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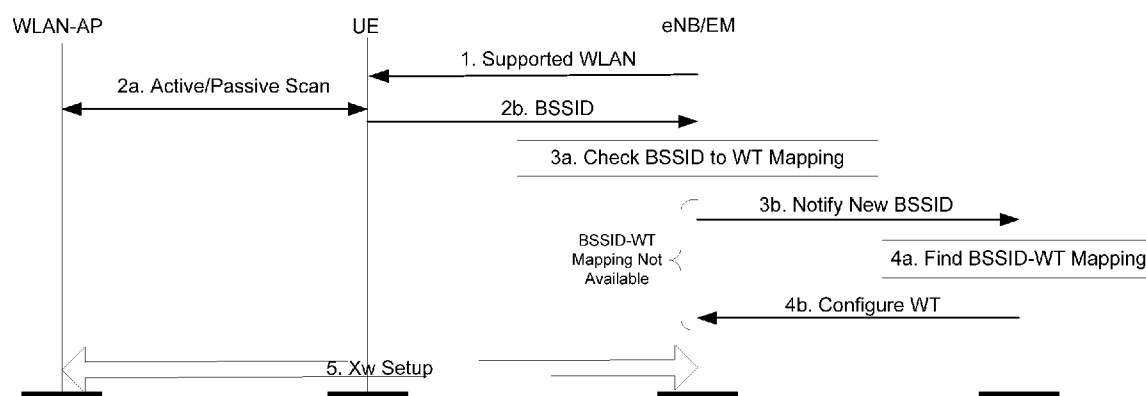


Fig. 6

(57) Abstract: For performing interworking between a network element of a radio access network of a cellular communication system and an access point of a local network, in case configuration information of a logical node of the local network, which controls the access point, is not available (3a) at the network element, the network element acquires (3b, 4b) the configuration information of the logical node based on an identifier of the access point from a network management system of the cellular communication system.

AUTO-CONFIGURATION OF LOCAL NETWORK PARAMETERS IN eNodeB FOR CELLULAR NETWORK-LOCAL NETWORK INTERWORKING

DESCRIPTION

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to auto-configuration of local network parameters in an eNodeB for cellular network-local network interworking, in particular 3GPP-WLAN interworking.

Related background Art

For example, in 3GPP standard, functionality and interfaces required to support offload of cellular network traffic to WLANs has been defined. While initial features supported core network functionality, recently RAN level interworking features have been introduced to allow for dynamic adaptation to radio performance of both the 3GPP and WLAN networks.

For successful operation of RAN level network interworking/aggregation, a network element of a radio access network (RAN) of a cellular communication system, e.g. an eNodeB, has to establish a direct interface to a logical node, e.g. a WT, managing access points (APs) of a local network, e.g. WLAN-APs, under a coverage area of the network element. However, the network element only receives access point identifiers from UE reports and does not know the corresponding logical node.

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

3GPP	Third Generation Partnership Project
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AP	Access Point
BSSID	Basic Service Set Identifier
CM	Configuration Management
EM	Element Manager
HESSID	Homogenous Extended Service Set Identifier
IRP	Interface Reference Point
LWA	LTE-WLAN Aggregation
NM	Network Manager
NMS	Network Management System
NRM	Network Resource Model
OAM	Operations Administration and Maintenance
RCLWI	RAN controlled LTE-WLAN Interworking
SSID	Service Set Identifier
UE	User Equipment
WT	WLAN Termination

SUMMARY OF THE INVENTION

At least one embodiment of the invention addresses the problem of identifying, at a network element of a radio access network of a cellular communication system, a logical node of a local network for a newly discovered access point of the local network, and acquiring configuration information allowing the network element to set up an interface to the logical node and operate network interworking/aggregation.

For overcoming the above and/or other problems, methods, apparatuses and a computer program product are provided as defined in the appended claims.

According to an embodiment of the invention, a network managing system of a cellular communication system is used as an interface between the cellular communication system and a local network, and an interface between an element manager entity of a network element of a radio access

network of the cellular communication system and a network manager entity of the network management system is used to provide mapping from an identifier of an access point of a local network, reported by a UE, to a corresponding logical node of the local network, which controls the access point, and to auto-configure required parameters of the logical node at the network element.

In particular, according to an implementation example of the invention, a 3GPP network manager is used as an interface between 3GPP and WLAN, and an interface Itf-N between an element manager of an eNB and the 3GPP network manager is used to provide mapping from a BSSID of a WLAN-AP reported by a UE to a corresponding WT which controls the WLAN-AP, and to auto-configure required parameters of the WT at the eNB.

At least some embodiments and implementation examples of the invention provide an extendable automated procedure to the network element, e.g. eNB, to acquire configuration information of an unknown logical node, e.g. WT, responsible for a newly discovered identifier, e.g. BSSID. The configuration of the logical node, e.g. WT, supports establishing a direct interface, e.g. an Xw interface, between the network element and the logical node, and successfully operating interworking features of the local network, e.g. WLAN.

By acquiring the configuration information through the network management system, modifications of an air interface of the local network are not required, and a unified interface for local networks is provided to deliver the required information to the cellular communication system. Additionally, providing each eNB with a BSSID to WT mapping is not required.

A point to note is that there may be some delay between the identification of the new BSSID and the establishment of the Xw interface as the eNB needs to acquire the required information from the NM system. However, as

the UE can still be connected to the 3GPP network, there will be no severe impact of this delay. Acquisition of the required information from the NM system may be done only once for all access points under a single logical node. According to an embodiment of the invention, this is achieved by receiving, in the configuration information, a list of identifiers of the access points controlled by the logical node acquired based on the newly discovered identifier. According to another embodiment of the invention, once the direct interface, e.g. Xw, is set up, the network element, e.g. eNB, can request the logical node, e.g. WT, directly via the Xw for all the other supported BSSIDs.

In the following the invention will be described by way of embodiments and implementation examples thereof with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a schematic block diagram illustrating an architecture for RAN level WLAN interworking, in which at least some embodiment of the invention are implementable.

Fig. 2 shows a flow chart illustrating a process 1 of acquiring configuration information for setting up an interface between a network element of a radio access network of a cellular communication system and a logical node of a local network, according to an embodiment of the invention.

Fig. 3 shows a flow chart illustrating a process 2 of acquiring configuration information for setting up the interface between the network element of the radio access network and the logical node of the local network, according to an embodiment of the invention.

Fig. 4 shows a schematic block diagram illustrating a configuration of control units in which examples of embodiments of the invention are implementable.

Fig. 5 shows a diagram illustrating communication between a radio access network and a network managing system for setting up the interface between the radio access network and the local network, according to an embodiment of the invention.

Fig. 6 shows a signaling diagram illustrating notification-configuration message exchange for setting up the interface between the radio access network of the cellular communication system and the local network, according to an implementation example of the invention.

DESCRIPTION OF THE EMBODIMENTS

Fig. 1 shows a schematic block diagram illustrating an architecture for RAN level WLAN interworking, in which at least some embodiments of the invention are implementable. For supporting Radio Controlled LTE-WLAN interworking (RCLWI) and LTE-WLAN Aggregation (LWA), a direct interface Xw between an eNB and one or more WLAN Termination(s) (WT(s)) on the WLAN side is used. For LWA, the Xw interface comprises a control plane (Xw-C) and user plane (Xw-U). The Xw-U is established using LWA specific signaling via the Xw-C. The Xw-U and LWA specific functions, like e.g. flow control, are not part of RCLWI.

A WT is a logical node and 3GPP does not specify where it is implemented, so it may for example be implemented in an AP or at another entity that may be capable of controlling one or more AP(s). Therefore, a WT on WLAN side may be connected to one or more WLAN Access Points (APs). A WT provides the WLAN-side Xw termination functionality for the interworking eNB. The Xw interface allows for the exchange of information between eNB and WT for the successful interworking operation.

Figs. 2 and 3 show flowcharts illustrating processes 1 and 2 of acquiring configuration information for setting up an interface, e.g. the Xw interface, between a network element of a radio access network of a cellular communication system, e.g. the eNB, and a logical node of a local network, e.g. the WT, according to an embodiment of the invention.

As shown in Fig. 2, for performing interworking between the network element of the radio access network of the cellular communication system and an access point of a local network, e.g. an AP of the WLAN, in step S21 of process 1 the network element checks whether configuration information of a logical node of the local network, which controls the access point, is available at the network element. In case the configuration information is not available at the network element, in step S22 the network element acquires the configuration information of the logical node based on an identifier of the access point from a network management system of the cellular communication system, e.g. the OAM shown in Fig. 1.

The network management system comprises a memory which holds mapping information between identifiers of access points of local networks and configuration information of logical nodes of the local networks. As shown in Fig. 3, in step S31 of process 2 the network management system, e.g. a network manager entity of the network management system, receives a notification including an identifier of an access point of a local network from a network element of a radio access network of the cellular communication system. In step S32, the network management system searches the memory based on the identifier for configuration information of a logical node which controls the access point. In step S33, the network management system returns the configuration information to the network element of the radio access network.

Returning to process 1 in Fig. 2, in case the configuration information of the logical node is available at the network element, either already in step S21

or after having acquired the configuration information from the network management system, for performing the interworking, the network element sets up a direct interface between the network element and the logical node based on the configuration information.

In step S22, according to an implementation example of the invention, the network element, e.g. eNB, acquires the configuration information of the logical node from the network management system via an interface, e.g. an Itf-N, between an element manager entity of the network element and a network manager entity of the network management system.

According to an implementation example of the invention to be described later, in step S22 of process 1, the network element informs the network management system about the identifier of the access point using a notification mechanism of the interface between the element manager entity and the network manager entity, and acquires the configuration information through a bulk/basic configuration management mechanism of the interface between the element manager entity and the network manager entity.

Referring again to Fig. 3, in case the configuration information is not found in the memory in step S32 in process 2, according to an embodiment of the invention, the network management system initiates a process to receive the configuration information from the local network.

The configuration information may comprising at least one of an IP address of the logical node, flow control parameters, and a list of identifiers of access points controlled by the logical node.

According to an embodiment of the invention, the network element of the radio access network stores mapping information between identifiers of access points of the local network and configuration information of logical

nodes received from the network management system, e.g. based on the list of identifiers received from the network management system.

Now reference is made to Fig. 4 which shows a schematic block diagram illustrating a configuration of control units 10 and 20 in which examples of embodiments of the invention are implementable.

The control unit 10 comprises processing resources (e.g. processing circuitry and/or processing software) 11, memory resources (memory circuitry) 12 and interfaces (interface circuitry) 13, connected via a bus 14.

Similarly, the control unit 20 comprises processing resources (e.g. processing circuitry and/or processing software) 21, memory resources (memory circuitry) 22 and interfaces (interface circuitry) 23, connected via a bus 24.

The control unit 10 may be part of and/or used by a network element of a radio access network of a cellular communication system, e.g. an eNB, which carries out process 1 of Fig. 2.

The control unit 20 may be part of and/or used by a network management system of the cellular communication system, which carries out process 2 of Fig. 3.

The control units 10 and 20 communicate with each other via their interfaces using a connection 44, e.g. an Itf-N.

According to an embodiment of the invention, information needed for LTE-WLAN inter-operability at an eNB, and in particular information required for Xw setup, is provided through 3GPP OAM using a north bound interface (Itf-N) between an Element Manager (EM) of the eNB and a Network Manager (NM) of the network management system (e.g. OAM).

Fig. 5 illustrates a high level workflow according to this embodiment of the invention. In communication "1" shown in Fig. 5, to support WLAN interworking, the eNB configures UEs to report any WLAN AP from partner WLAN networks. To identify the partner WLAN networks, the eNB communicates corresponding WLAN IDs including but not limited to e.g. SSID, HESSID, BSSID, etc.

In communication "2" in Fig. 5, if a UE observes an AP from the configured partner WLAN networks, by either reading the AP's beacon signal or asking the AP for its BSSID, it reports that BSSID to the serving eNB.

In communication "3" in Fig. 5, in case the eNB does not have the corresponding WT mapping for this BSSID, it triggers a WLAN WT discovery procedure in order to receive the necessary configuration from the NM for setting up the RCLWI/LWA.

In communication "4" in Fig. 5, based on the BSSID, the NM finds connection information (also referred to as configuration information) of a WT that is managing the WLAN AP and returns the configuration information required for setting up and configuring the Xw interface in the eNB.

Using the configuration information received in communication "4", the eNB initiates the Xw interface setup to the WT and configures the Xw.

In the following an implementation example of the invention will be described by referring to Fig. 6.

The explanation of the implementation example of the invention focusses on communications "3" and "4" in Fig. 5, which are based on process 1 in Fig. 2 and process 2 in Fig. 3, respectively.

The implementation example of the invention uses asynchronous "Notification IRP" by extending either an Alarm or Kernel CM IRP and

Bulk/Basic Configuration Management IRPs of 3GPP Itf-N to achieve two processes:

1. Once an eNB detects a WLAN BSSID for which it does not have a mapping to a corresponding WT/Xw, it informs the NM system via its EM about the newly detected BSSID, using the "Notification" mechanism of Itf-N.
2. Upon reception of this notification from the eNB, the NM system is able to look for the corresponding WT for this BSSID as given by the WLAN network and inform the eNB about the corresponding WT's configuration details through the "Bulk/Basic Configuration Management" mechanism of Itf-N.

As illustrated in Fig. 6, in step 1 the eNB configures a UE to report any WLAN AP from a partner WLAN network, similarly to communication "1" in Fig. 5.

In step 2a, the UE observes APs from the configured partner WLAN network, by either reading the AP's beacon signal or asking the AP for its BSSID, and in step 2b, if the UE observes an AP from the configured partner WLAN networks, it reports that BSSID to the serving eNB, similarly to communication "2" in Fig. 5.

In step 3a, the eNB checks if it already has a WT mapping for this BSSID e.g. from an earlier request to NM for a neighboring BSSID. Step 3a is based on step S21 in Fig. 2.

In step 3b, if the eNB does not already have a mapping for the reported BSSID, it asks the NM to provide the details of the relevant WT for this BSSID via the Itf-N. Step 3b is based on step S22 in Fig. 2.

In step 4a, the NM looks for the WT corresponding to the reported new BSSID as provided by the WLAN network. If not identified, the NM can initiate a parallel process to get the required information from the WLAN network. Step 4a is based on step S32 in Fig. 3.

In step 4b, if the WT is identified, the NM sends back (to the eNB via the Itf-N) the configuration details (also referred to as configuration information) of the identified WT including but not limited to e.g. the IP address of the WT, flow control capability supported by the APs controlled by this WT, etc. Step 4b is based on step S33 in Fig. 3.

In step 5, using the configuration information received in step 4b, the eNB initiates the Xw interface setup to the WT and configures the Xw.

According to the implementation example of the invention as described above, the Itf-N between the eNB and its NM system in the 3GPP network is used. In this case, Itf-N (specifically the Alarm and Kernel CM IRPs) is extended and proper messages are defined. Respective sub processes may be implemented in Fig. 6 as follows:

A. Check for BSSID-WT Mapping (Step 3a of Fig. 6)

Each WT provides a termination for multiple BSSIDs. Correspondingly, when a WT is configured in an eNB, the eNB is provided with a list of all the BSSIDs that are supported by that WT. The eNB keeps this list of BSSIDs since they are expected to be within its vicinity and as such may need to be added as neighbor WLAN APs. When one such AP is eventually discovered by a UE and the corresponding BSSID sent to the eNB in step 2b, the eNB identifies the corresponding WT and initiates the required configuration using the existing Xw to the WT.

If instead the eNB does not have a known WT corresponding to this submitted BSSID, it implies that this is a new AP with an unknown termination. The subsequent processes of steps 3b to 4b must then be followed. Note that the eNB may also only keep BSSIDs that have been identified by the UEs. In that case, steps 3b-4b will have to be executed for each new BSSID that is discovered.

B. Notify New BSSID (Step 3b of Fig. 6)

Each WLAN AP represents a neighbor Managed Object (MO) of the eNB for which particular attributes need to be tracked. Such attributes include the WT IP address and the flow control parameters. As soon as a BSSID is identified by UE, a corresponding WT is created at the eNB for the BSSID. Since its WT attributes are missing, that can be interpreted as a database inconsistency alarm at the eNB. Consequently the eNB will raise a database inconsistency alarm to the EM and subsequently to the NM.

According to an implementation example of the invention, steps 3a and 3b are implemented as follows:

1. WLAN_Neighbor_AP is added as a MO of the eNB Network Resource Model (NRM) created for each observed BSSID. Then for the new BSSID, the MO is created using a "createMO" operation of the Bulk/Basic CM mechanism of the EM.
2. MO attributes for this object are added to match the different configuration parameters required for each AP.
3. A specific alarm is added in the eNB alarm list. The specific alarm may be named "WLAN_AP MO_Attributes_Missing" of alarm type database inconsistency.
4. eNB raises the alarm as soon as the MO (WLAN_Neighbor_AP) is created but with attributes not fully configured. Alarm is sent to the NM as "Alarm IRP Notification".

C. Find BSSID-WT Mapping at the NM (Step 4a of Fig. 6)

The NM is assumed to have been synchronized a priori with the WLAN network, i.e., the NM already has a list of the BSSID-WT mapping for all partner WLANs. As such NM looks through this list to identify the appropriate BSSID-WT mapping. If not identified, however, the NM may initiate a parallel process to get the required information from the WLAN network. This could, for example, be done for the case where the NM is synchronized via a permanent Itf-N with the WLAN NM or where the same

NM manages both the 3GPP and WLAN networks as may be the case for a single operator for both networks.

D. Configure WT (Step 4b of Fig. 6)

After the NM has obtained the BSSID-WT mapping, it may configure the corresponding eNB's MO via the Bulk/Basic Configuration Management mechanisms. Since the MO has already been added to the eNB NRM with the appropriate attributes fields, the NM may configure the MO using the "setMO attributes" operation of the Bulk/Basic CM mechanism with the MO given as the WLAN AP.

According to an embodiment of the invention, the configuration details (also referred to as configuration information) reported by the NM system to the eNB include the WT's IP address for the Xw interface termination and the flow control capability supported by the APs controlled by this WT. It may, however, also include any other WT related parameter, which the NM system finds useful for optimal operation of the WLAN interworking, and which the eNB cannot access via the Xw interface. The granularity of such configuration parameters, except the WT's IP address, could be at the WT level or even at the AP level, in which case the AP-specific parameters are separately communicated.

According to an aspect of the invention, a network element of a radio access network of a cellular communication system is provided. According to an implementation example of this aspect, the network element comprises and/or uses the control unit 10 shown in Fig. 4. The network element comprises means for, for performing interworking between the network element and an access point of a local network, checking whether configuration information of a logical node of the local network, which controls the access point, is available at the network element, and means for, in case the configuration information is not available at the network element, acquiring the configuration information of the logical node

based on an identifier of the access point from a network management system of the cellular communication system.

According to an implementation example of the above aspect, the network element comprises means for, for performing the interworking, in case the configuration information is available at the network element, setting up a direct interface between the network element and the logical node based on the configuration information.

According to an implementation example of the above aspect, the network element comprises means for acquiring the configuration information of the logical node from the network management system via an interface between an element manager entity of the network element and a network manager entity of the network management system.

According to an implementation example of the above aspect, the network element comprises means for informing the network management system about the identifier of the access point using a notification mechanism of the interface between the element manager entity and the network manager entity, and means for acquiring the configuration information through a bulk/basic configuration management mechanism of the interface between the element manager entity and the network manager entity.

According to an implementation example of the above aspect, the network element comprises means for storing mapping information between identifiers of access points of the local network and configuration information of logical nodes received from the network management system.

According to an implementation example of the above aspect, the means of the network element are implemented by the processing resources 11, memory resources 12 and interfaces 13.

According to another aspect of the invention, an apparatus of a network management system of a cellular communication system is provided, the network management system comprising a memory which holds mapping information between identifiers of access points of local networks and configuration information of logical nodes of the local networks. According to an implementation example of this aspect, the apparatus comprises and/or uses the control unit 20 shown in Fig. 4.

According to an implementation example of the above aspect, the apparatus comprises means for receiving a notification including an identifier of an access point of a local network from a network element of a radio access network of the cellular communication system, means for searching the memory based on the identifier for configuration information of a logical node which controls the access point, and means for returning the configuration information to the network element of the radio access network.

According to an implementation example of the above aspect, the apparatus comprises means for, in case the configuration information is not found in the memory, initiating a process to receive the configuration information from the local network.

According to an implementation example of the above aspect, the apparatus comprises means for returning the configuration information of the logical node to the network element via an interface between an element manager entity of the network element and a network manager entity of the network management system. According to an implementation example of the above aspect, the apparatus comprises the network manager entity.

According to an implementation example of the above aspect, the apparatus comprises means for receiving the notification through a notification mechanism of the interface between the element manager entity and the network manager entity, and means for returning the configuration

information using a bulk/basic configuration management mechanism of the interface between the element manager entity and the network manager entity.

According to an implementation example of the above aspect, the means of the apparatus are implemented by the processing resources 21, memory resources 22 and interfaces 23.

According to an implementation example of the above aspects, the configuration information comprises at least one of an IP address of the logical node, flow control parameters, and a list of identifiers of access points controlled by the logical node, the cellular communication system comprises a third generation partnership project (3GPP) network, the local network comprises a wireless local area network (WLAN), and the network element comprises an eNodeB.

It is to be understood that the above description is illustrative of the invention and is not to be construed as limiting the invention. Various modifications and applications may occur to those skilled in the art without departing from the true spirit and scope of the invention as defined by the appended claims.

CLAIMS:

1. A method for use by a network element of a radio access network of a cellular communication system, the method comprising:

for performing interworking between the network element and an access point of a local network, checking whether configuration information of a logical node of the local network, which controls the access point, is available at the network element; and

in case the configuration information is not available at the network element, acquiring the configuration information of the logical node based on an identifier of the access point from a network management system of the cellular communication system.

2. The method of claim 1, comprising:

for performing the interworking, in case the configuration information is available at the network element, setting up a direct interface between the network element and the logical node based on the configuration information.

3. The method of claim 1 or 2, comprising:

acquiring the configuration information of the logical node from the network management system via an interface between an element manager entity of the network element and a network manager entity of the network management system.

4. The method of claim 3, comprising:

informing the network management system about the identifier of the access point using a notification mechanism of the interface between the element manager entity and the network manager entity; and

acquiring the configuration information through a bulk/basic configuration management mechanism of the interface between the element manager entity and the network manager entity.

5. The method of any one of claims 1 to 4, comprising:

storing mapping information between identifiers of access points of the local network and configuration information of logical nodes received from the network management system.

6. A method for use by a network management system of a cellular communication system, the network management system comprising a memory which holds mapping information between identifiers of access points of local networks and configuration information of logical nodes of the local networks, the method comprising:

receiving a notification including an identifier of an access point of a local network from a network element of a radio access network of the cellular communication system;

searching the memory based on the identifier for configuration information of a logical node which controls the access point; and

returning the configuration information to the network element of the radio access network.

7. The method of claim 6, comprising:

in case the configuration information is not found in the memory, initiating a process to receive the configuration information from the local network.

8. The method of claim 6 or 7, comprising:

returning the configuration information of the logical node to the network element via an interface between an element manager entity of the network element and a network manager entity of the network management system.

9. The method of claim 8, comprising:

receiving the notification through a notification mechanism of the interface between the element manager entity and the network manager entity; and

returning the configuration information using a bulk/basic configuration management mechanism of the interface between the element manager entity and the network manager entity.

10. The method of any one of claims 1 to 9, the configuration information comprising at least one of an IP address of the logical node, flow control parameters, and a list of identifiers of access points controlled by the logical node.

11. The method of any one of claims 1 to 10, wherein

the cellular communication system comprises a third generation partnership project (3GPP) network; and/or

the local network comprises a wireless local area network (WLAN); and/or

the network element comprises an eNodeB.

12. A computer program product including a program for a processing device, comprising software code portions for performing the steps of any one of claims 1 to 11 when the program is run on the processing device.

13. The computer program product according to claim 12, wherein the computer program product comprises a computer-readable medium on which the software code portions are stored.

14. The computer program product according to claim 12, wherein the program is directly loadable into an internal memory of the processing device.

15. A network element of a radio access network of a cellular communication system, the network element comprising at least one processor and at least one memory including computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause the network element at least to perform:

for performing interworking between the network element and an access point of a local network, checking whether configuration information of a logical node of the local network, which controls the access point, is available at the network element; and

in case the configuration information is not available at the network element, acquiring the configuration information of the logical node based on an identifier of the access point from a network management system of the cellular communication system.

16. The network element of claim 15, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the network element to perform:

for performing the interworking, in case the configuration information is available at the network element, setting up a direct interface between the network element and the logical node based on the configuration information.

17. The network element of claim 15 or 16, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the network element to perform:

acquiring the configuration information of the logical node from the network management system via an interface between an element manager entity of the network element and a network manager entity of the network management system.

18. The network element of claim 17, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the network element to perform:

informing the network management system about the identifier of the access point using a notification mechanism of the interface between the element manager entity and the network manager entity; and

acquiring the configuration information through a bulk/basic configuration management mechanism of the interface between the element manager entity and the network manager entity.

19. The network element of any one of claims 15 to 18, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the network element to perform:

storing mapping information between identifiers of access points of the local network and configuration information of logical nodes received from the network management system.

20. The network element of any one of claims 15 to 19, wherein

the cellular communication system comprises a third generation partnership project (3GPP) network; and/or

the local network comprises a wireless local area network (WLAN); and/or

the network element comprises an eNodeB; and/or

the network element comprises the element manager entity.

21. An apparatus of a network management system of a cellular communication system, the network management system comprising a memory which holds mapping information between identifiers of access points of local networks and configuration information of logical nodes of the local networks, the apparatus comprising at least one processor and at least one memory including computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus at least to perform:

receiving a notification including an identifier of an access point of a local network from a network element of a radio access network of the cellular communication system;

searching the memory based on the identifier for configuration information of a logical node which controls the access point; and

returning the configuration information to the network element of the radio access network.

22. The apparatus of claim 21, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to perform:

in case the configuration information is not found in the memory, initiating a process to receive the configuration information from the local network.

23. The apparatus of claim 21 or 22, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to perform:

returning the configuration information of the logical node to the network element via an interface between an element manager entity of the network element and a network manager entity of the network management system.

24. The apparatus of claim 23, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to perform:

receiving the notification through a notification mechanism of the interface between the element manager entity and the network manager entity; and

returning the configuration information using a bulk/basic configuration management mechanism of the interface between the element manager entity and the network manager entity.

25. The apparatus of any one of claims 21 to 24, wherein

the cellular communication system comprises a third generation partnership project (3GPP) network; and/or

the local network comprises a wireless local area network (WLAN); and/or

the network element comprises an eNodeB; and/or
the network element comprises the element manager entity; and/or
the apparatus comprises the network manager entity.

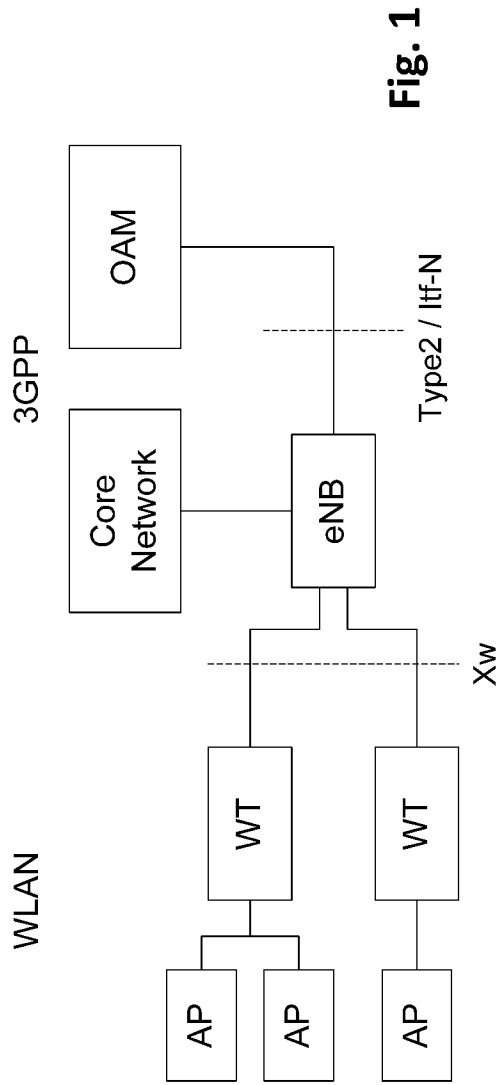


Fig. 1

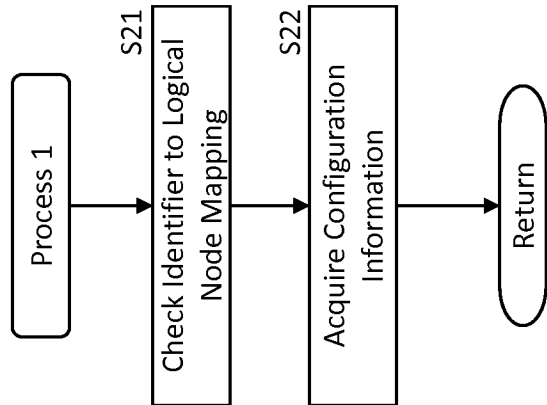


Fig. 2

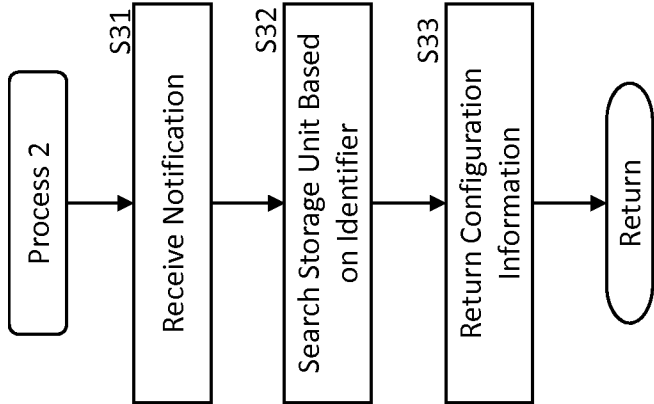


Fig. 3

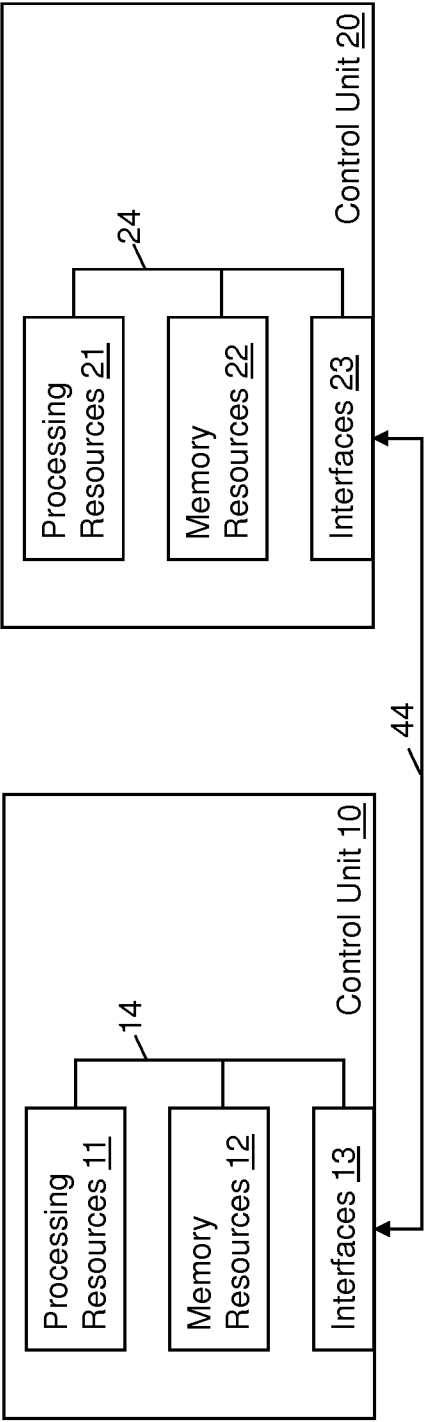


Fig. 4

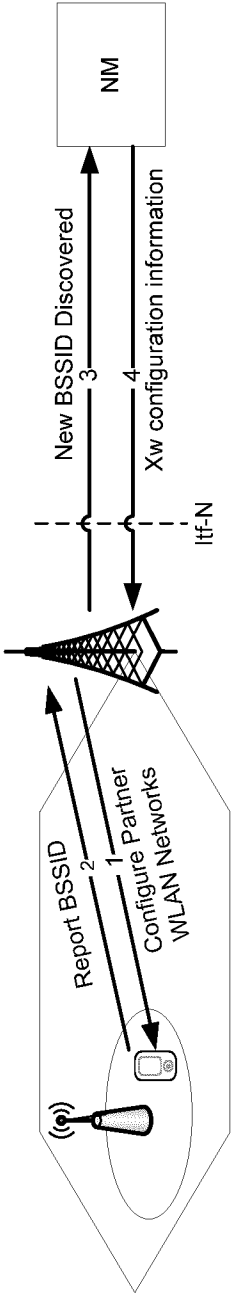


Fig. 5

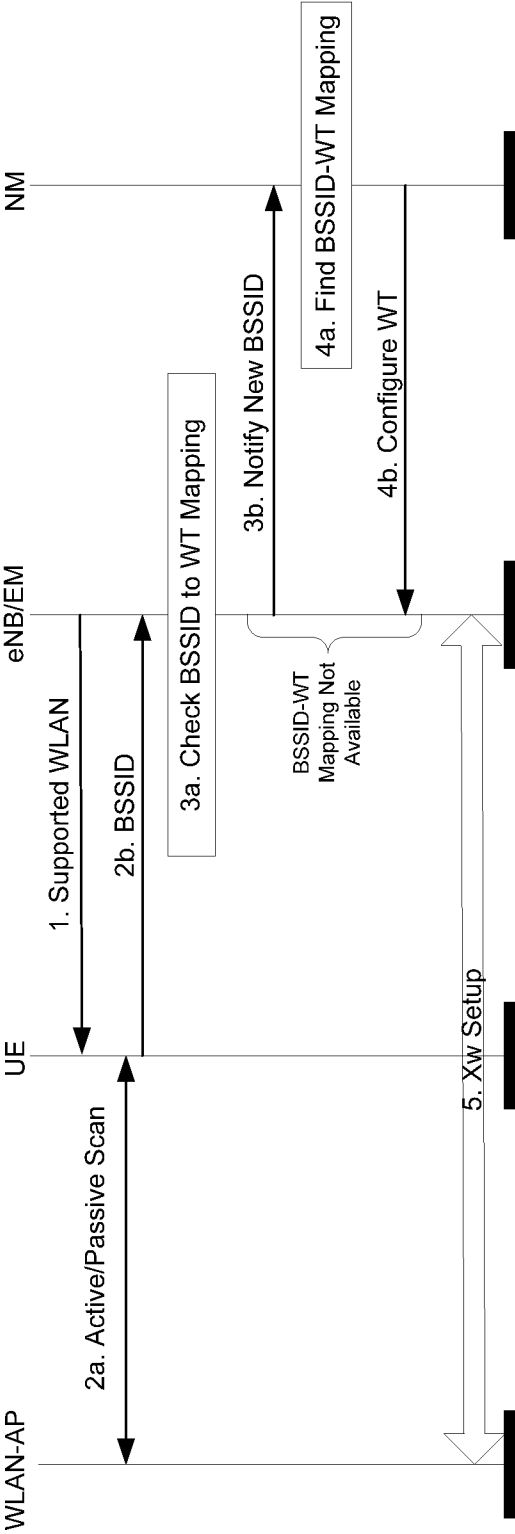


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/076649

A. CLASSIFICATION OF SUBJECT MATTER

INV. H04W92/02 H04W92/20
ADD. H04L12/24 H04W24/10 H04W72/04 H04W76/02

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 H04L

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)

EP0-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	ERICSSON: "The Importance of WT Address Look-Up", 3GPP DRAFT; R3-160088, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE vol. RAN WG3, no. Budapest, HU; 20160120 - 20160122 11 January 2016 (2016-01-11), XP051067040, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg_ran/WG3_Iu/TSGR3_AHGs/R3_AHG_NB-IOT/Docs/[retrieved on 2016-01-11]	1-6,8-25
Y	1 Introduction 2 Discussion (page 1) figure 1 2.2.1 DNS Query -/--	7,22



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

28 April 2017

Date of mailing of the international search report

11/05/2017

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/076649

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	figure 2 ----- NEC: "Automatic Neighbour Relation for LWA", 3GPP DRAFT; R3-161181 ANR, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. RAN WG3, no. Nanjing, P.R. China; 20160523 - 20160527 22 May 2016 (2016-05-22), XP051105985, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/Meetings_3GPP_SYNC/RAN3/Docs/ [retrieved on 2016-05-22]	1-6, 8-21, 23-25
A	1 Introduction 2.1 Network-based Solution figure 1	7,22
X	----- INTEL CORPORATION: "ANR aspects of LWA", 3GPP DRAFT; R2-162464-LWA-ANR-V1, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. RAN WG2, no. Dubrovnik, Croatia; 20160411 - 20160415 2 April 2016 (2016-04-02), XP051082421, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_93bis/Docs/ [retrieved on 2016-04-02]	1-6, 8-21, 23-25
A	1 Introduction figures 1,3 page 2 ----- -/--	7,22

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2016/076649

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	NOKIA NETWORKS: "WT address look-up for automated Xw-C Setup", 3GPP DRAFT; R3-160074 WAS 152648, 2122 - AUTOMATED XW-C SETUP, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. RAN WG3, no. Budapest, HU; 20160120 - 20160122 11 January 2016 (2016-01-11), XP051067030, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg_ran/WG3_Iu /TSGR3_AHGs/R3_AHG_NB-IOT/Docs/ [retrieved on 2016-01-11]	1-6, 8-21, 23-25
A	2.2.1 Network (OAM) based Xw setup figures 1, 2	7,22
Y	----- CATT: "Discussion on ANR for LWA", 3GPP DRAFT; R3-160613 DISCUSSION ON ANR FOR LWA, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE , vol. RAN WG3, no. Bangalore, India; 20160411 - 20160415 1 April 2016 (2016-04-01), XP051082826, Retrieved from the Internet: URL:http://www.3gpp.org/ftp/tsg_ran/WG3_Iu /TSGR3_91bis/Docs/ [retrieved on 2016-04-01] 2.2.1 Solutions proposed in Rel-13 2.2.2 Evolved solution Figure WT IP@ feceth and Xw automatic setup procedure	7,22
A	----- NUGGEHALLI PAVAN: "LTE-WLAN aggregation [Industry Perspectives]", IEEE WIRELESS COMMUNICATIONS, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 23, no. 4, 1 August 2016 (2016-08-01) , pages 4-6, XP011621032, ISSN: 1536-1284, DOI: 10.1109/MWC.2016.7553017 [retrieved on 2016-08-25] the whole document -----	1-25