

This Sheet Has Been Replaced



Method and Apparatus for Routing Incoming Calls in a Multi-Terminal Call System

The invention concerns a method for routing incoming calls in a multi-terminal call system having a base station, the method comprising storing selected incoming call identifiers in association with specific terminal identifiers in a base station memory, determining whether an incoming call originates from a selected incoming call identifier stored in the base station memory, and routing the incoming call to a specific terminal. The method also concerns a terminal connectable to a base station of a multi-terminal call system, the terminal comprising a key pad and a terminal memory, as well as a base station of a multi-terminal call system comprising a processor for storing selected incoming call identifiers and associated terminal identifiers in a base station memory, and for routing selective incoming calls to a selected terminal or terminals.

Multi-terminal call systems are, generally speaking, systems having at least one central access number and a plurality of handsets or terminals generally connected in parallel to a base station. Such multi-terminal call systems can have terminals connected to the base station through cables or through wire-less connections. A simple example of such multi-terminal systems is a plurality of telephones in a private household having one

9905363-9

23.11.98

111218

1267-115

28 OCT 1999



common external access number or a cordless telephone system within a private household having a plurality of handsets.

A general feature of such conventional systems is that incoming calls are normally routed to all handsets or terminals in the systems, wherein all terminals and handsets ring simultaneously in response to an incoming call. Since, however, the different handsets or terminals are generally located in different parts of the building in which the multi-terminal call system is installed, different users are normally associated with different terminals. It is therefore often the case that an incoming call is nearly invariably directed to a person normally using a particular terminal or handset. For such common calls, all users of all handsets are informed of an incoming call although the call was only likely to be directed to one particular user of one particular handset. As a result, all users of all handsets are often disturbed by incoming calls intended for only one handset.

WO 98/03004 discloses a multi-terminal call system of the above mentioned kind which attempts to address this problem. In particular, this publication discloses a cordless multi-terminal system having a central call processor and a controller. The cordless terminals of the system are adapted to communicate with the base station or, if out of range thereof, directly with mobile telephone cellular systems. The controller is programmable by a remote keyboard to download specific mapping instructions to a call processor in which particular call line identifiers are stored within the call processor in association with particular handsets or terminals. When an incoming call is received by the call processor, the call processor checks its internal memory for correlation between this call line identifier and information stored therein. Should the call processor find an entry associating this particular call line identifier with a particular handset,



the call processor automatically routes this call to the associated handset. In this manner, certain calls are automatically routed to a particular handset such that other handsets not likely to be interested or relevant to the incoming call remain unrouted and undisturbed by the call.

The system of WO98 03004 partially addresses the problem of prior art and prevents, under certain circumstances, all handsets from ringing in the event that only a particular handset is likely to be of interest. However, the system described in WO98 03004 can only associate particular hand sets or terminals with particular incoming calls using a centrally programmed call processor. In addition, should users of particular handsets wish to change correlations between incoming calls and target handsets, such changes can only be registered in the call processor through central programming via the remote key board.

In view of these disadvantages of prior art, it is the purpose of the present invention to develop a method and an apparatus for the routing of incoming calls within a multi-terminal call system which allows for a simple and user-friendly programming of a correlation between the incoming call and the target terminal or terminals.

This purpose is achieved in accordance with the method of the invention by storing, in each of a plurality of terminals, incoming call identifiers in a terminal memory of a respective terminal and by communicating those store identifiers along with an associated terminal identifier to the base station for storage in the base station memory in the form of selected incoming call identifiers.



The method in accordance with the invention thereby provides for a decentralized intelligence approach to programming of the multi-terminal call system. Instead of requiring centralized programming by means of a remote keyboard of the correlation in the base station between the incoming call identifier and the target terminal or handset, the method in accordance with the invention permits each separate handset user to program his own individual list of desired identifiers and to communicate this desired list to the central base station. In particular, the method in accordance with the invention facilitates simplified change of the entries in the base station memory. Should a handset user remap or realign his list of internal preferred numbers, the method in accordance with the invention allows each individual user to do so at his discretion and to reallocate the memory locations in the base station correlating the incoming call identifiers with the target terminal or handset. No external programming keyboard is required in order to reassign the correlation between incoming calls and target terminals, and each individual user of each particular handset can determine and change his allocations at his discretion.

An improvement of the method in accordance with the invention provides that the incoming call identifiers are stored in a terminal storage location occupied by stored frequently used outgoing call numbers. This improvement has the advantage that the frequently used outgoing call numbers, generally stored by the user in his handset for rapid recall of frequently called numbers likewise serve as the list of incoming call identifiers supplied by the handset to the central base station. This list might be programmed by the user, for example as a personal directory, or collected automatically by the handset, which monitors frequently used numbers dialed by the user. In fact, this list of frequently called outgoing call numbers is also likely to be the most appropriate list of incoming calls

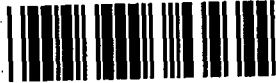


targeted for that particular handset. In this manner, a single programming of the handset satisfies both the routing for rapid outgoing calls to frequently used numbers as well as the routing for incoming calls to the handset most likely to be interested in receiving that call.

In an improvement of the method, selected incoming calls are routed with a predetermined identification at the selected terminal. This improvement allows the user of the selected terminal to recognize an incoming routed call prior to actually speaking with the calling party such that the user of this terminal can immediately judge the priority of an incoming call prior to receiving the call or initiating the conversation.

In a variation of this particular improvement, the predetermined identification at the selected terminal is an acoustical signal. This particular improvement has the advantage that, for example, a ringing signal which differs from a normal ringing signal can be utilized to identify an incoming routed call. In this manner, the user of the target terminal can recognize an internally routed call, likely to come from a party which he himself frequently calls and communicates with without having to look at e.g. a display on his handset.

A particular advantageous aspect of the invention involves providing the method with a step of routing a selected incoming call to a plurality of terminals if a selected specific terminal fails to indicate acceptance of said routed incoming call within a specific acceptance time. This particular improvement has the advantage of decreasing the probability that an incoming routed call remains unanswered in the event that the most likely user of the most likely handset targeted by the incoming call is not available to receive that call.



The purpose of the invention is also solved by a terminal connectable to a base station of a multi-terminal call system comprising means for storing incoming call identifiers in a terminal memory and having means for communicating the terminal identifier and associated incoming call identifiers to the base station for storage in the base station memory. This terminal in accordance with the invention has the advantage of providing a user-friendly method for programming the routing of incoming calls which allows the user of a particular handset or terminal to determine and to change his preferred list of incoming call routings in a decentralized fashion.

In an improvement of this terminal, the storage means of the terminal operate in response to key pad instructions entered by the user. This feature has the advantage of allowing the user to program his memory as well as download his programmed memory and/or memory changes to the base station simply by selected strokes on his key pad.

The purpose of the invention is also achieved in conjunction with a base station for a multi-terminal call system, characterized in that the processor of the base station comprises means for storing incoming call identifiers in response to incoming call identifiers stored in individual terminals and transferred from these individual terminals to the base station.

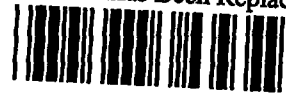
Further advantages of the invention can be extracted from the description of the accompanying drawings given below in association with a preferred embodiment thereof. This embodiment and its description are exemplary only and do not represent an exhaustive enumeration of inventive configurations. In general, the features disclosed in the drawings and



described in connection with the preferred embodiment can be used together in various combinations within the scope of the invention as claimed.

- Fig. 1: shows a schematic view of a multi-terminal system in accordance with the invention;
- Fig. 2: shows a detailed drawing of the base station portion of the multi-terminal user system in accordance with Fig. 1;
- Fig. 3: shows a detail of one particular terminal for use in the multi-terminal system in accordance with Fig. 1;
- Fig. 4a: schematically shows a first memory of a first terminal of the multi-terminal system of Fig. 1;
- Fig. 4b: shows a second memory of a second terminal of the multi-terminal system;
- Fig. 4c: shows a memory of an nth terminal of a multi-terminal system; and
- Fig. 5: shows a schematic view of the base station memory of the multi-terminal call system in accordance with the invention.

The multi-terminal call system in accordance with the invention as illustrated in Fig. 1 comprises a base station 3 connected via a cable connection 4 to a public switched telephone network 2 and having n terminals 7, 7', ..., 7" of



which only a first, second, and nth terminal are illustrated in the figure. The base station comprises a radio frequency transmitter/receiver 5 for communication with a plurality of cordless terminals 7, 7', ..., 7" of the n-terminal system via antenna 8. This particular embodiment preferentially represents a cordless telephone system of a PABX user (PABX = private automatic branch exchange). The invention, however, also applies to hard-wired systems, particular for PABX users.

Fig. 1 shows a first terminal 7, a second terminal 7' and an nth terminal 7" of the system. Each terminal has its own antenna 6, 6', 6" connected to respective transmitter/ receivers 9, 9', 9" for communication with the base station 3. Both the base station transmitter/receiver 5 and the terminal transmitter/receivers 6, 6', 6" comprise conventional radiofrequency electronics not explicitly illustrated.

Fig. 2 shows a more detailed sketch of the base station illustrating features pertinent to the invention. The incoming cable 4 from the public station telephone network 2 connects directly to a base station processor 10. The base station processor communicates with base station memory 11 as well as with the base station transmitter/receiver 5. The processor 10 accepts analogue and/or digital signals coming from the network 2 and translates these signals into appropriate digital signals for internal use within the multi-terminal system. The transmitter/receiver 5 receives digital signals exported by the base station processor 10 to generate radio frequency signals delivered to antenna 8. The transmitter/receiver 5 thereby comprises conventional means for conversion of outgoing digital instructions from the processor 10 into associated radio signals for interpretation by the terminals 7, 7', ..., 7" as well as conventional electronics for converting radio signals received from the terminals 7, 7', ..., 7" into appropriate digital



signals for internal use by the base station processor 10. The base station memory 11 communicates with the base station processor 10 to accept downloaded storage instructions therefrom.

Fig. 3 shows a somewhat more detailed sketch of a particular terminal 7. All terminals 7, 7' and 7" illustrated in Fig. 1 are, in this embodiment, considered to be of the same construction. The handset 7 of Fig. 3 comprises a key pad 21 communicating with a terminal processor 23. The terminal processor 23 is connected to a receiver/transmitter 9 as well as to a terminal memory 24. The receiver/transmitter 9 communicates radio frequency signals to the antenna 6 and receives signals therefrom and comprises conversion circuitry for appropriate analog/digital conversion for internal use by the terminal 7. The terminal processor 23 is adapted to accept key pad stroke instructions 21 entered by a user in order to download memory storage instructions into the memory 24 and/or to generate radio frequency signals via transmitter 9 for radiation by antenna 6. The terminal processor is also connected to a loud speaker for generating an acoustical signal to the user.

Figs. 4a, 4b and 4c sketch memory locations 24, 24', 24" appropriate to the invention for a first terminal 7' (Fig. 4a), a second terminal 7' (Fig. 4b), and an nth terminal 7" (Fig. 4c). The relevant portions of the memories 24, 24', 24" are illustrated by memory sections 25, 25', and 25" in Figs. 4a, 4b, and 4c respectively. Referring to Fig. 4a, memory section 25 comprises a list, CLI(1,1) to CLI(1,m) of m incoming call identifiers (for example calling line identifiers) selected by the user of terminal 7 for storage in memory 24, e.g., as a personal directory of the user. Each entry is labelled with two numbers, the first number (in the case of Fig. 4a the number "1") indicating a terminal number, and a second number indicating a particular identifier



associated with a particular call identifier number. In the embodiment shown in Figs. 4a through 4c, m incoming call identifiers can be stored in each terminal. In Fig. 4b the memory 24' of handset 7' is associated with identifier number "2" so that the stored incoming call numbers identified by the list extend from CLI (2,1) to CLI (2, m) and are indexed with the number "2". Fig. 4c shows the general case of terminal number " n " having a series of " m " storing locations.

Fig. 5 shows the corresponding storage location of the base station memory 11 following programming by the individual terminals 7, 7', 7" of the system for routing of selected incoming calls. The base station memory 11 comprises a memory section 30 consisting of particular memory sections 31, 32 and up to and including memory section 33. These memory portions 31 and 32 through 33 are correlated with information originally programmed in the corresponding sections 25, 25', 25" of Figs. 4a, 4b, and 4c associated with the terminals 7, 7', and 7" respectively. In the example shown in Fig. 5, the correlation between the incoming calls and the target terminal 7, 7', 7" is indicated as a simple 2x2 matrix extending from entry 1,1 to entry n,m respectively. Clearly, embodiments are possible in which data compression for zero locations as well as multiple correlations between a particular incoming call identifier, e.g., a calling line identifier (CLI), and one or more terminals 7, 7', 7" are possible. The system 1, in this event, would then be capable of routing a particular incoming call to one, two, or more selected individual terminals 7, 7', 7" depending on the programming of the central storage location 11 of the base station 3 as downloaded by processor 10.

The system operates as follows. For purposes of clarity, use by only one terminal 7 of the n terminals 7, 7', ..., 7" will be described in detail. The user



of a particular handset 7, enters a list of preferred numbers in his terminal memory 24 using keypad 21. These numbers could also correspond to a list of numbers which the user prefers for rapid execution of outgoing calls. It is, however, also possible for the user to program a separate memory location of his terminal memory 24 to direct the base station to a particular list of incoming calls which differs from his preferred list of outgoing calls. Following programming of his specific list of incoming calls, the user operates the key pad to signal the base station 10 that an update of the stored list is desired. If access allocation is allowed by the base station 10, the receiver/transmitter 9 is then activated by the terminal processor 23 to transfer the list of incoming calls stored in terminal memory 24 via antenna 6 to the base station 3. The base station processor 10 recognizes the list as an update list, and rewrites the new list in base station memory 11, correlating a particular incoming call identifier with the terminal or handset 7 requesting correlation and routing therewith. This process is repeated by the various users of the various handsets 7, 7', ..., 7" until the base station memory 11 is filled with the correlation matrix or matrixes uniquely identifying the user terminal or terminals 7, 7', 7" to be routed to in the event of a selected incoming call. In a further embodiment of the invention the base station 10 might request by a cyclic polling the various handsets 7, 7', ..., 7" to send information of their lists in the sections 25, 25', 25" of Figs. 4a, 4b, and 4c.

Following programming, and in the event that an incoming call is received by the base station processor 10, the base station processor 10 consults the base station memory 11 for a correlation or correlations between the incoming call identifier and possible target terminal or terminals 7, 7', ..., 7" stored in the base station memory 11. In the event that the base station processor 10 finds such a correlation 11, the base station processor 10

instructs the receiver/transmitter 5 to radiate signals for reception by the selected terminal 7 or terminals 7',..., 7". Should no correlation be found in the base station memory 11, the base station processor instructs the base station receiver/transmitter 5 to radiate signals to the plurality of terminals 7, 7',..., 7" for reception by all terminals. Should the target terminal 7 or terminals 7',..., 7" fail to respond to the routed call with a specified amount of time, the base station processor 10 instructs the receiver/transmitter to ring all terminals 7, 7',..., 7".

This Sheet Has Been Replaced



**Claims**

1. Method for connecting incoming calls in a multi-terminal call system (1), the multi-terminal system (1) having a base station (3), the method comprising storing selected incoming call identifiers in association with specific terminal identifiers in a base station memory (11), determining whether an incoming call originates from a selected incoming call identifier stored in the base station memory (11), and routing the incoming call to a specific terminal (7, 7', 7''), characterized by storing, in each of a plurality of terminals (7, 7', 7''), incoming call identifiers in a terminal memory (24, 24', 24'') of a respective terminal (7, 7', 7''), and communicating these stored identifiers along with an associated terminal identifier to said base station (10) for storage in said base station memory as said selected incoming call identifiers.
2. The method of claim 1, characterized in that said incoming call identifiers are stored in a terminal storage location occupied by stored frequently used outgoing call numbers (for example a directory).
3. The method of claim 1 or 2, characterized in that said multi-terminal system is a PABX (Private Automatic Branch Exchange) system.
4. The method of any one of the preceding claims, characterized in that said base station is a cordless telecommunication base station.

This Sheet Has Been Replaced





5. The method of claim 4, characterized in that said base station is a Digital Enhanced Cordless Telecommunication (DECT) base station.
6. The method of any one of the preceding claims, characterized in that the selected incoming calls are routed with a predetermined identification at the selected terminal (7, 7', 7").
7. The method of claim 6, characterized in that said predetermined identification at the selected terminal (7, 7', 7") is a particular acoustical signal.
8. The method of any one of the preceding claims, further characterized by the step of routing a selected incoming call to a plurality of terminals (7, 7', 7") if a selected specific terminal (7, 7', 7") fails to indicate acceptance of said routed incoming call within a specified acceptance time.
9. A terminal (7, 7', 7") connectable to a base station (3) of a multi-terminal call system (1), the terminal (7, 7', 7") comprising a key pad (21) and a terminal memory (24), characterized by means (23) for storing incoming calls identifiers in said terminal memory (24) and means for communicating a terminal identifier and said stored incoming call identifiers to said base station (3) for storage in a base station memory (11).
10. The terminal of claim 9, further characterized by means (23) responsive to selected incoming calls routed by said base station (31) to said terminal (7, 7', 7") for identifying a routed call.





11. The terminal of claim 10, characterized in that said responsive means (23) for identifying a routed call generate an acoustical signal.
12. The terminal of any one of the claims 9 through 11, characterized in that said storage means (23) and said communication means (23) operate in response to key pad instructions entered by a user.
13. The terminal of any one of the claims 9 through 12, characterized in that said incoming call identifiers are stored in a terminal storage location (25, 25', 25'') occupied by stored frequently used outgoing call numbers.
14. The terminal of any one of the claims 9 through 13, characterized in that said terminal is a PABX (Private Automatic Branch Exchange) system terminal.
15. A terminal of any one of the claims 9 through 14, characterized in that said terminal is a cordless telecommunication terminal.
16. A base station (3) of a multi-terminal call system (1), the base station (3) comprising a processor (10) for storing selected incoming call identifiers and associated terminal identifiers in a base station memory (11), and for routing selective incoming calls to a selected terminal or terminals (7, 7', 7''), characterized in that said processor (10) comprises means (10) for storing said incoming call identifiers in response to incoming call identifiers stored in individual terminals (7, 7', 7'') and transferred from said individual terminals (7, 7', 7'') to the base station (10).





16

17. The base station (3) of claim 16, characterized in that said base station (3) is a PABX (Private Automatic Branch Exchange) base station (3).
18. The base station (3) of any one of the claims 16 or 17, characterized in that said base station (3) is a cordless telecommunications base station (3).
19. The base station (3) of any one of the claims 16 through 18, characterized in that the selected incoming calls are routed with a predetermined identification at the selected terminal (7, 7', 7'').
20. The base station of claim 19, characterized in that said predetermined identification at said selected terminal (7, 7', 7'') is an acoustical signal.
21. The base station (1) of any one of the claims 16 through 20, wherein said selected incoming call is routed to a plurality of terminals (7, 7', 7''), if a selected terminal (7, 7', 7'') fails to indicate acceptance of said routed incoming call within a specified acceptance time.

This Sheet Has Been Replaced

