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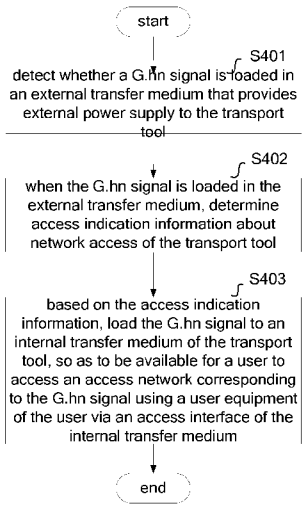


Fig. 4

(57) Abstract: An objective of the present invention is to provide a method and apparatus for providing network access to a transport tool based on G.hn Standard. The method comprises detecting whether a G.hn signal is loaded in an external transfer medium that provides external power supply to a transport tool; when the G.hn signal is loaded in the external transfer medium, determining access indication information about network access of the transport tool; based on the access indication information, loading the G.hn signal to an internal transfer medium of the transport tool so as to be available for a user to access an access network corresponding to the G.hn signal using a user equipment of the user via an access interface of the internal transfer medium. Compared with the prior art, the present invention provides a relatively stable network connection and enhances users' use experience; meanwhile, the present invention is more convenient and simple in implementation, which saves new inputs and shortens the construction period of building or rebuilding to the least extent. Further, the present invention saves costly and sparse radio resources of a mobile communication network and helps to realize coverage of a communication network in the transport tool.

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METHOD AND APPARATUS FOR PROVIDING NETWORK ACCESS TO TRANSPORT TOOLS BASED ON THE G.HN STANDARD

FIELD OF THE INVENTION

The present invention relates to the technical field of communication, and more specifically, to a technology of providing network access to transport tools based on the G.hn standard.

BACKGROUND OF THE INVENTION

Usually, most existing transport tools have no or do not have sufficient Ethernet RJ45 sockets. The transport tolls include, but not limited to passenger liner, yacht, business purpose vehicle, recreational vehicle(RV) or caravan, etc.

Moreover, when these transport tools are moving, broadband mobile communication networks such as 3G/4G mobile communication networks, WiMAX, Microwave network are more feasible schemes for accessing mobile communication networks, because communication satellites can only provide low bandwidth access.

Let us carefully analyze the cases of using these transport tools in a city or port, it would be found that on the one hand, these transport tools are in a still or anchored state in a large part of time (even the most part of time), particularly at nights; second, it also costs considerable time to charge an electrical vehicle which is now becoming increasingly popular; third, many cities have public transport electrical buses that are powered by overhead contact systems, and like transport tools; on the other hand, the radio resource of broadband mobile communication networks is very limited, particularly in a crowded city or port.

Therefore, when these transport tools are in a still or anchored state, it would become very helpful if these transport tools can automatically access a wired communication network or switch their access from a mobile communication network to a wired communication network. Of course, when these transport tools start moving, they should be capable of being automatically disconnected from the wired communication network or switching their access to a mobile communication network.

In order to achieve the above objective with a feasible method, for example, the new switch device and method between a mobile communication network and a wired communication network should use the existing physical connection mediums, for example, a power line, a line pipe and interface, and like facilities, so as to save new inputs as much as possible and shorten the construction period for building or rebuilding to the least extent. In fact, when transport tools are in a still or anchored state, most of them would use the existing power lines and their interfacing facilities to connect the power grid of the city or port so as to get power supply. In other words, the existing power line and its interfacing facility may be regarded as a ready connection medium and facility (for example, the interfaces and facilities that provide shore power to the anchored ships in a dock).

Currently, the ITU (International Telecommunication Union) has recommended the G.hn Standard as the international standard for next generation home network, which specifies basic characteristics of a unified high-speed home networking transceiver capable of operating the above lines, including inside telephone line, co-axial cable, and power line, as well as a combination thereof; the data rate for a network in compliance with the G.hn Standard can reach 1G bps (i.e., 1024M bit/s).

Therefore, based on the G.hn standard and the existing power line and corresponding

interfacing facilities connecting to a still/ anchored transport tool, a feasible device and method can be designed to implement automatic on/off, switch or superposition between a mobile communication network and a wired communication network for the transport tool.

SUMMARY OF THE INVENTION

An objective of the present invention is to provide a method and apparatus for providing network access to a transport tool based on G.hn Standard.

According to one aspect of the present invention, there is provided a method for providing network access to a transport tool based on G.hn Standard, wherein the method comprises steps of:

a. detecting whether a G.hn signal is loaded in an external transfer medium that provides external power supply to the transport tool;

b. when the G.hn signal is loaded in the external transfer medium, determining access indication information about network access of the transport tool;

c. based on the access indication information, loading the G.hn signal to an internal transfer medium of the transport tool, so as to be available for a user to access an access network corresponding to the G.hn signal using a user equipment of the user via an access interface of the internal transfer medium.

In a preferred embodiment, wherein the transport tool comprises a mobile access module that provides a network access service;

wherein, the step b comprises:

- when the G.hn signal is loaded in the external transfer medium, determining access indication information about network access of the transport tool, wherein the access indication information comprises first switch indication information about switching the network access of the transport tool from the mobile access module to an access network corresponding to the G.hn signal.

In a preferred embodiment, wherein the method further comprises:

- closing or sleeping the mobile access module based on the first switch indication information.

In a preferred embodiment, wherein the method further comprises:

- receiving a report on losing the G.hn signal of the external transfer medium;

wherein, the step b further comprises:

- updating the access indication information based on the report, wherein the updated access indication information comprises second switch information about switching the network access of the transport tool from the access network corresponding to the G.hn signal to an access network corresponding to the mobile access module;

wherein the method further comprises:

- switching the network access of the transport tool to the access network corresponding to the mobile access module based on the second switch indication information.

In a preferred embodiment, wherein the method further comprises:

- detecting whether a simultaneous access trigger condition for providing network access via the mobile access module is satisfied;

wherein, the step b further comprises:

- when the simultaneous access trigger condition is satisfied, updating the access indication information, wherein the updated access indication information comprises third switch

indication information about providing to a network access user in the transport tool a mobile communication network access corresponding to the mobile access module;

wherein the method further comprises:

- based on the third switch indication information, providing the mobile communication network access via the mobile access module so as to be available for a user to access the mobile communication network corresponding to the mobile access module by using a user equipment of the user via the mobile access module;

wherein the simultaneous access trigger condition comprises at least one of:

- the remaining available bandwidth being lower than a predefined available bandwidth threshold;

- a ratio of used bandwidth to total access bandwidth being higher than a predefined bandwidth utilization ratio threshold.

In a preferred embodiment, wherein the method further comprises:

- for communication data transferred via the mobile access module, performing format conversion between a G.hn protocol and a transfer protocol corresponding to the mobile access module so as to be available for subsequent transfer.

In a preferred embodiment, wherein the step c further comprises:

- based on the access indication information, providing a wireless local area network access via a wireless local area network access module, so as to be available for a user to access an access network corresponding to the G.hn signal by using a user equipment of the user via the wireless local area network access module;

wherein the method further comprises:

- for communication data transferred via the wireless local area network access module, performing format conversion between a G.hn protocol and a transfer protocol corresponding to the wireless local area network access module so as to be available for subsequent transfer.

In a preferred embodiment, wherein the step c further comprises:

- based on the access indication information, providing an Ethernet access via an Ethernet access module, so as to be available for a user to access an access network corresponding to the G.hn signal by using a user equipment of the user via an Ethernet interface of the Ethernet access module;

wherein the method further comprises:

- for communication data transferred via the Ethernet access module, performing format conversion between a G.hn protocol and an Ethernet transfer protocol so as to be available for subsequent transfer.

According to another aspect of the present invention, there is further provided a control device for providing network access to a transport tool based on G.hn Standard, wherein the device comprises:

- a G.hn extroversive analog front-end module configured to detect whether a G.hn signal is loaded in an external transfer medium that provides external power supply to the transport tool;

- a processing means configured to, when the G.hn signal is loaded in the external transfer medium, determine access indication information about network access of the transport tool;

- a G.hn introversive analog front-end module configured to, based on the access indication information, load the G.hn signal to an internal transfer medium of the transport tool, so as to be available for a user to access an access network corresponding to the G.hn signal using a user equipment of the user via an access interface of the internal transfer medium;

- a G.hn protocol processing module configured to cooperate with the processing means to process G.hn protocol-related operations;

- a mobile access module configured to provide a mobile communication network access corresponding to the mobile access module for the transport tool.

In a preferred embodiment, wherein the processing means is configured to:

- when the G.hn signal is loaded in the external transfer medium, determine access indication information about network access of the transport tool, wherein the access indication information comprises first switch indication information about switching the network access of the transport tool from the mobile access module to an access network corresponding to the G.hn signal.

In a preferred embodiment, wherein the processing means is configured to:

- receive a report on losing the G.hn signal of the external transfer medium;

- update the access indication information based on the report, wherein the updated access indication information comprises second switch information about switching the network access of the transport tool from the access network corresponding to the G.hn signal to an access network corresponding to the mobile access module;

- switch the network access of the transport tool to the access network corresponding to the mobile access module based on the second switch indication information.

In a preferred embodiment, wherein the processing means is configured to:

- detect whether a simultaneous access trigger condition for providing network access via the mobile access module is satisfied;

- when the simultaneous access trigger condition is satisfied, update the access indication information, wherein the updated access indication information comprises third switch indication information about providing to a network access user in the transport tool a mobile communication network access corresponding to the mobile access module;

- based on the third switch indication information, provide the mobile communication network access via the mobile access module so as to be available for a user to access the mobile communication network corresponding to the mobile access module by using a user equipment of the user via the mobile access module;

wherein the simultaneous access trigger condition comprises at least one of:

- the remaining available bandwidth being lower than a predefined available bandwidth threshold;

- a ratio of used bandwidth to total access bandwidth being higher than a predefined bandwidth utilization ratio threshold.

In a preferred embodiment, wherein the control device further comprises a wireless local area network access module configured to:

- based on the access indication information, provide a wireless local area network access, so as to be available for a user to access an access network corresponding to the G.hn signal by using a user equipment of the user via the wireless local area network access module.

In a preferred embodiment, wherein the control device further comprises an Ethernet access module configured to:

- based on the access indication information, provide an Ethernet access, so as to be available for a user to access an access network corresponding to the G.hn signal by using a user equipment of the user via an Ethernet interface of the Ethernet access module.

According to a further aspect of the present invention, there is further provided a system for

providing network access for a transport tool based on G.hn Standard, wherein the system comprises a control device according to any one of claims 9 to 14, and a G.hn gateway.

Compared with the prior art, the present invention detects whether a G.hn signal is loaded in an external transfer medium that provides external power supply to a transport tool; when the G.hn signal is loaded in the external transfer medium, determines access indication information about network access of the transport tool; based on the access indication information, loads the G.hn signal to an internal transfer medium of the transport tool, so as to be available for a user to access an access network corresponding to the G.hn signal using a user equipment of the user via an access interface of the internal transfer medium. Further, the present invention implements automatic switch for a transport tool between a mobile network and a G.hn network, which, compared with the prior art, has the following advantages:

1) saving costly and sparse radio resources of a mobile communication network. Since a transport tool usually has inside a plurality of users and a medium-and-large transport tool even has inside hundreds of users, it would pose a huge communication load and challenge to the existing mobile communication network when the transport tool moves into a crowded city or port; if the communication users inside the transport tool switch to a wired communication network via one or more G.hn access gateways (each gateway can provide a 1Gb/s bandwidth), the huge communication load will be shifted to the wired communication network directly.

2) Since the wired communication network connection is more stable than the wireless communication network connection, the network connection mode as provided in the present invention will provide a more stable network access service. It is known that the wireless network connection is not stable enough due to impacts from dynamic factors such as SNR, disturbances, shadow fading, rain fading, and SOL (sight on line) connection, etc.

3) The present invention can be implemented using the existing physical connections, such as a power line, a pipe of laying out the power line and interfacing facility, etc. In fact, when transport tools are in a still or anchored state, most of them would use the existing power lines and interfacing facilities to connect the power grid of the city or port so as to get power supply. Thus, the present invention, which sufficiently utilizes the existing power lines and interfacing facilities, can save new inputs as much as possible and shorten the construction period for building or rebuilding to the least extent.

4) Most of the existing transport tools (for example, passenger liner, yacht, RV, business purpose vehicle, or caravan, etc.) have no or do not have enough RJ45 Ethernet sockets. Unfortunately, it requires a considerable amount of network devices and cables to realize wireless local area network coverage in these transport vehicles. Now, the present invention may use the existing power outlets/sockets as the network interfaces. Since each room or corridor in the existing transport tools have ready power lines and outlets, it would be relatively convenient for implementing the present invention.

5) Even if the transport tool is moving, the G.hn-related device of the present invention can still be helpful to implement the wireless network coverage inside the transport tool.

6) Many cities have public transport tools such as public transport electrical buses or the like which are powered by overhead contact systems; since such transport tools maintain connection with the city grid during their travelling process, their connection with the communication network during their traveling process can be implemented through the G.hn-related device and power lines in the present invention.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Through reading the following detailed depiction on the non-limiting embodiments with reference to the accompanying drawings, the other features, objectives, and advantages of the present invention will become more apparent.

Fig. 1 shows a schematic diagram of a system for providing network access for a transport tool based on the G.hn Standard according to one aspect of the present invention.

Fig. 2 shows a schematic diagram of an apparatus for providing network access for a transport tool based on the G.hn Standard according to one aspect of the present invention.

Fig. 3 shows a schematic diagram of an apparatus for providing network access for a transport tool based on the G.hn Standard according to one aspect of the present invention.

Fig. 4 shows a schematic diagram of a process flow for providing network access for a transport tool based on the G.hn Standard according to one aspect of the present invention.

Same or like reference numerals in the accompanying drawings indicate the same or corresponding components.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, the present invention will be further described in detail with reference to the accompanying drawings.

Fig. 1 shows a schematic diagram of a system for providing network access for a transport tool based on the G.hn Standard. The system comprises a control device and a G.hn gateway.

A communication operator usually selects an appropriate address to install the G.hn gateway (usually utilizing an existing power line and its interfacing facility). The G.hn gateway comprises an interface supporting wired communication network access, for example a PON (Passive Optical Network) port connected to a PON cable. The G.hn gateway is connected to an external transfer medium 00 which provides power supply to a transport tool. The communication operator modulates a data signal according to a G.hn protocol and loads it on the current of the external transfer medium 00 so as to generate G.hn-related signals such as a G.hn pilot code, a G.hn physical layer frame, a G.hn MAC layer frame (simply called G.hn signal); further, the G.hn gateway transfers the G.hn signal and the power supply current together to the transport tool through an external transfer medium 01. The external transfer medium here includes, but not limited to, a power line, a phone line, and a cable TV co-axial line, etc. The wired communication network access here generally refers to accessing a wired communication network via GPON (Gigabit-Capable PON), EPON (Ethernet PON) or DSL (digital user line) and the like and can be further in communication with the Internet.

The control device determines network access of the transport tool based on signal detection on the external transfer medium. For example, once the control device detects a G.hn signal on the external transfer medium, the control device has the network access the transport tool to the network corresponding to the G.hn signal. For a simple example, once the control device is connected to the G.hn gateway, the network of the transport tool directly accesses to the network corresponding to the G.hn; or, the network access of the transport tool is directly switched from the mobile communication network to the network corresponding to the G.hn signal. In turn, once the control device finds that the transport tool is disconnected from the external transfer medium, for example, disconnected from the external power line, the network access of the transport tool is directly switched from the network corresponding to the G.hn signal to a mobile communication network. The specific operation process of the control device

will be detailed below.

As illustrated in Fig. 1, with the power line as an example, the control device 1 may provide an access point to a user equipment inside a transport tool via a G.hn transceiver, and a user may access an access network corresponding to the G. gn signal via the G.hn transceiver. Here, the G.hn transceiver can be installed on any power outlet of the transport tool, and each G.hn transceiver can be connected to the control device 1 via the existing power line and power outlet of the transport tool. In this way, the user may use a RJ45 Ethernet socket in the G.hn transceiver to access the network, and the additional power outlet in the G.hn transceiver can also provide power supply to the user as previously. Preferably, the G.hn transceiver may further comprise a wireless local area network module, for example, a Wi-Fi module capable of providing wireless local area network access to a wireless local area network terminal (for example, Wi-Fi terminal) of the transport tool. Here, the wireless local area network generally refers to various kinds of IEEE 802.11 series wireless local area network (Wi-Fi) network, Bluetooth network, wireless personal area network (WPAN), HomeRF, HIPERLAN, UWB, WAPI and other wireless communication networks.

Fig. 2 shows a schematic diagram of an apparatus for providing network access for a transport tool based on the G.hn Standard according to one aspect of the present invention. The control device 1 comprises a G.hn extroversive analog front-end module 201, a processing means 202, a G.hn introversive analog front-end module 203, a G.hn protocol processing module 204, and a mobile access network 205.

In this embodiment, the G.hn extroversive analog front-end module 201 is an interface for an external transfer medium of the transport tool and coupled to the external transfer medium of the transport tool, for example, connected to an external power line supplying power source to the of the transport tool. This module is responsible for fetching a valid G.hn data signal for the external transfer medium, or modulating the valid G.hn data signal according to a G.hn protocol and loading it on the external transfer medium.

The processing means 202 is a main controller of the control device 1. The processing means 202 controls program running of the control device 1, and controls and performs a switch between a G.hn network and a mobile communication network. Here, the processing means 202 for example may comprise a central processing unit, or a central processing unit and a memory, wherein the central processing unit includes, but not limited to, a single-chip machine, a single-core, a dual-core, or a multi-core processing chip, etc.

The G.hn introversive analog front-end module 203 is an interface for an internal transfer medium of the transport tool and connected to the internal transfer medium of the transport tool. This module is responsible for fetching a valid G.hn data signal for the internal transfer medium, or modulating the valid G.hn data signal according to a G.hn protocol and loading it on the internal transfer medium.

The G.hn protocol processing module 204 cooperates with the processing means to process G.hn protocol-related operations, for example, responsible for transferring and processing the G.hn-related protocol so as to assist the processing means 202 in controlling and executing the switch between the G.hn network and the mobile communication network.

The mobile access module 205 comprises an antenna or an antenna array, for providing a network access corresponding to the mobile access module 205 to the transport tool, for example, providing to the transport tool a broadband mobile communication network access, for example, an LTE/4G mobile communication network, a WiMAX, or a microwave network, etc.

Here, the broadband mobile communication network includes, but not limited to various kinds of 3G/LTE/4G mobile communication networks, WiMAX, microwave network, wireless metropolitan area network(WMAN), wireless local area network(WLAN), and other wireless communication networks, whose downlink bandwidth is generally higher than 1Mbps.

Preferably, the control device 1 may further comprise a memory that provides storage space and buffer space for the controller device 1. For example, the memory stores data information about the current access network from the processing means 202 or other means or modules. Those skilled in the art should understand that the memory is merely a specific embodiment, and in a specific implementation of the control device, the medium for storage may also be distributed in other means such as the processing means.

In one embodiment, the transport tool currently has no network access; the G.hn extroversive analog front-end module 201 detects whether a G.hn signal is loaded in the external transfer medium providing external power supply to the transport tool. For example, the G.hn extroversive analog front-end module 201 fetches a loaded signal from the external transfer medium periodically or triggered by an event for example, detects whether the loaded signal satisfies the G.hn protocol, and if the loaded signal satisfies the G.hn protocol, determines that the external transfer medium is loaded with the G.hn signal. Preferably, the G.hn extroversive analog front-end module 201 detects, based on a predefined G.hn signal rule, for example, the signal intensity and signal-to-noise ratio threshold of the G.hn signal or the signal format identification, whether the signal fetched from the external transfer medium satisfies the predefined G.hn signal rule; if the signal satisfies the G.hn signal rule, for example, the signal includes the G.hn signal format identification and/or satisfies the signal intensity and/or signal-to-noise ratio threshold, determines that the external transfer medium is loaded with a G.hn signal.

If the external transfer medium is loaded with the G.hn signal, the processing means 202 determines access indication information about network access of the transport tool, the access indication information including accessing the transport tool to the access network corresponding to the G.hn signal; further, the processing means 202 transfers the access indication information to the G.hn introversive analog front-end module 203; the G.hn introversive analog front-end module 203 modulates the G.hn signal and loads it to the internal transfer medium based on the access indication information so as to be available for a user to access the access network corresponding to the G.hn signal using a user equipment of the user via an access interface of the internal transfer medium.

In one preferred embodiment, the transport tool currently accesses a mobile communication network via the mobile access module 205. The G.hn extroversive analog front-end module 201 detects whether a G.hn signal is loaded in the external transfer medium that provides external power supply to the transport tool, and when the module detects the G.hn signal, it immediately transfers a report signal to the processing means 202. The processing means 202 receives the report signal and knows that the external transfer medium is loaded with the G.hn signal; the processing means 202 determines access indication information about network access of the transport tool based on the report signal, wherein the access indication information comprises first switch indication information about switching the network access of the transport tool from the mobile access module 205 to the access network corresponding to the G.hn signal. The G.hn introversive analog front-end module 203 loads the G.hn signal to the internal transfer medium of the transport tool based on the access indication information so as to be available for the user

to access the access network corresponding to the G.hn signal using a user equipment of the user via an access interface of the internal transfer medium.

Preferably, the processing means 202 closes or sleeps the mobile access module 205 based on the first switch indication information about switching the network access of the transport tool from the mobile access module 205 to the access network corresponding to the G.hn signal.

Preferably, after the access network of the transport tool is switched from the mobile communication network to the G.hn network, the G.hn extroversive analog front-end module 201 continuously detects the G.hn signal borne on the external transfer medium of the transport tool, such that when the module detects that the external transfer medium (e.g., a power line) loses the G.hn signal, it sends a report to the processing means 202. The processing means 202 receives the report on loss of the G.hn signal on the external transfer medium; updates the access indication information based on the report, wherein the updated access indication information comprises second switch indication information about switching the network access of the transport tool from the access network corresponding to the G.hn signal to an access network corresponding to the mobile access module 205; and switches the network of the transport tool into the access network corresponding to the mobile access module 205 based on the second switch indication information; further, the processing means 202 sends a trigger signal to the mobile access module 205; meanwhile, stores the existing connection information and stores some data information from the G.hn network into the memory. The mobile access module 205 provides a network access corresponding to the mobile access module 205 to the transport tool based on the trigger signal, for example, providing to the transport tool a broadband mobile communication network access, for example, a 3G, an LTE, a WiMAX, a microwave network, o a 4G network, etc.

Preferably, after the transport tool accesses the G.hn network, the processing means 202 detects whether a simultaneous access trigger condition for providing network access via the mobile access module is satisfied, for example, detecting whether the remaining available bandwidth is lower than the predefined available bandwidth threshold, whether the ratio of the used bandwidth to the total access bandwidth is higher than a predefined bandwidth utilization ratio threshold, etc. For example, suppose the available bandwidth of the G.hn network is 1Gbps (1024Mbps), since multiple users in the transport vehicle access the G.hn network via user equipments, which have occupied 930Mbps bandwidth (or, in other words, the remaining available bandwidth of the G.hn network is merely 94Mbps), and suppose the predefined available bandwidth threshold is 100Mbps, then the processing means 202 determines that the remaining available bandwidth is lower than the available bandwidth threshold, i.e., satisfying the simultaneous access trigger condition for providing network access via the mobile access module.

For another example, suppose the available bandwidth of the G.hn network is 1Gbps, since multiple users in the transport vehicle access the G.hn network via user equipments, the current used bandwidth of the G.hn network has amounted to 930Mbps, then the ratio of the used bandwidth to the total access bandwidth is 91%; suppose the predefined broadband utilization ratio threshold is 90% (or 0.9), then the processing means 202 determines that the ratio of the used bandwidth to the total access bandwidth is higher than the predefined bandwidth utilization ratio threshold, i.e., satisfying the simultaneous access trigger condition for providing network access via the mobile access module.

When the simultaneous access trigger condition is satisfied, the processing means 202 then

updates the access indication information, wherein the updated access indication information comprises third switch indication information about providing to a network access user inside the transport tool a mobile communication network access corresponding to the mobile access module 205; further, based on the third switch indication information, the mobile communication network access is provided via the mobile access module, for example, by transferring a trigger signal to the mobile access module 205 so as to activate the mobile access module 205, by adding an access network resource corresponding to the mobile access module 205 to the transport tool, so as to be available for the user to access the mobile communication network corresponding to the mobile access module using a user equipment of the user via the mobile access module. The mobile access module 205 provides a network access corresponding to the mobile access module 205 to the transport tool based on the trigger signal, for example, providing to the transport tool a broadband mobile communication network access, for example, a 3G, an LTE, a WiMAX, a microwave network, etc. This embodiment provides to the transport tool the network access corresponding to the G.hn signal and the mobile communication network access simultaneously to satisfy the users' bandwidth demand.

Fig. 3 shows a schematic diagram of an apparatus for providing network access for a transport tool based on the G.hn Standard according to one preferred embodiment of the present invention. The controller device 1 further comprises a wireless local area network access module 306 and an Ethernet access module 307, wherein a G.hn extroversive analog front-end module 301, a processing means 302, a G.hn introversive analog front-end module 303, a G.hn protocol processing module 304, and a mobile access module 305 are identical or substantially identical to the corresponding means in Fig. 2, which are therefore not detailed but incorporated here by reference.

The controller device 1 further comprises a wireless local area network access module 306, for example, a wireless local area network Wi-Fi module. The wireless local area network access module provides a wireless local area network access, for example, a wireless access based on IEEE 802.11 series protocols, HIPERLAN, HomeRF, or WAPI, based on the access indication information, so as to be available for the user to access an access network corresponding to the G.hn signal using a user equipment of the user via the wireless local area network access module 306. Here, for communication data transferred via the wireless local area network access module 306, format conversion is performed between the G.hn protocol and the transfer protocol corresponding to the wireless local area network access module 306, so as to be available for subsequent transfer. Here, the wireless local area network includes, but not limited to various kinds of IEEE 802.11 series wireless local area network (Wi-Fi network), Bluetooth network, wireless personal area network (WPAN), HomeRF, HIPERLAN, UWB, WAPI and other wireless communication networks.

For example, the controller device 1 further comprises a Wi-Fi module; the G.hn extroversive analog front-end module 301 detects a G.hn signal in the external transfer medium; the processing means 302 switches the network access of the transport tool from the mobile access module 305 to the access network corresponding to the G.hn signal based on the detection result; the Wi-Fi module converts the G.hn signal received by the control device 1 into a Wi-Fi signal in compliance with the transfer protocol, such that when the user accesses using his/her user equipment, he/she can directly access the wired access network corresponding to the G.hn signal via the control device 1.

Preferably, the control device 1 further comprises an Ethernet access module 307, which

Ethernet access module 307 comprising an Ethernet interface, for example, a RJ45 Ethernet socket, to be available for the user to directly access the wired access network corresponding to the G.hn signal through the control device 1 by using a user equipment of the user via the Ethernet access module.

Here, those skilled in the art should understand that in specific implementation of the control device 1, the wireless local area network access module 306 and the Ethernet access module 307 are both alternative modules. For example, in a small and medium-sized transport tool such as a car, the network coverage inside the transport tool can be implemented only by a set of control device 1 provided with a wireless local area network access module and/or an Ethernet access module, without a need of purchasing and installing a G.hn transceiver as in Fig. 1.

Preferably, the control device 1 may further provide an access point to the user equipment via the G.hn transceiver, and via the G.hn transceiver, the user may access the access network corresponding to the G.hn signal. Here, the G.hn transceiver can be installed on any power outlet of the transport tool, and each G.hn transceiver can be connected to the control device 1 via the existing power line and power source outlet of the transport tool. In this way, the user may use a RJ45 Ethernet socket inside the G.hn transceiver to access the network, and the additional power outlet in the G.hn transceiver can also provide power supply to the user as previously. Preferably, the G.hn transceiver may further comprise a wireless local area network access module, for example, a Wi-Fi module, capable of providing wireless local area network access to a wireless local area network terminal of the transport tool.

Fig. 4 shows a schematic diagram of a process flow for providing network access for a transport tool based on the G.hn Standard according to one aspect of the present invention.

In step 401, the control device 1 detects periodically or triggered by an event for example whether a G.hn signal is loaded in the external transfer medium providing external power supply to the transport tool. For example, when the transport tool is switched to the external power source, in step 401, the control device 1 fetches a loaded signal from the external transfer medium, detects whether the loaded signal satisfies the G.hn protocol, and if the loaded signal satisfies the G.hn protocol, determines that the external transfer medium is loaded with the G.hn signal. Preferably, the control device 1 detects, based on a predefined G.hn signal rule, for example, the signal intensity and signal-to-noise ratio threshold of the G.hn signal or the signal format identification, whether the signal fetched from the external transfer medium satisfies the predefined G.hn signal rule; if the signal satisfies the G.hn signal rule, for example, the signal includes the G.hn signal format identification and/or satisfies the signal intensity and/or signal-to-noise ratio threshold, determines that the external transfer medium is loaded with a G.hn signal. Preferably, when the control device 1 can not detect a G.hn signal in the external transfer medium, or can not detect a valid G.hn signal in the external transfer medium in step 401, the control device 1 will repeat the step 401(i.e., the control device 1 will continuously detect the external transfer medium) until it detects a G.hn signal or a valid G.hn signal in the external transfer medium.

In step 402, if the external transfer medium is loaded with the G.hn signal, the control device 1 determines access indication information about network access of the transport tool. For example, when the transport tool currently has no network access, if the external transfer medium is loaded with the G.hn signal, in step 402, the control device 1 determines access indication information about network access of the transport tool to the access network

corresponding to the G.hn signal. For another example, suppose the transport tool currently has been accessed to mobile communication network, if the external transfer medium is loaded with the G.hn signal, in step 402, the control device 1 determines access indication information about network access of the transport tool, wherein the access indication information comprises first switch indication information about switching the network access of the transport tool from the mobile access module to an access network corresponding to the G.hn signal.

In step 403, the control device 1 loads the G.hn signal to an internal transfer medium of the transport tool based on the access indication information, so as to be available for a user to access an access network corresponding to the G.hn signal using a user equipment of the user via an access interface of the internal transfer medium. For example, in step 403, the control device 1 loads the G.hn signal to an internal transfer medium of the transport tool based on the access indication information determined in step 402, for example, loads the G.hn signal to the internal power lines of the transport tool. The internal power lines have multiple outlets, the user can insert the G.hn transceiver through the socket. The G.hn transceiver includes Ethernet access module and RJ45 socket, power outlet and optional wireless local area network module. The user can access network via the RJ45 socket or via a wireless local area network.

In one preferred embodiment, the transport tool comprises a mobile access module configured to provide network access service, i.e., the transport tool currently accesses to a mobile communication network via the mobile access module. In step 401, the control device 1 detects whether a G.hn signal is loaded in an external transfer medium that provides external power supply to the transport tool. In step 402, when the G.hn signal is loaded in the external transfer medium, the control device 1 determines access indication information about network access of the transport tool, wherein the access indication information comprises first switch indication information about switching the network access of the transport tool from the mobile access module to an access network corresponding to the G.hn signal. In step 403, the control device 1 loads the G.hn signal into the internal transfer medium of the transport tool based the access indication information, so as to be available for a user to access an access network corresponding to the G.hn signal using a user equipment of the user via an access interface of the internal transfer medium.

Preferably, the control device 1 may also close or sleep the mobile access module based on the first switch indication information.

Preferably, the method further comprises step 404(not shown) and step 405(not shown). After the access network of the transport tool is switched from the mobile communication network to the G.hn network, in step 404, the control device 1receives the report on loss of the G.hn signal on the external transfer medium, or the control device 1 continuously detects the G.hn signal on the external transfer medium of the transport tool in step 404, such that when the control device 1 detects that the external transfer medium (e.g., a power line) loses the G.hn signal, it generates a report. Then in step 402, the control device 1 updates the access indication information based on the report, wherein the updated access indication information comprises second switch indication information about switching the network access of the transport tool from the access network corresponding to the G.hn signal to an access network corresponding to the mobile access module. Then in step 405, the control device 1 switches the network of the transport tool into the access network corresponding to the mobile access module based on the second switch indication information.

Preferably, the method further comprises step 406(not shown) and step 407(not shown).

After the transport tool accesses the G.hn network, in step 406, the control device 1 detects whether a simultaneous access trigger condition for providing network access via the mobile access module is satisfied, for example, detecting whether the remaining available bandwidth is lower than the predefined available bandwidth threshold, whether the ratio of the used bandwidth to the total access bandwidth is higher than a predefined bandwidth utilization ratio threshold, etc. For example, suppose the available bandwidth of the G.hn network is 1Gbps (1024Mbps), since multiple users in the transport vehicle access the G.hn network via user equipments, which have occupied 930Mbps bandwidth (or, in other words, the remaining available bandwidth of the G.hn network is merely 94Mbps), and suppose the predefined available bandwidth threshold is 100Mbps, then in step 406, the control device 1 determines that the remaining available bandwidth is lower than the available bandwidth threshold, i.e., satisfying the simultaneous access trigger condition for providing network access via the mobile access module.

For another example, suppose the available bandwidth of the G.hn network is 1Gbps, since multiple users in the transport vehicle access the G.hn network via user equipments, the current used bandwidth of the G.hn network has amounted to 930Mbps, then the ratio of the used bandwidth to the total access bandwidth is 91%; suppose the predefined broadband utilization ratio threshold is 90% (or 0.9), then in step 406, the control device 1 determines that the ratio of the used bandwidth to the total access bandwidth is higher than the predefined bandwidth utilization ratio threshold, i.e., satisfying the simultaneous access trigger condition for providing network access via the mobile access module.

When the simultaneous access trigger condition is satisfied, then in step 407, the control device 1 updates the access indication information, wherein the updated access indication information comprises third switch indication information about providing to a network access user inside the transport tool a mobile communication network access corresponding to the mobile access module; further, based on the third switch indication information, the mobile communication network access is provided via the mobile access module, for example, by transferring a trigger signal to the mobile access module so as to activate the mobile access module, by adding an access network resource corresponding to the mobile access module to the transport tool, so as to be available for the user to access the mobile communication network corresponding to the mobile access module using a user equipment of the user via the mobile access module. The mobile access module provides a network access corresponding to the mobile access module to the transport tool based on the trigger signal, for example, providing to the transport tool a broadband mobile communication network access, for example, a 3G, an LTE, a WiMAX, a microwave network, etc. This embodiment provides to the transport tool the network access corresponding to the G.hn signal and the mobile communication network access simultaneously to satisfy the users' bandwidth demand.

Preferably, the method further comprises step 408(not shown). In step 408, the control device 1 performs format conversion between a G.hn protocol and a transfer protocol corresponding to the mobile access module for communication data transferred via the mobile access module, so as to be available for subsequent transfer. For example, suppose the network access of the transport tool accesses to the mobile communication network via the mobile access module, for example, accesses to LTE network, the control device 1 obtains downlink communication data from the LTE network; in step 408, the control device 1 performs format conversion to the downlink communication data to convert it into the one in compliance with

the G.hn protocol; then in step 403, the control device 1 loads the downlink communication data in compliance with the G.hn protocol into the internal transfer medium of the transport tool, so as to be available for a user to access using his/her user equipment. Similarly, when the user equipment sends the uplink communication data in compliance with the G.hn protocol via the internal transfer medium of the transport tool, in step 408, the control device 1 performs format conversion to the uplink communication data to convert it into the one in compliance with the LTE transfer protocol, and sends it out via the mobile access module.

Preferably, the method further comprises step 409(not shown). In step 409, the control device 1 provides a wireless local area network access via a wireless local area network module based on the access indication information, for example, provides a wireless local area network access based on protocol standards of wireless local area network such as IEEE802.11b, IEEE802.11a, IEEE802.11g, IEEE802.11i, IEEE802.11e/f/h, HIPERLAN, HomeRF, or WAPI, so as to be available for the user to access an access network corresponding to the G.hn signal using a user equipment of the user via the wireless local area network access module. In step 409, for communication data transferred via the wireless local area network access module, the control device 1 performs format conversion between the G.hn protocol and the transfer protocol corresponding to the wireless local area network access module, so as to be available for subsequent transfer.

For example, the controller device 1 further comprises a Wi-Fi module; in step 401, the control device 1 detects a G.hn signal in the external transfer medium; in step 402, when the G.hn signal is loaded in the external transfer medium, the control device 1 determines access indication information about network access of the transport tool; in step 403, the control device 1 provides Wi-Fi access via the Wi-Fi module based on the access indication information, so as to be available for a user to access an access network corresponding to the G.hn signal using a user equipment of the user via the Wi-Fi module; in step 409, the control device 1 performs format conversion between the G.hn protocol and Wi-Fi transfer protocol for communication data transferred via the Wi-Fi module so as to providing Wi-Fi access when the user accesses using his/her user equipment.

Preferably, the method further comprises step 409(not shown). In step 409, for communication data transferred via the Ethernet access module, the control device 1 performs format conversion between a G.hn protocol and an Ethernet transfer protocol so as to be available for subsequent transfer. Specifically, in step 401, the control device 1 detects a G.hn signal in an external transfer medium; in step 402, when the G.hn signal is loaded in the external transfer medium, the control device 1 determines access indication information about communication network access of the transport tool; in step 403, the control device 1 provides an Ethernet access via an Ethernet access module based on the access indication information, so as to be available for a user to access an access network corresponding to the G.hn signal by using a user equipment of the user via an Ethernet interface such as an Ethernet RJ45 socket of the Ethernet access module; in step 403, the control device 1 performs format conversion between a G.hn protocol and an Ethernet transfer protocol for communication data transferred via the Ethernet access module so as to providing wired Ethernet signals when the user accesses using his/her user equipment.

To those skilled in the art, it is apparent that the present invention is not limited to the details of above exemplary embodiments, and the present invention can be implemented with other specific embodiments without departing the spirit or basic features of the present invention.

Thus, from any perspective, the embodiments should be regarded as illustrative and non-limiting. The scope of the present invention is limited by the appended claims, instead of the above description. Thus, meanings of equivalent elements falling within the claims and all variations within the scope are intended to be included within the present invention. Any reference numerals in the claims should be regarded as limiting the involved claims. Besides, it is apparent that such terms as "comprise" and "include" do not exclude other units or steps, and a single form does not exclude a plural form. The multiple units or modules as stated in apparatus claims can also be implemented by a single unit or module through software or hardware. Terms such as first and second are used to represent names, not representing any specific sequence.

What Is Claimed Is:

1. A method for providing network access to a transport tool based on G.hn Standard, wherein the method comprises steps of:

a. detecting whether a G.hn signal is loaded in an external transfer medium that provides external power supply to the transport tool;

b. when the G.hn signal is loaded in the external transfer medium, determining access indication information about network access of the transport tool;

c. based on the access indication information, loading the G.hn signal to an internal transfer medium of the transport tool, so as to be available for a user to access an access network corresponding to the G.hn signal using a user equipment of the user via an access interface of the internal transfer medium.

2. The method according to claim 1, wherein the transport tool comprises a mobile access module that provides a network access service;

wherein, the step b comprises:

- when the G.hn signal is loaded in the external transfer medium, determining access indication information about network access of the transport tool, wherein the access indication information comprises first switch indication information about switching the network access of the transport tool from the mobile access module to an access network corresponding to the G.hn signal.

3. The method according to claim 2, wherein the method further comprises:

- closing or sleeping the mobile access module based on the first switch indication information.

4. The method according to claim 2, wherein the method further comprises:

- receiving a report on losing the G.hn signal of the external transfer medium;

wherein, the step b further comprises:

- updating the access indication information based on the report, wherein the updated access indication information comprises second switch information about switching the network access of the transport tool from the access network corresponding to the G.hn signal to an access network corresponding to the mobile access module;

wherein the method further comprises:

- switching the network access of the transport tool to the access network corresponding to the mobile access module based on the second switch indication information.

5. The method according to claim 2, wherein the method further comprises:

- detecting whether a simultaneous access trigger condition for providing network access via the mobile access module is satisfied;

wherein, the step b further comprises:

- when the simultaneous access trigger condition is satisfied, updating the access indication information, wherein the updated access indication information comprises third switch indication information about providing to a network access user in the transport tool a mobile communication network access corresponding to the mobile access module;

wherein the method further comprises:

- based on the third switch indication information, providing the mobile communication network access via the mobile access module so as to be available for a user to access the mobile communication network corresponding to the mobile access module by using a user

equipment of the user via the mobile access module;

wherein the simultaneous access trigger condition comprises at least one of:

- the remaining available bandwidth being lower than a predefined available bandwidth threshold;

- a ratio of used bandwidth to total access bandwidth being higher than a predefined bandwidth utilization ratio threshold.

6. The method according to claim 4 or 5, wherein the method further comprises:

- for communication data transferred via the mobile access module, performing format conversion between a G.hn protocol and a transfer protocol corresponding to the mobile access module so as to be available for subsequent transfer.

7. The method according to claim 1, wherein the step c further comprises:

- based on the access indication information, providing a wireless local area network access via a wireless local area network access module, so as to be available for a user to access an access network corresponding to the G.hn signal by using a user equipment of the user via the wireless local area network access module;

wherein the method further comprises:

- for communication data transferred via the wireless local area network access module, performing format conversion between a G.hn protocol and a transfer protocol corresponding to the wireless local area network access module so as to be available for subsequent transfer.

8. The method according to claim 1, wherein the step c further comprises:

- based on the access indication information, providing an Ethernet access via an Ethernet access module, so as to be available for a user to access an access network corresponding to the G.hn signal by using a user equipment of the user via an Ethernet interface of the Ethernet access module;

wherein the method further comprises:

- for communication data transferred via the Ethernet access module, performing format conversion between a G.hn protocol and an Ethernet transfer protocol so as to be available for subsequent transfer.

9. A control device for providing network access to a transport tool based on G.hn Standard, wherein the device comprises:

- a G.hn extroversive analog front-end module configured to detect whether a G.hn signal is loaded in an external transfer medium that provides external power supply to the transport tool;

- a processing means configured to, when the G.hn signal is loaded in the external transfer medium, determine access indication information about network access of the transport tool;

- a G.hn introversive analog front-end module configured to, based on the access indication information, load the G.hn signal to an internal transfer medium of the transport tool, so as to be available for a user to access an access network corresponding to the G.hn signal using a user equipment of the user via an access interface of the internal transfer medium;

- a G.hn protocol processing module configured to cooperate with the processing means to process G.hn protocol-related operations;

- a mobile access module configured to provide a mobile communication network access corresponding to the mobile access module for the transport tool.

10. The control device according to claim 9, wherein the processing means is configured to:

- when the G.hn signal is loaded in the external transfer medium, determine access

indication information about network access of the transport tool, wherein the access indication information comprises first switch indication information about switching the network access of the transport tool from the mobile access module to an access network corresponding to the G.hn signal.

11. The control device according to claim 10, wherein the processing means is configured to:

- receive a report on losing the G.hn signal of the external transfer medium;

- update the access indication information based on the report, wherein the updated access indication information comprises second switch information about switching the network access of the transport tool from the access network corresponding to the G.hn signal to an access network corresponding to the mobile access module;

- switch the network access of the transport tool to the access network corresponding to the mobile access module based on the second switch indication information.

12. The control device according to claim 10, wherein the processing means is configured to:

- detect whether a simultaneous access trigger condition for providing network access via the mobile access module is satisfied;

- when the simultaneous access trigger condition is satisfied, update the access indication information, wherein the updated access indication information comprises third switch indication information about providing to a network access user in the transport tool a mobile communication network access corresponding to the mobile access module;

- based on the third switch indication information, provide the mobile communication network access via the mobile access module so as to be available for a user to access the mobile communication network corresponding to the mobile access module by using a user equipment of the user via the mobile access module;

wherein the simultaneous access trigger condition comprises at least one of:

- the remaining available bandwidth being lower than a predefined available bandwidth threshold;

- a ratio of used bandwidth to total access bandwidth being higher than a predefined bandwidth utilization ratio threshold.

13. The control device according to claim 9, wherein the control device further comprises a wireless local area network access module configured to:

- based on the access indication information, provide a wireless local area network access, so as to be available for a user to access an access network corresponding to the G.hn signal by using a user equipment of the user via the wireless local area network access module.

14. The control device according to claim 9, wherein the control device further comprises an Ethernet access module configured to:

- based on the access indication information, provide an Ethernet access, so as to be available for a user to access an access network corresponding to the G.hn signal by using a user equipment of the user via an Ethernet interface of the Ethernet access module.

15. A system for providing network access for a transport tool based on G.hn Standard, wherein the system comprises a control device according to any one of claims 9 to 14, and a G.hn gateway.

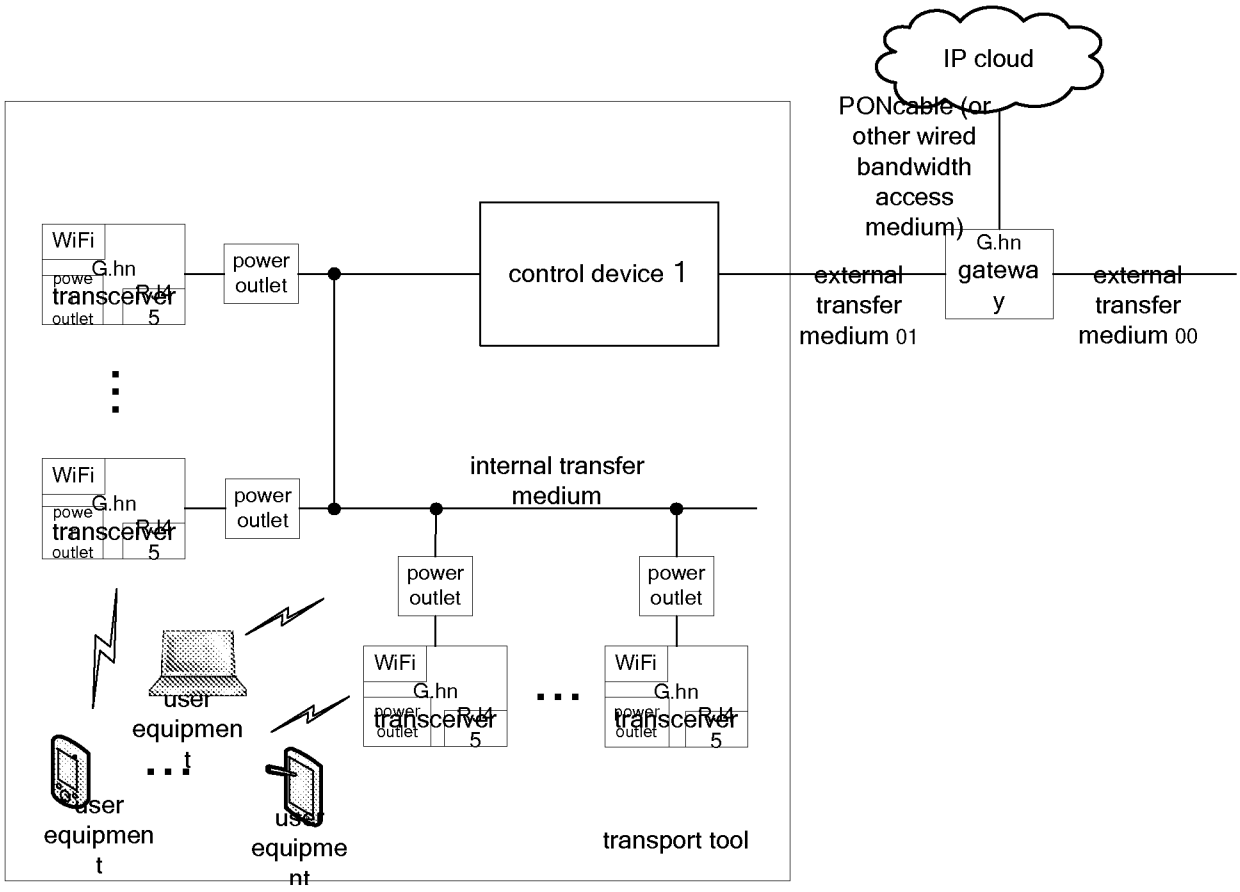

IP cloud
PONcable (or other wired bandwidth access medium)
G.hn gateway
external transfer medium 01
external transfer medium 00
control device 1
WiFi
G.hn transceiver
power outlet
internal transfer medium
user equipment
transport tool

Fig. 1

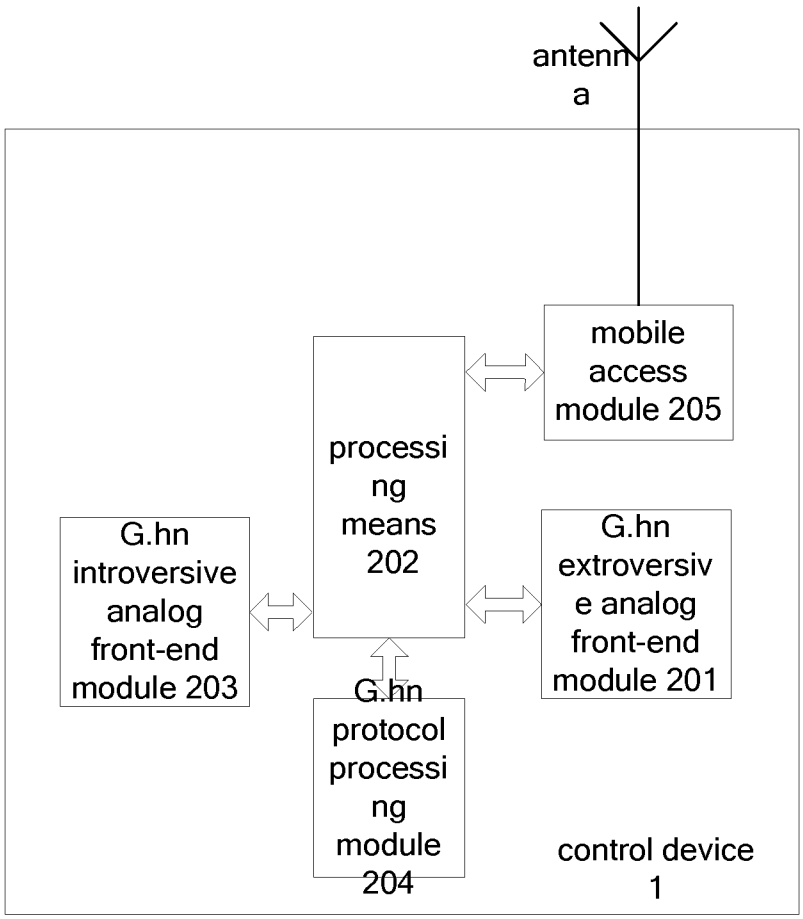

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module 201
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module
204
control device
1

Fig. 2

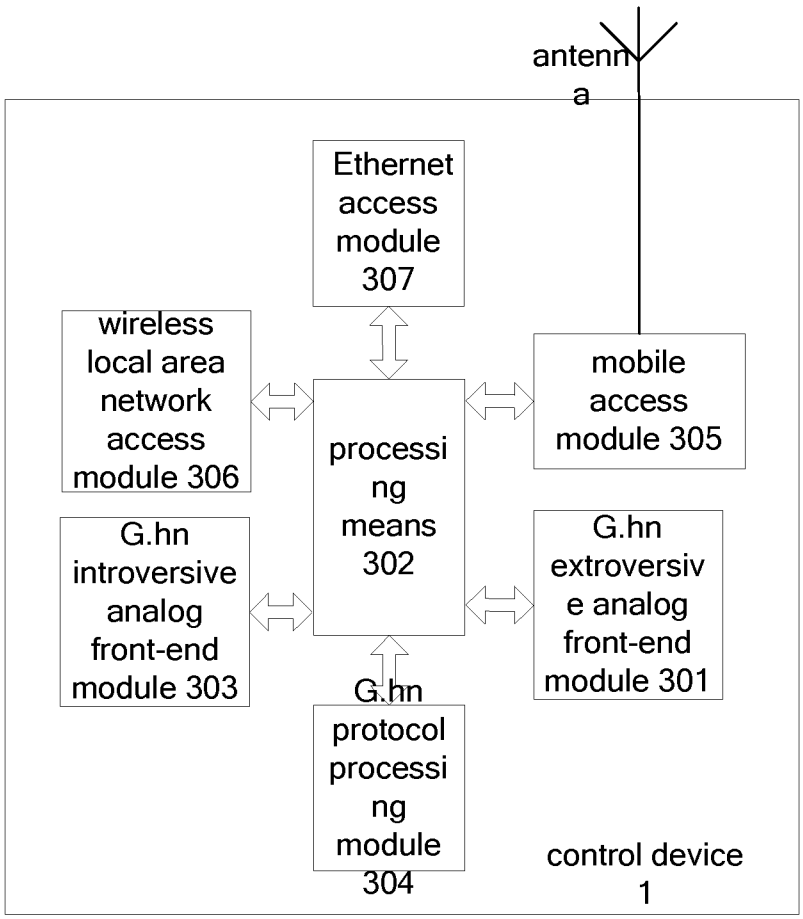

antenna
Ethernet access module 307
wireless local area network access module 306
processing means 302
mobile access module 305
G.hn introversive analog front-end module 303
G.hn extroversive analog front-end module 301
G.hn protocol processing module 304
control device 1

Fig. 3

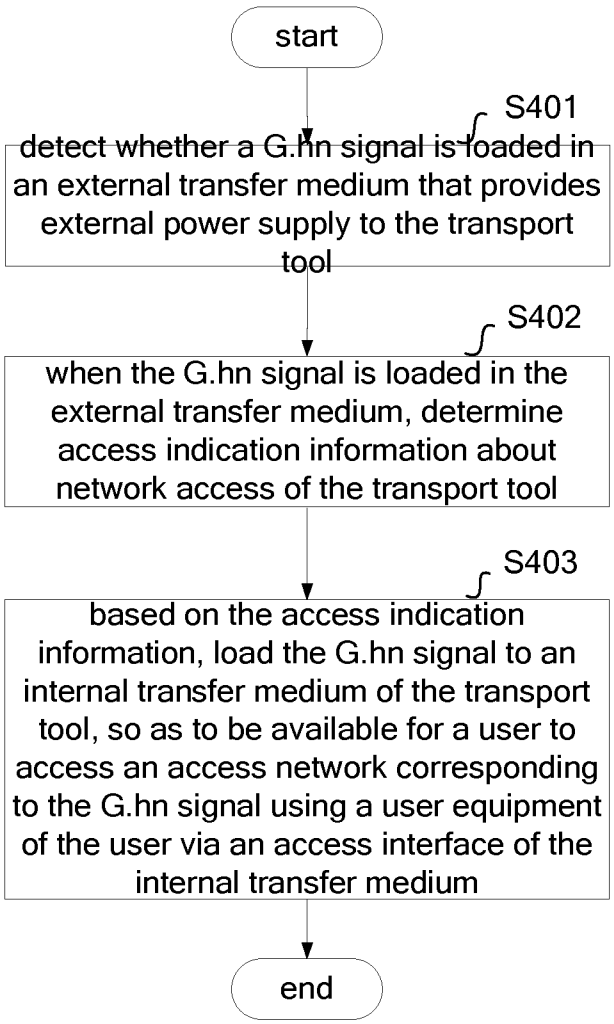

start
S401
detect whether a G.hn signal is loaded in an external transfer medium that provides external power supply to the transport tool
S402
when the G.hn signal is loaded in the external transfer medium, determine access indication information about network access of the transport tool
S403
based on the access indication information, load the G.hn signal to an internal transfer medium of the transport tool, so as to be available for a user to access an access network corresponding to the G.hn signal using a user equipment of the user via an access interface of the internal transfer medium
end

Fig. 4