Title: Route Furcation in IDRP

Source: IBM

1. ***Rationale:***

   CD 10747 requires that only the originator of a route can append distinguishing attributes for that route. This contribution will eliminate this restriction. The usage rules for a new well-known mandatory attribute, APPENDABLE, allow a BIS to append distinguishing attributes to a route that previously had no distinguishing attributes. Effectively, this process allows a BIS to dynamically create a new routes with distinguishing attributes from an original route that contained no distinguishing attributes. The APPENDABLE attribute therefore reduces the number of BISs that have to support various QOSs.

   This contribution also amends the forwarding process to permit an NPDU with a given set of distinguishing attributes to be forwarded, under certain conditions, along a path segments that supports no distinguishing attributes.

2. ***Proposed Changes:***

   a. Replace the third clause in 7.3 under Flags ("The third high-order...") with the following text:

      The third high-order bit (bit 6) of the attribute flag octet is the Partial Bit. It defines whether a path attribute in the UPDATE PDU is partial (if set to 1) or complete (if set to 0). A distinguishing attribute that was appended to the route by a BIS located in the domain that originated the route is called "complete"; a distinguishing attribute appended by BISs located in any other RDs is called "partial".

   b. Add at the end of 7.3 the following text:

      APPENDABLE is a well-known mandatory path attribute. It has a length of 2 octets. Its bits are used as a mask, defined as follows:

      bit 0: TRANSIT DELAY
      bit 1: RESIDUAL ERROR
      bit 2: EXPENSE
      bit 3: SOURCE SPECIFIC QOS
      bit 4: DESTINATION SPECIFIC QOS
      bit 5: SOURCE SPECIFIC SECURITY
      bit 6: DESTINATION SPECIFIC SECURITY
      bit 7: CAPACITY
      bit 8: PRIORITY
      bits 9—16: transmitted as 1, and ignored on receipt.

      Usage of this attribute is described in clauses 8.13.9, 8.13.10, 8.13.11, 8.13.12, 8.13.13, 8.13.17, 8.13.18, 8.13.19, 8.13.20, and 8.13.ZZ.

   c. Modify Table 1 to include APPENDABLE attribute (well-known, mandatory), Type Code X, Length 2 octets, Distinguishing No.

   d. Add new clause after 8.13.20 with the following text:

8.13.ZZ APPENDABLE ATTRIBUTE

This is a well-known mandatory attribute. When it is present in an UPDATE PDU that contains any distinguishing attributes, it shall be ignored.

This attribute allows a BIS to create new routes that have distinguishing attributes deriving them from a route with no distinguishing attributes that has been received from an adjacent RD and has been installed in the local BIS's LocRIB. (The installed route—with no distinguishing attributes—is called the *base route*, and the newly created routes —with distinguishing attributes—are called *derived routes*) The Partial Bit of the Flag field of each distinguishing attribute in the derived route shall be set to 1. The set of distinguishing attributes in a derived route shall be one of the RIB-Atts supported by the local BIS: that is, a local BIS can not install any route whose RIB-Att has not been reported in its OPEN PDU.

A BIS that advertises a derived route shall install this route into its appropriate Loc-RIB (as determined by the appended distinguishing attributes), and adjust appropriate Loc-FIB and Adj-RIBs-Out.

A BIS that advertises a route with no distinguishing attributes shall set the bits in the APPENDABLE attribute for that route as follows:

1. If none of its local RIB-Atts include Transit Delay distinguishing attribute, then set the TRANSIT DELAY bit to 0 when advertising the route to an adjacent BIS. In all other cases set the TRANSIT DELAY bit to 1.
2. If none of its local RIB-Atts include Residual Error distinguishing attribute, then set the RESIDUAL ERROR bit to 0 when advertising the route to an adjacent BIS. In all other cases set the RESIDUAL ERROR bit to 1.
3. If none of its local RIB-Atts include Expense distinguishing attribute, then set the EXPENSE bit to 0 when advertising the route to an adjacent BIS. In all other cases set the EXPENSE bit to 1.
4. If none of its local RIB-Atts include Source Specific QOS distinguishing attribute, then set the SOURCE SPECIFIC QOS bit to 0 when advertising the route to an adjacent BIS. In all other cases set the SOURCE SPECIFIC QOS bit to 1.
5. If none of its local RIB-Atts include Destination Specific QOS distinguishing attribute, then set the DESTINATION SPECIFIC QOS bit to 0 when advertising the route to an adjacent BIS. In all other cases set the DESTINATION SPECIFIC QOS bit to 1.
6. If none of its local RIB-Atts include Source Specific Security distinguishing attribute, then set the SOURCE SPECIFIC SECURITY bit to 0 when advertising the route to an adjacent BIS. In all other cases set the SOURCE SPECIFIC SECURITY bit to 1.
7. If none of its local RIB-Atts include Destination Specific Security distinguishing attribute, then set the DESTINATION SPECIFIC SECURITY bit to 0 when advertising the route to an adjacent BISs. In all other cases set the DESTINATION SPECIFIC SECURITY bit to 1.
8. If none of its local RIB-Atts include Capacity distinguishing attribute, then set the CAPACITY bit to 0 when advertising the route to an adjacent BIS. In all other cases set the CAPACITY bit to 1.

9. If none of its local RIB-Atts include Priority distinguishing attribute, then set the PRIORITY bit to 0 when advertising the route to an adjacent BIS. In all other cases set the PRIORITY bit to 1.

10. Once a bit in the APPENDABLE attribute is set to 1, it can not be reset back to 0.

e. Add after the third paragraph in each of 8.13.9 through 8.13.20, filling in *name* with the name of the attribute discussed in that clause:

   If a BIS advertises a route whose destinations are located in another RD, then the BIS may append the *name* attribute to the route from the default Loc-RIB, provided that the base route has the *name* bit of its APPENDABLE attribute set to 0, and the conditions specified in clause 8.13.ZZ are satisfied. The BIS shall set the the Partial bit to 1 in the FLAGS field of the *name* attribute in the derived route, and it shall also set the *name* bit of the APPENDABLE attribute to 1 in the corresponding base route (the one in the default Loc-RIB).

f. Add at the end of 8.17.5.3 the following text:

   APPENDABLE attribute: The value of the APPENDABLE attribute of the aggregated route shall be set equal to the logical OR of the APPENDABLE attributes of the routes being aggregated.

g. Replace item (2) of the clause 9 with the following text:

   It shall next apply the procedures of clause 9.3 to determine if the NPDU-derived Attributes match any of the RIB-Atts of the information base(s) supported by the local BIS.

   1. If there is a match, then the local BIS shall proceed as describe in clause 9.4.

   2. If there is no match, then the local BIS shall proceed as described in clause 9.5.

h. Add the following text to the end of clause 9.4:

   If the destination address of the incoming NPDU depicts a system located in a different routeing domain from the receiving BIS, and the receiving BIS does not have an entry in the FIB identified by RIB-Att than matches the NPDU-derived Distinguishing Attributes, then the BIS may use its Default FIB to attempt to forward the NPDU as describe in clause 9.5.

i. Add the new clause after clause 9.4 with the following text:

   9.5 Forwarding to External Destination with Loose QOS Binding

   If the destination address of the incoming NPDU depicts a system located in a different routeing domain from the receiving BIS, and the receiving BIS either does not have an entry in the FIB identified by RIB-Att that matches the NPDU-derived Distinguishing Attributes, or does not support the FIB identified by RIB-Att that matches the NPDU-derived Distinguishing Attributes, then the local BIS may use its Default FIB to attempt to forward the incoming NPDU as follows:

   1. Find the entry in the inter-domain Default FIB that corresponds to the destination address of the incoming NPDU.

   2. Extract from the Default Loc-RIB the route from which the FIB entry was derived.

   3. Derive the APPENDABLE attribute template from the incoming NPDU as follows:

- If the NPDU-Derived Attributes specify Transit Delay, then set bit 0 of the template to 1
- If the NPDU-Derived Attributes specify Residual Error, then set bit 1 of the template to 1
- If the NDPU-Derived Attributes specify Expense, then set bit 2 of the template to 1
- If the NPDU-Derived Attributes specify Source Specific QOS, then set bit 3 of the template to 1
- If the NPDU-Derived Attributes specify Destination Specific QOS, then set bit 4 of the template to 1
- If the NPDU-Derived Attributes specify Source Specific Security, then set bit 5 of the template to 1
- If the NPDU-Derived Attributes specify Destination Specific Security, then set bit 6 of the template to 1
- If the NDPU-Derived Attributes specify Capacity, then set bit 7 of the template to 1
- If the NDPU-Derived Attributes specify Priority, then set bit 8 of the template to 1

4. If the logical AND of the APPENDABLE attribute template and the APPENDABLE attribute of the route from the Default Loc-RIB yields 0, then the local BIS shall proceed to forward the NPDU as described in clauses a) and b) of 9.4.

5. In all other cases the local BIS shall perform the ISO 8473 ″Discard PDU Function (see clause 6.9 of ISO 8473), and shall generate an 8473 ER PDU with the parameter value set to ″Unsupported Option not Specified″.