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(54) NEW FRAME STRUCTURE FOR BRIDGING OPERATION IN HIGH-SPEED WIRELESS PERSONAL AREA NETWORK AND DATA TRANSMITTING METHOD THEREOF

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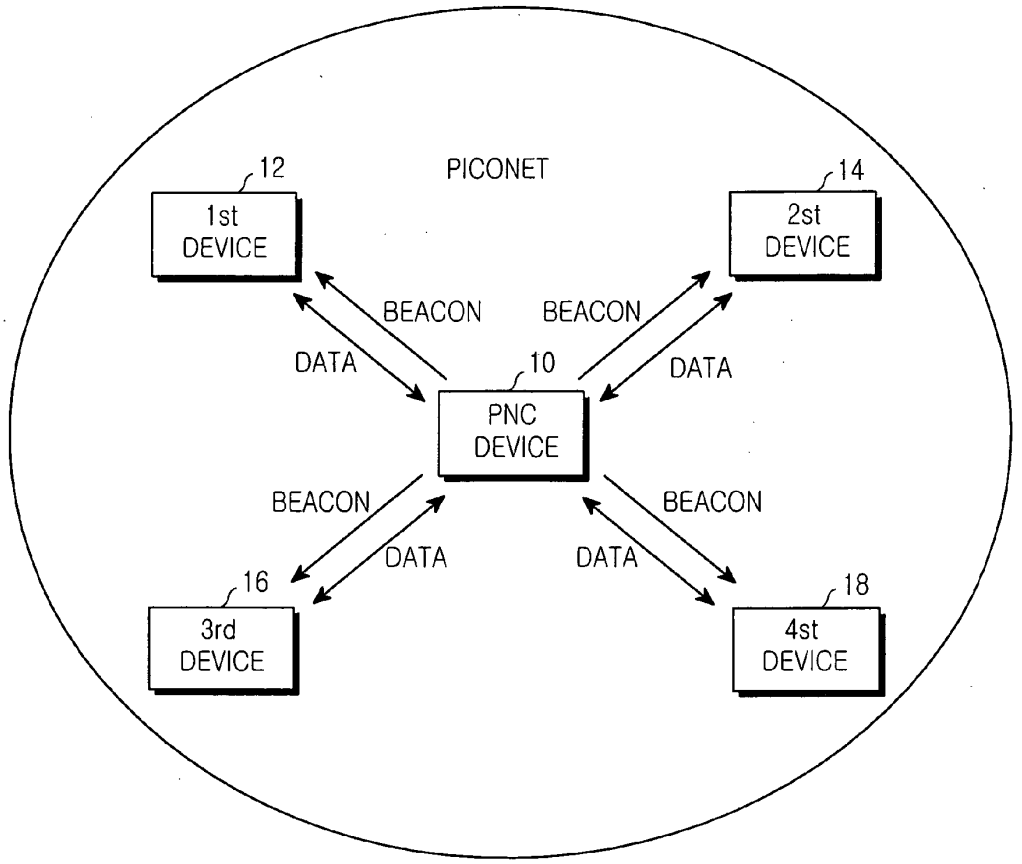
(57) **ABSTRACT**

Disclosed is a frame structure in a high-speed wireless personal area network (WPAN) and a message transmitting method thereof which enable communications among devices existing in different piconets by using a device that provides a bridging function in the IEEE 802.15.3 WPAN. In a high-speed WPAN system which includes a parent piconet having a plurality of devices and a child piconet using time slots allocated by the devices located in the parent piconet, and a bridge device located in the child piconet, that broadcasts information about the devices of the parent piconet and information about the devices of the child piconet to the devices included in the high-speed WPAN, and operates to perform a data transfer between a first specified device in the child piconet and a second specified device in the parent piconet. A specified device included in the high-speed WPAN constructs a MAC (Media Access Control) header data structure for a data transmission so that the data structure includes a source piconet identification (ID) field for indicating the piconet to which the specified device belongs, and a destination piconet ID field for indicating the destination piconet to which the destination device, to which the specified device intends to transmit data, belongs.



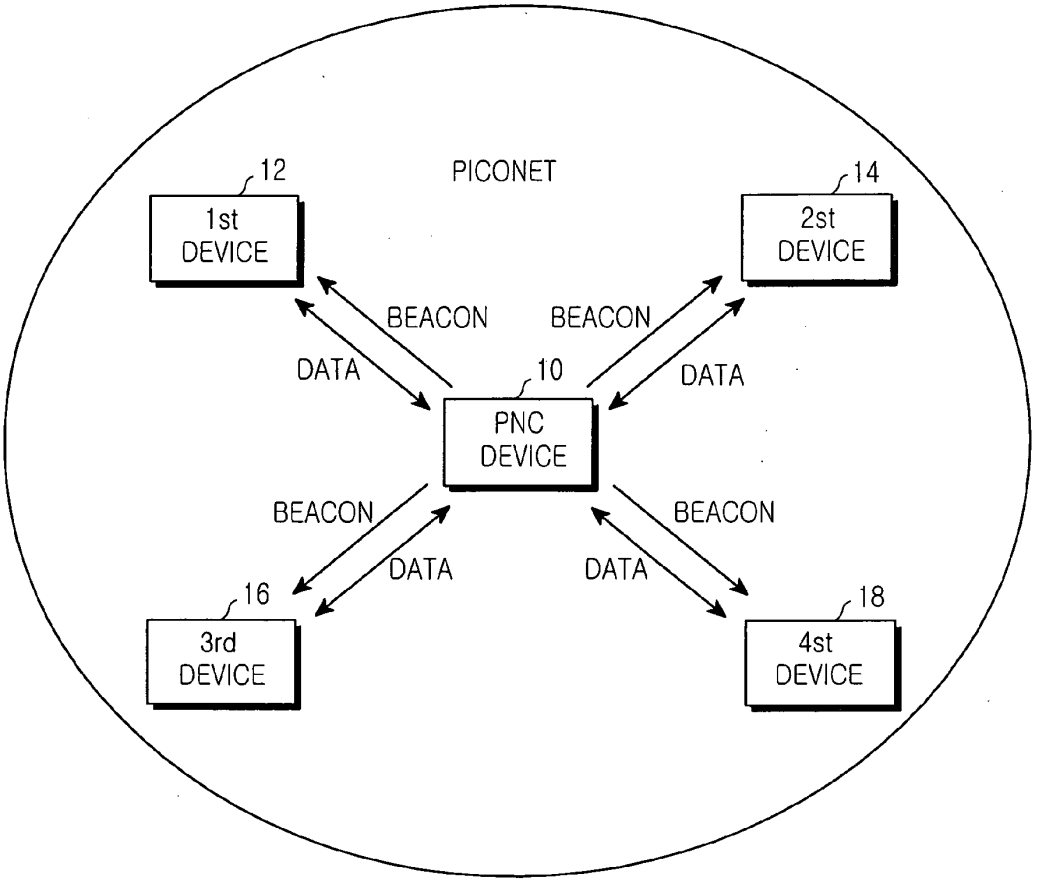

PICONET
12
1st DEVICE
14
2st DEVICE
BEACON
BEACON
DATA
10
DATA
PNC DEVICE
BEACON
BEACON
DATA
DATA
16
3rd DEVICE
18
4st DEVICE

FIG.1

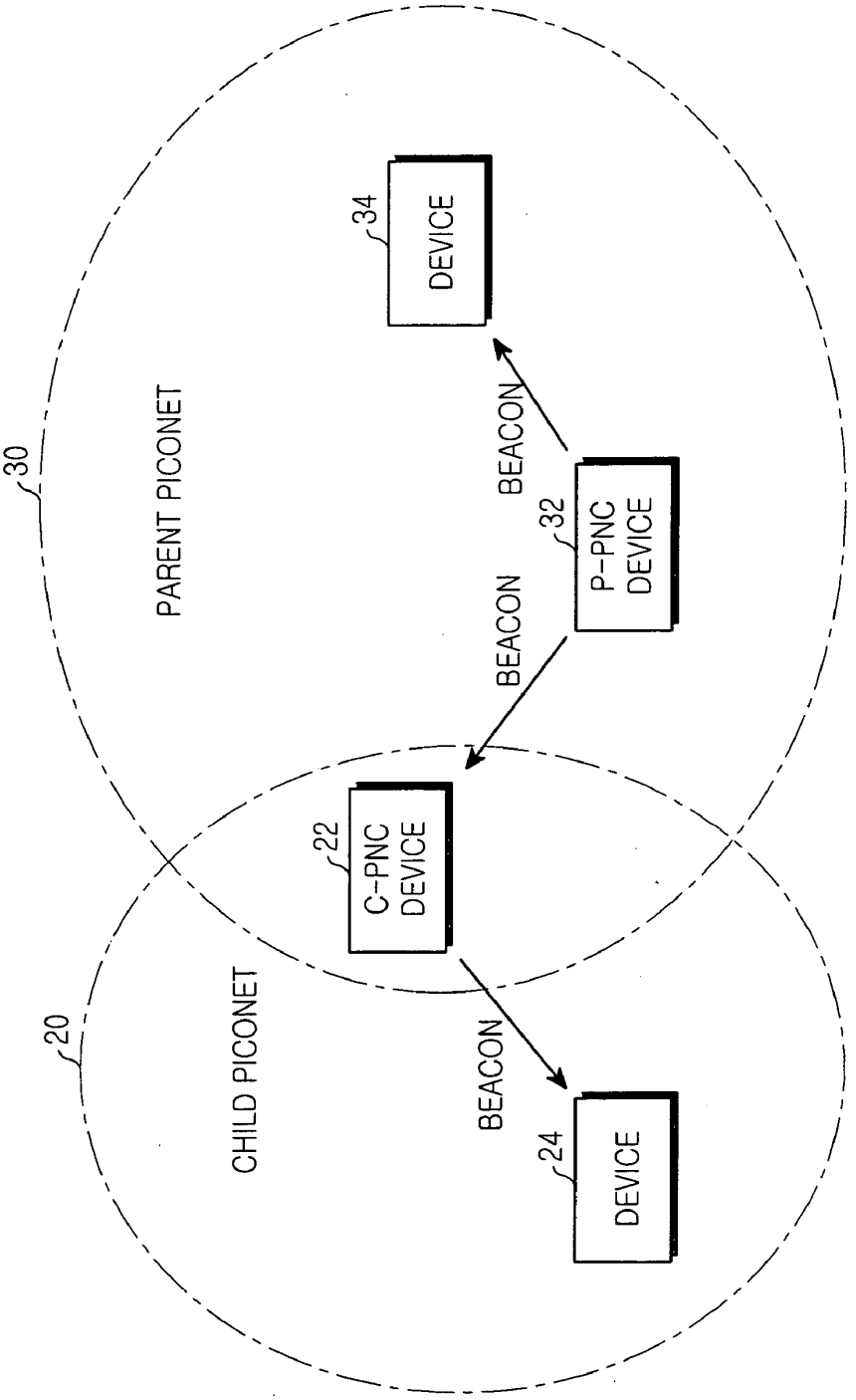

30
PARENT PICONET
34
DEVICE
BEACON
32
P-PNC DEVICE
BEACON
22
C-PNC DEVICE
20
CHILD PICONET
BEACON
24
DEVICE

FIG.2

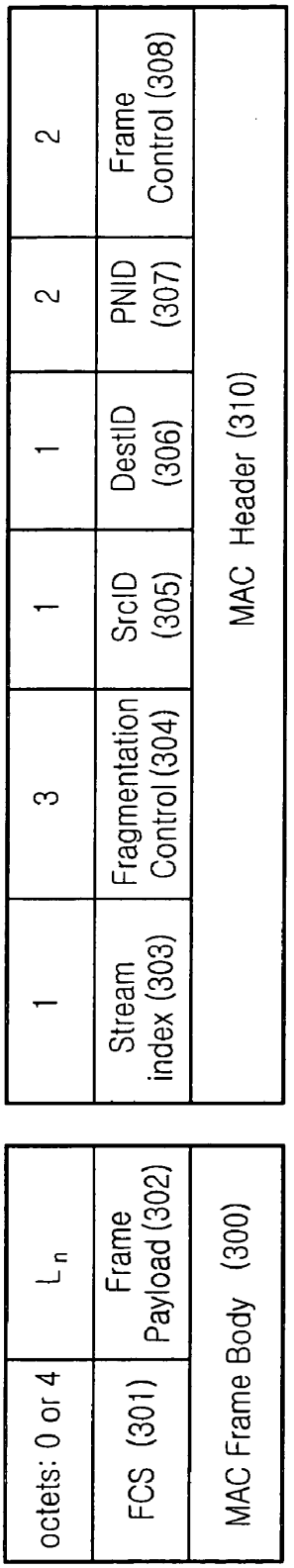

octets: 0 or 4
$L_n$
FCS (301)
Frame Payload (302)
MAC Frame Body (300)
1
3
1
1
2
2
Stream index (303)
Fragmentation Control (304)
SrcID (305)
DestID (306)
PNID (307)
Frame Control (308)
MAC Header (310)

FIG.3

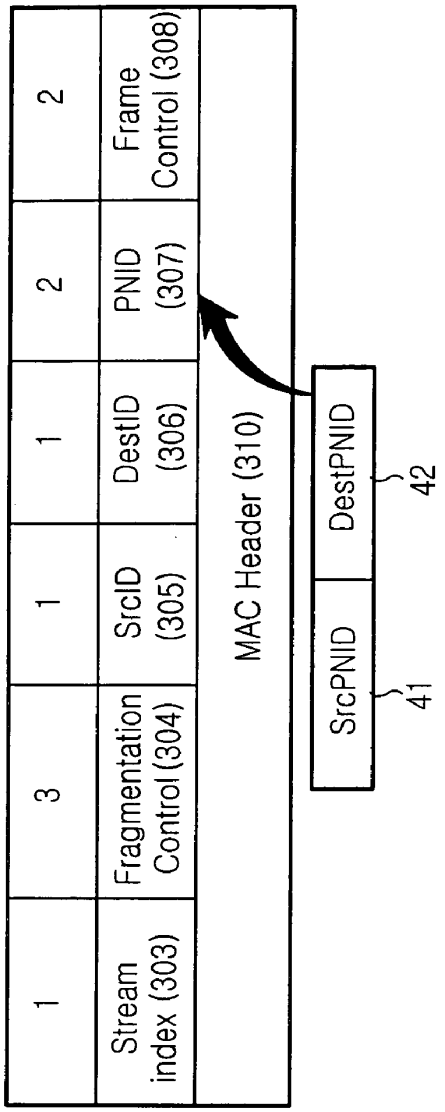

MAC Frame Body (300)
FCS (301)
octets: 0 or 4
Frame Payload (302)
$L_n$
MAC Header (310)
Stream index (303)
1
Fragmentation Control (304)
3
SrcID (305)
1
DestID (306)
1
PNID (307)
2
Frame Control (308)
2
SrcPNID
41
DestPNID
42

FIG.4

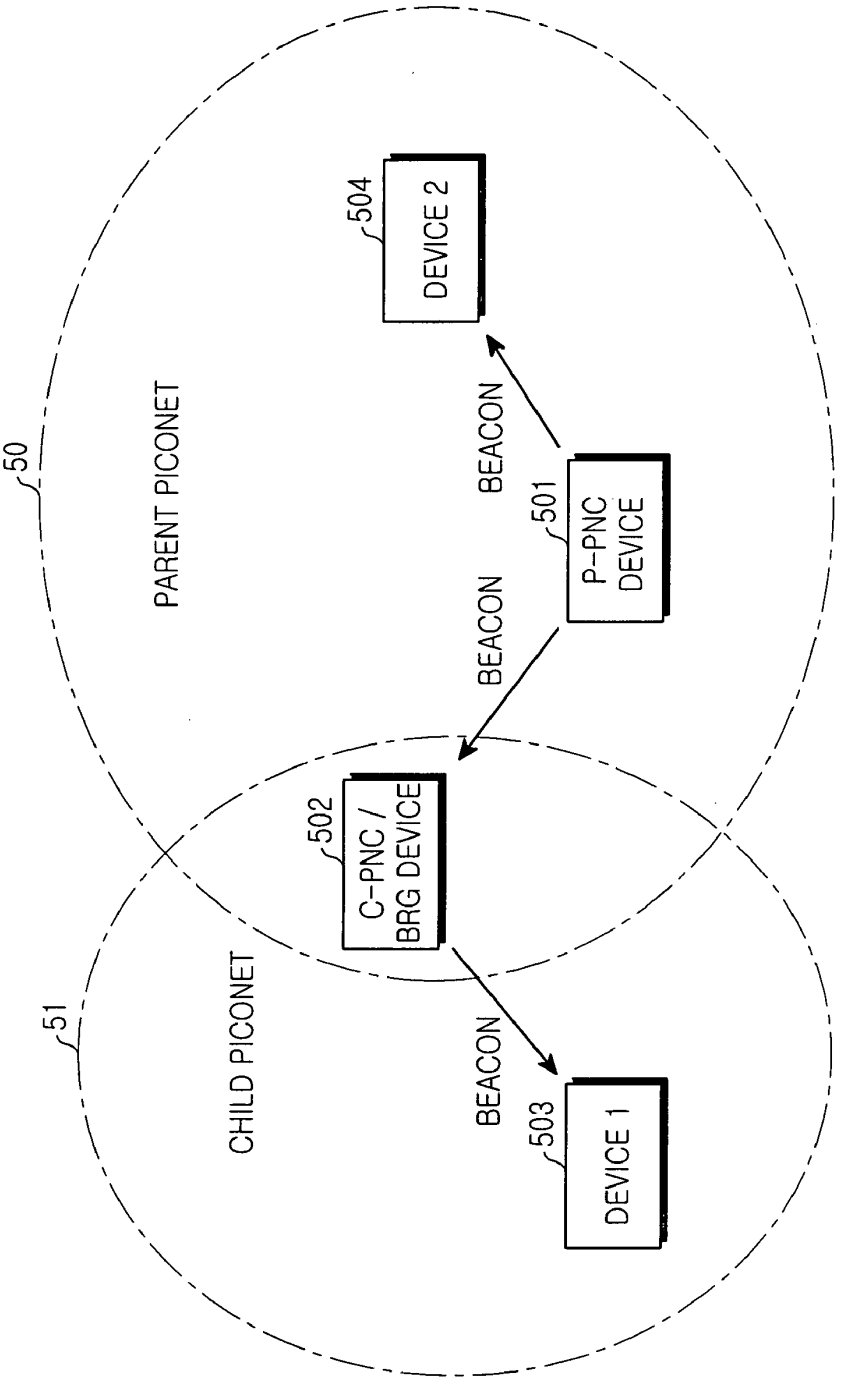

50
PARENT PICONET
504
DEVICE 2
BEACON
501
P-PNC DEVICE
BEACON
502
C-PNC / BRG DEVICE
51
CHILD PICONET
BEACON
503
DEVICE 1

FIG.5

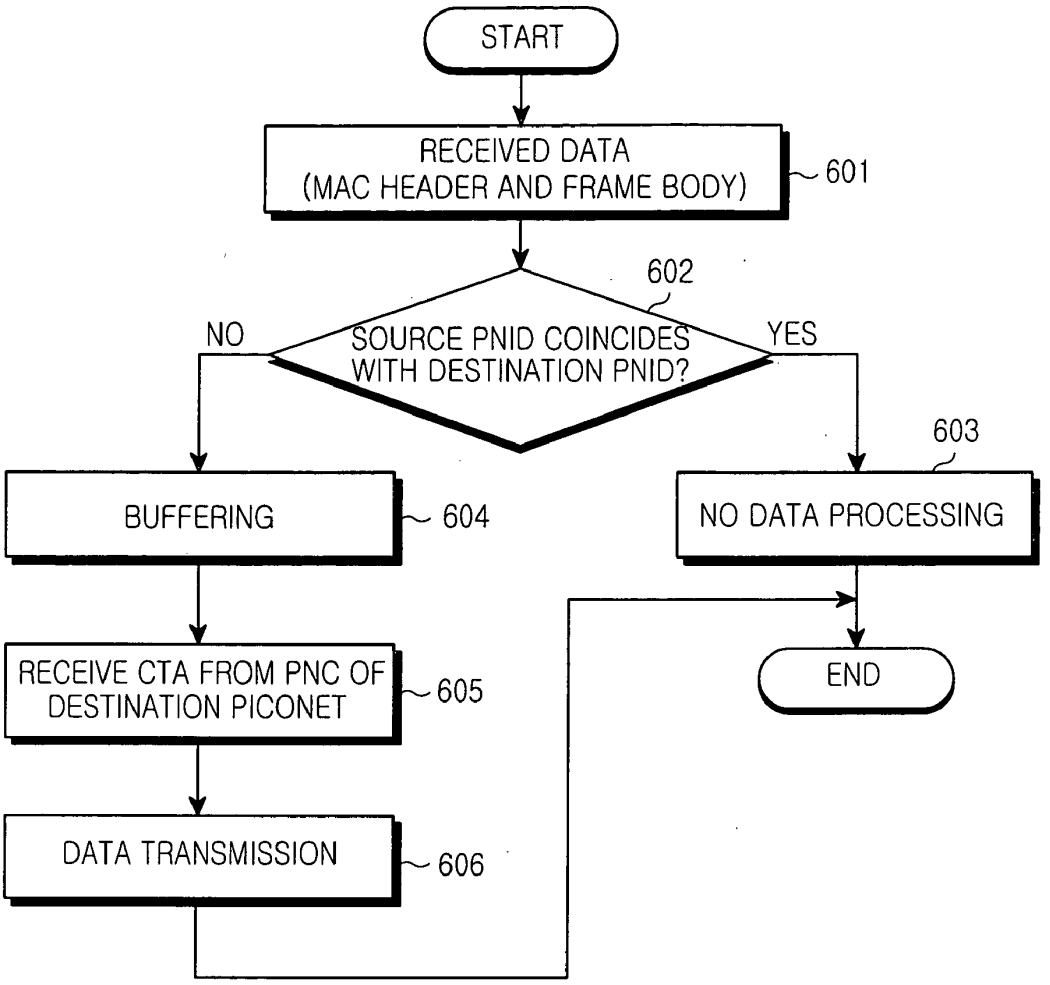

START
RECEIVED DATA
(MAC HEADER AND FRAME BODY)
601
602
SOURCE PNID COINCIDES
WITH DESTINATION PNID?
NO
YES
603
BUFFERING
604
NO DATA PROCESSING
RECEIVE CTA FROM PNC OF
DESTINATION PICONET
605
END
DATA TRANSMISSION
606

FIG.6

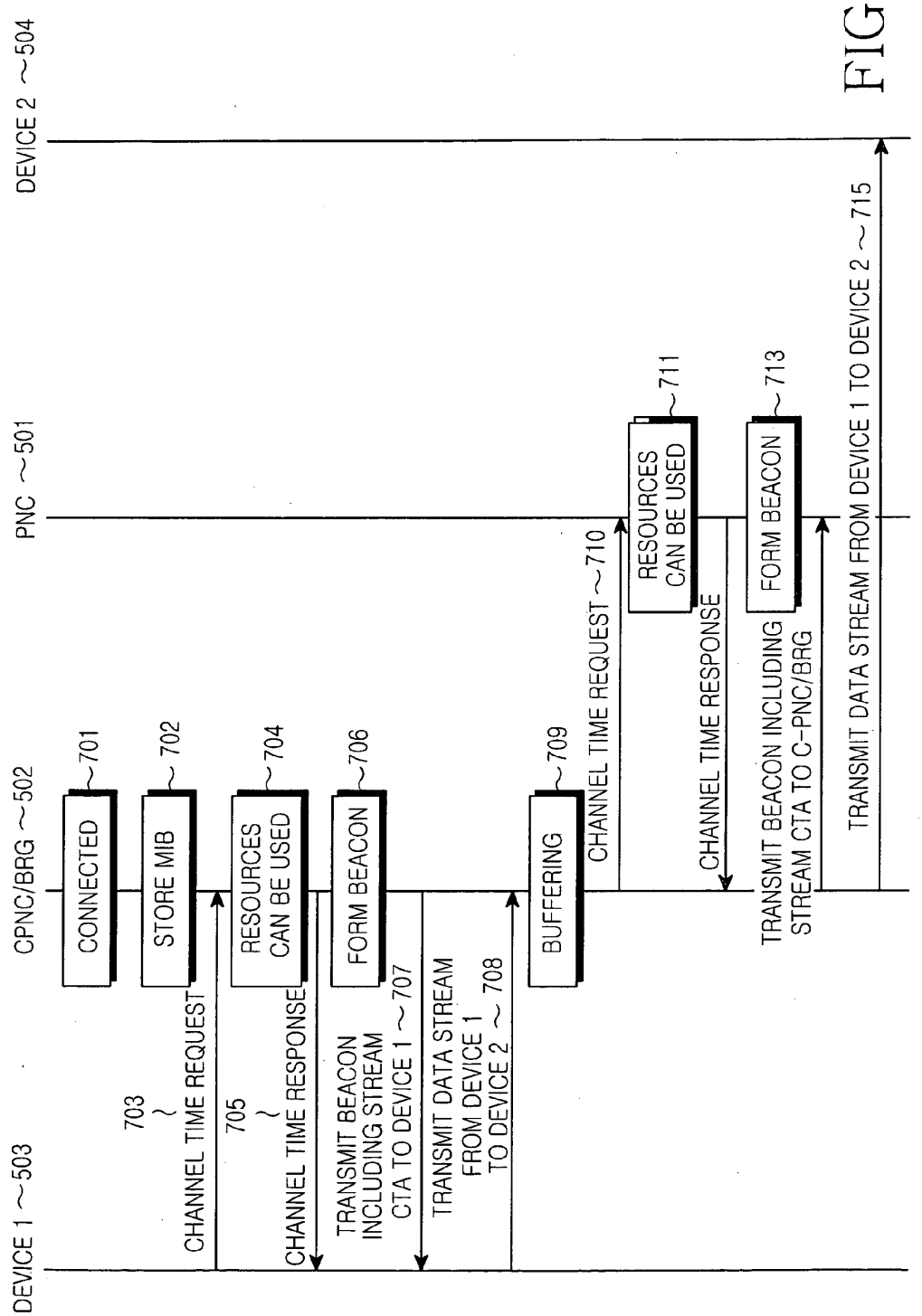
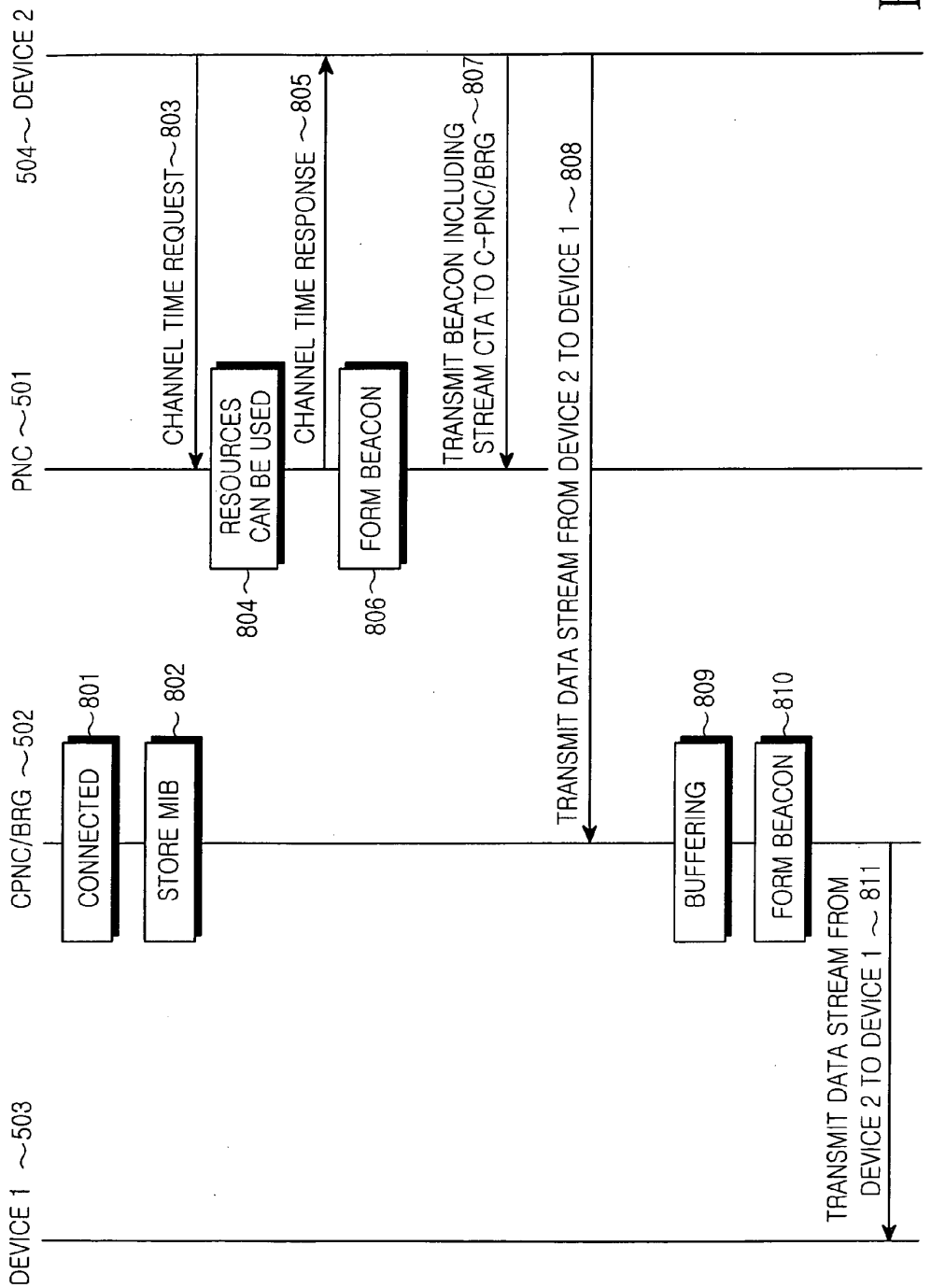

DEVICE 1 ~503
CPNC/BRG ~502
PNC ~501
DEVICE 2 ~504
CONNECTED ~701
STORE MIB ~702
703
CHANNEL TIME REQUEST
RESOURCES CAN BE USED ~704
705
CHANNEL TIME RESPONSE
FORM BEACON ~706
TRANSMIT BEACON INCLUDING STREAM CTA TO DEVICE 1 ~707
TRANSMIT DATA STREAM FROM DEVICE 1 TO DEVICE 2 ~708
BUFFERING ~709
CHANNEL TIME REQUEST ~710
RESOURCES CAN BE USED ~711
CHANNEL TIME RESPONSE
FORM BEACON ~713
TRANSMIT BEACON INCLUDING STREAM CTA TO C-PNC/BRG
TRANSMIT DATA STREAM FROM DEVICE 1 TO DEVICE 2 ~715

FIG. 7

FIG.8


DEVICE 1 ~503
CPNC/BRG ~502
PNC ~501
504~ DEVICE 2
CONNECTED
801
STORE MIB
802
CHANNEL TIME REQUEST~803
RESOURCES CAN BE USED
804~
CHANNEL TIME RESPONSE ~805
FORM BEACON
806~
TRANSMIT BEACON INCLUDING STREAM CTA TO C-PNC/BRG ~807
TRANSMIT DATA STREAM FROM DEVICE 2 TO DEVICE 1 ~808
BUFFERING
809
FORM BEACON
810
TRANSMIT DATA STREAM FROM DEVICE 2 TO DEVICE 1 ~811

# NEW FRAME STRUCTURE FOR BRIDGING OPERATION IN HIGH-SPEED WIRELESS PERSONAL AREA NETWORK AND DATA TRANSMITTING METHOD THEREOF

## CLAIM OF PRIORITY

[0001] This application claims priority, pursuant to 35 USC §119, to that patent application entitled "New Frame Structure For Bridging Operation In High-Speed Wireless Personal Area Network And Data Transmitting Method Thereof" filed in the Korean Intellectual Property Office on Nov. 24, 2003 and assigned Serial No. 2003-83782, the contents of which are hereby incorporated by reference.

## BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to an IEEE 802.15.3 high-speed wireless personal area network (WPAN) using an ultra-wide band (UWB), and more particularly to a high-speed WPAN which can support communications among devices included in different piconets in the high-speed WPAN.

[0004] 2. Description of the Related Art

[0005] A wireless communication technique using UWB is a technique that guarantees a transmission distance in the range of 10 m to 1 km. The UWB wireless communication technique had been used as a military wireless communication technique by the US Department of Defense for the past 40 years, and has been open to the nonmilitary sector by the Federal Communications Commission (FCC), which is the US authority on communication frequencies.

[0006] The UWB wireless communication technique is a ultrahigh-speed wireless data transmitting technique using a bandwidth of several GHz, for high transmitting speed (of 500 Mbps to 1 Gbps) with a low power consumption (1/100 of the power consumption of a mobile phone or a wireless LAN) in comparison to other existing transmission techniques, such as IEEE 802.11, Bluetooth, etc. The UWB wireless communication technique can be used in diverse fields such as a short-distance personal communication network that connects a computer, peripheral devices and home appliances to an ultrahigh-speed wireless interface in a short distance (up to 100 m), a radar for examining, by fluoroscopy, the interior of a building, a high-precision position measurement, a device for preventing a car collision, an underground mine detector, a system for preventing the loss of an article, or a detection of an object inside a body, etc.

[0007] A standard for the UWB wireless communication technique has been proposed as a high-speed wireless personal area network (WPAN) in IEEE 802.15.3. In the IEEE 802 standards groups, IEEE 802.15.1 is a group that establishes the Bluetooth standards, and IEEE 802.11 is a group that establishes the wireless LAN standards.

[0008] Bluetooth has been commercialized as a widely known personal area network (PAN), and has recently been applied to many network-related products. Bluetooth generally uses a frequency band of 2.4 GHz (i.e., ISM band), and provides a personal area network (PAN) solution with its communication distance limited to less than 10 m. The wireless LAN of the IEEE 802.11 group that takes charge of the wireless LAN standard has already been standardized.

[0009] IEEE 802.15.3 has be divided into three task groups; TG1 (Task Group 1), TG2 and TG3. TG1 establishes the Bluetooth standards, and TG2 performs technical analysis of methods for enabling Bluetooth products and existing wireless LAN business to coexist. TG3 researches the standard of a high data rate PAN solution, and is now conducting research in a transmission system having transmission speeds of more than 55 Mbps.

[0010] **FIG. 1** illustrates an exemplary piconet designated among communication devices in an IEEE **802.15.3** high-speed wireless PAN.As shown the piconet that forms the high-speed wireless PAN is composed of a plurality of communication devices **10**, **12**, **14**, **16** and **18**. One device **10** among them operates as a piconet coordinator (PNC). Here, the PNC serves as a master of the corresponding piconet and performs synchronization with the respective devices, manages time slots for data communication, and performs other control operations.

[0011] PNC device **10** manages the time slots required for the communications among the devices located in the piconet by using a message referred to as a beacon in order to perform synchronization with the connected devices **12**, **14**, **16** and **18**. PNC **10** additionally serves to control a QoS (Quality of Signal), a power save mode, and piconet access.

[0012] As described above, the IEEE 802.15.3 device **10**, serving as the piconet coordinator, can designate the piconet. The device having a capability as the piconet coordinator forms the piconet by searching

[0013] channels in order to start the piconet, selecting one of the channels that is not in use, and broadcasts a beacon frame through the selected channel. The devices **12**, **14**, **16** and **18** that have received the broadcast beacon frame set the channel for their communications in response to the received beacon frame. In this case, the PNC device **10** allocates and provides IDs for the respective devices **12**, **14**, **16** and **18** that have responded to the beacon.

[0014] In another aspect, a device may take part in the piconet already formed, through an association procedure. That is, the device, which has moved from the outside onto the already formed piconet A, requests connection with a device in the piconet A . Accordingly, PNC device **10** provides a single device ID to the device that has requested the connection., which can be used in the piconet A.

[0015] Through the above-described process, the piconet as shown in **FIG. 1** is formed. Here, the respective devices **12**, **14**, **16** and **18**, except for the PNC device **10**, request PNC device **10** for data transmission. The PNC device **10** allocates communicable time slots to the respective devices **12**, **14**, **16** and **18** in response to the data transmission request. When the PNC device **10** allocates the time slots to the respective devices **12**, **14**, **16** and **18**, it uses the beacon frame. The respective devices **12**, **14**, **16** and **18** perform the data transmission in a time corresponding to the time slot allocated by the PNC device **10**.

[0016] When a device desires to terminate the communication in the piconet or to perform a disconnection, a piconet disassociation procedure is performed between the PNC device **10** and the corresponding device. In this case, the

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PNC device **10** deletes information about the recorded device through the piconet disassociation procedure.

[**0017**] The piconet designated between the PNC device **10** and the respective devices **12**, **14**, **16** and **18** may be divided into an independent piconet which can independently allocate the time slots to the devices existing in the piconet, and a dependent piconet which distributes and allocates the time slots provided from a PNC device located outside the piconet to the devices existing in the piconet. If a dependent piconet is newly produced in a independent piconet, the independent piconet at that time is referred to as a parent piconet, and the newly produced dependent piconet is referred to as a child piconet or a neighbor piconet. In this case, the independent piconet becomes the parent piconet, and the dependent piconet becomes the child piconet. In this case, the child piconet (i.e., dependent piconet) shares and uses the channel provided from the PNC device of the parent piconet.

[**0018**] **FIG. 2** is a view illustrating an example of a dependent piconet designated in the IEEE 802.15.3 high-speed wireless PAN network.

[**0019**] According to **FIG. 2**, the existing piconet is a parent piconet **30**, and a PNC device of the parent piconet **30** is referred to as P-PNC device **32**. A device having a capability of being a PNC device, except for the P-PNC device **32**, among the devices **22**, **32** and **42**, which constitute the parent piconet **30**, can be defined as child piconet **20** (C-PNC).

[**0020**] P-PNC device **32***c*, located in the parent piconet **30**, allocates time slots to the C-PNC device **22** and another device **34**, which define the child piconet, and transmits the beacon frame. Here, the C-PNC device **22** is a device that performs a PNC function in the child piconet **20**.

[**0021**] C-PNC device **22** may also define the child piconet **20**, and separately manage and control the device **24** that is included in child piconet **20**. The communication in the child piconet **20** can be performed only between the devices **22** and **24** that define the child piconet **20**.

[**0022**] Accordingly, the C-PNC device **22** is a member that is included in the parent piconet **30** and manages and controls the child piconet **20**. Thus, the C-PNC device **22** can perform a communication with the devices **32** and **34** in the parent piconet **30**.

[**0023**] However, in the conventional IEEE 802.15.3 high-speed wireless PAN using the ultra-wide band (UWB), it is impossible to perform a communication between the device **34** in the parent piconet **30** and the device **24** in the child piconet **24**. This results in inefficient communication between devices of different networks. Hence, there is a need in the industry for a method and system for communicating between devices of different networks

## SUMMARY OF THE INVENTION

[**0024**] Accordingly, the present invention has been made to solve the above-mentioned problems occurring in the prior art, and an object of the present invention is to provide a frame structure in a high-speed wireless personal area network (WPAN) and a message transmitting method thereof that enables communications among devices existing in different piconets by using a device that provides a bridging function in the IEEE 802.15.3 WPAN.

[**0025**] In order to accomplish this object, there is provided a new data structure for a bridging operation in a high-speed wireless personal area network (WPAN) system which includes a parent piconet and having a plurality of devices and a newly defined child piconet using time slots allocated by the devices located in the parent piconet, the system having a bridge device which is located in the child piconet, that broadcasts information about the devices of the parent piconet and information about the devices of the child piconet to the devices included in the high-speed WPAN, and operates to perform a data transfer between a first specified device included in the child piconet and a second specified device included in the parent piconet, wherein a specified device included in the high-speed WPAN constructs a MAC. (Media Access Control) header data structure for a data transmission so that the data structure includes a source piconet identification (ID) field for indicating the piconet to which the specified device belongs, and a destination piconet identification (ID) field for indicating the destination piconet to which the destination device, to which the specified device intends to transmit data, belongs.

[**0026**] In another aspect of the present invention, there is provided a data transmitting method in a high-speed wireless personal area network (WPAN) which includes a parent piconet designated in advance and having a plurality of devices, a newly designated child piconet using time slots allocated by the devices located in the parent piconet, and a bridge device which is located in the child piconet, broadcasts information about the devices of the parent piconet and information about the devices of the child piconet to the devices included in the high-speed WPAN so that the respective devices store complete device information, and operates to perform a data transfer between a first specified device included in the child piconet and a second specified device included in the parent piconet, the data transmitting method comprising a first step of the first specified device being allocated with a first channel time for a data transmission from a first piconet coordinator that is a piconet coordinator of the child piconet, and transmitting data to the first piconet coordinator at the first channel time, a second step of the first piconet coordinator buffering the transmitted data, and a third step of the first piconet coordinator being allocated with a second channel time for a data transmission from a second piconet coordinator that is a piconet coordinator of the parent piconet, and transmitting the data to the second specified device at the second channel time.

[**0027**] In still another aspect of the present invention, there is provided a data transmitting method in a high-speed wireless personal area network (WPAN) which includes a parent piconet designated in advance and having a plurality of devices, a newly designated child piconet using time slots allocated by the devices located in the parent piconet, and a bridge device which is located in the child piconet, broadcasts information about the devices of the parent piconet and information about the devices of the child piconet to the devices included in the high-speed WPAN so that the respective devices store device information, and operates to perform a data transfer between a first specified device included in the child piconet and a second specified device included in the parent piconet, the data transmitting method comprising a first step of the second specified device being

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allocated with a first channel time for a data transmission from a first piconet coordinator, which is a piconet coordinator of the parent piconet, and transmitting data to a second piconet coordinator, which is a piconet coordinator of the child piconet at the first channel time, a second step of the second piconet coordinator buffering the transmitted data, and a third step of the second piconet coordinator allocating a second channel time for the data transmission, and transmitting the data to the second specified device at the second channel time.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0028] The above and other objects, features and advantages of the present invention will be more apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

[0029] **FIG. 1** is a view illustrating an example of a piconet designated among devices in an IEEE 802.15.3 high-speed wireless personal area network;

[0030] **FIG. 2** is a view illustrating an example of a dependent piconet designated in an IEEE 802.15.3 high-speed wireless personal area network;

[0031] **FIG. 3** is a view illustrating a message structure in a general IEEE 802.15.3 high-speed wireless personal area network;

[0032] **FIG. 4** is a view illustrating a frame structure for communications between piconets in an IEEE 802.15.3 high-speed wireless personal area network according to the present invention;

[0033] **FIG. 5** is a view illustrating an IEEE 802.15.3 high-speed wireless personal area network enabling communications between different piconets according to an embodiment of the present invention;

[0034] **FIG. 6** is a flowchart illustrating a switching operation of a bridge according to PNID information according to an embodiment of the present invention;

[0035] **FIG. 7** is a flowchart illustrating data communications among devices that belong to different piconets according to an embodiment of the present invention; and

[0036] **FIG. 8** is a flowchart illustrating data communications among devices that belong to different piconets according to another embodiment of the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

[0037] Hereinafter, a frame structure in a high-speed wireless personal area network (WPAN) and a message transmitting method thereof according to embodiments of the present invention are described with reference to the accompanying drawings. In the following description of the present invention, same drawing reference numerals are used for the same elements even in different drawings. Also, a detailed description of known functions and configurations incorporated herein will be omitted when it may make the subject matter of the present invention rather unclear.

[0038] **FIG. 3** is a view illustrating a message structure in a general IEEE 802.15.3 high-speed wireless personal area network. As shown, the message in the general IEEE 802.15.3 high-speed wireless personal area network (WPAN) is composed of a MAC frame body **300** and a MAC header **310**. The MAC frame body **300** is composed of a FSC **301** for an error control and a frame payload **302** that includes data to be transmitted.

[0039] The MAC header **310** includes a stream index field **303**, composed of one byte, for discriminating a message, a fragmentation control field **304**, composed of three bytes, for a fragmentation control, an SrcID field **305**, composed of one byte, for displaying a source device, a DestID field **306**, composed of one byte, for displaying a destination device, a PNID field **307**, composed of two bytes, for displaying a piconet in which devices are located, and a frame control field **308**, composed of two bytes, for a frame control.

[0040] Although the source device (e.g., SrcID field) and the destination device (e.g., DestID field) may be divided from each other, communications between devices are basically performed only in one piconet since there is only one PNID field **307**.

[0041] **FIG. 4** is a view illustrating a frame structure for communications between piconets in an IEEE 802.15.3 high-speed wireless personal area network according to the present invention.

[0042] As shown in **FIG. 4**, the frame structure has the same structure as the conventional frame structure as illustrated in **FIG. 3**, however, a two-byte PNID field **307** is included wherein one-byte designates a source device and one-byte designates a destination device. Further, by indicating the positions of the respective piconets even if the source device and the destination device are located in different piconets, it become possible to perform communications between devices that belong to different piconets.

[0043] Undoubtedly, it is impossible to perform the communications only by discriminating between the source piconet and the destination piconet. That is, in order to perform the communications between the source piconet and the destination piconet, an intermediate construction between them is required. Such a construction is illustrated in **FIG. 5**.

[0044] **FIG. 5** is a view illustrating an IEEE 802.15.3 high-speed wireless personal area network enabling communications between different piconets according to an embodiment of the present invention.

[0045] As shown in **FIG. 5**, the IEEE 802.15.3 high-speed wireless personal area network (WPAN) according to the present invention is composed of a parent piconet **50** and a child piconet **51**. The parent piconet **50** includes a P-PNC device **501**, a device **2504**, and a C-PNC/BRG device **502** of the child piconet. The child piconet **51** includes the C-PNC/BRG device **502** and a device **1503**.

[0046] Here, the C-PNC/BRG device **502** serves to perform a control operation so as to perform communications between the piconets. That is, the C-PNC/BRG device **502** provides the communications between a source device and a destination device using respective PNID values in the case that a source PNID and a destination PNID are separately provided as shown in FIG **4**. The operation of the C-PNC/BRG device **502** according to the different source PNID and destination PNID will be explained later with reference to **FIG. 6**.

[0047] In the construction of **FIG. 5**, the C-PNC/BRG device **502** additionally serves as a bridge in addition to the functions related to a conventional C-PNC device. That is, the C-PNC/BRG device may not only serve as a piconet coordinator of the child piconet but also a bridge between the piconets. In the embodiment of the present invention shown, one device performs functions of both the child piconet coordinator and the bridge. However, the C-PNC device and the bridge may be separated from each other, and another of the devices in the child piconet may perform the function of the bridge.

[0048] The operation of the bridge according to the present invention will now be explained.

[0049] First, the IEEE 802.15.3 high-speed WPAN is constructed in a manner that a plurality of devices that support the IEEE 802.15.3 high-speed WPAN are connected together, i.e., located in a predetermined area, and one of the devices operates as the piconet coordinator (PNC).

[0050] The P-PNC device **501** generates mapping information composed of MAC (Media Access Control) addresses of 64 bits and device IDs of 8 bits using information transmitted from the devices **502** and **504** in the parent piconet, and stores and manages the mapping information in a P-MIB (Parent Piconet Management Information Base). Also, the P-PNC device **501** broadcasts information about the devices **502** and **504** registered in the parent piconet **50** using a beacon frame.

[0051] Only the devices **502** and **504** registered in the parent piconet **50** can receive the beacon frame broadcast by the P-PNC device **501**. The respective devices **502** and **504** in the parent piconet **50** generate mapping information about the devices **502** and **504** using information of the beacon frame transmitted from the P-PNC device **501**, store and manage the mapping information in MIBs for the respective devices.

[0052] C-PNC/BRG device **502** that manages and controls the child piconet **51** broadcasts information about the device **1503** that exists in the child piconet **51**, which is not registered as mapping information of a C-MIB (Child Piconet Management Information Base), using the beacon frame. Here, only the device **503** that is registered as the child piconet **51** in the C-PNC/BRG device **502** can receive the beacon frame.

[0053] Also, the device **1503** stores and manages the mapping information about the devices registered in C-MIB of the C-PNC/BRG device **502** in C-MIBs for the respective devices using the beacon frame information broadcast from the C-PNC/BRG device **502**.

[0054] As described above, in the conventional high-speed wireless PAN, there is no way to share the information about the devices between the parent piconet and the child piconet. However, according to the present invention, it is possible to share the information about the devices between the parent piconet and the child piconet by the bridging operation.

[0055] Specifically, the device having the bridging function broadcasts the information about the devices which are located in the different piconets to the devices which exist in other piconets. Here, the information about the devices which exist in the different piconets is called bridging information. If the respective devices receive the information about the devices which exist in the different piconets, they generate B-MIB (Bridging Management Information Base) about the devices of all the piconets which are connected through the received information about the devices of the different piconets.

[0056] Meanwhile, the device having the bridging function switches or transfers the data transmitted from the devices located in the different piconets.

[0057] If the bridging operation is performed as described above, there is no exchange of information between the respective piconets although the conventional device ID is allocated, and thus overlapping of the device IDs by piconets can be prevented.

[0058] **FIG. 6** is a flowchart illustrating the switching operation of a bridge according to PNID information according to an embodiment of the present invention. As shown in **FIG. 6**, if the bridge device according to the present invention receives data which includes a MAC header and a frame body (step **601**), it confirms whether a source PNID included in the MAC header coincides with a destination PNID (step **602**).

[0059] If it is confirmed that the source PNID coincides with the destination PNID at step **602**, the bridge device does not perform the data process through the bridge, but performs communications according to the data processing method in the piconet through the PNC of the corresponding piconet.

[0060] However, if it is confirmed that the source PNID does not coincide with the destination PNID at step **602**, the bridge device performs a buffering of the transferred data (step **604**), and waits for reception of a CTA (Channel Time Allocation) from the PNC of the piconet to which the data is to be transmitted (step **605**). If the CTA is received from the piconet, the bridge device transmits the data (step **606**).

[0061] **FIG. 7** is a flowchart illustrating data communications among devices that belong to different piconets according to an embodiment of the present invention. In **FIG. 7**, an example of a data transmission from the device **1503** that belongs to the child piconet to the device **2504** that belongs to the parent piconet is shown.

[0062] In this illustrative example, the parent piconet and the child piconet are connected together (step **701**), and MIBs of the respective devices are stored through the bridging operation (step **702**).

[0063] Device **1503** requests a channel time to the C-PNC/BRG device **502** for the data transmission (step **703**). At this time, if the C-PNC/BRG device **502** can use resources for a TDM type data allocation (step **704**), it transfers a channel time response to the device **1503** (step **705**).

[0064] The C-PNC/BRG device **502** forms a beacon in which control information is described (step **706**), and transmits the beacon which includes a stream CTA for the requested data transmission to the device **1503** (step **707**). The device **1503**, which has received the stream CTA, transmits the data stream to the C-PNC/BRG device **502** at the corresponding channel time (step **708**).

[0065] The C-PNC/BRG device **502** performs a buffering of the transmitted data stream (step **709**), requests a channel time to the PNC device **501** for the data transmission (step

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710). When the PNC **501** can use resources for a TDM type data allocation (step **711**), it transfers a channel time response to the PNC/BRG device **502** (step **712**).

[**0066**] The PNC device **501** forms a beacon in which control information is described (step **713**), and transmits the beacon which includes a stream CTA for the requested data transmission to the C-PNC/BRG device **502** (step **714**). The C-PNC/BRG device **502**, which has received the stream CTA, transmits the data stream to the device **2504** at the corresponding channel time (step **715**). Since the C-PNC/BRG device **502** and the device **2504** perform the data transmission in the same piconet, the data transmission is performed without passing through the PNC device **501**.

[**0067**] For the above-described operation, it should be possible to confirm the positions of the piconets for the respective devices. This becomes possible by providing the destination piconet ID and the source piconet ID through the data structure according to the present invention as shown in **FIG. 4**. Also, for the data transmission between the piconets, it is required for the bridge as shown in **FIG. 6** to perform the bridging operation according to the destination piconet ID and the source piconet ID.

[**0068**] **FIG. 8** is a flowchart illustrating data communications among devices that belong to different piconets according to another embodiment of the present invention. In **FIG. 8**, an example of a data transmission from the device **2504** that belongs to the parent piconet to the device **1503** that belongs to the child piconet is shown.

[**0069**] In this illustrative case, the parent piconet and the child piconet are connected together (step **801**), and MIBs of the respective devices are stored through the bridging operation (step **802**).

[**0070**] Then, the device **2504** requests a channel time to the PNC device **501** for the data transmission (step **803**). At this time, when the PNC device **501** can use resources for a TDM type data allocation (step **804**), it transfers a channel time response to the device **2504** (step **805**).

[**0071**] The PNC device **501** forms a beacon in which control information is described (step **806**), and transmits the beacon which includes a stream CTA for the requested data transmission to the device **2504** (step **807**). The device **2504**, which has received the stream CTA, transmits the data stream to the C-PNC/BRG device **502** at the corresponding channel time (step **808**). Since the C-PNC/BRG device **502** and the device **2504** perform the data transmission in the same piconet, the data transmission is performed without passing through the PNC device **501**.

[**0072**] The C-PNC/BRG device **502** performs a buffering of the transmitted data stream (step **809**), forms a beacon in which control information that includes the CTA is described (step **810**), and transmits the data stream to the device **1503** (step **811**). Through the above-described method, it is possible to perform communications between the different piconets.

[**0073**] For the above-described operation, it should be possible to confirm the positions of the piconets for the respective devices. This becomes possible by providing the destination piconet ID and the source piconet ID through the data structure according to the present invention as shown in **FIG. 4**. Also, for the data transmission between the piconets, it is required for the bridge as shown in **FIG. 6** to perform the bridging operation according to the destination piconet ID and the source piconet ID.

[**0074**] The method according to the present invention as described above may be implemented by a program, and stored in a recording medium (e.g., CD ROM, floppy disc, hard disc, optomagnetic disc, etc.) in a form readable through a computer.

[**0075**] As described above, the frame structure in a high-speed WPAN using a UWB and the message transmitting method thereof according to the present invention enables communications among devices existing in different piconets by using a device that provides a bridging function in the IEEE 802.15.3 WPAN.

[**0076**] Also, the present invention broadcasts information of all the devices using a bridging device, and can avoid overlapping of the device IDs.

[**0077**] Although one child piconet and one parent piconet have been described in the embodiment of the present invention, it will be apparent to those skilled in the art that the present invention can also be applied to communications among plural piconets which are constructed in a manner that a first child piconet, a second child piconet that has the first child piconet as its parent piconet, a third child piconet that has the second child piconet as its parent piconet, etc., are connected in series.

[**0078**] Also, the present invention can also be applied to communications among plural piconets which are constructed in a manner that plural devices in a parent piconet designate their child piconets, respectively.

[**0079**] While the invention has been shown and described with reference to certain preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

**1**. A data structure for a bridging operation in a high-speed wireless personal area network (WPAN) system that includes a parent piconet having a plurality of devices, a child piconet using time slots allocated by the devices located in the parent piconet, and a bridge device, located in the child piconet that broadcasts information about the devices of the parent piconet and information about the devices of the child piconet to the devices included in the high-speed WPAN, and operates to perform a data transfer between a first specified device included in one piconet and a second specified device included in a second piconet, wherein

a specified device included in the high-speed WPAN constructs a MAC (Media Access Control) header data structure for a data transmission so that the data structure includes a source piconet identification (ID) field for indicating the piconet to which the specified device belongs, and a destination piconet identification (ID) field for indicating the destination piconet to which the destination device, to which the specified device intends to transmit data, belongs.

**2**. The data structure as claimed in claim 1, wherein the bridge device performs an operation that includes:

a first step of receiving data from the first specified device;

a second step of comparing a value of the source piconet ID field included in the data from the first specified device with a value of the destination piconet ID field;

a third step of terminating a bridging operation with respect to the data if the value of the source piconet ID field is equal to the value of the destination piconet ID field as a result of comparison at the second step;

a fourth step of buffering the data if the value of the source piconet ID field is different from the value of the destination piconet ID field as a result of comparison at the second step; and

a fifth step of receiving a time allocation message from the destination piconet, and transmitting the buffered data at a time allocated by the time allocation message.

**3**. The data structure as claimed in claim 1, wherein the bridge device operates as a piconet coordinator of the child piconet.

**4**. The data structure as claimed in claim 1, wherein both the source piconet ID field and the destination piconet ID field are each composed of one byte.

**5**. The data structure as claimed in claim 1, wherein information about the devices included in the high-speed WPAN system is broadcast through the bridge device, so that overlapping of device IDs among the devices is prevented.

**6**. A data transmitting method in a high-speed wireless personal area network (WPAN) that includes a parent piconet having a plurality of devices, a child piconet using time slots allocated by the devices located in the parent piconet, and a bridge device located in the child piconet, that broadcasts information about the devices of the parent piconet and information about the devices of the child piconet to the devices included in the high-speed WPAN so that the respective devices store device information, and operates to perform a data transfer between a first specified device included in the child piconet and a second specified device included in the parent piconet, the data transmitting method comprising the steps of:

allocating the first specified device with a first channel time for a data transmission from a first piconet coordinator, which is a piconet coordinator of the child piconet, and transmitting data to the first piconet coordinator at the first channel time;

buffering the transmitted data in the first piconet coordinator; and

allocating the first piconet coordinator with a second channel time for a data transmission from a second piconet coordinator that is a piconet coordinator of the parent piconet, and transmitting the data to the second specified device at the second channel time.

**7**. The data transmitting method as claimed in claim 6, wherein the step of allocating a first channel times comprises the steps of:

requesting, by the first specified device, a channel time of the first piconet coordinator that is the piconet coordinator of the child piconet;

confirming in the first piconet coordinator, which has received the channel time request, whether resources can be used, and responding to the channel time request;

forming a beacon that includes the first channel time in the first piconet coordinator, which has responded to the channel time request, , and transferring the beacon to the first specified device; and

transferring, by the first specified device, the data to the first piconet coordinator at the first channel time.

**8**. The data transmitting method as claimed in claim 6, wherein the step of allocating a second channel time comprises the steps of:

requesting, by the first piconet coordinator, a channel time of the second piconet coordinator that is a piconet coordinator of the parent piconet;

confirming in the second piconet coordinator, which has received the channel time request, whether resources can be used, and responding to the channel time request;

forming a beacon that includes the second channel time in the second piconet coordinator, which has responded to the channel time request, , and transferring the beacon to the first piconet coordinator; and

transferring, by the first piconet coordinator, the data to the second device at the second channel time.

**9**. The data transmitting method as claimed in claim 8, wherein the first piconet coordinator is the bridge device.

**10**. A data transmitting method in a high-speed wireless personal area network (WPAN) which includes a parent piconet having a plurality of devices, a child piconet using time slots allocated by the devices located in the parent piconet, and a bridge device located in the child piconet, that broadcasts information about the devices of the parent piconet and information about the devices of the child piconet to the devices included in the high-speed WPAN so that the respective devices store device information, and operates to perform a data transfer between a first specified device included in the child piconet and a second specified device included in the parent piconet, the data transmitting method comprising the steps of:

allocating in the second specified device a first channel time for a data transmission from a first piconet coordinator, which is a piconet coordinator of the parent piconet, and transmitting data to a second piconet coordinator, which is a piconet coordinator of the child piconet at the first channel time;

buffering the transmitted data; and

allocating, in the second piconet coordinator, a second channel time for the data transmission, and transmitting the data to the second specified device at the second channel time.

**11**. The data transmitting method as claimed in claim 10, wherein the step of allocating a first channel time comprises the steps of:

requesting, by the second specified device. a channel time of the first piconet coordinator that is the piconet coordinator of the parent piconet;

confirming in the first piconet coordinator, which has received the channel time request, whether resources can be used, and responding to the channel time request;

forming a beacon that includes the first channel time by the first piconet coordinator, which has responded to the channel time request, and transferring the beacon to the first specified device; and

transferring, by the first specified device, the data to the second piconet coordinator at the first channel time.

**12**. The data transmitting method as claimed in claim 10, wherein the step of allocating a second channel time comprises the steps of:

forming a beacon that includes the second channel time in the second piconet coordinator; and

transferring, by the second piconet coordinator, the data to the second specified device at the second channel time.

**13**. The data transmitting method as claimed in claim 12, wherein the second piconet coordinator is the bridge device.

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