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(54) **Title**: METHOD AND DEVICE FOR MODIFYING A RETRANSMISSION TIMER IN A COMMUNICATION NETWORK

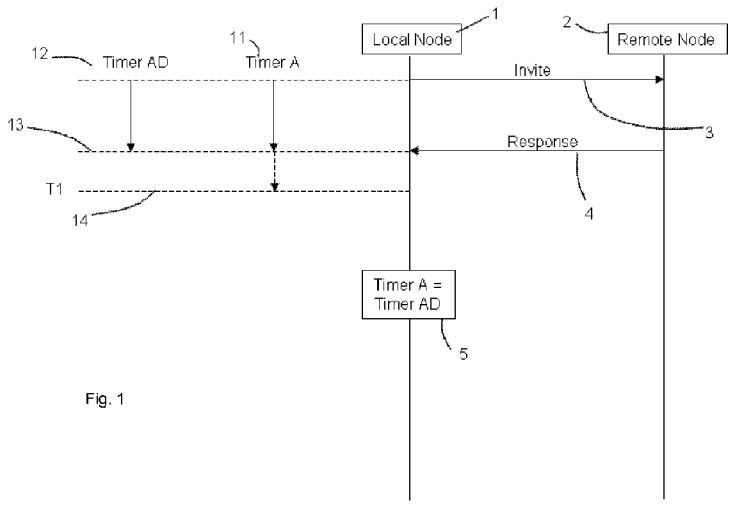

Fig. 1

(57) **Abstract**: A method of modifying a retransmission timer (11) in an originating node (1) of a communication network, wherein the retransmission timer (11) is started when a message (3, 3') is sent from the originating node (1) to a terminating node (2) and wherein an expiry of the retransmission timer (11) before a response message (4) is received by the originating node (1), triggers a re-sending of the message (3') and a restart of the retransmission timer (11), the method comprises the steps of: -conducting a measurement of the time between the sending of the message (3) and the receipt of the response message (4) by the originating node (1) to determine a time value; -modifying the retransmission timer (11) in accordance with the measured time value.

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Method and device for modifying a retransmission timer in a communication network

Technical Field

The present invention relates to a method of modifying a retransmission timer in an originating node of a communication network, wherein the retransmission timer is started when a message is sent from the originating node to a receiving node and wherein an expiry of the retransmission timer before a response message is received by the originating node, triggers a resending of the message and a restart of the retransmission timer. Devices and software programs embodying the invention are also described.

Background

In a communication network there are many applications that require the creation and management of a session, where a session is considered an exchange of data between different nodes. To manage a session, several protocols are known so far. One example of a management protocol is the Session Initiation Protocol (SIP) which enables network nodes to discover one another and to agree on a characterization of a session they would like to share. For locating prospective session participants and for other functions SIP enables the creation of an infrastructure of network hosts. The characteristics of the SIP are e.g. standardized in RFC 3261. Other management protocols are also known, such as the SS7 Mobile Application Part (MAP) Protocol which provides an application layer for the various nodes in a mobile communication network to communicate with each other in order to provide services to a mobile subscriber of the communication network.

In order to establish a communication between different nodes, which might be located in one or different communication networks, the originating node has to send a first message to the terminating node. This message can e.g.

be an INVITE message in accordance with the SIP, which must be answered by the receiving node with a RESPONSE message. After the originating node received the RESPONSE message, an ACKNOWLEDGE (ACK) message terminates this three-way handshake according to the SIP standard. Other messages according to other protocols might have different names. It is also possible to have just a two-way handshake without an ACKNOWLEDGE message between two nodes.

After the originating node sends the first message to the terminating node, a timer is started to supervise the receipt of a response message from the terminating node. In the SIP standard RFC 3261, there are several definitions of timers which have to be started when messages are sent to other nodes. Some of the timers have to be started when a non-reliable connection has to be established (e.g. a UDP connection). The standard RFC 3261 defines e.g. some basic time values (e.g. T1 as 500ms) which are used as reference values for the timers. One example is the INVITE request retransmit timer "A" which uses T1 as an initial value. The value of this timer will be doubled after each retransmission step. If timer "A" expires before a RESPONSE message is received by the originating node the INVITE message is retransmitted and timer "A" is started with a value of 2*T1. This process has to be continued so that the request is retransmitted with intervals that double after each retransmission (4*T1, 8*T1, etc...). If several networks are connected to each other, different delays between nodes might happen. This can also occurs if there are congestions in the communication path or the terminating node is not able to handle the INVITE message without delay due to an overload condition in the node.

It might be possible that between two nodes of different networks the time between sending an INVITE message and receiving a RESPONSE message is e.g. 5 seconds. The retransmission of the INVITE message will take place after 500ms, 1 s, 2s and 4s. After the retransmission timer is set to 4s (8*T1), the RESPONSE message is received and the process is stopped. The INVITE message was sent four times to build up a connection to another node. This will lead to high netload in both networks and will also occupy resources at the originating node because the message has to be transmitted several times. To fine-tune the value of the retransmission timer, it is not possible to change

the basic values (e.g. T1) because this will influence all other timers which are also based on the same basic value.

Summary

It is an object of the present invention to reduce the netload in a communication network. This object is achieved by the independent claims. Advantageous embodiments are described in the dependent claims.

One embodiment of the invention relates to a method of modifying a retransmission timer in an originating node of a communication network, wherein the retransmission timer is started when a message is sent from the originating node to a terminating node. An expiry of the retransmission timer, before a response message is received by the originating node, triggers a re-sending of the message and a restart of the retransmission timer. The method comprises the step of conducting a measurement of the time between the sending of the message and the receipt of the response message by the originating node to determine a time value. Further the method comprises the step of modifying the retransmission timer in accordance with the measured time value. The measured time value can be used to adapt the value of the retransmission timer to the current netload. Because in the standard situation the originating node has to re-send the message after expiry of the timer, the network is overloaded by such messages very fast if the duration between the sending and receiving of a message at the originating node is very long. By adjusting the retransmission timer according to the netload situation, the amount of messages can be reduced. Further the internal processing in an originating node can be reduced because the node just has to send a message once or maybe twice and not several times. The retransmission timer starts right after the message was sent. The time between the sending of the message and the starting of the retransmission timer should be as short as possible and is mostly affected by internal processes in the originating node. The retransmission timer expires if the time is running out when counting from a starting value to a stopping value, wherein the starting value

can be a defined value which represents the time the timer is running and the stopping value can be "0" or the starting value can be "0" and the stopping value is the defined value. A timer fires or expires when the timer reaches the stopping value regardless of that the timer counts to zero or to a specific value which was defined before. The resending of the message happens right after the retransmission timer expires. The delay between the expiry of the retransmission timer and the resending of the message can be affected by internal processes of the originating node to resend a message.

In a further embodiment the step of conducting a measurement is performed by starting a modification timer when the message is sent and stopping the modification timer when the response message is received. As described before, the delay between the trigger event and the start of a timer must be as short as possible to measure the exact time. This delay might also be affected by congestions in the internal communication of the originating node.

In a further embodiment the measured time value is stored in the originating node. Further, the step of modifying the retransmission timer can be performed by setting the retransmission timer in accordance with a calculated average of a predefined amount of stored measured time values. Using the calculated average of measured time values can eliminate outlier values.

In a further embodiment the modification of the retransmission timer is performed after each receipt of a response message in the originating node. The retransmission timer can be adapted or modified very fast or nearly in real-time to a fast changing network performance.

In a further embodiment the modification of the retransmission timer is performed after a predefined amount of measurements. This embodiment has the advantage that the value on which the modification of the retransmission timer is based consists of several measurements to eliminate outlier values due to a temporarily change of the network performance.

In a further embodiment the retransmission timer is allocated to a receiving node. If the originating node is in communication with many receiving nodes, the performance of the network for every receiving node can be different if the receiving nodes are located e.g. in different networks with different performances.

In a further embodiment the communication network is a mobile communication network. Further the message can be an INVITE message according to the Session Initiating Protocol, SIP.

The invention relates also to an originating node of a communication network, comprising a sending unit, adapted to send a message to a terminating node and a receiving unit, adapted to receive a response message from the terminating node. The originating node further comprises a retransmission timer which is started when the message is sent from the originating node to the terminating node and which re-starts and triggers the sending unit to re-send the message if the retransmission timer expires before the response message is received. Further, the originating node comprises a first processing unit, adapted to conduct a measurement of the time between the sending of the message by the sending unit and the receipt of the response message by the receiving unit to determine a time value, and a second processing unit, adapted to modify the retransmission timer in accordance with the measured time value.

In a further embodiment the originating node comprises a modification timer which is started when the message is sent by the sending unit and stopped when the response message is received by the receiving unit.

In a further embodiment the originating node comprises a storing unit, adapted to store the measured time value. The storing unit can be any kind of internal storage.

The invention relates further to an originating node, adapted to perform all the steps of the method of at least one of the prescribed embodiments.

The present invention also concerns computer programs comprising portions of software codes in order to implement the method as described above when operated by a respective processing unit of a user device and a recipient device. The retransmission timer may be a piece of software which is triggered by an input. After counting a pre-defined period, the timer software triggers the prescribed further steps in the originating node. The computer program can be stored on a computer-readable medium. The computer-readable medium can be a permanent or rewritable memory within the user device or the recipient device or located externally. The respective computer program can also be transferred to the user device or recipient device for example via a cable or a wireless link as a sequence of signals.

In the following, detailed embodiments of the present invention shall be described in order to give the skilled person a full and complete understanding. However, these embodiments are illustrative and not intended to be limiting.

Brief Description of the Figures

Fig. 1 shows a schematic diagram of a first embodiment of the invention;

Fig. 2 shows a schematic diagram of a second embodiment of the invention;

Fig. 3 shows an embodiment of an originating node according to the invention.

Detailed Description

Fig. 1 and 2 show exemplary sequence diagrams according to one embodiment of the invention. Both figures disclose a local node 1 and a

remote node 2. Messages 3, 3', 4 are transmitted between the local node 1 and the remote node 2. Both nodes 1, 2 can be located in the same network or in different networks. A local node 1 can also be named as an originating node 1 and the remote node 2 can also be named as a terminating node 2. The nodes 1, 2 can be control nodes, like mobile switching centers of mobile communication networks. It is also possible that these nodes 1, 2 are serving gateway support nodes (SGSN) or any other kind of control nodes or any kind of access agent in a network. In the embodiment according Fig. 1, the local node 1 tries to establish a communication with the remote node 2 by using the Session Initiation Protocol, SIP, according to standard RFC 3261. Therefore, a first INVITE message 3 has to be sent to the remote node 2. The remote node 2 answers with a RESPONSE message 4 which afterwards will be acknowledged by an ACK message which is not depicted in Fig. 1 and 2. In both figures the time axis extends from top to bottom. Two timers, timer "A" 11 and timer "AD" 12, are depicted in both figures. These timers 11, 12 can be located in the local node 1 or in a further sub-node which is not depicted in the figures. In both figures, the first step starts with sending an INVITE message 3 from the local node 1 to the remote node 2. At the same time, timer "A" 11 and timer "AD" 12 are started. Both timers 11, 12 can be started directly by the local node 1 after the INVITE message 3 is send. "Directly" means that they should start as soon as possible after the INVITE message 3 is sent. The timers "A" 11 and "AD" 12 can be started synchronously or serially one after the other.

Fig. 1 depicts an embodiment of the invention wherein the local node 1 receives at a point in time 13 a RESPONSE message 4 from the remote node 2 before timer "A" 11 fires (or is running out or stops) at a second point in time 14.

According to the SIP standard RFC 3261, the value for timer "A" 11 is 500ms which is defined as a fixed value T1. Other timers according to this standard are also based on T1 (or a multiple of T1). If the local node 1 receives the RESPONSE message 4 before timer "A" 11 fires, timer "A" stops. The local node 1 measures the time between sending the INVITE message 3 and

receiving the RESPONSE message 4 by determining the value of a further timer "AD" 12, which was started at the same time as timer "A" 11 and which is stopped after the receipt 13 of the RESPONSE message 4. The value of timer "AD" 12 can be used to modify timer "A" 11 in a further step 5. The measurement of the response time can be performed each time an INVITE message 3 is sent from the local node 1 to the remote node 2. If the local node 1 contains more than one connection to several remote nodes 2 in different networks, each connection is linked to a timer "A" 11 and timer "AD" 12.

In Fig. 2 timer "A" 11 fires before the local node 1 receives a RESPONSE message 4. According to the standard RFC 3261, timer "A" 11 is restarted with a value which is two times higher than before. This means that timer "A" 11 fires at a point in time 15 which is 2*T1 later as the point in time of the re-start of the timer "A" 11. If the RESPONSE message 4 is still not received after timer "A" 11 fires after 2*T1, timer "A" is set to 4*T1. Each time, the timer "A" 11 fires, the INVITE message 3' is retransmitted to the remote node 2. Timer "AD" 12, which has been started after the first transmission of the INVITE message 3, will not be stopped until the RESPONSE message 4 is received 13' by the local node 1. After the RESPONSE message 4 is received at a point in time 13', the value of timer "AD" 12 is used to modify timer "A" 11 by setting the value of timer "A" 11 to the value of timer "AD". This modification 5 can be performed every time, timer "AD" fires due to a reception of a RESPONSE message 4.

In a further embodiment, timer "AD" 12 can also be started when a CANCEL message for terminating the connection between the local node 1 and the remote node 2 is sent from the local node 1 to the remote node 2. Timer "AD" stops after an ACK message is received by the local node 1.. The processing of a received INVITE message 3 or a CANCEL message at the remote node 2 is nearly the same so both messages can be used to calculate, by running the timer "AD" 12, the time between sending a message and receiving a response message.

In one embodiment of the invention, timer "A" 11 is modified each time a measurement is performed. In another embodiment an average value is calculated based on several measured values. The duration of timer "A" 11 is set as an average of several timers "AD" 12 after a specific number of measurements. It is possible to modify the average of several timers "AD" 12 by calculating the average of e.g. the last five or ten measurements. The number of measurements for a calculation of an average value can be defined e.g. by an operator. If there is a high variability in the connection speed between the local node 1 and the remote node 2, the number of measured values on which the average value is based might be decreased to modify the timer "A" 11 more flexible. If the connection speed between the two nodes is stable over a long time period, the number of average values might be increased.

The message flow between local node 1 and remote node 2 might increases which can be caused by a long response time of the remote node 2 (longer than the value of timer "A" 11). If the duration of timer "A" 11 is set to the duration of timer "AD" 12 or an average value of timer "AD" 12, the number of messages and re-transmission attempts will decrease. Further the setup-time period of a communication can be reduced because the internal capacity of the local node 1 is lower than before.

Fig. 3 depicts a further embodiment of a local node 1 which can also be named as an originating node 1. The originating node 1 comprises a sending unit 101, adapted to send a message to a remote or terminating node 2. The originating node 1 further comprises a receiving unit 102, adapted to receive a response message from the terminating node 2. A retransmission timer "A" 11 which is started when the message is sent from the sending unit 101 of the originating node 1 to the terminating node 2 is located in the originating node 1. The retransmission timer "A" 11 will re-start and trigger the sending unit 101 to re-send the message if the retransmission timer "A" 11 expires before the response message is received by the receiving unit 102. The originating node 1 comprises a first processing unit 103, adapted to conduct a measurement of the time between the sending of the message by the sending unit 101 and the

receipt of the response message by the receiving unit 102 to determine a time value. This can be performed by starting a timer "AD" 12 in the originating node 1 which stops when the response message is received by the receiving unit 102. A second processing unit 104 is located in the originating node 1, adapted to modify the retransmission timer "A" 11 in accordance with the measured time value. The first and the second processing unit 103, 104 can be arranged in one processing unit. Further the originating node 1 comprises a storing unit 105, adapted to store the measured time value from timer "AD" 12. The second processing unit 104 can calculate an average of stored measured time periods to modify timer "A" 11 by replacing the current value of timer "A" 11 by the calculated average value.

Claims

1. A method of modifying a retransmission timer (11) in an originating node (1) of a communication network, wherein the retransmission timer (11) is started when a message (3, 3') is sent from the originating node (1) to a terminating node (2) and wherein an expiry of the retransmission timer (11) before a response message (4) is received by the originating node (1), triggers a re-sending of the message (3') and a restart of the retransmission timer (11), the method comprises the steps of:
   - conducting a measurement of the time between the sending of the message (3) and the receipt of the response message (4) by the originating node (1) to determine a time value;
   - modifying the retransmission timer (11) in accordance with the measured time value.

2. Method according to claim 1, wherein the step of conducting a measurement is performed by starting a modification timer (12) when the message (3) is sent and stopping the modification timer (12) when the response message (4) is received.

3. Method according to any of the claims 1 or 2, wherein the measured time value is stored in the originating node (1).

4. Method according to claim 3, wherein the step of modifying the retransmission timer (11) is performed by setting the retransmission timer (11) in accordance with a calculated average of a predefined amount of stored measured time values.

5. Method according to any of the claims 1 to 4, wherein the modification of the retransmission timer (11) is performed after each receipt of a response message (4) in the originating node (1).

6. Method according to any of the claims 1 to 5, wherein the modification of the retransmission timer (11) is performed after a predefined amount of

measurements.

7. Method according to any of the claims 1 to 6, wherein the retransmission timer (11) is allocated to a receiving node (2).

8. Method according to any of the claims 1 to 7, wherein the communication network is a mobile communication network.

9. Method according to any of the claims 1 to 8, wherein the message (3) is an INVITE message according to the Session Initiating Protocol, SIP.

10. An originating node (1) of a communication network, comprising:
    - a sending unit (101), adapted to send a message (3, 3') to a terminating node (2);
    - a receiving unit (102), adapted to receive a response message (4) from the terminating node (2);
    - a retransmission timer (11) which is started when the message (3) is sent from the originating node (1) to the terminating node (2) and which re-starts and triggers the sending unit (101) to re-send the message (3') if the retransmission timer (11) expires before the response message (4) is received;
    - a first processing unit (103), adapted to conduct a measurement of the time between the sending of the message (3) by the sending unit (101) and the receipt of the response message (4) by the receiving unit (102) to determine a time value;
    - a second processing unit (104), adapted to modify the retransmission timer (11) in accordance with the measured time value.

11. An originating node (1) according to claim 10, wherein the originating node (1) comprises a modification timer (12) which is started when the message is sent by the sending unit (101) and stopped when the response message (4) is received by the receiving unit (102).

12. An originating node (1) according to any of the claims 10 or 11, wherein originating node (1) comprises a storing unit (105), adapted to store the measured time value.

13. An originating node (1) according to any of the claims 10 to 12, adapted to perform all the steps of the method of at least one of the claims 1 to 9.

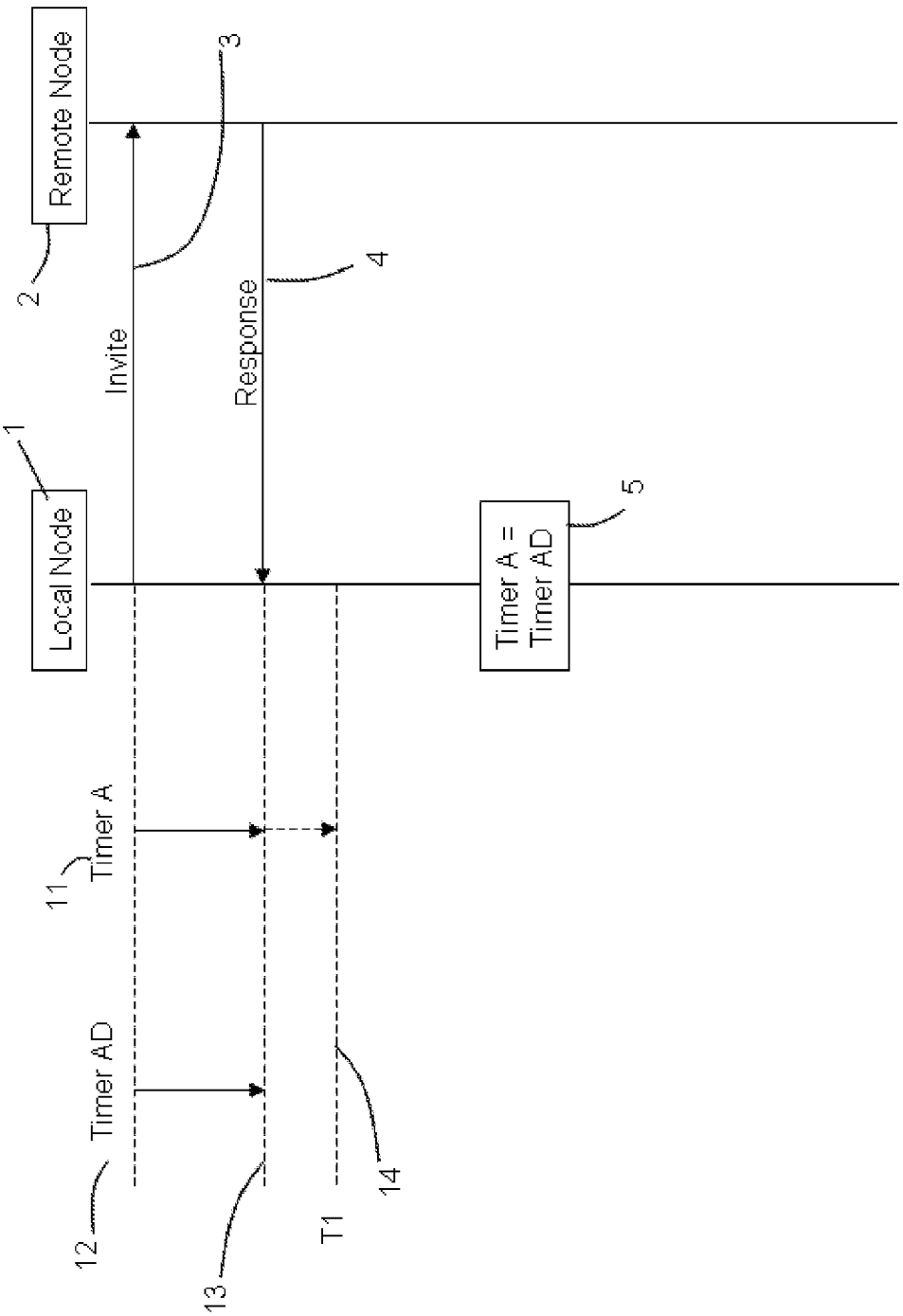
Remote Node
2
3
Invite
Response
4
1
Local Node
5
Timer A =
Timer AD
11
Timer A
Timer AD
12
13
T1
14

Fig. 1

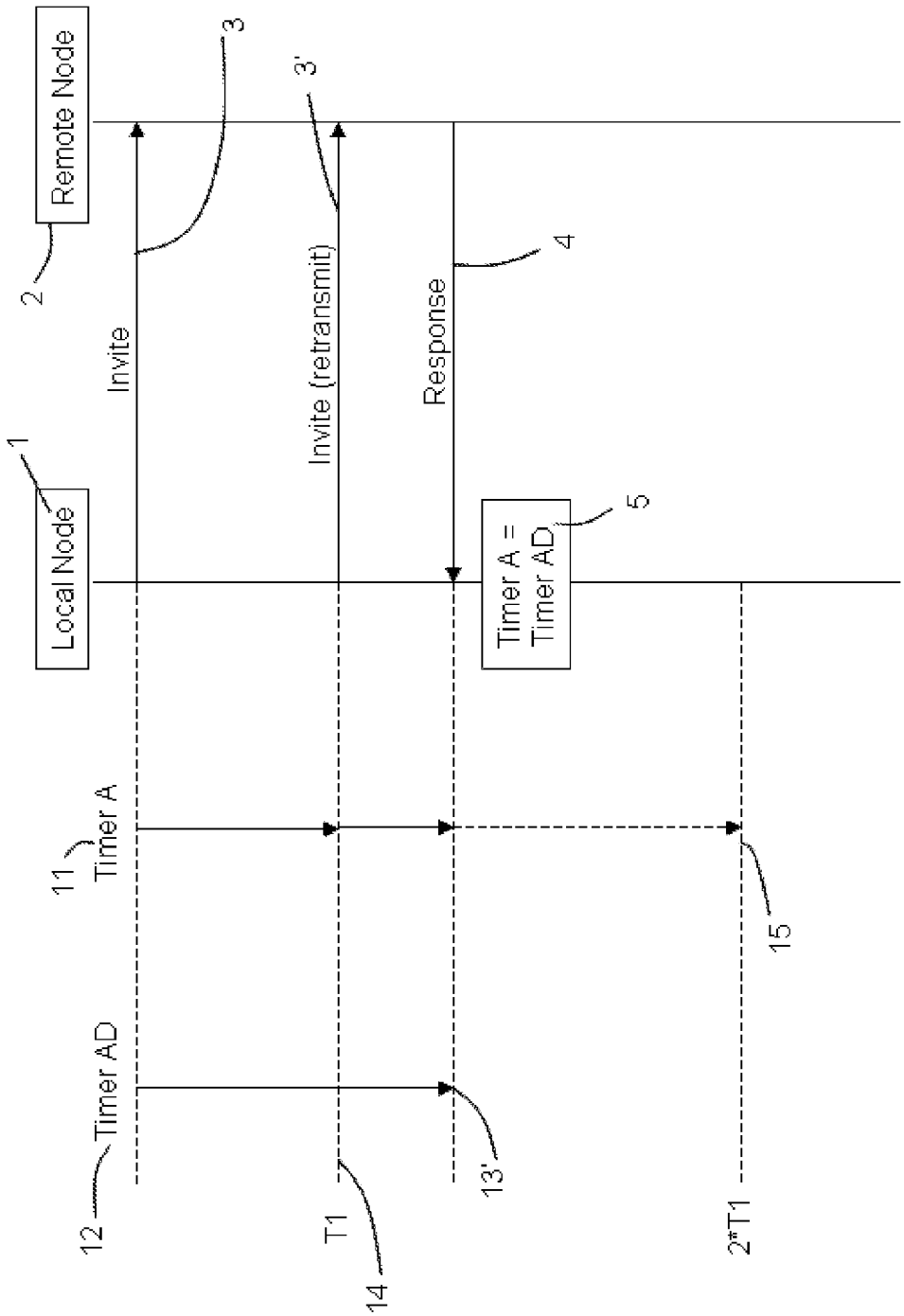
Remote Node
2
3
3'
Invite
Invite (retransmit)
Response
4
1
Local Node
Timer A = Timer AD
5
11
Timer A
Timer AD
12
T1
14
13'
15
2*T1

Fig. 2

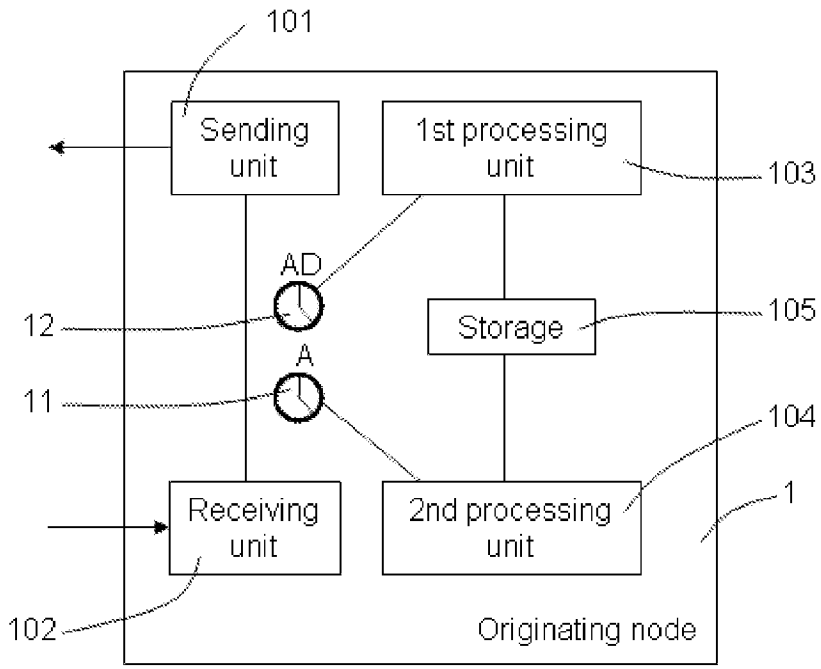
101
Sending unit
1st processing unit
103
AD
12
Storage
105
A
11
104
Receiving unit
2nd processing unit
1
102
Originating node

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/056774

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L29/06
ADD.

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)
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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 405 337 B1 (GROHN OSSI I [US] ET AL) 11 June 2002 (2002-06-11) abstract column 1, line 16 - column 3, line 2 column 6, line 24 - column 7, line 26 column 3, line 65 - column 6, line 13 figures 1-6 claims 1-7 -----	1-13
X	US 2005/169180 A1 (LUDWIG REINER [DE]) 4 August 2005 (2005-08-04) abstract paragraph [0003] - paragraph [0013] paragraph [0015] - paragraph [0018] paragraph [0025] - paragraph [0088] figure 1 claims 1, 2-4, 11, 17, 34-39, 43, 44, 45 ----- -/--	1-13

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 March 2012	04/04/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Konrad, Markus

1

Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 00/51296 A1 (ERICSSON TELEFON AB L M [SE]) 31 August 2000 (2000-08-31) the whole document	1-13
A	US 6 076 114 A (WESLEY AJAMU A [US]) 13 June 2000 (2000-06-13) the whole document	1-13
A	EP 1 638 275 A2 (WECOMM LTD [GB]) 22 March 2006 (2006-03-22) the whole document	1-13
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Information on patent family members

International application No
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