Title: CLNP and Routeing Support for Weak/Strong QOS

Source: IBM

IBM would like to see discussion of the issues related to support of weak and/or strong QOS examined in the context of possible implications to the Connectionless Network Protocol (ISO 8473) and the two Network layer routeing protocols (ISO 10589 and CD 10747). We propose changes to all these protocols that will allow a consistent treatment of QOS and Security parameters in the Network layer. We propose that the originator of a PDU specify the desired forwarding mode (weak or strong), and that the routeing protocols record in the PDU header the mode that actually was used for the PDU.

In the context of this contribution, we use the following generic definitions:

Weak QOS Forwarding: When an NPDU carries a given QOS parameter, that NPDU will be forwarded preferentially on a path with the requested QOS, if such a path is available; otherwise, the NPDU will be forwarded on a path with ″default QOS″.

Strong QOS Forwarding: When an NPDU carries a given QOS parameter, that NPDU will be forwarded on a path with the requested QOS when such a path is available; otherwise, the NPDU will be discarded.

We address both the QOS Maintenance parameter and also its Security Parameter. We will review what ISO 8473 has to say on the subject, and relate that to the ways that the two routeing protocols implement their forwarding processes.

What Does ISO 8473 Say?

ISO 8473 (CLNP) was developed before the two ISO routeing protocols, and it attempted to anticipate what would be a reasonable way to handle them. In the areas that we are concerned about, ISO 8473 classifies QOS MAINTENANCE as a type 3 function: that is, according to ISO 8473 clause 6.19, ″If an implementation does not support a Type 3 function and the function is selected in a PDU, then the function is not performed and the PDU is processed exactly as though the function had not been selected. The protocol data until shall not be discarded for this reason″. On the other hand, IS 8473 classifies SECURITY as a type 2 function: that is, ″If an implementation does not support a Type 2 function and the function is selected in a PDU, then that PDU shall be discarded and an Error Report PDU shall be generated...″.

According to Note 2 of ISO 8473′s Table 4, ″The rationale for the inclusion of type 3 functions is that in the case of some functions it is more important to forward PDUs between intermediate systems or deliver them to an end-system than it is to support the functions.″ One could surmise by analogy that the reason for type 2 functions is that it is more important to support the requested function than it is to forward the PDU as if the requested function were not supported.

What Does ISO 10589 Say?

ISO 10589 (Intra-domain Routeing) treats forwarding of PDUs that contain the QOS MAINTENANCE parameter as ″weak″. It is silent about what it will do if the SECURITY parameter is present in the

PDU-- presumably it will treat it as ″weak″. That is, it acts on a reasonable assumption in the context of performance-based routeing: namely, that it is more important to forward the PDU than to respect the requested ″QOS″ or ″Security″.

What Does CD 10747 Say?

CD 10747 (Inter-domain Routeing) treats forwarding of PDUs that contain the QOS MAINTENANCE or the SECURITY parameter as ″strong″. That is, it acts on a reasonable assumption in the context of policy-based routeing: namely, that it is more important to respect the requested ″QOS″ or ″Security″ parameter than it is to forward the PDU on a default path.

What Is ISO 8473 Silent About?

There areambiguities in ISO 8473, however. Clause 6.9 (Discard PDU) says that PDUs should be discarded if a PDU contains an unsupported option (item ″i″), but clause 6.19 names certain categories of functions for which this is not true. Clause 6.9 is a mandatory item in the PICS, but clause 6.19 is not. Which prevails?

Clause 6.19 says that if a requested QOS is unavailable, the IS should attempt to deliver the PDU at a ″different QOS″, but is silent on what this ″different QOS″ might be. If one interpreted clause 6.9, item ″f″ in a literal fashion, a PDU whose address is unreachable should be discarded. Does ″unreachable″ mean unreachable on a path with the requested QOS? If so, then 6.9 and 6.19 are in conflict, but both clauses are manadatory in the PICS for ISO 8473 (ISO 8473:1988/PDAM 4, our document 91-287).

The crux of the problem that needs to be addressed is this question: should ISO 8473 arbitrarily prioritize the relative importance of function support versus forwarding, or is this something that is best specified by the originator of the PDU? That is, should ISO 8473 be amended so that the originator of the PDU can declare whether the forwarding support for certain parameters is to be ″strong″ or ″weak″, and then mandate that the routeing protocols used in conjunction with it forward the PDUs accordingly?

A Possible Solution

Rather than choose one mode of forwarding and deprecate the other, or rather than devote a good deal of time to splitting hairs on how to interpret the ambiguous parts of ISO 8473, IBM recommends that we recognize that both types of forwarding have a valid place in a CLNP that operates in conjunction with both performance-oriented and policy-oriented routeing protocols. We propose that the 8473 parameters be treated as follows:

- The ″globally unique″ settings of the QOS MAINTENANCE parameter as described in ISO 8473 are clearly performance oriented, and hence PDUs containing them should be forwarded in a ″weak″ manner.
- The Security parameter of ISO 8473 (both globally unique setting and the address-specific options) are clearly policy oriented, and hence PDUs containing them should be forwarded in a ″strong″ manner.
- The ″address-specific″ settings of the QOS MAINTENANCE parameter could be used either for performance or policy reasons. Hence, PDUs that contain them should be able to be routed in either a ″weak″ or a ″strong″ manner, and the manner of forwarding to be employed should be determined by the originator of the PDU and should be carried in the parameter itself.

To accomplish these goals, we need to change ISO 8473 (amendment, corrigenda, defect report?) so that it can operate in conjunction with the routeing protocols along the following guidelines:

1. The 8473 QOS MAINTENANCE parameter needs needs to be changed so that the originating system can specify whether that PDU should be forwarded in a ″weak″ or a strong″ manner for address-specific QOS.
2. The 8473 should contain an indicator to show whether the PDU (in the case of ″weak″ forwarding″ was forwarded on a path with requested QOS or on a default path,
3. The routeing protocols should be amended so that they respect the type of forwarding (″weak″ or ″strong″) carried in the data PDU′s header.

Changes to ISO 8473:

The two parameters that are the major concern are the QOS MAINTENANCE parameter and the SECURITY parameter of the ISO 8473 header. ISO 8473 permits each of these parameters to have a variable length, and defines the encoding only for the first octet of the respective parameter value fields (see ISO 8473 7.5.3 and 7.5.6, which are largely identical in a generic sense. The proposed changes to ISO 8473 are:

- There is no change to the currently specified syntax or semantics of the Security parameter
- The syntax and semantics of the QOS maintenance parameter are changed as follows:

  1. Currently, bits 8 and 7 of the first octet of the parameter value field of the QOS MAINTENANCE field can request ″address-specific″ operations (see ISO 8473, clause 7.5.6). Unfortunately, this clause states that when the address-specific modes are selected, the remainder of this octet must contain all 0′s. We propose to modify this requirement so that if either of the address-specific modes are selected, then the low order bit (bit 1) will be named ″Fwd Mode Request″, and is used to request ″weak″ or ″strong″ forwarding. A value of ″0″ indicates that ″weak″ forwarding is requested; ″1″ indicates ″strong″. This bit is set by the originator of the PDU and can not be changed by any other system.
  2. Bit 6 of the first octet of the parameter value field is presently listed as ″reserved″ (see ISO 8473, clause 7.5.6.3). This bit will now be used as the ″Fwd Mode Indicator″ bit. Its value indicates the indicates forwarding mode actually in use for those PDUs that specify, or default to, ″weak forwarding″; it is ignored for those PDUs that specify or default to ″strong″ forwarding. It is initially set to 0 by the originator of the PDU that requests ″weak″ forwarding, and can be set to 1 by any IS on the path. Once set to 1, it can not be set back to 0 by any system along the path. If equal to 0, then forwarding is taking place on a path with the requested QOS value; if equal 1, forwarding is taking place on a ″non-requested″ path (for example, a default path that does not have the requested QOS value).

The related change in ISO 8473 is to amend clause 6.6 to include a definition of ″weak″ and ″strong″ forwarding, and to require that the forwarding function respect the setting of the ″Fwd Mode Request″ and ″Fwd Mode Indicator″ bits. That is, IBM feels that forwarding is properly specified unambiguously in one place (ISO 8473), rather than in several routeing protocols (ISO 10589 and CD 10747).

Changes to the Routeing Protocols:

The forwarding processes of the routeing protocols need to be amended so that they respect the new ″Forwarding Type″ field in the ISO 8473 NPDUs:

- If ″strong″ forwarding is requested, and a path with the requested properties is not available in the FIB, then the PDU will be discarded and an error report will be sent back to the source.
- If ″weak″ forwarding is requested, and the ″Fwd Mode Indicator″ of the incoming PDU is equal to 0, and a path with the requested property is available, forward the PDU along that path
- If ″weak″ forwarding is requested and the ″Fwd Mode Indicator″ the incoming PDU is equal to 0, and a path with the requested property is not available in the FIB, set ″Fwd Mode Indicator″ to 1 and then forward the PDU on a default path
- If ″weak″ forwarding is requested and the ″Fwd Mode Indicator″ of the incoming PDU is equal to 1, forward the PDU on a default path
- If a given carries PDU any parameter that specifies or defaults to ″strong″ forwarding, then the PDU must be forwarded in a ″strong″ manner, even if another parameter requests ″weak″ forwarding. (This situation could occur, for example, if a given PDU contained both a Security parameter and a QOS MAINTENANCE parameter.)

By not allowing the ″Fwd Mode Request″ bit to be set only by the originator of the PDU, we assure that the ultimate recipient of the PDU will be able to determine whether or not the PDU actually traversed a complete source-to-destination path with the requested properties. That is, the ″Fwd Mode Request″ bit in the received PDU is equal to 0 and the ″Fwd Mode Indicator″ bit is equal to 1, then the requested QOS value was not available, while values of 0 and 0 mean that it was.