

2057329

- 1 -

TELEPHONE SPEECH PATH RECOVERY

The present invention relates to a method of recovering a speech path of a telephone call.

5

Generally it is required for a telephone exchange system not to disconnect a speech path of an existing (pre-engaged) call in any circumstances. However, a modem exchange system may be restarted in its entirety from occurrence of a system failure, due to its highly complex structure of hardware and software. In such a case, there may be a problem that a subscriber's speech path engaged in a preceding telephone call is disconnected because both the software and the hardware have to be initialized when restarting the system.

15 Preferred embodiments of the present invention aim to provide a method of recovering a pre-engaged call without disconnecting a speech path of the call upon restarting a digital exchange system from occurrence of a system failure.

20 According to another aspect of the present invention, there is provided a method of recovering a speech path of a pre-engaged call upon restarting a digital exchange system from occurrence of a system failure, the method comprising the steps of:

25 initializing all hardware and all software except for a subscriber's table buffer of said digital exchange system upon generation of a predetermined restarting signal of said system;

initializing a variable port number in the communication control software at a given initial value;

generating a unique address in said subscriber's table buffer
5 corresponding to said variable port number;

checking whether or not a talk bit of a line status word at a position in said subscriber's table buffer corresponding to said unique address is set, said line status word indicating the state of said port;

10

obtaining a subscriber's port number from a line number buffer at a position in said subscriber's table buffer corresponding to said unique address and an opposite subscriber's port number from an opposite subscriber buffer at a position in said subscriber's table buffer corresponding to said unique
15 address if said talk bit is set, said line number buffer storing said subscriber's port number and said opposite subscriber buffer storing said opposite subscriber's port number; and

forming said speech path of said call by connecting said subscriber's
20 port number in said line number buffer with said opposite subscriber's port number in said opposite subscriber buffer.

Such a method may further comprise the step of incrementing said variable port number by a given value and checking whether or not said
25 variable port number is a last number and, if not, performing repeatedly the steps of the method according to the invention other than said initializing steps for a next port.

Preferably, said subscriber's table buffer comprises a plurality of sections corresponding to respective ports and each of said sections comprises said line status word indicating the state of the respective port, said line number buffer storing said subscriber's port number, and said opposite subscriber buffer storing said opposite subscriber's port number.

Preferably, the or each said line status word comprises an idle bit, a busy bit, a talk bit and a hold bit.

10 According to another aspect of the present invention, there is provided a method of recovering a speech path of a call in a telephone system following failure of the system, the method comprising the steps of initially storing in a buffer the number of each calling subscriber of the system on a current call together with the number of the opposite subscriber connected to or called by
15 the respective subscriber, and upon restarting the system following said failure, reconnecting each calling subscriber who was on a current call when the system failed and whose number is stored in said buffer to the respective opposite subscriber whose number is stored in said buffer.

20 The invention extends to a telephone system having a control means arranged to carry out a method according to either of the preceding aspects of the invention.

25 For a better understanding of the invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings, in which:

Figure 1 is a block diagram of one example of a system embodying the invention;

5 Figure 2 is a flow chart illustrating an example of operation of the system;

Figure 3A is a table structure of a call buffer, and Figure 3B is a structure of a line status word of a call buffer; and

10 Figure 4A is a table structure of communication between port #1 and port #2, Figure 4B is a table structure of port #1 being in a busy state, and Figure 4C is a table structure of port #1 being in an idle state.

Referring to Figure 1, there is shown an extension subscriber matching
15 circuit 104 for detecting a hook on/off state of an extension subscriber's telephone and supplying a current thereto. A memory 102 is provided to access or record certain data by a given control signal. A central processing unit 101 generates a control signal for allocating a time slot according to signalling information from the extension subscriber matching circuit 104 and
20 accesses the memory 102. A complex frequency receiver 107 converts a dialled signal, from an extension subscriber telephone connected with the subscriber matching circuit 104, into a digital signal, and transmits it to the central processing unit 101. A complex frequency transmitter 106 generates a DTMF (Dual Tone Multi Frequency) signal by a digit data output of the
25 central processing unit 101. A switching circuit 105 connects a speech path of an office line with the extension subscriber matching circuit 104 according to a control of the central processing unit 101. An office line matching circuit 103 interfaces an office line of a central telephone office with the switching

circuit 105. A tone generator 108 supplies various tones to an extension subscriber or an office line subscriber through the switching circuit 105.

With reference to Figure 2, the system operation comprises the steps of
5 initializing all hardware and all software except for a call buffer in case of a
minor restarting grade, generating an address of a corresponding port number
for a variable port number set by a given value and checking whether or not
a busy bit of a line status word is set, connecting a speech path of a pre-
engaged call by detecting a corresponding port number in a line number and
10 an opposite port number of an opposite subscriber engaged in a call, in the
case of the busy bit being set in the above step, and detecting a last port
number by repeating the steps beginning from the second step if the port
number increased by 1 is not a last one, after connecting the speech path of
the call in the third step.

15

With reference to Figure 3, a call buffer records information according
to progress of a call and it is allocated to each port. A line status word
indicates a state of a port and comprises 4 bits. An idle bit D0 indicates
whether or not a state of a port is idle, and if '1', indicates an idle state. A
20 busy bit D1 indicates a state of a busy tone wherein one party hears a busy
tone if the other party hooks on, and of which '1' indicates a busy tone state.
A talk bit D2 indicates a state of communication with an office line or an
extension line and '1' indicates a speech state. The illustrated system is for
recovering a speech path of a pre-engaged call only for a talk state (a
25 completely established call) on restarting a system. A hold bit D3 indicates
a state of holding and '1' indicates a holding state. A line number (Line No.)
byte is a store for recording a specific number allocated in hardware to each
port. For example, the line number of port #1 is recorded as 0, the line

number of port #2 is recorded as 1, and the line number of port #N is recorded likewise as N-1. An opposite port number engaged in a call is recorded in an opposite subscriber byte. In an idle state, OFF is recorded as the opposite subscriber byte.

5

With reference to Figures 1 through 4, an example of operation of the system will now be described.

Generally, there are inevitable causes for restarting a system. It is a major grade when restarting a system from power-on reset or power off-on, and a minor grade when restarting a system from a system failure occurring from a software fault or by using a reset button.

15 A step 2B is performed in the case of a major grade and a step 2D in case of a minor grade, after checking the restarting grade of a system in a step 2A. After initializing all hardware in the step 2B and all software in the step 2C, the step returns to start. If the restarting grade of a system is detected to be the minor grade in the step 2A, all hardware is initialized in the step 2D and all software except for the call buffer is initialized in the step 2E.

20

In the step 2F, a variable number of port # N of the call buffer as shown in Figure 3 is set by '1' and a step 2G is performed. In the step 2G, an address of the call buffer for a variable number of port # N is generated and a step 2H is performed. A step 2L is performed in the case of the talk bit not being set and a step 2I is performed in case of the talk bit being set, after checking whether or not the talk bit of the line status word (as shown in Figure 3) is set in the step 2H. The step 2I detects the corresponding port number in the line number byte of the call buffer and a step 2J is performed.

25

In the step 2J, an opposite port number previously engaged in a call is detected from the opposite subscriber byte of the call buffer and a step 2K is performed. In the step 2K, a subscriber's speech path of the call is connected by the corresponding port number of the line number and the opposite port number of the opposite subscriber. For example, a table of Figure 4A is formed for the communication between port # 1 and port # 2, a table of Figure 4B is formed for the busy state of port # 1 and a table of Figure 4C is formed for the idle state of port # 1. After the speech path is connected in the step 2K, the port number is increased by 1 in a step 2L and a step 2M is performed. The step jumps to the step 2G in the case of a port number not being a last one by checking the port number in the step 2M and repeats the steps 2G to 2M until detecting the last one, and returns to start in the case of the last port number.

As described above, the method recovers a pre-engaged call without disconnecting a speech path of the call, especially in the case of a minor restarting grade of a system from any failure occurred on a digital exchange system so as to secure reliability and improved function of a digital exchange system.

CLAIMS:

1. A method of recovering a speech path of a pre-engaged call upon restarting a digital exchange system from occurrence of a system failure, the
5 method comprising the steps of:

initializing all hardware and all software except for a subscriber's table
buffer of said digital exchange system upon generation of a predetermined
restarting signal of said system;

10

initializing a variable port number in the communication control
software at a given initial value;

15

generating a unique address in said subscriber's table buffer
corresponding to said variable port number;

checking whether or not a talk bit of a line status word at a position in
said subscriber's table buffer corresponding to said unique address is set, said
line status word indicating the state of said port;

20

obtaining a subscriber's port number from a line number buffer at a
position in said subscriber's table buffer corresponding to said unique address
and an opposite subscriber's port number from an opposite subscriber buffer
at a position in said subscriber's table buffer corresponding to said unique
25 address if said talk bit is set, said line number buffer storing said subscriber's
port number and said opposite subscriber buffer storing said opposite
subscriber's port number; and



forming said speech path of said call by connecting said subscriber's port number in said line number buffer with said opposite subscriber's port number in said opposite subscriber buffer.

- 5 2. A method as claimed in claim 1, further comprising the step of incrementing said variable port number by a given value and checking whether or not said variable port number is a last number and, if not, performing repeatedly the steps of claim 1 other than said initializing steps for a next port.
- 10 3. A method as claimed in claim 1 or claim 2, wherein said subscriber's table buffer comprises a plurality of sections corresponding to respective ports and each of said sections comprises said line status word indicating the state of the respective port, said line number buffer storing said subscriber's port number, and said opposite subscriber buffer storing said opposite subscriber's port
15 number.
4. A method as claimed in any one of claims 1-3, wherein the or each said line status word comprises an idle bit, a busy bit, a talk bit and a hold bit.
- 20 5. A method of recovering a speech path of a call in a telephone system following failure of the system, the method comprising the steps of initially storing in a buffer the number of each calling subscriber of the system on a current call together with the number of the opposite subscriber connected to or called by the respective subscriber, and upon restarting the system following
25 said failure, reconnecting each calling subscriber who was on a current call when the system failed and whose number is stored in said buffer to the respective opposite subscriber whose number is stored in said buffer.



6. A method of recovering a speech path of a call in a telephone system following failure of the system, the method being substantially as hereinbefore described with reference to Figure 2 or to Figures 2 to 4C of the accompanying drawings.

5

7. A telephone system having a control means arranged to carry out a method according to any of the preceding claims.

