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INTEGRATED SERVICES DIGITAL NETWORKS

INTEGRATED MANAGEMENT OF THE ISDN CUSTOMER ACCESS

ITU-T Recommendation M.3621

(Previously "CCITT Recommendation")

FOREWORD

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The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation M.3621 was prepared by ITU-T Study Group 4 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 27th of July 1995.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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ABSTRACT

It has been observed that events occurring at the lower layers of a protocol stack may impact higher layers. This Recommendation provides information which may be used to correlate event indications from each of the first three layers of ISDN BRI and PRI to determine if they are related to a single lower layer event.

KEYWORDS

ISDN customer access; Fault Management; Management of ISDN D-channel.

Recommendation M.3621

INTEGRATED MANAGEMENT OF THE ISDN CUSTOMER ACCESS

(Geneva, 1995)

1 General

This Recommendation provides potential relationships between fault indications from management information provided by the three protocol layers. This information could be used by network managers to correlate, where applicable, various indications from the three protocol layers to a single fault. TMN developers could utilize these relationships in their software to provide tools to solve customer access problems more rapidly. Future activities in the area of protocol stack design may benefit from this work due to the observation that the current layers' notifications are not entirely independent where faults are concerned.

1.1 Scope

For the management of the ISDN customer access, several recommendations are available. In Recommendation M.3640 [3], management of the data link and network layers of the D-channel is described. In Recommendations M.3603 [1] and M.3604 [2], the application of maintenance principles to the ISDN basic and primary rate accesses is described.

The management of the customer access is rather complex. Therefore a subdivision for the management of the three protocol layers was applied. The management of each protocol layer is considered separately. In this way, the management of the ISDN customer access is subdivided into three parts. However, these three parts are strongly related. For example there may be several alarms from different layers, caused by the same error. A problem is the way in which an operator has to deal with all the management information about the network, data link and physical layers. It is expected that the management information, received from different layers will often be related.

It is not described which relations exist and how the relations between the ISDN customer access management Recommendations should be dealt with. This Recommendation only describes fault relationships between the management information in Recommendations M.3603 [1], M.3604 [2] and M.3640 [3].

2 References

The following Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision: all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

[1] CCITT Recommendation M.3603 (1992), *Application of maintenance principles to ISDN basic rate access*.

[2] CCITT Recommendation M.3604 (1992), *Application of maintenance principles to ISDN primary rate acces*.

[3] CCITT Recommendation M.3640 (1992), *Management of D-channel – Data Link and Network Layer*.

3 Sample relationships between management information from different layers

There is a relationship between management information from layers 1 and 2 as described in the following three examples:

- The reception of Invalid frames or Frames with errors at layer 2 may be a consequence of Loss of frame alignment at layer 1.

- It is possible that Invalid frames are caused due to Loss of incoming signal or perhaps Loss of power at layer 1.

- When layer 2 cannot be established after N200 SABME frames are sent without proper response being received, it is possible that at layer 1 loss of frame alignment, loss of power or loss of incoming signal occurred.

There is a relationship between management information from layers 2 and 3 as described in the following example:

- As a result of a data link failure, timers may expire at layer 3. For some timers, this results in a notification. When these timers expire, one of the following notifications may be issued at layer 2:

  – The proper responses not received to establish or restore the link after N200 SABME frames were sent.

  – DM frames received in response to a SABME frame.

  – DM frames sent in response to a SABME frame.

From the examples, it is clear that a manager will receive a large amount of management information, but may have problems investigating the cause of a fault.

In Figure 1, an example is given on how errors from different layers may be related in case of a layer 3 timer expiry (cause value 102).

4 Layer faults and indications

In general, it is better to first solve lower layer problems and then the higher layer problems. The reason for this is that higher layer problems may be caused by lower layer problems but not the other way around. In the first case, when a lower layer problem is solved, the higher layer error messages that were received may be neglected, because they were generated due to the same error cause.

When related errors from different layers are detected at approximately the same time, it is expected that they were caused by the same root cause. Of course, it is necessary to check the complete error message to verify if the error messages were related to a single cause.

This Recommendation gives the relationships between the management information of layers 3 and 2, between the management information of layers 2 and 1 and between the management information of layers 1, 2 and 3. This means that for each error of layer 3, a list of possible layer 2 errors should be given, that could be the cause of the layer 3 error. This also holds for the relations between layer 2 and layer 1 and layers 3, 2 and 1.

4.1 BRI and PRI Layer 1, 2 and 3 events and indications

Each of the following tables provides examples of events and possible indications for an event occurring at a specific layer. The tables also provide possible indications generated by the layers above the layer where the event occurred. For example, in Table 1, extreme impulse noise at layer 1 may cause a L1 indication of a loss of frame alignment and may also be responsible for causing an FCS error at layer 2 and might also lead to RESTART messages at layer 3. More detailed information which provided the basis of the table entries can be found in the references. (See Tables 1 to 4.)

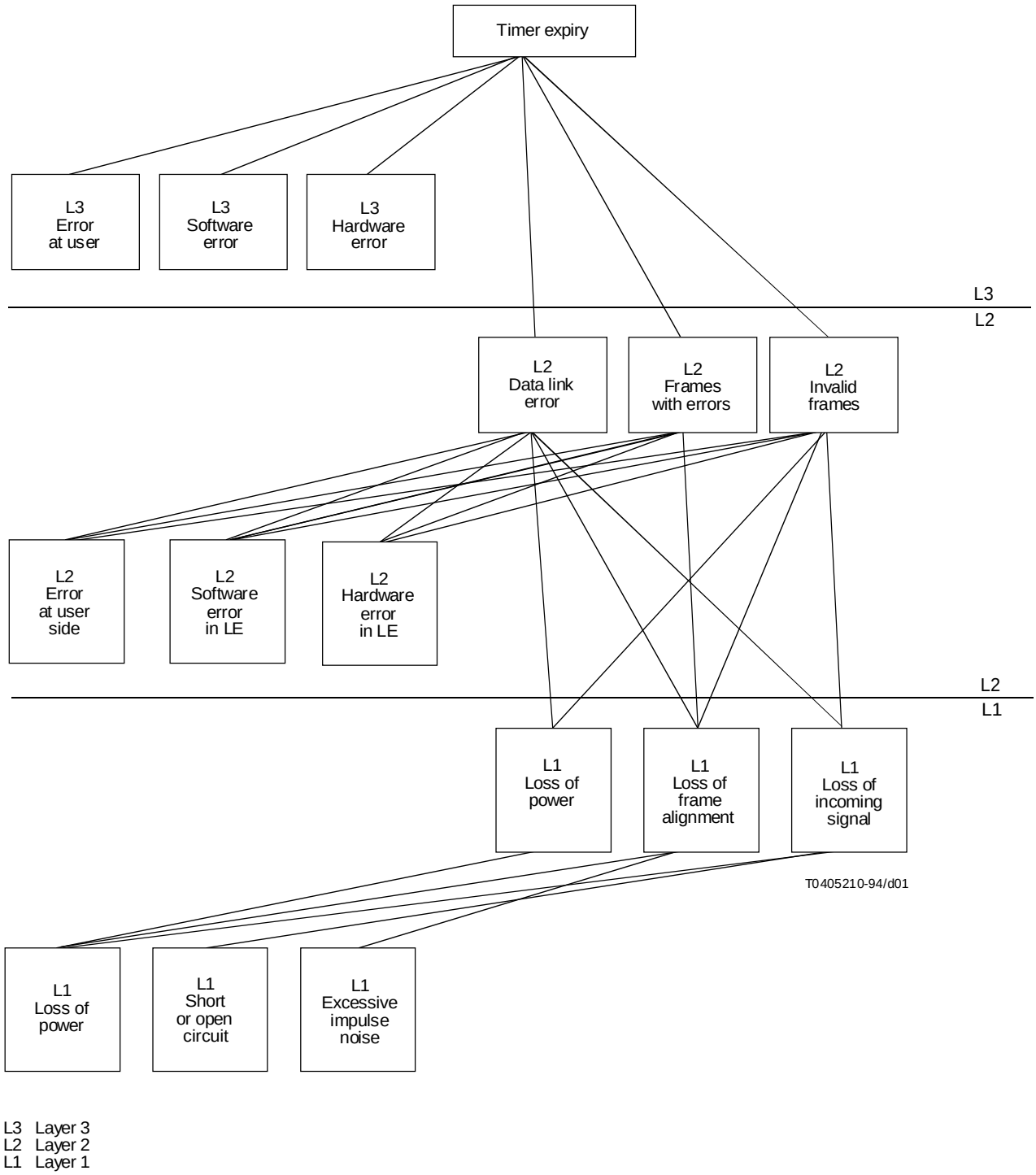

FIGURE 1/M.3621

Example of layer faults and indications

TABLE 1/M.3621

Layer 1 events

L1 event	L1 indication	L2 indication	L3 indication
– Impulse noise – Wideband noise – 50/60Hz noise – Excessive insertion loss	– Block error (near or far end error)	– FCS error – Frames retransmitted Threshold exceeded – Invalid frames (Errors where L2 recovers)	– No indication
– Extreme case of above faults	– Loss of frame alignment at the ET	– Invalid frames – Frames with errors – Frames retransmitted Threshold exceeded – Proper Responses not rec. after N200 SABME – FCS Error	– Timers expire (T303, T308, T309, T310, T316, T317) – RELEASE messages transmitted (cause 102) – DISCONNECT messages transmitted (cause 102) – RESTART messages transmitted – STATUS
– Loss of power at the customer premise	– Loss of power at the customer premise	– Invalid frames – Proper responses not rec. after N200 SABME	– Timers expire (T303, T308, T309, T310, T316, T317) – RELEASE messages transmitted (cause 102) – DISCONNECT messages transmitted (cause 102) – RESTART messages transmitted – STATUS
– Loss of frame alignment at the customer premise	– RAI (Remote Alarm Indication) – RFI (Remote Failure Indication, if supported)	– Invalid frames – Frames retransmitted Threshold exceeded – Proper responses not rec. after N200 SABME	– Timers expire (T303, T308, T309, T310, T316, T317) – RELEASE messages transmitted (cause 102) – DISCONNECT messages transmitted (cause 102) – RESTART messages transmitted – STATUS
– Short or open circuit	– Loss of incoming signal	– Invalid Frames – Frames retransmitted Threshold exceeded – Proper responses not rec. after N200 SABME	– Timers expire (T303, T308, T309, T310, T316, T317) – RELEASE messages transmitted (cause 102) – DISCONNECT messages transmitted (cause 102) – RESTART messages transmitted – STATUS
– Failure to activate or deactivate	– Failure to activate or deactivate (only applicable to interfaces supporting deactivation)	– No indication	– No indication

TABLE 2/M.3621

Layer 2 events

L2 event	L1 indication	L2 indication	L3 indication
– Malfunctioning state machine in CPE	– No indication	– DM frames received in response to a SABME	– Timers expire (T303, T308, T309, T310, T316, T317) – RELEASE messages transmitted (cause 102) – DISCONNECT message (cause 102) – RESTART messages transmitted
– Malfunctioning state machine in CPE or ET – Missing TEI	– No indication	– Invalid frames	– Timers expire (T303, T308, T309, T310, T316, T317) – RELEASE messages transmitted (cause 102) – DISCONNECT messages transmitted (cause 102) – RESTART messages transmitted
– Malfunctioning state machine in CPE or ET	– No indication	– Unexpected messages	– Timers expire (T303, T308, T309, T310, T316, T317) – RELEASE messages transmitted (cause 102) – DISCONNECT messages transmitted (cause 102) – RESTART messages transmitted
– Malfunctioning state machine in ET	– No indication	– DM frames sent in response to a SABME	– Timers expire (T303, T308, T309, T310, T316, T317) – RELEASE messages transmitted (cause 102) – DISCONNECT messages transmitted (cause 102) – RESTART messages transmitted
– Conformance	– No indication	– Info too long	– No indication
– Incorrect window	– No indication	– Sequence error	– No indication

TABLE 3/M.3621

Layer 3 events

L3 event	L1 indication	L2 indication	L3 indication
– Malfunctioning state machine in CPE	– No indication	– No indication	– Messages with mandatory information element missing – Messages with general information element missing – STATUS messages transmitted (cause 96 or 100) – RELEASE COMPLETE messages transmitted (cause 96 or 100) – RELEASE messages transmitted (cause 96 or 100)
– Malfunctioning state machine in ET	– No indication	– No indication	– Messages with mandatory information element missing – Messages with general information element missing – STATUS messages received (cause 96 or 100) – RELEASE COMPLETE messages received (cause 96 or 100) – RELEASE messages received (cause 96 or 100)
– Malfunctioning state machine in CPE	– No indication	– No indication	– Message with call reference error – RELEASE COMPLETE messages transmitted (cause 81) – RELEASE messages transmitted (cause 81) – STATUS messages transmitted (cause 81)
– Malfunctioning state machine in ET	– No indication	– No indication	– Message with call reference error – RELEASE COMPLETE messages received (cause 81) – RELEASE messages received (cause 81) – STATUS messages received (cause 81)
– Malfunctioning state machine in CPE	– No indication	– No indication	– Timer expires – RELEASE messages transmitted (cause 102) – DISCONNECT messages transmitted (cause 102) – RESTART messages transmitted

TABLE 4/M.3621

TEI events

TEI event	L1 indication	L2 indication	L3 indication
– Duplicate TEI Non-automatic assignment Duplicate TEI Automatic assignment – Unassigned TEI used – User errors – CPE failure	– No indication	– Unexpected frames	– No indication
– Number of unused TEI values gets too high – Too many data links requested by users – TEI removal fails	– No indication	– TEI resources exhausted	– No indication
– TEI removed by user	– No indication	– Proper responses not received to establish or restore the link after N200 SABME frames were sent	– No indication