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Integrated Services Digital Network (ISDN) – Call Waiting Supplementary Service

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ATIS-1000613.1991(R2012), *Integrated Services Digital Network (ISDN) – Call Waiting Supplementary Service*

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American National Standard
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Integrated Services Digital Network (ISDN) – Call Waiting Supplementary Service

Secretariat
Exchange Carriers Standards Association

Approved April 8, 1991
American National Standards Institute, Inc.

Contents

Foreword (This Foreword is not part of American National Standard T1.613-1991.)

This standard defines and describes the Call Waiting supplementary service in the context of an Integrated Services Digital Network (ISDN). The Call Waiting service permits a subscriber to be notified of an incoming call with an indication that no interface channel is available. The subscriber then has the choice of accepting, rejecting, or ignoring the waiting call. This service applies to both an ISDN basic rate access and an ISDN primary rate access. It is intended to supplement the basic circuit mode bearer services contained in, *American National Standard for Telecommunications – Integrated Services Digital Network (ISDN) – Circuit mode bearer service category description,* ANSI T1.620.[1)] This standard also includes the interaction of Call Waiting with other ISDN supplementary services.

Manufacturers of ISDN user terminals and manufacturers of ISDN switching equipment can apply this standard to the design and development of their products.

This standard was developed over the past several years by Technical Subcommittee T1S1 of Accredited Standards Committee T1 – Telecommunications. Many of T1S1's participants are also active participants in similar activities of the CCITT. Therefore, this standard is consistent with existing and emerging CCITT recommendations.

Suggestions for improvement of this standard will be welcome. They should be sent to the Exchange Carriers Standards Association, T1 Secretariat; 5430 Grosvenor Lane; Bethesda, MD 20814-2122.

This standard was processed and approved for submittal to ANSI by Accredited Standards Committee T1 – Telecommunications. Committee approval of the standard does not imply that all committee members voted for its approval. At the time it approved this standard, Accredited Standards Committee T1 had the following members:

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[1)] This standard is under development. Contact the secretariat for more information.

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American National Standard for Telecommunications –

Integrated Services Digital Network (ISDN) – Call Waiting Supplementary Service

1 Scope, purpose, and application

1.1 Scope and purpose

This standard is one of a series that defines and describes supplementary services within the context of an Integrated Services Digital Network (ISDN). The interaction of this service with other ISDN services is also included. The purpose of the standard is to allow maximum compatibility among network- and user-owned telecommunication equipment in order to increase the attractiveness and usefulness of ISDN-based capabilities.

1.2 Application

This service applies to both an ISDN basic rate access and ISDN primary rate access and is intended to supplement the basic circuit mode bearer services contained in *American National Standard for Telecommunications – Integrated Services Digital Network (ISDN) – Circuit Mode Bearer Service Category Description*, ANSI T1.620.[1)] It should be used in conjunction with other ISDN standards for ISDN supplementary services for a complete understanding of the interactions between this and other ISDN services.

This supplementary service is applicable to all circuit mode bearer services (see *American National Standard for Telecommunications – Integrated Services Digital Network (ISDN) – Circuit Mode Bearer Service Category Description,* ANSI T1.620[1)]).

2 Normative references

The following standards contain provisions that, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

ANSI T1.113-1988, *Telecommunications – Signaling system number 7 (SS7) – Integrated Services Digital Network (ISDN) user part*

ANSI T1.607-1990, *Telecommunications – Digital Subscriber Signaling System Number 1 (DSS1) – Layer 3 signaling specification for circuit switched bearer service*

ANSI T1.620, *Telecommunications – Integrated Services Digital Network (ISDN) – Circuit mode bearer service category description*[1)]

3 Definitions

Throughout this document, the following terminology will be used.

3.1 B-channel control: A terminal that has B-channel control either has an outgoing call in a state following or including the Overlap Sending state, or is active on a call, or has a call on hold with B-channel reservation.

3.2 bearer service: The services as defined in ANSI T1.620. However, for purposes of subscription parameters and service operation, speech and 3.1-kHz audio may be treated as a single bearer service.

3.3 Network: In this context, "network" refers to all telecommunications equipment that has any part in processing a call or a supplementary service for the user referred to. It may

include local exchanges, transit exchanges, and NT2s, but does not include the ISDN terminal and is not limited to the "public" network or any particular piece of equipment.

3.4 No Answer Timer T2: As a network-provider option, this optional timer specifies the period the network will wait for a response (answer) from one of the terminals at Subscriber B's access to the offered call from User C. This is the same timer as described in T1.620.

3.5 Response Timer T1: Specifies the period the network will wait for a positive response from a terminal at Subscriber B's access to the offered call. This is the same timer as described in T1.620.

3.6 service provider: A company, organization, administration, or business, etc., that sells, administers, maintains, charges for, etc., the service. The service provider may or may not be the provider of the service.

3.7 Subscriber B: The set of terminals on a particular interface capable of accepting calls for the ISDN number and bearer service that is subscribed to the Call Waiting service.

3.8 Subscriber B's access: The ISDN interface to which all terminals of Subscriber B are connected.

3.9 User A: A user who is engaged in a call that occupies one of the channels on Subscriber B's access. (There may be multiple User A's, and each call can be in any state.)

3.10 User C: The user who has originated a call to Subscriber B that causes the Call Waiting service to be invoked.

3.11 waiting call: A call directed to an ISDN number and bearer service offered using the Call Waiting procedures. A call ceases to be a waiting call when the call is cleared or when the call is answered.

4 Description of Call Waiting from the user's perspective

The Call Waiting service permits a subscriber to be notified of an incoming call with an indication that no interface information channel is available. The subscriber then has the choice of accepting, rejecting, or ignoring the waiting call.

This clause defines Call Waiting in terms of procedures and other aspects visible to the user or users without regard to the means of implementation. It describes interworking with non-ISDNs and interactions between Call Waiting and other ISDN services. This clause provides a prose description and a diagrammatic description of Call Waiting in the form of a Specification and Description Language Diagram.

4.1 Description

Call Waiting is applicable when an incoming call is received by the called subscriber and no channel is available to connect the call. A check is made to determine the maximum number of calls that are allowed and the maximum number of calls that can be waiting. If neither of these maximums is exceeded, then call waiting may be invoked. The called party may then ignore, reject, or accept the waiting call. Ignoring the call leaves it to network timers or the calling party to initiate a release of the waiting call. Rejection of the call invokes normal network release procedures. If the called party accepts the call, then a channel must be made available for the waiting call. This can be done in several ways such as holding an active call, releasing an active call, or releasing a previously held call. Finally, an option allowed in the service may provide an indication to the calling party that his or her call is a waiting call.

The ISDN Call Waiting service allows notification to the called subscriber of the incoming call to be out-of-band, and this is the assumed case for this description.

In addition, as a service provider option available on a subscription basis, in-band tones may also be provided to the called subscriber to indicate a waiting call. The determination of how to apply these tones (i.e., the nature of the tone, the timing, which information channel to apply the tone to, and for which Bearer Services) is an option of the service provider and is not described in this standard. This subscription option may be used by users to avoid disruption of a call (i.e., voiceband data calls).

4.2 Procedures

4.2.1 Provision/withdrawal

Call Waiting can be provided on a subscription basis or, as a service provider option, can be provided to some or all users without subscription. Call Waiting can be withdrawn for administrative reasons or at the request of the subscriber.

As a part of each applicable bearer service, there is an option specifying the maximum number of information channels that can be used (occupied) on the interface either for each ISDN number, all numbers, or subsets of numbers for that bearer service. A call waiting condition occurs (and the Call Waiting service is invoked) only when an attempt is made to exceed this limit.

As a service provider option, Call Waiting can be offered with several subscription options. The options apply separately to each ISDN number and bearer service combination. Subscription options that can be specified per ISDN number and bearer service are given in table 1. Those that can be specified for each number and bearer service, all numbers and bearer service, or subsets of numbers and bearer service are given in table 2.

The following additional two subscription parameters, described as a part of each circuit mode bearer service, also affect the operation of Call Waiting:

- maximum number of total calls that can be handled (e.g., active, held, alerting, waiting) for each ISDN number and bearer service on a given interface;
- maximum number of information channels available to each ISDN number or group of numbers per bearer service.

4.2.2 Normal procedures

4.2.2.1 Activation/deactivation

Activation and deactivation can be provided by subscription, or as a service provider option, can be provided to some or all users without subscription.

4.2.2.2 Invocation and operation

Figure 1 shows an overall SDL diagram for the invocation and operation of the Call Waiting service.

Table 1 – Subscription options for Call Waiting (per number and bearer service)

Subscription options	Values
Call Waiting assigned	No Yes
Calling user receives notification their call is waiting	No Yes
Called user receives in-band notification	Yes No

Table 2 – Subscription options for Call Waiting (per ISDN number and bearer service, all ISDN numbers and bearer service, or subsets of ISDN numbers and bearer service)

Subscription option	Values
Maximum number of calls that can be waiting	1 to N, where the maximum value of "N" is a service provider option

4.2.2.2.1 Invocation

When an incoming call from User C arrives at the access of Subscriber B and encounters the channels busy condition without a network-determined user busy condition, then the Call Waiting service shall be invoked and the call shall be offered to Subscriber B with an indication that the channels busy condition exists.

4.2.2.2.2 Indication

If a response is received from a terminal at Subscriber B's access, within the normal basic call period, that Subscriber B is being informed about the incoming call, then User C shall be given an indication that the called subscriber is being informed of the incoming call if Subscriber B subscribes to the "Calling user receives notification their call is waiting" option. The optional timer T2 may be started when Subscriber B is informed of the incoming call. As

a service provider option and a network provider option, a call waiting indication may be included in the alerting indication provided to User C. Delivery of call waiting notification to User C is dependent on all intermediate networks supporting the option to deliver the notification.

4.2.2.2.3 Clearing an existing call and then accepting a waiting call

If one of the terminals on Subscriber B's access terminates a call with User A before the expiry of the optional No Answer Timer T2, then the User A call shall be released in the normal manner. Any compatible terminal on Subscriber B's access shall then be able to accept the waiting call from User C.

If one of the terminals on Subscriber B's access terminates a held call, any compatible terminal on Subscriber B's access shall be able to accept the waiting call, subject to the channel reservation restrictions of the Call Hold service.

4.2.2.2.4 Holding an existing call and then accepting a waiting call

If one of the terminals on Subscriber B's access holds an active call with User A before the expiry of the optional No Answer Timer T2, the call shall be held in the normal manner. Any compatible terminal on Subscriber B's access shall then be able to accept the waiting call from User C, subject to the channel reservation restrictions of Call Hold.

4.2.2.2.5 Accepting a waiting call if User A terminates

If User A terminates a call with one of the terminals on Subscriber B's access before the expiration of the optional No Answer Timer T2, the call shall be released in the normal manner. Any compatible terminal on Subscriber B's access shall then be able to accept the waiting call from User C.

If the call that was released was a held call, any compatible terminal on Subscriber B's access shall be able to accept the waiting call, subject to the channel reservation restrictions of the Call Hold service.

4.2.3 Exceptional procedures

4.2.3.1 Activation/deactivation/registration

None identified.

4.2.3.2 Invocation and operation

4.2.3.2.1 Incoming call from User C ignored by Subscriber B

If the optional No Answer Timer T2 expires without any acceptance from Subscriber B of the incoming call, then the network shall inform Subscriber B that the call is no longer waiting and also inform User C that the call cannot be connected. Normal release procedures apply and an appropriate indication shall be given to User C.

4.2.3.2.2 Incoming call from User C rejected by Subscriber B

A rejection of the waiting call by one of the terminals on Subscriber B's access shall not stop the optional No Answer Timer T2, as another terminal may subsequently accept the waiting call within the remainder of the specified period. Such a rejection shall, however, cancel any indication provided to that rejecting terminal.

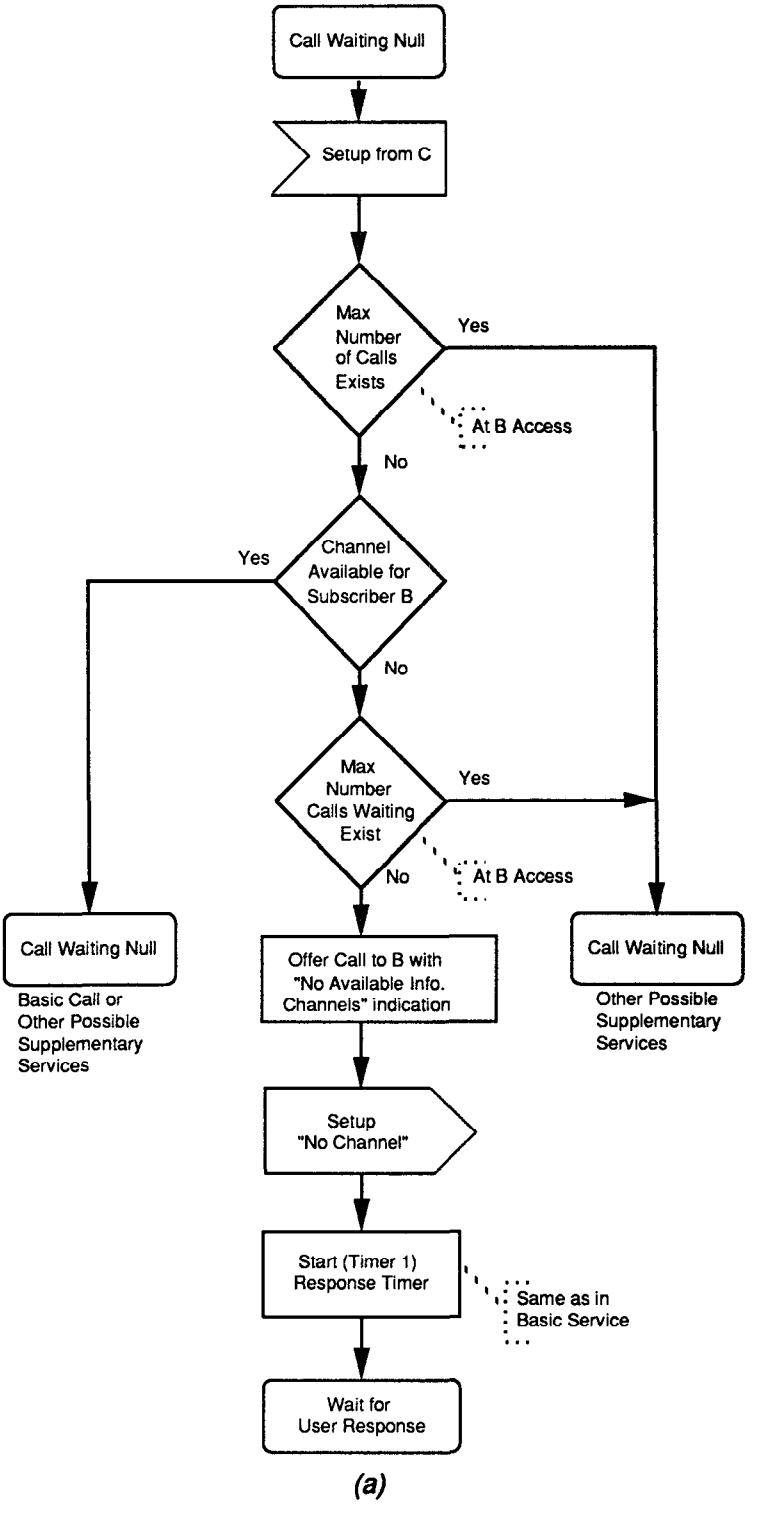
If rejections of a waiting call have been received from all those terminals that responded with an alerting indication before the expiry of the No Answer Timer T2, then the network shall inform User C that this call cannot be connected. Normal release applies to the call attempt from User C, with the call being cleared indicating user rejection. Subscriber B shall be notified that the call is no longer waiting.

4.2.3.2.3 Release by User C within the specified period

If User C informs the network, before the expiration of the optional No Answer Timer T2, that he or she wishes to release this call attempt to Subscriber B, then the network shall inform Subscriber B of this situation and complete the release of the call attempt from User C.

4.2.3.2.4 No positive response from terminals at Subscriber B's interface

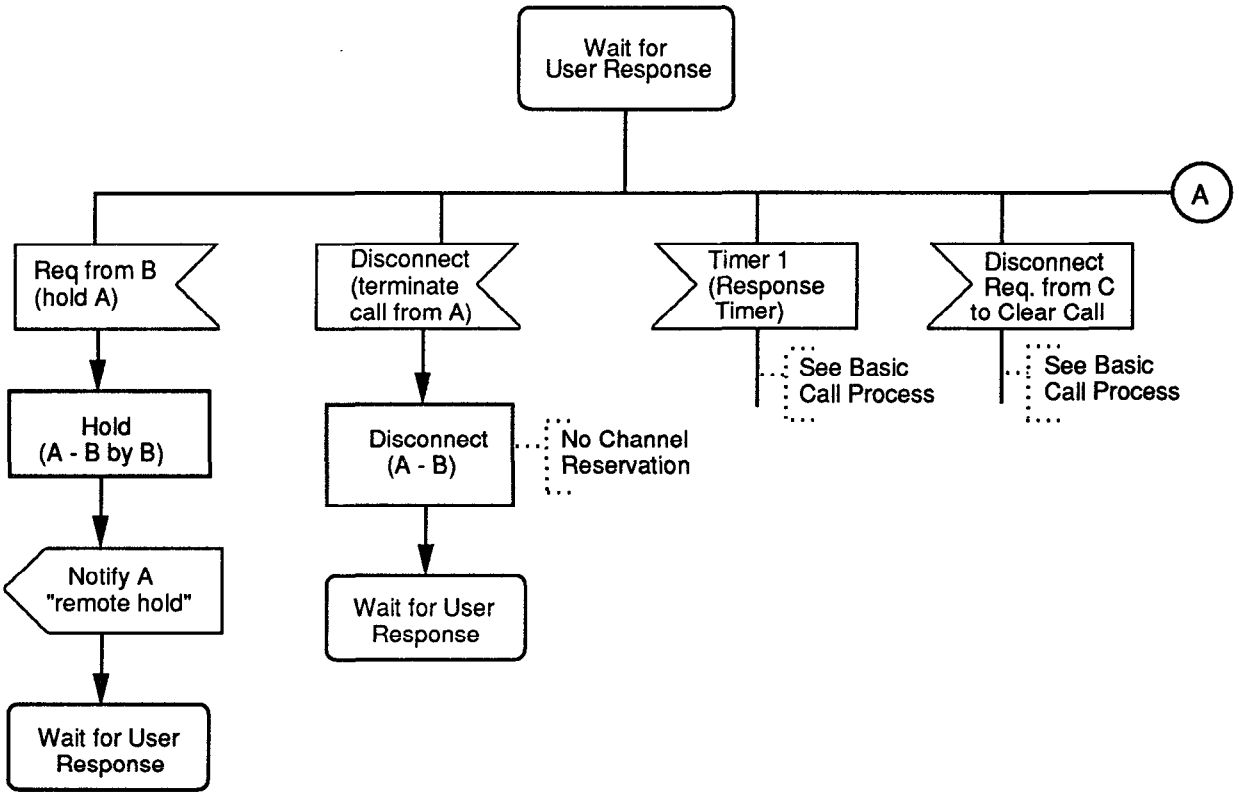
If no positive response that Subscriber B is being informed of the waiting call is received from any terminal at Subscriber B's access during the normal call period (Response Timer T1), then the network shall release the call attempt from User C and give User C the reason for the release.



(a)

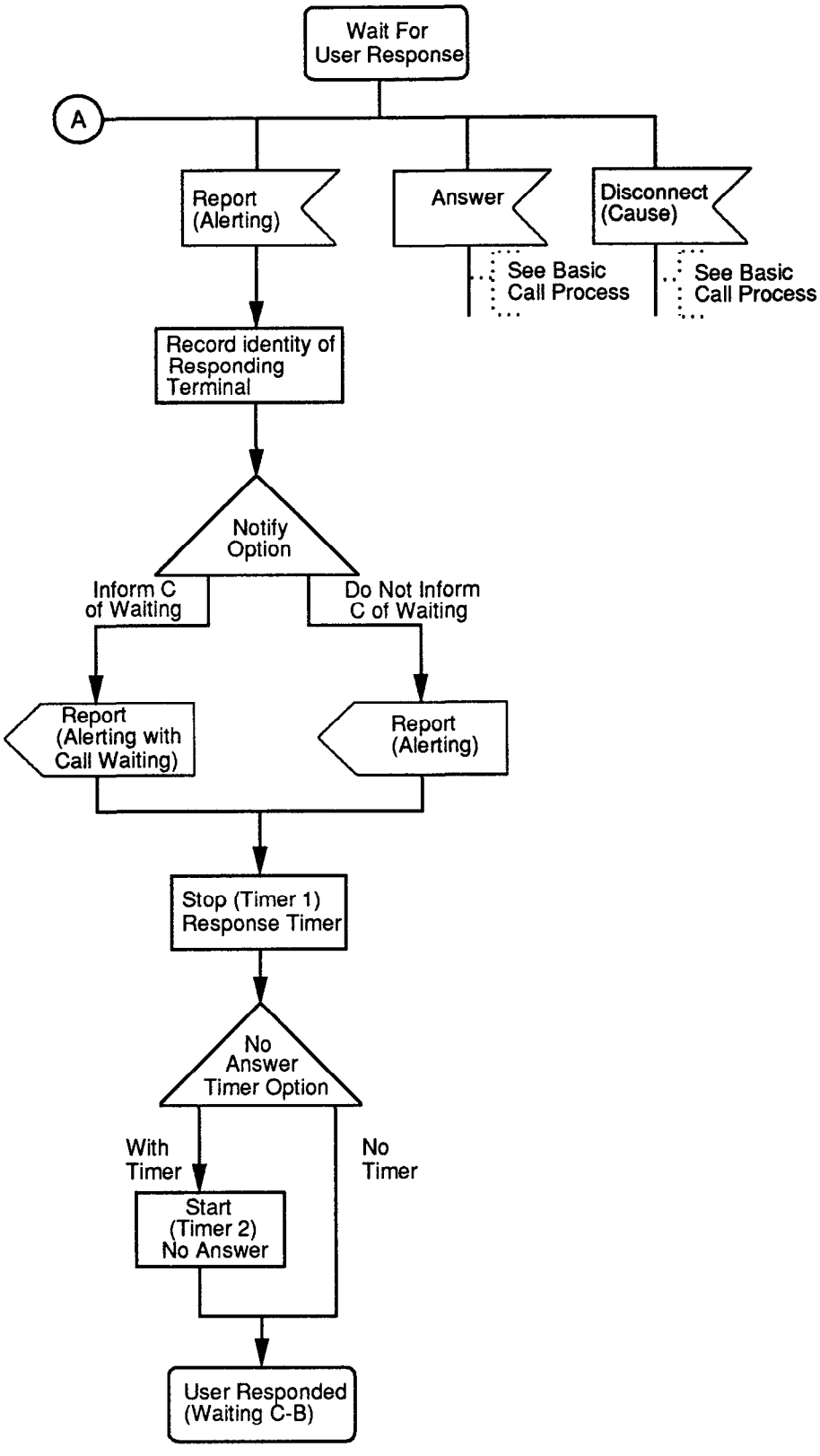
NOTE – A is User A;
B is User B;
C is User C.

Figure 1 – Overall SDL diagram of Call Waiting



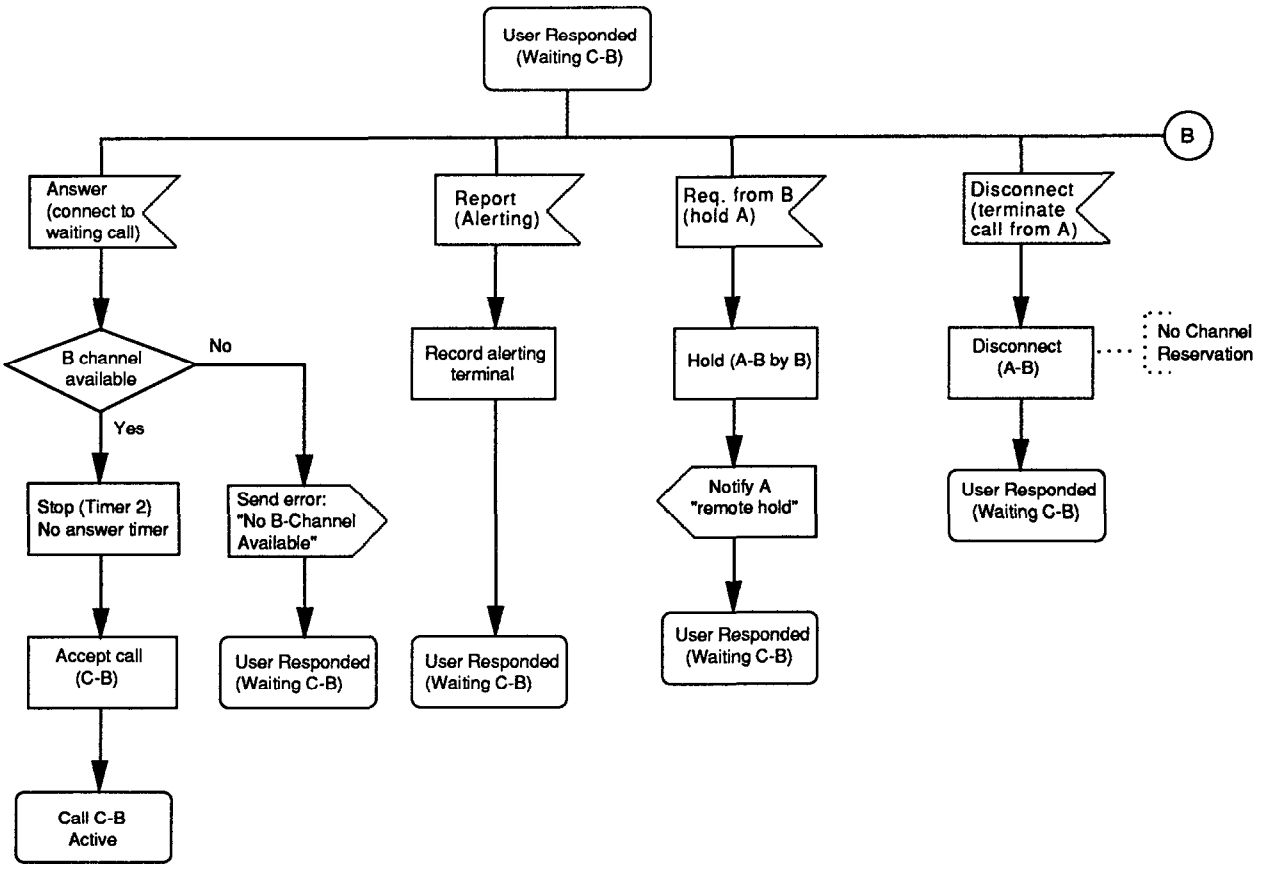
(b)

Figure 1 *(continued)*



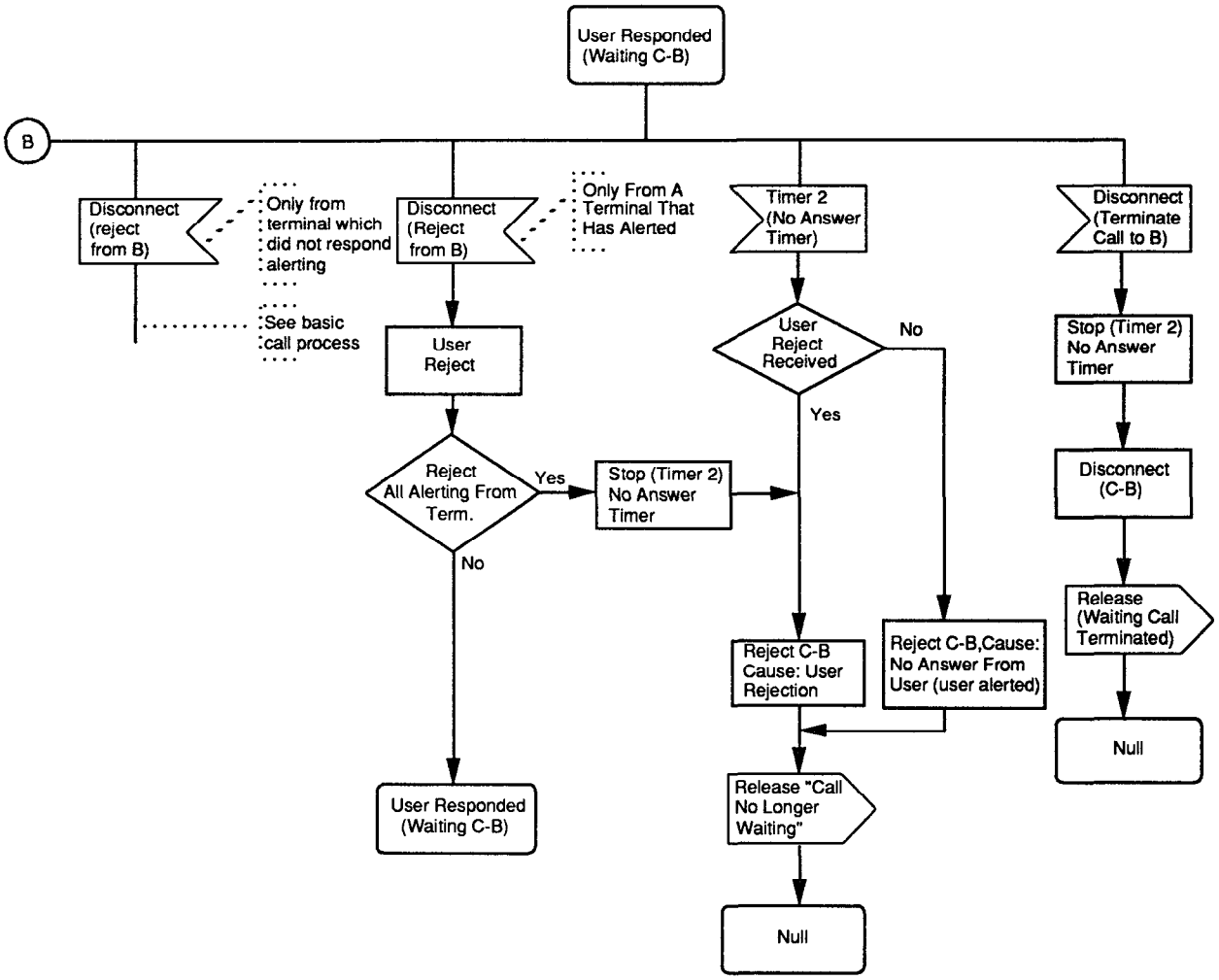
(c)

Figure 1 *(continued)*



(d)

Figure 1 *(continued)*



(e)

Figure 1 *(concluded)*

4.2.3.2.5 No resources available

If one of the terminals on Subscriber B's access accepts a call and network resources do not exist to complete the call (i.e., no information channels are available), the network shall indicate an error to that terminal. The network shall not clear the call but shall wait for another indication of acceptance from another terminal on Subscriber B's access until User C clears the call or the optional No Answer Timer T2 expires.

4.3 Interworking considerations

4.3.1 ISDN-served user: Non-ISDN calling user

No interworking situations exist beyond those required for communications with respect to the basic call. If an ISDN Subscriber B receives a call from a non-ISDN calling party, the network shall send the Call Waiting indication to Subscriber B in the normal way. A non-ISDN calling party may not be capable of receiving the optional notification that the call is waiting.

4.3.2 Non-ISDN Served Party: ISDN calling party

Not applicable, since a non-ISDN served party shall not be able to subscribe to ISDN Call Waiting.

4.4 Interactions with other supplementary services

When multiple supplementary services are allowed by subscription parameters and are or may be invoked on the same call, the interactions between their operations are as follows:

4.4.1 Call Waiting

Not applicable.

4.4.2 Calling Line Identification Presentation

The Calling Line Identification Presentation (CLIP) and Call Waiting services do not affect each other's operation. If presentation is allowed, it shall be made along with the notification of a Call Waiting.

4.4.3 Calling Line Identification Restriction

The Calling Line Identification Restriction (CLIR) and Call Waiting services do not affect each other's operation.

4.4.4 Call Hold

When Subscriber B receives a Call Waiting indication, it may be possible to use the Call Hold service to hold an established call and then to answer the waiting call.

It shall not be possible for Subscriber B to place a waiting call on Hold. It must first be accepted (answered).

4.5 Network capabilities for charging

It shall be possible for either the service provider or the network provider to charge accurately for this service.

5 Functional capabilities and information flows needed for Call Waiting service

This clause identifies a way of dividing the overall functionality for the Call Waiting service into functional units, each of which could be placed in one location. The overall functionality results from communication between the functional units (called "entities") using information flows, which are also identified in this clause. An information flow is an abstraction that is subsequently realized in clauses 6 through 8 by means of additions to existing signaling system messages or by new messages. Finally, this clause identifies several ways in which the functional entities of the Call Waiting services can be located in specific network or user equipment.

5.1 Functional entity model for the Call Waiting service

This clause identifies a way of partitioning the Call Waiting service functionality into functional entities and identifies actions that occur in each functional entity. Each functional entity is an abstract representation that could be implemented in more than one kind of telecommunications equipment (e.g., in terminal equipment, in a local switching machine, or in a database). Functional entities have been defined to cover the most complex scenario (see 5.3) for which information flows have been defined. Functional entities may be combined in a single piece of telecommunications equipment, and for some scenarios may not

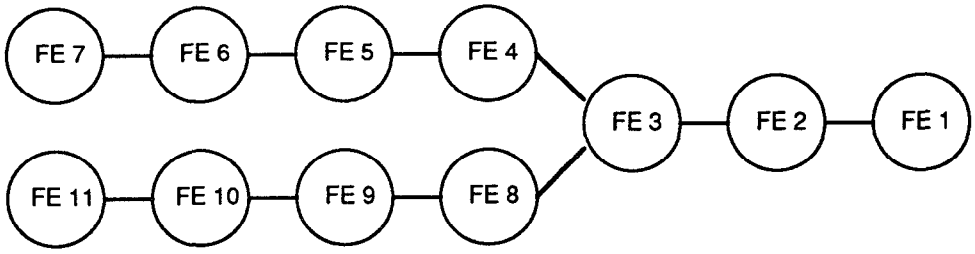


Figure 2 – Functional Entity model for the Call Waiting service

exist at all. Figure 2 shows the Call Waiting service functional model. See table 3 of 5.3 for an identification of different plans, called "scenarios", for allocating the functional subdivision of the Call Waiting service to specific network or user equipment.

5.1.1 Description of Functional Entity 1

Functional Entity 1 provides the following functionality in support of the users at the called interface and FE2:

- receives and processes calls from FE2 that have an indication that a channels busy condition exists;
- provides an indication to FE2 that a Subscriber B is being informed about the incoming call;
- accesses the service-providing capabilities of FE2 by way of service requests, for example, by issuing
  - a "hold existing call" request;
  - a "terminate existing call" request;
  - a "clear waiting call" request;
  - a "retrieve held call" request;
  - a "connect to a waiting call" request.
- Receives and processes functional indications relating to a call from FE2 and relays them to the users at Subscriber B's access. For example, FE1 may receive
  - a "hold" confirmation;
  - a "retrieve" confirmation;
  - an "existing call clearing" confirmation;
  - a "waiting call is clearing" indication or confirmation;
  - a "connect to a waiting call " confirmation.

5.1.2 Description of Functional Entity 2

Functional Entity 2 provides the following functionality in support of FE1, FE7, and FE11:

- When an incoming call from FE11 is received, FE2 determines if a call waiting condition exists at FE1's interface;
- When a call waiting condition exists, FE2 offers a call to FE1 with an indication that a "channels busy condition" exists;
- When an indication is received from FE1 that a Subscriber B is being informed about the waiting call, FE2 may send an optional notification that the Call Waiting service is in operation towards FE11;
- When a user at FE holds an existing call with FE7, FE2
  - receives the hold service request from FE1, verifies the request, and relays appropriate information towards FE7;
  - performs the hold function;
  - provides the optional sending of a hold notification towards FE7;
  - sends hold confirmation to FE1;
  - reserves a B-channel, if appropriate.
- When a user at FE1 clears an existing call with FE7, FE2
  - receives a call-clearing request for an existing call with FE7 from FE1;

– processes the clearing of the FE1↔ FE7 call towards both FE1 and FE7.

– It clears the waiting call from FE11 to FE1 if the No Answer Timer T2 expires before an acceptance is received from any Subscriber B of the waiting call;

– It clears the waiting call from FE11 to FE1 if the waiting call is rejected by all of the terminals that responded with an alerting indication;

– It clears the waiting call from FE11 to FE1 if a release indication is received from FE11 prior to the expiration of the No Answer Timer T2;

– It receives and verifies connection requests from FE1 to the waiting call from FE11. The waiting call is connected to the appropriate Subscriber B terminal and a connection indication is sent towards FE11.

5.1.3 Description of Functional Entity 3

Functional Entity 3 provides the functional support of a possible Local Exchange (LE) connection for a Network Termination 2 (NT2) at FE2, when FE1 is connected to this NT2. FE3 may or may not exist, depending upon the allocation of equipment scenario for which the Call Waiting service is being applied (see 5.3). FE3 provides the following functionality in support of FE2, FE7, and FE11:

– It receives the optional notification of a Call Hold and optional notification of retrieval from FE2, and optionally relays them toward FE7;

– It receives the optional notification that a call is waiting at Subscriber B's access from FE2, and optionally relays this toward FE11;

– On receipt of a clearing request for the waiting call from FE2, FE3 relays the clearing request toward FE11;

– On receipt of a clearing request for an existing call from FE2, FE3 relays the clearing request toward FE7;

– On receipt of a connection request for the waiting call from FE2, FE3 relays the connection request toward FE11;

– On receipt of a clearing indication from FE7 or FE11, FE3 relays the clearing indication toward FE2.

5.1.4 Description of Functional Entities 4, 5, and 6

Functional Entity 4 provides the functional support of a possible Transit Network between FE1 and FE7. Functional Entity 5 provides the functional support of a possible local exchange connection for FE6 or FE7. Functionality Entity 6 may provide the functional support of an NT2 connection for FE7. FE4, FE5, and FE6 may or may not exist, depending upon the allocation of equipment scenario for which the Call Waiting service is being applied (see 5.3). Functional Entities 4, 5, and 6 provide the following functionality in support of FE2 and FE7:

– They receive the optional notification of hold and optional notification of retrieval from FE2 and optionally relay them toward FE7;

– On receipt of a clearing request for an existing call from FE2, they relay the clearing request toward FE7;

– On receipt of a clearing request for an existing call from FE7, they relay the clearing request toward FE2.

5.1.5 Description of Functional Entity 7

Functional Entity 7 provides the following functionality in support of User A and FE2:

– It receives the optional notification of hold and optional notification of retrieval from FE2 and optionally informs (relays these notifications to) User A;

– On receipt of a clearing request for the existing FE ↔ FE7 call from FE2, it informs (relays this clearing request) User A.

5.1.6 Description of Functional Entities 8, 9, and 10

Functional Entity 8 provides the functional support of a possible Transit Network between FE1 and FE11. Functional Entity 9 provides the functional support of a possible Local Exchange connection for FE10 or FE11. Functional Entity 10 may provide the functional support of an NT2 connection for FE11. FE8, FE9, and FE10 may or may not exist, depending upon the allocation of equipment scenario for which the Call Waiting service is being

applied (see 5.3). Functional Entities 8, 9, and 10 provide the following functionality in support of FE2 and FE11:

– They receive the optional notification that a call is waiting at Subscriber B's access from FE2 and optionally relay this notification toward FE11;

– On receipt of a clearing request for the waiting call from FE2, they relay this clearing request toward FE11;

– On receipt of a connection request for the waiting call from FE2, they relay this connection request toward FE11;

– On receipt of a clearing indication from FE11, they relay this clearing indication toward FE2.

5.1.7 Description of Functional Entity 11

Functional Entity 11 provides the following functionality in support of User C and FE2:

– It receives the optional notification that a call is waiting at Subscriber B's access from FE2 and optionally informs (relays this notification to) User C;

– On receipt of a clearing request for the waiting call from FE2, it informs (relays this clearing request to) User C;

– On receipt of a connection request for the waiting call from FE2, it informs (relays this connection request to) User C.

5.2 Information flow model for the Call Waiting service

Figures 3 and 4 provide two examples of a high-level view of the sequence of information passed between functional entities, the types of information passed between functional entities, and the actions performed within the functional entities to support Call Waiting.

5.3 Allocation of functions to equipment

Table 3 identifies a number of different plans, called "scenarios", for allocating the functional subdivision of the Call Waiting service to specific network or user equipment. Each scenario implicitly identifies which protocol is used by the Call Waiting service information flows. Functional Entities 3, 4, 5, 6, 8, 9 and 10 may not exist for the identified scenarios.

The variations shown (1 through 30) are applicable to Scenarios 1, 2, and 3 (they show the various combinations of existence or lack of existence of FE4, FE5, FE6, FE8, FE9, and FE10).

FE1, FE7, and FE11 are the functional entities that support the users of the Call Waiting service. FE1 provides the functional support of Subscriber B, FE7 provides the functional support of User A, and FE11 provides the functional support of User C.

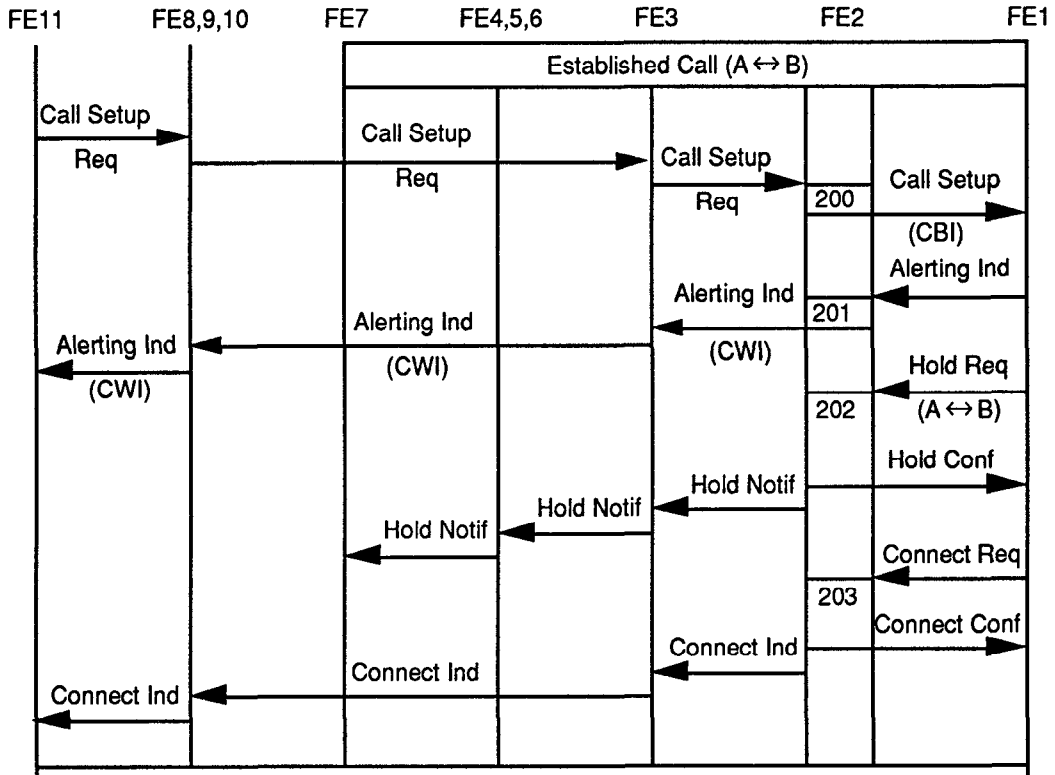
FE2 is the Functional Entity that provides the network aspects of the Call Waiting service.

FE3, FE4, FE5, FE6, FE8, FE9, and FE10 are Functional Entities that need not exist in all variations of each scenario. For each of the scenarios, there are possible representations in which one or more of these Functional Entities is not present.

5.3.1 Scenario 1

One representative of this scenario would be an ISDN terminal (supported at FE1) connected via either a point-to-point or a point-to-multipoint data link on a Basic Rate Interface to an ISDN PBX (supported at FE2). For this example, Subscriber B consists of a single ISDN terminal and the ISDN PBX provides the Call Waiting service. The ISDN terminal may receive call waiting indications from the ISDN PBX and may use any of the methods described in 4.2.2.2 to accept a waiting call. Notification of a waiting call sent to a calling user would be provided by the ISDN PBX.

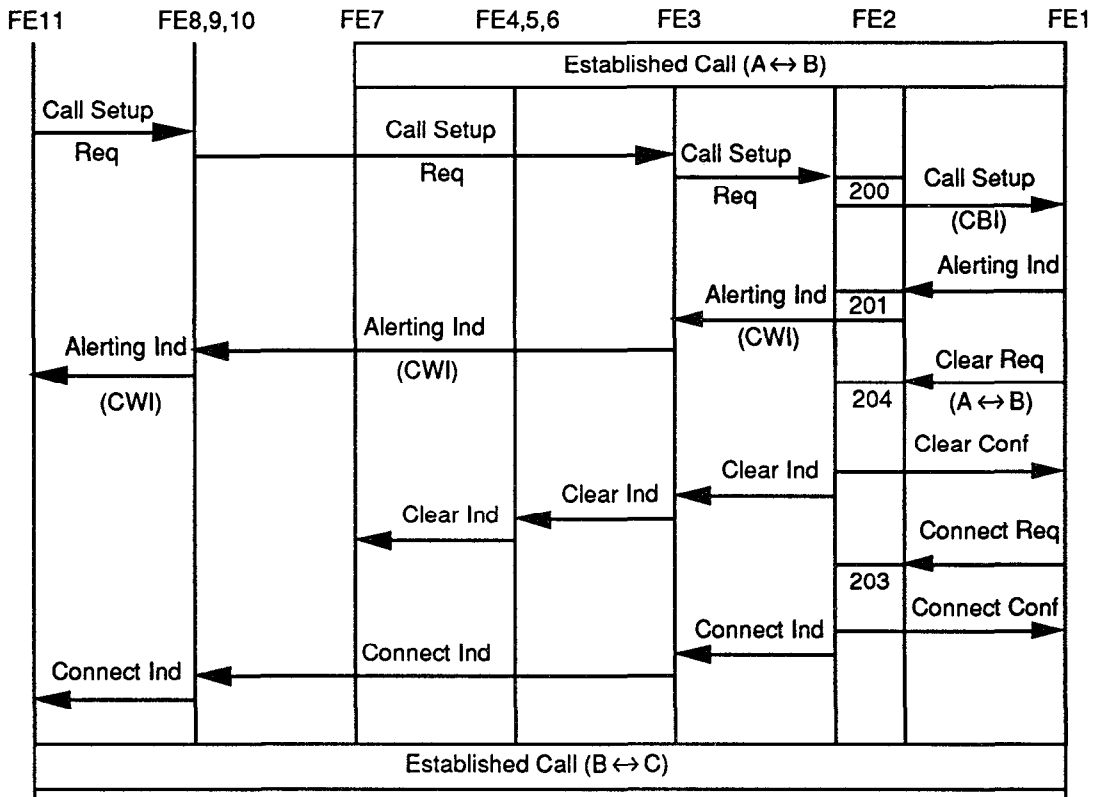
Note that in this representation, there is a normal call delivery (i.e., not a call waiting indication) between the Local Exchange (supported at FE3) and the ISDN PBX (supported at FE2) of a call from User C (supported at FE11). The call waiting condition is occurring behind the ISDN PBX (i.e., between the ISDN PBX and its attached ISDN terminal). This scenario shows the Local Exchange (FE3) accepting (and passing on to User C) an optional call waiting indication that may be included in an alerting indication from the ISDN PBX.



NOTE – CBI is Channels Busy Indication;
CWI is Call Waiting Indication;
Req is Request;
Ind is Indication;
Conf is Confirmation;
Notif is Notification.

Functional entity actions:
– 200: Determines that a call waiting condition exists and, if so, sends the Call Setup Request with a "Channels Busy" condition.
– 201: When an indication is received from FE1 that a Subscriber B is being informed about the incoming call, determines if an optional notification of the call waiting operation should be sent to FE11.
– 202: Verifies user subscription to Call Hold. Interrupts the B-channel communication between FE1 and FE2 for the indicated call. Reserves a B-channel for the served user, if applicable.
– 203: Verifies the connection request and B-channel selection and connects the waiting call from FE11.

Figure 3 – Holding an existing call and then accepting a waiting call



NOTE – CBI is Channels Busy Indication;
CWI is Call Waiting Indication;
Req is Request;
Ind is Indication;
Conf is Confirmation;
Notif is Notification;

Functional entity actions:
– 200: Determines that a call waiting condition exists and, if so, sends the Call Setup Request with a "Channels Busy" condition.
– 201: When an indication is received from FE1 that a Subscriber B is being informed about the incoming call, determines if an optional notification of the call waiting operation should be sent to FE11.
– 203: Verifies the connection request and B-channel selection and connects the waiting call from FE11.
– 204: Processes the request to clear the established A ↔ B call. Clears the call in both the FE1 and FE7 directions.

Figure 4 – Clearing an existing call and then accepting a waiting call

Table 3 – Call Waiting service scenarios

	FE11	FE10	FE9	FE8	FE7	FE6	FE5	FE4	FE3	FE2	FE1
Scenario 1	TE	NT2	LE	TR	TE	NT2	LE	TR	LE	NT2	TE
Scenario 2	TE	NT2	LE	TR	TE	NT2	LE	TR	–	LE	TE
Scenario 3	TE	NT2	LE	TR	TE	NT2	LE	TR	–	LE	NT2
Variation 1	TE	–	LE	TR	TE	NT2	LE	TR	X	X	X
Variation 2	TE	–	LE	–	TE	NT2	LE	TR	X	X	X
Variation 3	TE	–	–	–	TE	NT2	LE	TR	X	X	X
Variation 4	TE	NT2	LE	–	TE	NT2	LE	TR	X	X	X
Variation 5	TE	NT2	–	–	TE	NT2	LE	TR	X	X	X
Variation 6	TE	–	LE	TR	TE	–	LE	TR	X	X	X
Variation 7	TE	–	LE	–	TE	–	LE	TR	X	X	X
Variation 8	TE	–	–	–	TE	–	LE	TR	X	X	X
Variation 9	TE	NT2	LE	–	TE	–	LE	TR	X	X	X
Variation 10	TE	NT2	–	–	TE	–	LE	TR	X	X	X
Variation 11	TE	–	LE	TR	TE	NT2	LE	–	X	X	X
Variation 12	TE	–	LE	–	TE	NT2	LE	–	X	X	X
Variation 13	TE	–	–	–	TE	NT2	LE	–	X	X	X
Variation 14	TE	NT2	LE	–	TE	NT2	LE	–	X	X	X
Variation 15	TE	NT2	–	–	TE	NT2	LE	–	X	X	X
Variation 16	TE	–	LE	TR	TE	–	LE	–	X	X	X
Variation 17	TE	–	LE	–	TE	–	LE	–	X	X	X
Variation 18	TE	–	–	–	TE	–	LE	–	X	X	X
Variation 19	TE	NT2	LE	–	TE	–	LE	–	X	X	X
Variation 20	TE	NT2	–	–	TE	–	LE	–	X	X	X
Variation 21	TE	–	LE	TR	TE	NT2	–	–	X	X	X
Variation 22	TE	–	LE	–	TE	NT2	–	–	X	X	X
Variation 23	TE	–	–	–	TE	NT2	–	–	X	X	X
Variation 24	TE	NT2	LE	–	TE	NT2	–	–	X	X	X
Variation 25	TE	NT2	–	–	TE	NT2	–	–	X	X	X
Variation 26	TE	–	LE	TR	TE	–	–	–	X	X	X
Variation 27	TE	–	LE	–	TE	–	–	–	X	X	X
Variation 28	TE	–	–	–	TE	–	–	–	X	X	X
Variation 29	TE	NT2	LE	–	TE	–	–	–	X	X	X
Variation 30	TE	NT2	–	–	TE	–	–	–	X	X	X

NOTE – TE is Terminal Equipment;
NT2 is Network Termination - Type 2,
LE is Local Exchange;
TR is Transit Exchange;
"–" (dash) - This FE does not exist for this scenario or variation;
X applies to scenarios 1, 2, and 3

5.3.2 Scenario 2

One representation of this scenario would be an ISDN terminal (supported at FE1) connected (via either a point-to-point or a point-to-multipoint data link on a Basic Rate Interface) to a Local Exchange (supported at FE2). For this example, Subscriber B consists of a single ISDN terminal and the Local Exchange is providing the Call Waiting service. The ISDN terminal may receive call waiting indications and may use any of the methods described in 4.2.2.2 to accept a waiting call. Notification of a waiting call sent to a calling user would be provided by the Local Exchange.

5.3.3 Scenario 3

One representation of this scenario would be an ISDN PBX (supported at FE1) connected (via a point-to-point data link on either a Basic or Primary Rate Interface) to a Local Exchange (supported at FE2). The ISDN PBX is the Subscriber B, and the Local Exchange is providing the Call Waiting service. The ISDN PBX may receive call waiting indications and may use any of the methods described in 4.2.2.2 to accept a waiting call. Notification of a waiting call sent to a calling user would be provided by the Local Exchange.

6 Switching and signaling specifications for the Call Waiting service at the user/network interface

This clause contains the detailed specifications of switching and signaling capabilities for the Call Waiting service. This clause identifies the Digital Subscriber Signaling System No. 1 (DSS1) messages and procedures needed to support the functional entity actions for the scenarios described in clause 5.

6.1 Formats and codings for Call Waiting

This clause identifies the D-channel call control messages, information elements, and codepoints needed for the Call Waiting service. A "*" denotes an undefined maximum length that may be network- or service-dependent.

6.1.1 Messages

A description of the message structure can be found in clause 3 of ANSI T1.607.

6.1.1.1 ALERTING message

Message type: ALERTING
Significance: global
Direction: both

Information element	Reference	Type	Length
Protocol discriminator	4.2/ANSI T1.607	M	1
Call reference	4.3/ANSI T1.607	M	2–*
Message type	4.4/ANSI T1.607	M	1
Channel identification	4.5.12/ANSI T1.607	O (Note 1)	2–*
Notification indicator	6.1.2.3/ANSI T1.613	O (Note 2)	3
Other information elements as described in 3.1.1 of ANSI T1.607			

NOTES

1 The Channel identification information element is not mandatory even if the ALERTING message is the first response to the SETUP message when sent in the user-to-network direction.

2 The Notification indicator information element is optionally sent to the calling party to indicate that their call is a waiting call. This information element would be provided in the user-to-network direction when the indicator is provided by an NT2 (see 5.3). See 6.2.2.3 for the calling party notification procedure.

Figure 5 – ALERTING message content

6.1.1.2 CALL PROCEEDING message

Message type: CALL PROCEEDING
Significance: local
Direction: u → n

Information element	Reference	Type	Length
Protocol discriminator	4.2/ANSI T1.607	M	1
Call reference	4.3/ANSI T1.607	M	2–*
Message type	4.4/ANSI T1.607	M	1
Channel identification	4.5.12/ANSI T1.607	O(See note)	2–*
Other information elements as described in 3.1.2 of ANSI T1.607			

NOTE – The Channel identification information element is not mandatory even if the CALL PROCEEDING message is the first response to the SETUP message.

Figure 6 – CALL PROCEEDING message content

6.1.1.3 CONNECT message

Message type: CONNECT
Significance: global
Direction: u → n

Information element	Reference	Type	Length
Protocol discriminator	4.2/ANSI T1.607	M	1
Call reference	4.3/ANSI T1.607	M	2–*
Message type	4.4/ANSI T1.607	M	1
Channel identification	4.5.12/ANSI T1.607	O(See note)	2–*
Other information elements as described in 3.1.3 of ANSI T1.607			

NOTE – The Channel identification information element is not mandatory even if the CONNECT message is the first response to the SETUP message.

Figure 7 – CONNECT message content

6.1.1.4 CONNECT ACKNOWLEDGE message

Message type: CONNECT ACKNOWLEDGE
Significance: local
Direction: n → u

Information element	Reference	Type	Length
Protocol discriminator	4.2/ANSI T1.607	M	1
Call reference	4.3/ANSI T1.607	M	2–*
Message type	4.4/ANSI T1.607	M	1
Channel identification	4.5.12/ANSI T1.607	O (See note)	2–*
Other information elements as described in 3.1.4 of ANSI T1.607			

NOTE – The Call Waiting service has expanded channel negotiation procedures. The CONNECT ACKNOWLEDGE message shall contain an exclusive B-channel indication. See 6.2.2.4.1 for the channel negotiation procedures.

Figure 8 – CONNECT ACKNOWLEDGE message content

6.1.1.5 NOTIFY message

See 3.1.7 of ANSI T1.607.

Due to interactions with other supplementary services, the Notification description, "Call is a waiting call", contained in the Notification indicator information element may be sent to the calling party in a NOTIFY message to indicate that their call is a waiting call. This message may be sent in the user-to-network direction when the Call Waiting service is provided by an NT2.

6.1.1.6 SETUP message

Message type: SETUP
Significance: global
Direction: n → u

Information element	Reference	Type	Length
Protocol discriminator	4.2/ANSI T1.607	M	1
Call reference	4.3/ANSI T1.607	M	2–*
Message type	4.4/ANSI T1.607	M	1
Channel identification	4.5.12/ANSI T1.607	M (Note 1)	3
Signal	4.5.24/ANSI T1.607	M (Note 2)	3
Other information elements as described in 3.1.11 of ANSI T1.607			

NOTES

1 For the Call Waiting service, the Channel selection shall be coded as "no channel" in the network-to-user direction.

2 The Signal information element is mandatory in the SETUP message for the Call Waiting service and shall contain Signal value #7, "Call Waiting tone on".

Figure 9 – SETUP message content

6.1.2 Information elements

6.1.2.1 Channel identification information element

See 4.5.12 of ANSI T1.607.

For the Call Waiting service, the following field designations shall be used in the Channel identification information element:

– *Interface identifier present:* Set to "0"; interface implicitly identified;

– *Interface type:* Set to "0" for basic rate interface; set to "1" for a primary rate interface;

– *Preferred/exclusive:* Set to "0"; indicated channel is preferred;

– *D-channel indicator:* Set to "0"; the channel identified is not the D-channel;

– *Information Channel selection:* Set to "0 0"; the "no channel" indication;

– *Optional octets 3.1, 3.2, and 3.3:* Shall not be present in this information element.

6.1.2.2 Signal information element

See 4.5.24 of ANSI T1.607.

For the Call Waiting service, the following signal value shall be used in the signal information element:

– Signal value #7, "Call waiting tone on".

6.1.2.3 Notification indicator information element

See Section 4.5.20 of ANSI T1.607.

For the Call Waiting service, the following Notification description shall be used in the Notification indicator information element:

Bits 7 6 5 4 3 2 1	Meaning
1 1 0 0 0 0 0	Call is a waiting call

Figure 10 – Notification description

6.2 Procedures for the Call Waiting service

This clause specifies the detailed switching and signaling procedures for the invocation, notification, and operation of the Call Waiting service.

6.2.1 Support assumptions

The Call Waiting service has counters and parameters that are maintained on an ISDN number and bearer service basis. For DSS1 procedures, a Directory Number (DN) identifies the ISDN Number and a Bearer Capability (BC) identifies the bearer service. Thus a DN and BC provide the indication of an ISDN number and bearer service.

6.2.1.1 Network

For the operation of the Call Waiting service, the network shall maintain the subscription parameters described in 4.2.1 and the following counters:

– *Number of Calls per ISDN Number and Bearer Service counter:* The counter maintained by the network to keep track of the current number of active call references established via a SETUP message (in either direction) for a given ISDN Number and Bearer Service. When the call reference for a given ISDN Number and Bearer Service is released (as a result of call clearing), the Number of Calls per ISDN Number and Bearer Service counter is decremented;

– *Number of Waiting Calls per ISDN Number and Bearer Service Counter:* The counter maintained by the network to keep track of the current number of waiting calls for a given ISDN Number and Bearer Service or group of ISDN Numbers and Bearer Service. When a call ceases to be waiting, the Number of Waiting Calls per ISDN Number and Bearer Service Counter is decremented.

In addition, the network shall maintain the following basic call parameters:

– *Number of B-channels per Interface parameter:* The parameter maintained by the network that indicates the maximum number of B-channels allowed in use (either busy or reserved) per interface;

– *Number of B-channels per ISDN Number parameter:* The parameter maintained by the network that indicates the maximum number of B-channels allowed in use per ISDN Number or group of ISDN Numbers;

– *Number of B-channels per ISDN Number and Bearer Service parameter:* The parameter maintained by the network that

indicates the maximum number of B-channels allowed in use per ISDN Number and Bearer Service or (group of ISDN Numbers) and Bearer Service.

When a parameter refers to a particular bearer capability, the network shall allow the speech and 3.1 kHz audio bearer capabilities to be combined for subscription options and for service operation.

6.2.1.2 Terminal

A terminal subscribing to the Call Waiting service shall support call establishment from the network (as defined in ANSI T1.607), and shall support the expanded channel negotiation procedures defined in 6.2.2.4.1.

It is possible that a terminal compatible with an offered waiting call may not be controlling a B-channel when the SETUP message is received.

The calling terminal shall support the procedure contained in 6.2.2.3 if the optional out-of-band indication that their call is waiting is to be understood.

No assumptions are made about how the called terminal informs the user of the waiting call (e.g., a visual, audible, or other type of indication may be provided, as appropriate).

6.2.2 Call Waiting procedures

6.2.2.1 Service States and Timers

No states beyond those defined in ANSI T1.607 are needed for the Call Waiting service operation.

No timers beyond those defined in ANSI T1.607 are needed for the Call Waiting service operation.

Timers T1 and T2 defined in clause 4 are equivalent to one or more timers defined in ANSI T1.607. Table 4 shows the mappings between T1, T2 and the ANSI T1.607 timers.

Table 4 – Timers for Call Waiting

Service Description timer	Call Establishment timer
Start T1	Start T303 (first transmission of SETUP)
Stop T1	Stop T303
Expiry T1	Second expiry of T303
Start T2	Start T310 or T301, whichever occurs first
Stop T2	Stop T301 or stop T310 (due to receipt of CONNECT)
Expiry T2	Expiry T301 or expiry T310

6.2.2.2 Invocation

The Call Waiting service is applied by the network when a call is to be terminated to an ISDN number and bearer service for which the Call Waiting service has been subscribed, and when all three of the following conditions are true:

- Resources are busy. Resources are considered busy if one (or more) of the following is true:
  - the maximum number of B-channels per interface are in use (either busy or reserved);
  - the maximum number of B-channels per ISDN Number or group of ISDN Numbers is in use; or
  - the maximum number of B-channels per ISDN Number and Bearer Service or (group of ISDN Numbers) and Bearer Service is in use.
- the Number of Calls per ISDN Number and Bearer Service Counter has not reached its maximum value;
- the Number of Waiting Calls per ISDN Number and Bearer Service Counter has not reached its maximum value.

When the network invokes the Call Waiting service, the network shall increment the Number of Calls per ISDN Number and Bearer Service counter and the Number of Waiting Calls per ISDN Number and Bearer Service counter.

If Call Waiting call offering is not applied, then the procedures in ANSI T1.607 shall be followed.

6.2.2.3 Notification

If the service provider supports the out-of-band call waiting notification option and the subscription option "Calling User Receives Notification that their Call is Waiting" is set to

"Yes", then an indication shall be sent to the calling party that their call is a waiting call.

For this indication, the Notification description, "Call is a waiting call" shall be sent to the calling party in the notification indicator information element in the ALERTING message when an alerting indication is received from the called user. If required due to interactions with other supplementary services, this Notification Description contained in the Notification indicator information element shall be sent to the calling party in a NOTIFY message.

6.2.2.4 Normal operation

When the network has determined that the Call Waiting service shall be applied for a particular waiting call, the network shall send to the B access a SETUP message with Channel identification = "No channel" and Signal = "Call waiting tone on".

The SETUP message shall be sent using the broadcast capability at the data-link layer when a multipoint configuration exists. If the network has knowledge that a single-point configuration exists, a point-to-point data link shall be used to carry the SETUP message.

The call establishment timers shall be the same for the Call Waiting service as for the call establishment procedures in 5.2 of ANSI T1.607.

A Subscriber B has the choice of accepting, rejecting, or ignoring a waiting call using the procedures contained in ANSI T1.607. If the call is to be accepted, the expanded channel-negotiation procedures, which are described in 6.2.2.4.1, shall be used. The network treatment given due to multiple ISDN users responding to the same waiting call on the same interface shall be the same (except for the expanded channel-negotiation procedures) as the procedures in 5.2 of ANSI T1.607.

6.2.2.4.1 Subscriber B accepts a waiting call

If a Subscriber B wishes to accept a waiting call, then the nonrejecting messages that may be sent in response to the SETUP message are CALL PROCEEDING, ALERTING, and CONNECT.

The procedures for the network's receipt of a CALL PROCEEDING and/or ALERTING message are as described in 5.2.5.2 of ANSI T1.607, with the exception of the procedures associated with the Channel identification information element. In the context of the Call Waiting service, the Channel identification information element is not mandatory in the first response to the SETUP message. A channel designation in either a CALL PROCEEDING or ALERTING message is ignored by the network for the Call Waiting service operation. The CALL PROCEEDING and ALERTING messages may be sent prior to the holding or clearing of an existing call. The expanded channel-negotiation procedures allow a Subscriber B to designate a channel in the CONNECT message, rather than restricting channel designation to a Subscriber B's first response to the SETUP message.

Three methods are available to free a B-channel. The user that frees a B-channel may or may not be compatible with the waiting call.

1) *Terminate an existing call*

After a call waiting indication is offered, an existing call may be cleared using normal call clearing procedures. This will result in freeing a B-channel; however, the cleared channel shall not be reserved by the network for a waiting call. When a call is cleared, the Number of Calls per ISDN Number and Bearer Service Counter shall be decremented for the ISDN Number and Bearer Service that cleared the call.

If a held call is cleared, a B-channel may be released subject to the channel reservation procedures of the Call Hold service.

2) *Hold an existing call*

Subscriber B (point-to-point configuration) or a terminal on Subscriber B's access (multipoint configuration) must subscribe to the Call Hold service.

For a multi-point-data link configuration, the terminal on Subscriber B's access that holds an existing call may or may not have subscribed to the B-channel reservation option of the Call Hold service. If this option were subscribed to, then this user would have to release the B-channel reservation if another terminal were to accept the waiting call.

3) *User A terminates an existing call*

If User A terminates an existing call, then the conditions of item (1) apply.

When accepting a waiting call, a Subscriber B shall return a CONNECT message with one of the following channel designations:

a) channel is indicated, no acceptable alternative;

b) channel is indicated, any alternative is acceptable;

c) any channel is acceptable; or

d) no channel designation present in the CONNECT message (the Channel identification information element is not mandatory in the CONNECT message even if it is the first response to the SETUP message).

When the network receives a CONNECT message from a Subscriber B, the channel designation shall be checked:

– If the designated channel is not available and is indicated as in case (a), the network shall initiate call clearing to the responding Subscriber B following the procedures in ANSI T1.607 with a call clearing message containing a Cause information element with a cause value #44 "requested circuit/channel not available."

– If the designated channel is available and is indicated as in case (a) or (b), the network shall return a CONNECT ACKNOWLEDGE message containing a channel designation in the Channel identification information element to the responding Subscriber B, and follow the procedures contained in 5.2.8 (receipt of active indication) and 5.2.9 (to clear nonselected users) of ANSI T1.607.

– If the designated channel is not available, is indicated as in case (b), and another channel is available, the network shall return a CONNECT ACKNOWLEDGE message containing a channel designation in the Channel identification information element to the responding Subscriber B, and follow procedures contained in 5.2.8 and 5.2.9 of ANSI T1.607.

– If a channel is available and is indicated as in case (c) or (d), the network shall return a CONNECT ACKNOWLEDGE message containing a channel designation in the Channel identification information element to the responding Subscriber B, and follow the procedures contained in 5.2.8 and 5.2.9 of ANSI T1.607.

– If no channel is available and the channel is indicated as in case (b), (c), or (d), the network shall initiate call clearing to the responding Subscriber B following the procedures in ANSI T1.607 with a call clearing message containing a Cause information element with a cause value #34, "no circuit/channel available".

After the network has sent a CONNECT ACKNOWLEDGE message, the Number of Waiting Calls per ISDN Number and Bearer Service counter shall be decremented.

A Subscriber B accepting a waiting call shall not connect to any B-channel until a CONNECT ACKNOWLEDGE message has been received. A Subscriber B accepting a waiting call shall connect to the B-channel specified in the CONNECT ACKNOWLEDGE message from the network.

6.2.2.4.2 *Called User rejects waiting call*

If a Subscriber B rejects a waiting call, the procedures contained in 5.2.5.3 of ANSI T1.607 shall be followed.

Incompatible terminals reject a waiting call as they would for a normal basic call.

When a waiting call is cleared, the Number of Calls per ISDN Number and Bearer Service counter and Number of Waiting Calls per ISDN Number and Bearer Service counter shall be decremented.

6.2.2.4.3 Subscriber B ignores waiting call

If a Subscriber B ignores a waiting call, the procedures contained in 5.2.5.4 of ANSI T1.607 shall be followed.

When a waiting call is cleared, the Number of Calls per ISDN Number and Bearer Service counter and Number of Waiting Calls per ISDN Number and Bearer Service counter shall be decremented.

6.2.2.5 Error handling

If any error conditions exist that are not contained in 6.2.2, the appropriate procedures in ANSI T1.607 shall be followed. If a waiting call is cleared, the Number of Calls per ISDN Number and Bearer Service counter and Number of

Waiting Calls per ISDN Number and Bearer Service counter shall be decremented.

6.3 Interactions for Call Waiting

6.3.1 Basic call

The Channel-identification information element shall be ignored by the network in a response to a SETUP message unless it is in the CONNECT message. The network shall specify an exclusive channel indication within the CONNECT ACKNOWLEDGE message that is returned to the party awarded the call.

6.3.2 Other services

6.3.2.1 Call Waiting

Not applicable.

6.3.2.2 Calling Line Identification Presentation

If the CLIP procedures allow the calling number to be presented, the calling number shall be sent in the SETUP message containing the call waiting indication.

6.3.2.3 Calling Line Identification Restriction

No interaction.

6.3.2.4 Call Hold

See 6.2.2.4.1.

6.4 Specification and Description Language diagrams for Call Waiting

Same as those contained in ANSI T1.607.

7 Switching and signaling specification for Call Waiting at interexchange interfaces

Only ISDN User Part protocol has been identified in association with Signaling System No. 7 (SS7) procedures supporting ISDN Call Waiting. No Transactions Capabilities Application Part (TCAP) procedures have been identified for this service.

The functional description, formats and codes, and general procedures for the ISDN User Part are contained in ANSI T1.113.

7.1 Formats and codings for Call Waiting

7.1.1 Messages

ISDN User Part Messages are described in detail in ANSI T1.113.

No new ISDN-UP messages are required for this service. An indication that the service has been invoked may be carried in existing ISDN-UP messages, Address Complete (ACM), and Call Progress (CPG).

7.1.2 Parameters

There is only one parameter associated with this service. When notification of call waiting is to be sent, the Notification Indicator parameter is used in either the ACM or the CPG messages, to carry the indication to the calling party that the call is receiving call waiting treatment at the destination exchange.

The Notification Indicator parameter field is coded as shown in figure 11 to indicate "Call is a waiting call".

8	7	6	5	4	3	2	1	bit
1/ext	1	1	0	0	0	0	0	

Figure 11 – Notification Indicator parameter field

This coding is consistent with that of the Notification indicator information element described in ANSI T1.607 to simplify the interworking of DSS1 and SS7.

7.2 Procedures for Call Waiting

When ISDN Call Waiting has been invoked at the destination interface and indication is to be sent to the calling user, or if the ISDN Call Waiting notification is received from the destination interface, the notification is transported in the Notification Indication parameter coded "call is a waiting call" in either the ACM or CPG.

If the notification is to be sent with an indication of alerting at the destination interface, either the ACM or CPG, whichever is used to carry the alerting indication, should also carry the Notification Indicator parameter.

If the notification is to be sent without an alerting indication at the destination interface, the Notification Indicator parameter should be carried in a CPG message. The Event Indicator field of the mandatory Event Information

parameter in CPG is coded "notification for supplementary service". The Event Presentation restricted indicator field is coded "no indication".

If no alerting indication is received over the called interface (e.g., the called user's first response to the call setup is a connect indication), then no notification of Call Waiting is sent to the calling party.

7.3 Interactions for Call Waiting

The SS7 procedures of the ISDN Call Waiting service do not interact with the SS7 procedures of the ISDN Call Waiting, Call Hold, Calling Line Identification Presentation, and Calling Line Identification Restriction supplementary services.

7.4 Flow diagrams for Call Waiting

Flow diagrams are not provided for this service because of its simplicity from the SS7 perspective. See 7.2 for a description of the SS7 ISDN-UP procedures for ISDN Call Waiting.

8 Specifications for protocol interworking

8.1 Interworking between SS7 and DSS1

When an ALERTING message is received from a user at Subscriber B's access and the calling user is to be notified that a call waiting treatment is being applied at the destination interface, the Notification Indicator parameter coded "Call is a waiting call", shall be placed into the appropriate SS7 message as described in 7.2.

When the Call Waiting service is applied by an NT2 and the calling user is to be notified that call waiting treatment is being applied at the destination interface, the terminating exchange shall map the notification information received in the ALERTING or NOTIFY message from the NT2 from the Notification indicator information element to the Notification Indicator parameter. The Notification Indicator parameter shall be placed into the appropriate SS7 message as described in 7.2.

At the local exchange serving the calling user, the notification information shall be mapped from the Notification Indicator parameter to the Notification indicator information element in the appropriate DSS1 message as described in 6.2.2.3.

8.2 Interworking between SS7 and MF signaling

In the event that MF signaling is encountered, the indication to the calling user that the Call Waiting service has been invoked at the destination interface will not be sent.