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(54) **Title**: MECHANISM FOR CONTROLLING DISCOVERY AND SELECTION FUNCTION OF ACCESS POINTS

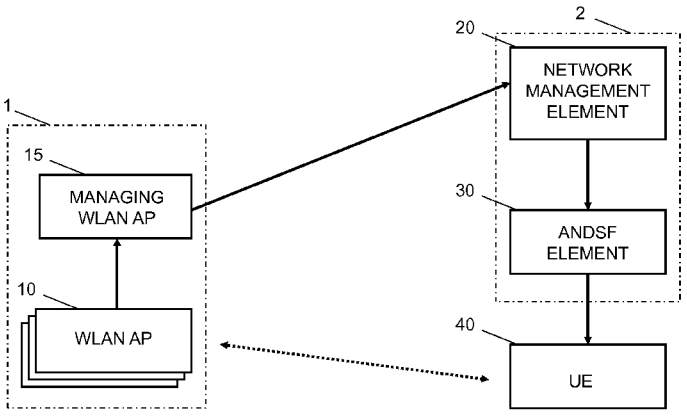


Fig. 1

(57) **Abstract**: There is provided a mechanism for controlling a discovery and selection function for access points of a first communication network by communication elements of a second communication network. A network management element receives performance information related to a communication performance of a plurality of communication network access elements of the first communication network, and sends a processing result of the received performance information in the form of a priority list of access elements to a device management element of the second communication network. The priority list is used by the device management element for providing the communication elements with information usable for selecting an access element of the first network for communication on the basis of performance information detected at the access points themselves.

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DESCRIPTION

TITLE

MECHANISM FOR CONTROLLING DISCOVERY AND SELECTION FUNCTION OF ACCESS POINTS

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to a mechanism for controlling a discovery and selection function for access points of a first communication network by communication elements of a second communication network. Specifically, the present invention is related to an apparatus, a method and a computer program product which provide an improved mechanism for controlling which access points of a first communication network, such as WLAN access points, are selected for conducting a communication with a communication element of a second communication network, such as a user equipment of a 3GPP based cellular communication network.

Related background Art

Prior art which is related to this technical field can e.g. be found in technical specifications according to 3GPP TS 23.402 (e.g. version 11.3.0), 3GPP TS 24.302 (e.g. version 11.3.0), and 3GPP TS 24.312 (e.g. version 11.3.0).

The following meanings for the abbreviations used in this specification apply:

ANDSF:	access network discovery and selection function
AP:	access point
CPU:	central processing unit
ID:	identification
ISMP:	inter-system mobility policy
ISRP:	inter-system routing policy
ITF-N:	northbound interface
LTE:	Long Term Evolution
LTE-A:	LTE Advanced
MO:	managing object
OMA DM:	open mobile alliance device management
QoS:	quality of service
SON:	self-organizing network
SSID:	service set identifier
UE:	user equipment
WLAN:	wireless local area network

In the last years, an increasing extension of communication networks, e.g. of wire based communication networks, such as the Integrated Services Digital Network (ISDN), DSL, or wireless communication networks, such as the cdma2000 (code division multiple access) system, cellular 3rd generation (3G) and fourth generation (4G) communication networks like the Universal Mobile Telecommunications System (UMTS), enhanced communication networks based e.g. on LTE or LTE-A, cellular 2nd generation (2G) communication networks like the Global System for Mobile communications (GSM), the General Packet Radio System (GPRS), the Enhanced Data Rates for Global Evolution (EDGE), or other wireless communication system, such as the Wireless Local Area Network (WLAN), WiFi, Bluetooth or Worldwide Interoperability for Microwave Access (WiMAX), took place all over the world. Various organizations, such as the 3rd Generation Partnership Project (3GPP), Telecoms & Internet converged Services & Protocols for Advanced Networks (TISPAN), the International Telecommunication Union (ITU), 3rd Generation Partnership Project 2 (3GPP2), Internet Engineering Task Force (IETF), the IEEE (Institute of Electrical and Electronics Engineers), the WiMAX Forum and the like are working on standards for telecommunication network and access environments.

Generally, for properly establishing and handling a communication connection between terminal devices such as a user equipment (UE) and another communication network element or user equipment, a database, a server, etc., one or more intermediate network elements such as communication network control elements, such as base transceiver stations, control nodes, support nodes or service nodes are involved which may belong to different communication network.

Due to the increasing number of users and the growing size of data to be transmitted, while at the same time the available resources in terms of bandwidth etc. do not grow (at least not in the scale), network operators are searching for possibilities to use existing resources in a better way. One option is, for example, to outsource traffic to other existing networks while keeping control of the overall communication in the own network.

For example, it has been considered to use existing networks based, for example, on WiFi or WLAN technology, for communications of terminal devices or UEs connected to a cellular network, such as a 3GPP based network. In order to connect a terminal device of a cellular network to a WiFi network or WLAN, either a user or provisioning server has configured certain WiFi network details so that the UE can connect to that WiFi network.

In order to support a terminal device or UE in the selection process of a suitable network, assisting network functions are provided. For example, according to 3GPP specifications, a so-called Access Network Selection and Discovery Function (ANDSF) is introduced. An operator can use ANDSF to provide access network discovery and selection information to UEs about non-3GPP access networks such as WiFi networks.

SUMMARY OF THE INVENTION

It is an object of the invention to provide an enhanced mechanism which allows an improved discovery and selection function for access points of a first communication network by communication elements of a second communication network. Specifically, it is an object of the present invention to provide an apparatus, a method and a computer program product which provide an improved mechanism for controlling which access points of a first communication network, such as WLAN access points, are selected for

conducting a communication with a communication element of a second communication network, such as a user equipment of a 3GPP based cellular communication network.

These objects are achieved by the measures defined in the attached claims.

According to an example of an embodiment of the proposed solution, there is provided, for example, an apparatus comprising at least one processor, at least one interface to at least one other network element, and at least one memory for storing instructions to be executed by the processor, wherein the at least one memory and the instructions are configured to, with the at least one processor, cause the apparatus at least to perform: a performance information receiving function configured to receive performance information related to a communication performance of a plurality of communication network access elements of a first communication network, a performance information processing portion configured to process the received performance information by using at least one predetermined algorithm for obtaining a priority list for the plurality of communication network access elements of the first communication network, the priority list indicating a preference order for selecting the plurality of communication network access elements of the first communication network for communicating with communication elements of a second communication network, and a priority list transmitting function configured to cause transmission of the priority list to a device management element of the second communication network.

Furthermore, according to an example of an embodiment of the proposed solution, there is provided, for example, a method comprising receiving performance information related to a communication performance of a plurality of communication network access elements of a first communication network, processing the received performance information by using at least one predetermined algorithm for obtaining a priority list for the plurality of communication network access elements of the first communication network, the priority list indicating a preference order for selecting the plurality of communication network access elements of the first communication network for communicating with communication elements of a second communication network, and causing transmission of the priority list to a device management element of the second communication network.

According to further refinements, these examples may comprise one or more of the following features:

- the performance information related to the communication performance of the plurality of communication network access elements of the first communication network may comprise, related to each of the plurality of communication network access elements of a first communication network, at least one of: an identification of the respective communication network access element, performance metrics indicating communication performance measurement results at the respective communication network access element, and statistical information related to the communication performance of the respective communication network access element;

- the at least one predetermined algorithm used in the processing may evaluate the received performance information in accordance with specific criteria, the specific criteria comprises at least one of a quality of a communication to be conducted via the respective communication network access element, a load situation of the respective communication network access element, a location of the respective communication network access element; charging rules of the respective communication network access element, a proprietor of the respective communication network access element, and another example for a specific criterion which can be evaluated by the at least one predetermined algorithm and which is related to the received performance information;

- weighting factors may be applied for the results of the at least one predetermined algorithm according to the specific criteria and the plurality of communication network access elements in the priority list may be ordered on the basis of the weighted results of the at least one predetermined algorithm;

- on the basis of the performance information, a communication network access element of the plurality of communication network access elements being inappropriate for communicating with communication elements of the second communication network may be determined, and at least one of discarding the inappropriate communication network access element from the priority list, or preparing a second list in parallel to the priority list, the second list indicating the inappropriate communication network access element, and causing transmission of the second list to the device management element of the second communication network may be performed;

- the performance information may be received via a northbound interface from a management element of the plurality of communication network access elements or directly from the plurality of communication network access elements;

- the above described processing may be implemented in a network management entity or network management layer of the second communication network.

In addition, according to an example of an embodiment of the proposed solution, there is provided, for example, an apparatus comprising at least one processor, at least one interface to at least one other network element, and at least one memory for storing instructions to be executed by the processor, wherein the at least one memory and the instructions are configured to, with the at least one processor, cause the apparatus at least to perform a priority list receiving function configured to receive priority list information indicating a preference order for selecting a communication network access element of a plurality of communication network access elements of a first communication network for communicating with communication elements of a second communication network, an assistance information generation function configured to generate, on the basis of a processing of the received priority list, assistance information for communication elements of the second communication network, the assistance information is related to a discovery and selection function conducted in the communication elements of the second communication network, and an assistance information transmitting function configured to cause transmission of the assistance information to at least one communication element of the second communication network.

Furthermore, according to an example of an embodiment of the proposed solution, there is provided, for example, a method comprising receiving priority list information indicating a preference order for selecting a communication network access element of a plurality of communication network access elements of a first communication network for communicating with communication elements of a second communication network, generating, on the basis of a processing of the received priority list, assistance information for communication elements of the second communication network, the assistance information is related to a discovery and selection function conducted in the communication elements of the second communication network, and causing transmission

of the assistance information to at least one communication element of the second communication network.

According to further refinements, these examples may comprise one or more of the following features:

information contained in the received priority list concerning the plurality of communication network access elements of the first communication network may be mapped to at least one of inter-system mobility policy information, inter-system routing policy information and discovery information to be provided to the communication element of the second communication network;

- a second list comprised in the priority list information may be processed, the second list indicating a communication network access element of the plurality of communication network access elements being inappropriate for communicating with the communication elements of the second communication network, and indicating the inappropriate communication network access element in the assistance information as being inappropriate for the discovery and selection function conducted in the communication elements of the second communication network;

- the priority list information may be received via a northbound interface from a management element or management layer of the second communication network.

In addition, according to examples of the proposed solution, there is provided, for example, a computer program product for a computer, comprising software code portions for performing the steps of the above defined methods, when said product is run on the computer. The computer program product may comprise a computer-readable medium on which said software code portions are stored. Furthermore, the computer program product may be directly loadable into the internal memory of the computer and/or transmittable via a network by means of at least one of upload, download and push procedures.

By virtue of the proposed solutions, it is possible to provide an enhanced mechanism which allows improving the discovery and selection function for access points of a first communication network by communication elements of a second communication network. Specifically, a priority list for access points can be generated on the basis of performance

information retrieved from available access points being candidates for a connection in a central entity on a network management level or layer, and the priority list can then be used for providing UEs conducting a discovery and selection function with more sophisticated information which consider also quality aspects of the respective access points. Hence, it is possible to improve the communication quality by influencing the selection process of an access point of a first communication network, such as a WLAN access point, for a communication with a communication element of a second communication network, such as a UE of a 3GPP based cellular communication network, under consideration of a communication performance of plural access points being available and selectable. Hence, the subscriber can be provided with reliable services based on quality information from WLAN or WiFi networks.

The above and still further objects, features and advantages of the invention will become more apparent upon referring to the description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a diagram illustrating a communication network configuration where examples of embodiments of the invention are implemented.

Fig. 2 shows a flowchart illustrating a processing executed in a communication network management element according to examples of embodiments of the invention.

Fig. 3 shows a flowchart illustrating a processing executed in a device management network element according to examples of embodiments of the invention.

Fig. 4 shows a block circuit diagram of a communication network management element including processing portions conducting functions according to examples of embodiments of the invention.

Fig. 5 shows a block circuit diagram of a device management network element including processing portions conducting functions according to examples of embodiments of the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

In the following, examples and embodiments of the present invention are described with reference to the drawings. For illustrating the present invention, the examples and embodiments will be described in connection with WiFi networks or WLAN networks as examples of a first communication network and a cellular communication network based on a 3GPP based communication system as an example for a second communication network. However, it is to be noted that the present invention is not limited to an application using such types of communication networks or systems, but is also applicable in other types of communication systems and the like.

A basic system architecture of a communication network where examples of embodiments of the invention are applicable may comprise a commonly known architecture of one or more communication systems comprising a wired or wireless access network subsystem and a core network. Such an architecture may comprise one or more access points, access network control elements, radio access network elements, access service network gateways or base transceiver stations, such as a base station, which control a coverage area also referred to as a cell and with which one or more communication elements or terminal devices such as a UE or another device having a similar function, such as a modem chipset, a chip, a module etc., which can also be part of a UE or attached as a separate element to a UE, or the like, are capable to communicate via one or more channels for transmitting several types of data. Furthermore, core network elements such as gateway network elements, policy and charging control network elements, mobility management entities and the like may be comprised.

The general functions and interconnections of the described elements, which also depend on the actual network type, are known to those skilled in the art and described in corresponding specifications, so that a detailed description thereof is omitted herein. However, it is to be noted that several additional network elements and signaling links may be employed for a communication to or from a communication element or terminal device like a UE and to or from a network element such as an access point, a management element, a communication network control element and the like, besides those described in detail herein below.

Furthermore, the described network elements, such as terminal devices like UEs, access points, network elements, management elements or entities, communication network control elements and the like, as well as corresponding functions as described herein may be implemented by software, e.g. by a computer program product for a computer, and/or by hardware. In any case, for executing their respective functions, correspondingly used devices, nodes or network elements may comprise several means and components (not shown) which are required for control, processing and communication/signaling functionality. Such means may comprise, for example, one or more processor units including one or more processing portions for executing instructions, programs and for processing data, memory means for storing instructions, programs and data, for serving as a work area of the processor or processing portion and the like (e.g. ROM, RAM, EEPROM, and the like), input means for inputting data and instructions by software (e.g. floppy disc, CD-ROM, EEPROM, and the like), user interface means for providing monitor and manipulation possibilities to a user (e.g. a screen, a keyboard and the like), interface means for establishing links and/or connections under the control of the processor unit or portion (e.g. wired and wireless interface means, an antenna, etc.) and the like. It is to be noted that in the present specification processing portions should not be only considered to represent physical portions of one or more processors, but may also be considered as a logical division of the referred processing tasks performed by one or more processors.

As described above, in order to support a terminal device or UE in the selection process for a suitable network used for a further connection for outsourcing or the like, an assisting network function such as ANDSF is provided. In order to influence which WiFi network or WLAN is actually selected to be connected to the UE, the cellular network, i.e. a control or management element thereof, can send to the UE a list of selectable WLANs or the like,

for example by informing the UE about a corresponding AP identification. That is, ANDSF can be used for providing a kind of list for WiFi access points or WLAN access points which can be used by the subscribers of a certain operators, i.e. by the UEs of the 3GPP based network.

For example, in order to improve the selection process, it is desired that only those WLANs or the like are presented in the list as being selectable which offer a certain level of connection quality or performance. For this purpose, according to examples of embodiments of the invention, network operators use the information provided by ANDSF not only for transferring the list of access points or the like but also information which are useful for selecting the access points with regard to a provided level of quality, or with regard to another criterion. According to examples of embodiments of the invention, the information useful for selecting a proper AP or WLAN, for example, are provided by means of a priority list created under consideration of the performance of the APs etc..

With regard to Fig. 1, a diagram illustrating a communication network configuration is shown where examples of embodiments of the invention are implemented. It is to be noted that the configuration shown in Fig. 1 shows only those devices, network elements and parts which are useful for understanding principles underlying the examples of embodiments of the invention. As also known by those skilled in the art there may be several other network elements or devices involved in a communication network which are omitted here for the sake of simplicity.

In Fig. 1, a communication network configuration is illustrated in which examples of embodiments of the invention are implementable. The network according to Fig. 1 contains elements of a first communication system, such as WLAN APs and managing elements of APs, and elements of a second network system, such as 3GPP management system elements, and ANDSF, which is an OMA DM element. It is to be noted that the general functions of the elements described in connection with Fig. 1 as well as of reference points/interfaces therebetween are known to those skilled in the art so that a detailed description thereof is omitted here for the sake of simplicity.

As shown in Fig. 1, in the exemplary communication network configuration, it is assumed that a terminal device or communication element 40, such as a UE, is located such that it is connectable to at least one of plural access points of a first communication network 1, which is assumed to be a respective WiFi network or WLAN, and a second communication network 2, such as the cellular 3GPP based home network of the UE 40, for example, which conducts several control functions for the UE 40 by means of management elements and control elements.

In the first communication network, one or more access points 10 for e.g. a WLAN are provided. The WLAN APs 10 are connected, for example, to a managing network element of the first communication network, such as a WLAN controller or managing WLAN AP 15. It is to be noted the functions of the WLAN AP 10 and the WLAN controller 15 can be implemented in separate elements or in one common element or AP. Furthermore, it is to be noted that the WiFi networks forming the first communication network can be owned by the same operator as that of the second communication network (i.e. e.g. a 3GPP operator) or may be operated by one or more third party providers (i.e. independent to the second communication network).

In the second communication network 2, the elements being of relevance for examples of embodiments of the invention are a network management element 20 which is a part of the network infrastructure's network management system, and a device management element 30, such as an ANDSF element. In the second communication network, the network management element 20 is connected to the device management element 30 for providing information promoting the assistance function of the ANDSF element for the selection and discovery function of the UE 40 in order to find and select a suitable AP of the first communication network 1 to which the UE 40 establishes a connection (shown by the dashed arrow in Fig. 1). The device management element 30, on the other hand, provides the assistance information to the UE 40 e.g. via a communication according to the OMA DM protocol wherein the OMA DM protocol is utilising a so called user plane connection, which means that some kind of connection is setup to the UE from the OMA DM server (in this case the ANDSF) wherein via this connection information is delivered (for this the UE needs to support also the OMA DM protocol). The OMA DM session is

run, for example, on top of any IP connection, i.e. ANDSF server – UE session can be run through the 3GPP access network or e.g. through the WLAN network.

According to examples of embodiments of the invention, the network managing element or controller 15 of the first network 1 (or the APs 10 of the first network 1, which is not shown) has an interface towards the network management element 20 of the second network 2. Via this interface, performance specific information related to each AP 10 of the first network 1 are sent to the network management element 20 of the second network 2.

It is to be noted that even though only one first communication network 1 is shown in Fig. 1, it is of course possible that more than one "first" communication network is present (basically, each AP 10 can represent an own communication network), which are all connected to the network management element 20 of the second network 2 and provide corresponding information.

As described above, the device management element 30 is, according to examples of embodiments of the invention, an ANDSF element. ANDSF provides, for example, three types of information to the UE 40 in order to assist the discovery and selection of e.g. a WLAN. These three types of information include Inter-System Mobility Policy (ISMP) information, Inter-System Routing Policy ISRP information and discovery information.

ISMP information provides network selection rules and can be used to prioritize networks of a specific type, e.g. Wi-Fi networks, over each other and also over 3GPP networks. ISMP is used when a UE does not support simultaneous 3GPP and Wi-Fi radio usage. An example of prioritized ISMP information is, for example, 1.) to use Wi-Fi AP with SSID=Operator_A, 2.) to use any Wi-Fi AP available, 3.) to use 3GPP radio accesses.

On the other hand, ISRP information provides network selection rules and can be used to prioritize radio accesses for specific applications. With ISRP, it is assumed that the UE can use both 3GPP and e.g. Wi-Fi radio accesses simultaneously. An example of ISRP

information is, for example, to use for a specific type of traffic/application radio accesses in priority order of: 1.) Wi-Fi AP with SSID=Operator_A, 2.) to use any Wi-Fi available, 3.) to use 3GPP radio accesses.

Discovery information can be used to inform the UE about certain Wi-Fi networks being available for the UE, and to provide assistance information useful for establishing a connection to a corresponding AP.

At least one or combinations of these information parts can be conveyed in an ANDSF Management Object (MO) towards the UE, wherein the ANDSF MO can also be used to convey location information of the UE to the ANDSF element (or server) an during ANDSF session.

It is to be noted that the ANDSF element 30 is, according to examples of embodiments of the invention, an OMA DM server that is configured to provide information (such as a priority list of WiFi APs, e.g. by the means of preferred SSIDs) to UEs.

It is to be further noted that according to examples of embodiments of the invention, since the ANDSF element 30 is an OMA DM server, the ANDSF element 30 is not limited to a separate element, but can also be considered as an element in the management domain. That is, the network management element 20 and the ANDSF element 30 can be implemented in one network element or entity. For example, the combined network element is part of a centralized SON functionality. However, in praxis, the management element 20 and the ANDSF element 30 are usally separated. For example, the element management layer is implemented more closely to the network elements. The interface between element management layer and network management layer may be standardized. Typically element management layer is provided by one vendor (e.g. providing the network element), while the network management layer may be from another vendor.

According to examples of embodiments of the invention, the APs 10 of the first network, i.e. for example the WiFi APs 10, send performance information of their own, such as collected statistical information or performance metrics related to the communication quality achievable with the respective AP, to the managing element or(WLAN) controller 15. According to examples of embodiments of the invention, this performance information comprise at least one of an information concerning an available throughput, a used throughput, a packet delay, etc. However, it is to be noted that also any other statistical information representing the performance view of the WiFi network can be used as (part of) the performance information. The managing element or controller 15 sends this performance data, together with an identification of the respective AP 10, to the network management element 20 of the second network. According to further examples of embodiments of the invention, the performance information of an AP 10 is directly sent to the network management element, provided a corresponding interface is present.

According to examples of embodiments of the invention, the interface between the network management element 20 of the second communication network and the elements of the first communication element (AP 10 and/or managing AP or controller 15) is, for example, a ITF-N northbound interface. In other words, the WiFi APs are integrated to the network management system by a type 2 interface (ITF-N) towards the network management layer.

The performance information of each AP, i.e. the statistical information, performance metrics etc. of the APs 10 are utilized by the network management system in order generate or to modify contents of a priority list used by the ANDSF element for indicating the WLAN APs usable by a UE, wherein the contents are based on certain quality criteria. That is, the quality criteria are determined based on collected statistical information from the WiFi APs 10. Then, the priority list thus generated is delivered to the device management system (the ANDSF element 30) via a corresponding interface, e.g. a northbound interface. Algorithms for creating the priority list information from the performance information are run, according to examples of embodiments of the invention, in a centralized manner in the network management system 20.

That is, according to examples of embodiments of the invention, the network management layer of the second communication network 20 collects all the statistical information from all WiFi APs 10 in the first communication network. Based on predetermined algorithms that are running in the network management layer a priority list of the WiFi APs is generated which reflects those APs which fulfill certain criteria, for example with regard to communication quality and performance thresholds set in the algorithms. The priority list is then transferred to the ANDSF element, e.g. in via an ITF-N interface of the type described above.

It is to be noted that according to examples of embodiments of the invention, in case the algorithms run in the network management element results that one or more of the APs do not fulfill the necessary criteria, e.g. in case their reported performance is insufficient, so that a poor user experience is to be expected, such an AP is banned from the priority list. Alternatively, such APs not fulfilling the criteria and being thus inappropriate may be listed in an own list indicating the APs which are not to be selected, which is sent to the ANDSF element like the priority list and which is processed in the ANDSF element correspondingly. Hence, it is possible that a 3GPP operator bans using a WiFi AP or the like for the subscribers which helps to further improve the user experience.

Fig. 2 shows a flowchart illustrating a processing executed in a communication network management element 20 of Fig. 1 according to examples of embodiments of the invention in a control mechanism as described above.

In step S100, the network management element 20 receives from the first network 1 side e.g. via a northbound interface performance information related to the communication performance of plural communication network access elements such as WLAN APs 10 of a first communication network 1.

According to examples of embodiments of the invention, the performance information related to the communication performance of the plurality of communication network access elements of the first communication network comprise, related to each of the plurality of communication network access elements of the first communication network,

information comprising one or more of the following: an identification of the respective communication network access element (IDs of the AP, the network, or the like), performance metrics indicating communication performance measurement results at the respective communication network access element, and/or statistical information related to the communication performance of the respective communication network access element.

In step S110, the management network element 20 processes the received performance information by using at least one predetermined algorithm.

For example, according to examples of embodiments of the invention, the predetermined algorithms are used to evaluate the received performance information in accordance with specific criteria. These, the specific criteria comprises, for example, at least one of a quality of a communication conducted via the respective communication network access element, a load situation of the respective communication network access element, a location of the respective communication network access element, charging rules of the respective communication network access element, and a proprietor of the respective communication network access element. It is to be noted that according to further examples of embodiments of the invention, the specific criteria being implemented comprise also other criteria, parameters or the like besides those indicated above, which define hence only examples. Furthermore, when e.g. more than one criterion is to be evaluated, the results may be weighted. For example, in case an AP has a slightly better connection quality but a very high load, it may be set in the priority list below another AP having a slightly poorer connection quality but a much less load factor, or the like.

As a result of the processing using the algorithms, a priority list for the plurality of communication network access elements of the first communication network is obtained. The priority list indicates a preference order for selecting the plurality of communication network access elements of the first communication network for communicating with communication elements (UE) of a second communication network.

According to further examples of embodiments of the invention, the processing step S110 comprises also the following. If it is determined, on the basis of the performance information, that a communication network access element of the plurality of communication network access elements is inappropriate for conducting a communication with the communication element of the second communication network, for example since it shows a poor communication quality, or is too expansive, or the like, the processing includes to discard the communication network access element being determined to be inappropriate from the priority list, i.e. the AP in question is not indicated and ignored. Alternatively, a second list in parallel to the priority list is prepared by the network management element, wherein the second list indicates the inappropriate communication network access element.

Finally, in step S120, the priority list (and optionally the second list, if provided) is sent to a device management element of the second communication network, i.e. the ANDSF element 30, for example.

Fig. 3 shows a flowchart illustrating a processing executed in a device management element such as the ANDSF element 30 of Fig. 1 according to examples of embodiments of the invention in a control mechanism as described above.

In step S200, the ANDSF element 30 receives the priority list information sent in step S130 of Fig. 2, which indicates the preference order for selecting the communication network access element of a plurality of communication network access elements of the first communication network for communicating with communication elements of the second communication network.

In step S210, on the basis of a processing of the received priority list, assistance information for the communication elements of the second communication network is generated. The assistance information is related to a discovery and selection function conducted in the communication elements of the second communication network for finding and selecting, for example, WiFi networks for connecting.

The processing of the priority list comprises, for example, a mapping of contents of the priority list concerning the plurality of communication network access elements of the first communication network to one or more of ISMP, ISMR and discovery information of ANDSF. Alternatively, the priority list information can be used directly or in another form for informing the UEs accordingly.

In step S220, the assistance information is transmitted to at least one communication element of the second communication network which is thus enabled to execute a discovery and selection function in an improved manner.

It is to be noted that the preparation of the assistance information in step S220 comprises, according to further examples of embodiments of the invention, also a processing of the second list, if provided, so as to ban the inappropriate communication network access elements of the second communication network. For example, an indication to the UEs to ignore those access elements of the first network, even if detected, can be provided to the UEs.

In Fig. 4, a block circuit diagram illustrating a configuration of a communication network management element 20, is shown, which is configured to implement the control mechanism as described in connection with the examples of embodiments of the invention. It is to be noted that the communication network management element 20 shown in Fig. 4 may comprise several further elements or functions besides those described herein below, which are omitted herein for the sake of simplicity as they are not essential for understanding the invention. Furthermore, the network management element 20 may be also contained in a device as an element having a corresponding function, such as a chipset, a chip, a module etc., which can also be part of a communication network control element or attached as a separate element to a communication network control element, or the like.

The communication network management element 20 may comprise a processing function or processor 21, such as a CPU or the like, which executes instructions given by programs or the like related to the control mechanism. The processor 21 may comprise one or more processing portions dedicated to specific processing as described below, or the processing may be run in a single processor. Portions for executing such specific processing may be also provided as discrete elements or within one or more further processors or processing portions, such as in one physical processor like a CPU or in several physical entities, for example. Reference signs 22 and 23 denote transceiver or input/output (I/O) units (interfaces) connected to the processor 21. The I/O units 22 may be used for communicating with one or more network elements of a first communication network, such as WLAN based networks. The I/O units 23 may be used for communicating with one or more network elements of the second communication network, such as the ANDSF element. The I/O units 22 and 23 may be a combined unit comprising communication equipment towards several network elements, or may comprise a distributed structure with a plurality of different interfaces for different network elements. Reference sign 24 denotes a memory usable, for example, for storing data and programs to be executed by the processor 21 and/or as a working storage of the processor 21.

The processor 21 is configured to execute processing related to the above described control mechanism. In particular, the processor 21 comprises a sub-portion 210 as a processing portion which is usable for receiving the performance information from the first communication network. The portion 210 may be configured to perform processing according to steps S100 of Fig. 2, for example. Furthermore, the processor 21 comprises a sub-portion 211 usable as a portion for processing the performance information. The portion 211 may be configured to perform processing according to step S110 of Fig. 2, for example. Furthermore, the processor 21 comprises a sub-portion 212 usable as a portion for obtaining the priority (and the second list). The portion 212 may be configured to perform processing according to step S110 of Fig. 2, for example. In addition, the processor 21 comprises a sub-portion 213 as a processing portion which is usable for instructing transmission of the priority list (and the second list). The portion 213 may be configured to perform processing according to step S120 of Fig. 2, for example.

In Fig. 5, a block circuit diagram illustrating a configuration of a device management element 30, such as the ANDSF element 30, is shown, which is configured to implement the control mechanism as described in connection with the examples of embodiments of the invention. It is to be noted that the device management element 30 shown in Fig. 5 may comprise several further elements or functions besides those described herein below, which are omitted herein for the sake of simplicity as they are not essential for understanding the invention. Furthermore, the device management element 30 may also be contained in a device as an element having a corresponding function, such as a chipset, a chip, a module etc., which can also be part of a communication network control element or attached as a separate element to a communication network control element, or the like.

The device management element or ANDSF element 20 may comprise a processing function or processor 31, such as a CPU or the like, which executes instructions given by programs or the like related to the control mechanism. The processor 31 may comprise one or more processing portions dedicated to specific processing as described below, or the processing may be run in a single processor. Portions for executing such specific processing may be also provided as discrete elements or within one or more further processors or processing portions, such as in one physical processor like a CPU or in several physical entities, for example. Reference signs 32 and 33 denote transceiver or input/output (I/O) units (interfaces) connected to the processor 31. The I/O units 32 may be used for communicating with the network management element 20. The I/O units 33 may be used for communicating with one or more communication elements such as UEs of the second communication network. The I/O units 32 and 33 may be a combined unit comprising communication equipment towards several network elements, or may comprise a distributed structure with a plurality of different interfaces for different network elements. Reference sign 34 denotes a memory usable, for example, for storing data and programs to be executed by the processor 31 and/or as a working storage of the processor 31.

The processor 31 is configured to execute processing related to the above described control mechanism. In particular, the processor 31 comprises a sub-portion 310 as a processing portion which is usable for receiving the priority list information (and second list information) from the communication network management element 20. The portion 310

may be configured to perform processing according to steps S200 of Fig. 3, for example. Furthermore, the processor 31 comprises a sub-portion 311 usable as a portion for processing the priority list information (and second list information). The portion 311 may be configured to perform processing according to step S210 of Fig. 3, for example. Furthermore, the processor 31 comprises a sub-portion 312 usable as a portion for generating the assistance information for the UEs. The portion 312 may be configured to perform processing according to step S210 of Fig. 3, for example. In addition, the processor 31 comprises a sub-portion 313 as a processing portion which is usable for instructing transmission of the assistance information. The portion 313 may be configured to perform processing according to step S220 of Fig. 3, for example.

According to a further example of embodiments of the invention, there is provided an apparatus comprising performance information receiving means for receiving performance information related to a communication performance of a plurality of communication network access elements of a first communication network, performance information processing means for processing the received performance information by using at least one predetermined algorithm for obtaining a priority list for the plurality of communication network access elements of the first communication network, the priority list indicating a preference order for selecting the plurality of communication network access elements of the first communication network for communicating with communication elements of a second communication network, and priority list transmitting means for causing transmission of the priority list to a device management element of the second communication network.

According to a still further example of embodiments of the invention, there is provided an apparatus comprising priority list receiving means for receiving priority list information indicating a preference order for selecting a communication network access element of a plurality of communication network access elements of a first communication network for communicating with communication elements of a second communication network, assistance information generation means for generating, on the basis of a processing of the received priority list, assistance information for communication elements of the second communication network, the assistance information is related to a discovery and selection function conducted in the communication elements of the second communication network,

and assistance information transmitting means for causing transmission of the assistance information to at least one communication element of the second communication network.

For the purpose of the present invention as described herein above, it should be noted that

- an access technology via which signaling is transferred to and from a network element may be any technology by means of which a network element or sensor node can access another network element or node (e.g. via a base station or generally an access node). Any present or future technology, such as WLAN (Wireless Local Access Network), WiMAX (Worldwide Interoperability for Microwave Access), LTE, LTE-A, Bluetooth, Infrared, and the like may be used; although the above technologies are mostly wireless access technologies, e.g. in different radio spectra, access technology in the sense of the present invention implies also wired technologies, e.g. IP based access technologies like cable networks or fixed lines but also circuit switched access technologies; access technologies may be distinguishable in at least two categories or access domains such as packet switched and circuit switched, but the existence of more than two access domains does not impede the invention being applied thereto,

- usable communication networks, stations and transmission nodes may be or comprise any device, apparatus, unit or means by which a station, entity or other user equipment may connect to and/or utilize services offered by the access network; such services include, among others, data and/or (audio-) visual communication, data download etc.;

- a user equipment or communication network element (station) may be any device, apparatus, unit or means by which a system user or subscriber may experience services from an access network, such as a mobile phone or smart phone, a personal digital assistant PDA, or computer, or a device having a corresponding functionality, such as a modem chipset, a chip, a module etc., which can also be part of a UE or attached as a separate element to a UE, or the like;

- method steps likely to be implemented as software code portions and being run using a processor at a network element or terminal (as examples of devices, apparatuses and/or modules thereof, or as examples of entities including apparatuses and/or modules for it), are software code independent and can be specified using any known or future developed

programming language as long as the functionality defined by the method steps is preserved;

- generally, any method step is suitable to be implemented as software or by hardware without changing the idea of the invention in terms of the functionality implemented;

- method steps and/or devices, apparatuses, units or means likely to be implemented as hardware components at a terminal or network element, or any module(s) thereof, are hardware independent and can be implemented using any known or future developed hardware technology or any hybrids of these, such as a microprocessor or CPU (Central Processing Unit), MOS (Metal Oxide Semiconductor), CMOS (Complementary MOS), BiMOS (Bipolar MOS), BiCMOS (Bipolar CMOS), ECL (Emitter Coupled Logic), TTL (Transistor-Transistor Logic), etc., using for example ASIC (Application Specific IC (Integrated Circuit)) components, FPGA (Field-programmable Gate Arrays) components, CPLD (Complex Programmable Logic Device) components or DSP (Digital Signal Processor) components; in addition, any method steps and/or devices, units or means likely to be implemented as software components may for example be based on any security architecture capable e.g. of authentication, authorization, keying and/or traffic protection;

- devices, apparatuses, units or means can be implemented as individual devices, apparatuses, units or means, but this does not exclude that they are implemented in a distributed fashion throughout the system, as long as the functionality of the device, apparatus, unit or means is preserved; for example, for executing operations and functions according to examples of embodiments of the invention, one or more processors may be used or shared in the processing, or one or more processing sections or processing portions may be used and shared in the processing, wherein one physical processor or more than one physical processor may be used for implementing one or more processing portions dedicated to specific processing as described,

- an apparatus may be represented by a semiconductor chip, a chipset, or a (hardware) module comprising such chip or chipset; this, however, does not exclude the possibility that a functionality of an apparatus or module, instead of being hardware implemented, be implemented as software in a (software) module such as a computer program or a computer program product comprising executable software code portions for execution/being run on a processor;

- a device may be regarded as an apparatus or as an assembly of more than one apparatus, whether functionally in cooperation with each other or functionally independently of each other but in a same device housing, for example.

As described above, there is provided a mechanism for controlling a discovery and selection function for access points of a first communication network by communication elements of a second communication network. A network management element receives performance information related to a communication performance of a plurality of communication network access elements of the first communication network, and sends a processing result of the received performance information in the form of a priority list of access elements to a device management element of the second communication network. The priority list is used by the device management element for providing the communication elements with information usable for selecting an access element of the first network for communication on the basis of performance information detected at the access points themselves.

Although the present invention has been described herein before with reference to particular embodiments thereof, the present invention is not limited thereto and various modifications can be made thereto.

CLAIMS

1. An apparatus comprising

at least one processor,

at least one interface to at least one other network element, and

at least one memory for storing instructions to be executed by the processor, wherein

the at least one memory and the instructions are configured to, with the at least one processor, cause the apparatus at least to perform:

a performance information receiving function configured to receive performance information related to a communication performance of a plurality of communication network access elements of a first communication network,

a performance information processing portion configured to process the received performance information by using at least one predetermined algorithm for obtaining a priority list for the plurality of communication network access elements of the first communication network, the priority list indicating a preference order for selecting the plurality of communication network access elements of the first communication network for communicating with communication elements of a second communication network, and

a priority list transmitting function configured to cause transmission of the priority list to a device management element of the second communication network.

2. The apparatus according to claim 1, wherein the performance information related to the communication performance of the plurality of communication network access elements of the first communication network comprise, related to each of the plurality of communication network access elements of a first communication network, at least one of:

an identification of the respective communication network access element,

performance metrics indicating communication performance measurement results at the respective communication network access element, and

statistical information related to the communication performance of the respective communication network access element.

3. The apparatus according to any of claims 1 to 2, wherein the at least one predetermined algorithm used by the performance information processing portion evaluates the received performance information in accordance with specific criteria, the specific criteria comprises at least one of:

a quality of a communication to be conducted via the respective communication network access element,

a load situation of the respective communication network access element,

a location of the respective communication network access element;

charging rules of the respective communication network access element,

a proprietor of the respective communication network access element, and

another example for a specific criterion which can be evaluated by the at least one predetermined algorithm and which is related to the received performance information.

4. The apparatus according to claim 3, wherein the performance information processing portion is further configured to apply weighting factors for the results of the at least one predetermined algorithm according to the specific criteria and to order the plurality of communication network access elements in the priority list on the basis of the weighted results of the at least one predetermined algorithm.

5. The apparatus according to any of claims 1 to 4, wherein the performance information processing portion is further configured to determine, on the basis of the performance information, a communication network access element of the plurality of communication network access elements being inappropriate for communicating with communication elements of the second communication network, wherein the performance information processing portion is further configured

to discard the inappropriate communication network access element from the priority list, or

to prepare a second list in parallel to the priority list, the second list indicating the inappropriate communication network access element,

wherein the priority list transmitting function is configured to cause transmission of the second list to the device management element of the second communication network.

6. The apparatus according to any of claims 1 to 5, wherein the performance information receiving function is further configured to receive the performance information via a northbound interface from a management element of the plurality of communication network access elements or directly from the plurality of communication network access elements.

7. The apparatus according to any of claims 1 to 6, wherein the apparatus is comprised in a network management entity or network management layer of the second communication network.

8. A method comprising

receiving performance information related to a communication performance of a plurality of communication network access elements of a first communication network,

processing the received performance information by using at least one predetermined algorithm for obtaining a priority list for the plurality of communication network access elements of the first communication network, the priority list indicating a preference order for selecting the plurality of communication network access elements of the first communication network for communicating with communication elements of a second communication network, and

causing transmission of the priority list to a device management element of the second communication network.

9. The method according to claim 8, wherein the performance information related to the communication performance of the plurality of communication network access elements of the first communication network comprises, related to each of the plurality of communication network access elements of a first communication network, at least one of:

an identification of the respective communication network access element,

performance metrics indicating communication performance measurement results at the respective communication network access element, and

statistical information related to the communication performance of the respective communication network access element.

10. The method according to any of claims 8 to 9, wherein the at least one predetermined algorithm used in the processing evaluates the received performance information in accordance with specific criteria, the specific criteria comprises at least one of:

a quality of a communication to be conducted via the respective communication network access element,

a load situation of the respective communication network access element,

a location of the respective communication network access element;

charging rules of the respective communication network access element,

a proprietor of the respective communication network access element, and

another example for a specific criterion which can be evaluated by the at least one predetermined algorithm and which is related to the received performance information.

11. The method according to claim 10, further comprising applying weighting factors for the results of the at least one predetermined algorithm according to the specific criteria and ordering the plurality of communication network access elements in the priority list on the basis of the weighted results of the at least one predetermined algorithm.

12. The method according to any of claims 8 to 11, further comprising

determining, on the basis of the performance information, a communication network access element of the plurality of communication network access elements being inappropriate for communicating with communication elements of the second communication network, and performing at least one of

discarding the inappropriate communication network access element from the priority list, or

preparing a second list in parallel to the priority list, the second list indicating the inappropriate communication network access element, and causing transmission of the second list to the device management element of the second communication network.

13. The method according to any of claims 8 to 12, further comprising receiving the performance information via a northbound interface from a management element of the plurality of communication network access elements or directly from the plurality of communication network access elements.

14. The method according to any of claims 8 to 13, wherein the method is implemented in a network management entity or network management layer of the second communication network.

15. An apparatus comprising

at least one processor,

at least one interface to at least one other network element, and

at least one memory for storing instructions to be executed by the processor, wherein

the at least one memory and the instructions are configured to, with the at least one processor, cause the apparatus at least to perform:

a priority list receiving function configured to receive priority list information indicating a preference order for selecting a communication network access element of a

plurality of communication network access elements of a first communication network for communicating with communication elements of a second communication network,

an assistance information generation function configured to generate, on the basis of a processing of the received priority list, assistance information for communication elements of the second communication network, the assistance information is related to a discovery and selection function conducted in the communication elements of the second communication network, and

an assistance information transmitting function configured to cause transmission of the assistance information to at least one communication element of the second communication network.

16. The apparatus according to claim 15, wherein the assistance information generation function is further configured to map information contained in the received priority list concerning the plurality of communication network access elements of the first communication network to at least one of inter-system mobility policy information, inter-system routing policy information and discovery information to be provided to the communication element of the second communication network.

17. The apparatus according to any of claims 15 to 16, wherein the assistance information generation function is further configured to process a second list comprised in the priority list information, the second list indicating a communication network access element of the plurality of communication network access elements being inappropriate for communicating with the communication elements of the second communication network, and to indicate the inappropriate communication network access element in the assistance information as being inappropriate for the discovery and selection function conducted in the communication elements of the second communication network.

18. The apparatus according to any of claims 15 to 17, wherein the priority list receiving function is further configured to receive the priority list information via a northbound interface from a management element or management layer of the second communication network.

19. The apparatus according to any of claims 15 to 18, wherein the apparatus is comprised in a device management entity or an element management layer of the second communication network, in particular an access network discovery and selection function server element of the second communication network.

20. A method comprising

receiving priority list information indicating a preference order for selecting a communication network access element of a plurality of communication network access elements of a first communication network for communicating with communication elements of a second communication network,

generating, on the basis of a processing of the received priority list, assistance information for communication elements of the second communication network, the assistance information is related to a discovery and selection function conducted in the communication elements of the second communication network, and

causing transmission of the assistance information to at least one communication element of the second communication network.

21. The method according to claim 20, further comprising mapping information contained in the received priority list concerning the plurality of communication network access elements of the first communication network to at least one of inter-system mobility policy information, inter-system routing policy information and discovery information to be provided to the communication element of the second communication network.

22. The method according to any of claims 20 to 21, further comprising processing a second list comprised in the priority list information, the second list indicating a communication network access element of the plurality of communication network access elements being inappropriate for communicating with the communication elements of the second communication network, and indicating the inappropriate communication network access element in the assistance information as being inappropriate for the discovery and

selection function conducted in the communication elements of the second communication network.

23. The method according to any of claims 20 to 22, further comprising receiving the priority list information via a northbound interface from a management element or management layer of the second communication network.

24. The method according to any of claims 20 to 23, wherein the method is implemented in a device management entity or an element management layer of the second communication network, in particular an access network discovery and selection function server element of the second communication network.

25. A computer program product for a computer, comprising software code portions for performing the steps of any of claims 8 to 14 or 20 to 24 when said product is run on the computer.

26. The computer program product according to claim 25, wherein

the computer program product comprises a computer-readable medium on which said software code portions are stored, and/or

the computer program product is directly loadable into the internal memory of the computer and/or transmittable via a network by means of at least one of upload, download and push procedures.

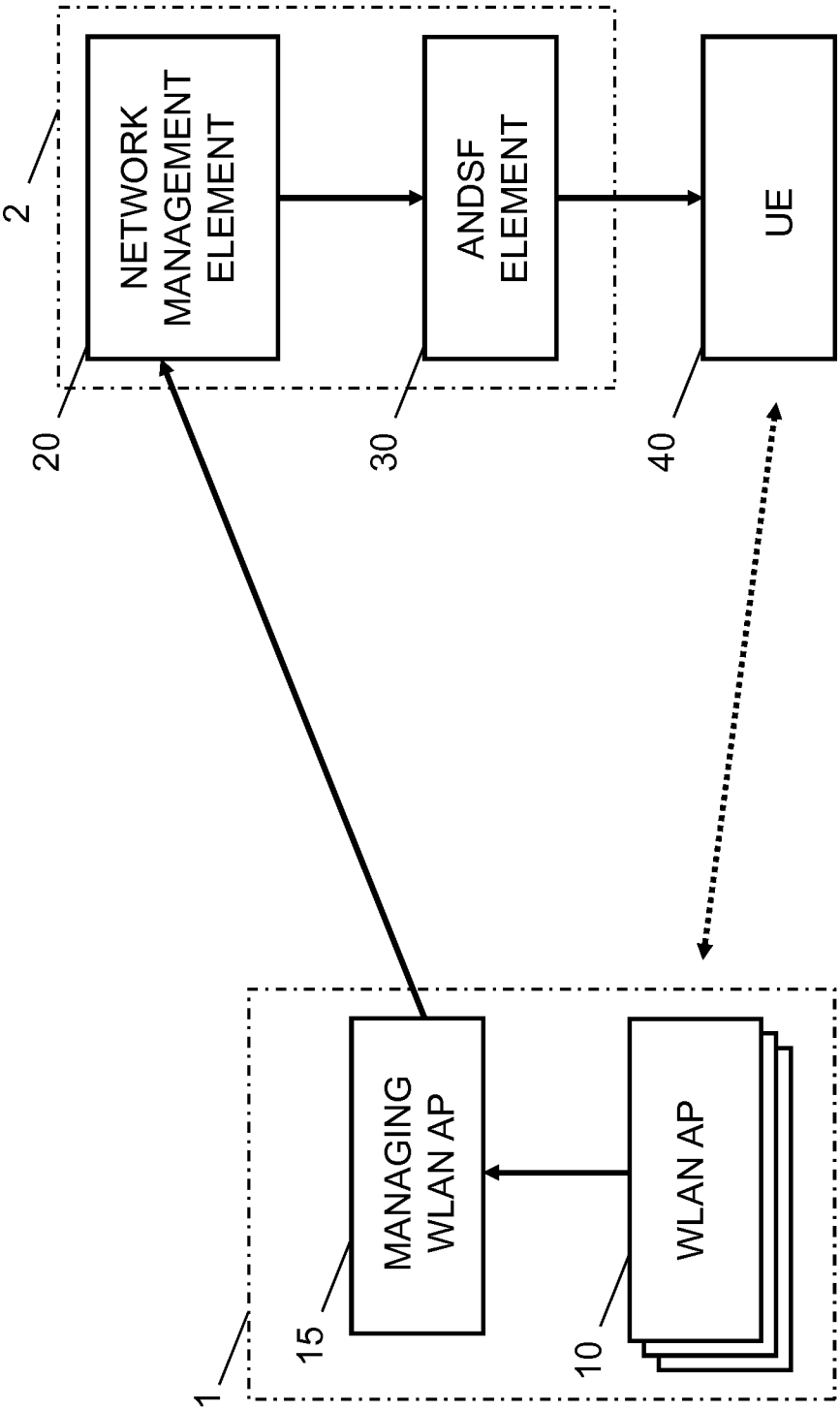

2
NETWORK MANAGEMENT ELEMENT
ANDSF ELEMENT
UE
20
30
40
MANAGING WLAN AP
WLAN AP
15
10
1

Fig. 1

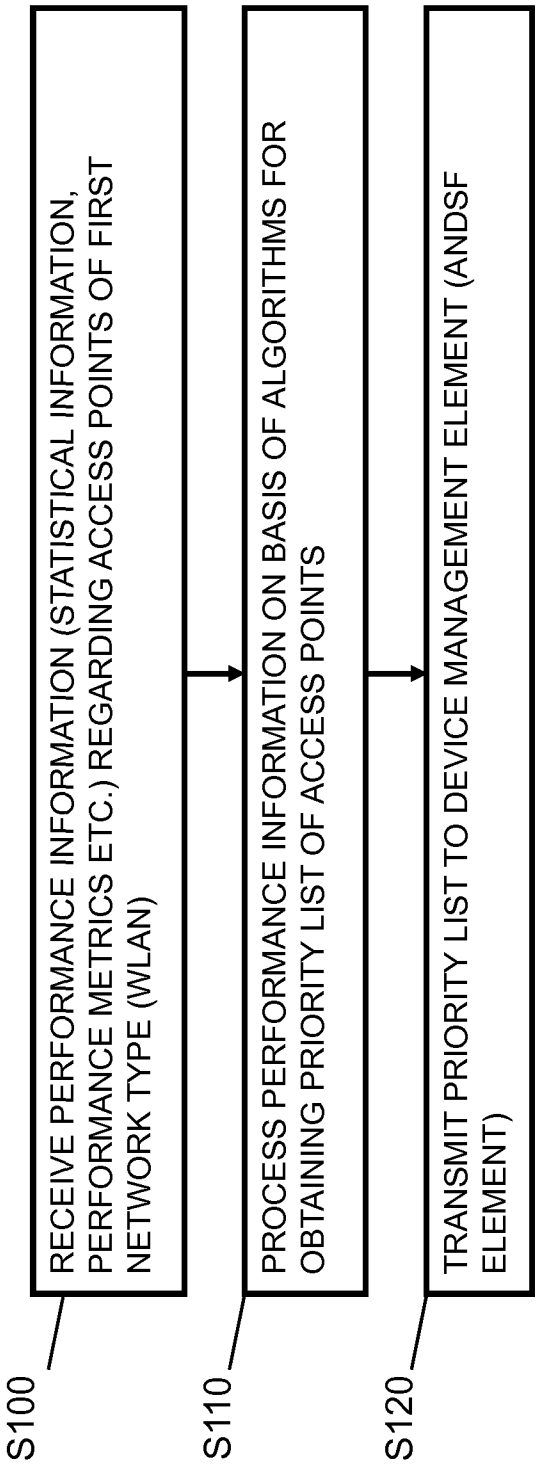

S100
RECEIVE PERFORMANCE INFORMATION (STATISTICAL INFORMATION, PERFORMANCE METRICS ETC.) REGARDING ACCESS POINTS OF FIRST NETWORK TYPE (WLAN)
S110
PROCESS PERFORMANCE INFORMATION ON BASIS OF ALGORITHMS FOR OBTAINING PRIORITY LIST OF ACCESS POINTS
S120
TRANSMIT PRIORITY LIST TO DEVICE MANAGEMENT ELEMENT (ANDSF ELEMENT)

Fig. 2

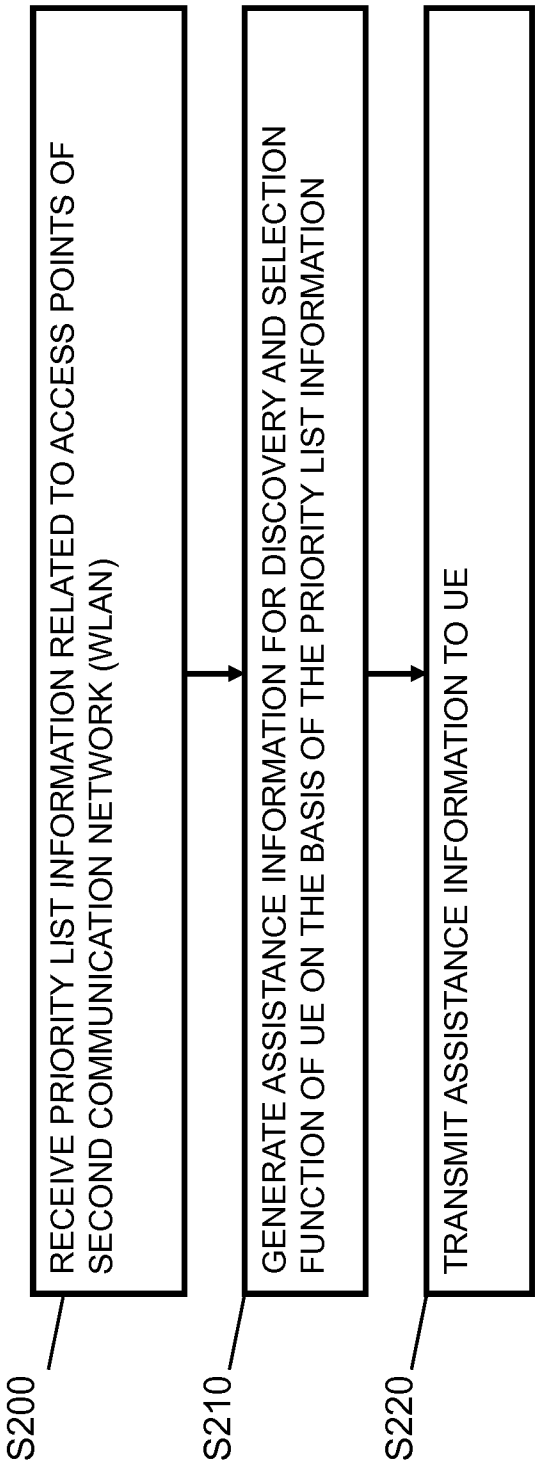

S200
RECEIVE PRIORITY LIST INFORMATION RELATED TO ACCESS POINTS OF SECOND COMMUNICATION NETWORK (WLAN)
S210
GENERATE ASSISTANCE INFORMATION FOR DISCOVERY AND SELECTION FUNCTION OF UE ON THE BASIS OF THE PRIORITY LIST INFORMATION
S220
TRANSMIT ASSISTANCE INFORMATION TO UE

Fig. 3

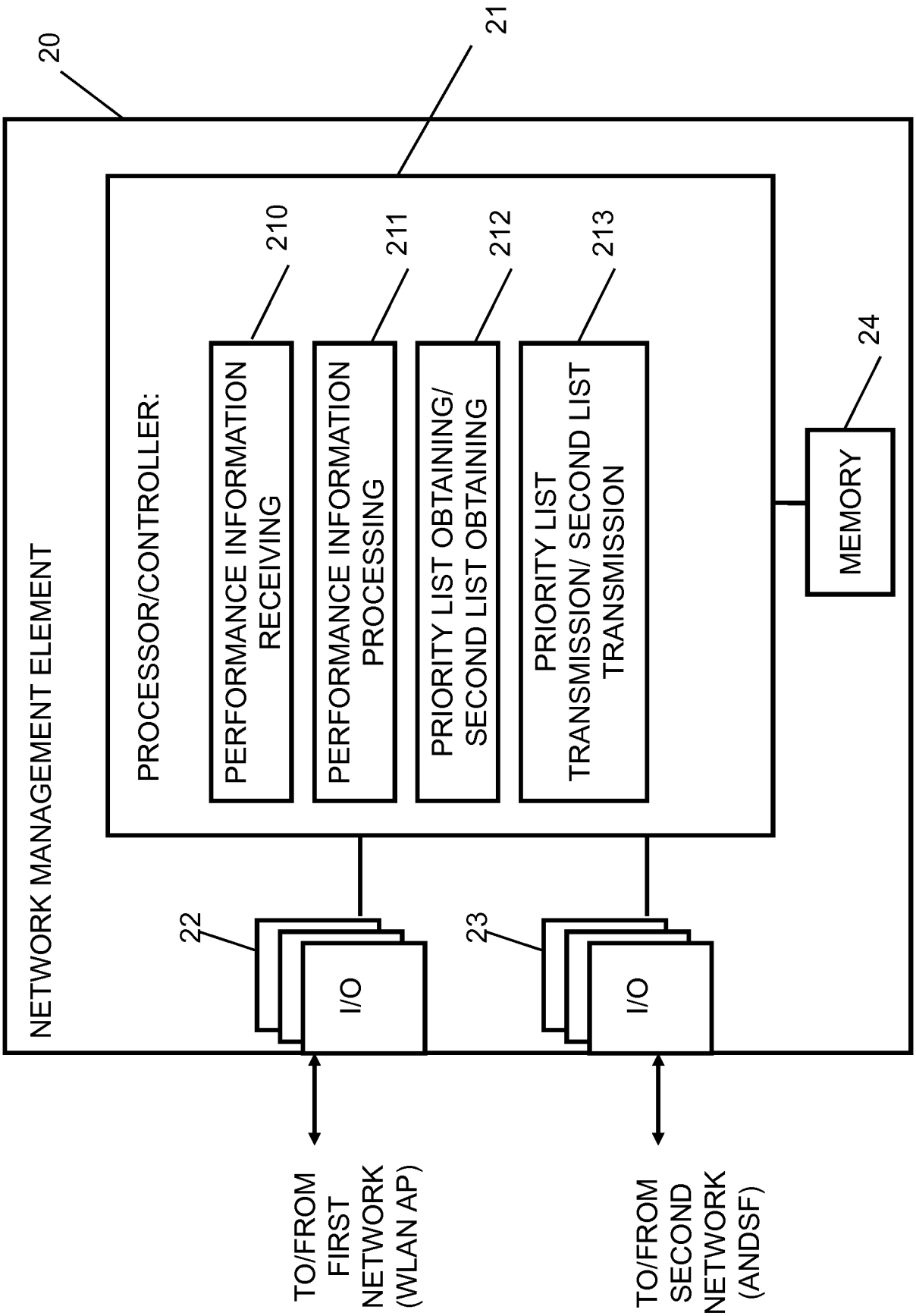

20
21
NETWORK MANAGEMENT ELEMENT
PROCESSOR/CONTROLLER:
210
PERFORMANCE INFORMATION RECEIVING
211
PERFORMANCE INFORMATION PROCESSING
212
PRIORITY LIST OBTAINING/ SECOND LIST OBTAINING
213
PRIORITY LIST TRANSMISSION/ SECOND LIST TRANSMISSION
24
MEMORY
22
I/O
23
I/O
TO/FROM FIRST NETWORK (WLAN AP)
TO/FROM SECOND NETWORK (ANDSF)

Fig. 4

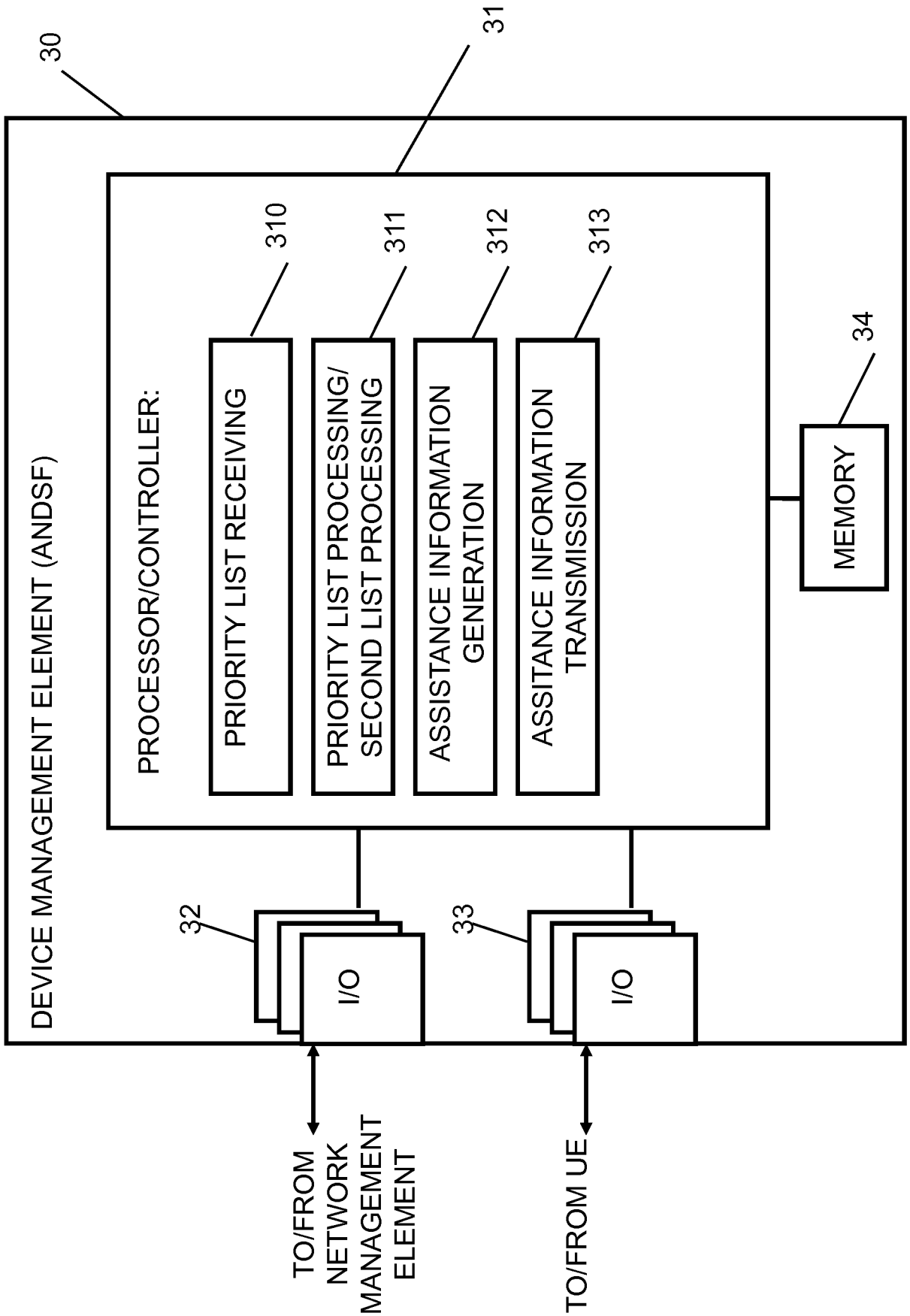

30
31
DEVICE MANAGEMENT ELEMENT (ANDSF)
PROCESSOR/CONTROLLER:
310
PRIORITY LIST RECEIVING
311
PRIORITY LIST PROCESSING/ SECOND LIST PROCESSING
312
ASSISTANCE INFORMATION GENERATION
313
ASSITANCE INFORMATION TRANSMISSION
34
MEMORY
32
I/O
33
I/O
TO/FROM NETWORK MANAGEMENT ELEMENT
TO/FROM UE

Fig. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/065426

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W48/20
ADD.

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

B. FIELDS SEARCHED

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

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012/196644 A1 (SCHERZER SHIMON [IL] ET AL) 2 August 2012 (2012-08-02)	1-4, 7-11, 14-16, 19-21, 24-26
Y	abstract page 3, paragraph 57 page 4, paragraphs 58-60,62-67 page 5, paragraphs 68,75-80 page 6, paragraph 81 - page 7, paragraph 85 page 9, paragraph 102	5,6,12, 13,17, 18,22,23

-/--

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

[X] See patent family annex.

* Special categories of cited documents :

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

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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 April 2013	06/05/2013

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Jurca, Dan

2

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

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2009/080381 A1 (YASHAR HAIM [US] ET AL) 26 March 2009 (2009-03-26) page 2, paragraph 13-15 page 3, paragraph 29 - page 4, paragraph 39 page 4, paragraph 51	5,6,12, 13,17, 18,22,23
A	PANASONIC ET AL: "Interaction of ANDSF with enhanced policy framework", 3GPP DRAFT; S2-104705_ANDSF_POLICY-ENHANCEMENT_V2, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. SA WG2, no. Prague, Czech Republic; 20101011 - 20101015, 5 October 2010 (2010-10-05), XP050631105, [retrieved on 2010-10-05] the whole document	1-26
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