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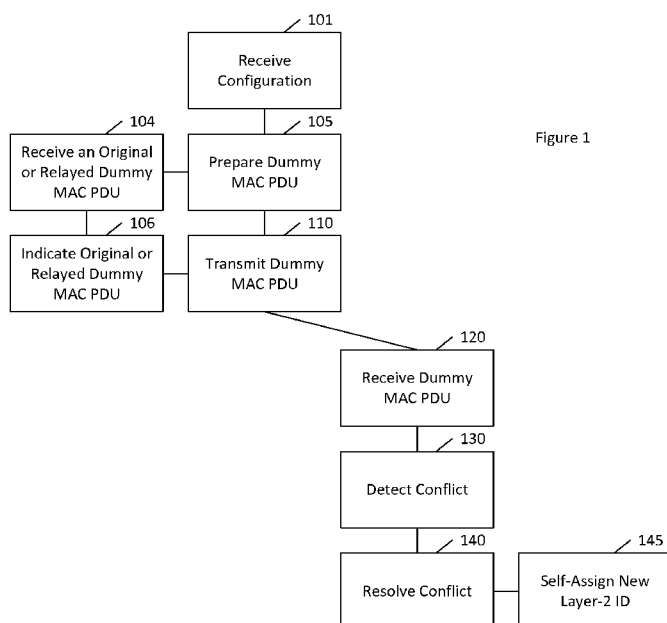
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(54) Title: PROXIMITY SERVICES LAYER-2 ID COLLISION DETECTION



(57) Abstract: Various communication systems may benefit from unequivocal identification of participants in the communication. For example layer-2 identifier collision detection may be useful in wireless communications systems, such as those configured to operate proximity services. A method can include preparing, at a user equipment, a control information including at least a source identifier and a destination identifier. The method can also include transmitting, by the user equipment, the control information to a plurality of user equipment. The source identifier and the destination identifier can be configured to correspond to identifiers being used by the user equipment.

TITLE:

Proximity Services Layer-2 ID Collision Detection

BACKGROUND:**Field:**

[0001] Various communication systems may benefit from unequivocal identification of participants in the communication. For example layer-2 identifier collision detection may be useful in wireless communications systems, such as those configured to operate proximity services.

Description of the Related Art:

[0002] Proximity services (ProSe)/ device-to-device (D2D) enhancement in 3GPP rel'13 or beyond can be concerned with defining enhancements to D2D communication to enable features such as the support of the extension of network coverage using L3-based user equipment (UE)-to-Network Relays, including service continuity (if needed), based on Release 12 D2D communication, considering applicability to voice, video. This is discussed in the third generation partnership project (3GPP) report RP-150441, "Revised WI: Enhanced LTE Device to Device Proximity Services," which is hereby incorporated herein by reference in its entirety.

[0003] Rel'12 ProSe communication focused on one-to-many ProSe direct communication, which is connectionless and thus there is no signaling over PC5 control plane. The Source Layer-2 ID in medium access control (MAC) packet data unit (PDU) header can be used to identify the sender of the data over PC5 and Destination Layer-2 ID can be used to identify the target of the data transmitted over PC5. No access stratum signaling may be required to configure Source Layer-2 ID, Destination Layer-2 ID in the UE. These identities can either be provided by higher layer or derived from identities provided by higher layer. In case of groupcast and broadcast, the ProSe UE ID provided by higher layer can be used directly as the Source Layer-2 ID and the

ProSe Layer-2 Group ID provided by higher layer can be used directly as the Destination Layer-2 ID in the MAC layer.

[0004] 3GPP rel'13 enhanced ProSe to support one-to-one direct communication. Each UE may have a Layer-2 ID for unicast communication that is included in the Source Layer-2 ID field of every frame that it sends on the layer-2 link and in the Destination Layer-2 ID of every frame that it receives on the layer-2 link.

[0005] The UE may need to ensure that the Layer-2 ID for unicast communication is at least locally unique. So the UE may need to be prepared to handle Layer-2 ID conflicts with adjacent UEs using some mechanisms, for example to self-assign a new Layer-2 ID for unicast communication when a conflict is detected.

[0006] Considering ProSe UE ID used as Source/Destination Layer-2 ID with 24 bits may not ensure globally uniqueness, Layer-2 ID conflict (which means two ProSe UEs within proximity are configured/self-assigned the same Layer-2 ID) may need to be resolved. One option would be to self-assign a new layer-2 ID for unicast communication when a conflict is detected. However, detection of Layer-2 ID conflict should be performed before the conflict can be resolved, especially in out-of-coverage scenario lacking a central control/management entity to coordinate the layer-2 ID assignment.

[0007] These and related materials are discussed in the following documents, each of which is hereby incorporated herein by reference: 3GPP TR 23.303 Proximity-based services; stage 2, V12.5.0; 3GPP TS 36.300 E-UTRAN Overall description; stage 2, V12.6.0; and 3GPP TR23.713 Study on extended architecture support for proximity-based services, V1.5.0.

SUMMARY:

[0008] According to certain embodiments, a method can include preparing, at a user equipment, a control information including at least a source

identifier and a destination identifier. The method can also include transmitting, by the user equipment, the control information to a plurality of user equipment. The source identifier and the destination identifier can be configured to correspond to identifiers being used by the user equipment.

[0009] In certain embodiments, a method can include receiving, by a second user equipment a control information including at least a source identifier and a destination identifier, from a first user equipment. The method can also include detecting a conflict based on at least one of the source identifier or the destination identifier in the control information. The method can further include resolving the detected conflict.

[0010] An apparatus, according to certain embodiments, can include at least one processor and at least one memory including computer program code. The at least one memory and the computer program code can be configured to, with the at least one processor, cause the apparatus at least to prepare, at a user equipment, a control information including at least a source identifier and a destination identifier. The at least one memory and the computer program code can also be configured to, with the at least one processor, cause the apparatus at least to transmit, by the user equipment, the control information to a plurality of user equipment. The source identifier and the destination identifier can be configured to correspond to identifiers being used by the user equipment.

[0011] An apparatus, in certain embodiments, can include at least one processor and at least one memory including computer program code. The at least one memory and the computer program code can be configured to, with the at least one processor, cause the apparatus at least to receive, by a second user equipment a control information including at least a source identifier and a destination identifier from a first user equipment. The at least one memory and the computer program code can also be configured to, with the at least one processor, cause the apparatus at least to detect a conflict based on at least one of the source identifier or the destination identifier in the

control information. The at least one memory and the computer program code can be further configured to, with the at least one processor, cause the apparatus at least to resolve the detected conflict.

[0012] According to certain embodiments, an apparatus can include means for preparing, at a user equipment, a control information including at least a source identifier and a destination identifier. The apparatus can also include means for transmitting, by the user equipment, the control information to a plurality of user equipment. The source identifier and the destination identifier can be configured to correspond to identifiers being used by the user equipment.

[0013] In certain embodiments, an apparatus can include means for receiving, by a second user equipment a control information including at least a source identifier and a destination identifier, from a first user equipment. The apparatus can also include means for detecting a conflict based on at least one of the source identifier or the destination identifier in the control information. The apparatus can further include means for resolving the detected conflict.

[0014] A computer program product can, in certain embodiments, encode instructions for performing a process. The process can be any of the above-described methods.

[0015] A non-transitory computer-readable medium can, according to certain embodiments, be encoded with instructions that, when executed in hardware, perform a process. The process can be any of the above-described methods.

BRIEF DESCRIPTION OF THE DRAWINGS:

[0016] For proper understanding of the invention, reference should be made to the accompanying drawings, wherein:

[0017] Figure 1 illustrates a method according to certain embodiments.

[0018] Figure 2 illustrates a system according to certain embodiments.

DETAILED DESCRIPTION:

[0019] Certain embodiments provide an in-band collision detection mechanism on an access stratum (AS) level without either UE monitoring all the MAC PDUs or out-of-band signaling on UE ID request and response. Thus, certain embodiments can address an issue that can arise when conflicts occur and the same layer-2 ID is provided by higher layers to numerous UEs that use Proximity Services. The layer-2 ID can be used in the MAC PDU header for UE identification purposes. Certain embodiments may ensure that such conflicts are detected.

[0020] Figure 1 illustrates a method according to certain embodiments. As shown for example in Figure 1, in certain embodiments a dummy MAC PDU can be transmitted, at 110, by a UE. This may be a UE that uses proximity services. The transmitted dummy MAC PDU can be prepared at 105.

[0021] The dummy MAC PDU can then be received, at 120, by one or more other UEs. These other UEs can also be using proximity services. This dummy MAC PDU can include a Source Layer-2 ID and Destination Layer-2 ID within the MAC PDU header, in which both Source Layer-2 ID and Destination Layer-2 ID is set to its own Layer-2 ID. The receiving UE, having the same layer-2 ID, can receive the dummy packet based on the Destination Layer-2 ID in the MAC PDU header of the dummy packet. The receiving UE can, at 130, detect that the Source Layer-2 ID in the packet is the same as its own Layer-2 ID, and therefore can detect a conflict. The receiving UE can then, at 140 resolve this conflict according to any desired or currently defined mechanisms.

[0022] Thus, certain embodiments may provide a simple AS level L2 ID collision detection method facilitated by a dummy MAC PDU that is transmitted by a ProSe UE and received by other ProSe UEs who are assigned the same L2 ID.

[0023] ProSe capable UEs may be configured to transmit the dummy MAC PDU either periodically or event triggered or both. The periodic trigger may be configured to the ProSe UEs which may be mainly on the listening/receiving mode or during the continuous ProSe communication transmission. The event triggers may be defined, for example before ProSe UE starts new transmission after certain time period silence, or ProSe receiving (Rx) UE receives more than a configurable parameter, M , MAC PDUs from more than another configurable parameter, N , different ProSe Tx UEs during less than a third configurable parameter, L , time period. In such cases, the probability of L2 ID collision may be higher as some ProSe Tx UEs may send data to another ProSe UEs which are assigned the same L2 ID. The triggers may be pre-configured to out-of-coverage ProSe UEs. For in-coverage ProSe UEs, the triggers may be configured by the network either via dedicated or broadcast signaling. This configuration can be received by the user equipment at 101 in Figure 1.

[0024] ProSe UEs, upon triggering the transmission of the dummy MAC PDU, may transmit the dummy MAC PDU in which both the Source Layer-2 ID and Destination Layer-2 ID in MAC PDU header are set to its own Layer-2 ID. In this way, the other ProSe UE that has the same Layer-2 ID can receive the dummy packet, as the destination Layer-2 ID can indicate the packet is targeted to it. Based on the source layer-2 ID in the received MAC PDU, the other ProSe UE can detect L2 ID collision and can resolve the collision. One option for resolving the collision may be to, at 145, self-assign a new layer-2 ID.

[0025] The dummy MAC PDU may consist of only a SideLink-Shared Channel (SL-SCH) MAC subheader as specified in 3GPP TS 36.321 to have source layer-2 ID and destination Layer-2 ID. If any further information is desired in the dummy MAC PDU (as described, for example, below), one or more new MAC control element may be specified to convey the further information.

[0026] Certain embodiments may solve a hidden node problem on the L2 ID collision detection, such as two ProSe UEs with same Layer-2 ID that cannot hear each other, but both of them may be in the proximity of another ProSe UE that has ProSe communication with one of the ProSe UEs. To detect the L2 ID conflict in this case, a ProSe UE may be configured to relay the received dummy MAC PDU if the dummy MAC PDU receiving UE has active ProSe communication with the dummy MAC PDU transmitting UE. In order to avoid multi-hop relay of the dummy MAC PDU, a new MAC control element may be introduced to indicate if the dummy MAC PDU is the original or relayed one with one or multiple bits indication. This may be used to prevent the relayed dummy MAC PDU from being relayed more than once, or more than a set number of times.

[0027] Thus, at 104 a user equipment can receive an original or relayed dummy MAC PDU if the user equipment has active ProSe communication with the dummy MAC PDU transmitting UE. If the dummy MAC PDU has already been relayed, the user equipment can simply discard it. If it is an original MAC PDU, then preparing at 105 can involve updating one or more bits of the message to change it from original to relayed. Then, the transmitting at 110 can involve forwarding the packet data unit with the source layer-2 ID setting to layer-2 ID of the original dummy MAC PDU transmitting UE. Prior to transmitting, and in connection with the preparation of the dummy MAC PDU, the method can include at 106 indicating in the MAC PDU whether the MAC PDU is original or relayed.

[0028] The Layer-2 ID collision detection method may be fully compatible with 3GPP rel'12 ProSe direct communication on ProSe communication transmission and reception. In certain embodiments, the new triggers can be specified and a new MAC control element can be introduced, for example to avoid a hidden node issue from arising.

[0029] As another implementation option, the dummy MAC PDU may be implemented on physical layer instead of MAC layer. In this option, sidelink

control information, such as scheduling assignment of ProSe communication, may be used to convey the source Layer-2 ID and destination Layer-2 ID by a newly introduced sidelink control information (SCI) format.

[0030] Figure 2 illustrates a system according to certain embodiments of the invention. It should be understood that each block of the flowchart of Figure 1 may be implemented by various means or their combinations, such as hardware, software, firmware, one or more processors and/or circuitry. In one embodiment, a system may include several devices, such as, for example, network element 210 and user equipment (UE) or user device 220.

The system may include more than one UE 220 and more than one network element 210, although only one of each is shown for the purposes of illustration. As mentioned above, there may be multiple UEs 220, some of which may be out of communication with others, thus presenting a hidden node situation.

[0031] A network element can be an access point, a base station, an eNode B (eNB), or any other network element. Each of these devices may include at least one processor or control unit or module, respectively indicated as 214 and 224. At least one memory may be provided in each device, and indicated as 215 and 225, respectively. The memory may include computer program instructions or computer code contained therein, for example for carrying out the embodiments described above. One or more transceiver 216 and 226 may be provided, and each device may also include an antenna, respectively illustrated as 217 and 227. Although only one antenna each is shown, many antennas and multiple antenna elements may be provided to each of the devices. Other configurations of these devices, for example, may be provided. For example, network element 210 and UE 220 may be additionally configured for wired communication, in addition to wireless communication, and in such a case antennas 217 and 227 may illustrate any form of communication hardware, without being limited to merely an

antenna.

[0032] Transceivers 216 and 226 may each, independently, be a transmitter, a receiver, or both a transmitter and a receiver, or a unit or device that may be configured both for transmission and reception. The transmitter and/or receiver (as far as radio parts are concerned) may also be implemented as a remote radio head which is not located in the device itself, but in a mast, for example. It should also be appreciated that according to the “liquid” or flexible radio concept, the operations and functionalities may be performed in different entities, such as nodes, hosts or servers, in a flexible manner. In other words, division of labor may vary case by case. One possible use is to make a network element to deliver local content. One or more functionalities may also be implemented as a virtual application that is provided as software that can run on a server.

[0033] A user device or user equipment 220 may be a mobile station (MS) such as a mobile phone or smart phone or multimedia device, a computer, such as a tablet, provided with wireless communication capabilities, personal data or digital assistant (PDA) provided with wireless communication capabilities, portable media player, digital camera, pocket video camera, navigation unit provided with wireless communication capabilities or any combinations thereof. The user device or user equipment 220 may be a sensor or smart meter, or other device that may usually be configured for a single location.

[0034] In an exemplifying embodiment, an apparatus, such as a node or user device, may include means for carrying out embodiments described above in relation to Figure 1.

[0035] Processors 214 and 224 may be embodied by any computational or data processing device, such as a central processing unit (CPU), digital signal processor (DSP), application specific integrated circuit (ASIC), programmable logic devices (PLDs), field programmable gate arrays (FPGAs), digitally enhanced circuits, or comparable device or a combination

thereof. The processors may be implemented as a single controller, or a plurality of controllers or processors. Additionally, the processors may be implemented as a pool of processors in a local configuration, in a cloud configuration, or in a combination thereof.

[0036] For firmware or software, the implementation may include modules or unit of at least one chip set (e.g., procedures, functions, and so on). Memories 215 and 225 may independently be any suitable storage device, such as a non-transitory computer-readable medium. A hard disk drive (HDD), random access memory (RAM), flash memory, or other suitable memory may be used. The memories may be combined on a single integrated circuit as the processor, or may be separate therefrom. Furthermore, the computer program instructions may be stored in the memory and which may be processed by the processors can be any suitable form of computer program code, for example, a compiled or interpreted computer program written in any suitable programming language. The memory or data storage entity is typically internal but may also be external or a combination thereof, such as in the case when additional memory capacity is obtained from a service provider. The memory may be fixed or removable.

[0037] The memory and the computer program instructions may be configured, with the processor for the particular device, to cause a hardware apparatus such as network element 210 and/or UE 220, to perform any of the processes described above (see, for example, Figure 1). Therefore, in certain embodiments, a non-transitory computer-readable medium may be encoded with computer instructions or one or more computer program (such as added or updated software routine, applet or macro) that, when executed in hardware, may perform a process such as one of the processes described herein. Computer programs may be coded by a programming language, which may be a high-level programming language, such as objective-C, C, C++, C#, Java, etc., or a low-level programming language, such as a machine language, or assembler. Alternatively, certain embodiments of the

invention may be performed entirely in hardware.

[0038] Furthermore, although Figure 2 illustrates a system including a network element 210 and a UE 220, embodiments of the invention may be applicable to other configurations, and configurations involving additional elements, as illustrated and discussed herein. For example, multiple user equipment devices and multiple network elements may be present, or other nodes providing similar functionality, such as nodes that combine the functionality of a user equipment and an access point, such as a relay node.

[0039] One having ordinary skill in the art will readily understand that the invention as discussed above may be practiced with steps in a different order, and/or with hardware elements in configurations which are different than those which are disclosed. Therefore, although the invention has been described based upon these preferred embodiments, it would be apparent to those of skill in the art that certain modifications, variations, and alternative constructions would be apparent, while remaining within the spirit and scope of the invention. In order to determine the metes and bounds of the invention, therefore, reference should be made to the appended claims.

[0040] List of Abbreviations

[0041] D2D Device to Device

[0042] ProSe Proximity Services

[0043] SCI Sidelink Control Information

[0044] SL-SCH SideLink-Shared Channel

WE CLAIM:

1. A method, comprising:
preparing, at a user equipment, a control information comprising at least a source identifier and a destination identifier; and
transmitting, by the user equipment, the control information to a plurality of user equipment,
wherein the source identifier and the destination identifier are configured to correspond to identifiers being used by the user equipment.
2. The method of claim 1, wherein the control information comprises at least one of physical layer control information or a medium access control layer packet data unit.
3. The method of claim 1, wherein the user equipment and the plurality of user equipment are configured to use proximity services.
4. The method of claim 1, wherein the control information comprises a source layer-2 identifier and a destination layer-2 identifier within a medium access control packet data unit header.
5. The method of claim 4, wherein preparing comprises using both the source layer-2 identifier and the destination layer-2 identifier of the user equipment in the control information.
6. The method of claim 1, wherein the user equipment is configured to transmit the control information at least one of periodically or upon a triggering event.
7. The method of claim 1, further comprising:
indicating in the control information whether the control information

is original or relayed.

8. A method, comprising:

receiving, by a second user equipment a control information comprising at least a source identifier and a destination identifier, from a first user equipment;

detecting a conflict based on at least one of the source identifier or the destination identifier in the control information; and

resolving the detected conflict.

9. The method of claim 8, wherein the first user equipment and the second user equipment are configured to use proximity services.

10. The method of claim 8, wherein the control information comprises a source layer-2 identifier and a destination layer-2 identifier within a medium access control packet data unit header

11. The method of claim 8, wherein the detecting the conflict comprises detecting that a source layer-2 identifier in the packet data unit is the same as the second user equipment's own layer-2 identifier.

12. An apparatus, comprising:

at least one processor; and

at least one memory including computer program code,

wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus at least to prepare, at a user equipment, a control information comprising at least a source identifier and a destination identifier; and

transmit, by the user equipment, the control information to a plurality of user equipment,

wherein the source identifier and the destination identifier are configured to correspond to identifiers being used by the user equipment.

13. The apparatus of claim 12, wherein the control information comprises at least one of physical layer packet data unit or a medium access control layer packet data unit.

14. The apparatus of claim 12, wherein the user equipment and the plurality of user equipment are configured to use proximity services.

15. The apparatus of claim 12, wherein the control information comprises a source layer-2 identifier and a destination layer-2 identifier within a medium access control packet data unit header.

16. The apparatus 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 apparatus at least to use both the source layer-2 identifier and the destination layer-2 identifier of the user equipment in the control information.

17. The apparatus of claim 12, wherein the user equipment is configured to transmit the control information at least one of periodically or upon a triggering event.

18. The apparatus of claim 12, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus at least to indicate in the control information whether the control information is original or relayed.

19. An apparatus, comprising:

at least one processor; and
at least one memory including computer program code,
wherein the at least one memory and the computer program code are
configured to, with the at least one processor, cause the apparatus at least to
receive, by a second user equipment a control information comprising
at least a source identifier and a destination identifier, from a first user
equipment;
detect a conflict based on at least one of the source identifier or the
destination identifier in the control information; and
resolve the detected conflict.

20. The apparatus of claim 19, wherein the first user equipment and
the second user equipment are configured to use proximity services.

21. The apparatus of claim 19, wherein the control information
comprises a source layer-2 identifier and a destination layer-2 identifier
within a medium access control packet data unit header

22. The apparatus of claim 19, wherein the at least one memory and
the computer program code are configured to, with the at least one
processor, cause the apparatus at least to detect that a source layer-2
identifier in the packet data unit is the same as the second user equipment's
own layer-2 identifier.

23. An apparatus, comprising:
means for preparing, at a user equipment, a control information
comprising at least a source identifier and a destination identifier; and
means for transmitting, by the user equipment, the control information
to a plurality of user equipment,
wherein the source identifier and the destination identifier are

configured to correspond to identifiers being used by the user equipment.

24. The apparatus of claim 23, wherein the control information comprises at least one of physical layer packet data unit or a medium access control layer packet data unit.

25. The apparatus of claim 23, wherein the user equipment and the plurality of user equipment are configured to use proximity services.

26. The apparatus of claim 23, wherein the control information comprises a source layer-2 identifier and a destination layer-2 identifier within a medium access control packet data unit header.

27. The apparatus of claim 26, wherein preparing comprises using both the source layer-2 identifier and the destination layer-2 identifier of the user equipment in the control information.

28. The apparatus of claim 23, wherein the user equipment is configured to transmit the control information at least one of periodically or upon a triggering event.

29. The apparatus of claim 23, further comprising:
means for indicating in the control information whether the control information is original or relayed.

30. An apparatus, comprising:
means for receiving, by a second user equipment a control information comprising at least a source identifier and a destination identifier, from a first user equipment;
means for detecting a conflict based on at least one of the source

identifier or the destination identifier in the control information; and
means for resolving the detected conflict.

31. The apparatus of claim 30, wherein the first user equipment and the second user equipment are configured to use proximity services.

32. The apparatus of claim 30, wherein the control information comprises a source layer-2 identifier and a destination layer-2 identifier within a medium access control packet data unit header

33. The apparatus of claim 30, wherein the detecting the conflict comprises detecting that a source layer-2 identifier in the packet data unit is the same as the second user equipment's own layer-2 identifier.

34. A computer program product encoding instructions for performing a process, the process comprising the method according to any of claims 1-11.

35. A non-transitory computer-readable medium encoded with instructions that, when executed in hardware, perform a process, the process comprising the method according to any of claims 1-11.

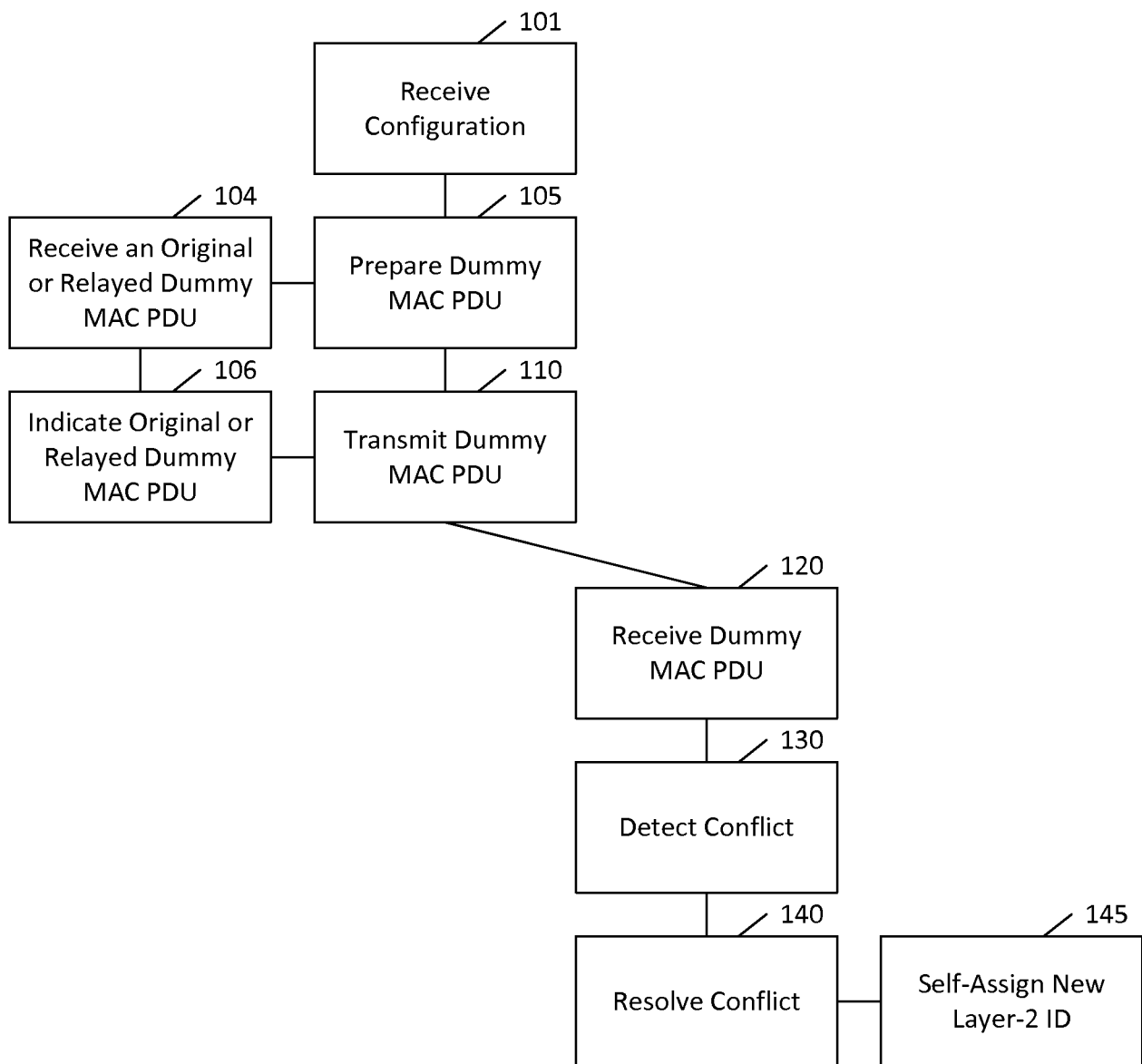


Figure 1

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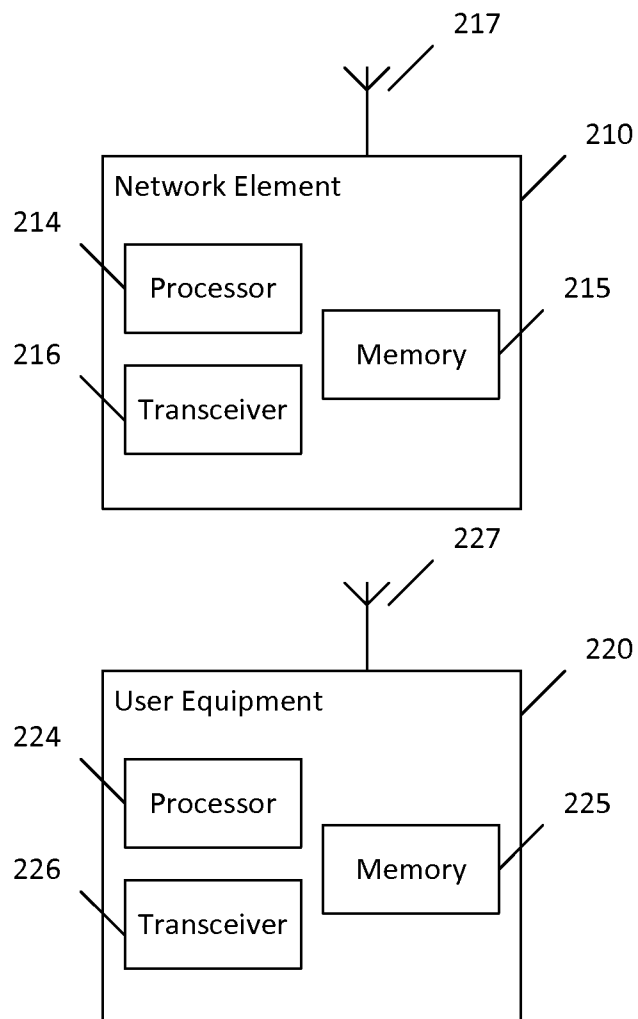


Figure 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US15/52283

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H04H 60/35 (2016.01)

CPC - H04L 61/6022

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)

IPC(8) Classification(s): H04W 8/26; H04N 21/647; H04H 60/35 (2016.01)

CPC Classification(s): H04W 4/02; H04W 36/0083; H04L 61/6022

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)

PatSeer (US, EP, WO, JP, DE, GB, CN, FR, KR, ES, AU, IN, CA, INPADOC Data); Google/ GooglePatents; IEEE; EBSCO; Espacenet.

Keywords: user equipment; MAC address; source; destination; relay; original; proximity.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013/0182604 A1 (MORENO, V et al.) 18 July 2013; Abstract; paragraphs [0030], [0041], [0051].	1-35
A	US 2008/0318630 A1 (GIL, A) 25 December 2008; whole document.	1-35
A	US 2014/0064275 A1 (HAMMER, M et al.) 06 March 2014; whole document.	1-35
A	US 2012/0063316 A1 (GHANWANI, A et al.) 15 March 2012; whole document.	1-35

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

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

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"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

26 February 2016 (26.02.2016)

Date of mailing of the international search report

03 JUN 2016

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US15/52283

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

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

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

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

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

Group I: Claims 1-7, 12-18, and 23-29; Group II: Claims 8-11, 19-22, and 30-35

-Continued within extra sheet-

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

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

INVITATION TO PAY ADDITIONAL FEES
AND, WHERE APPLICABLE, PROTEST FEE

International application No.

PCT/US15/52283

Continued from Box III: Observations where unity of invention is lacking.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fee must be paid.

Group I: Claims 1-7, 12-18, and 23-29 are directed toward a method and apparatuses including corresponding source and destination identifiers.

Group II: Claims 8-11, 19-22, and 30-35 are directed toward a method and apparatuses including detecting and resolving conflicts.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The special technical features of Group I include wherein the source identifier and the destination identifier are configured to correspond to identifiers being used by the user equipment, which is not present in Group II.

The special technical features of Group II include detecting a conflict based on at least one of the source identifier or the destination identifier in the control information; and resolving the detected conflict, which is not present in Group I.

The common technical features shared by Groups I and II are an apparatus, comprising: at least one processor; and at least one memory including computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus at least to: transmit at a user equipment, and receive at at least one other user equipment, a control information comprising at least a source identifier and a destination identifier.

However, these common features are previously disclosed by US 2008/0318630 A1 to Gil, A (hereinafter 'Gil'). Gil discloses an apparatus, comprising: at least one processor; and at least one memory including computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus (processors direct operation at a terminal using program codes stored in memory, paragraph [0029]) at least to: transmit at a user equipment, and receive at at least one other user equipment, a control information comprising at least a source identifier and a destination identifier (a terminal, which may be a user equipment, may communicate with another terminal application layer using TCP, which includes source and destination port fields, paragraphs [0023], [0042]-[0043], and [0045]).

Since the common technical features are previously disclosed by the Gil reference, these common features are not special and so Groups I and II lack unity.