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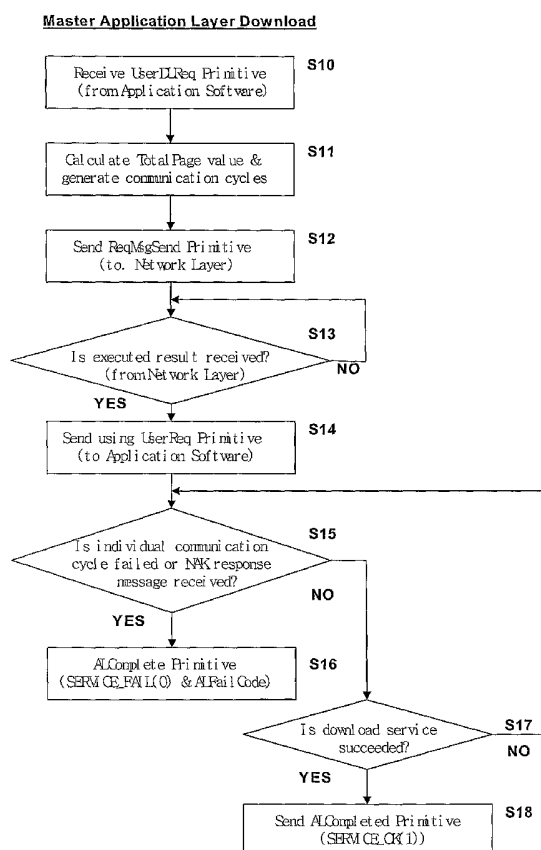
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[Continued on next page]

(54) Title: METHOD FOR PROVIDING DOWNLOAD AND UPLOAD SERVICE IN NETWORK CONTROL SYSTEM



(57) Abstract: The present invention relates to a method for providing a download and upload service using variable length packet communication in a living network control system. For example, a user located inside or outside a house controls or monitors operations or operation states of various appliances such as refrigerator or laundry machine through a living network installed at home, such as a RS-485 network, small output network, or power line network so that convenience of remote control and supervision can be provided to a user. Further, in a case where a download or upload service is executed in a living network in which various appliances connected thereto, variable length packet communication, which is capable of dividing data by the buffer size of a device, and then sending and assembling the data, is used so that a download and upload service for various appliances connected through the living network can be more effectively executed.



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DESCRIPTION

METHOD FOR PROVIDING DOWNLOAD AND UPLOAD SERVICE IN NETWORK CONTROL SYSTEM

1. Technical Field

5 The present invention relates to a method for providing a download and upload service in a network control system, by which a user, for example, who is locating at home or out-of-home can effectively control household appliances such as refrigerator or laundry machine connected to a network.

10

2. Background Art

 In general, 'home network' means a network in which various digital appliances are connected to one another for the user to enjoy economical home services in a convenient and safe way
15 anytime at home or out-of-home, and due to the development of digital signal processing technology, various types of appliances such as refrigerator or laundry machine are being gradually digitalized.

 On the other hand, in recent years, home network has been
20 more advanced, since operating system and multi-media technology for appliances has been applied to digital appliances, as well as new types of information appliances have appeared.

 Moreover, in a general meaning, a network which is established for providing file exchanges or internet services
25 between personal computers and peripheral devices, a network between appliances for handling audio or video information, and a network established for home automation of various appliances

such as refrigerator or laundry machine, appliance control such as remote meter reading, and the like are called a 'living network', for example.

Furthermore, in the network services in which small-scale data transmission for the remote control, or operating state monitoring of the appliances included in the network, for example, various appliances such as refrigerator or laundry machine, is the main object of their communication, each of appliances connected to one another should be directly controlled by a network manager, which is included in the network, with the use of the minimum required communication resources. However, its effective solution has not been provided yet, and thus it is a matter of urgency to provide its solution.

3. Disclosure of Invention

Accordingly, the present invention is devised in consideration of the aforementioned situation, and it is an object of the invention to provide a download and upload service in a network control system, by which a user, for example, who is locating at home or out-of-home can effectively control various appliances such as refrigerator or laundry machine connected to a network by using the minimum required communication resources, and a download and upload service for the appliances can be more effectively implemented at the same time.

In order to achieve the aforementioned object, there is provided a method for providing a download service in a network control system, the method comprising the steps of: receiving a UserDLReq primitive from application software in a master application layer of the network control system; generating communication cycles to be suitable for a buffer size of a device to be downloaded; sending a ReqMsgSend primitive to a network

layer as the unit of the generated communication cycle; and generating a UserRes primitive and then sending it to the application software if an executed result of the communication cycle is received from the network layer.

5 Also, according to another aspect of the present invention for achieving the object, there is provided a method for providing a download service in a network control system, the method comprising the steps of: sequentially recording downloaded communication cycle messages in a previously allocated memory and
10 sending a response message in a slave application layer of the network control system; and determining that the download service is succeeded if download messages are received as many as the TotalPage necessary for download completion.

 Also, according to a further aspect of the present invention
15 for achieving the object, there is provided a method for providing an upload service in a network control system, the method comprising the steps of: requesting a slave to send upload data by the DataLength size included in a UserULReq primitive while sequentially increasing PageNo of communication cycles necessary
20 for uploads if the UserULReq primitive is received from application software in a master application layer of the network control system; sending a ReqMsgSend to a network layer while dividing as the unit of each communication cycle; and generating a UserRes primitive and then sending it to the application
25 software if an executed result of each communication cycle is received from the network layer.

 Also, according to a still further aspect of the present invention for achieving the object, there is provided a method for providing an upload service in a network control system, the
30 method comprising the steps of: containing upload data in a response message as the unit of a predetermined data length and

then sending the response message to a master whenever an upload request message is received in a slave application layer of the network control system; and completing an upload service by sending a response message with no data to the master if a request
5 message is received after all the upload data are sent.

4. Brief Description of Drawings

FIG. 1 illustrates a configuration of a network control system according to the present invention;

10 FIGS. 2 and 3 illustrate master-slave based communication structures applied to the present invention;

FIG. 4 illustrates a hierarchical structure of an LnCP network applied to the present invention;

15 FIGS. 5 to 7 illustrate embodiments for a communication cycle service applied to the present invention;

FIG. 8 illustrates an embodiment of a method for providing a download service in a master application layer according to the present invention;

20 FIG. 9 illustrates an embodiment of a method for providing a download service in a slave application layer according to the present invention;

FIG. 10 illustrates an embodiment of a method for providing an upload service in a master application layer according to the present invention; and

25 FIG. 11 illustrates an embodiment of a method for providing an upload service in a slave application layer according to the present invention.

5. Modes for Carrying out the Invention

30 Hereinafter, preferred embodiments of a method for providing a download and upload service in a network control

system will be described in detail with reference to the accompanying drawings.

FIG. 1 illustrates a configuration of a network control system according to the present invention. An LnCP Internet server 100 and a living network control system 400, to which a network control protocol newly defined in the present invention, e.g., an LnCP (Living network Control System) is applied, are connected to each other via Internet 300 as shown in FIG. 1. Further, the LnCP Internet server 100 implements interfaces with a variety of communication terminals 200 such as PCs, PDAs or PCSs.

In the meantime, the living network control system 400 includes a home gateway 40, a network manager 41, an LnCP router 42, an LnCP adaptor 43 and appliances 44. As shown in FIG. 1, the components use a non-standardized transmission method of a data link layer such as an RS-485 network or small output RF network, or a standardized transmission medium of a data link layer such as power line communications or IEEE 802.11.ZigBee (IEEE 802.15.4).

Further, the living network control system 400 is referred to as an "LnCP network", for example. As shown in FIG. 1, the LnCP network is configured as an individual network in which appliances belonging to the category of a living network are connected through a wire or wireless transmission medium at an individual home.

In the meantime, a master device capable of controlling or supervising operations of other appliances, and a slave device with functions of responding to the request of the master device and notifying information on changes of their own states are connected to the LnCP network.

As shown in FIG. 1, the network manager 41 implements a function of environment setting and management of the applices

44 connected to the LnCP network. At this time, the appliances
44 may be connected directly to the network or indirectly to the
network via the LnCP adaptor 43, and the RS-485 network, RF network,
power line network and the like are connected to the network via
5 the LnCP router 42.

Further, the LnCP network provides a function in that a user
located outside a house can identify or control the states of
appliances installed at home through a connection with the
external Internet 300. Here, the home gateway 40 implements a
10 function of connecting the LnCP network with the external Internet.
If the user accesses the Internet server 100 and then passes
through an authentication procedure, the user can use a function
of identifying or controlling the states of appliances conneted
to the LnCP network.

15 In addition, the user can connect to the LnCP Internet server
100 from the appliances connected to the LnCP network via the home
gateway 40 and then download contents provided from the LnCP
Internet server 100. Main features of the LnCP network for this
purpose will be described in detail below.

20 First, digital information appliances have micro
controllers with various performances such that each of them
implements their unique function. In the LnCP network according
to the present invention, functions are more effectively
simplified to operate in such micro controllers with various
25 performances so that the resources of the micro controller built
in the appliances can be used at the minimum. In particular,
according thereto, micro controllers with low performances can
implement not only unique functions of the appliances but also
LnCP communication functions, and micro controllers with high
30 performances can support multi-tasking functions.

Further, the main features of the LnCP network according to

the present invention may be classified into master-slave based communication structure, event-driven communication support, multiple network manager support, four-layer structure, communication cycle service, flexible address management, 5 variable length packet communication and standard message set offer.

In the meantime, the master-slave based communication structure, which is used as a communication structure for connection between appliances in the LnCP network, should include 10 at least one master device, and the master device should have information on slave devices to be controlled and control codes. At this time, the master device controls another slave device in accordance with a previously input program or through a user's input.

15 For example, as shown in FIG. 2, the flow of messages between the master and the slave devices is accomplished through a process in that if a request message is sent from the master device to the slave device, the slave device sends a response message thereto to the master device. As shown in FIG. 3, the LnCP network 20 may have a multi-master and multi-slave based communication structure.

In addition, the LnCP network supports an event-driven communication service, and a user, for example, can set an event required to an appliance. Then, if there occurs an event set by 25 the user in an appliance while performing a certain operation, the correspondent appliance notifies the fact or content that the event occurs to another appliance or controls the operation state of another appliance.

Further, the LnCP network includes at least one network 30 manager for implementing a function of environment setting and management of appliances and may support a plurality of network

managers as occasion demands. In this case, the management information of the appliances should be synchronized to provide for errors produced from the plurality of network managers.

Furthermore, as shown in FIG. 4, the LnCP network has a
5 four-layer structure comprising a physical layer, a data link layer, a network layer and an application layer. In the LnCP network, a service is provided by the communication cycle, while there may be only one communication cycle at a given time point in the slave device.

10 That is, although one slave device cannot be controlled by any master devices while a communication cycle is being executed in the slave device, a plurality of communication cycles for a plurality of slave devices can be executed at a given time point in the master device. Such communication cycles are divided into
15 four classes such as {1-Request, 1-Response}, {1-request, Multi-Request}, {1-Notification} and {Repeated-Notification}.

For example, the communication cycle {1-Request, 1-Response} refers to a communication cycle in which one master device transmits one request packet to one slave device, and the
20 slave device transmits a response packet to the master device in response thereto. If there occurs an error in the received packet, as shown in FIG. 5, the master device transmits a re-request packet to the slave device, and the slave device retransmits a response packet in response thereto.

25 In addition, as shown in FIG. 6, the {1-request, Multi-Request} refers to a communication cycle in which one master device transmits one request packet with a group address to multiple slave devices, and each of the slave devices transmits a response packet in response thereto. The master device
30 completes the communication cycle after the available maximum receiving time elapses. At this time, even if there occurs an

error in the response packet received from the slave device, the master device does not respond thereto.

Moreover, as shown in FIG. 7, the communication cycle {1-Notification} refers to a communication cycle in which one master device transmits one notification packet to one or multiple slave devices and then completes communications immediately, and the communication cycle {Repeated-Notification} refers to a communication cycle in which one master device repeatedly transmits the same packet and then completes communications so as to guarantee transmission reliability in the communication cycle {1-Notification}.

In the meantime, a function of flexible address management is supported in the LnCP network. For example, since an address is allocated to appliances provided with an LnCP function for each class when they are shipped from a factory, the appliances automatically configures a network without any user's intervention. At this time, since appliances belonging to the same class are initialized with the same address, a network manager has an algorithm for allocating a single unique address when connecting the appliances.

In addition, in the LnCP network, a unique group address is allocated to appliances belonging to the same class so that group communications are available using one message and that various kinds of appliances are classified into clusters as a user demands, and a group address can be allocated to each of the clusters.

Further, variable length packet communications are supported in the LnCP network. For example, in a case where contents such as application programs related to operations of appliances are downloaded, or data stored from the appliances are uploaded, the lengths of a packets are controlled using buffer size information on the appliances.

Furthermore, the LnCP network provides a standard message set. For example, a standard message set suitable for a variety of appliances is defined such that the master device can control other appliances, and the message set is divided into a common
5 area message set for basic LnCP communications, an application area message set for supporting unique functions of appliances and a developer area message set for providing unique functions of manufacturers at the same time.

In the meantime, the message set described above may be
10 extended as occasion demands, and a factor may be added to a previously defined message. A download and upload service, which is one of main features in the LnCP network according to the present invention, will be described in detail below.

First, in an application layer of the LnCP network according
15 to the present invention, there is provided a download and upload service using variable length packet communication, which is capable of dividing data by the size of a buffer contained in a device, and then sending and assembling the data, in case of a plurality of communication cycles such as downloads or uploads.

20 Further, a function of receiving data from a network layer is controlled to prevent an application layer buffer from being overflowed. For example, command codes for providing a download service includes "TotalPage" and "CurrentPage" as input factors, and a memory area for combining a message is previously allocated
25 for each command code for downloads in a slave device for supporting the download service.

As shown in FIG. 8, in a master application layer, if a UserDLReq primitive is received from application software at operation S10, a download function corresponding thereto is
30 implemented. After the number of the total communication cycles (TotalPage value) for downloads is calculated while dividing by

the node parameter buffer size (NP_BufferSize) byte in a download file (DownloadFile), a communication cycles with the same CycleID value is generated at operation S11.

In addition, while dividing as the unit of each of the
5 communication cycles, a ReqMsgSend primitive is sent to a network layer at operation S12. Then, if an executed result of each of the communication cycles is received from the network layer at operation S13, a UserReq primitive is sent to application software at operation S14.

10 Further, before the download service is completed, if an individual communication cycle is failed, or an NAK (Negative Ack) response message is received at operation S15, the download service is determined to be failed so that an ALCompleted primitive including SERVICE_FAILED(0) and ALFailCode is sent to
15 the application software. If the download service is successfully completed at operation S16, the ALCompleted primitive including SERVICE_OK(1) is sent to the application software at operation S17. As such, a series of download service operations are performed.

20 In the meantime, as shown in FIG. 9, in a slave application layer, received messages are sequentially recorded in a previously allocated memory, and a response message is sent at operation S20. Then, if download messages are received as many as the number of TotalPage at operation S21, the download service
25 is determined to be succeeded at operation 22.

On the other hand, if another download request message is not received within a DLInterval time after one download request message is received at operation S23, the download service is determined to be failed at operation S24 so that the received
30 download data is removed from the memory at operation S25.

Further, an upload service is provided in the LnCP network

according to the present invention. For example, command codes for providing an upload service includes "PageNo" and "DataLength" as input factors, and a data area to be uploaded is previously allocated for each command code for uploads in a slave
5 device for supporting the upload service.

As shown in FIG. 10, in the master application layer, if a UserULReq primitive is received from application software at operation S30, an upload function corresponding thereto is implemented. In the master application layer, a PageNo value is
10 increased by one from the number 1, and a request for transmitting upload data by the DataLength size included in the UserULReq primitive is made to a slave device at operation S31.

In addition, while dividing by the communication cycle, a ReqMsgSend primitive is sent to a network layer at operation S32,
15 and a UserRes primitive is sent to the application software at operation S33. Then, if an executed result of each of the communication cycles is received from the network layer at operation S34, a UserReq primitive is sent to application software at operation S35.

20 Further, before the upload service is completed, if an individual communication cycle is failed, an NAK (Negative Ack) response message is received at operation S36, the upload service is determined to be failed so that an ALCompleted primitive including SERVICE_FAILED(0) and ALFailCode is sent to the
25 application software at operation S37. If an ACK response message with no data is received at operation S38, the upload service is determined to be successfully completed so that the ALCompleted primitive including SERVICE_OK(1) is sent to the application software at operation S39.

30 In the meantime, in the slave application layer, in a case where an upload function is implemented as shown in FIG. 11, upload

data is contained by the DataLength in a response message and then sent to the master device whenever a request message is received at operation S40. After all the upload data are sent at operation S41, if the request message is received S42, an ACK response
5 message with no data is sent to the master device at operation S43 so that the upload service is successfully completed at operation S44.

Further, in the present invention, the receiving buffer of each of the layers is allowed to be shared such that the slave
10 device is executed even in a micro controller with a low performance, and thus an overflow may be generated in the buffer of each of the layers in case where continuous data is received from the network layer. To prevent this, a function of temporarily suspend data reception from the network layer is implemented when
15 one message is received from the network layer.

As described above, according to the present invention, there is provided a method for providing a download and upload service in a network control system, wherein convenience of remote control and supervision can be provided to a user, and a download
20 and upload service for various appliances connected through the living network can be more effectively executed.

As describe above, while the present invention has been disclosed for the purpose of illustration with reference to the aforementioned preferred embodiment, more various appliances can
25 be connected to a living network, which may be referred to as another network of a different name, according to the present invention and it will be understood by those skilled in the art that the foregoing embodiment can be improved, modified, substituted or added in a variety of ways without departing from
30 the technical spirit and scope of the invention as defined by the appended claims.

CLAIMS

1. A method for providing a download service in a network control system, the method comprising the steps of:

receiving a UserDLReq primitive from application software
5 in a master application layer of the network control system;
generating communication cycles to be suitable for a buffer size of a device to be downloaded;

sending a ReqMsgSend primitive to a network layer as the unit of the generated communication cycle; and

10 generating a UserRes primitive and then sending it to the application software if an executed result of the communication cycle is received from the network layer.

2. The method according to claim 1, wherein the buffer size
15 of the device to be downloaded corresponds to an NP_BufferSize (Node Parameter Buffer Size).

3. The method according to claim 1, wherein the step of generating communication cycles further comprises a step of
20 obtaining the total number of the communication cycles to be downloaded (TotalPage).

4. The method according to claim 1, wherein each of the generated communication cycles has the same CycleID value.

25

5. The method according to claim 4, wherein the same communication CycleID value is provided to each communication cycle unit.

6. The method according to claim 1, further comprising a step of generating an ALCompleted primitive including SERVICE_OK(1) and then sending it to the application software if the download service is successfully completed.

5

7. The method according to claim 1, further comprising a step of generating an ALCompleted primitive including SERVICE_FAILED(0) and ALFailCode and then sending it to the application software by determining that the download service is failed if it is failed to send an individual communication cycle before the download service is completed.

8. The method according to claim 1, further comprising a step of generating an ALCompleted primitive including SERVICE_FAILED(0) and ALFailCode and then sending it to the application software by determining that the download service is failed if a failure response message is received from the network layer before the download service is completed.

9. The method according to claim 3, wherein the TotalPage is a value dividing a download file by the bytes of an NP_BufferSize (Node Parameter Buffer Size), which corresponds to the buffer size of the device to be downloaded.

10. The method according to claim 1, wherein a network layer, a data link layer and a physical layer are sequentially laminated beneath the master application layer, and application software is laminated on the master application layer.

11. A method for providing a download service in a network control system, the method comprising the steps of:

sequentially recording downloaded communication cycle messages in a previously allocated memory and sending a response message in a slave application layer of the network control system; and

5 determining that the download service is succeeded if download messages are received as many as the TotalPage necessary for download completion.

12. The method according to claim 11, further comprising a
10 step of determining that the download service is failed if a download request message is not received within a predetermined time interval before the download messages are received as many as the TotalPage necessary for download completion.

13. The method according to claim 12, further comprising a
15 step of removing download data recorded in the memory if it is determined that the download service is failed.

14. A method for providing an upload service in a network
20 control system, the method comprising the steps of:

requesting a slave to send upload data by the DataLength size included in a UserULReq primitive while sequentially increasing PageNo of communication cycles necessary for uploads if the UserULReq primitive is received from application software in a
25 master application layer of the network control system;

sending a ReqMsgSend to a network layer while dividing as the unit of each communication cycle; and

generating a UserRes primitive and then sending it to the application software if an executed result of each communication
30 cycle is received from the network layer.

15. The method according to claim 14, further comprising a step of sending a correspondent success completion primitive to the application software by determining that the upload service is succeeded if a response message with no data is received from
5 the slave.

16. The method according to claim 14, further comprising a step of sending a correspondent failure completion primitive to the application software by determining that the upload service
10 is failed if it is failed to send an individual communication cycle before the upload service is succeeded.

17. The method according to claim 14, further comprising a step of sending a correspondent failure completion primitive to
15 the application software by determining that the upload service is failed if an abnormal response message is received from the network layer before the upload service is succeeded.

18. A method for providing an upload service in a network
20 control system, the method comprising the steps of:

containing upload data in a response message as the unit of a predetermined data length and then sending the response message to a master whenever an upload request message is received in a slave application layer of the network control system; and
25 completing an upload service by sending a response message with no data to the master if a request message is received after all the upload data are sent.

19. The method according to claim 18, wherein download data
30 are received while sharing each of the receiving buffers of the slave application layer, a network layer, a data link layer and

a physical layer.

20. The method according to claim 18, further comprising a step of preventing the generation of an overflow by temporarily
5 suspending data reception from the network layer when one message is received from the network layer.

FIG. 1

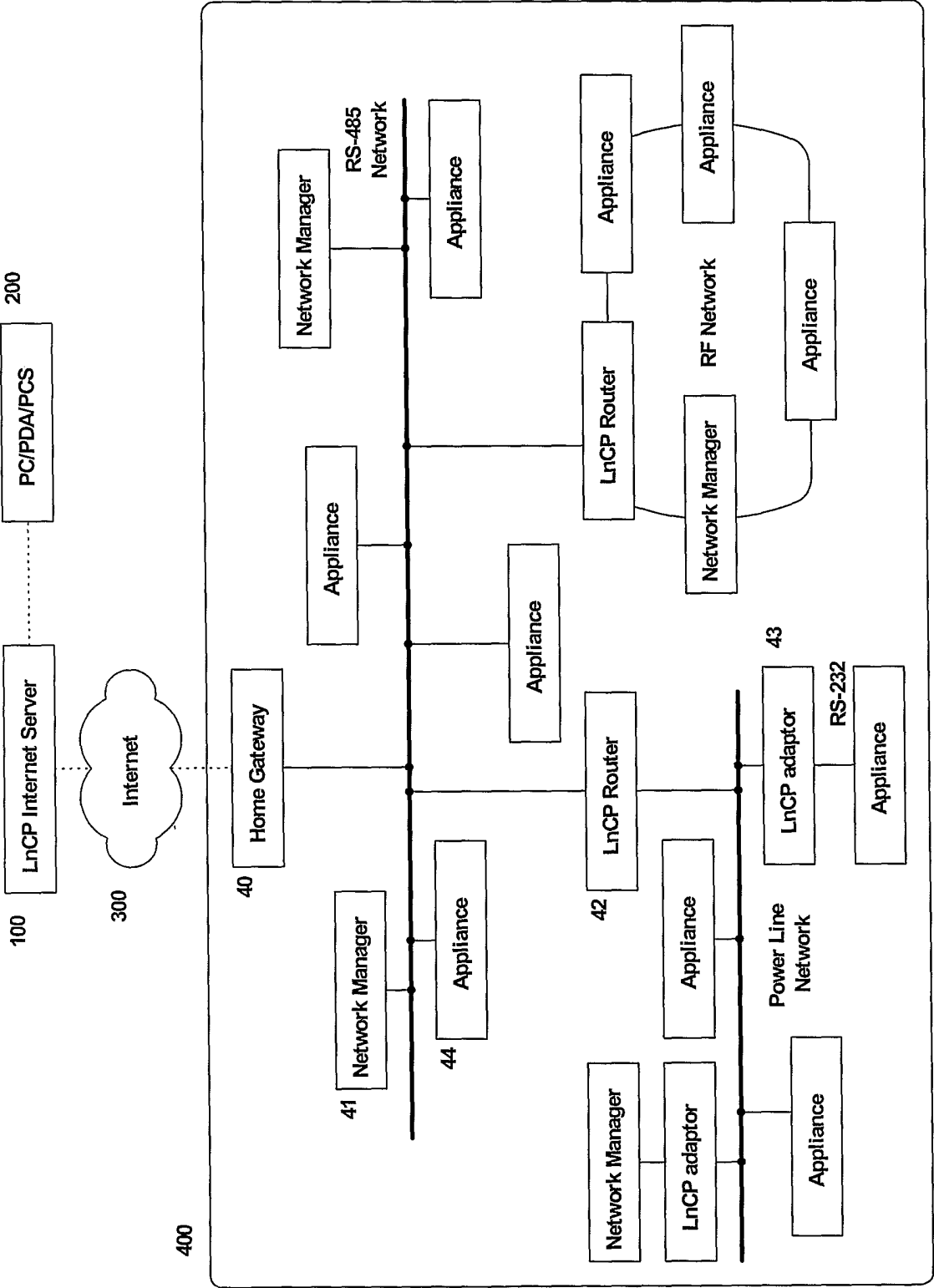


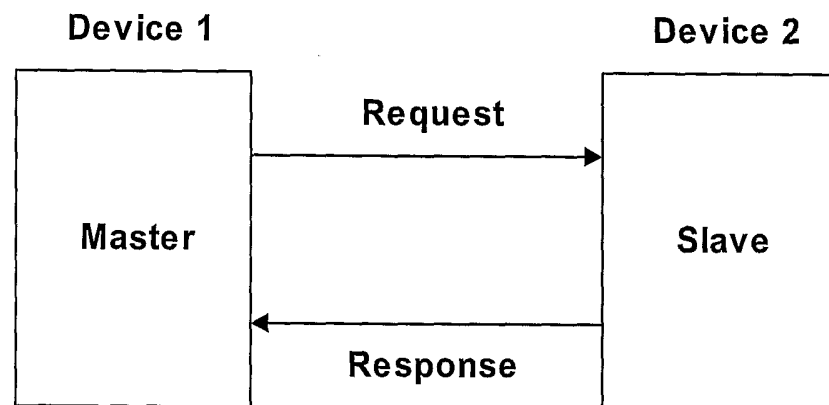
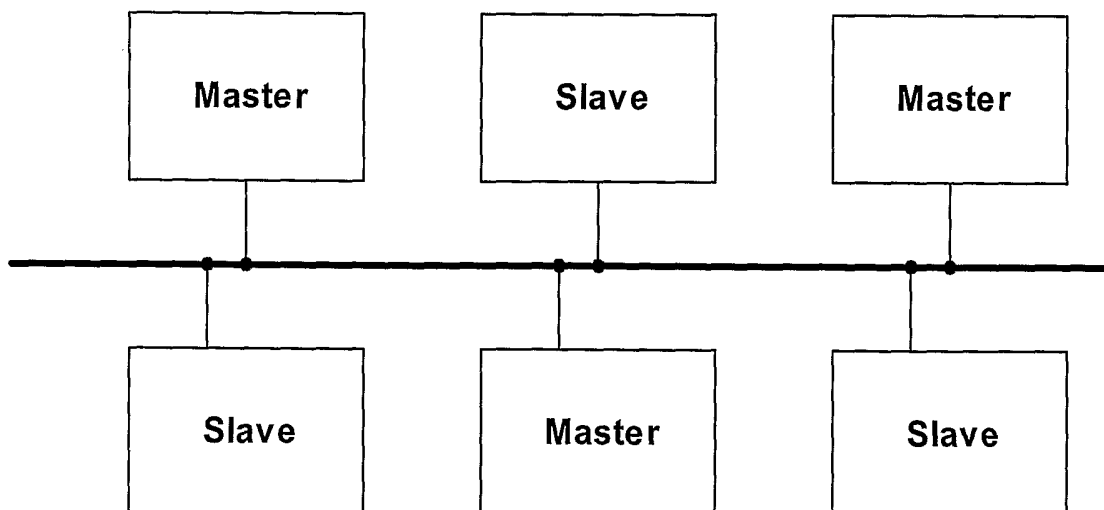
FIG. 2**FIG. 3****Multi-Master and Multi-Slave**

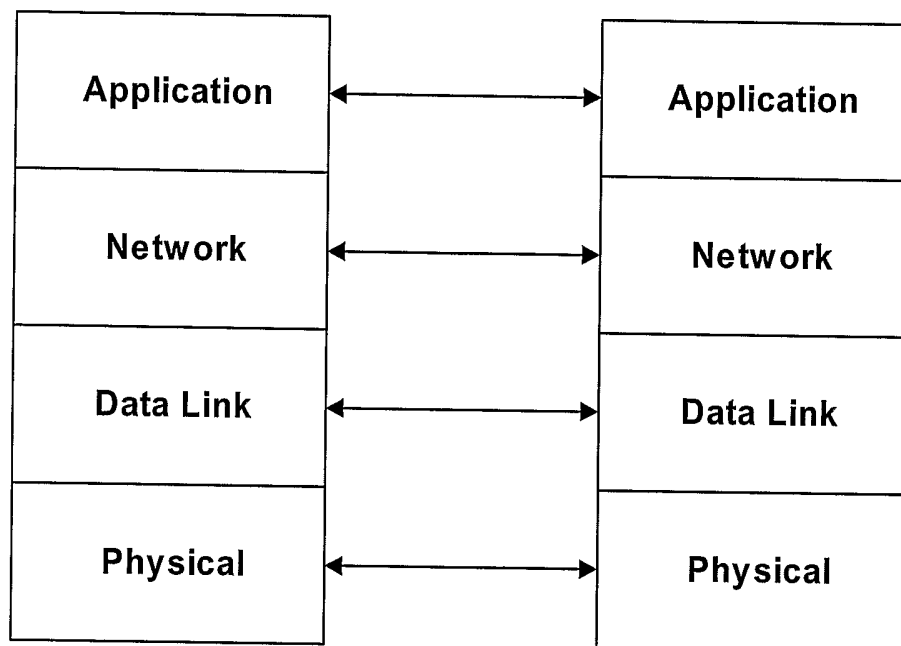
FIG. 4**LnCP Layer Structure**

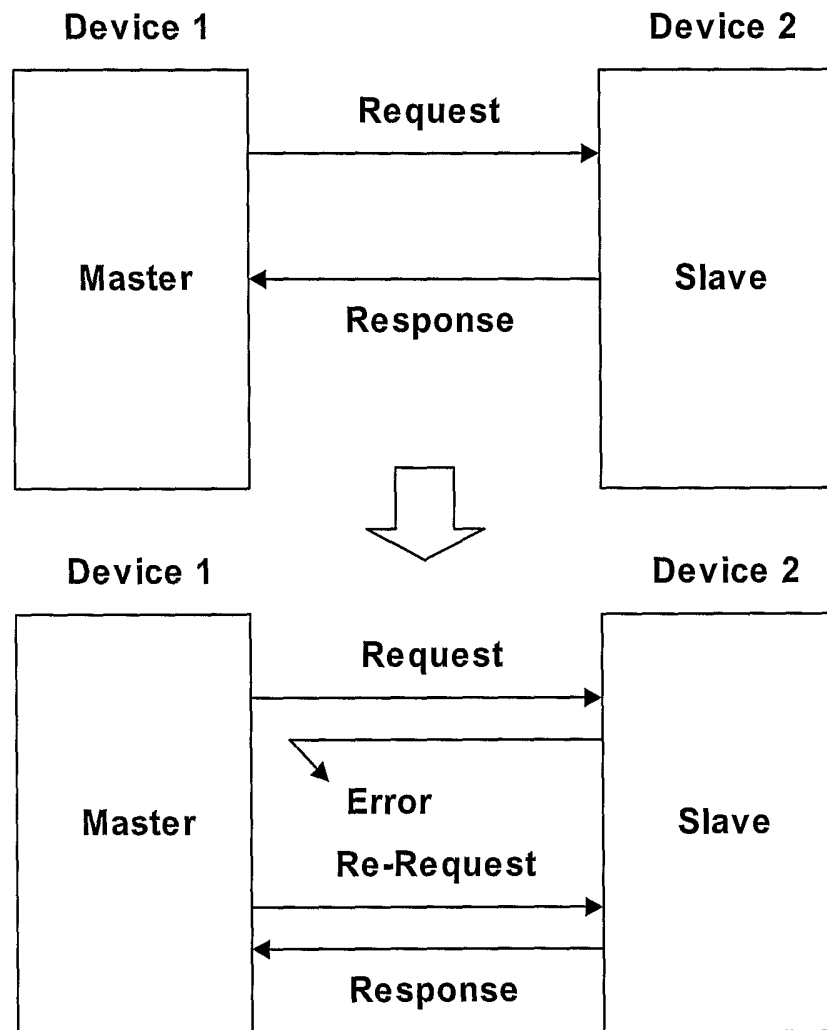
FIG. 5**1 Request & 1 Response**

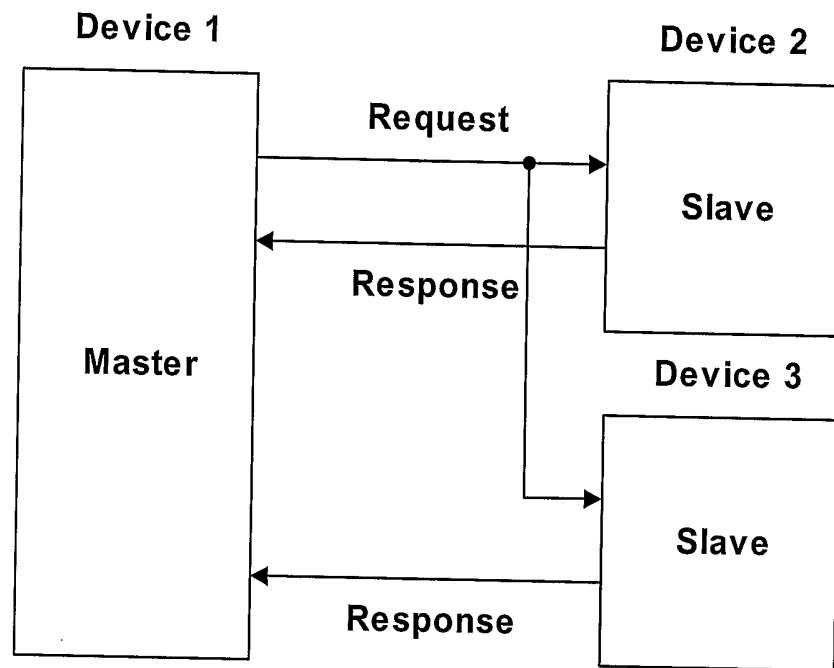
FIG. 6**1 Request & Multi- Response**

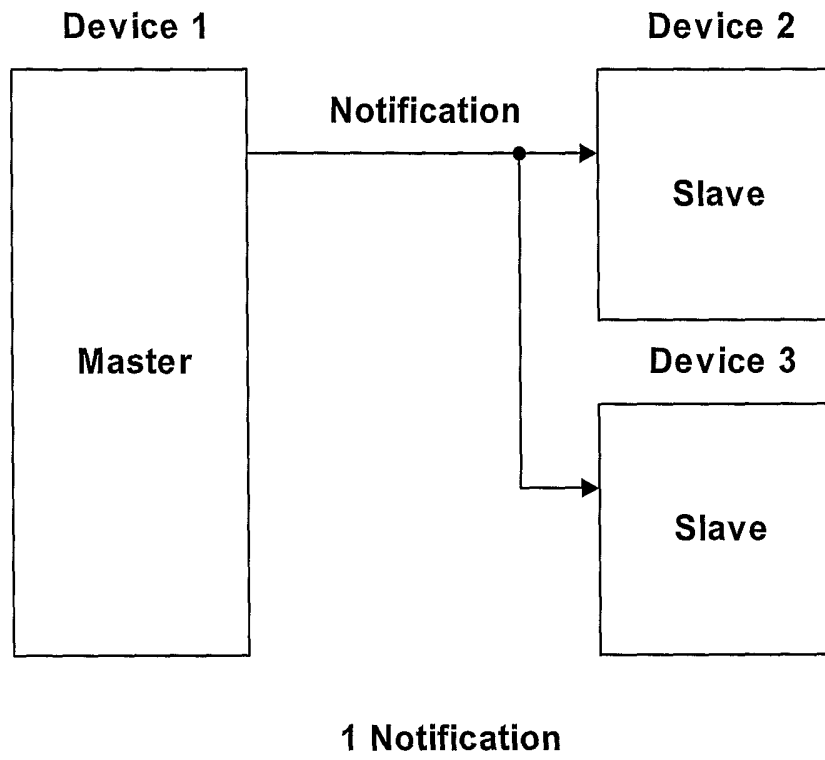
FIG. 7

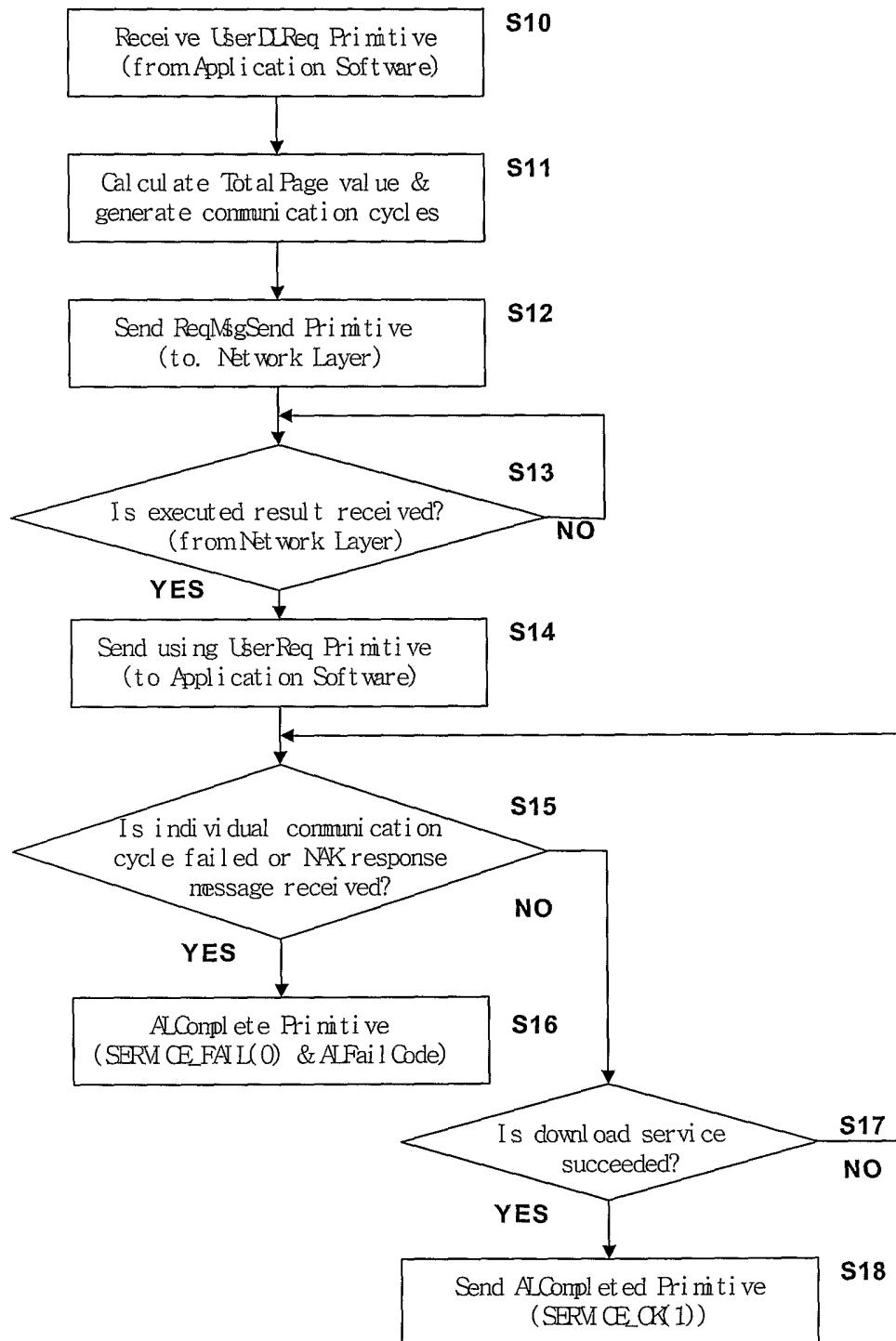
FIG.8**Master Application Layer Download**

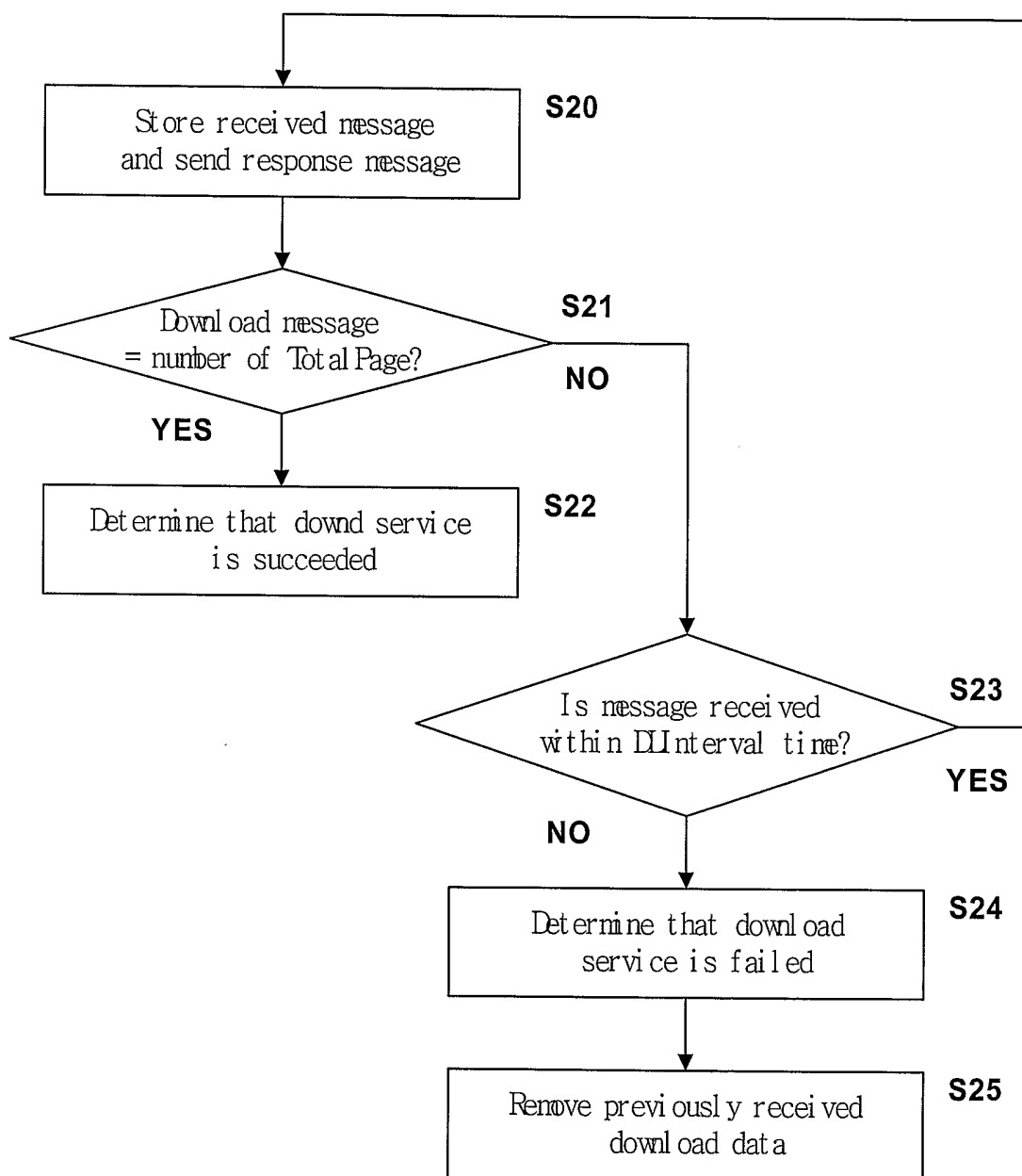
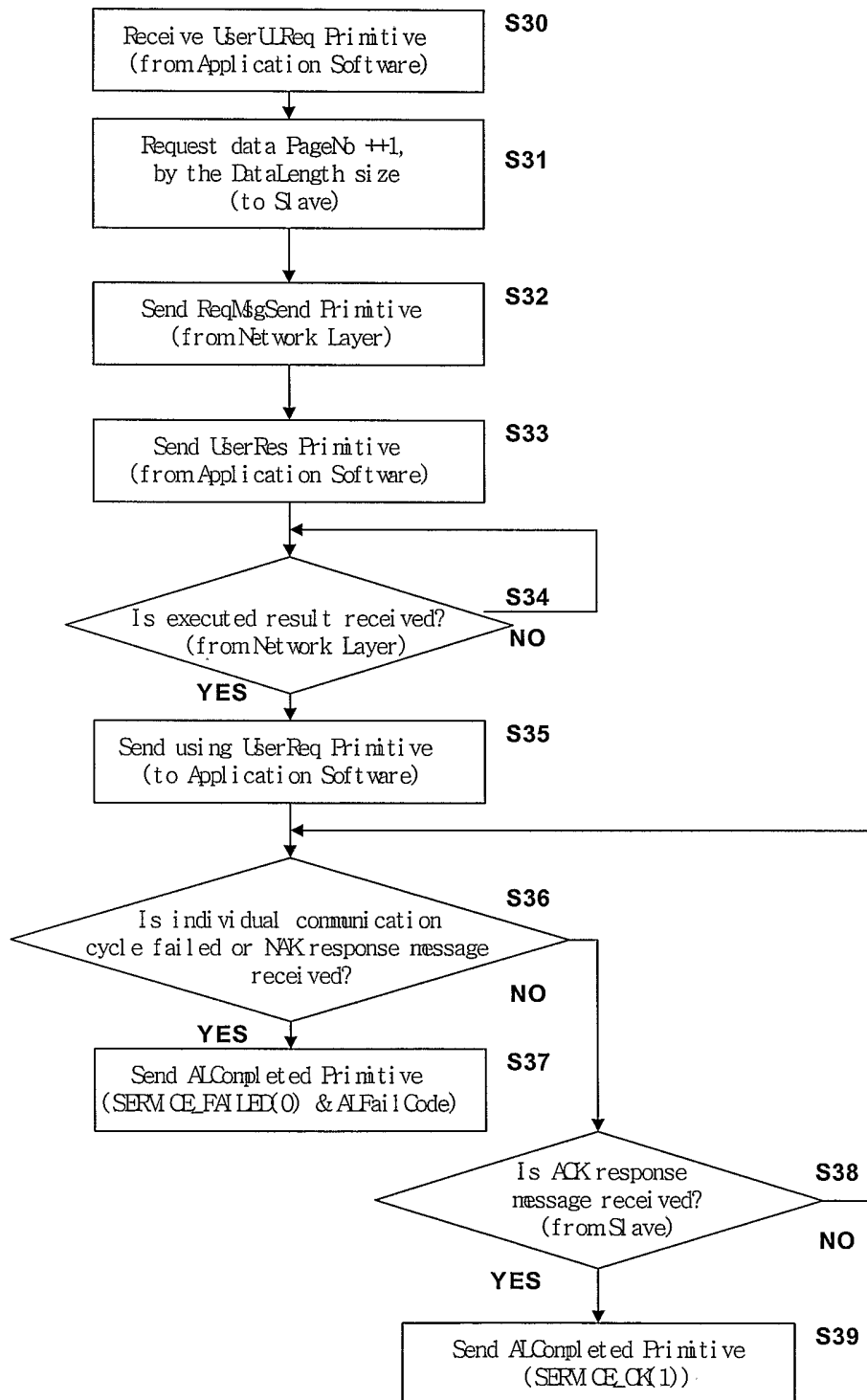
FIG.9**Slave Application Layer Download**

FIG.10**Master Application Layer Upload**

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2006/000434**A. CLASSIFICATION OF SUBJECT MATTER****H04L 29/10(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 8: H04B, H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

D/B: eKIPASS(Search System of theKIPO), IEEE, ESPACENET

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2004/107710 A1(LG ELECTRONICS, INC.) 09 December 2004 See whole document	1-20
A	WO 2004/107093 A2(LG ELECTRONICS, INC.) 09 December 2004 See whole document	1-20

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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