parameters associated with the received request to generate a list of policy rules. The processing unit (208) is configured for provisioning a mutual exclusive flag for each policy rule in the generated list of policy rules and pushing a policy rule to a session management function (SMF) (110) after
30 determining that the provisioned mutual exclusive flag is true for the policy rule.

[00138] The present disclosure is configured to provide a system and a method for policy rule change in a communication network. Consider a 5G user who is streaming high-definition video content on a mobile device. The goal is to provide an optimal streaming experience while efficiently managing network resources. The PCF comes into play to define policies for the user's session. In this case, the PCF identifies that the user is engaged in an eMBB service (high-definition video streaming) and sets policies accordingly. As the user moves through different network areas or encounters varying levels of congestion, the PCF continually adapts policies in real time. This could involve adjusting the QoS parameters, applying traffic shaping, or even providing priority access during peak usage times. The PCF is also responsible for enforcing charging and billing policies. It ensures that the user is appropriately billed for the consumed resources during the streaming session. When the user finishes streaming, the SMF handles the termination of the session, and the PCF adjusts policies accordingly. The present disclosure is configured to enhance the functionalities of PCF by changing policy rules on its own. The present system provides a seamless and optimized experience for a specific 5G service. The dynamic nature of 5G networks, coupled with the capabilities of PCF and SMF, allows for intelligent and real-time adaptation to varying conditions, ensuring efficient resource utilization and a high-quality user experience. The system is placed within a 5G communication network or with various network elements that may involve various algorithms, protocols, or mechanisms to enhance the efficiency and reliability of triggering events, ensuring a smoother operation of user equipment and network elements in 5G networks.

[00139] The method and system of the present disclosure may be implemented in a number of ways. For example, the methods and systems of the present disclosure may be implemented by software, hardware, firmware, or any combination of software, hardware, and firmware. The above-described order for the steps of the method is for illustration only, and the steps of the method of the present disclosure are not limited to the order specifically described above unless specifically stated otherwise. Further, in some embodiments, the present disclosure may also be embodied as programs recorded in a recording medium, the programs

including machine-readable instructions for implementing the methods according to the present disclosure. Thus, the present disclosure also covers a recording medium storing a program for executing the method according to the present disclosure.

- 5 **[00140]** 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 described embodiments, versions, or examples, which are included to enable a
10 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.

ADVANTAGES OF THE PRESENT DISCLOSURE

- 15 **[00141]** The present disclosure provides a policy rule engine with a capability to remove the previously installed rules on its own, if already installed rules condition doesn't match.

[00142] The present disclosure provides exclusive flags to rule to enable a specific rule to be pushed to a session management function (SMF) and ignore other rules which match the condition.

- 20 **[00143]** The present disclosure provides different left terms and operator choices for different interfaces.

[00144] The present disclosure provides policy control function (PCF) to selectively send rules to the SMF.

- 25 **[00145]** The present disclosure enables network operators to create new policy with action removal to avoid policy modification of existing rule.

We Claim:

1. A system (114) for changing policy rules in a communication network (106), the system (114) comprising:
 - 5 a receiving unit (202) configured for receiving a request from a user equipment (UE) (102);
 - a database (210) configured for storing the request;
 - a processing unit (208) coupled with the receiving unit (202) and the database (210) and configured for receiving the request from the database (210);
 - 10 the processing unit (208) is configured for:
 - extracting a plurality of parameters associated with the received request to generate a list of policy rules;
 - provisioning a mutual exclusive flag for each policy rule in the generated list of policy rules; and
 - 15 pushing a policy rule to a session management function (SMF) (110) after determining that the provisioned mutual exclusive flag is true for the policy rule.
- 20 2. The system (114) as claimed in claim 1, further configured to establish a SMF session for the policy rule on receiving the request.
3. The system (114) as claimed in claim 1, wherein the plurality of parameters includes one or more of a rule name, an assumption, and an action.
- 25 4. The system (114) as claimed in claim 3, wherein the rule name and the assumption form a condition associated with the policy rule.
5. The system (114) as claimed in claim 4, wherein the action is executed when
- 30 the condition is met for the policy rule.

6. The system (114) as claimed in claim 2, wherein the request includes an addition, a removal, or an updation of a policy rule in a policy rule engine (214).
- 5 7. The system (114) as claimed in claim 6, wherein the removal of the policy rule is communicated from a policy control function (PCF) (112) to the SMF (110) when the policy rule is successfully installed for a subscriber in the SMF session.
8. The system (114) as claimed in claim 1, wherein a precedence for each
10 policy rule in the list of policy rules is defined by a user.
9. The system (114) as claimed in claim 7, wherein the PCF (112) is configured to remove an installed policy rule when the condition associated with the installed policy rule is not met, wherein the condition associated with the policy rule is formed based on the rule name and the assumption.
- 15 10. The system (114) as claimed in claim 6, wherein the policy rule engine (214) is configured to evaluate a set of policies with the plurality of parameters associated with the request during the SMF session.
11. The system (114) as claimed in claim 10, wherein the policy rule engine (214) is configured to evaluate at least two policies having similar matching
20 conditions.
12. A method (500) for changing policy rules in a communication network (106), the method (500) comprising:
 receiving (502) a request from a user equipment (UE) (102);
 extracting (504) a plurality of parameters associated with the
25 received request to generate a list of policy rules;
 provisioning (506) a mutual exclusive flag for each policy rule in the generated list of policy rules; and

pushing (508) a policy rule to a session management function (SMF) (110) after determining that the provisioned mutual exclusive flag is true for the policy rule.

- 5 13. The method (500) as claimed in claim 12, further comprising establishing a SMF session for the policy rule on receiving the request.
- 10 14. The method (500) as claimed in claim 12, wherein the plurality of parameters includes one or more of a rule name, an assumption, and an action.
- 15 15. The method (500) as claimed in claim 14, wherein the rule name and the assumption form a condition associated with the policy rule.
- 15 16. The method (500) as claimed in claim 15, wherein the action is executed when the condition is met for the policy rule.
- 20 17. The method (500) as claimed in claim 13, wherein the request includes an addition, a removal, or an updation of a policy rule in a policy rule engine (214).
18. The method (500) as claimed in claim 17, wherein the removal of the policy rule is communicated from a policy control function (PCF) (112) to the SMF (110) when the policy rule is successfully installed for a subscriber in the SMF session.
- 25 19. The method (500) as claimed in claim 12, wherein a precedence for each policy rule in the list of policy rules is defined by a user.
20. The method (500) as claimed in claim 18, wherein the PCF (112) is configured to remove an installed policy rule when the condition associated

with the installed policy rule is not met, wherein the condition associated with the policy rule is formed based on the rule name and the assumption.

21. The method (500) as claimed in claim 17, wherein the policy rule engine (214) is configured to evaluate a set of policies with the plurality of parameters associated with the request during the SMF session.

22. The method (500) as claimed in claim 17, wherein the policy rule engine (214) is configured to evaluate at least two policies having similar matching conditions.

23. A user equipment (UE) (102) communicatively coupled with a communication network (106), the coupling comprises steps of:

receiving, by the communication network (106), a connection request from the UE (102);

sending, by the communication network (106), an acknowledgment of the connection request to the UE (102); and

transmitting a plurality of signals in response to the connection request, wherein policy rules in the communication network (106) is changed by a system (114) as claimed in claim 1.

24. 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 (500) for changing policy rules in a communication network (106), the method (500) comprising:

receiving (502) a request from a user equipment (UE) (102);

extracting (504) a plurality of parameters associated with the received request to generate a list of policy rules;

provisioning (506) a mutual exclusive flag for each policy rule in the generated list of policy rules; and

pushing (508) a policy rule to a session management function (SMF) (110) after determining that the provisioned mutual exclusive flag is true for the policy rule.

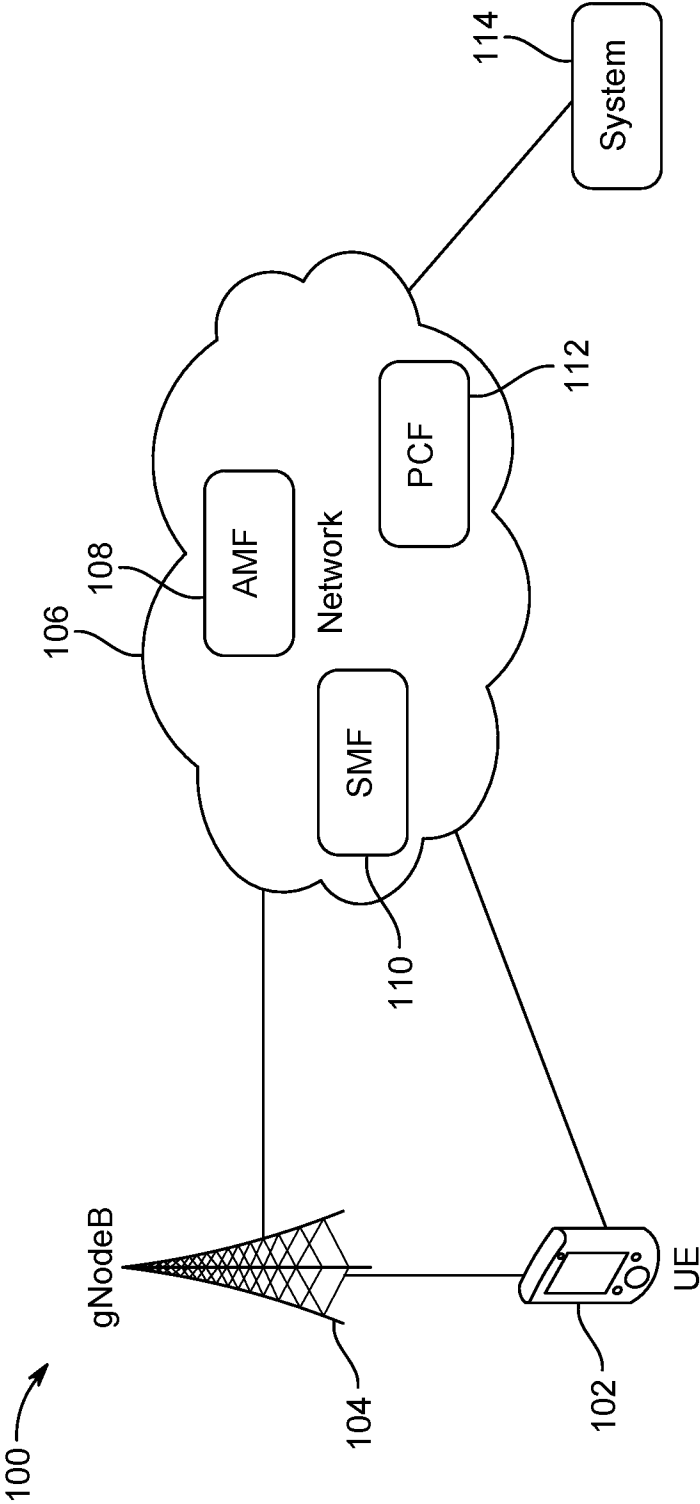


FIG. 1

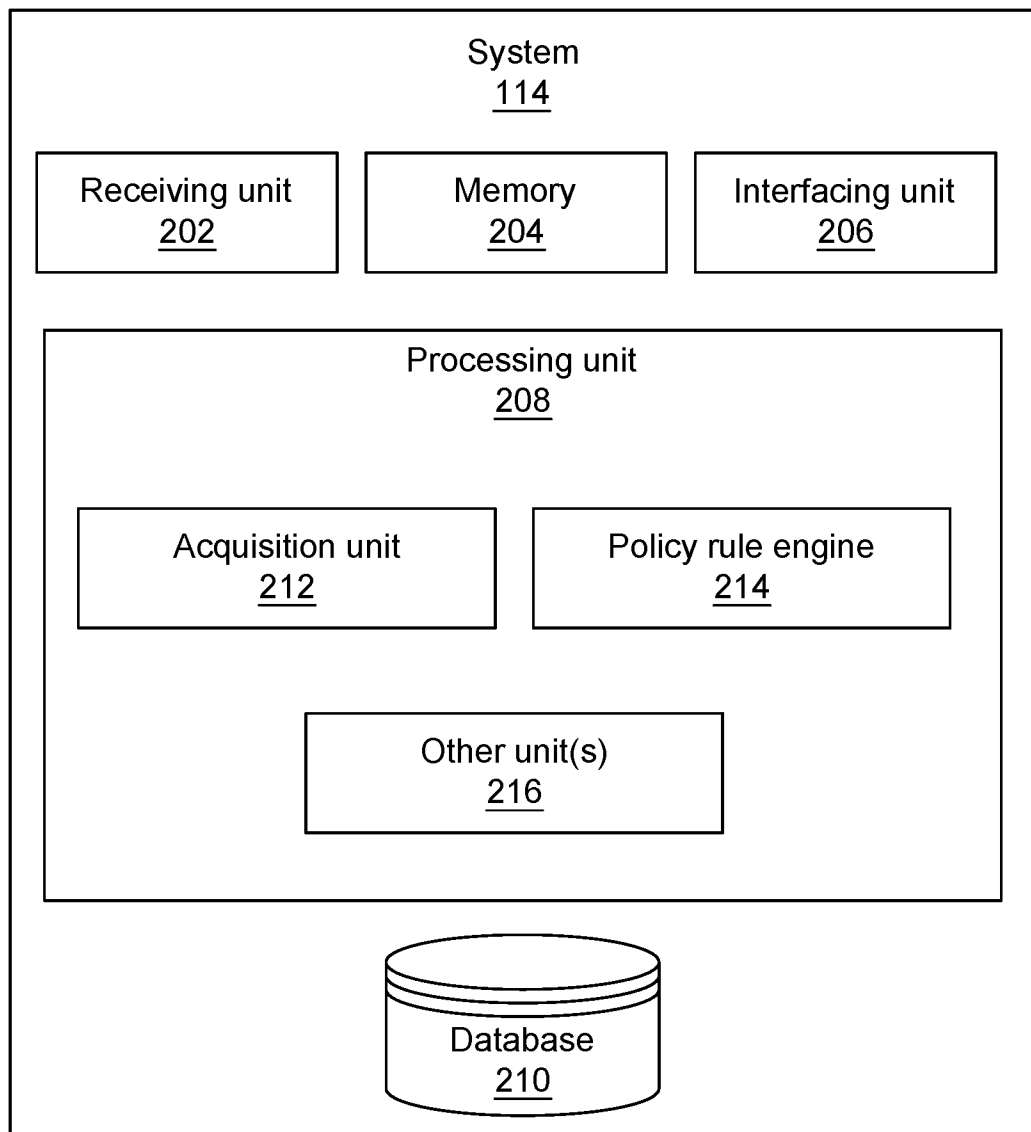
200 

FIG. 2

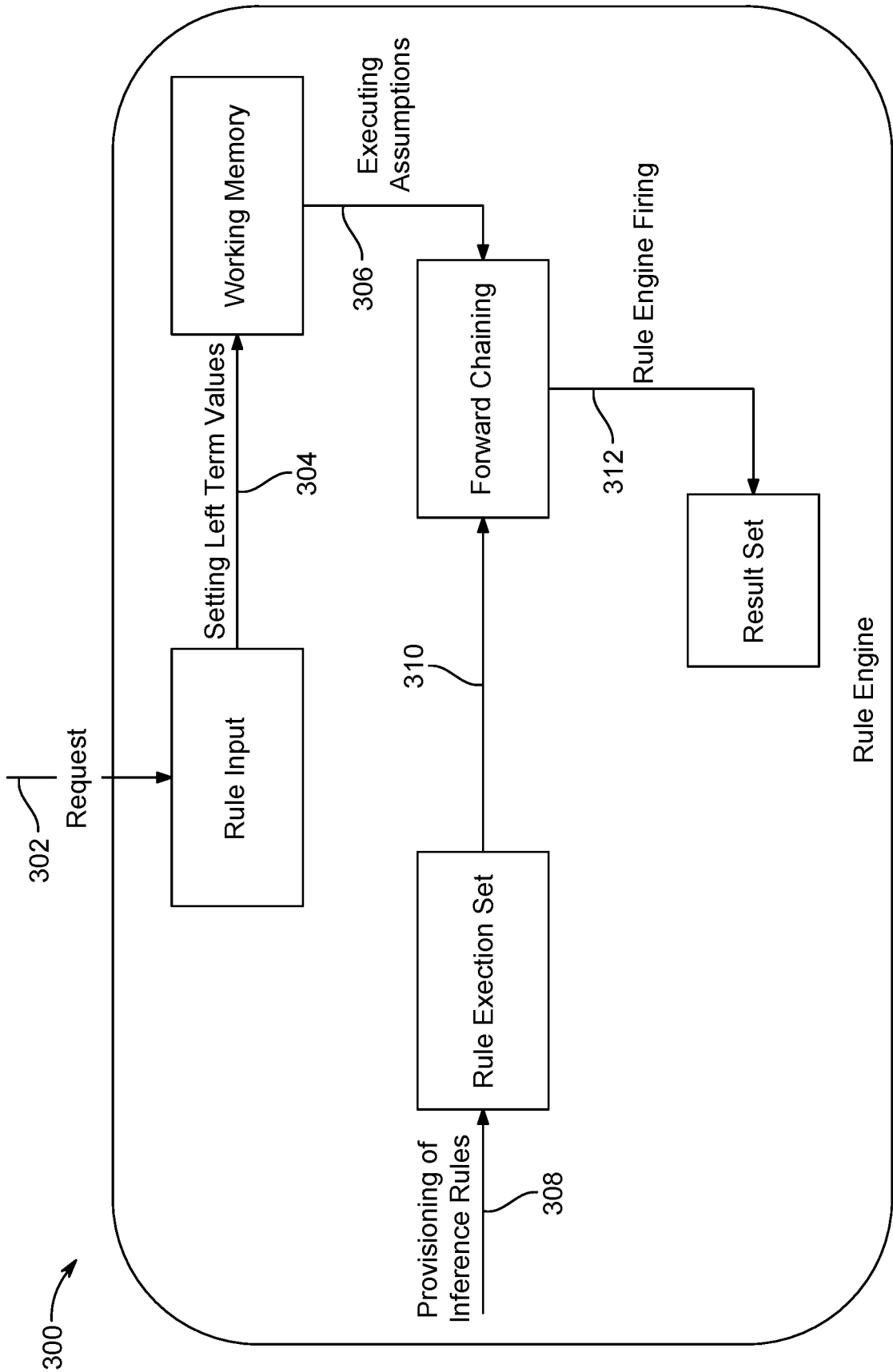


FIG. 3

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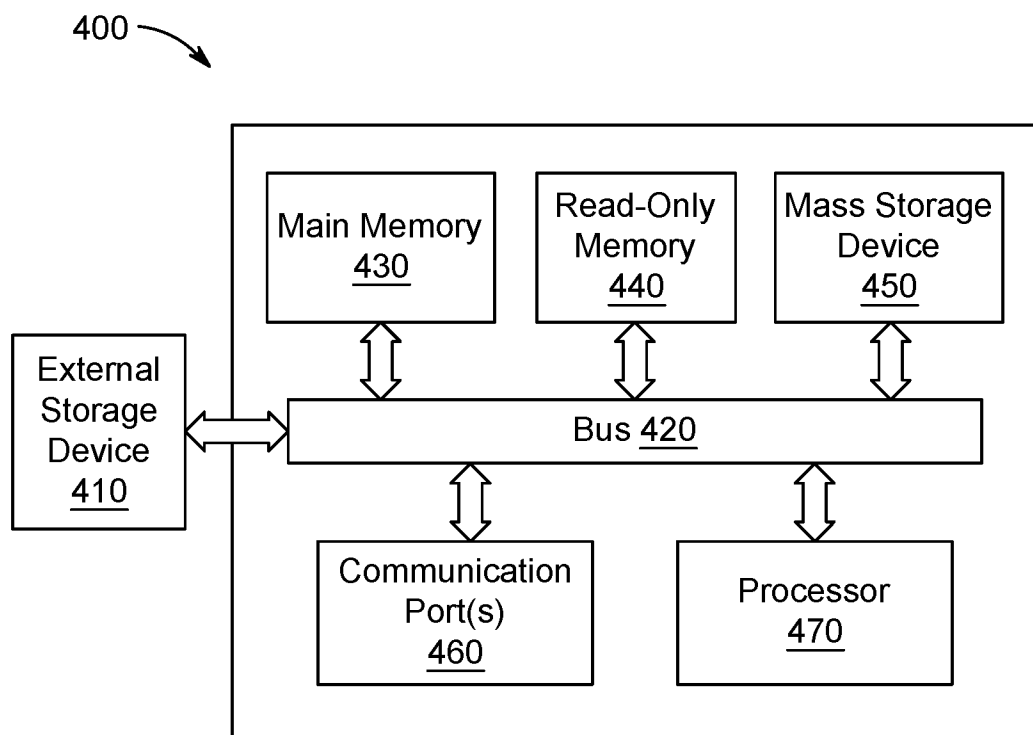


FIG. 4

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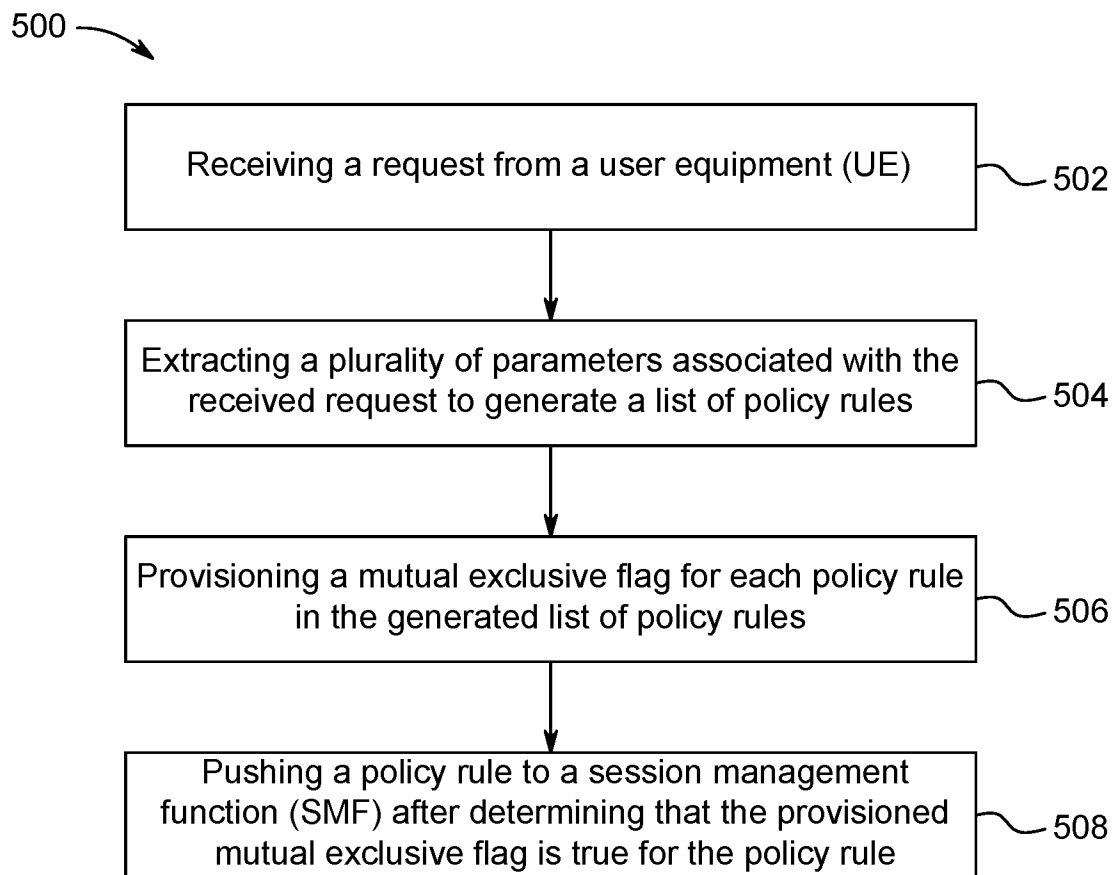


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2024/050690

A. CLASSIFICATION OF SUBJECT MATTER

H04W76/10, H04W60/04, H04W80/10, H04W8/20 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)

H04W

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)

PatSeer, IPO Internal Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US20200260401 A1; (TRICCI SO); 13 AUGUST 2020 (13/08/2020) Paragraphs [004]-[005], [020]-[022], [065]-[073] & Figs. 1-2	1-24
Y	US2023022184 A1; (ARUNA SAJJAN [ET] [AL.]); 26 JANUARY 2023 (26/01/2023) Paragraphs [012]-[013], [029]-[031] & Figs. 2-3	1-24
Y	WO2019137555 A1; (ZTE CORP.); 18 JULY 2019 (18/07/2019) (English Translation Copy from Google Patents) Fig. 2 at corresponding description	3-6, 8, 10-11, 14-17, 19 & 21-22
A	US2021400146 A1; (MIGUEL ANGEL MUNOZ DE LA TORRE ALONSO [ET] [AL.]); 23 DECEMBER 2021 (23/12/2021) Paragraphs [004]-[016], [031]-[038] & Figs. 3-4	1-2, 12-14 & 23-24



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

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"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)

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