

SPONTANEOUS CALLER IDENTIFICATION WITH CALL-WAITING

Field of the Invention

The invention relates generally to telephone
5 subscriber services and more particularly to an enhanced
form of call-waiting service that includes off-hook third
party calling number delivery.

Background of the Invention

10 The call-waiting (CW) telephony feature is
generally well-known and has been offered in the last few
years by most telephone operating companies. In
conventional CW, when a customer who subscribes to CW
service is engaged in a telephone conversation with a
15 second party and a third party calls that customer, the
customer receives a special call-waiting tone, typically
440 Hz for 300 milliseconds, whereas the third party
receives audible ringing. If the CW customer chooses to
receive the call from the third party, a switch-hook flash
20 holds the second party while the subscriber's connection is
switched to the third party. If the first call-waiting
tone is ignored, a second CW tone is given after a few
seconds and if this signal is also ignored, the third party
is given a busy tone.

25 Early versions of call-waiting service are
discussed in U.S. patent number 3,133,995 to Zarouni
whereas later versions are discussed in Pommerening et al.,
U.S. patent number 3,963,874, George et al., U.S. patent
number 3,997,731, Beth, U.S. patent number 3,584,156, and
30 Brecher, U.S. patent number 4,661,975.

When a call-waiting subscriber receives the call-
waiting tone(s) he is frequently very reluctant to
interrupt the existing conversation for what may be an
entirely unsolicited and unwanted call from a third party.
35 However, the CW subscriber would be in a position to make
an informed decision if he knew the identity of the third
party.

Another customer service presently being introduced to the marketplace is calling number identification (CNID). Early proposed versions of this service may be found in U.S. patent numbers 3,727,003 and 3,812,296 to Paraskevakos, as well as in U.S. patent number 3,787,626 to Subieta. A more recent scheme of CNID is discussed in U.S. patent Re. 31,789 to Hashimoto. In these patents, the directory number of a calling party is coded as digital pulse trains and is transmitted from the originating central office to the terminating office and sent to the called party's telephone set either before it is sent an alerting signal such as ringing or during the silent interval between the first and second ringing signals. In these patents, the called party's telephone set must be equipped with receiving circuitry for decoding the digital pulse trains as well as a display device to indicate the identity of the calling party. The called party is then placed in the position of being given the opportunity to answer the call or ignore it.

The contemporary method and protocols of data transfers necessary to the realization of the CNID feature are available from Bellcore Technical References TR-TSY-00030 and TR-TSY-00031. Basically, these specifications require the use of modem data (frequency shift keying - FSK) to transfer the identification information from the central office to the subscriber set during the silent interval between the first and second ringing signals.

Yet another patent related to calling number identification is U.S. patent number 4,873,719 to Reese. This patent is directed to the privacy issue of CNID and proposes to solve the question by granting the calling party exclusive control of the delivery of his identity to the called party. The patent proposes to use conventional call-waiting tones and to deliver the calling party identification information using Dual-Tone Multifrequency (DTMF) data signals while the called party is off-hook.

A first difficulty with this approach is that

detection of a conventional call waiting tone in the presence of voice is unreliable at best. Secondly, the appearance of modem data signals (frequency shift keyed data - FSK) or DTMF encoded data signals for a duration of
5 even a few seconds is very annoying to the conversing parties and is thus undesirable.

It is therefore an object of this invention to provide an improved call waiting service to telephone subscribers.

10 It is also an object of this invention to provide an improved method and apparatus of providing calling party identification information to a called party's telephone set while the latter is off-hook.

It is another object of the invention to provide a
15 robust alerting scheme for use on in-use subscriber loops.

It is yet another object of the invention to provide CNID on a busy telephone line only when the called party's subscriber telephone set is capable of receiving and displaying the information.

20 It is a further object of the invention to provide this improved call waiting service on analog subscriber lines using non-ISDN (Integrated Services Digital Network) technology.

25 **Summary of the Invention**

In accordance with the invention, there is provided to a first party engaged in a conversation with a second party via a local switching office, identification information related to a third party wishing to converse
30 with said first party. The local office initiates the procedure by sending a call waiting tone having predetermined characteristics to the first party. The first party apparatus responds to the call waiting tone by, muting its associated handset for a predetermined interval
35 of time. The local switching office then transmits data corresponding to the said identification information related to the third party. The first party apparatus

receives and displays the identification information and thus allows the first party to either accept or reject the waiting call from the third party.

From another perspective, the invention provides a method of transmitting data between a central office and a subscriber terminal having receiving and transmitting transducers while the subscriber terminal is presenting an off-hook condition to the subscriber loop, comprising the steps of sending an alerting tone having predetermined characteristics from the central office to the subscriber terminal to alert the latter that the central office wishes to send data. In response to the alerting tone, the subscriber terminal mutes its handset for a predetermined duration of time corresponding to at least the duration of the data to be transmitted between the central office and the subscriber terminal. Following reception of the data, normal operation resumes.

From yet another perspective, the invention provides subscriber telephone apparatus for receiving third party caller identification while a first party associated with the telephone apparatus is conversing with a second party via a local switching office. The apparatus comprises detector circuit means for detecting the presence of a call waiting tone in the presence of voice signals on the subscriber loop and a control circuit means responsive to the detection of the call waiting tone for muting the receive and transmit transducers for a predetermined period of time during which a receiver and display circuit receives and displays the identity of the third party caller.

In the preferred embodiment of the invention, the call waiting tone and other control tones (beeps) appearing on the subscriber loop are dual-tone signals and the calling number identification data is formatted in accordance with the existing and well-known Bellcore standards with only minor variations as discussed below.

Brief Description of the Drawings

A more complete understanding of the invention may be obtained from the following description and the accompanying drawings in which:

5 Figure 1 is a block schematic diagram of a telephone subscriber set in accordance with the invention; and

Figure 2 is a waveform diagram illustrating the sequence of operation of the method of the invention.

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Description of the Preferred Embodiment

Figure 1 is a block diagram of at least the portion of a subscriber set necessary to implement the invention. The tip and ring leads of the subscriber loop extend from
15 the subscriber premises equipment shown in figure 1 to a local telephone switching office.

As is conventional, the set comprises line protection circuitry 10 connected to a ring detect circuit 11 that may provide visual and/or audible alerting signals
20 to the subscriber that a call has arrived. The line protection circuitry is also connected to a 2 wire/4 wire hybrid circuit 12 via a hookswitch 13. The hybrid circuit 12 is also connected to a handset 14 comprising transmit and receive transducers 15 and 16 respectively. In this
25 case, the hybrid circuit 12 is connected to the transducers 15 and 16 via respective switches 17 and 18 as will be discussed below.

The subscriber set also comprises a control circuit which may conveniently be a microprocessor 20 such as a
30 Signetics^(RTM) type PCD-3348, a conventional keypad and DTMF (Dual-Tone Multifrequency) generator 21, and an FSK (Frequency Shift Keying) demodulator circuit 22 which may be an off-the-shelf unit such as model QM2211 manufactured by the Exar Corporation. The microprocessor 20 is also
35 connected to a display 23 including a register 24 and visual display unit 25 that may comprise one or more rows each having a plurality of cells 1 to n; these are

available as off-the-shelf components.

Also connected to the microprocessor 20 and the tip and ring leads are a parallel set detector circuit 26 and a dual tone detector circuit 27. The parallel set detector circuit 26 functions to provide an output signal that indicates whether or not the subscriber set of figure 1 is connected with an off-hook extension set. Such a circuit is the subject matter of a patent application bearing serial number 07/631,255, filed in the United States Patent Office and assigned to the same assignee as the present invention.

The dual-tone detector circuit 27 must be suitable to detect the presence of a dual-tone signal such as a DTMF signal in the presence of voice signals on the subscriber loop. United States patent application bearing serial number 07/676,593 and also assigned to the same assignee as that of the present invention is suitable to detect reliably the presence of a predetermined tone in the presence of voice signals. Two such circuits connected together are fully capable of reliably detecting a dual-tone signal in the presence of voice signals.

The microprocessor 20 functions as a control hub of the subscriber set by responding to signals from the ring detect circuit 11, the circuits 22, 26, 27 and hookswitch 13 to provide control signals to the muting switches 17 and 18, the DTMF generator 21 and the display 23.

The operation of the circuit will be explained using figure 2 in conjunction with the circuit of figure 1. It will be assumed that a first subscriber associated with the apparatus of figure 1 is conversing with a second subscriber via a local central office and that a third party is attempting to reach the first subscriber.

On detecting the incoming call from the third party, the central office prepares to enter the off-hook call waiting procedure of this invention. This is represented by the Xms (x milliseconds) guard band TG1 in figure 2. During this period, the call processor of the

central office enters a call processing software program associated with the CW feature and it causes the central office to transmit a predetermined dual-tone signal (CW tone) which may preferably be a DTMF signal having a
5 predetermined duration t_1 (e.g. 200 milliseconds). As mentioned above, a conventional CW single tone signal may be used but is very difficult to detect reliably in the presence of voice signals.

At this point, the microprocessor 20 in the
10 subscriber set is aware of the off-hook status of the set as well as of any extension set(s) connected to it. During the t_1 period, the dual-tone detector circuit 27 detects the presence of the call waiting tone and signals the microprocessor 20 which reacts by muting the handset 14 via
15 switches 17 and 18 and entering a control loop that entails determining the status of any extension set and signalling the DTMF generator 21 to generate an acknowledgement signal t_3 on the subscriber loop to inform the central office that it is a subscriber set capable of receiving calling number
20 identification data. Without this signal, the central office would always send the modem data burst to the great annoyance of subscribers using a non-muted set. In the case that an extension set is off-hook, the microprocessor 20 will prevent the acknowledgement signal t_3 from being
25 transmitted by not causing it to be generated, thus causing the data transmission sequence at the central office to be terminated. Without the use of this control mechanism, the subscriber on the extension set would hear the modem burst and the control tones and its voice may mutilate the modem
30 data on the subscriber loop. The acknowledgement tone is transmitted in a very quiet period on the subscriber loop since both the first and second subscribers have been muted, the first subscriber by its own set and the second subscriber by the central office in the manner conventional
35 for a call-waiting process. Almost any tone could therefore be used but it is preferable to use a DTMF signal since it is not easily duplicated by random events or voice

signals.

During the t_4 period, the subscriber set prepares itself to receive data and the central office prepares to transmit the data. Periods t_5 and t_6 represent the data transmission itself. The signalling method, format and definition of the messages and parameters are defined in the aforementioned TR-TSY-30 standard. The standards requirement of a channel seizure tone is of course not required since the subscriber set is ready to receive. The t_5 portion thus consists of X milliseconds (e.g. 150 ms) of logical 1 data to condition the FSK demodulator 22 for receiving the ensuing data which has a period t_6 of a length dependent on the amount of data transmitted. This data may correspond to the third party telephone number, name, date, time of day, etc.... The FSK data is received by the FSK demodulator circuit 22 which translates it to a digital bit stream that is fed to the microprocessor 20 which translates the data into information displayed on the display 23. The subscriber is then in a position to decide whether or not to accept the waiting call based on the identity of the caller. Acceptance of the waiting call simply entails generating a hookswitch flash in the conventional manner whereas rejection of the waiting call is achieved by ignoring it. If the subscriber ignores the waiting call, the central office may generate a second call waiting alerting tone after a predetermined period. However, the data transmission would not be repeated unless the first transmission was not correctly received. In that case, the acknowledgement tone t_3 would be generated but would not be generated otherwise.

During a short interval t_7 , the circuits at both ends prepare to resume normal operation and the microprocessor 20 unmutes the handset 14 thereby allowing the subscriber to be alerted by a suitable DTMF tone t_2 that the conversation may be renewed. After a guard band time TG2 of Xms, the central office is fully recovered from the

departure from conventional operation and the conversation may resume.

It will be realized that the time periods discussed are arbitrary and may be predetermined to any value
5 consistent with proper operation.

Although the invention was discussed using a conventional subscriber set into which is integrated special circuitry to realize the invention, the same or equivalent results may be obtained with an adjunct display
10 box containing the described circuitry properly connected to a conventional telephone set.

Numerous other modifications, variations and adaptations may be made to the described embodiments without departing from the scope of the invention as
15 defined in the claims.



CLAIMS:

1. A method of transmitting data between a central office and a subscriber terminal having transmit and receive transducers for voice communication while the subscriber terminal is presenting an off-hook condition to the subscriber loop comprising the steps of:

 sending an alerting tone having predetermined characteristics from the central office to the subscriber terminal to alert the latter that the central office wishes to send data;

 in response to the alerting tone, muting the transducers of the subscriber terminal for a predetermined duration of time corresponding to at least the duration of the data to be received; and

 sending the data from the central office to the subscriber terminal.

2. A method as defined in claim 1 wherein the alerting tone is a dual-tone signal.

3. A method of transmitting data between first and second apparatus including transmit and receive transducers while the transmission line between the first and second apparatus is being utilised for voice communication, comprising the steps of:

 the first apparatus sending an audio alerting tone detectable by the second apparatus and recognisable by the user of the second apparatus as an indication that the first apparatus is to transmit a predetermined amount of data on the transmission line;

 the second apparatus responding to the alerting tone by muting at least its transmit transducer for a period of time corresponding to the predetermined amount of data thereby preventing mutilation of the data on the transmission line by voice signals.



4. A method as defined in claim 3 and comprising the further step of also muting the receive transducer of the second apparatus in response to the alerting tone.

5. A method as defined in claim 3 wherein after the muting of the transmitter and before the data is transmitted, the second apparatus transmits a signal acknowledging that it is able to receive data, the first apparatus responding to the absence of the acknowledgement signal by terminating the data transmitting sequence and allowing voice communication to resume.

6. A method as defined in claim 5 and comprising the additional step of verifying the status of a third apparatus connected in parallel with the second apparatus and if the third apparatus is off-hook, the second apparatus not transmitting said signal acknowledging that it is able to receive the data.

7. A method as defined in claim 6 wherein, following the unmuting of the transmit transducer, the first apparatus transmits a second audio alerting tone thereby indicating that the transmission line is available for voice communication.

8. A method as defined in claim 7 wherein each of the alerting tones comprises a conventional dual tone multifrequency signal.

9. A method of transmitting data between a central office and a subscriber, which method is substantially as described herein with reference to the accompanying drawings.



10. A method of providing to a first party already engaged in a conversation with a second party via a local switching office, identification information related to a third party wishing to converse with said first party, comprising the steps of:

the local office sending a call waiting tone having predetermined characteristics to the first party;

the first party apparatus responding to the call waiting tone by muting its associated handset for a predetermined interval of time;

the local office then transmitting data corresponding to the said identification information related to said third party; and

the first party apparatus receiving and displaying to the first party said identification information related to said third party thereby allowing the first party to either accept or reject the call from the third party.

11. A method as defined in claim 10 and comprising the further step of, the first party apparatus responding to the call waiting tone by transmitting to the local office an acknowledgement tone indicating that it is capable of receiving calling party identification data.

12. A method as defined in claim 11 wherein said acknowledgement tone is transmitted only if extension apparatus associated with the first party apparatus is not off-hook.

13. A method as defined in claim 12 wherein following the transmission of said data, the local office transmits an alerting tone to indicate to the first party that the transmission of said data is complete.



14. A method as defined in claim 13 wherein the call waiting tone is a dual-tone signal.

15. A method as defined in claim 14 wherein the acknowledgement tone is also a dual-tone signal.

16. A method as defined in claim 15 wherein the alerting tone is also a dual-tone signal.

17. A method as defined in claim 14 and including the further step of, in the instance that the first party has not responded to the first call waiting tone, the local office transmits a second call waiting tone to the first party a predetermined period of time following the termination of the first call waiting sequence but the first party transmits a second acknowledgement tone in response to said second call waiting tone only if said data was not correctly received following the first call waiting tone.

18. Subscriber telephone apparatus for receiving third party caller identification information while a first party associated with the telephone apparatus is conversing with a second party via a local switching office, comprising:

detector circuit means for detecting the presence of a call waiting tone in the presence of voice signals on the subscriber loop;

control circuit means responsive to the detection of said call waiting tone for muting the receive and transmit transducers of the telephone apparatus for a predetermined period of time; and

means for receiving and displaying said third party caller identification information received during said predetermined period of time.



19. Subscriber telephone apparatus as defined in claims 18 wherein the control circuit means is further responsive to the detection of the call waiting tone for producing a signal to cause the generation of an acknowledgement signal on the subscribers loop to indicate to the switching office that it is capable of receiving data corresponding to said third party caller identification information.

20. Subscriber telephone apparatus as defined in claim 19 and further comprising a parallel set detector circuit, the control circuit means being responsive to a signal corresponding to an extension set being off-hook from the parallel set detector circuit, for preventing the generation of said acknowledgement signal.

21. Subscriber telephone apparatus substantially as described herein with reference to and as shown in the accompanying drawings.