7.20.8 RIB REFRESH PDU Error Handling

If any of the following error conditions are detected, the BIS shall issue an IDRP ERROR PDU with the following error indications:

a) Invalid OpCode not in Range 1 to 3: indicate RIB REFRESH error with error subcode ″Invalid OpCode″

b) Receipt of an OpCode 3 (RIB Refresh End) without prior receipt of OpCode 2 (Rib Refresh Start): indicate FSM Error

c) Receipt of an unsupported RIB-Att in the Rib-Atts variable length field in the RIB REFRESH PDU for a RIB Refresh Start OpCode: indicate RIB REFRESH error with error subcode ″Unsupported RIB-Atts″

8. Forwarding Process for CLNS

The forwarding process for CLNS operation is driven by the header information carried in an ISO 8473 NPDU:

a) If the NPDU contains an ISO 8473 complete source route parameter, then further forwarding of this NPDU shall be handled by the ISO 8473 protocol, not by the mechanisms defined in this international standard.

b) If the NPDU contains an ISO 8473 partial source route parameter, the NPDU shall be forwarded on a path to the next system listed in the partial source route parameter.

c) If the NPDU does not contain an ISO 8473 source route parameter, the NPDU shall be forwarded on a path to the system listed in the destination address field of the NPDU.

Having determined the system to which a path is needed, the BIS shall proceed as follows:

a) If the destination system is located in its own RD, the local BIS shall proceed as defined in clause 8.1.

b) If the destination system is located in a different RD, the local BIS shall perform the following actions:

   1) It shall determine the *NPDU-Derived Distinguishing Attributes* of the NPDU, according to clause 8.2.

1 2) It shall next apply the procedures of 8.3 to
1 determine if the NPDU-derived Distinguishing
1 Attributes match any of the FIB-Atts of the
1 Forwarding Information Bases of the local
1 BIS:

1 i) If the NPDU-derived Distinguishing Attri-
1 butes match the FIB-Att of a local FIB,
1 then the NPDU shall select that FIB and
1 shall forward the NPDU using the
1 methods of clause 8.4.

4 ii) Otherwise, perform the ISO 8473
4 ″Discard PDU Function″ and generate an
4 ER PDU with the parameter value set to
4 ″Unsupported Option not Specified″.

1 If the underlying data protocol permits the modifi-
1 cation or removal of the QOS or Priority parame-
1 ters of the data PDU, then the BIS may modify
1 such information appropriately and forward the
1 data PDU according to a fallback FIB. Otherwise,
1 the BIS shall discard the data PDU if changing the
1 QOS or Priority parameter as described above
1 would violate conformance to the underlying data
1 protocol as seen by systems other than the par-
1 ticipating BIS.

8.1 Forwarding to Internal Destinations

If the destination address of an incoming NPDU depicts a system located within the routeing domain of the receiving BIS, then it shall forward that NPDU to any of the ISs listed in managed object **INTRA-IS**. That is, any further forwarding of the NPDU is the responsibility of the intra-domain routeing protocol.

8.2 Determining the NPDU-derived Distinguishing Attributes

As the first step in forwarding an NPDU to a destination located in another routeing domain, the receiving BIS shall determine the *NPDU-derived Distinguishing Attributes* of the incoming ISO 8473 NPDU. This determination shall be based on an examination of the priority parameter, security parameter, and QOS maintenance parameter in the NPDU′s header:

— The 8473 priority parameter corresponds to the PRIORITY path attribute.

4 — The first two bits of the ISO 8473 security param-
4 eter are decoded:

4 • if they equal ′11′, then the parameter identi-
4 fies a globally unique and unambiguous secu-
4 rity level (see ISO 8473, clause 7.5.3.3)
4 • if they equal ′01′ then the responsible Secu-
4 rity Authority is identified by the NPDU′s
4 source NSAP Address
4 • if they equal ′10′ then the responsible Secu-
4 rity Authority is identified by the NPDU′s des-
4 tination NSAP Address.

4 The corresponding NPDU-Derived Distinguishing
4 attribute is then a SECURITY attribute identifying
4 the same Security Authority.

Table 4. NPDU-Derived Attribute Set. Some NPDU-derived Distinguishing attributes are by examining the QOS Maintenance Parameter octet for 1 or 0 in the bit positions shown below. The symbol ″-″ indicates that the corresponding bit does not enter into the determination.

QOS Maintenance Parameter								NPDU-Derived Attributes
b_8	**b_7**	**b_6**	**b_5**	**b_4**	**b_3**	**b_2**	**b_1**	
1	1	-	-	-	1	0	0	Transit Delay
1	1	-	-	-	1	0	1	Transit Delay
1	1	-	-	-	0	0	0	Expense
1	1	-	-	-	0	1	0	Expense
1	1	-	-	-	0	1	1	Residual Error
1	1	-	-	-	1	1	1	Residual Error

— The first two bits of the ISO 8473 QoS Maintenance parameter are decoded:

a) If they equal ′01′ then the responsible QoS Authority is indicated by the source NSAP Address, and the NPDU-Derived Distinguishing attribute is determined using the remaining octets of the QoS Maintenance parameter and by applying the rules specified by the QoS Authority and contained in the PIB for selection of the NPDU-Derived Distinguishing attribute. If no such rules exist then no NPDU-Derived Distinguishing attribute shall be associated with this QoS Maintenance parameter.

b) If they equal ′10′ then the responsible QoS Authority is indicated by the destination NSAP Address, and the NPDU-Derived Distinguishing attribute is determined using the remaining octets of the QoS Maintenance parameter and by applying the rules specified by the QoS Authority and contained in the PIB for selection of the NPDU-Derived Distinguishing attribute. If no such rules exist then no NPDU-Derived Distinguishing attribute shall be associated with this QoS Maintenance parameter.

c) If they equal ′11′ then the NPDU-Derived Distinguishing attribute is as shown in Table 4.

If examination of the 8473 header shows that no NPDU-Derived Distinguished Attributes are present, then the NPDU shall be associated with the Empty Distinguishing Attribute.

8.3 Matching RIB-Att to NPDU-derived Distinguishing Attributes

Within the BIS, each of its FIB(s) has an unambiguous RIB-Att (see clause 7.9.1) which is constructed from the set of Distinguishing Attributes that the local BIS supports. The set of NPDU-derived Distinguishing Attributes matches a given RIB-Att (which is itself a set of Distinguishing Attributes) when all of the following conditions are satisfied:

a) Both sets contain the same number of attributes.

b) Each instance of a type-specific attribute in the NPDU-derived Distinguishing Attributes must have an equivalent instance in the FIB-Att. The type-specific path attributes supported by IDRP are:

— Transit delay
— Residual error
— Expense
— Priority

c) Each instance of a type-value specific attribute in the NPDU-Derived Distinguishing Attributes has a corresponding instance in an FIB′s RIB-Att, and, depending on the type of the NPDU-Derived Distinguishing Attribute:

LOCALLY DEFINED QOS: The NSAP Address prefixes and QoS Values are identical.

SECURITY: The same Security Authority is identified in each case.

Provided that such a RIB-Att can be found then the contents is inspected to find an entry such that:

a) the NLRI contains the NPDU′s destination NSAP Address, or an NSAP Address prefix which is a prefix of the NPDU′s destination NSAP Address;

b) the subnetwork hop′s priority, if present, is less than or equal to the NPDU′s priority

c) with reference to the applicable Security Policy rules contained in the PIB, the subnetwork hop provides sufficient protection for the NPDU, and the NPDU is permitted to use the subnetwork hop.

d) when a type specific NPDU-Derived Distinguishing Attribute has been selected by a rule specified by a QoS Authority from a source or destination specific QoS Maintenance parameter, then an additional matching rule may also be specified that determines whether the value of the QoS metric is acceptable.

If such a RIB-Att or entry cannot be found, then perform the following procedure in the order indicated, terminating when either a match is found or all three steps have been executed:

a) if the NPDU′s security parameter does not express a requirement for protection, the SECURITY attribute may be removed from the NPDU-Derived Distinguishing attributes, and the above procedures repeated in order to find a match.

b) the PRIORITY attribute may be removed from the NPDU-Derived Distinguishing attributes, and the above procedures repeated in order to find a match.

c) LOCALLY DEFINED QOS, EXPENSE, TRANSIT DELAY, or RESIDUAL ERROR (only one of which can be present in a valid set of distinguishing attributes) may be removed from the NPDU-Derived Distinguishing attributes, and the above procedures repeated to find a match.

NOTE 33: If no match was found in the first two steps, the third step will reduce the NPDU-Derived distinguishing attributes to either an empty set or a single security attribute. In the first case, the empty set will match the Empty RIB-Att; in the second case, there can be either a match or a mismatch with the security parameter.

8.4 Forwarding to External Destinations

If the destination address of the incoming NPDU depicts a system located in a different routeing domain from the receiving BIS, then the receiving BIS shall use the FIB identified by the FIB-Att that matches the NDPU-derived Distinguishing Attributes of the incoming NPDU. The incoming NPDU shall be forwarded based on the longest address prefix that matches (as in 7.1.2.2) the destination NSAP address of the incoming NPDU, as follows:

a) If the entry in the inter-domain FIB that corresponds to the destination address of the incoming NPDU contains a NEXT_HOP entry that identifies a BIS which is located on at least one common subnetwork with the local BIS, then the NPDU shall be forwarded directly to the BIS indicated in the NEXT_HOP entry.

b) If the entry in the inter-domain FIB that corresponds to the destination address of the incoming NPDU contains a NEXT_HOP entry that identifies a BIS which is not located on at least one common subnetwork with the local BIS, then the local BIS has the following options:

   1) **Encapsulate the NPDU:** The local BIS may encapsulate the NPDU, using its own NET as the source address and the NET of the next-hop BIS as the destination address. Copy the following, when present in the header of the encapsulated (inner) NPDU, to the header of the encapsulating (outer) NPDU: QOS Maintenance parameter, Segmentation Permitted Flag, Error Report Flag, and PDU Lifetime field. When the inner NPDU is decapsulated, replace its PDU Lifetime field with PDU Lifetime field of the outer NPDU. The encapsulated NPDU shall then be handed over to the intra-domain routeing protocol.

      NOTE 34: It is a local responsibility to insure that the NPDU is encapsulated appropriately for the RD′s intra-domain protocol. Since this international standard does not mandate the use of a specific intra-domain protocol, encapsulation details for specific intra-domain protocols are outside its scope.

   2) **Use Paths Provided by the Intra-domain Routeing Protocol:** The local BIS may query the intra-domain FIB to ascertain if the intra-domain protocol is aware of a route to the destination system[4]. If there is an intra-domain route that supports the QOS Maintenance parameter of the NPDU and will deliver the NPDU to the appropriate next-hop BIS, then the NPDU may be forwarded along this route.

      NOTE 35: This case makes use of the intra-domain protocol′s knowledge of suitable paths through the local RD which support the specified QOS parameter. It does not require encapsulation of the NPDU.

      Details of the mapping between the QOS parameters of used by a given intra-domain protocol and the QOS Maintenance parameter of the NPDU must be determined by the intra-domain routeing protocol; this mapping is not within the scope of IDRP.

[4] For example, if ISO 10589 were used as the intra-domain routeing protocol, it would be able to calculate path segments through the RD for systems contained in its ″reachable address prefixes″.