INTERNATIONAL STANDARD

ISO/IEC
4335

Fifth edition
1993-12-15
AMENDMENT 7
1995-11-15

Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — Elements of procedures

AMENDMENT 7: Enhanced multi-selective reject option

Technologies de l'information — Télécommunications et échange d'information entre systèmes — Procédures de commande de liaison de données à haut niveau (HDLC) — Éléments de procédures

AMENDEMENT 7: Option de rejet à choix multiples améliorée

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Amendment 7 to International Standard ISO/IEC 4335:1993 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems.*

Introduction

This amendment to ISO/IEC 4335:1993 further extends the multi-selective reject option by including a streamlined and detailed set of procedures that do not generate duplicate retransmissions and allow the maximum number of outstanding frames to be less than or equal to modulus number minus one.

This page intentionally left blank

Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — Elements of procedures

AMENDMENT 7: Enhanced multi-selective reject option

Page 19

Subclause 8.2.1

After first paragraph, add a new paragraph as follows:

When using the multi-selective reject option, any I frames that were retransmitted subsequent to the transmission of the last frame with the P/F bit, respectively, set to "1", shall not be retransmitted. For a combined station, if any frames are retransmitted, then a poll shall be sent, either by transmitting an RR command (or RNR command if the station is in the busy condition) with the P bit set to "1" or by setting the P bit to "1" in the last retransmitted I frame.

In the paragraph labelled c), modify the first 2 lines as follows:

In the case of a secondary/primary station, if the multi-selective reject option is not used and if one or more SREJ frames .....

In the paragraph labelled d), modify the first 2 lines as follows:

In the case of a combined station, if the multi-selective reject option is not used and if a SREJ command with .....

Add new paragraph labeled i):

i) In the case of a primary/secondary station, when the multi-selective reject option is used, checkpoint retransmission on receipt of an RR frame with the P/F bit set to "1" shall be inhibited if any new I frames were transmitted subsequent to the last frame with the P/F bit set to "1". In the case of a combined station, when the multi-selective reject option is used, checkpoint retransmission on receipt of an RR frame with the F bit set to "1" shall be inhibited if any new I frames were transmitted subsequent to the last frame with the P bit set to "1".

Page 19

Subclause 8.2.3

Replace text as follows:

The SREJ command/response shall be used primarily to initiate more efficient error recovery by requesting the retransmission of one or more (not necessarily contiguous) I frames following the detection of sequence errors rather than the retransmission of the earliest frame in need of retransmission plus all additional I frames which may have been transmitted subsequently.

8.2.3.1 Single SREJ recovery

The SREJ command/response shall be used primarily to initiate more efficient error recovery by requesting the retransmission of a single I frame following the detection of a sequence error rather than the retransmission of the I frame requested plus all additional I frames which may have been transmitted subsequently.

When an I frame sequence error is detected, and it is determined that SREJ recovery is to be employed, the SREJ frame shall be transmitted at the earliest possible time. When a primary/secondary station sends one or more SREJ frames, each with the P/F bit set to "0", and these "sent SREJ" exception conditions are not cleared when the primary/secondary station is ready to issue the next frame with the P/F bit set to "1", the primary/secondary station shall send an SREJ frame with the P/F bit set to "1" with the same N(R) as the oldest unresolved SREJ frame. When a combined station sends one or more SREJ commands, each with the P bit set to "0" or "1", or one or more SREJ responses, each with the F bit set to "0" and these "sent SREJ" exception conditions are not cleared when the combined station is ready to issue the next response frame with the F bit set to "1", the combined station shall send an SREJ response with the F bit set to "1" with the same N(R) as the oldest unresolved SREJ frame.

In a primary/secondary station, since an I or S format frame sent with the P/F bit set to "1" has the potential of causing checkpoint retransmission, a primary/secondary station shall not send SREJ frames until it receives at least one in-sequence I frame or it perceives by time-out that the checkpoint retransmission will not be initiated by the remote station. In a combined station, since an I or S format frame sent with the F bit set to "1" has the potential of causing checkpoint retransmission, a combined station shall not send SREJ frames until it receives at least one in-sequence I frame or it perceives by time-out that the checkpoint retransmission will not be initiated by the remote station.

With respect to each direction of transmission on the data link, one or more "sent SREJ" exception conditions from a given primary/secondary station to another primary/secondary station may be established at a time. A "sent SREJ" exception condition shall be cleared when the requested I frame is received.

When a primary/secondary station perceives by time-out that the requested I frame will not be received, because either the requested I frame or the SREJ frame was in error or lost, the SREJ frame may be repeated.

A primary/secondary station receiving one or more SREJ frames shall, when appropriate, initiate retransmission of the individual I frames indicated by the N(R) contained in each SREJ frame. After having retransmitted the frames above, new I frames may be transmitted subsequently if they become available.

When a primary/secondary station receives and actions one or more SREJ frames, each with the F bit (primary station) or P bit (secondary station) set to "0", it shall disable actioning of the next SREJ frame if that frame has the F bit (primary station) or P bit (secondary station) set to "1" and has the same N(R), (i.e., same value and same numbering cycle) as the previously actioned SREJ frame, and if the resultant retransmission was made following the transmission of P bit (primary station) or F bit

(secondary station). When a combined station receives and actions one or SREJ commands, each with the P bit set to "0", or a SREJ command with the P bit set to "1", or one or more SREJ responses, each with the F bit set to "0", it shall disable actioning of the next SREJ response frame if that SREJ frame has the F bit set to "1" and has the same N(R), (i.e., same value and same numbering cycle) as a previously actioned SREJ frame, and if the resultant retransmission was made following the transmission of the P bit set to "1".

When the SREJ mechanism is used, the receiving station shall retain correctly received I frames and deliver then to the higher layer in sequence number order.

8.2.3.2 Multiple SREJ recovery

Multiple SREJ reject recovery shall be used when the multi-selective reject option is used.

The SREJ frame shall be used to initiate more efficient error recovery by selectively requesting the retransmission of one or more (not necessarily contiguous) lost or errored I frame(s) following the detection of sequence errors, rather than requesting the retransmission of all I frames.

When a primary/secondary station receives an out-of-sequence frame, the I frame shall be held for later delivery. The I frame shall be delivered to the upper layer only when all I frames numbered below N(S) are correctly received. If frame number N(S)-1 has not been received previously, then an SREJ frame with the P/F bit set to "0" shall be transmitted at the earliest possible time, that contains the sequence numbers of the list of consecutive missing I frames ending at N(S)-1; the N(R) field in the control field shall be set to the first sequence number in the list; the information field shall contain the rest of the sequence numbers. If the list of sequence numbers is too large to fit in the information field of the SREJ frame, then the list shall be truncated by including only the earliest sequence numbers. The primary/secondary station on receiving an SREJ frame with the P/F bit set to 0 shall retransmit all requested I frames. After having retransmitted these I frames, the primary/secondary station may transmit new I frames, if they become available.

When a primary/secondary station is ready to issue the next frame with the P/F bit to "1" and if there are out-of-sequence I frames saved in the receive buffer, the primary/secondary station shall send a SREJ frame with the P/F bit set to "1" with N(R) equal to the oldest unacknowledged I frame and the information field containing the sequence numbers of the rest of the missing I frames. When a combined station is ready to issue the next response frame with the F bit to "1" and if there are out-of-sequence I frames saved in the receive buffer, the combined station shall send a SREJ response with the F bit set to "1" with N(R) equal to the oldest unacknowledged I frame and the information field containing the sequence numbers of the rest of the missing I frames. If the list of sequence numbers is too large to fit in the information field of the SREJ frame, then the list shall be truncated by including only the earliest sequence numbers. When a primary/secondary station receives an SREJ frame with the P/F bit set to "1", the primary/secondary station shall retransmit all requested I frames, except those that were transmitted subsequent to the last frame with the P/F bit set to "1". When a combined station receives an SREJ frame with the F bit set to "1", the primary/secondary station shall retransmit all requested I frames, except those that

were transmitted subsequent to the last frame with the P bit set to "1". After having retransmitted these I frames, the primary/secondary station may transmit new I frames, if they become available.

Annex C gives examples of the possible use of multi-selective reject option and implementation guidelines.

Page 20

Subclause 8.2.4

After second paragraph, add a new paragraph as follows:

If the multi-selective option is used, then status inquiry should be done using a supervisory frame. For a primary/secondary station, I frame retransmissions shall be done only after a frame with the P/F bit set to "1" or an SREJ frame with the P/F bit set to "0" is received. For a combined station, I frame retransmissions shall be done only after a response with the F bit set to "1" or an SREJ response with the F bit set to "0" is received.

Page 43

Add the following new annex after annex B.

Annex C
(informative)

Examples of the use of multi-selective reject option

This annex shows examples of the use of multi-selective reject option and some implementation specifics.

Subclauses 8.2.1, 8.2.2, 8.2.3.1 and 8.2.3.2 describe mechanisms for recovering lost I frames. There is no prohibition regarding implementation of more than one mechanism. However, if more than one mechanism is implemented, it is recommended that only one mechanism be used at a time. That is, a different mechanism should not be used to recover lost I frames until the previous mechanism has completed according to its definition (as given in the above clauses) or the data station perceives by time-out that the mechanism will not succeed in I frame recovery. Annex B showed examples of recovery using the multi-selective reject option of 8.2.3.2. Combined stations send SREJ responses but not SREJ commands.

For a combined station, after retransmission of I frames caused by the receipt of an SREJ frame with the P/F bit set to 0, if there is no outstanding poll condition (i.e., the station is not waiting for a frame with the F bit set to "1" as a response to a frame with the P bit set to "1"), then a poll is sent, either by transmitting an RR command (or RNR command if the station is in the busy condition) with the P bit set to "1" or by setting the P bit in the last retransmitted I frame.

For a combined station, after retransmission of I frames caused by the receipt of an SREJ frame with the P/F bit set to 1, if any frames are retransmitted, then a poll is sent, either by transmitting an RR command (or RNR command if the combined station is in the busy condition) with the P bit set to "1" or by setting the P bit to "1" in the last retransmitted I frame.

Figure C.1 shows the frame exchange between stations when I frames are lost and recovered by retransmissions using the SREJ frame with the F bit set to "0".
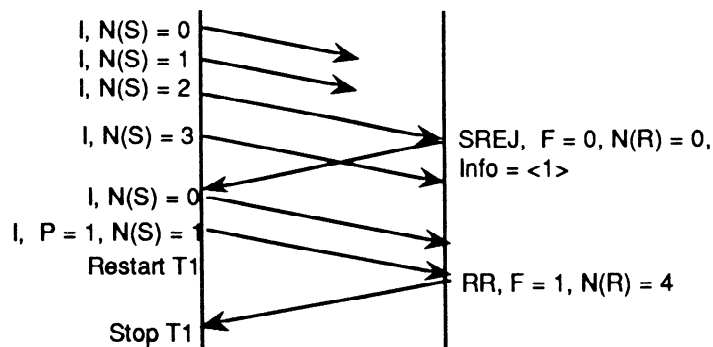

Figure C.1 — I frame recovery due to SREJ frame with F bit set to "0"

Figure C.2 shows the frame exchange between stations when I frames are lost and the resulting SREJ frame with the F bit set to "0" is also lost.