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Communication device and method for achieving multi-protocol interoperability

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ABSTRACT

Provided are a communication device and method for achieving multi-protocol interoperability. The communication device comprises: a first interface assembly configured as an interface for transmission of information using a standard communication protocol; a second interface assembly configured as an interface for transmission of information using a self-defined communication protocol; and a microcontroller comprising a virtual exchange module for providing interaction between information using different communication protocols. The present invention can achieve interoperability between information using different protocols, and can be designed as a device simple in hardware structure, small in size and light in weight. The invention can be powered by a common battery, and thus is very suitable for emergency and rescue applications.

IMAGES (6)

[Patent Drawing](#) [Patent Drawing](#) [Patent Drawing](#) [Patent Drawing](#) [Patent Drawing](#) [Patent Drawing](#)

DESCRIPTION translated from [Chinese](#)

Communication device and a communication method for multi-protocol interoperability FIELD

The present invention relates to the field of information communication technology, and particularly to a communication device and a communication method for multi-protocol interoperability.

Background technique

With the rapid development of communication technology, a variety of different communication protocols to meet the different needs. For example, WiFi communications protocol, a Bluetooth (Bluetooth) communication protocol, ZigBee protocol, the third / fourth-generation (3G / 4G) communication protocols, and satellite communication protocols. Development of the above-described protocol, although to meet various needs of a human, but because of diversification of user, a communication protocol and a communication protocol between users not another communication protocol, which is not provided between the protocol interoperability. Does not have between various devices using different protocols interoperability to people's lives bring a lot of trouble. For example: In the process of emergency relief, a number of departments (including medical, police, fire rescue, military, inside each country charitable aid agencies, international relief and charitable organizations, etc.) can not communicate with each other due, the parties can not lead to a coordinated work, reducing the efficiency of the rescue.

In order to solve the problem is not interoperable communications between systems, in addition to strengthening intergovernmental cooperation and coordination among countries other than the communication protocol, people take a variety of technical means to try to solve this problem fundamentally. From published patent point of view, the technical means there are two categories:

The first technical means:

Pre-allocated resources, devices using different protocols according to the resource allocation, the communication mode regulator, the purpose

CLAIMS (10) translated from [Chinese](#)

1. A multi-protocol communication device interoperability, comprising:

A first interface component, the configuration information using a standard communication protocol that provides interface information transmission;

A second interface component, the configuration of the interface to customize the information that the communication protocol of providing information transfer;

Microcontroller, comprising a virtual switching module, the configuration information using different communication protocol that provides information exchange.

- The communication apparatus according to claim 1, wherein at least the first interface component comprises at least one of the following interfaces: WiFi interfaces, 3G interfaces, 4G interfaces, ZigBee the interface, LAN interface, a Bluetooth interface, a telephone interface and the fixed satellite communications interface.
- The communication apparatus of claim 1 or claim 2, wherein said second interface component comprises one or more radio interface, said radio communication protocol interface customized according to different radio band.
- The communication apparatus as claimed in any of claims 1-3, further comprising a second interface coupled to the FPGA component, the communication protocol for FPGA custom software update.
- The communication apparatus according to any one of claims 1-4, wherein the virtual switch module comprises a plurality of different protocols corresponding to the virtual machine, each virtual machine has a specific ID, the communication apparatus further comprises:

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example, U.S. Patent (Patent No. US 8280364 B1), which is incorporated herein by reference. And such methods similar to U.S. Patent Document (entitled: Communication Assets Survey and Mapping Tool (communication resource monitoring and mapping tools) Publication No. US 20140310400 A1), which is incorporated herein by reference. However, the disadvantage of such solutions exist: on the one hand, the device must be reserved in advance and Coordination resources to communicate with the central controller. This new device, if there is no reserved resources can not be added to the system. On the other hand, all the communications equipment only classified in the same class of device can communicate with each other, but different types of communications equipment are still unable to communicate, this does not solve operational problems fundamentally from each other.

The second category of technical means:

Still further technical means than the second type of the first type techniques. The second category of prior art methods are not required to do any communication device. It is a third type communicate with each other through their corresponding devices and interface modules. A new network is formed between the third class of devices, the new data network interaction, indirectly satisfies interoperability problems. Wherein the type of equipment to achieve the third network, there are two methods. The first method is further formed a band shared by a new network. For example: U.S. Patent (Patent No: US7508840 B2), which is incorporated herein by reference. The second method, for example: U.S. Patent (Patent No: US6185205 B1), which is incorporated herein by reference. The second method is to change the data format, the data collected from different protocols in accordance with a further new protocol reformatted to satisfy compatibility between the data. However, although the above-described second method satisfies interoperability between different protocols through a unified data format, but the system is more complex, the need for a third category of protocols to satisfy the interoperability indirectly, and the volume of equipment used large, power consumption and more, not easy to carry, the applicability of poor, can not meet the application of emergency rescue and other occasions.

SUMMARY

To solve the above problems of the prior art at least partially, the embodiment of the present invention provides a multi-protocol interoperability communication device, comprising:

A first interface component, the configuration information using a standard communication protocol that provides interface information transmission;

A second interface component, the configuration of the interface to customize the information that the communication protocol of providing information transfer;

Microcontroller, comprising a virtual switching module, configured to use the information to different communication protocols to exchange information.

Embodiments of the invention also provides a communication method for multi-protocol interoperability, comprising:

Employing standard communication protocol interface to provide information transfer;

Using an interface to customize the information provided to the communication protocol of information transfer;

Based on the virtual exchange of information using different communication protocols to interact.

The present embodiment provides a region corresponding to the base station, the communication device can make all the different protocols (including wired and wireless devices) by interaction of the base station information (which may include data, voice and video). Accordingly, the present embodiment can meet the different information protocol interoperability, and simple hardware structure. Further, because the virtual technique is implemented on a microcontroller, which can be designed to a small size, light weight, low power consumption, and may simply rely on conventional battery-powered device can be easy carried by individuals, particularly for emergency and rescue occasions.

BRIEF DESCRIPTION

Virtual router, configured to provide a virtual transmission path between the information exchange, such information using different communication protocols having different virtual ID corresponding to each of said transmission path to interact with the virtual router in accordance with the determination.

6. The communication device claimed in any one of claims, wherein said communication device further comprises:

Multi-band antennas, and

A transceiver for receiving or transmitting, respectively, a plurality of bands connected to said multi-band radio antenna and FPGA.

7. A multi-protocol communication method interoperable, comprising:

Employing standard communication protocol interface to provide information transfer;

Using an interface to customize the information provided to the communication protocol of information transfer;

Based on the virtual exchange of information using different communication protocols to interact.

8. Wherein at least one of the standard communications protocol in a communication protocol selected communication method according to claim 7:

WiFi communications protocol, 3G communications protocols, 4G communication protocol, ZigBee protocol, LAN protocol, Bluetooth communication protocol, a fixed telephone communication protocol, and satellite communication protocols.

9. The communication method according to claim 7 or claim 8, wherein said custom communication protocol customized to different radio band, and the FPGA custom communication protocol software update.

10. The communication method as claimed in any one of claims 7-9, wherein, the information will be used based on different communication protocols to interact with the virtual exchange comprises:

Construction of the plurality of virtual devices corresponding to different protocols, and is given to each of the specific virtual ID, and

Construction of a virtual ID used to provide different virtual router between the transmission path information exchange, such information using different communication protocols corresponding to different virtual machine ID interacts transmission path according to the determined virtual router.

description of the accompanying drawings show some embodiments of the present invention, those of ordinary skill in the art changes may be made that the drawings and detailed description of the program or at some of the features of the inventive concept.

Multi-functional communication device protocol module configuration of FIG. 1 one embodiment of the present invention, a schematic view of interoperability;

FIG 2 is a schematic framework of a virtual system in FIG 1 constructs a plurality of virtual microcontroller composed of;

Multi-functional communication device configuration protocol module of the present invention FIG 3 is another embodiment of a schematic interoperable;

FIG 4 is a schematic embodiment of a multi-protocol process communication method of embodiment of the present invention is interoperable;

FIG 5 is a schematic flow chart of neutron 4;

FIG 6 is an example of a communication method of a multi-protocol interoperability embodiment of the present invention.

detailed description

Order that the invention object, technical solutions, and advantages of the embodiments more clearly below in conjunction with the present invention in the accompanying drawings, technical solutions in the embodiments will be apparent to the present invention, completely described, obviously, the described embodiments some embodiments of the present invention rather than all embodiments. Based on the embodiments of the present invention, those of ordinary skill in the art to make all other embodiments without creative work obtained by, it falls within the scope of the present invention. Further, herein, no detailed description of some conventional well-known structures or implementation details, in order to avoid substantial aspect of the present invention obscure.

Functional structural diagram of multi-protocol communication device module of FIG. 1 one embodiment of the present invention is interoperable.

As shown in FIG 1: multi-protocol interoperability communication device may include: a first interface component 100, the second interface component 200 and a microcontroller 300. among them:

The first interface component 100 can provide an interface for the transmission of information using standard communication protocols.

In the present embodiment, the first interface component 100 supports conventional standard communication protocols. Existing standard communication protocol, for example, the communication protocol may be a WiFi, 3G communications protocols, 4G communication protocol, ZigBee protocol, LAN protocol, Bluetooth communication protocol, a fixed telephone communication protocol, and satellite communication protocols. In practical applications, especially in emergency rescue process, this embodiment can provide convenience for the many departments in several countries. These sectors involved in the rescue can use their own standard communication protocols. Applied to different standards for communication protocols, the first interface component 100 may include one or more of the following interfaces: WiFi interfaces, 3G interfaces, 4G interfaces (which may be later developed 5G Interface), ZigBee the interface, LAN interface (FIG. not labeled), a Bluetooth interface, an interface unlabelled fixed telephone (in the drawing) and a satellite communication interface (not labeled in the drawing) and the like. Incidentally, the figure does not list all the interfaces, those skilled in the art will appreciate, the first interface component 100 may further expand more interfaces, the present application is expansion of the number of interfaces is not limited; and, expand the interface may also include not mentioned above as well as other types of interfaces developed in the future, this application is not limited in this regard. It said interface can be employed for the communication protocol existing international standards corresponding support. These interface modules are independent, when using the appropriate communications protocol, do not interfere with each other. The prior art method is based on the configuration information transmission channel of a particular protocol, are not repeated here. Thus, the present embodiment is provided by way of a plurality of different standard protocols and the interface to match, so that the device and other communication devices can freely communicate enhance the usefulness of the product.

A second interface component 200 may be a non-standardized information from the communication protocol provides an interface defined by information transmitted is employed.

For some non-standardized protocols included in the communication system, to meet future or new communication protocols, the present embodiment is also provided based on software radio (Software Defined Radio: SDR) technology, the second interface component 200. A second interface component 200 may include one or more radio interfaces (SDR interfaces, for example: SDR-1 interface and the interface SDR-N, where, N is a natural number). The SDR radio interface interfaces may be based on different radio bands (e.g., a low frequency band) for a custom communication protocol. Thus, the present embodiment according to different radio band custom communications protocol, such that a simple protocol procedures, specifications, easy to expand, and reliability.

The microcontroller 300 includes a virtual switch module, to provide interactive information using different communication protocols. Wherein the microcontroller includes a controller 300 must be virtualization technology. The microcontroller may be based on the virtualization technology virtualization virtual functional components of the system

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FIG 2 is a schematic framework of a virtual system in FIG 1 the microcontroller constructs composed of a plurality of virtual. As shown in FIG 2, the virtual system includes an application layer service, the operating system, management, and the hardware layer. Wherein: the service application layer includes seven service application (the APP) (service application service using 1- 7). Operating system layer includes the operating system corresponding to the seven respective service application (the OS) (OS Operating System 1- 7). Incidentally, the above-described operating system may be the same type of operating system, or may be of different types, or some of which are the same type of operating system, the present application is not limited in this respect. Management includes a hypervisor (secure hypervisor). The hardware layer includes a central processor (e.g., MIPS M-class CPU). Layers to achieve the above microcontroller 300 is based.

In the present embodiment, the microcontroller 300 may be used for the model from Imagination Technologies MIPS M5150 microcontroller. The company's MIPS M series microcontrollers is the first virtual technology in the world. M Series supports Hardware Virtualization, so far can support multiple (eg 7) virtual operating system.

With continued reference to FIGS. 1 and 2, in the present embodiment, the dummy switch module may include a plurality of different protocols corresponding to a virtual machine (e.g. virtual machine may be a WiFi, 3G / 4G virtualizer, later developed 5G virtualizer , ZigBee virtualizer, LAN virtual, Bluetooth virtual machine, the virtual fixed-line and satellite communications virtual machine, etc.). Each virtual machine has a specific ID (the ID number of the virtual identifier for the virtual machine, each ID number is not the same). In the specific communication connection therewith each interface is connected to a virtual adapter. For example: WiFi interface WiFi virtual connection, 3G / 4G interfaces with the 3G / 4G virtualizer connected ZigBee interface ZigBee virtualizer connected LAN interface and the virtual LAN is connected, a Bluetooth interface with Bluetooth virtual machine is connected, fixed telephone interface (not labeled in the drawing) is connected to the fixed telephone virtualizer (not labeled in the drawing), a satellite communication interface (not labeled in the drawing) satellite communication virtualizer (not labeled in the drawing) is connected.

In the present embodiment, the communication device further comprises a virtual router. Virtual router for providing a virtual transmission path between the information exchange, such information using different communication protocols having different virtual ID corresponding to each of the interacting virtual router in accordance with the determined transmission path.

In the virtual system microcontroller supports according to the present embodiment, each virtual system and a communication protocol interfaces are connected, the purpose of a complete system supports multiple communication protocols. Inside each virtual information exchange may be achieved by sophisticated virtual exchange (Virtual Switch) technology. Open source software such as Open vSwitch can achieve the purpose of data exchange. The exchange of data may also be achieved through the development of new routing protocol.

In the present embodiment, the virtual management program layer router can be employed (Secure Hypervisor) in the data exchange technology. Hypervisor can coordinate hardware resources (e.g., a microcontroller) to the virtual access protection between devices, and various virtual machines. When hardware resources starts, it loads all VM guest operating system, while the virtual machine is allocated memory, disk and network as the.

In addition, virtualization is a routine technique. Virtual technology is mainly used for running multiple systems under a single hardware platform. The technology implemented on a conventional computer. Such as a computer with Windows systems implemented in Linux simulation environment is a kind of virtual technology. For another example a large number of virtual cloud computing technology. The computer may be implemented generally a strong function of calculation, but does not have a strong communication capabilities. Further, the computer bulky, inconvenient to connect the call to the like where small, demand for flexible communication devices (e.g. smart phones) a. Therefore, at present people have not use virtual technology to solve technical solutions to communicate in a conventional computer. Embodiment of the present embodiment implemented by a microprocessor using the virtualization server 300 instead of the large, not only satisfies interoperability between different protocols, and may be designed to a small volume, simple hardware structure, light weight, low power consumption, may only rely on normal the battery-powered devices that support (such as smart phones), easy to carry personal, especially for emergency, rescue and other occasions.

A schematic functional configuration of a communication device for a multi-protocol module Figure 3 is another embodiment of the invention. 3, the embodiment according to the present embodiment based on the embodiment of FIG. 1 on the increase of multi-band antenna 400, a radio transceiver 500 and FPGA (Field Programmable Gate Array: Field Programmable Gate Array) 600. Wherein the multi-band antenna 400 may be connected to a radio transceiver 500, FPGA 600 may be connected to the radio transceiver 500 and the second interface component 200.

In the present embodiment, software updates 600 may be a custom communications protocol FPGA. Transceiver 500 may receive or transmit radio signals in multiple bands.

In the present embodiment, the software radio technology may be implemented using sophisticated techniques. One common technique is a FPGA. FPGA allows developers to quickly carry out the functions of the design, development software, and download the software to run the FPGA, and enables repeatedly revised and download. In Xilinx FPGA module, for example, by a CPLD (Complex Programmable Logic Device: Complex Programmable Logic Device) XC95288X may be implemented locally or remotely updating software. FPGA implementations of the SDR to very mature technology, for example, U.S. Patent Application (Software Defined Radio (radio software), Publication Number: US20040242261A1) discloses an example of SDR implemented by FPGA, the entirety of which is incorporated herein by reference. Specific client may be some common software modules stored in the database (may be within a cloud server).

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Application No. 201310452351.1 disclosed in Patent Document e.g., which is incorporated herein by reference. Thus, the present embodiment by way of communications products FPGA custom communication protocol for software updates, can facilitate the successful design powerful, low power consumption, simple operation, small volume.

In the present embodiment, by providing a plurality of interface modules, including various wireless interface modules, respectively, for example, WiFi protocol, 3G / 4G 5G protocol and future protocols, satellite communications protocol, a Bluetooth protocol, ZigBee protocol, landline protocol, wired local area network (LAN) protocol interface module. Meanwhile, in order to meet the needs of future development, integration of new communication protocols, the device has a long-term, sustainable purpose applications, the system also built more SDR modules, through monitoring and analysis of new wireless signal protocol, download the relevant protocol module, generating interface module compatible with the new protocol. This ongoing integration of new communication protocols.

The detection signal may be achieved by one of three techniques or in various combinations: (1) Energy (Energy); (2) matched filter (Matched Filter); (3) cyclostationary signal characteristic (Cyclostationary Feature). Corresponding to the embodiment examples with reference CA2746269 C, US8571119 B2 and the like in Patent Document US7327777 B2, which is hereby incorporated herein incorporated by reference. By detecting the signal, most of the known types can be distinguished signal, the system by calling the relevant signaling protocol, a communication protocol is completed and the new object signal. If you can not distinguish the new signal, the signal modulation techniques to distinguish the next transmission. Resolved modulation techniques fall into two categories: (1) based on the likelihood (Likelihood-based); (2) wherein (Feature-Based) based. The manner known in the art may be employed, for example, refer to U.S. Patent Document US8750425B1, which is hereby incorporated herein incorporated by reference. After distinguish modulation, the modulation technique based on software module can be called from the system itself, can be downloaded from a neighboring node or the database in the background, reference may download method disclosed in Patent Document No. CA201310452351.1, which is hereby incorporated herein by reference Reference.

Protocol communication between different modules may be implemented in a virtual network technology. Hypervisor example, using the standard Virtual Switch layer functional modules can communicate with each other between each virtual system. Between different protocols achieve complete information exchange through the virtual layer. Specific embodiments may be implemented on a microcontroller. Microcontrollers inexpensive, small, and simple programming. MIPS Technologies, Inc's M-Class M51XX chips virtualization function can be achieved Hardware Assisted Virtualisation, support multiple virtual devices is present, and is given to each virtual an ID.

The microcontroller according to the present embodiment can be flexibly configured. For example, an interface component corresponding to the first and second interface component each provide one or more microcontrollers, or only for the first interface component and the second component provides an interface to the microcontroller.

The method of multi-protocol communication flow of FIG 4 is an embodiment of the invention, a schematic diagram of the interoperation. 4, the method may comprise the steps of:

S401: providing an interface for information transfer using standard communication protocols.

In the present embodiment, the standard communication protocol communication protocol is selected from at least one of:

WiFi communications protocol, 3G / 4G communication protocol, ZigBee protocol, LAN protocol, Bluetooth communication protocol, a fixed telephone communication protocol, and satellite communication protocols. Provided that interfaces with the communication protocols that match these interfaces.

S402: customize the information communication protocol provides an interface for the transmission of information using.

In the present embodiment, a custom communication protocol based on a different custom radio band, and the FPGA custom communication protocol software update.

S403: interaction based on virtual information exchange will use different communication protocols.

4 5 is a schematic flow diagram showing a specific step 403. As illustrated, step 5 S403 may include:

S4031: Construction of a plurality of virtual devices corresponding to different protocol-based virtualization technology, and give each a specific virtual machine ID.

S4032: Construction of the transmission path for the virtual router provides information exchange between different virtual ID, so that the information using different communication protocols corresponding to different virtual machine ID interacts transmission path according to the determined virtual router.

FIG 6 is an example of a communication method of a multi-protocol interoperability embodiment of the present invention. In the example shown ZigBee, Bluetooth and WiFi examples of exchanging data through a shared file system's service virtualization (Shared File System Service).

First, information transmission may provide an interface for using standard communication protocols. In the present embodiment illustrated embodiment is an information transmission using ZigBee, Bluetooth, WiFi, and other standard communication protocols provide a ZigBee interface, a WiFi interface and a Bluetooth interface. In order that those skilled in the art to better understand the essence of the invention, in the present embodiment is not shown associated with custom protocol interface.

Thereafter, based on the virtual may interact to exchange information using different communication protocols. Specifically, first, a plurality of virtual devices can be constructed corresponding to different protocols (e.g., FIG. 6 shows the ZigBee, WiFi, and Bluetooth virtual machine) based on the virtualization technology, and give each a specific virtual machine ID (e.g. FIG. 6 shown in ZigBee: 10.1.2.19, Bluetooth: 10.1.2.10 and WiFi: 10.1.2.21).

Then, the virtual router can be constructed for a transmission path to provide different information exchange between the virtual ID, so that the information using different communication protocols corresponding to different virtual machine ID interacts transmission path according to the determined virtual router. In the present embodiment, the virtual router may employ a hypervisor layer (Hypervisor in) the data exchange technology. Hypervisor may coordinate the hardware (FIG. 6 interfaces) for access to each of the virtual devices corresponding to each hardware platform through the cloud (Cloud Platform), so that the information can use different communication protocols corresponding to different virtual machine according to the ID transmission path to the virtual router determines interact. For example, in the Linux operating system, can share information between each virtual bash command by the command on the respective nodes are examples:

The following files are installed bash on 10.1.2.21:

```
#!/ Bin / sh

// This package installs 10.1.2.21 machine using the network file sharing to share data on

apt-get install nfs-kernel-server

// This command installs the Network File Sharing Services (NFS). File-sharing services allow systems network

Network with others to share directories and files. It is a distributed file system protocol that allows service

Load remote directory on the device. Allows management of storage space at different positions, from a plurality of clients
and writing

The space

echo "/ data 10.1.2.0/24(rw,fsid=0,insecure,no_subtree_check,async,no_root_squash)">>/etc/exports

// can be configured to export the directory by adding the directory to / etc / exports file

exportfs-a

// The command export / etc all file system path / exports file specified

service nfs-kernel-server restart

// restart nfs-kernel-server service
```

The following bash file needs to be created for the client in the second virtual machine on (10.1.2.19):

```
#!/ Bin / sh

apt-get install nfs-common

// via remote network file sharing services added to / etc / fstab file on the virtual machine client to automatically install
remote Network File Sharing Services

echo "10.1.2.21://data nfs4defaults 0 0" >> / etc / fstab

// the following command to manually install

mount-t nfs 10.1.2.21:/data/data
```

Similar to the node 10.1.2.19, 10.1.2.20 node during follows:

```
#!/ Bin / sh

apt-get install nfs-common

echo "10.1.2.21://data nfs4defaults 0 0" >> / etc / fstab

mount-t nfs 10.1.2.21:/data/data
```

By the present embodiment, information interaction between the different communication protocols may be implemented. Those skilled in the art according to the exemplary embodiment of the present embodiment, also by way of example in the implementation of the interactive self-interaction and defines the communication protocol between the information from the information relating to the standard communication protocol interaction between the information defining the communication protocol, this application in this respect not to repeat.

It means the above-described embodiments are merely illustrative, as a unit wherein the separate parts may be or may not be physically separate, parts displayed as units may be or may not be physical units, i.e. may be located a place, or they may be distributed to multiple network units. You can select some or all of the modules according to actual needs to

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achieve the object of the solutions of the embodiments. Those of ordinary skill in the art in the case without creative labor, i.e., can be understood and implemented.

By the above described embodiments, those skilled in the art may clearly understand that the embodiments may be implemented by software plus a necessary universal hardware platform, also be implemented by hardware. Based on such understanding, the technical solutions of the above or the part contributing to the prior art may be embodied in a software product out of the computer software product may be stored in a computer-readable storage medium, such as ROM / RAM, magnetic disk, optical disk, etc., some parts of the various method embodiments or embodiment includes a plurality of instruction execution to enable a computer device (may be a personal computer, a server, or network device).

Finally, it should be noted that: the above embodiments are intended to illustrate the present invention, rather than limiting;. Although the embodiments of the present invention has been described in detail, those of ordinary skill in the art should be understood: that they may still to the technical solutions described in each embodiment to modify, or to some technical features equivalents; as such modifications or replacements do not cause the essence of corresponding technical solutions to depart from the spirit and scope of the technical solutions of the embodiments of the present invention.

CLASSIFICATIONS

International Classification	H04L29/06
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