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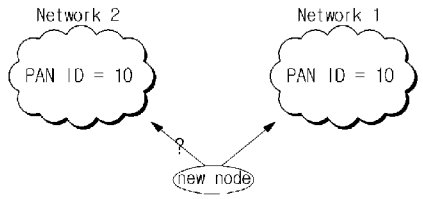
(54) Title: METHOD OF DETECTING AND SOLVING NETWORK ID CONFLICT



(57) Abstract: A method of detecting and solving a network ID conflict is provided. The method of detecting and solving a network ID conflict includes generating and transmitting a personal area network identifier (PAN ID) report command frame that includes an extended PAN ID, and receiving a PAN ID update command frame in response to the transmitted PAN ID report command frame. According to the method, the PAN ID report command and the PAN ID update command are generated and provided by providing an extended PAN ID (EPID), and thus a network ID conflict can be detected and a new PAN ID is provided to solve the network ID conflict.

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Description

METHOD OF DETECTING AND SOLVING NETWORK ID CONFLICT

Technical Field

[1] Methods consistent with the present invention relate to detecting and solving a network ID conflict, and more particularly, to detecting and solving a network ID conflict that can solve the network ID conflict by generating and providing a network ID related command by providing an extended network ID in a wireless network system.

Background Art

[2] A personal area network (PAN), in contrast to a well-known local area network (LAN) or a wide area network (WAN), means, for example, a network owned by a person for personal use. In other words, the PAN is a network constituted by devices owned by a person for the purpose of providing convenience to the person.

[3] Such a PAN, as described above, selects a PAN identifier (PAN ID) on the basis of local network information. In such a case, two or more different PANs may select the same PAN ID.

[4] FIG. 1 is a view explaining a network ID conflict occurring in the related art when two different PAN networks use the same PAN ID.

[5] Referring to FIG. 1, when a new node intends to access a network 1 in a state that both network 1 and network 2 have the same PAN ID, the new node that desires to access network 1 may undesirably access network 2, instead of accessing network 1. Even if the new node has accessed the desired network 1 without fail, the new node may nevertheless wrongly transmit a packet to network 2 because both network 1 and network 2 have the same PAN ID.

[6] FIG. 2 is a view explaining a network ID conflict occurring in the related art when two different networks have the same PAN ID and the same node address.

[7] Referring to FIG. 2, when a node B that is a member of network 1 transmits a packet to node C, node A also receives the packet transmitted from node B. That is, because both network 1 and network 2, to which node A and node B belong, respectively, have the same PAN ID and the same node address, node A receives and processes the packet from node B.

Disclosure of Invention

Technical Problem

[8] As described above, a node, which belongs to a different network, and which is not the intended destination of a transmitted packet, receives and processes the packet due

to the network ID conflict, and this causes network overhead to be increased.

Technical Solution

[9] An aspect of the present invention provides a method of detecting and solving a network ID conflict that can monitor a network state and manage a network efficiently by generating and providing a network ID related command by providing an extended network ID.

[10] An aspect of the present invention provides a method of detecting and solving a network identifier (ID) conflict, which includes generating and transmitting a personal area network identifier (PAN ID) report command frame that includes an extended PAN ID, and receiving a PAN ID update command frame in response to the transmitted PAN ID report command frame.

[11] The PAN ID report command frame may include at least one of a command frame ID, an extended PAN ID (EPID), PAN ID information, and a neighboring PAN ID list. Further, the PAN ID information may include at least one of a PAN ID conflict flag, the number of neighboring PAN ID list, and a reserved region.

[12] The EPID can be allocated, for instance, using a 64-bit extended MAC address, a PAN security key, or a specified name set by a user.

[13] The PAN ID update command frame may include at least one of a command frame ID, an EPID, an old PAN ID, and a new PAN ID.

[14] The method of detecting and solving a network ID conflict according to exemplary embodiments of the present invention may further include scanning beacon frames from PANs in order to access a network intended to be accessed, and judging whether one or more neighboring networks exist for the network intended to be accessed on the basis of the beacon frames.

[15] If one or more neighboring networks exist for the network intended to be accessed as a result of judgment, the transmission operation generates and transmits the PAN ID report command frame. Also, the transmission operation can transmit the PAN ID report command frame to a coordinator of the network.

[16] The transmission operation may include a PAN ID conflict search operation of searching whether networks using the same PAN ID exist. The transmission operation may transmit the PAN ID report command frame by setting a different PAN ID conflict flag, in accordance with the result of conflict search in the searching operation.

[17] Further, the transmission operation may retransmit the PAN ID report command frame to the coordinator if the PAN ID update command frame is not received when a preset PAN ID update interval elapses after the transmission of the PAN ID report command frame.

[18] The extended PAN ID may be added to a payload of the beacon frame.

[19] An exemplary method of detecting and solving a network ID conflict may further include allocating the extended PAN ID (EPID), and the EPID can be allocated before or when the node that intends to access the network accesses the network.

[20] An exemplary method of detecting and solving a network ID conflict may further include broadcasting an extended PAN ID request command frame to request the extended PAN ID (EPID) allocated to the network, and receiving an EPID response command frame including the EPID in response to the EPID request command frame.

[21] The receiving operation may include collecting EPIDs of the networks on the basis of the EPID response command frame, comparing the EPID of the currently accessed network with the EPID of the network intended to be accessed, and releasing the access to the current network and accessing the network intended to be accessed on the basis of the result of comparison.

[22] The accessing operation may include releasing the access to the current network and accessing the network intended to be accessed on the basis of the EPID collected in the collecting operation if the EPID of the current network is not the EPID of the network intended to be accessed.

[23] An exemplary method of detecting and solving a network ID conflict may further include judging whether one or more neighboring networks exist in the neighborhood of the network, wherein if the neighboring networks exist as a result of judgment, the transmission operation generates and transmits the PAN ID report command frame to the coordinator of the network.

[24] In another aspect of the present invention, there is provided a method of detecting and solving a network identifier (ID) conflict, which includes receiving a personal area network identifier (PAN ID) report command frame that includes an extended PAN ID, and generating and transmitting a PAN ID update command frame for the received PAN ID report command frame.

[25] The PAN ID report command frame may include at least one of a command frame ID, an extended PAN ID (EPID), PAN ID information, and a neighboring PAN ID list. Moreover, the PAN ID information may include at least one of a PAN ID conflict flag, the number of neighboring PAN ID list, and a reserved region.

[26] The EPID can be allocated using a 64-bit extended MAC address, and the EPID can be allocated using a PAN security key or a specified name set by a user.

[27] The PAN ID update command frame may include at least one of a command frame ID, an EPID, an old PAN ID, and a new PAN ID.

[28] An exemplary method of detecting and solving a network ID collision may further include adding PAN IDs of the neighboring PAN ID list included in the PAN ID report command frame to a PAN ID blacklist that manages the PAN IDs allocated to the neighboring networks, and selecting a new PAN ID if the PAN ID conflict flag

included in the PAN ID report command frame is set to a PAN ID conflict, wherein the transmission operation generates the PAN ID update command frame including the new PAN ID selected in the selection operation and then broadcasts the generated PAN ID update command frame.

[29] The PAN ID blacklist may be managed by a coordinator of the network, and the selection operation can select one of PAN IDs except for the PAN IDs included in the PAN ID blacklist as the new PAN ID.

[30] An exemplary method of detecting and solving a network ID conflict may further include changing the PAN ID from the old PAN ID to the new PAN ID when a preset network broadcast delivery time elapses after the broadcasting of the PAN ID report command frame.

[31] An exemplary method of detecting and solving a network ID conflict may further include receiving the EPID request command frame requesting the EPID allocated to the network, and transmitting the EPID response command frame including the EPID in response to the EPID request command frame.

[32] An exemplary method of detecting and solving a network ID conflict may further include adding PAN IDs of the neighboring PAN ID list included in the PAN ID report command frame to a PAN ID blacklist that manages the PAN IDs allocated to the neighboring networks, wherein the PAN ID blacklist can be managed in a plurality of nodes.

Advantageous Effects

[33] As described above, according to exemplary embodiments of the present invention, a PAN ID report command and a PAN ID update command are generated and provided by providing an extended PAN ID (EPID), and thus a network ID conflict can be detected and a new PAN ID is provided to solve the network ID conflict.

[34] In addition, according to exemplary embodiments of the present invention, with the use of EPID request command frames and EPID response command frames, the network ID conflict can be effectively solved.

[35] In addition, according to exemplary embodiments of the present invention, each node monitors and manages the network state by managing a PAN ID blacklist, and thus an efficient network operation becomes possible without any specified node having a central control function.

[36] The foregoing exemplary embodiments are merely illustrative and are not to be construed as limiting the present invention. The present teachings can be readily applied to other types of apparatuses. Also, the above description of the exemplary embodiments of the present invention is intended to be illustrative, and not to limit the scope of the claims, and many alternatives, modifications, and variations will be

apparent to those skilled in the art.

Brief Description of the Drawings

[37] The aspects of the present invention will be more apparent by describing certain exemplary embodiments of the present invention with reference to the accompanying drawings, in which:

[38] FIG. 1 is a view explaining a network ID conflict occurring in the related art when two different PAN networks use the same PAN ID;

[39] FIG. 2 is a view explaining a network ID conflict occurring in the related art when two different networks have the same PAN ID and the same node address;

[40] FIG. 3 is a flowchart illustrating a method of generating a PAN ID report command frame when a new node intends to access a network according to an exemplary embodiment of the present invention;

[41] FIG. 4 is a view illustrating an example of a PAN ID report command frame according to an exemplary embodiment of the present invention;

[42] FIG. 5 is a flowchart illustrating a method of generating a PAN ID update command frame when a new node intends to access a network according to an exemplary embodiment of the present invention;

[43] FIG. 6 is a view illustrating an example of a PAN ID update command frame according to an exemplary embodiment of the present invention;

[44] FIG. 7 is a view explaining a method of detecting and solving a network ID conflict using commands generated as illustrated in FIGS. 3 and 5 according to an exemplary embodiment of the present invention;

[45] FIGS. 8, 9 and 10 are views provided to explain a method of detecting and solving a network ID conflict occurring due to the mobility of a network according to an exemplary embodiment of the present invention;

[46] FIG. 11 is a flowchart illustrating a method of detecting and solving a network ID conflict according to an exemplary embodiment of the present invention;

[47] FIGS. 12 and 13 are views illustrating the structures of an EPID request command frame and an EPID response command frame according to an exemplary embodiment of the present invention; and

[48] FIG. 14 is a flowchart illustrating a method of detecting and solving a network ID conflict according to another exemplary embodiment of the present invention.

Best Mode for Carrying Out the Invention

[49] Certain exemplary embodiments of the present invention will be described in greater detail below with reference to the accompanying drawings.

[50] In the following description, the same drawing reference numerals are used for the same elements even in different drawings. The matters defined in the description such

as a detailed construction and elements are nothing but examples provided to assist one of ordinary skill in a comprehensive understanding of the present invention. Thus, it is apparent that the present invention can be carried out with or without those defined examples. Also, well-known functions or constructions are not described in detail since they would obscure the invention in unnecessary detail.

[51] FIG. 3 is a flowchart illustrating a method of generating a PAN ID report command frame when a new node intends to access a network according to an exemplary embodiment of the present invention, and FIG. 4 is a view illustrating an example of a PAN ID report command frame according to an exemplary embodiment of the present invention.

[52] Referring to FIGS. 3 and 4, a new node that intends to access a network scans beacon frames from neighboring networks in operation (S310). In this example, the new node collects personal area network identifiers (PAN IDs) and extended PAN IDs (EPIDs) of the neighboring networks of the network intended to be accessed by scanning the beacon frames.

[53] Then, the new node negotiates with and accesses the network intended to be accessed in operation (S315).

[54] The new node then judges whether one or more networks exists in the neighborhood of the network (S320). That is, the new node judges the number of networks existing in the neighborhood of the accessed network by scanning the beacon frames received from the neighboring networks in operation S310.

[55] If one or more networks exist, the new node generates a PAN ID report command frame operation (S330).

[56] Specifically, referring to FIG. 4, the new node generates a PAN ID report command frame that includes, for instance, a command frame ID, an EPID of the accessed network, PAN ID information, and a neighboring PAN ID list of the neighboring networks of the accessed network. According to the example shown in FIG. 4, the PAN ID information may include a PAN ID conflict flag, a length of a neighboring PAN ID list, and a reserved region.

[57] The neighboring PAN ID list includes, for example, PAN IDs of the neighboring networks gathered on the basis of the beacon frames of the neighboring networks that the new node has received.

[58] Referring to FIG. 3, the new node then searches for whether a network ID conflict occurs in operation (S340). That is, the new node searches whether any networks that use different EPIDs and any of the same PAN IDs exist.

[59] If, as a result of the search, it is determined that a network ID conflict has occurred, then the new node sets a PAN ID conflict flag in operation (S360).

[60] Specifically, if a network that uses a same PAN ID as the network that has been

accessed by the new node is found in operation (S340), the new node judges that a network ID conflict has occurred, and sets the PAN ID conflict flag. For example, if a network ID conflict has occurred, the new node sets the PAN ID conflict flag to "1", while if no network ID conflict has occurred, the new node sets the PAN ID conflict flag to "0".

[61] Then, the new node transmits the generated PAN ID report command frame to a co-ordinator of the network that the node has accessed in operation (S370). The co-ordinator, for example, allocates node addresses to nodes constituting the network, and manages the whole operation of the network.

[62] FIG. 5 is a flowchart illustrating a method of generating a PAN ID update command frame when a new node intends to access a network according to an exemplary embodiment of the present invention, and FIG. 6 is a view illustrating an example of a PAN ID update command frame according to an exemplary embodiment of the present invention.

[63] Referring to FIGS. 5 and 6, the coordinator receives a PAN ID report command frame in operation (S510).

[64] Then, the coordinator updates a PAN ID blacklist on the basis of the contents included in the PAN ID report command frame in operation (S520).

[65] That is, the coordinator adds the PAN IDs that are included in the neighboring PAN ID list to its own PAN ID blacklist on the basis of the neighboring PAN ID list included in the received PAN ID report command frame.

[66] Then, the coordinator judges whether the PAN ID conflict flag is set based on the PAN ID report command frame in operation (S530).

[67] Specifically, the coordinator judges whether any network using a same PAN ID as its own network exists by judging whether the PAN ID conflict flag is set. According to the exemplary embodiment shown in FIG. 5, the coordinator judges whether the PAN ID conflict flag is set to "1" or "0". If the PAN ID conflict flag is set, the co-ordinator judges that a network using a same PAN ID as its own network exists, and selects a new PAN ID in operation (S540).

[68] More specifically, if the coordinator judges that the PAN ID conflict flag is set to 1 in operation (S530), the coordinator judges that a network using a same PAN ID as its own network exists. And in such a case, the coordinator selects one of the PAN IDs except for the PAN IDs included in the PAN ID blacklist, which was updated in operation (S520), as a new PAN ID.

[69] Then, the coordinator generates a PAN ID update command frame, and broadcasts the generated PAN ID update command frame in operation (S550).

[70] Referring to FIG. 6, the coordinator generates the PAN ID update command frame that includes a command frame ID, an EPID of the network to which the coordinator

itself belongs, an old PAN ID that is the existing PAN ID, and a new PAN ID, and then broadcasts the generated PAN ID update command frame.

[71] Referring to FIG. 5, if a network broadcast delivery time elapses, then the co-ordinator changes the PAN ID from the old PAN ID to the new PAN ID in operation (S560). Specifically, if the preset network broadcast delivery time elapses after the PAN ID update command frame is broadcast in operation (S550), then the coordinator changes the PAN ID from the old PAN ID to the new PAN ID. According to the exemplary embodiment shown in FIG. 5, the network broadcast delivery time is a preset time during which the nodes belonging to the network that uses the old PAN ID can receive and process the PAN ID update command frame.

[72] Meanwhile, if the PAN ID conflict flag is judged to be set to "0" in operation S530, then the coordinator discards the PAN ID report command frame in operation (S570).

[73] In operation (S510), a router, rather than the coordinator, can receive the PAN ID report command frame. In such a case, if the PAN IDs that are included in the neighboring PAN ID list are all included in a neighboring node management table that manages information on neighboring nodes in the neighborhood of the router, when the router receives the PAN ID report command frame, then the router discards the received PAN ID report command frame.

[74] Also, if the PAN IDs included in the neighboring PAN ID list have been recorded in the router, the router discards the received PAN ID report command frame. In other words, if the router has received the PAN ID report command frame transmitted from other nodes more than twice, then the router discards the received PAN ID report command frame.

[75] In the method of generating a PAN ID report command frame and a PAN ID update command frame according to exemplary embodiments of the present invention, the new node retransmits the PAN ID report command frame to the coordinator if the PAN ID update command frame is not received when the PAN ID update interval elapses after the transmission of the PAN ID report command frame having the set PAN ID conflict flag.

[76] FIG. 7 is a view explaining a method of detecting and solving a network ID conflict using commands generated as illustrated in FIGS. 3 and 5 according to an exemplary embodiment of the present invention.

[77] Referring to FIG. 7, node A, that desires to access network 1, receives a beacon frame from neighboring network 1 and neighboring network 2 in operation (S710).

[78] Then, node A negotiates with network 1, that is intended to be accessed, and when the negotiation is completed, node A becomes a member of network 1 in operation (S720).

[79] Then, if one or more networks are detected in the neighborhood of network 1,

which is accessed on the basis of a received beacon frame, node A generates a PAN ID report command frame, and transmits the generated PAN ID report command frame to the coordinator of node A itself in operation (S730).

[80] According to the exemplary embodiment shown in FIG. 7, since network 1 and network 2 use the same PAN ID "10" a PAN ID report command frame, in which the PAN ID conflict flag is set to "1,"is transmitted by node A.

[81] Then, the coordinator of network 1 updates the PAN ID blacklist on the basis of the received PAN ID report command frame, and if the PAN ID conflict flag has been set to "1," the coordinator generates and broadcasts the PAN ID update command frame in operation (S740).

[82] FIGS. 8, 9 and 10 are views provided to explain a method of detecting and solving a network ID conflict occurring due to the mobility of a network according to an exemplary embodiment of the present invention.

[83] FIG. 8 shows a case where a boundary node broadcasts a packet. Referring to FIG. 8, if boundary node 8, which is located at the boundary of network 1, broadcasts a packet to network 1 when the node 8 moves and reaches the communication range of boundary node 5 of network 2, then node 5 of network 2, in addition to nodes that constitute network 1, receives the packet. According to the exemplary embodiment shown in FIG. 8, the node 5 checks the EPID of the packet transmitter (i.e., node 8) by scanning the received beacon frame, if the packet transmitter (i.e., node 8) is not included in a neighboring node management table of the node 5.

[84] Accordingly, node 5 discards the aforementioned packet broadcast from the transmitter (i.e., node 8) without processing the packet. Also, as described above, node 5 can generate and transmit a PAN ID report command frame to a coordinator (not illustrated) of network 2, and the coordinator of network 2 can generate and broadcast a PAN ID update command frame.

[85] FIG. 9 shows a case where a boundary node unicasts a packet. Referring to FIG. 9, node 8, which is a member of network 1, unicasts a packet to node 7, that is a member of network 1. Here, since node 7 of network 1 and node 7 of network 2 use the same node address (i.e., 7) and have the same PAN ID (i.e., PAN ID = 10), both the node 7 of network 1 and the node 7 of network 2 receive the packet unicast from node 8.

[86] In such a case, the node 7 of network 2 confirms that the node 8 of network 1 is not included in its own neighboring node management table, and then checks the EPID of node 8 by scanning the beacon frame. As a result of such checking, the node 7 of network 2 discards the packet from node 8 without processing it. Also, as described above, node 7 of network 2 can generate and transmit a PAN ID report command frame to a coordinator (not illustrated) of network 2, and the coordinator of network 2 can generate and broadcast a PAN ID update command frame.

[87] FIG. 10 shows a case where a boundary node receives a wrongly transmitted acknowledgement (ACK). Referring to FIG. 10, if node 8 of network 1 unicasts a packet to node 7 of network 1, then node 8 receives an acknowledgement (ACK) from node 7 of network 1 that is a response to the unicasted packet.

[88] In this case, since node 7 of network 1 and node 7 of network 2 use the same node address (i.e., 7) and have the same PAN ID (i.e., PAN ID = 10), node 7 of network 2 also receives the packet from node 8 of network 1, and transmits an ACK to node 8 in response to the received packet.

[89] In such a case, since the node 8 of network 1 and node 8 of network 2 have the same PAN ID and the same node address, they both receive the ACK from node 7 of network 2. At such a time, node 8 of network 1 confirms duplicate reception of the ACK, and scans the beacon frame from the neighboring network in order to detect whether a network ID conflict occurs. The subsequent processes are analogous to the processes of generating the PAN ID report command frame and the PAN ID update command frame as illustrated in FIGS. 3 and 5 and, accordingly, the detailed explanation thereof has been omitted.

[90] Since node 8 of network 2 receives the ACK from node 7 of network 2, wherein the received ACK is a response to a packet which the node 8 did not transmit , the node 8 scans the beacon frame from the neighboring network in order to detect whether a network ID conflict occurs. The subsequent processes are analogous to those of node 8 of network 1. In this case, node 8 of network 2 may transmit a request message for checking whether the network ID conflict occurs due to node 7 of network 1 having transmitted the ACK.

[91] In an exemplary embodiment of the present invention, it is preferable, but not necessary, that an extended PAN ID (EPID), which has been allocated to each network, is added to the payload of a beacon frame. The EPID can be allocated using a 64-bit extended MAC address, a PAN security key, or a specified name set by a user.

[92] In the method of detecting and solving a network ID conflict according to an exemplary embodiment of the present invention, the coordinator can detect whether a network ID conflict occurs by periodically receiving and scanning beacon frames from neighboring networks.

[93] Also, in the method of detecting and solving a network ID conflict according to an exemplary embodiment of the present invention, if a node recognizes the beacon frame received by the neighboring node, the node can update its neighboring node management table, and can check whether a network ID conflict occurs.

[94] A method of detecting and solving a network ID conflict according to an exemplary embodiment of the present invention, in which the PAN ID report command frame and the PAN ID update command frame are added to a payload of a beacon frame to be

transmitted, has been explained above.

[95] Hereinafter, a method of detecting and solving a network ID conflict according to another exemplary embodiment of the present invention will be explained with reference to FIGS. 9, 10A and 10B.

[96] FIG. 11 is a flowchart illustrating a method of detecting and solving a network ID conflict according to an exemplary embodiment of the present invention.

[97] Referring to FIG. 11, a new node that intends to access a network selects a node having a minimum depth from the new node, from among its neighboring nodes, as a parent node, and negotiates with the selected parent node in operation (S910). According to the exemplary embodiment shown in FIG. 11, the new node then detects the existence of a network, which uses a same PAN ID as the network that the new node has accessed, by scanning beacon frames.

[98] Then, the new node broadcasts an EPID request command frame to its neighboring nodes in operation (S920).

[99] That is, referring to FIG. 12, the new node broadcasts the EPID request command frame that includes a command frame identifier (ID) to the neighboring nodes.

[100] The nodes having received the EPID request command frame transmit an EPID response command frame to the new node in operation (S930). Referring to FIG. 13, the nodes having received the EPID request command frame transmit to the new node an EPID response command frame that includes an EPID and a command frame identifier of the network, to which the respective nodes belong.

[101] Then, the new node collects the received EPIDs and PAN IDs of the neighboring nodes on the basis of the EPID response command frames received from the neighboring nodes in operation (S940). At this time, the new node collects the PAN IDs of the neighboring nodes by scanning the beacon frames.

[102] Then, the new node judges whether one or more networks exist in the neighborhood of the network that the new node is currently accessing, on the basis of the collected PAN IDs in operation (S950).

[103] If one or more networks exist, the new node generates a PAN ID report command frame and transmits the generated PAN ID report command frame to its coordinator in operation (S960).

[104] The subsequent processes are analogous to those in operations S340 to S370 as described above with reference to FIG. 3 and, accordingly, the detailed explanation thereof has been omitted. If the new node detects a neighboring network that uses a same PAN ID as the network to which the new node belongs, the new node sets the PAN ID conflict flag to "1," and transmits the PAN ID report command frame to the coordinator.

[105] The processes of receiving the PAN ID report command frame and generating the

PAN ID update command frame, which are performed by the coordinator, are analogous to those in operations S510 to S570 as discussed above with respect to FIG. 5, accordingly, the detailed explanation thereof has been omitted.

[106] Then, the new node receives the EPID update command frame, updates the PAN ID, and then judges whether the new node has accessed the network intended to be accessed in operation (S970).

[107] Specifically, the new node compares the EPID of the network intended to be accessed with the EPID of the currently accessed parent node, on the basis of the EPIDs of the neighboring nodes collected in operation S940. If the EPID of the network intended to be accessed is judged to be different from the EPID of the parent node as a result of comparison, the new node releases the access to the parent node in operation (S980).

[108] Then, the new node directly accesses the network intended to be accessed on the basis of the EPIDs of the collected neighboring networks in operation (S990). In this case, the new node selects a node having a minimum depth with respect to the new node among members of the network intended to be accessed, as a parent node, and negotiates with the selected parent node.

[109] In a method of detecting and solving a network ID conflict according to another exemplary embodiment of the present invention, the new node may access one of the other nodes selected from among the nodes transmitting the EPID response command frame, if the EPID of the network intended to be accessed, among the EPIDs of the neighboring networks collected in operation S990. In this case, the new node selects a node having a minimum depth with respect to the new node, as a parent node.

[110] Additionally, in another exemplary embodiment of the present invention, the method of detecting and solving a network ID conflict in consideration of the mobility of a network detects whether the network ID conflict occurs using the EPID request command frame, instead of using the exemplary embodiment of the present invention discussed above.

[111] For instance, the EPID request command frame can be transmitted to a new node which intends to access the network and a new neighboring node found due to the network mobility. In such a case, the EPID request command frame can be periodically transmitted to search whether a network ID conflict occurs. Except for the point that the EPID request command frame is used instead of the beacon frame, the method of detecting and solving a network ID conflict according to the mobility of a network is analogous to that as illustrated in FIGS. 8, 9 and 10 and, accordingly, the detailed explanation thereof has been omitted.

[112] The method of detecting and solving a network ID conflict using the EPID request command frame and the EPID response command frame according to another

exemplary embodiment of the present invention has been explained above.

[113] Hereinafter, a method of detecting and solving a network ID conflict according to still another exemplary embodiment of the present invention will be explained with reference to FIG. 14.

[114] FIG. 14 is a flowchart illustrating a method of detecting and solving a network ID conflict according to another exemplary embodiment of the present invention.

[115] Referring to FIG. 14, a node adds PAN IDs of neighboring networks to its own PAN ID blacklist by scanning beacon frames in operation (S1110).

[116] Then, the node detects whether a network ID conflict occurs in a network to which the node belongs in operation (S1120). That is, the node detects the existence or nonexistence of networks using a same PAN ID as the network to which the node itself belongs.

[117] If a network ID conflict is detected, the node selects a new PAN ID, and broadcasts the PAN ID update command frame in operation (S1130).

[118] Specifically, if the node detects a network ID conflict, it selects a PAN ID that is different from the PAN IDs included in its own PAN ID blacklist. The node then broadcasts the PAN ID update command frame, which includes the selected new PAN ID.

[119] The nodes that have received the PAN ID update command frame then check whether the new PAN ID conflicts with the PAN ID of its neighboring network in operation (S1140).

[120] Then, if a network ID conflict occurs, the node having received the PAN ID update command frame generates the PAN ID report command frame, and transmits the generated PAN ID report command frame to the node having transmitted the PAN ID update command frame in operation (S1150).

[121] The node having received the PAN ID report command frame then updates its own PAN ID blacklist, selects a new PAN ID again, and then broadcasts a new PAN ID update command frame in operation (S1160). The new PAN ID selected in operation S1160 is a new PAN ID that is different from the PAN IDs included in the PAN ID blacklist.

Mode for the Invention

[122] Methods consistent with the present invention relate to detecting and solving a network ID conflict, and more particularly, to detecting and solving a network ID conflict that can solve the network ID conflict by generating and providing a network ID related command by providing an extended network ID in a wireless network system.

Claims

[1] A method of detecting and solving a network identifier (ID) conflict, the method comprising:
generating and transmitting a personal area network identifier (PAN ID) report command frame that comprises an extended PAN ID (EPID); and
receiving a PAN ID update command frame in response to the transmitted PAN ID report command frame.

[2] The method as claimed in claim 1, wherein the PAN ID report command frame comprises at least one of: a command frame ID, an extended PAN ID (EPID), PAN ID information, and a neighboring PAN ID list.

[3] The method as claimed in claim 2, wherein the PAN ID report command frame comprises PAN ID information; and
wherein the PAN ID information comprises at least one of: a PAN ID conflict flag, a number indicating a length of a neighboring PAN ID list, and a reserved region.

[4] The method as claimed in claim 1, wherein the EPID comprises a 64-bit extended MAC address.

[5] The method as claimed in claim 1, wherein the EPID comprises at least one of a PAN security key or a specified name set by a user.

[6] The method as claimed in claim 1, wherein the PAN ID update command frame comprises at least one of: a command frame ID, an EPID, an old PAN ID, and a new PAN ID.

[7] The method as claimed in claim 1, further comprising:
scanning beacon frames from a network in order to access a network intended to be accessed,; and
determining whether one or more neighboring networks exist with respect to the network intended to be accessed on the basis of the scanned beacon frames;
wherein if it is determined that one or more neighboring networks exist, then the PAN ID report command frame is generated and transmitted.

[8] The method as claimed in claim 1, wherein the PAN ID report command frame is transmitted to a coordinator of a network.

[9] The method as claimed in claim 1, further comprising searching whether a second network, using a same PAN ID as a first network, exists;
wherein the PAN ID report command frame comprises a PAN ID conflict flag, and
wherein generating the PAN ID report command frame comprises setting a value of the PAN ID conflict flag, in accordance with the result of searching whether a

second network, using a same PAN ID as the first network, exists.

[10] The method as claimed in claim 1, further comprising retransmitting the PAN ID report command frame to a network coordinator if the PAN ID update command frame is not received when a preset PAN ID update interval elapses after the PAN ID report command frame is transmitted.

[11] The method as claimed in claim 1, wherein the extended PAN ID is added to a payload of a beacon frame.

[12] The method as claimed in claim 1, further comprising allocating the extended PAN ID (EPID);
wherein the EPID is allocated before or at a time when a node accesses a network.

[13] The method as claimed in claim 1, further comprising:
broadcasting an extended PAN ID request command frame to request an extended PAN ID (EPID) that is allocated to a network; and
receiving an EPID response command frame, which comprises an EPID, in response to the broadcasted EPID request command frame.

[14] The method as claimed in claim 13, further comprising:
collecting EPIDs of networks based on the EPID response command frame;
comparing an EPID of a currently accessed network with an EPID of a network intended to be accessed; and
releasing access to the current accessed network and accessing the network intended to be accessed based on the result of the comparison.

[15] The method as claimed in claim 14, further comprising releasing access to the current accessed network and accessing the network intended to be accessed based on the result of the comparison only if the EPID of the current accessed network is not equal to the EPID of the network intended to be accessed.

[16] The method as claimed in claim 13, further comprising determining whether one or more neighboring networks exist with respect to the network; and
transmitting the PAN ID report command to a coordinator of the network if it is determined that any neighboring networks exist.

[17] A method of detecting and solving a network identifier (ID) conflict, the method comprising:
receiving a personal area network identifier (PAN ID) report command frame that comprises an extended PAN ID (EPID); and
generating and transmitting a PAN ID update command frame in response to the received PAN ID report command frame.

[18] The method as claimed in claim 17, wherein the PAN ID report command frame comprises at least one of: a command frame ID, an extended PAN ID (EPID),

PAN ID information, and a neighboring PAN ID list.

[19] The method as claimed in claim 18, wherein the PAN ID report command frame comprises PAN ID information; and
wherein the PAN ID information comprises at least one of: a PAN ID conflict flag, a number indicating a length of a neighboring PAN ID list, and a reserved region.

[20] The method as claimed in claim 17, wherein the EPID comprises a 64-bit extended MAC address.

[21] The method as claimed in claim 17, the EPID comprises at least one of a PAN security key or a specified name set by a user.

[22] The method as claimed in claim 17, wherein the PAN ID update command frame comprises at least one of: a command frame ID, an EPID, an old PAN ID, and a new PAN ID.

[23] The method as claimed in claim 17, further comprising:
adding PAN IDs of a neighboring PAN ID list, which is included in the PAN ID report command frame, to a PAN ID blacklist that comprises the PAN IDs allocated to neighboring networks;
selecting a new PAN ID, if a PAN ID conflict flag included in the PAN ID report command frame indicates a PAN ID conflict;
generating the PAN ID update command frame so as to include the selected new PAN ID; and
broadcasting the generated PAN ID update command frame.

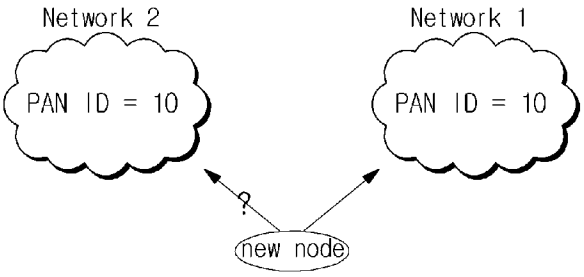
[24] The method as claimed in claim 23, wherein the PAN ID blacklist is managed by a coordinator of a network;
wherein a new PAN ID is selected that is different from the PAN IDs included in the PAN ID blacklist.

[25] The method as claimed in claim 23, further comprising changing a PAN ID to a new PAN ID if a preset network broadcast delivery time elapses after the broadcasting of the PAN ID update command frame.

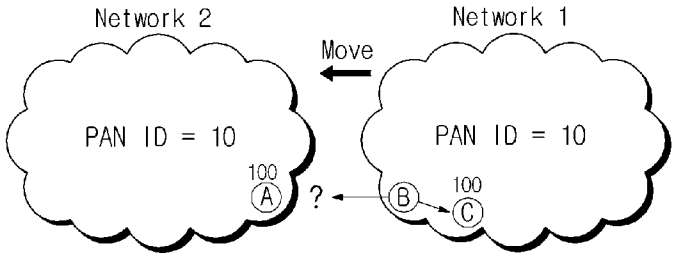
[26] The method as claimed in claim 17, further comprising:
receiving an EPID request command frame requesting an EPID that is allocated to a network; and
transmitting an EPID response command frame, which comprises an EPID, in response to the EPID request command frame.

[27] The method as claimed in claim 26, further comprising adding PAN IDs of a neighboring PAN ID list included in the PAN ID report command frame to a PAN ID blacklist that comprises the PAN IDs that are allocated to neighboring networks, wherein the PAN ID blacklist is managed in a plurality of nodes.

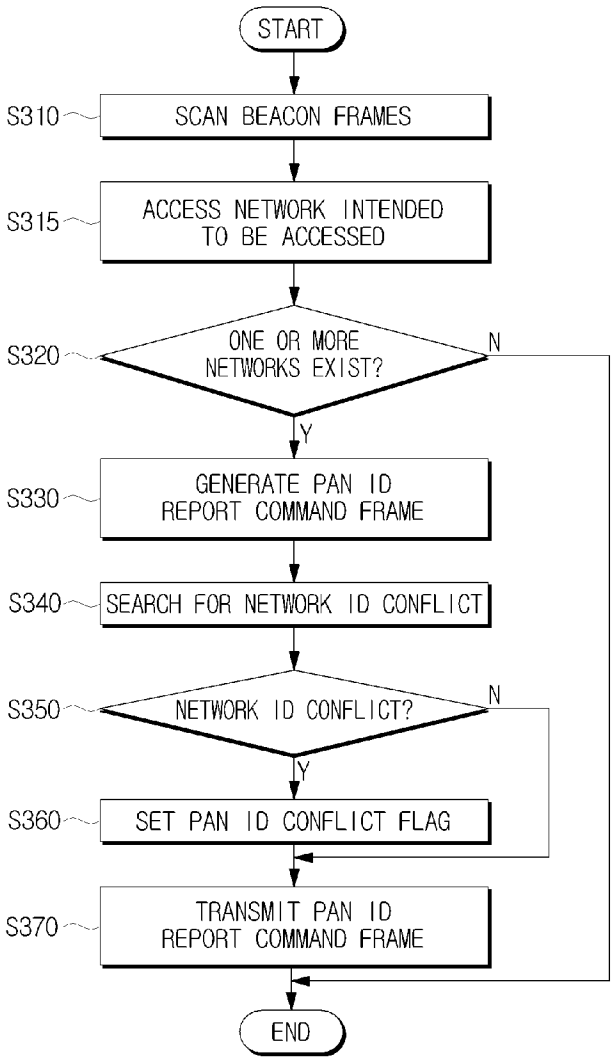
[Fig. 1]



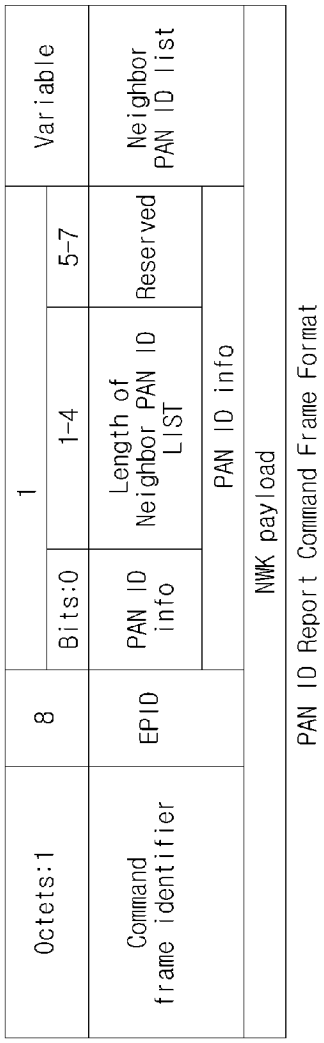
[Fig. 2]



[Fig. 3]

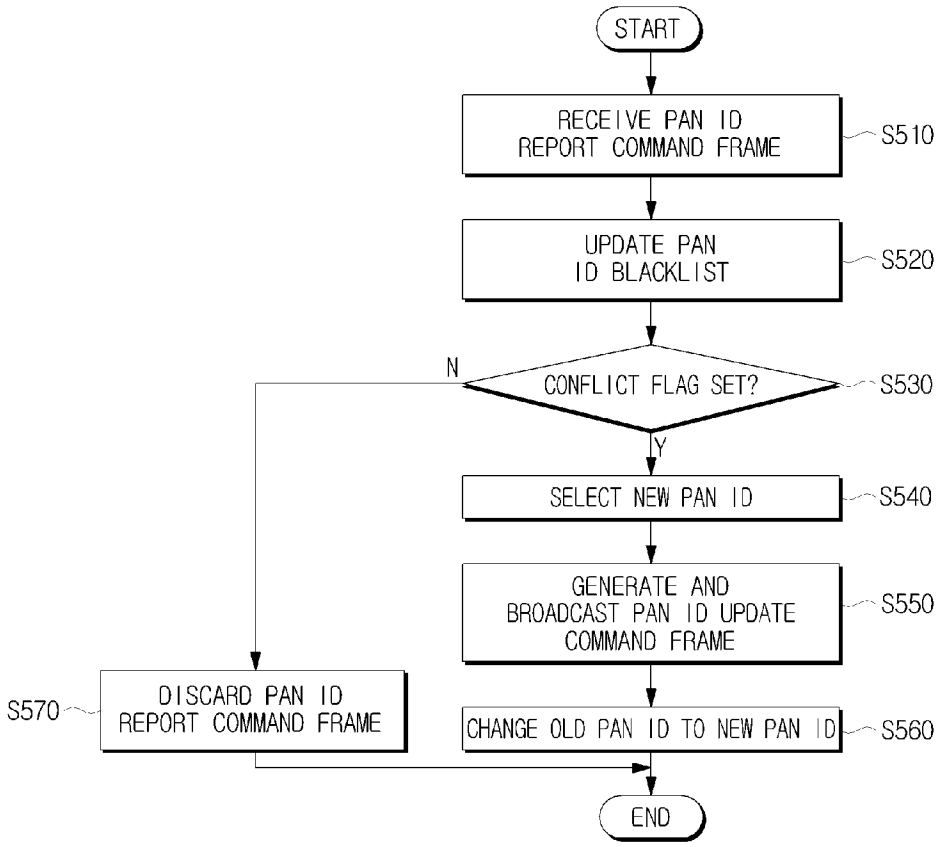


[Fig. 4]



PAN ID Report Command Frame Format

[Fig. 5]

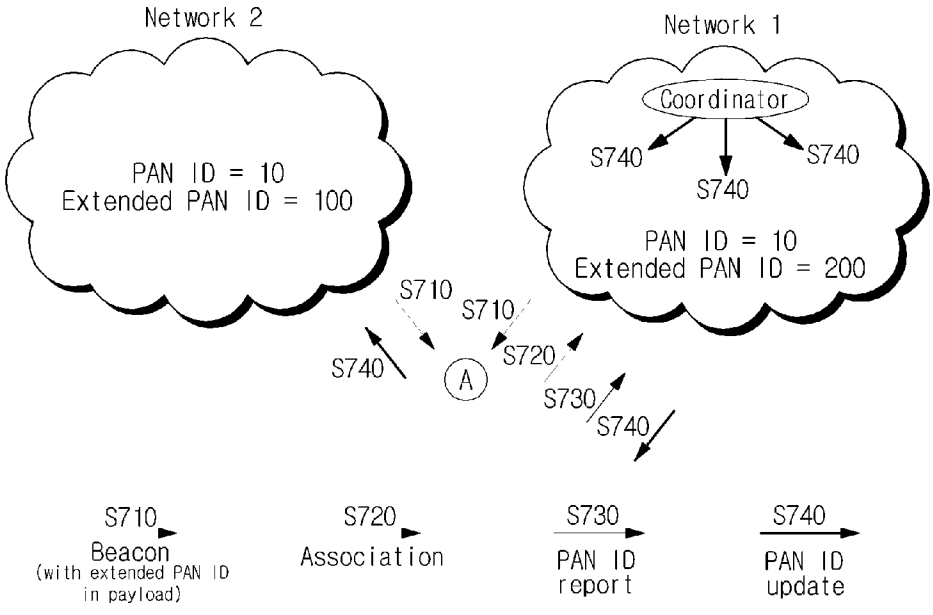


[Fig. 6]

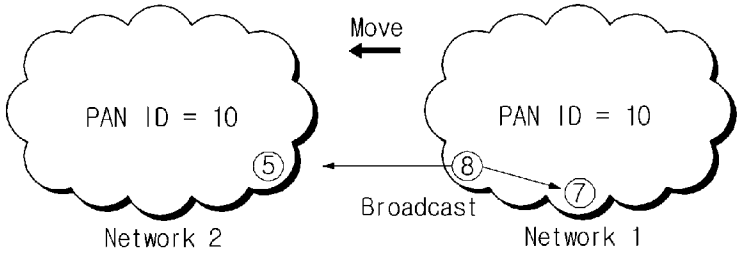
Octets:1	8	2	2
Command frame identifier	EPID	Old PAN ID	New PAN ID
NWK payload			

PAN ID update command frame

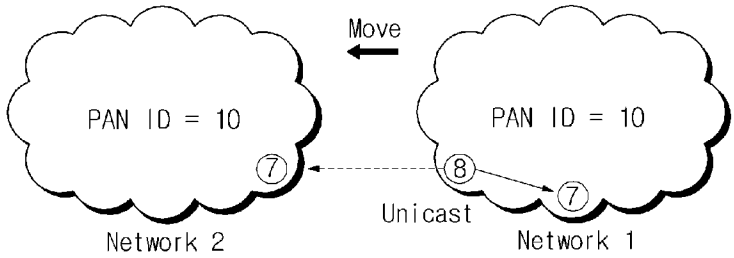
[Fig. 7]



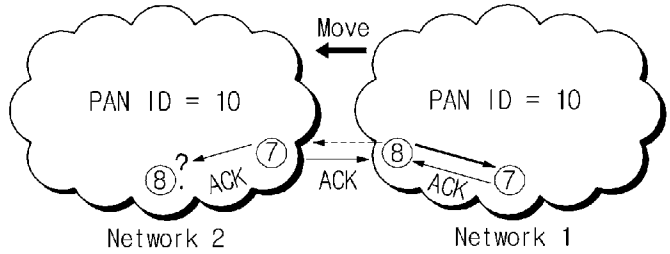
[Fig. 8]



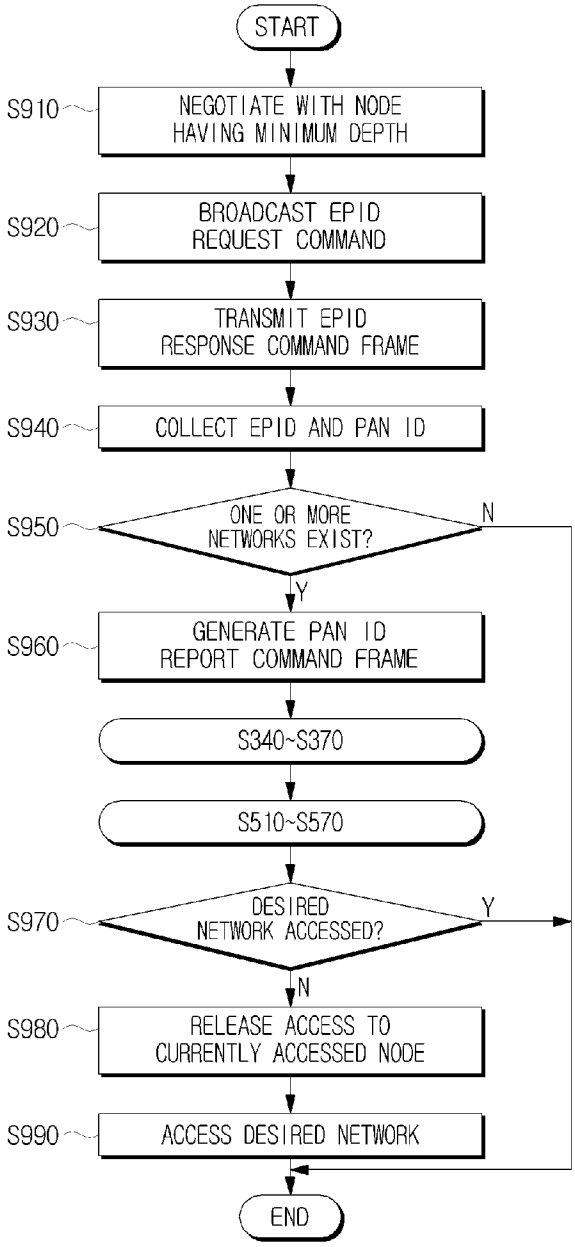
[Fig. 9]



[Fig. 10]



[Fig. 11]



[Fig. 12]

Octets:1
Command frame identifier
NWK payload

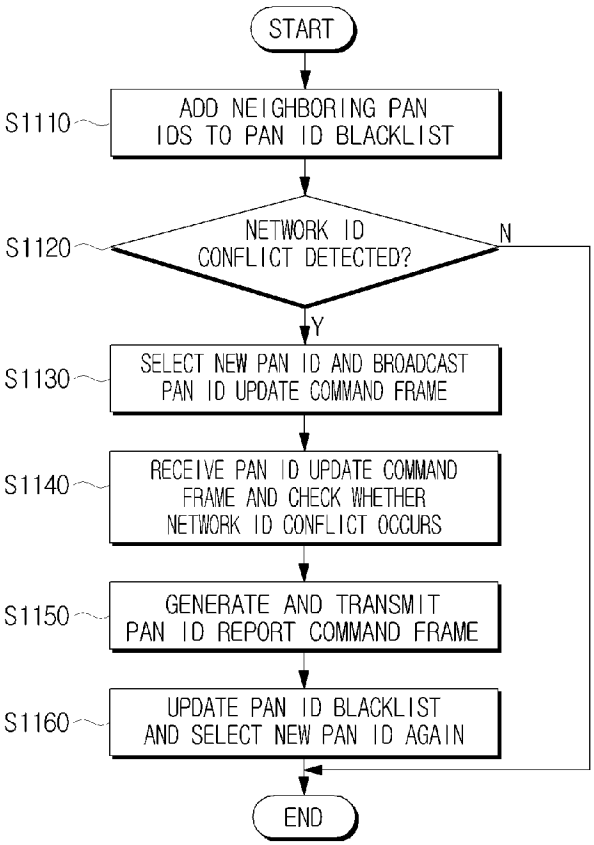
EPID request command frame

[Fig. 13]

Octets:1	8
Command frame identifier	EPID
NWK payload	

EPID response command frame

[Fig. 14]


START
S1110
ADD NEIGHBORING PAN IDS TO PAN ID BLACKLIST
S1120
NETWORK ID CONFLICT DETECTED?
N
Y
S1130
SELECT NEW PAN ID AND BROADCAST PAN ID UPDATE COMMAND FRAME
S1140
RECEIVE PAN ID UPDATE COMMAND FRAME AND CHECK WHETHER NETWORK ID CONFLICT OCCURS
S1150
GENERATE AND TRANSMIT PAN ID REPORT COMMAND FRAME
S1160
UPDATE PAN ID BLACKLIST AND SELECT NEW PAN ID AGAIN
END

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2006/003607

A. CLASSIFICATION OF SUBJECT MATTER

H04L 12/413(2006.01)i

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)
IPC8 H04L 12/413

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Patents and applications for inventions since 1975
Korean Utility Models and application for Utility Models since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)
eKIPASS(KIPO internal) : "Keyword : conflict, network, ID, solve, detect, personal area network"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO2005015751A1 (QUICK ASHLEIGH GLEN et al.) 17.02.2005 see page9, line23 - page page 18, line 28	1 - 27
A	US20040114619A1 (Chan Won Park et al.) 17.06.2004 see Par.[0026]- Par.[0050]	1 - 27
A	US6240414B1 (EISOLUTIONS INC) 29.05.2001 see Col.3,line 60 - Col.13, line 18	1 - 27
A	WO0124452A1 (LOPEZ PATRICK) 05.04.2001 see Abstract; Figures 1-3; claims 1-2	1 - 27
A	EP01261174A1 (Sony Corp.) 27.11.2002 see par.[0091] - par.[0146]	1 - 27

☐ 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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"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
12 DECEMBER 2006 (12.12.2006)	**12 DECEMBER 2006 (12.12.2006)**

Name and mailing address of the ISA/KR	Authorized officer
Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	SHIN, Sung Kil Telephone No. 82-42-481-5688

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

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR2006/003607

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