problem that it is not possible to easily implement various services through the communication network.

[0005] Although the invention of a communication device into which an application program is embedded in advance is disclosed in Patent Literature 1, the user is not able to freely add, delete, or change the application program in the communication device disclosed in Patent Literature 1. Accordingly, even if the user uses the communication device disclosed in Patent Literature 1, the user is not able to freely provide the desired service.

[0006] Embodiments of the present invention provide a technique by which the user can provide freely and easily the various services through a communication network.

Solution to Problem

[0007] According to an aspect of the present invention, there is provided a relay device including relay means for relaying data communication between first and second communication networks; storage means for storing data in a rewritable manner, and storing an application program for implementing a predetermined communication service by data communication through at least one of the first and second communication networks, and a subprogram library which is a collection of subprograms called in an execution process of the application program and utilized in common regardless of the types of application programs; and program execution means for executing the application program.

[0008] According to such a relay device, there is no need to separately prepare a server device that executes an application program. Further, in embodiments of the present invention, since the application program is executed in the relay device, there is no fear of wiretapping, and it is not necessary to pay particular attention to ensuring security. In addition, according to embodiments of the present invention, it is not necessary to secure a communication address to be assigned to the server device, and there is an effect of being capable of saving the communication address. In particular, when the communication address is an Internet Protocol (IP) address of Internet Protocol version 4 (IPv4), the lack thereof has been a big problem, such that there is a great advantage of being capable of being able to save the IP address to be assigned to the server device. Further, according to embodiments of the present invention, the data communication performed between the relay device and the server through a communication network in a communication system in the related art is replaced

with communication through the internal bus of the relay device, such that there is an effect capable of reducing traffic in the communication network. Then, in the relay device of embodiments of the present invention, unlike the communication device disclosed in Patent Literature 1, the application program to be stored in the storage means can be rewritten freely according to the desire of the user. Further, as the subprogram library, if a collection of subprograms causing the program execution means to execute a process to be executed commonly in various types of application programs is prepared in advance, and the call specification is published as an application program interface (API), it is possible to save the effort and time required for the user to generate the sub-programs one by one. Thus, according to embodiments of the present invention, the user can easily implement the provision of various services through the communication network.

[0009] In an embodiment, in a case where a subprogram called in the execution process of the application program is a program including a specific process causing trouble in the relay of the data communication performed by the relay means, the program execution means determines whether or not the data communication is being currently relayed by the relay means, and in a case during the relay, the program execution means postpones the execution of the specific process until the data communication is completed. According to such an embodiment, even if the specific process causing trouble in the relay of data communication performed by the relay means is included in the application program executed by the program execution means, if the data communication is being currently relayed by the relay means, the execution of the specific process is postponed until the data communication is completed. Here, a process of rewriting parameters (for example, communication address of the relay device, and the like) used during the relay of the data communication and a process of restarting the relay device are examples of the specific process causing trouble in the relay of data communication by the relay means. Therefore, according to embodiments of the present invention, even if the user does not pay close attention, it is possible to avoid the occurrence of a problem caused by the execution of the specific process (disruption of data communication which is being currently relayed, or the like).

[0010] In another embodiment, respective priorities are set for communication services that are implemented by the relay means executing the relay of data communication and the program execution means executing the application program, and in a case where the relay of data communication and the communication service compete, until one of them having the higher priority is

completed, the execution of the other may be postponed. According to such an embodiment, it is possible to prevent one having the higher priority of the services that are implemented by the relay means executing the relay of data communication and by executing the application program from being inhibited by the other. In addition, in another embodiment, the respective priorities of the communication services that are implemented by the relay means executing the relay of data communication and the program execution means executing the application program are set for each time, and time acquisition means (for example, a real-time clock or a GPS receiver) for acquiring the current time is provided in the relay device, and the conflict avoidance may be implemented by using the priority corresponding to the time acquired by the time acquisition means.

[0011] Further, according to another aspect of the present invention, there is provided a method causing a control unit of a relay device connected to the first and second communication networks to execute in parallel a relay step of relaying data communication between first and second communication networks; and a program execution step of reading and executing an application program from storage means for storing the application program for implementing a predetermined communication service by data communication through at least one of the first and second communication networks, and a subprogram library which is a collection of subprograms called in an execution process of the application program and utilized in common regardless of the types of application programs, in advance.

[0012] Further, the relay device may be a wireless local area network (LAN) router.

Brief Description of Drawings

[0013] Fig. 1 is a block diagram illustrating a configuration example of a communication system including a relay device 10 according to an embodiment of the present invention.

Fig. 2 is a block diagram illustrating a configuration example of the relay

CLAIMS

1. A relay device comprising:

relay means for relaying data communication between first and second communication networks;

storage means for storing data in a rewritable manner, and storing an application program for implementing a predetermined communication service by data communication through at least one of the first and second communication networks, and a subprogram library which is a collection of subprograms called in an execution process of the application program and utilized in common regardless of the types of application programs; and

program execution means for executing the application program.

2. The relay device according to claim 1, wherein in a case where a subprogram called in the execution process of the application program is a program including a specific process causing trouble in the relay of the data communication performed by the relay means, the program execution means determines whether or not the data communication is being currently relayed by the relay means, and in a case during the relay, the program execution means postpones the execution of the specific process until the data communication is completed.

3. The relay device according to claim 2, wherein the specific process is a process of restarting the relay device, or a process of rewriting parameters used at the time of the relay of data communication performed by the relay means.

4. The relay device according to any one of claims 1 to 3, wherein priorities are respectively set for the relay of the data communication performed by the relay means and the communication service, and

wherein, during execution of one out of the relay of the data communication performed by the relay means and the application program executed by the program execution means, in a case where the other is executed, the execution having a lower priority is postponed until the completion of the execution having a higher priority.

5. The relay device according to any one of claims 1 to 4, wherein at least one of the first communication network and the second communication network is a wireless communication network.

6. The relay device according to any one of claims 1 to 5, wherein the relay device is a wireless LAN router.

7. The relay device according to any one of claims 1 to 6, wherein the subprograms include processing for acquiring at least one of device information of the relay device and environment information about the surrounding of the relay device.

8. The relay device according to any one of claims 1 to 7, wherein the subprograms include processing for changing the operation setting of the relay device.

9. The relay device according to any one of claims 1 to 8, wherein the subprograms include processing unique to a communication device.

10. The relay device according to any one of claims 1 to 9, wherein the subprograms include at least one of processing for acquiring a list of MAC addresses of wireless terminals connected to the relay device, processing for acquiring or changing IP address of the relay device, or processing for identifying a network address of wireless terminal connected to the relay device.

11. The relay device according to any one of claims 1 to 10, wherein the subprograms include processing for updating database.

12. The relay device according to any one of claims 1 to 11, wherein the relay device is one of a switching hub, a gateway or a wireless access point.

13. A method causing a control unit of a relay device, which is connected to first and second communication networks, to execute in parallel:

a relay step of relaying data communication between the first and second communication networks; and

a program execution step of reading and executing an application program from storage means for storing the application program for implementing a predetermined communication service by data communication through at least one of the first and second communication networks, and a subprogram library which is a collection of subprograms called in an execution process of the application program and utilized in common regardless of the types of application programs, in advance.

14. The method according to claim 13, wherein in a case where a subprogram called in the execution step of the application program is a program including a specific process causing trouble in the relay of the data communication performed in the relay step, the program execution step determines whether or not the data communication is being currently relayed in the relay step, and in a case during the relay, the program execution step postpones the execution of the specific process until the data communication is completed.

15. The method according to claim 14, wherein the specific process is a process of restarting the relay device, or a process of rewriting parameters used at the time of the relay of data communication performed in the relay step.

16. The method according to any one of claims 13 to 15, wherein priorities are respectively set for the relay of the data communication performed in the relay step and the communication service, and

wherein, during execution of one out of the relay of the data communication performed in the relay step and the application program executed in the program execution step, in a case where the other is executed, the execution having a lower priority is postponed until the completion of the execution having a higher priority.

17. The method according to any one of claims 13 to 16, wherein at least one of the first communication network and the second communication network is a wireless communication network.

18. The method according to any one of claims 13 to 17, wherein the relay device is a wireless LAN router.

19. The method according to any one of claims 13 to 18, wherein the subprograms include processing for acquiring at least one of device information of the relay device and environment information about the surrounding of the relay device.

20. The method according to any one of claims 13 to 19, wherein the subprograms include processing for changing the operation setting of the relay device.

21. The method according to any one of claims 13 to 20, wherein the subprograms include processing unique to a communication device.

22. The method according to any one of claims 13 to 21, wherein the subprograms include at least one of processing for acquiring a list of MAC addresses of wireless terminals connected to the relay device, processing for acquiring or changing IP address of the relay device, or processing for identifying a network address of wireless terminal connected to the relay device.

23. The method according to any one of claims 13 to 22, wherein the subprograms include processing for updating database.

24. The method according to any one of claims 13 to 23, wherein the relay device is one of a switching hub, a gateway or a wireless access point.