To: INCITS T10 Committee

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Subject: Modify ADT ACK and NAK to differentiate Initiate Recovery acknowledgements

1 Revision History

Revision 0:
Posted to the T10 web site 29 June 2004.

Revision 1:
Posted to the T10 web site 14 July 2004. Updated document based on discussion and agreement at ADI WG meeting. Updated to reflect acceptance of proposal #2 by removing the other proposals.
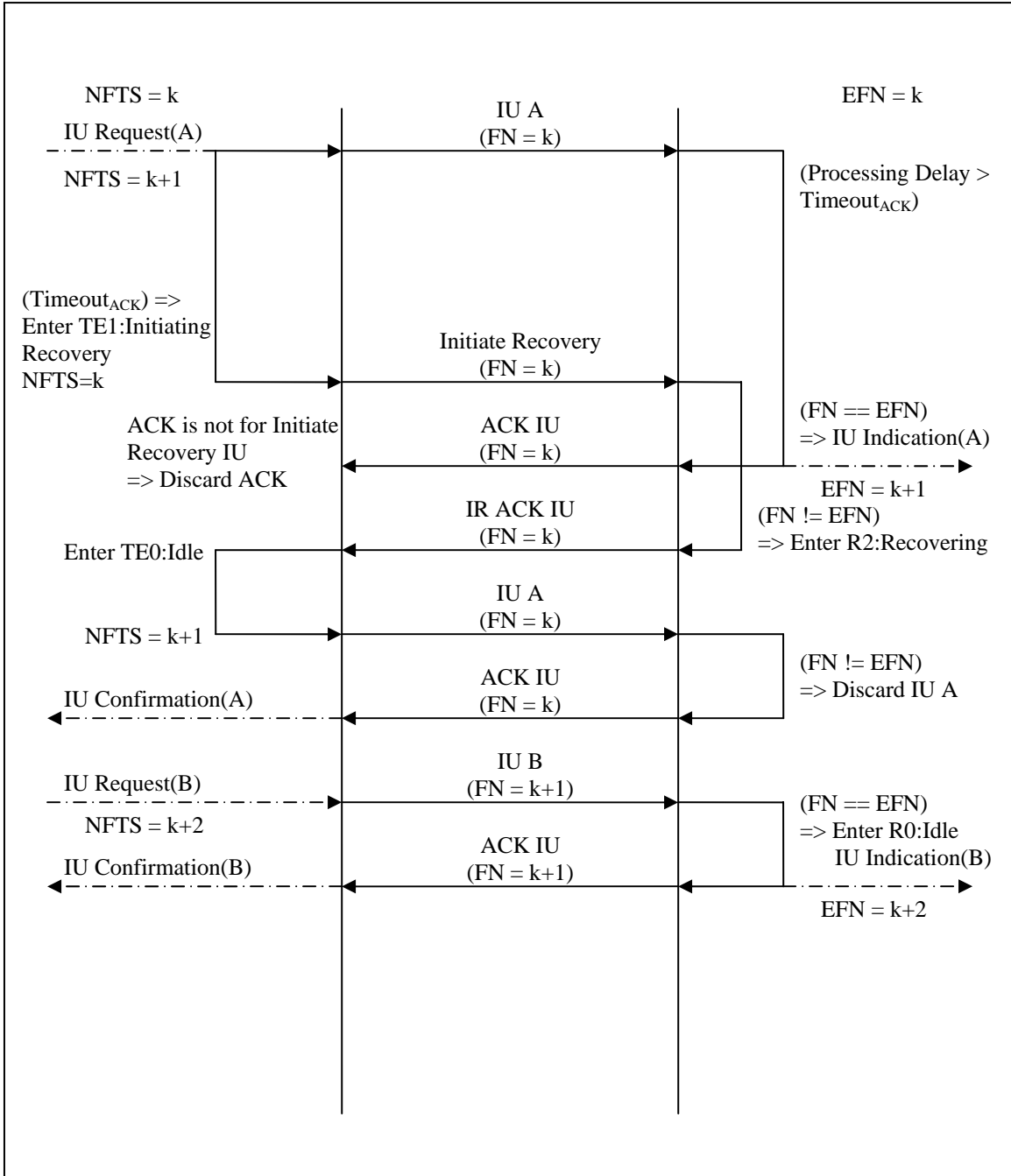
2 General

When handling recovery for an acknowledgement time-out, there is a possibility for confusion because the ACK for the Initiate Recovery IU cannot be distinguished from the ACK for the original frame. If the ACK for the original frame is received after the Initiate Recovery IU is sent, it will be interpreted as an ACK for the Initiate Recovery IU. When the actual ACK for the Initiate Recovery IU is received, the port will no longer be expecting it. Another situation that is currently possible is for a similar sequence as mentioned above to occur, but for the Initiate Recovery IU to be corrupted. In this case, the port initiating recovery will think that the other port is in the R2:Recovering state, but when the frame is resent, a NAK for an unexpected frame number will be sent. After resolving these issues, an error recovery scenario would proceed as shown in section 3 below. In order to address these issues, a proposal is discussed below along with the pros and cons of the solution.

3 Error Handling Scenario

The following sequence shows how the error scenario posed in the statement above would be handled after implementing the solution discussed below. This scenario should be added to appendix B as follows:

B.11 Delayed response with recovery driven by timeout

Figure B.11 shows a scenario in which the recipient of a frame is delayed in processing the frame by some other factor in the device. It is the timeout on the ACK which begins the error recovery sequence.

NFTS = k
IU Request(A)

IU A
(FN = k)

EFN = k

NFTS = k+1

(Processing Delay > $Timeout_{ACK}$)

$(Timeout_{ACK}) =>$
Enter TE1:Initiating
Recovery
NFTS=k

Initiate Recovery
(FN = k)

ACK is not for Initiate
Recovery IU
=> Discard ACK

ACK IU
(FN = k)

(FN == EFN)
=> IU Indication(A)

EFN = k+1
(FN != EFN)
=> Enter R2:Recovering

IR ACK IU
(FN = k)

Enter TE0:Idle

IU A
(FN = k)

NFTS = k+1

(FN != EFN)
=> Discard IU A

ACK IU
(FN = k)

IU Confirmation(A)

IU B
(FN = k+1)

IU Request(B)

NFTS = k+2

(FN == EFN)
=> Enter R0:Idle
     IU Indication(B)

ACK IU
(FN = k+1)

IU Confirmation(B)

EFN = k+2

4 Proposal

4.1   Provide ACK/NAK for use with Initiate Recovery

4.1.1   Add the following entries to Table 12:

Frame Type	Description
7h	Initiate Recovery ACK (acknowledge)
8h	Initiate Recovery NAK (negative acknowledge)
9h-Fh	Reserved

4.1.2   Add the following sections to describe the IUs added above:

6.5.9 Initiate Recovery ACK information unit
This information unit is identical to the ACK information unit, but it is used exclusively as a
response to the Initiate Recovery information unit.

6.5.10 Initiate Recovery NAK information unit
This information unit is identical to the NAK information unit, but it is used exclusively as a
response to the Initiate Recovery information unit.

4.1.3   Add the following statement to 4.3.5.3.1 and 4.3.5.4.1:
A port in TE1:Initiating Recovery state shall discard ACK IUs and NAK IUs for frames other than
Port Login IU, NOP IU, Pause IU, and Port Logout IU.

4.1.4   In 4.3.5.3.2, replace ACK IU with Initiate Recovery ACK IU

4.1.5   In 4.3.5.3.3, replace NAK IU with Initiate Recovery NAK IU

4.1.6   In 4.3.5.4.2, replace ACK IU with Initiate Recovery ACK IU

4.1.7   In 4.3.5.4.2, replace NAK IU with Initiate Recovery NAK IU

4.1.8   In 4.6.2.3.a, replace ACK IU with Initiate Recovery ACK IU

4.1.9   In 4.6.2.4.4, replace ACK IU with Initiate Recovery ACK IU

4.1.10   In 4.6.2.4.4, replace NAK IU with Initiate Recovery NAK IU

4.1.11   Remove references to Initiate Recovery in 4.6.2.5.2 and add following section:

4.6.2.5.3 Initiate Recovery IU
If a protocol error is detected on an Initiate Recovery, the port shall send an Initiate Recovery
NAK IU with PR bit set to zero and appropriate status code (see table 14) then discard the frame.

4.1.12 Remove references to Initiate Recovery in 4.6.2.6.2 and add following section:

4.6.2.6.2 Initiate Recovery IU
If a resource limitation error is detected on an Initiate Recovery IU, the port shall send an Initiate Recovery NAK IU with the appropriate status code (see table 14) and PR bit set to zero then discard the frame.

If the port is unable to send an acknowledgment IU due to a resource limitation, it shall discard the frame.

4.1.13 Change first sentence of 6.5.3.1 to the following:

An acknowledgement IU is an ACK IU, NAK IU, Initiate Recovery ACK IU, or Initiate Recovery NAK IU.

4.1.14 Change section 3.1.1 to the following:

3.1.1. acknowledgement IU: An ACK information unit (IU), NAK IU, Initiate Recovery ACK IU, or Initiate Recovery NAK IU. See 6.5.3.

4.1.15 Update figures in Appendix B

All of the figures in Appendix B need to be changed to make the acknowledgement of an Initiate Recovery IU an IR ACK IU instead of an ACK IU.

4.2 Pros of Proposal

1. Makes a clear distinction between the ACK for the original frame and the ACK for the Initiate Recovery IU.
2. Has little impact on anything but the recovery path.

4.3 Cons of Proposal

1. Requires two new link service frame types.