US 20070058549A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2007/0058549 A1**

Speks et al. (43) **Pub. Date: Mar. 15, 2007**

(54) **METHOD AND SIGNALING NODE FOR REDUCING SIGNALING DURING CALL SETUP**

(76) Inventors: **Oliver Speks**, Eschweiler (DE); **Henning Brandes**, Aachen (DE)

Correspondence Address:
ERICSSON INC.
6300 LEGACY DRIVE
M/S EVR 1-C-11
PLANO, TX 75024 (US)

(21) Appl. No.: **11/227,772**

(22) Filed: **Sep. 14, 2005**

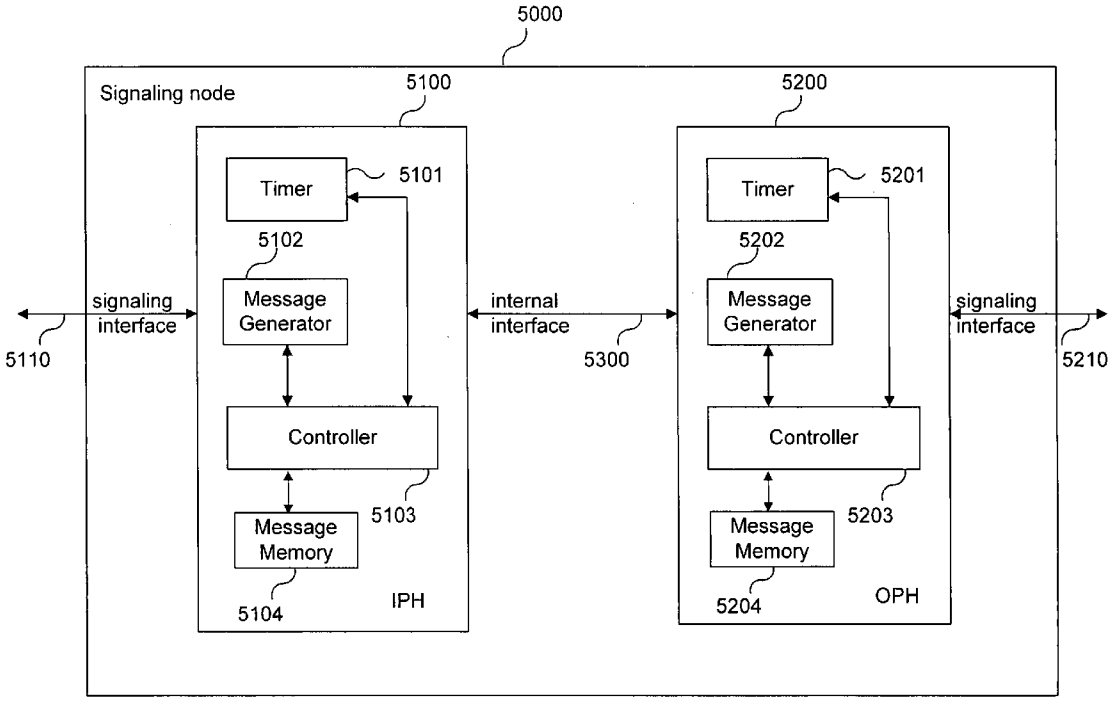
Publication Classification

(51) **Int. Cl.**
H04L 12/26 (2006.01)
H04B 1/44 (2006.01)

(52) **U.S. Cl.** **370/236**; 370/282

(57) **ABSTRACT**

A method and a signaling node for reducing signaling during call setup in a communication network. The signaling node is an intermediate node on a signaling path between an origination node and a destination node. When a call setup delay is experienced, the intermediate node receives a first excessive delay indication signal from the destination node and forwards the signal to the origination node. A timer for supervising excessive delay indication signals is then started in the intermediate node. Prior to expiration of the timer, additional excessive delay indication signals received from the destination node are not forwarded. After expiration of the timer, the intermediate node sends a single excessive delay indication signal to the origination node.



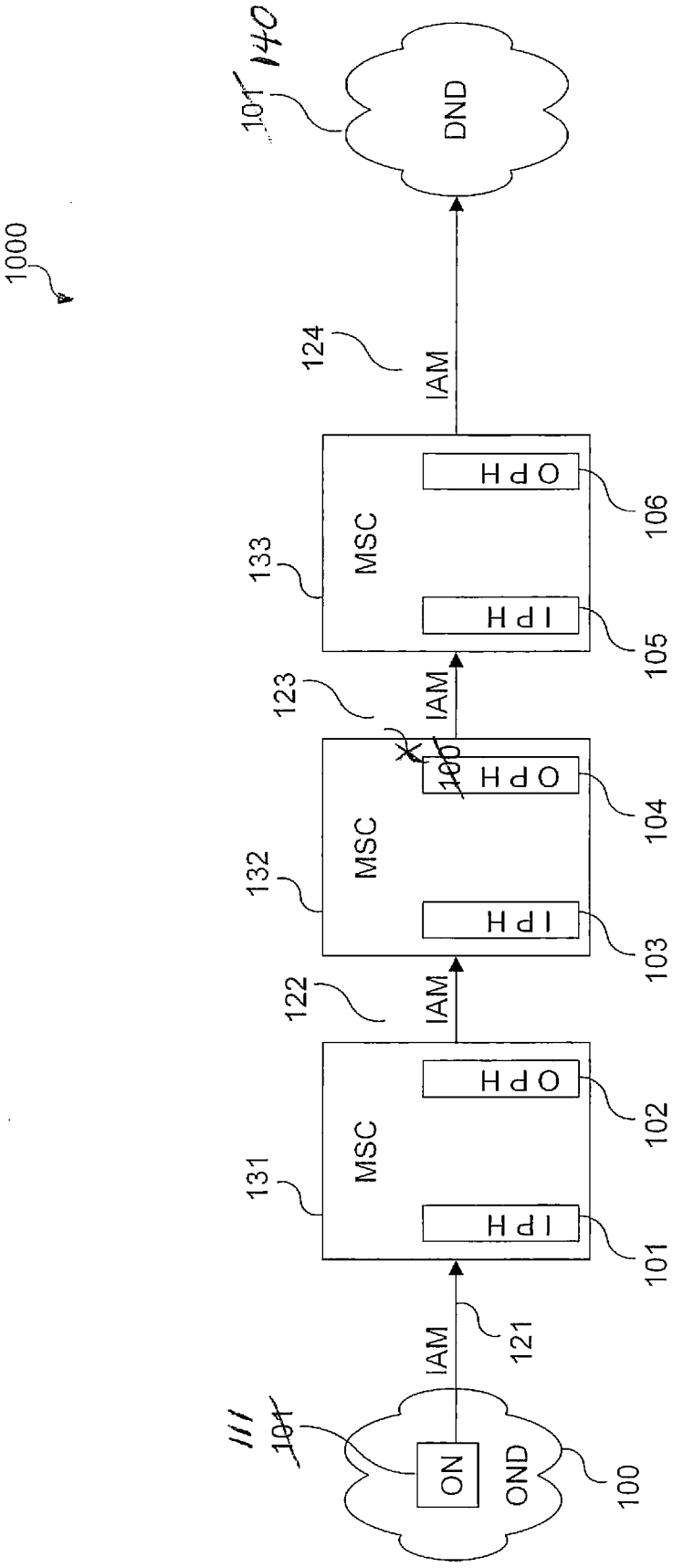


Fig. 1
(Prior Art)

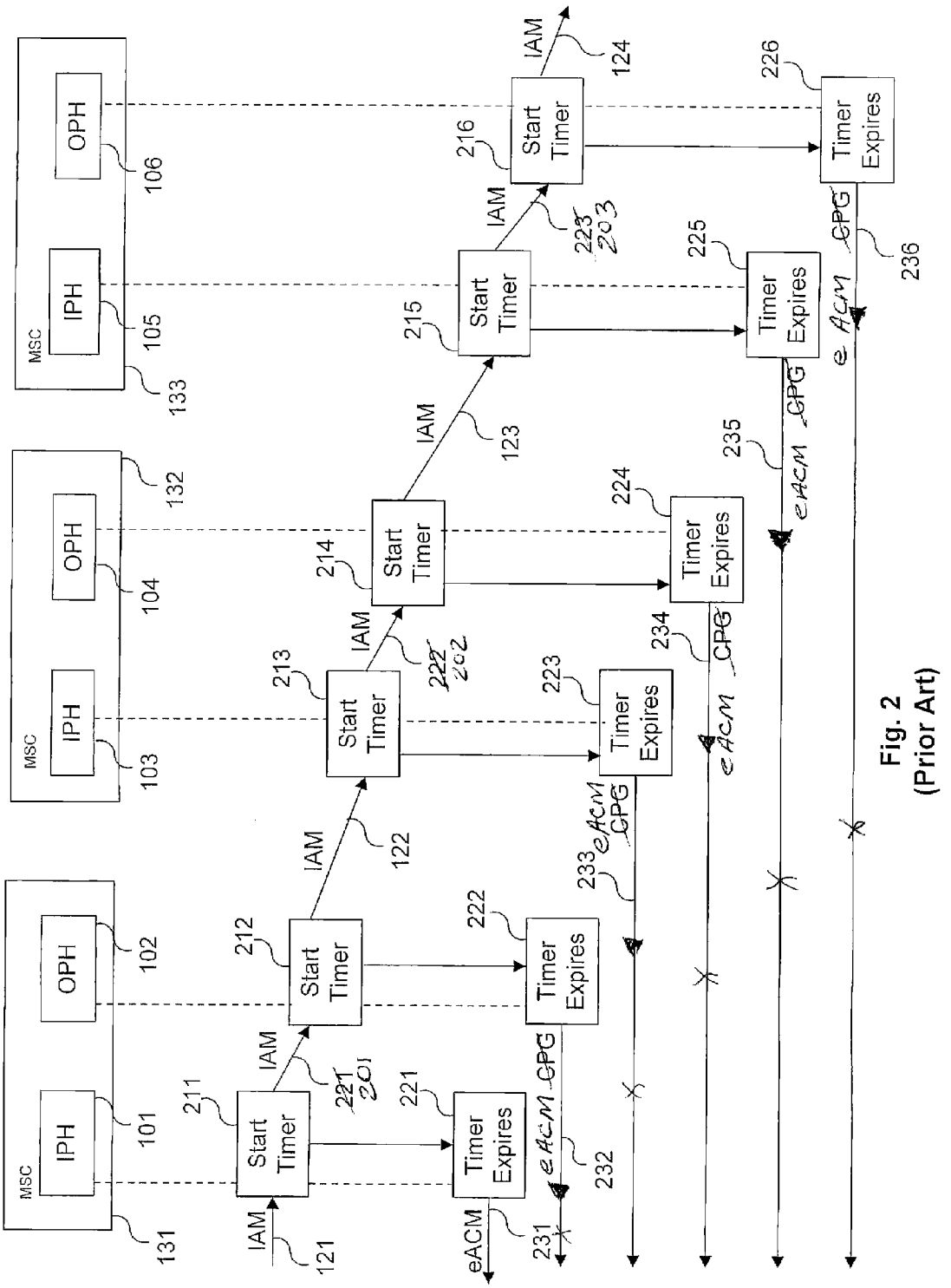


Fig. 2
(Prior Art)

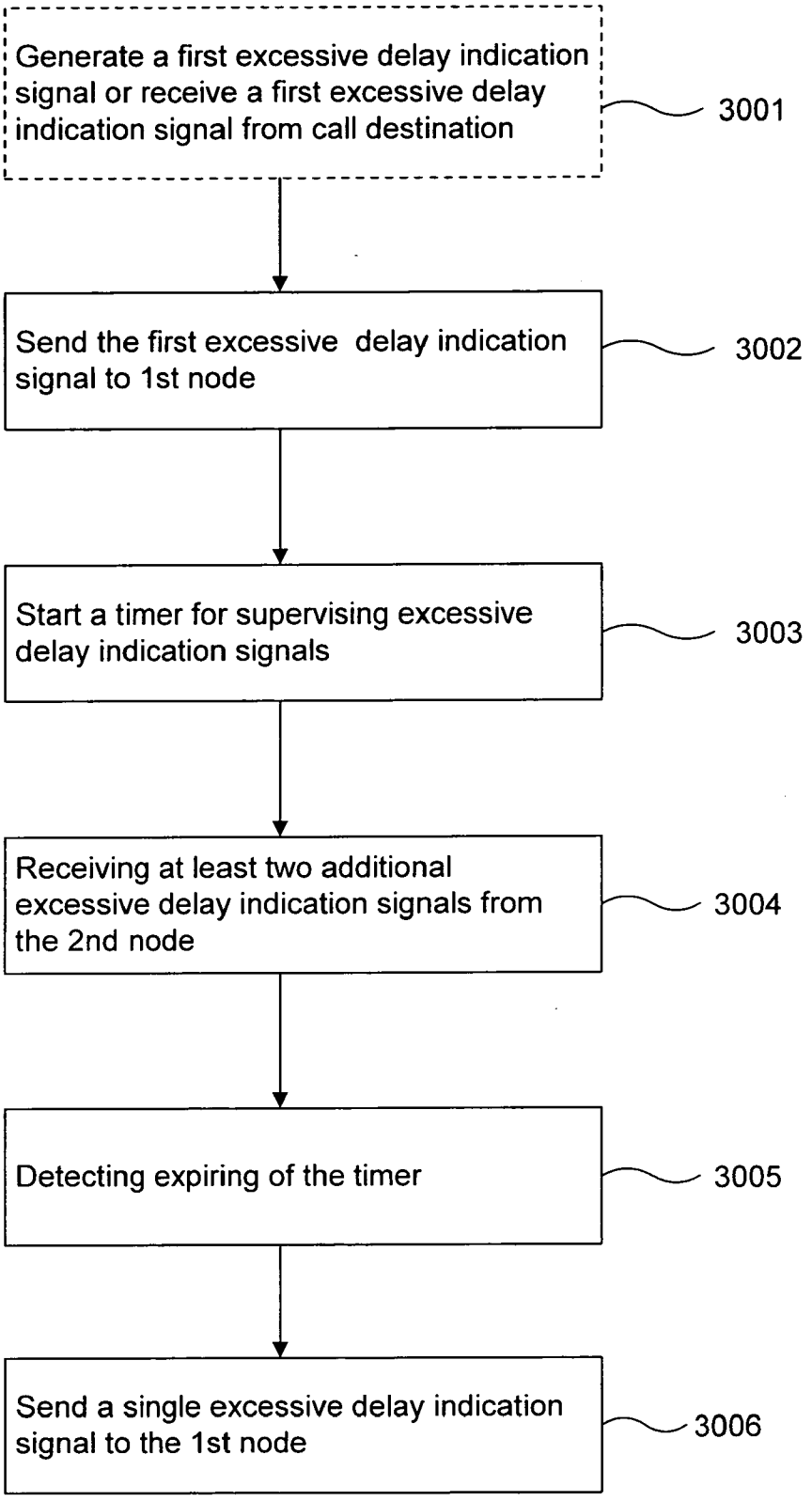

Generate a first excessive delay indication signal or receive a first excessive delay indication signal from call destination
3001
Send the first excessive delay indication signal to 1st node
3002
Start a timer for supervising excessive delay indication signals
3003
Receiving at least two additional excessive delay indication signals from the 2nd node
3004
Detecting expiring of the timer
3005
Send a single excessive delay indication signal to the 1st node
3006

Fig. 3

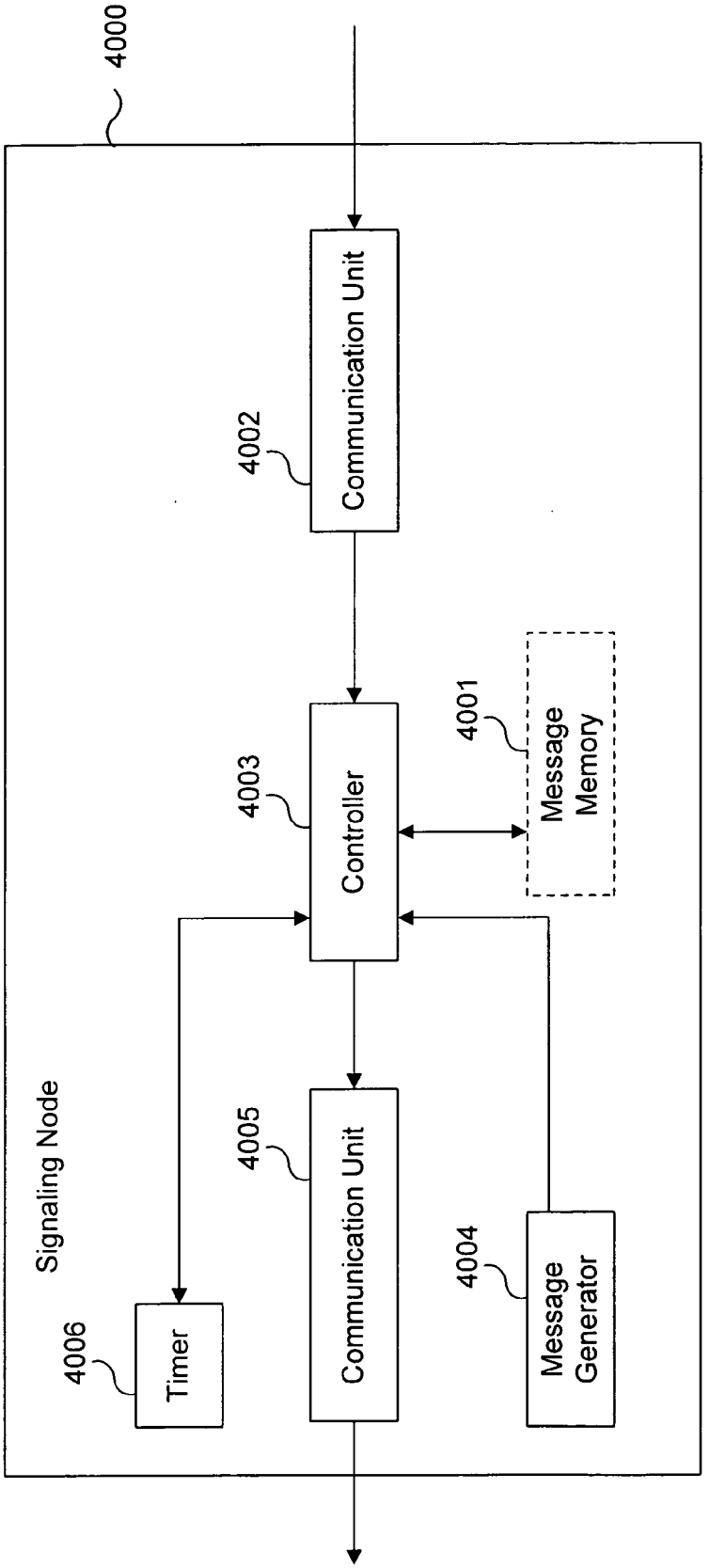

4000
Signaling Node
Communication Unit
4002
Controller
4003
Message Memory
4001
Communication Unit
4005
Message Generator
4004
Timer
4006

Fig. 4

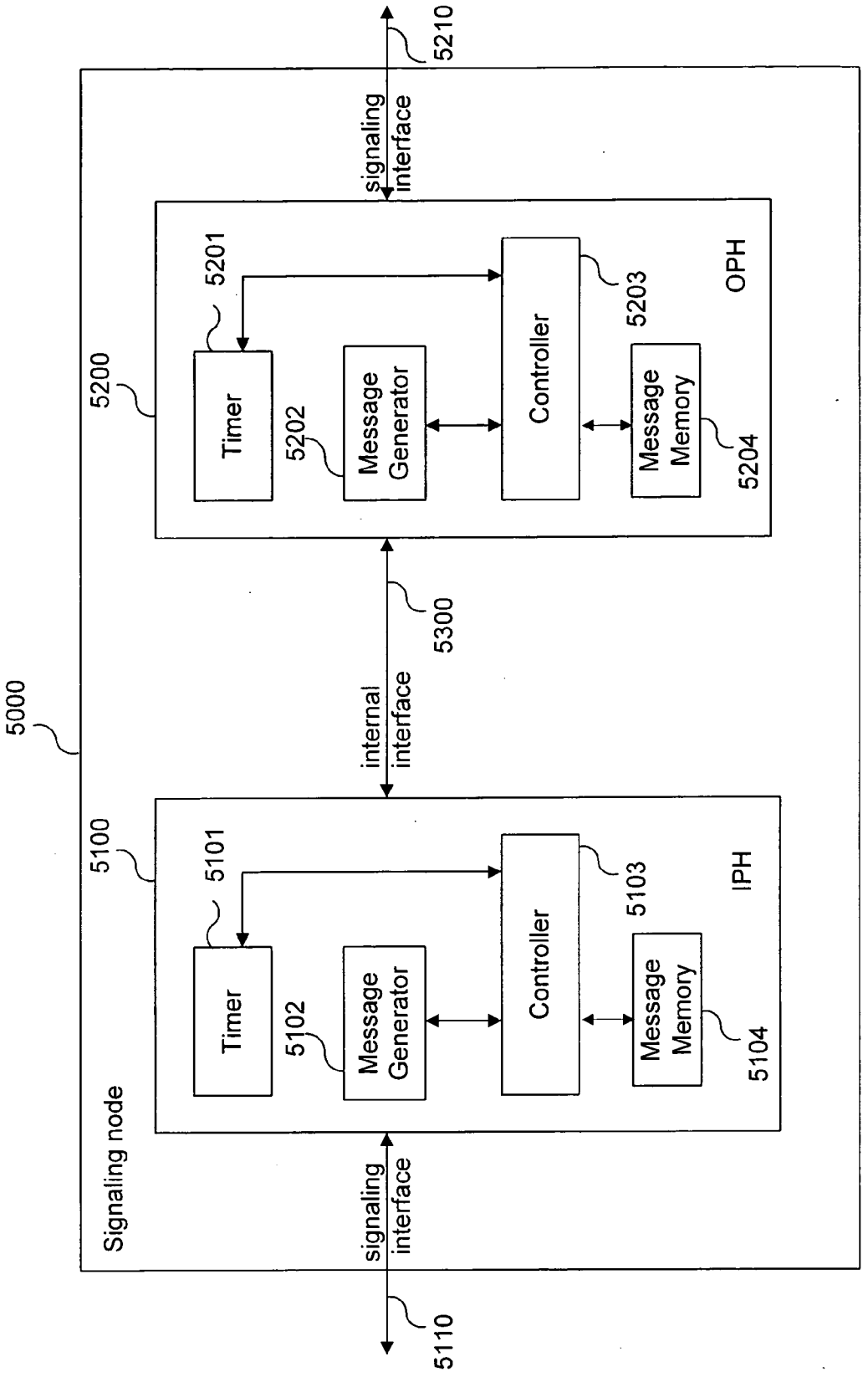

5000
Signaling node
5100
IPH
5101
Timer
5102
Message Generator
Controller
5103
Message Memory
5104
5200
OPH
5201
Timer
5202
Message Generator
Controller
5203
Message Memory
5204
internal interface
5300
signaling interface
5110
signaling interface
5210

Fig. 5

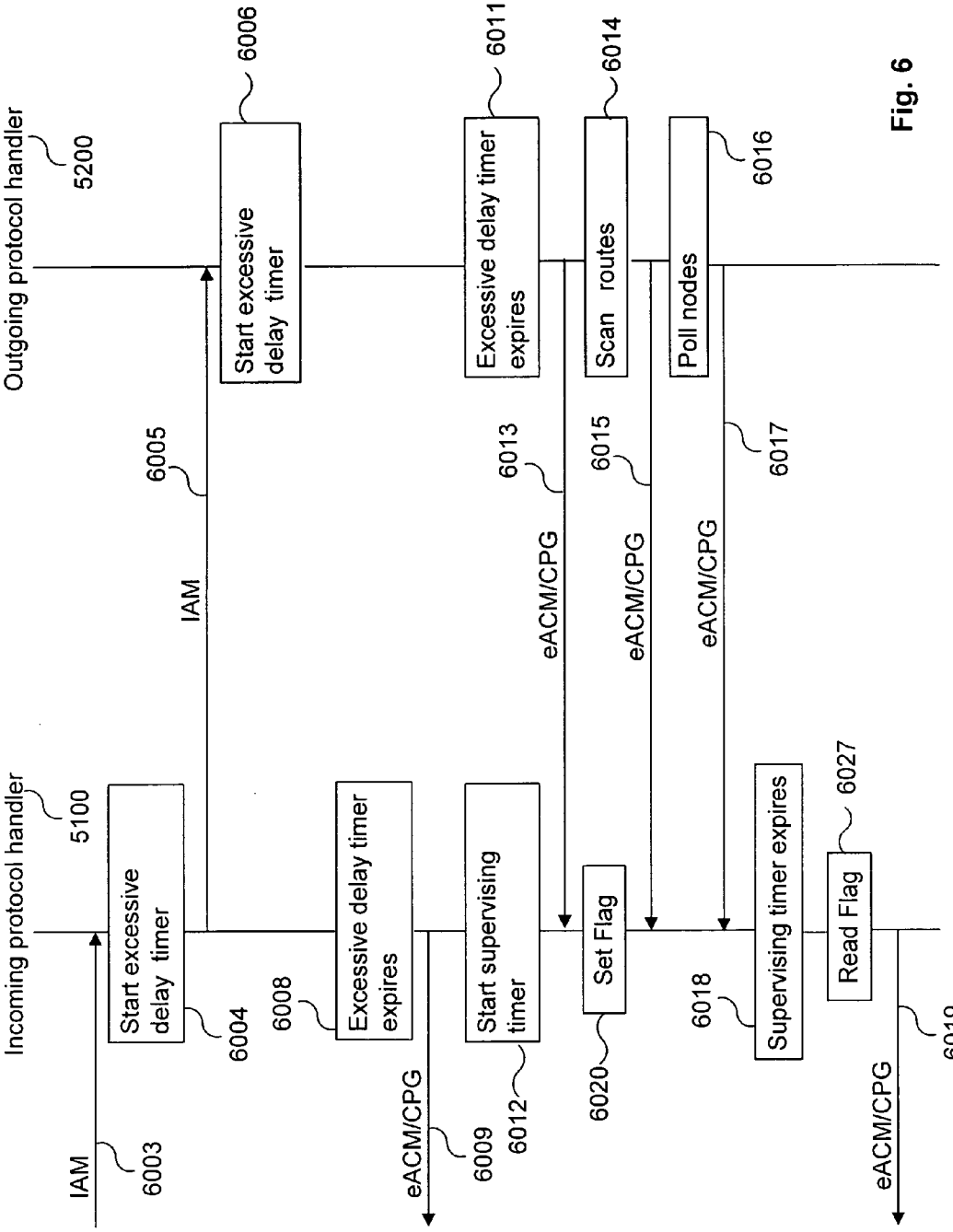

Incoming protocol handler
5100
Outgoing protocol handler
5200
IAM
6003
Start excessive delay timer
6004
IAM
6005
Start excessive delay timer
6006
Excessive delay timer expires
6008
eACM/CPG
6009
Start supervising timer
6012
eACM/CPG
6013
Excessive delay timer expires
6011
Set Flag
6020
eACM/CPG
6015
Scan routes
6014
Supervising timer expires
6018
eACM/CPG
6017
Poll nodes
6016
Read Flag
6027
eACM/CPG
6019

Fig. 6

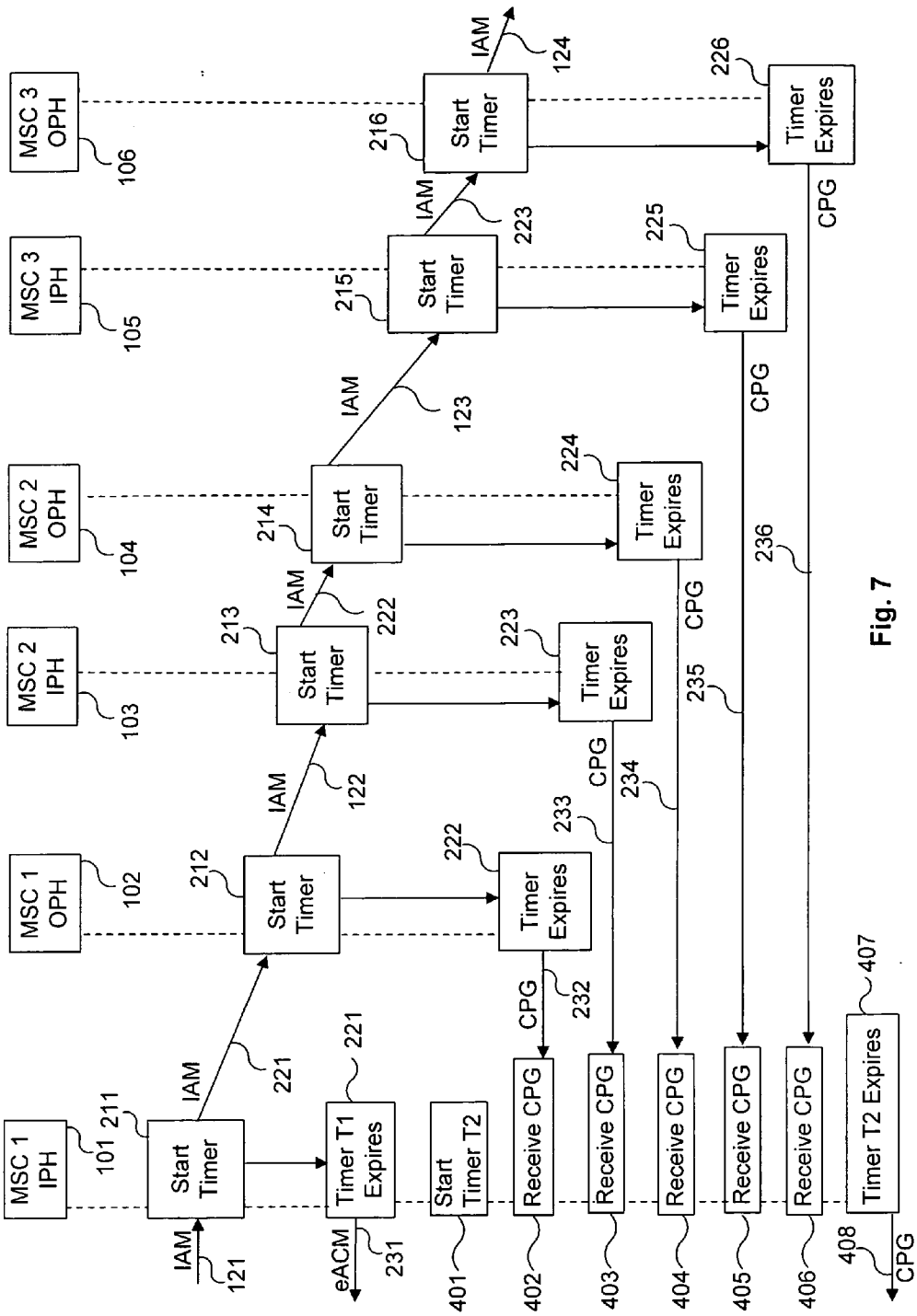

MSC 1 IPH
101
211
Start Timer
IAM
121
IAM
221
Timer T1 Expires
eACM
231
MSC 1 OPH
102
212
Start Timer
IAM
122
Start Timer T2
401
MSC 2 IPH
103
213
Start Timer
IAM
222
Timer Expires
CPG
232
Receive CPG
402
MSC 2 OPH
104
214
Start Timer
IAM
123
Timer Expires
CPG
233
Receive CPG
403
MSC 3 IPH
105
215
Start Timer
IAM
223
Timer Expires
CPG
234
Receive CPG
404
MSC 3 OPH
106
216
Start Timer
IAM
124
Timer Expires
CPG
235
Receive CPG
405
224
Timer Expires
CPG
236
Receive CPG
406
225
Timer Expires
Timer T2 Expires
407
408
CPG
226

Fig. 7

METHOD AND SIGNALING NODE FOR REDUCING SIGNALING DURING CALL SETUP

FIELD OF THE INVENTION

[0001] This invention relates to a method and a signaling node for reducing a signaling load in a mobile communications network during call setup. In particular the invention relates to a method and a signaling node for reducing the number of excessive delay signals during call setup.

BACKGROUND OF THE INVENTION

[0002] To establish a call connection in a mobile communication network, a call setup procedure must be performed to determine the transmission route for the call connection and to reserve network resources for the call connection.

[0003] A call setup can be delayed for various reasons. A signaling route can be congested causing a signaling node to perform a scanning or a polling attempt in the communication network; network resources can be occupied by ongoing call connections; or an establishment of a radio link can be delayed.

[0004] To avoid assigning resources to a call that is never completed, the duration of the call setup is supervised. To that end call setup supervision timers are provided in mobile communication networks. When a call originating node initiates a call setup procedure, and a call setup message is transmitted towards a chain of nodes that transmit the call setup message, a supervision timer is started in the call originating node and in each of the other nodes that transmit the call setup message. When a response message is not received within a predefined expiration period, the call is released. When a response message is received within the expiration time, the supervision timer is reset.

[0005] More than one supervision timer can be provided in a node. For example, in the Bearer Independent Call Control (BICC) protocol, network timers T7 and T9 may be provided. The timer T7 is started in the call originating node and in each of the chain of nodes transmitting the call setup message during the call setup when an Initial Address Message (IAM) is sent towards a call terminating node. The timer T7 is reset when an Address Complete Message (ACM) is received, indicating that a network address of the terminating node has successfully been determined. When no ACM is received during the predefined expiration time of the T7 timer, the call is released. A second timer T9 is started when the ACM message is received in the call originating node, and is reset when an Answer (ANM) message is received. When no ANM message is received within the predetermined expiration time of the T9 timer, the call is released.

[0006] To prevent releasing a call when a specific reason for the prolongation of a call setup has been determined, excessive delay indication signals have been introduced. Reasons for a prolongation of a call setup may be that the network is congested. An excessive delay timer may be provided that initiates sending of an excessive delay indication signal when the timer expires.

[0007] A first excessive delay indication signal may be embodied as an early Address Complete Message (eACM), that is formatted as an ACM message without actually indicating that the network address of the terminating node has successfully been determined. Like an ACM message, an eACM message stops the T7 timer and starts the T9 timer. Further excessive delay indication signals may be embodied as Call Progress (CPG) messages that restart the T9 timer.

[0008] Reference is now made to FIG. **1**, which illustrates a mobile network **1000** and IAM messages sent during call setup in the mobile communication network. The mobile communication network **1000** comprises an originating node (ON) **101** within a originating network domain (OND) **100** and a destination network domain (DND) **140**, that are interconnected by a set of Mobile Switching Centers (MSCs) **131**, **132**, and **133** forming a signaling path. Each of the MSCs comprises an incoming protocol handler and an outgoing protocol handler. In particular MSC **131** comprises incoming protocol handler **101** and an outgoing protocol handler **102**; MSC **132** comprises incoming protocol handler **103** and an outgoing protocol handler **104**; and MSC **133** comprises incoming protocol handler **105** and an outgoing protocol handler **106**.

[0009] When a call is set up, the originating node **101** sends an IAM message **121** towards the destination network domain **140** and starts a supervising timer for supervising the duration of the call setup duration. The call setup is further continued by forwarding IAM messages **122**, **123**, and **124** towards the destination network domain **140**.

[0010] Reference is now made to FIG. **2**, which is a signaling sequence diagram depicting message within the mobile network of FIG. **1**. Equally labeled elements refer to the respective elements in FIG. **1**. In particular, FIG. **2** depicts the transmission and processing of IAM messages within the signaling path of FIG. **1** as well as the generation and conventional handling of excessive delay indication signals.

[0011] Upon reception of the IAM **121** in the incoming protocol handler **101** of MSC **131**, an excessive delay timer for initiating the generation of an excessive delay indication signal is started, and IAM message **221** is forwarded to the outgoing protocol handler **102** within MSC **131**. The outgoing protocol handler, in turn, starts a further timer for generating an excessive delay indication signal in step **212**, and forwards IAM message **122** to MSC **132**, which receives the IAM message **122** on its incoming protocol handler **103**.

[0012] In MSC **132**, a corresponding procedure is performed (i.e., the incoming protocol handler **103** starts its timer for initiating the generation of excessive delay indication signals in step **213** and forwards IAM **222** to its corresponding outgoing protocol handler). The outgoing protocol handler responds by forwarding IAM message **223** towards MSC **133** and starts its associated excessive delay timer in step **214**.

[0013] Correspondingly, MSC **133**, receives IAM **123** on its incoming protocol handler **105**, starts the associated excessive delay timer in step **215**, and forwards IAM **223** internally to outgoing protocol handler **106**. The outgoing protocol handler, in turn, forwards IAM **124** and starts its excessive delay timer at step **216**.

[0014] Accordingly in each of the incoming and outgoing protocol handlers of MSCs **131**, **132**, and **133**, excessive delay timers are started.

[0015] When call setup is not completed within the predetermined expiration time of one of the excessive delay

timers, an excessive delay indication signal is generated within the corresponding protocol handlers. The excessive delay indication signals restart a timer in the originating node **101** and in the other transmitting nodes **132** and **133** that supervise the duration of the call setup

[**0016**] As depicted in FIG. **2**, when the timer for incoming protocol handler **101** within MSC **131** expires, an eACM message **231** indicating excessive delay is generated and transmitted towards the call-originating end of the signaling path of FIG. **1**. Accordingly CPG messages **232-236**, each indicating an excessive delay are generated in the protocol handlers **102-106**, respectively, and are transmitted towards the call originating end of the signaling path.

[**0017**] Thus depending on the call setup conditions, a large amount of early ACM/CPG messages indicating an excessive delay can be generated and transmitted in the mobile network **1000**. Sending a plurality of messages with excessive delay indication not only unnecessarily consumes signaling capacity, it can also lead to call release because the limit for the number of restarts of the timer T**9** is exceeded.

[**0018**] Accordingly there is a need in the state of the art to limit the signaling load during a delayed call setup in a mobile communication network.

SUMMARY OF THE INVENTION

[**0019**] The present invention provides a method of reducing signaling during call setup in a communication network having an intermediate node on a signaling path between a first node and a second node. The invented method is performed in the intermediate node and includes sending a first excessive delay indication signal to the first node; starting a timer for supervising excessive delay indication signals; receiving at least two additional excessive delay indication signals from the second node prior to expiration of the timer; and after expiration of the timer, sending a single excessive delay indication signal to the first node.

[**0020**] According to a further aspect, the invention is directed to a method of reducing signaling during call setup in a communication network having an intermediate node on a signaling path between a first node and a second node. This invented method is performed in the intermediate node and includes receiving a first excessive delay indication signal from the second node; forwarding the first excessive delay indication signal to the first node; receiving at least one additional excessive delay indication signal from the second node; and discarding the at least one additional excessive delay indication signal. Thus, signaling is reduced in the network by reducing the number of excessive delay indication signals sent from the intermediate node to the first node.

[**0021**] In yet another aspect, the present invention is directed to a signaling node for reducing signaling during call setup in a communication network. The signaling node is an intermediate node on a signaling path between a first node and a second node. The invented signaling node includes means for sending a first excessive delay indication signal to the first node; a timer for supervising excessive delay indication signals; means for starting the timer; means for receiving at least two additional excessive delay indication signals from the second node prior to expiration of the timer; and means for sending a single excessive delay indication signal to the first node after expiration of the timer.

[**0022**] According to a further aspect, the signaling node includes means for receiving a first excessive delay indication signal from the second node; means for forwarding the first excessive delay indication signal to the first node; means for receiving at least one additional excessive delay indication signal from the second node; and means for discarding the at least one additional excessive delay indication signal. Thus signaling is reduced in the network by reducing the number of excessive delay indication signals sent from the signaling node to the first node.

[**0023**] In another aspect, the present invention is directed to a communication network with reduced signaling during call setup. The inventive communication network includes an intermediate node on a signaling path between a first node and a second node. The intermediate node includes means for sending a first excessive delay indication signal to the first node; a timer for supervising excessive delay indication signals; means for starting the timer; means for receiving at least two additional excessive delay indication signals from the second node prior to expiration of the timer; and means for sending a single excessive delay indication signal to the first node after expiration of the timer.

[**0024**] In a further aspect, the communication network includes an intermediate node comprising means for receiving a first excessive delay indication signal from the second node; means for forwarding the first excessive delay indication signal to the first node; means for receiving at least one additional excessive delay indication signal from the second node; and means for discarding the at least one additional excessive delay indication signal. Thus, signaling is reduced in the network by reducing the number of excessive delay indication signals sent from the signaling node to the first node.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[**0025**] FIG. **1** is a block diagram illustrating a mobile communication network;

[**0026**] FIG. **2** (Prior Art) is a signal sequence diagram for illustrating the generation and conventional handling of excessive delay indication signals in the network of FIG. **1**;

[**0027**] FIG. **3** is a flowchart diagram depicting an embodiment of a method in accordance with the teachings of the present invention;

[**0028**] FIG. **4** is a block diagram depicting an embodiment of a signaling node in accordance with the teachings of the present invention;

[**0029**] FIG. **5** is a block diagram depicting a further embodiment of a signaling node in accordance with the teachings of the present invention;

[**0030**] FIG. **6** is a signal sequence diagram in accordance with the teachings of the present invention; and

[**0031**] FIG. **7** is a signal sequence diagram illustrating the handling of excessive delay indication signals in the network of FIG. **1** in accordance with the teaching of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS

[**0032**] FIG. **3** depicts a sequence of processing steps in accordance with the teachings of the present invention. The

depicted sequence may be performed in any of the MSCs of FIG. **1**, or in any other intermediate node on a signaling path between a call originating node and a call terminating node. The signaling path can be regarded from the view of the intermediate node as having a segment towards the call origin and a segment towards the call destination.

[**0033**] The depicted sequence starts with message sending step **3002**, during which a first excessive delay indication signal is sent towards the call origin. The excessive delay indication signal may have been previously received from a node on the call destination segment of the signaling path or been previously generated within the intermediate node in step **3001**.

[**0034**] In response to sending the excessive delay indication signal, a timer for supervising excessive delay indication signals is started in step **3003**. Prior to the expiration of the timer, at least two additional excessive delay indication signals are received from the call destination segment of the signaling path in step **3004**. Expiration of the timer is detected in step **3005**, and, at step **3006**, a single excessive delay indication signal is transmitted towards the call origin.

[**0035**] Reference is now made to FIG. **4** illustrating a block diagram of a signaling node **4000** embodied to perform the method to reduce the signaling load of FIG. **3**. When connected within a communication network, the signaling node **4000** may be an intermediate node on a signaling path between a call originating domain and call destination domain of the communication network. To connect the signaling node **4000** within such a communication network, communication units **4005**, **4002** are provided. Communication unit **4005** may connect the signaling node **4000** towards the call originating segment of the signaling path, while communication unit **4002** may connect the signaling node **4000** towards the call destination segment of the signaling path. The communication unit **4005** may be embodied as an incoming protocol handler of the BICC protocol (i.e., as a protocol handler for handling incoming BICC call setup messages), and communication unit **4002** may be embodied as an outgoing protocol handler outgoing BICC call setup messages.

[**0036**] With regard to the handling of excessive delay indication signals, communication unit **4002** receives an excessive delay indication signal from the call destination domain, and communication unit **4005** sends an excessive delay indication signal towards the call originating domain. The signaling node **4000** further comprises timer **4006** for supervising excessive delay indication signals, message generator **4004**, and optionally, message memory **4001**. Controller **4003** controls and coordinates timer **4006**, communication units **4005** and **4002**, message generator **4004**, and message memory **4001**.

[**0037**] At operation of the signaling node **4000**, controller **4003** initiates sending a first excessive delay indication signal by the communication unit **4005**. The excessive delay indication signal may be generated previously within the message generator, or, alternatively be previously received in the communication unit **4002** and stored in the message memory **4001**. The controller is adapted to start the timer **4006** when the first excessive delay indication signal is sent. Furthermore, the controller is adapted to monitor the timer and to refrain from sending excessive delay indication signals until timer **4006** expires. To that end, the controller **4003** is adapted to handle further excessive delay indication signals received from the communication unit **4002** by ignoring at least two of them, or by storing one further excessive delay indication signal in the message memory **4001** and ignoring further excessive delay indication signals. Alternatively or in addition, the reception of the excessive delay indication signal may be memorized by setting a flag indicating the reception.

[**0038**] When controller **4003** detects the expiration of the timer **4006**, and previous excessive delay indication signals have been received, the controller is adapted to send a single excessive delay indication signal by the communication unit **4005** towards the call origin. To this end, the communication unit may either instruct the message generator **4004** to generate an excessive delay indication signal or fetch a previously stored excessive delay indication signal from the message memory **4001**.

[**0039**] Alternatively, the controller **4003** may be adapted to enter a mode of operation in which further excessive delay indication signals are ignored as long as timer **4006** has not expired. When the timer **4006** expires, controller **4003** switches to a mode of operation during which excessive delay messages are not ignored. Thus, a next excessive delay indication signal received from the communication unit **4002** is forwarded to the communication unit **4005** to be sent towards the call origin. Upon sending the next excessive delay indication signal, the timer **4006** is restarted, and the controller **4003** proceeds with handling excessive delay indication signals as above described.

[**0040**] Reference is now made to FIG. **5** illustrating a block diagram of a further signaling node **5000** embodied to perform the method of FIG. **3**. The signaling node **5000** comprises an incoming protocol handler **5100** and an outgoing protocol handler **5200**, for connecting the signaling node **5000** within a signaling route from a call origin to a call destination. Thus, when connected within a communication network, incoming protocol handler **5100** receives call setup signals from a call origin, and outgoing protocol handler **5200** transmits call setup signals towards the call destination.

[**0041**] Incoming protocol handler **5100** is connectable towards a call origin via signaling interface **5110**, and correspondingly, outgoing protocol handler **5200** is connectable towards a call destination via signaling interface **5210**. Within the signaling node **5000**, incoming protocol handler **5100** and outgoing protocol handler **5200** are connected via internal interface **5300**.

[**0042**] With regard to the handling of excessive delay indication signals, outgoing protocol handler **5200** handles excessive delay indication signals originating from the call destination, and incoming protocol handler **5100** handles excessive delay indication signals destined for the call origin.

[**0043**] Each of the incoming and outgoing protocol handlers **5100** and **5200** include a timer, a message generator, a controller, and, optionally, a message memory. More specifically, incoming protocol handler **5100** includes a timer **5101**, a controller **5103**, a message generator **5102**, and optionally a message memory **5104**. Outgoing protocol handler **5200** includes a timer **5201**, a controller **5203**, a message generator **5202**, and optionally, a message memory **5204**.

[0044] At operation of the signaling node **5000**, the controller **5103** sends a first excessive delay indication signal. The excessive delay indication signal may be previously generated within the message generator **5102**, may be previously generated in the message generator **5202** and transmitted via the internal interface **5300**, or may be received from the call origin via the signaling interface **5210** and forwarded via the internal interface **5300**.

[0045] The controller **5103** is adapted to start the timer **5101** responsive to sending the first excessive delay indication signal. Furthermore, the controller **5103** is adapted to monitor the timer **5101** and to refrain from sending excessive delay indication signals until the timer **5101** expires. To that end the controller **5103** is adapted to ignore at least one of them. After the timer **5101** has expired, the controller **5103** may resume sending excessive delay indication signals.

[0046] A delay indication message may be created in the message generator in response to an expiration of the timer **5101**, and may be sent via the signaling interface **5110**. Alternatively, an excessive delay indication signal previously received and stored within the message memory **5104** by the controller **5103** may be retrieved and forwarded via the signaling interface **5110** upon detecting the expiration of the timer **5101**.

[0047] Reference is now made to FIG. **6** depicting a signaling sequence diagram that involves instances of the signaling node **5000** and may be executed therein. In particular, the embodiment of FIG. **6** depicts processing steps and messages processed by the incoming protocol handler **5100** and the outgoing protocol handler **5200** of FIG. **5**. In the embodiment of FIG. **6**, the incoming and outgoing protocol handlers **5100** and **5200** are BICC protocol handlers.

[0048] The signaling sequence of FIG. **6** commences with a BICC IAM message **6003** being received in the incoming protocol handler **5100**. Upon reception of the IAM message **6003**, the incoming protocol handler **5100** starts its excessive delay timer at step **6004** and forwards the IAM **6005** to the outgoing protocol handler. The outgoing protocol handler, in turn, starts its excessive delay timer in step **6006**. When the excessive delay timer in the incoming protocol handler **5100** expires at step **6008**, incoming the protocol handler **5100** generates an excessive delay indication signal **6009**. The excessive delay indication signal **6009** may be embodied as an eACM message or a CPG message depending, as previously described, on whether excessive delay indication signal **6009** is a first excessive delay indication signal, or not.

[0049] Upon sending the excessive delay indication signal **6009**, incoming protocol handler **5100** starts a timer for supervising excessive delay indication signals at step **6012**. When the outgoing protocol handler determines at step **6011** that its excessive delay timer has expired, the outgoing protocol handler generates an excessive delay indication signal **6013** and sends it to the incoming protocol handler **5100**. In response, the incoming protocol handler **5100** sets a flag in step **6020** to memorize that the excessive delay indication signal **6013** has been received.

[0050] The outgoing protocol handler **5200** proceeds with the call setup and initiates a scanning operation on potential transmission routes at step **6014**. When scanning operation **6014** lasts excessively long and the scanning timer expires, the outgoing protocol handler **5200** generates and forwards a further excessive delay indication signal **6015** to the incoming protocol handler **5100**. When further proceeding with the call setup, the outgoing protocol handler **5200** performs a polling operation on potential transmission nodes in step **6016** and issues a further excessive delay indication signal **6017** towards the incoming protocol handler **5100**, when the polling operation lasts excessively long and the polling timer expires.

[0051] The incoming protocol handler refrains from immediate forwarding of the excessive delay indication signals **6013**, **6015**, and **6017**. Instead, the incoming protocol handler detects the expiration of the supervising timer in step **6018**, and, in response, reads the flag indicating whether an excessive delay indication has been received within the runtime of the supervising timer in step **6027**. If the flag is set, indicating that an excessive delay indication signal has actually been received, a single excessive delay indication signal **6019** is transmitted towards the call origin. As described above with reference to FIGS. **4** and **5**, the single excessive delay indication signal may either be generated when it is needed or fetched from a signal memory, where it has been previously stored. Upon sending the excessive delay indication signal **6019**, advantageously the supervising timer is restarted and the procedure continues according to step **6012**. When the reading step **6027** results in detecting that no flag has been set, no excessive delay indication signal **6019** is transmitted.

[0052] Referring now to FIG. **7** a signaling sequence diagram in accordance with the present invention is depicted. The signaling sequence diagram of FIG. **7** involves processing steps and signals that correspond to equally labeled processing steps and transmitted signals of the signaling sequence diagram of FIG. **2**. For purpose of conciseness, the description of the processing steps and signals is referred to rather than repeated.

[0053] The signaling sequence of FIG. **7** is adapted with regard to the signaling sequence of FIG. **2** in that the incoming protocol handler **101** performs a modified handling of excessive delay indication signals in order to prevent unnecessary sending of excessive delay indication signals. The modified handling of the excessive delay indicating signals involves a filtering operation on excessive delay indicating messages that may be implemented in a plurality of transmission nodes. For the purpose of conciseness, the implementation of the filtering operation on a selected incoming protocol handler, i.e. the incoming protocol handler **101**, is depicted.

[0054] In particular, the signaling sequence of FIG. **7** is adapted, in that a supervision timer is started at step **401** in response to sending the excessive delay indication signal **231**. The signaling sequence of FIG. **7** is further adapted in that the incoming protocol handler **101** refrains from immediate forwarding of the excessive delay indication signals **232**-**236** that are received during the runtime of the supervision timer. Instead, the incoming protocol handler receives the excessive delay indication signal at step **402**, and sets a flag indicating the reception. In addition, step **402** may include storing the excessive delay indication signal **232**, or alternatively, discarding the excessive delay indication sig-

nal **232**. The incoming protocol handler **101** receives the further delay indication signals **233-236** during the runtime of the supervising timer, and when accessing the flag set in step **402**, determines that a previous excessive delay indicating signal has been received and that the succeeding excessive delay indicating signals **233-236** may be discarded.

[**0055**] When the supervising timer expires at step **407**, the incoming protocol handler accesses the flag set in step **402** and determines that a delay indication signal has been previously received during the runtime of the supervision timer and that a delay indication signal should be sent towards the call origin. Accordingly, depending on whether an excessive delay indication signal has been previously stored or a flag indicating the previous reception of a delay indication signal has been set, excessive delay indication signal **408** is either retrieved from a message memory or generated and transmitted towards the call origin. Thus, the single excessive delay indication signal **408** replaces the previous delay indication signals **232-236**. Upon sending of the excessive delay indication signal **408**, timer T**2** is restarted, and the operation of the incoming protocol handler continues according to step **401**. When reading of the flag results in determining that no excessive delay indication signal has been received during the runtime of timer T**2**, no excessive delay indication is sent and timer T**2** is not restarted.

[**0056**] Advantageously the expiration time of the supervision timer that supervises the time interval between excessive delay indication signals is configured to be shorter than the expiration time of the timer in the call originating node **101**, which supervises the call setup duration. In that manner, the single excessive delay indication may be sent early enough to prevent the expiration of the supervision timer of the call setup.

What is claimed is:

1. A method of reducing signaling during call setup in a communication network having an intermediate node on a signaling path between a first node and a second node, said method being performed in the intermediate node and comprising:

sending a first excessive delay indication signal to the first node;

starting a timer for supervising excessive delay indication signals;

receiving at least two additional excessive delay indication signals from the second node prior to expiration of the timer; and

after expiration of the timer, sending a single excessive delay indication signal to the first node.

2. The method of claim 1, wherein the intermediate node and the second node are implemented in a common node.

3. The method of claim 2, wherein the second node is a protocol handler.

4. The method of claim 1, wherein the step of sending the first excessive delay indication signal to the first node includes generating the first excessive delay indication signal in the intermediate node.

5. The method of claim 1, wherein the step of sending a first single excessive delay indication signal to the first node includes forwarding the first excessive delay indication signal received from the second node.

6. The method of claim 1, wherein the step of sending a single excessive delay indication signal to the first node includes generating the single excessive delay indication signal in the intermediate node.

7. The method of claim 1, wherein the step of sending a single excessive delay indication signal to the first node includes forwarding a next excessive delay indication signal received from the second node after the timer expires.

8. The method of claim 1, wherein the first node includes a call setup timer having an expiration period, and the step of starting a timer for supervising excessive delay indication signals in the intermediate node includes starting a timer with an expiration period shorter than the expiration period of the call setup timer in the first node.

9. A method of reducing signaling during call setup in a communication network having an intermediate node on a signaling path between a first node and a second node, said method being performed in the intermediate node and comprising:

receiving a first excessive delay indication signal from the second node;

forwarding the first excessive delay indication signal to the first node;

receiving at least one additional excessive delay indication signal from the second node; and

discarding the at least one additional excessive delay indication signal;

wherein signaling is reduced in the network by reducing the number of excessive delay indication signals sent from the intermediate node to the first node.

10. A signaling node for reducing signaling during call setup in a communication network, wherein the signaling node is an intermediate node on a signaling path between a first node and a second node, the signaling node comprising:

means for sending a first excessive delay indication signal to the first node;

a timer for supervising excessive delay indication signals;

means for starting the timer;

means for receiving at least two additional excessive delay indication signals from the second node prior to expiration of the timer; and

means for sending a single excessive delay indication signal to the first node after expiration of the timer.

11. The signaling node of claim 10, being implemented with the second node on a common node.

12. The signaling node of claim 11, wherein the second node is a protocol handler.

13. The signaling node of claim 10, wherein the means for sending the first excessive delay indication signal to the first node includes means for generating the first excessive delay indication signal.

14. The signaling node of claim 10, wherein the means for sending the first excessive delay indication signal includes means for forwarding the first excessive delay indication signal received from the second node.

15. The signaling node of claim 10, wherein the means for sending a single excessive delay indication signal to the first node includes means for generating the single excessive delay indication signal.

16. The signaling node of claim 10, wherein the means for sending a single excessive delay indication signal to the first node includes means for forwarding a next excessive delay indication signal received from the second node after the timer expires.

17. The signaling node of claim 10, wherein the first node includes a call setup timer having an expiration period, and wherein the means for starting a timer for supervising excessive delay indication signals includes means for starting a timer with an expiration period shorter than the expiration period of the call setup timer in the first node.

18. A signaling node for reducing signaling during call setup in a communication network, wherein the signaling node is an intermediate node on a signaling path between a first node and a second node, the signaling node comprising:

means for receiving a first excessive delay indication signal from the second node;

means for forwarding the first excessive delay indication signal to the first node;

means for receiving at least one additional excessive delay indication signal from the second node; and

means for discarding the at least one additional excessive delay indication signal;

wherein signaling is reduced in the network by reducing the number of excessive delay indication signals sent from the signaling node to the first node.

19. A communication network with reduced signaling during call setup, comprising:

an intermediate node on a signaling path between a first node and a second node, said intermediate node including:

means for sending a first excessive delay indication signal to the first node;

a timer for supervising excessive delay indication signals;

means for starting the timer;

means for receiving at least two additional excessive delay indication signals from the second node prior to expiration of the timer; and

means for sending a single excessive delay indication signal to the first node after expiration of the timer.

20. The communication network of claim 19, wherein the intermediate node and the second node are implemented in a common node.

21. The communication network of claim 20, wherein the second node is a protocol handler.

22. The communication network of claim 19, wherein the means for sending the first excessive delay indication signal to the first node includes means for generating the first excessive delay indication signal.

23. The communication network of claim 19, wherein the means for sending the first excessive delay indication signal includes means for forwarding the first excessive delay indication signal received from the second node.

24. The communication network of claim 19, wherein the means for sending a single excessive delay indication signal to the first node includes means for generating the single excessive delay indication signal.

25. The communication network of claim 19, wherein the means for sending a single excessive delay indication signal to the first node includes means for forwarding a next excessive delay indication signal received from the second node after the timer expires.

26. The communication network of claim 19, wherein the first node includes a call setup timer having an expiration period, and wherein the means for starting a timer for supervising excessive delay indication signals comprises means for starting a timer with an expiration period shorter than the expiration period of the call setup timer in the first node.

27. A communication network with reduced signaling during call setup, comprising:

an intermediate node on a signaling path between a first node and a second node, said intermediate node including:

means for receiving a first excessive delay indication signal from the second node;

means for forwarding the first excessive delay indication signal to the first node;

means for receiving at least one additional excessive delay indication signal from the second node; and

means for discarding the at least one additional excessive delay indication signal; wherein signaling is reduced in the network by reducing the number of excessive delay indication signals sent from the signaling node to the first node.

* * * * *