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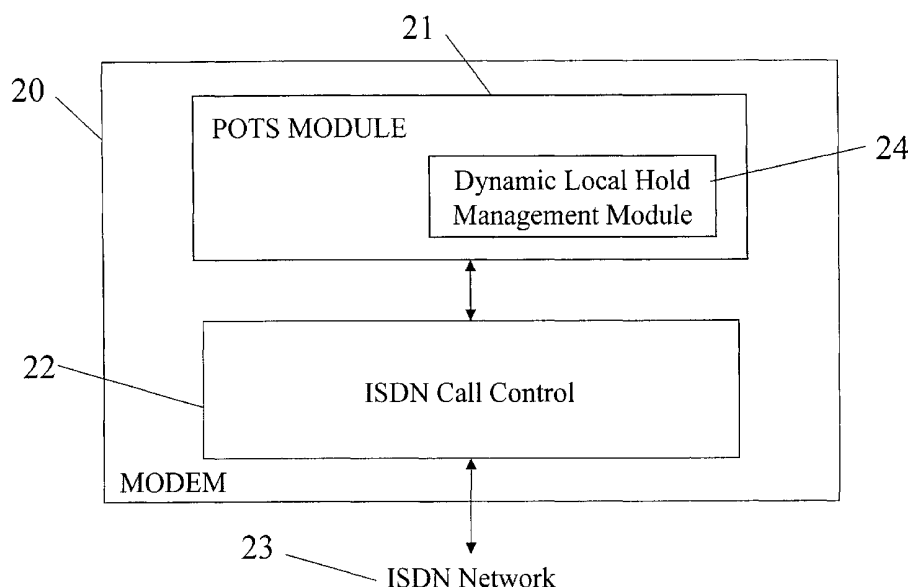
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(54) Title: DYNAMIC LOCAL HOLD



(57) Abstract: This feature implements held call management by defaulting to "External hold" behavior and automatically switching to "Local hold" behavior if the attempt to hold the call in the switch fails. This ensures that held call management can be transparently supported without the user having to be aware of whether or not the HOLD service is provisioned in the switch. The software always attempts to use the method which is most efficient in terms of resource usage first (i.e. the method that allows two calls to use one channel). The fact that switching to "local hold" is dynamic is particularly useful given that the failure of a particular HOLD request may be due to a transient condition. The methods can also be used to answer requests for other features on the line such as conference or transfer to other parties.



WO 01/76314 A2



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

DYNAMIC LOCAL HOLDField of the Invention

The invention relates to the field of call management on ISDN lines and BRI-like transmission lines such as Primary rate ISDN, Voice over IP, Voice
5 over DSL, PBX signaling (Q. sig.), etc. More particularly, this invention relates to held call management and other features such as conference and transfers to third parties.

Background of the Invention

10 The user interface for held call management on analog lines in European Telecommunications Standards Institute (ETSI) regions is based on the use of the "Flash" key (or "R" button) on the phone keypad. The user interaction works as follows:

User A goes off-hook, obtains a dial tone and dials remote user B. B
15 answers the call and the call connects.

User A presses the "R" button. The call to B is put on hold in the switch and A hears a new dial tone.

User A calls a third party, user C. C answers this call and it connects. User A now has two calls present on the local interface, the connected call to C
20 and the held call to B.

User A can now do one of the following:

Toggle between the two calls, by pressing "R" and then "2". This places the active (connected) call on hold and retrieves the background (held) call.

Disconnect the party he or she is talking to and revert to the other party
25 by pressing "R" and then "1". This drops the active (connected) call and retrieves the background (held) call,

Make a conference call with both users B and C, by pressing "R" and then "3". This places the active (connected) call and the background (held) call both in an active mode and permits conferencing.

30

Integrated Services Digital Network (ISDN) modems that support analog Plain Old Telephone System or Service (POTS) ports also called Public Switched Telephone Network (PSTN) ports normally include support for held call management. The user interface is the same as that used on analog

telephone lines (i.e. "R", "R" + "2", "R" + "1"). The modems invoke the relevant ISDN D-channel signaling based on the phone keypad input from the user.

There are two methods used to support held call management on ISDN modems. The first method is the Local Hold and the second method is the External Hold. The Local Hold uses one B-channel for each call present on the POTS port. When user A has one call present and presses "R" to put the call on hold, the modem simply mutes the connected B channel and sends a SETUP message to the switch to originate the new call (i.e. the call is "held" internally). When user A later toggles between the calls, the currently connected channel is muted and the POTS port is connected to the other call's channel. No D-channel signaling is used to put either call on hold within the switch. The main disadvantage with this method is that both B-channels are used when a call is held and therefore, no other B-channel data can be communicated on the line.

The External hold uses the ETSI HOLD and RETRIEVE Q.931 call control messages (as defined in ETS 300 196) to explicitly put a call in the held state within the ISDN switch. Once a call is held in the switch, its B-channel is available for use by other calls. This method therefore has the advantage that the management of two calls is supported while using just one B-channel. The problem is that the HOLD message will be rejected if the service is not provisioned on the line. Also, the user may not be aware or warned that the HOLD message will be rejected and will not foresee that calls to this function will not work properly.

On an ISDN line, a B-channel is a 64 Kbps access channel that carries customer information such as voice calls, circuit-switched data, or packet-switched data. A D-channel is a 16 Kbps or 64 Kbps access channel that carries control or signaling information and, optionally, packetized customer information.

Basic Rate Interface (BRI), also known as 2B +D with B = bearer and D = delta, is a standardized user interface to ISDN service providing access to two B-channels and one 16Kbps D-channel. This access provides three bi-

directional, symmetrical digital channels to the user's premises using two-wire copper circuits. Each of the B-channels can be independently switched, and either or both B-channels may be permanently connected in special service applications. Control over B-channel connections for demand applications
5 resides in the signaling messages passed via the D-channel. The customer can use all or parts of the two B-channels and the D-channel.

Summary of the Invention

Accordingly, an object of the present invention is to provide a method for
10 holding calls which requires the least amount of resources (B-channels).

Another object of the present invention is to provide a method for holding calls which makes use of the user's available functions on the line.

15 According to one aspect of the present invention, a method for holding calls on a transmission line, wherein a first call has been connected is provided. The method comprises the steps of attempting to hold the first call using an external hold; and if the external hold is not available on the line, holding the first call using a local hold; wherein the first call is held using either an external
20 hold or a local hold depending on the availability of the external hold on the line.

The method can further comprise a step of storing an indication of the non-availability of the external hold on the line.

25 The method can also comprise a step of using the indication of the non-availability of the external hold to terminate the step of attempting to hold the first call using an external hold.

The method can further comprise a step of resetting the indication of the
30 non-availability of the external hold after at least one of a next power down and the lapse of a pre-determined time period.

The availability of the external hold can be determined by the receipt of an acknowledgment message for a hold request that was sent to a switch on

the line.

According to another aspect of the invention, a method for holding calls wherein a first call has been connected is provided, the method comprising the steps of: receiving a user command to hold the first call, sending a hold message for the first call to a switch, setting the first call state to held if a hold_ack message is received for the first call, setting the first call state to local_held and muting the first call's B-channel if the hold_ack message is not received for the first call and sending a setup message to the switch to originate a second call on the line, wherein the first call is held using an external hold if the switch supports the hold feature and the first call is held using a local hold if the switch does not support the hold feature.

The transmission line can be an ISDN line, a Primary Rate ISDN, a voice over IP, a voice over DSL, a Private Branch eXchange (PBX) signaling device, etc.

According to yet another aspect of the present invention, an apparatus for holding calls on a transmission line, wherein a first call has been connected is provided. The apparatus comprises: means for attempting to hold the first call using an external hold and means for holding the first call using a local hold in the case where the external hold is not available.

According to still another aspect of the present invention, there is provided a method for answering a request to use a feature on a transmission line, comprising the steps of: attempting to answer to the request by using the external feature from a switch; and if said external feature is not available on said line, answering said request by using a local feature; wherein said request to use a feature on said transmission line is answered by using the external feature on the switch if available or is answered locally if not.

According to another aspect of the present invention, there is provided an apparatus for holding calls on a transmission line, wherein a first call has been connected. The apparatus comprises an external hold requester for attempting

to hold the first call using an external hold; an external hold status determiner for determining if the external hold is available on the line; a local holder for holding the first call using a local hold when the external hold is not available on the line; wherein the first call is held using either an external hold or a local hold
5 depending on the availability of the external hold on the line.

Preferably, the apparatus further comprises a status memory for storing an indication of the non-availability of the external hold on the line. Preferably, it further comprises a request stopper for, using the indication of the non-
10 availability of the external hold, terminating the attempt to hold the first call using an external hold.

Preferably, the apparatus further comprises a reset for resetting the indication of the non-availability of the external hold after at least one of a next
15 power down and the lapse of a pre-determined time period.

Preferably, the external hold requester sends a hold request to a switch on the line and wherein the external hold status determiner determines the availability of the external hold by the receipt of an acknowledgment message
20 for the hold request.

Preferably, the apparatus comprises: a user input receiver receiving a user command to hold the first call; the external hold requester sending a hold message for the first call to a switch; the external hold determiner setting the
25 first call state to held if an acknowledgment message for a hold request is received for the first call; the local holder setting the first call state to local_held and muting the first call's B-channel if the acknowledgement message for a hold request is not received for the first call and sending a setup message to the switch to originate a second call on the line, wherein the first call is held using
30 an external hold if the switch supports the hold feature and the first call is held using a local hold if the switch does not support the hold feature. Preferably, the transmission line is an ISDN line.

According to another aspect of the present invention, there is provided an

apparatus for answering a request to use a feature on a transmission line, comprising: an external feature requester for attempting to answer to the request by using the external feature from a switch; an external feature status determiner for determining if the external feature is available on the line; a local manager for answering the request by using a local feature if the external feature is not available on the line; wherein the request to use a feature on the transmission line is answered by using the external feature on the switch if available or is answered locally if not.

10 Brief Description of the Drawings

These and other features, aspects and advantages of the present invention will become better understood with regard to the following description and accompanying drawings wherein:

FIG. 1 illustrates the different components of the system in which the dynamic local hold management module according to the present invention can be included;

FIG. 2 is a flow chart of the steps of the method according to a preferred embodiment of the present invention.

20 Detailed Description of the Preferred Embodiment

The Dynamic Local Hold Management Module of the present invention implements held call management by defaulting to "External hold" behavior and automatically switching to "Local hold" behavior if the attempt to hold the call in the switch fails. This ensures that held call management can be transparently supported without the user having to be aware of whether or not the HOLD service is provisioned in the switch. The software always attempts to use the method that is most efficient in terms of resource usage first (i.e. the method that allows two calls to use one channel). The fact that switching to "local hold" is dynamic is particularly useful given that the failure of a particular HOLD request may be due to a transient condition.

FIG. 1 describes the components used in the system. A modem 20 is shown divided into two main parts: the POTS module 21 and the ISDN call control module 22. It is to be understood that both of these parts may not be

physically independent in the modem. The modules are separated to facilitate illustration. The POTS module 21 comprises a Dynamic Local Hold Management Module 24 which is built according to a preferred embodiment of the present invention. An ISDN network 23 communicates with the ISDN Call control module 22. The POTS module 21 also communicates with the ISDN Call control module 22.

Referring now to FIG. 2, a flow chart of the steps of a preferred embodiment of the present invention is shown. A concrete example will be used to illustrate how this method can be used in a Dynamic Local Hold Management Module. User A calls user B. A first call (CR1) is connected 30 between user A and user B by the Modem 20 on the ISDN network 23. User A then presses 31 the "R" button on his phone to hold his call to user B. A "HOLD" message for call CR1 is sent 32 to the switch. If the switch's hold feature is activated for the line and working properly, the switch will send a "HOLD_ACK" message back to the modem who requested it.

If this "HOLD_ACK" message is received 33 by the modem, it means that the external hold feature is available. Because the external hold feature is the least expensive in terms of resources (the second B-channel will still be available), this method is used by default. A request to change the state of call CR1 to "HELD" is then made 34 and a "SETUP" message is sent 35 to originate a new dial tone for a new call CR2. User A will then be able to dial a second number and be connected to a second call CR2.

If the "HOLD_ACK" message is not received 33, the local hold method for holding calls will be used. Instead of a "HOLD_ACK" message, a "HOLD_REJECT" message can be sent by the switch to warn the user that the external hold feature is not available. Also, another type of message such as a "STATUS" message can be sent by the switch. The status of the first call could then be extracted from this message and the fact that the message cannot be held externally would then be known. The apparatus according to a preferred embodiment of the present invention can also wait for a pre-determined period of time to get the "HOLD_ACK" message. If the message is not received in this

pre-determined period of time, the apparatus simply assumes that the external hold is not available at this time and will switch into local hold mode.

5 The local hold method uses both B-channels and disables all transmissions of data which are usually possible when a B-channel stays available while a call is taking place on the other B-channel. The first call CR1's state will be changed 36 to "LOCAL_HELD" and the CR1's B-channel will be muted 37. A "SETUP" message is then sent 35 to originate a new dial tone for a new call CR2. User A will then be able to dial a second number and be
10 connected to a second call CR2.

This method can be used each time a call has to be held. If the switch's hold feature is temporarily unavailable or de-activated, the user will still be able to hold the first call and connect to a second call.

15

It would also be possible to use this invention to conference between 5 parties, 1 local and 4 outside, whenever External Hold is available. Indeed, a first call between user A (local) and user B could be connected. Knowing that external hold is available on its line, user A would then hold the call (by pressing
20 "R") to user B and connect another call with user C. User A would then conference the two conversations (to B and C) by pressing "R" and "3". User A would then hold this 3-way conference by pressing "R". The HOLD_ACK message would not be received since two calls are already connected. Then, the local hold feature would be used to mute the 3-way conference's B-channel.
25 A new call to D would be originated on the other B-channel. A could then conference this new conversation with the held 3-way conference by pressing "R" and "3". A could finally hold locally this 4-way conference between A, B, C and D and connect to a fourth external party by calling E. A could then conference all callers in and obtain a five-way conference between users A, B,
30 C, D and E.

An indication to the user could be used to warn that the holding operation did not work. This audible indication could be, for example, a "beep" to be generated by the apparatus, a message to appear in the display window of the

telephone, or another indication such as the illumination of a LED on the telephone, in the case where the HOLD has failed. The HOLD could, for example, fail for the following reason: the external hold service is not available on the line and there are no more B-channel resources available to hold the call
5 locally. This situation would result in a fail of the HOLD feature and an indication could be sent to the user.

While the present invention has been described in relation with ISDN lines, it is to be understood that it could be implemented for BRI-like
10 transmission types such as Primary rate ISDN, Voice over IP, Voice over DSL, PBX signaling (Q. sig.), etc.

While the present invention has been described in relation with the HOLD feature on transmission lines, it will be readily apparent to one skilled in
15 the art that the present invention could be used for other features on a transmission line such as transfers to third parties and conference calls. A method similar to those described herewith would be used to try to use the external feature if available and if not, to perform the task required by the feature locally.

20

The present invention makes use of features readily available on a telephone such as the "R" button and the numbered keypad. However, as will be apparent to one skilled in the art, the "R" button could be replaced by some other means of interfacing with the telephone apparatus and the numbers could
25 also be chosen to be different.

While the invention has been described in connection with specific embodiments thereof, it will be understood that it is capable of further modifications and this applications intended to cover any variations, uses, or
30 adaptations of the invention following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice within the art to which the invention pertains and as may be applied to the essential features hereinbefore set forth, and as follows in the scope of the appended claims.

CLAIMS

1. A method for answering a request to use a feature on a transmission line, comprising the steps of:
 - receiving a request for a feature to be used on a transmission line;
 - attempting to answer to said request by using an external feature from a switch on said transmission line; and
 - if said external feature is not available from said switch, answering said request locally by using a local feature;wherein said request to use a feature on said transmission line is answered by using the external feature on the switch if it is available or is answered locally if it is not available.
2. A method as claimed in claim 1, wherein said request is a request for holding a call, wherein a first call has been connected and wherein said first call is held using either an external hold or a local hold depending on the availability of said external hold on said line.
3. A method as claimed in any one of claims 1 and 2, further comprising a step of storing an indication of the non-availability of said external feature on said line.
4. A method as claimed in claim 3, further comprising a step of using said indication of the non-availability of said external feature to terminate said step of attempting to answer to said request using said external feature.
5. A method as claimed in any one of claims 3 and 4, further comprising a step of resetting said indication of the non-availability of said external feature after at least one of a next power down and the lapse of a pre-determined time period.
6. A method as claimed in any one of claims 1 to 5, wherein said availability of said external feature is determined by the receipt of an acknowledgment message for a feature request that was sent to a switch on said line.

7. A method as claimed in claim 2, wherein the method comprises the steps of:

receiving a user command to hold the first call,

sending a hold message for the first call to a switch,

setting the first call state to held if an acknowledgment message for a hold request is received for the first call,

setting the first call state to local_held and muting the first call's B-channel if the acknowledgement message for a hold request is not received for the first call and

sending a setup message to the switch to originate a second call on the line,

wherein the first call is held using an external hold if the switch supports the hold feature and the first call is held using a local hold if the switch does not support the hold feature.

8. A method as claimed in any one of claims 1 to 7, wherein said transmission line is an ISDN line.

9. An apparatus answering a request to use a feature on a transmission line, comprising:

a feature request receiver for receiving a request to use a feature on a transmission line;

an external feature requester for attempting to answer to the request by using an external feature from a switch on said transmission line;

an external feature status determiner for determining if said external feature is available from said switch on said line;

a local manager for answering said request by using a local feature if said external feature is not available on said line;

wherein said request to use a feature on said transmission line is answered by using the external feature on the switch if available or is answered locally if not.

10. An apparatus as claimed in claim 9, wherein said request is a request for

holding a call, wherein a first call has been connected and wherein said first call is held using either an external hold or a local hold depending on the availability of said external hold on said line.

11. An apparatus as claimed in any one of claims 9 and 10, wherein said external feature status determiner stores an indication of the non-availability of said external feature on said line.

12. An apparatus as claimed in claim 11, further comprising an attempt reset for using said indication of the non-availability of said external feature to terminate said attempt to answer to said request using said external feature.

13. An apparatus as claimed in any one of claims 11 and 12, further comprising an indication reset for resetting said indication of the non-availability of said external feature after at least one of a next power down and the lapse of a pre-determined time period.

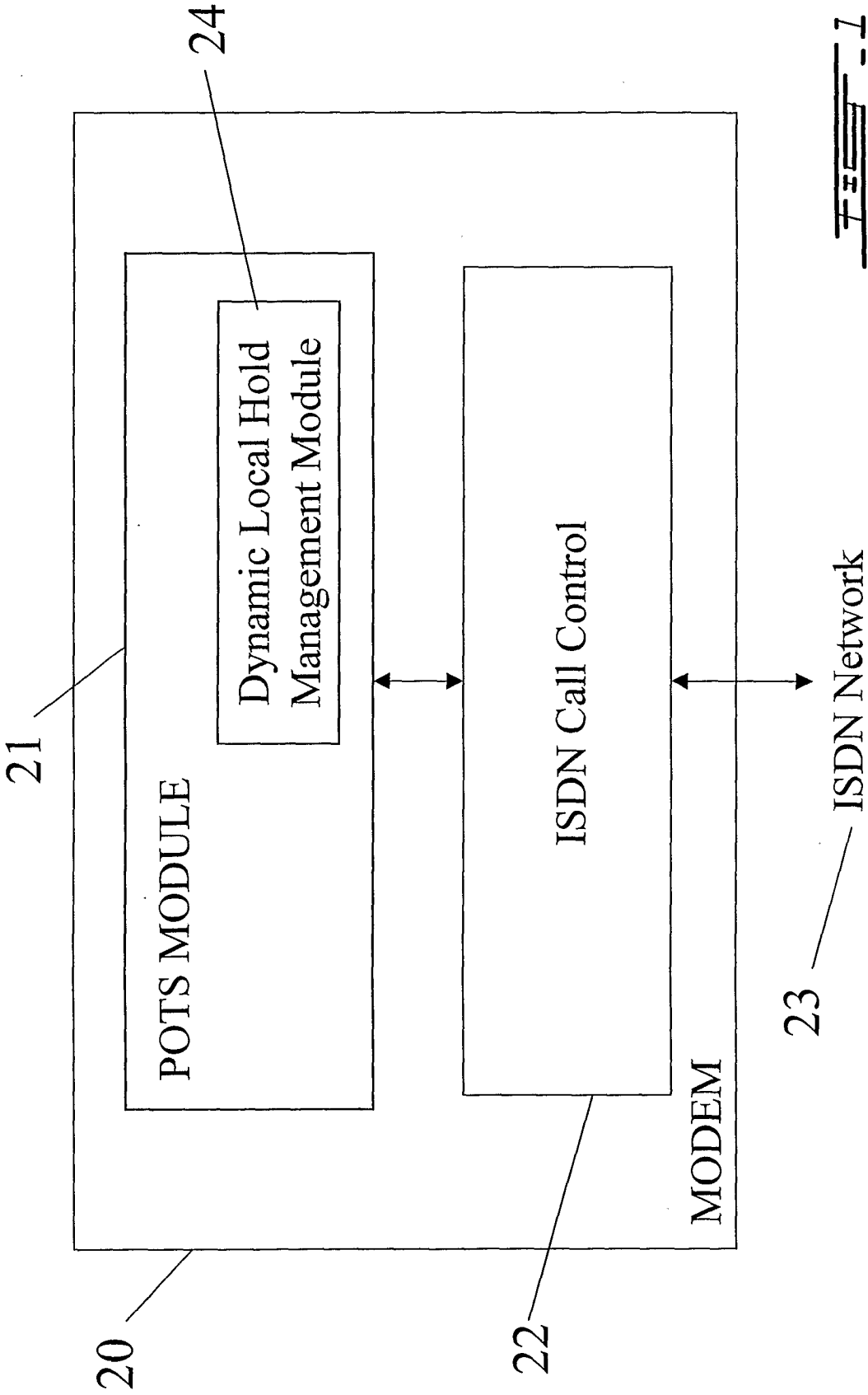
14. An apparatus as claimed in any one of claims 9 to 13, wherein said an external feature status determiner determines the availability of said external feature by the receipt of an acknowledgment message for a feature request that was sent to a switch on said line.

15. An apparatus as claimed in claim 10, wherein:

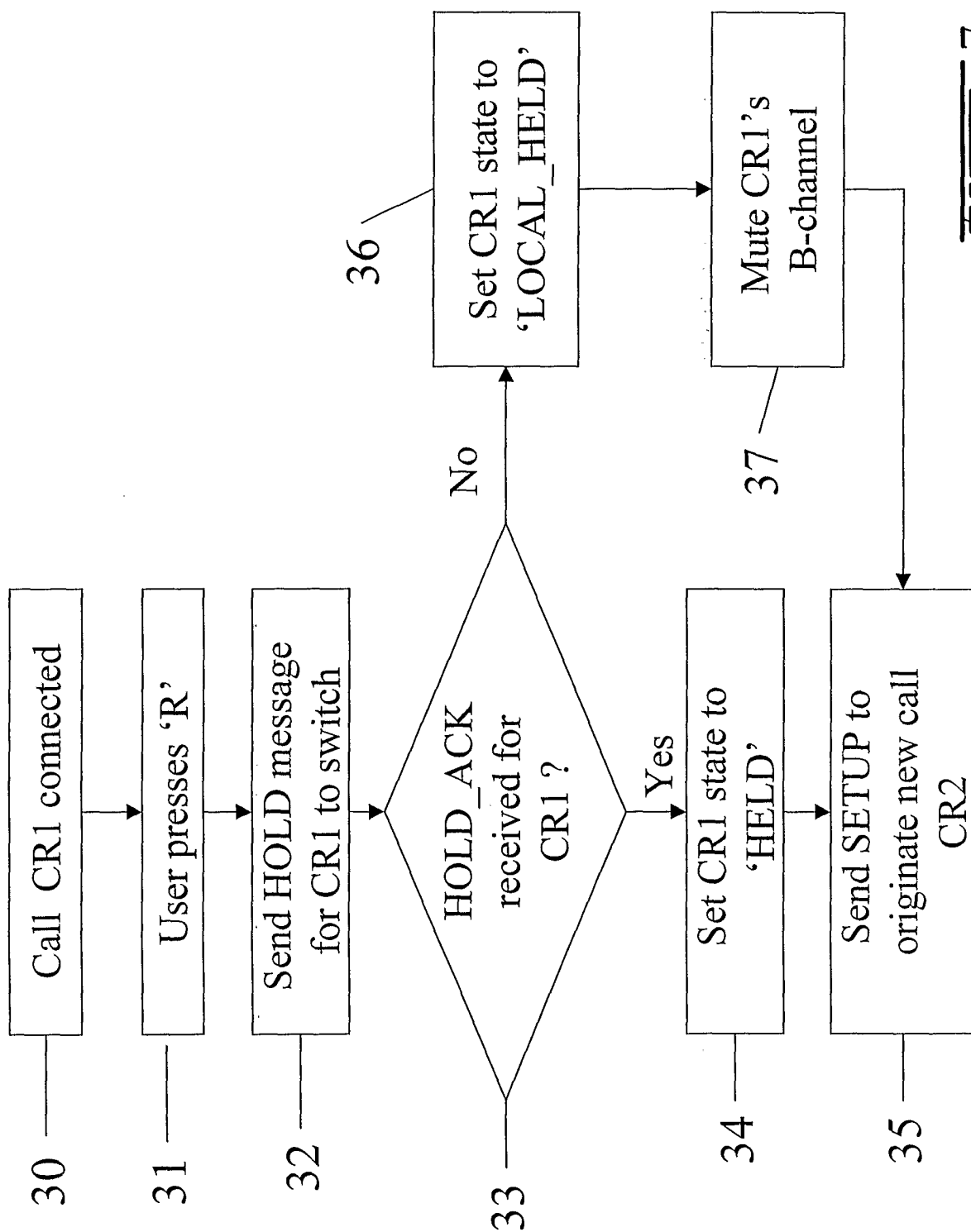
- the feature request receiver receives a user command to hold the first call;
- the external feature requester sends a hold message for the first call to a switch,
- the external feature status determiner sets the first call state to held if an acknowledgment message for a hold request is received for the first call and sets the first call state to local_held if the acknowledgement message for a hold request is not received for the first call;
- the local manager mutes the first call's B-channel and sends a setup message to the switch to originate a second call on the line,
- wherein the first call is held using an external hold if the switch supports

the hold feature and the first call is held using a local hold if the switch does not support the hold feature.

16. A method as claimed in any one of claims 9 to 15, wherein said transmission line is an ISDN line.



2 / 2

FIG. 2