

METHOD FOR THE OPERATION OF A NETWORK WITH TERMINALS THAT CAN BE CONNECTED WITH EACH OTHER

5 The present invention relates to a method in accordance with the preamble of patent claim 1 or patent claim 2.

10 Telecommunication switching systems exist in which other authorized participants enter into a connection between two participants and are thereby able to listen in and participate in the conversation. This feature of performance is in particular desired in systems for traders or personal secretaries. Trader systems are predominantly used in banks, among
15 other things for exchange dealings. In such applications an additional requirement exists for reasons of confidentiality, whereby two of the participants in the connection want to temporarily only speak to each other, and therefore all other participants of the connection have to be disconnected from this connection and then again be linked in at a later point in time. The disconnection can be initiated by any participant of the respective connection. The participants disconnected from the connection are placed in a hold state so that he or she can be linked back into the connection by one of the two participants still connected to the connection. In the disconnection, the connection to the terminals of the disconnected participants is therefore not terminated definitively; only the listening and speaking circuits
20 are disconnected from the connection.

25 The aim of the present invention is to state a method that ensures a reliable and clear disconnection of participants sharing a connection, while realizing the feature of performance described above.

 This task is solved by the features listed in the characterizing portion of patent claim 1 or patent claim 2. Preferred embodiments of the invention are listed in additional claims.

 The method in accordance with the invention makes it possible in a network of

terminals, that can be connected via nodes, to exclusively leave two selected terminals of a large number of terminals that are temporarily linked to each other and make up the interlinking network, in the connection upon the request of any terminal and to temporarily disconnect the remaining terminals from the interlinking network. For this, no overriding station that controls this procedure is required in the network so that nodes of the same type can be implemented in the network without any exception. The network can thereby be easily complemented with additional nodes of the same type.

The invention is described in the following as an example with the aid of a drawing, wherein

Fig. 1 shows a first interlinking network constructed of inter-connected terminals, Fig. 2 shows a second interlinking network constructed of inter-connected terminals, and Fig. 3 shows a message diagram for the execution of the method.

Fig. 1 shows a network, for example, a telecommunications network, with terminals EG1 ... EGn that can establish a connection with each other via switching nodes K1 ... Km - in the following also briefly referred to as nodes. Both more nodes, as well as one or more terminals can be connected directly to the nodes. Terminals are understood here as telephones, for example. The transfer of the information required for establishing and switching off a connection each occurs via a signaling channel, whereas the user information is transmitted over a bi-directional data signal channel. To explain the invention, one shall assume that a speech connection exists between terminal EG1 and terminal EG2. This connection is directed over the nodes K1, K2, and K3 of the network. It is furthermore assumed that the additional terminals EG3 to EG6 have joined this connection and are therefore able to listen in to the conversation between terminals EG1 and EG2 and also share in the talking. The nodes K1 to K5 and the terminals EG1 to EG6 therefore make up an interlinking network over which the participants at the terminals EG1 to EG6 can communicate with each other. In each of the nodes of the interlinking network, a conference is created by adding the data signals arriving from different directions, subtracting its own

data signal and transferring the results into the different directions. Each of the participants participating in the interlinking network thereby hear all of the other participants sharing the interlinking network but not himself or herself.

5 If one of the terminals EG3 to EG6 wants to enter the connection between the terminals EG1 and EG2, the respective participant has to actuate the key "enter" on his terminal, upon which the corresponding node establishes the connection between the terminal and the existing connection between terminals EG1 and EG2 in accordance with the mentioned principle of establishing conferences. One can thereby make provision such that
10 a signal is sent to the two terminals EG1 and EG2 when another terminal has entered into their connection.

 If a participant of terminals EG1 to EG6 now desires to temporarily converse with only one of the participant for reasons of confidentiality, the other terminals sharing the
15 connection have to be excluded from listening/talking for a desired period of time. The participant at terminal EG1, for example, who originally had only been connected to the participant at terminal EG2, wishes to again temporarily speak only with the participant at terminal EG2. For this exclusive connection between terminals EG1 and EG2 the requirement exists to disconnect the terminals EG3 to EG6 in a simple way from the connection such that
20 they can afterwards be easily linked back in after the need for discretion has been eliminated. The temporary disconnection of terminals EG3 to EG6 is initiated by the appropriately authorized terminal EG1, whereby the participant activates the "privacy" function on his or her terminal EG1 and in addition indicates with which terminal he or she wants to talk exclusively. As a result, a message corresponding to this function is sent from the terminal
25 EG1 to the assigned node K1.

 This message can have the form $r(p\ 1,2)$. "r" stands for the type of message (request), "p" for the type of request (privacy), "1" for the identification of the requesting station in the network (terminal EG1), and "2" for the identification of the station (terminal EG2) of the

network that should stay connected.

5 The node K1 - as all the other nodes in the network that receive a message -
remembers from where it received the message and sends a message $r(p\ 1,2;K1)$ to the
adjacent node K2. This message is complemented with "K1" in order to identify the
requesting node K1. The node K2 remembers from where the message arrived and sends a
message $r(p\ 1,2;K2)$ to each of the adjacent nodes K3 and K4. Node K3 finally sends a
message $r(p\ 1,2;K3)$ to node K5 in the same manner. All nodes K1 to K5 sharing the
interlinking network, made up of the connection between terminals EG1 and EG2 as well as
10 the terminals EG3 ... EG6 entering into this connection, thereby receive the "privacy" request
that was sent from terminal EG1. The interlinking network is free of loops and consists of the
connections illustrated with continuous and dash-dotted lines in Fig. 1. Deviating from the
interlinking network shown in Fig. 1, an interlinking network is also conceivable in which
other nodes are present that do not exhibit any terminals sharing the interlinking network, i.e.
15 nodes that act as transit nodes.

Each node that receives a request and is able to disconnect from the respective
terminal connected to it, sends a corresponding confirmation back to the node from which it
received the request. The return message each begins with the end nodes of the interlinking
20 network. Thus node K5 sends a message $g(p\ 1,2;K5)$ back to the node K3 from which it
previously received the request $r(p\ 1,2;K3)$.

25 In the message $g(p\ 1,2;K5)$ "g" signifies the type of message (confirmation), "p" the
type of the confirmed request (privacy), "1" the identification of the requesting station
(terminal EG1), "2" the identification of the station (terminal EG2) that is to remain in the
connection and "K5" the node from which the confirmation originates.

The node K3 that previously sent the message $r(p\ 1,2;K2)$ to node K5 and is therefore
waiting for a response from node K5, registers the input of the message $g(p\ 1,2;K5)$ from

node K5. Each node of the interlinking network that sent a request to another node monitors whether or not a response (confirmation) arrives from this node within a certain period of time. This can be done with a timer that is started in the node every time a message is sent out.

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If an expected confirmation does not arrive within the period of time, the attempt of the terminal EG1 to establish an exclusive connection with terminal EG2, remains unsuccessful, because the node K1 ultimately does not receive a confirmation within a pre-determined period of time either. In this case a respective signaling occurs from node K1 to terminal EG1.

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After the receipt of the confirmation from node K5, the node K3 in turn sends out a message $g(p\ 1,2;K3)$ back to the node K2. A message $g(p\ 1,2;K4)$ is received by node K4 in the same manner in the node K2. The node K2, in contrast to node K3, waits for two confirmations before it can send a confirmation to the node K1. After the receipt and confirmation from nodes K3 and K4, the node K2 sends a confirmation $g(p\ 1,2;K2)$ back to the node K1. The node K1 thereby knows that the "privacy" request, sent from terminal EG1, for an exclusive connection was successful and the interlinking network therefore can be transferred into a state in which the terminal EG1 is, as desired, only connected to terminal EG2. The node K1 sends a request/message $ok(p\ 1,2)$ which reaches the nodes sharing the interlinking network, disconnecting the respective terminals as a result. Node K5 disconnects the connection to terminal EG6 in this manner due to the received message $ok(p\ 1,2)$. The terminal EG6 is thereby placed in a holding state, whereby the connection between the node K5 and the terminal EG6 can be re-activated at a later point in time. The disconnection is signaled to the terminal EG6 and displayed at that location. The disconnection of terminals EG3, EG4, and EG5 in the nodes K1, K2, and K4 and the display of the holding state in the terminal occurs in the same manner, so that the affected participants on hold are informed.

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The executed disconnection of the terminals EG3 to EG6 is displayed to the terminal

EG1 by a return message from nodes K2 to K5, arriving in node K1, so that the participant at terminal EG1 knows that the desired confidentiality is ensured and he can act accordingly. Provisions can furthermore be made such that the nodes K1 to K5 let the disconnected terminals EG3 to EG6 know when the desired exclusive connection from terminal EG1 to terminal EG2 has been established. The existence of an exclusive connection between terminal EG1 and EG2 can then be displayed in the terminals EG3 to EG6.

The following rule is categorically valid for the entry of the requests into the interlinking network: If a node has received a request to disconnect terminals that are listening in / participating in the talking - independent from whether or not these requests originate from a another node or from another terminal connected to the node - it rejects later requests for an exclusive connection of terminals connected directly to it, as long as the first request is effective, i.e. the first request is not invalidated by a terminal remaining in the connection or as long as the timer has not expired while waiting for a confirmation.

As soon as the confidentiality is no longer required, one of the participants of the exclusive connection (either EG1 or EG2) can send a message "lift privacy" from its terminal, which again reaches the nodes K1 to K5. The terminals EG3 to EG6, disconnected previously from the interlinking network, are again transferred from the hold state into a listening/talking state by the corresponding node.

The participants of terminals EG2 to EG6, instead of the participant with terminal EG1, can of course likewise initiate the disconnection of listening/talking terminals and establish an exclusive connection with a certain other terminal, if they have the proper authorization.

In the described process, the case can occur in which several terminals sharing an interlinking network and belonging to different nodes can send off a request for an exclusive connection virtually at the same and as a result not only one, but several conflicting requests

arrive shortly after one another in a node of the network. The problem of which request the node should choose therefore arises in the node. "Shortly after one another" means: a request sent from a terminal reaches the interlinking network via the corresponding node before a request, sent earlier from another terminal of another node has reached the node of the first-mentioned terminal in the manner described with the aid of Fig. 1. At this point in time the interlinking network is not yet adjusted to one of these requests, i.e. it has not reached the state in which a certain request has produced any exclusive connections. As a result, the different requests collide somewhere in the interlinking network. The solution to the conflict is described in the following with the aid of Fig. 2.

Fig. 2 shows an interlinking network, which exhibits a structure that corresponds to the interlinking network described in Fig. 1, and which is constructed by inter-linking terminals EG1 to EG8. The additional terminals EG7 and EG8 are assigned to the nodes K1 or K3, respectively.

It is assumed that the terminal EG7 wants to establish a temporary exclusive connection with the terminal EG4 and, as a result, disconnects the remaining terminals EG1 to EG3, EG5, EG6, and EG8 from the interlinking network. In principle this occurs in the same manner as described with the aid of Fig. 1. For a better overview, the message flow is illustrated separately in Fig. 3 in a message diagram. The process over time occurs by reading the diagram from the top to the bottom. The terminal EG7 sends a request $r(p\ 7,4)$ to the node K1, which in turn sends a request $r(p\ 7,4;K1)$ to the node K2. Node K2 sends the request $r(p\ 7,4;K2)$ to the node K3 as well as the node K4.

Shortly before the node K3 receives the request $r(p\ 7,4;K2)$ from node K2, another request $r(p\ 8,3)$ is received from terminal EG8 by the node K3 because this terminal desires an exclusive connection with the terminal EG3. The node K3 thus receives two conflicting requests $r(p\ 8,3)$ and $r(p\ 7,4;K2)$ shortly after one another. This conflict has to be resolved since only one exclusive connection between two terminals is possible among a large number

of terminals sharing the interlinking network.

Each node of the interlinking network that gets into such a conflict has to decide for one request. One possibility exists in letting the node decide based on the number of the requesting terminals, for example for the requesting terminal with the higher number. Instead, the decision could also be made in favor of the requesting terminal with the lower number. In the same manner, the number of the partner terminal of the exclusive connection can also be used. It is important that all conflicts occurring in the interlinking network are treated in each node in accordance with the same criteria.

In the present example the node K3 decides - as do all other nodes in such case of conflict - for the request that originates from the terminal with the higher number, i.e. for the request $r(p8,3)$. It therefore ignores the request $r(p\ 7,4;K2)$ arriving later and only processes the request $r(p\ 8,3)$ further.

If, in contrast to the present example, the request $r(p\ 8,3)$ had arrived after the request $r(p\ 7,4;K2)$ in the node K3, the node K3 would use the rule mentioned above in the example in accordance with Fig. 1, wherein a node that has already received a request rejects a later request from terminals directly connected to it. As a result, the node K3 would reject the request $r(8,3)$ - as well as other requests of terminals connected to it - independent of the number of the requesting terminals and would further process the request $r(p\ 7,4;K2)$ that arrived first.

In the present case, however, where the node K3 further processes the request $r(p\ 8,3)$ of the terminal EG8, the node K3 sends to the node K5 a request $r(p\ 8,3;K3)$. The node K3 furthermore sends a request $r(p\ 8,3;K3)$ to the node K2. The node K2 determines that the request $r(p\ 8,3;K3)$ is in conflict with the request $r(p\ 7,4;K1)$ received earlier from the node K1. It also decides for the request $r(p\ 8,3;K3)$ of the terminal EG8 with the higher number than terminal EG7. In accordance therewith, the node K2 sends one request $r(p\ 8,3;K2)$ each

to the node K1 and the node K4 and "forgets" everything associated with the earlier request $r(p\ 7,4;K1)$.

5 The node K4 determines that the received request $r(p\ 8,3;K2)$ stands in conflict with the earlier request $r(p\ 7,4;K2)$ and decides to forward the later request $r(p\ 8,3;K2)$ using the noted criterion. The earlier request $r(p\ 7,4;K2)$ is therefore likewise dropped by the node K4.

10 The node K1 likewise determines that the request $r(p\ 8,3;K2)$ conflicts with the earlier request $r(p\ 7,4)$ and decides to further process the request $r(p\ 8,3;K2)$. As a result, the node K1 sends a confirmation $g(p\ 8,3;K1)$ to the node K2, which in turn sends a confirmation $g(p\ 8,3;K2)$ to the node K3 after it has received the confirmation $g(p\ 8,3;K4)$ from the node K4. The confirmation $g(p\ 8,3;K4)$ replaces the confirmation $g(p\ 7,4;K4)$ indicated earlier at the node K2 from the node K4 to the request $r(p\ 7,4;K2)$, sent from the node K4 to the node K2. The node K5 furthermore sends a confirmation $g(p\ 8,3;K5)$ to the node K3. Thus the
15 confirmation is present in node K3 - the entry node for the request $r(p\ 8,3)$ of the terminal EG8 - so that the desired temporary exclusive connection of the terminal EG8 with the terminal EG3 can be established. With the arrival of the confirmation from the nodes K2 and K5 in the entry node K3 of the request $r(p\ 8,3)$ the interlinking network has reached a stable state, illustrated in Fig. 3 with "E", whereby the request originating from terminal EG8
20 prevailed in the network. The conflict occurring in nodes K1 to K4 - illustrated in Fig. 3 with "W" - between the requests $r(p\ 8,3)$ and $r(p\ 7,4)$ were each decided in favor of request $r(p\ 8,3)$ by using the described criteria. The desired exclusive connection can now be created from this state.

25 For this, the node K3 sends a message $ok(p\ 8,3)$ to the nodes K2 and K5, sharing the interlinking network, which then disconnect the respective terminals. The node K5 thus disconnects its connection to terminal EG6 due to the message $ok(p\ 8,3;K3)$ received from K3. The terminal EG6 is thereby placed into a hold state from which the connection between the node K5 and the terminal EG6 can be activated at a later point in time. The disconnection

is signaled to the terminal EG6 and displayed at that location. The node K2 receives a message ok(p 8,3;K3) from node K3 in the same manner and disconnects the terminal EG4. The node K4 receives the message ok(p 8,3;K2) from node K2 and disconnects the terminal EG5. The node K1 receives the message ok(p 8,3;K2) from the node K2 and disconnects the terminals EG1 and EG7. The terminal EG2 is disconnected from the interlinking network by the node K3. The terminal EG8 is, as desired, exclusively connected with the terminal EG3.

The executed disconnection of the terminals EG1, EG2, and EG4 to EG7 can be displayed by the terminal EG8 due to a return message arriving in node K3 from nodes K1, K2, K4, and K5. The participant of the terminal EG8 thereby knows that the desired confidentiality exists and he or she can act accordingly. Provisions can furthermore be made, wherein the nodes K1 to K5 signal the disconnected terminals EG1, EG2, and EG4 to EG7 the establishment of a desired exclusive connection from terminal EG8 to EG3. The existence of the exclusive connection between the terminals EG8 and EG3 can then be displayed in the terminals EG1, EG2, and EG4 to EG7, so that the affected participants are informed about their holding state.

As soon as the confidentiality is no longer necessary, one of the two participants can send a message "lift privacy" from his or her terminal EG3 or EG8, which again reaches the nodes K1 to K5. There the terminals EG1, EG2, and EG4 to EG7, previously disconnected from the interlinking network, are transferred from the holding state back into the listening/talking state with the aid of the respective nodes.

Instead of the participant at terminal EG8, the other participants at the terminals EG1 to EG7 taking part of the interlinking network can also initiate the described temporary disconnection of the listening/talking terminals and thereby create an exclusive connection with another terminal, if they are properly authorized.

In the examples described thus far, it was assumed that the disconnection of the

remaining terminals required for the creation of a desired exclusive connection between two terminals takes place when a request has prevailed in the interlinking network and the message ok is sent to all affected nodes in the network. In another embodiment of the method, provisions are made such that each node disconnects the terminals already after receipt of a request and transfers the request to the next node(s). If a "stronger" request arrives in a node at a later point in time as a result of using the criteria in a case of a collision, the node disconnects the respective terminals and, if needed, activates the terminals on that had been disconnected. This is illustrated in Fig. 3, whereby the establishment or disconnection in nodes K1 to K5 of connected terminals is illustrated in dotted frames. "EG out" thereby refers to disconnecting the terminals and "EG on" or "EG on again" to activate it. The terminals EG1 and EG3 are thus disconnected in node K1 due to the request r(p 7,4). Due to the request r(p 8,3) prevailing as described in the interlinking network, the terminal EG3 is then re-activated, and the terminal EG7 is disconnected, thereby establishing an exclusive connection between the terminals EG8 and EG3. In this variation of the method, the sending of a message ok is not required after reaching the stable state of the interlinking network, what reduces the message flow.

The application of the method is not limited to the illustrated example of a telecommunications network. It can be used universally in networks with terminals that can be connected with each other via the network and of which all, with the exception of two, have to be temporarily disconnected. In particular, an application is conceivable in a computer network where all connections to other computers have to be disconnected for the transmission of data between two certain computers in order to enable an uninterrupted and expedient transmission.

WHAT IS CLAIMED IS:

1. A method for the operation of a network with terminals (EG1, ..., EGm) that
5 can be connected to each other via transmission nodes (K1, ..., Km) of the
network, whereby, with the existence of a connection between two terminals,
other terminals, properly authorized, can link into this connection, wherein
one terminal (EG1) of the terminals (EG1 to EG6), sharing the connection,
maintains a connection with only one terminal (EG2) and desires to separate
10 the other terminals (EG3 to EG6) from the connection, this terminal (EG1)
sends out a corresponding request,
wherein the request is transmitted to all transmission nodes (K1, ..., K5) that
are part of the interlinking network, made up of the terminals (EG1 to EG6),
whereby a transmission node that has received a request rejects other requests
of terminals assigned to it, as long as the first request is effective,
15 wherein after receipt of the request each transmission node of the interlinking
network sends back a corresponding confirmation to the transmission node
from which it received the request, whereby a transmission node sends back
a confirmation to the transmission node from which it received the request
only when it has received a confirmation from all transmission nodes to which
20 it sent a request,
wherein during the arrival of the confirmation in the transmission node (K1),
assigned to the terminal (EG1) sending out the request, this transmission node
(K1) sends a request for the disconnection of the respective terminal (EG3 to
EG6) to the other transmission nodes (K2 to K5), and
25 wherein the transmission nodes (K1, K2, K4, K5), assigned to the terminals
(EG3 to EG6) to be disconnected, disconnect these terminals from the
interlinking network.
2. A method for the operation of a network with terminals (EG1, ..., EGm) that



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can be connected to each other via transmission nodes (K1, ..., Km) of the network, whereby, with the existence of a connection between two terminals, other terminals, properly authorized, can link into this connection, wherein one terminal (EG1) of the terminals (EG1 to EG6), sharing the connection, maintains a connection with only one terminal (EG2) and desires to separate the other terminals (EG3 to EG6) from the connection, this terminal (EG1) sends out a corresponding request,

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wherein the request is transmitted to all transmission nodes (K1, ..., K5) that are part of the interlinking network, made up of the terminals (EG1 to EG6), whereby a transmission node that has received a request rejects other requests of terminals assigned to it, as long as the first request is effective, wherein each transmission node of the interlinking network disconnects the corresponding terminals from the connection and sends back a corresponding confirmation to the transmission node from which it received the request, whereby a transmission node only sends back a confirmation to the transmission node from which it has received the request when a confirmation has been received by from all transmission nodes to which it sent a request.

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3. A method in accordance with claim 1 or 2, wherein when several conflicting requests arrive shortly after one another in a transmission node, the transmission node forwards only one of these requests in accordance with a criterion that is consistent through the network and ignores the other requests.

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4. A method in accordance with claim 3, wherein the number of the requesting terminal (EG1) or the number of the partnering terminal (EG2) is used as the criterion.

5. A method in accordance with claim 3 or 4, wherein the disconnected terminals (EG3 to EG8) are placed in a holding state from which they are able to be



linked back into the network with the aid of one or both terminals (EG1, EG2) remaining in the connection by sending a corresponding message to the respective nodes.

- 5 6. A method in accordance with one of the preceding claims, wherein the disconnection of the desired terminals (EG3 to EG6) is signaled to the terminal (EG1) which initiated the disconnection as soon as the disconnection is executed.
- 10 7. A method in accordance with one of the preceding claims, wherein the disconnection is signaled to the disconnected terminals (EG3 to EG6) as soon as the disconnection is executed.
- 15 8. A method in accordance with one of the preceding claims, wherein a transmission node sends the confirmation to the other transmission node from which it received the request only if it receives a confirmation in a pre-determined period of time from all transmission nodes to which it sent requests.
- 20 9. The use of the method in accordance with claim 1 or 2 in a network of computers that can be connected with each other via the network, whereby two or more computers can be connected to each other.

