Date: 1993-02-12

Information technology — Protocol for providing the connectionless–mode network service

AMENDMENT *ext*: Extensibility, Quality of Service, and Record Route Timestamps

Introduction

This Amendment to CCITT Rec. X.233 | ISO/IEC 8473-1 adds features to the protocol that support

- extensibility — the ability for a system to classify each option in a received PDU according to whether or not the option can be ignored, even if it does not recognize the individual option type code (so that new options can be added to future revisions of the standard with minimal impact on existing implementations);
- “strong” as well as “weak” quality of service — the ability for Intermediate Systems to identify PDUs containing Type 3 options that have been forwarded by one or more systems that do not support those options; and
- timestamps — the ability to associate a timestamp with each Network Entity Title in the “recording of route” option.

1 Scope

This Amendment makes no changes to clause 1 of CCITT Rec. X.233 | ISO/IEC 8473-1.

2 Normative references

This Amendment makes no changes to clause 2 of CCITT Rec. X.233 | ISO/IEC 8473-1.

3 Definitions

This Amendment makes no changes to clause 3 of CCITT Rec. X.233 | ISO/IEC 8473-1.

4 Abbreviations

This Amendment makes no changes to clause 4 of CCITT Rec. X.233 | ISO/IEC 8473-1.

5 Overview

This Amendment makes no changes to clause 5 of CCITT Rec. X.233 | ISO/IEC 8473-1.

6 Protocol functions

6.15 Record route function

Replace the text of clause 6.15, in its entirety, with the following:

The record route function records the path taken by a PDU as it traverses a series of intermediate systems. A recorded route consists of a list of entries held in a parameter within the options part of the PDU header. Each entry consists of either a Network entity title, or a timestamp followed by a Network entity title. The length of this parameter is determined by the originating Network entity, and does not change during the lifetime of the PDU.

The list is constructed as the PDU is forwarded along a path towards its destination. Only entries corresponding to intermediate system Network entities shall be included in the recorded route. No entry shall be recorded for the originator of the PDU.

When an intermediate system Network entity processes a PDU containing the record route parameter, the Network entity adds its own entry at the end of the list. An indicator is maintained to identify the next available octet to be used for recording of route. This indicator is updated as entries are added to the list as follows. The length of the entry to be added to the list is added to the value of the next available octet indicator, and this sum is compared with the length of the record route parameter. If the addition of the entry to the list would exceed the size of the parameter, the next available octet indicator is set to indicate that route recording has been terminated. The entry is not added to the list. The PDU may still be forwarded to its final destination, without further addition of entries.

If the addition of the entry would not exceed the size of the record route parameter, the next available octet indicator is updated with the new value, and the entry is added to the end of the list.

Two forms of the record route function are provided. The first form is referred to as complete route recording. It requires that the list of Network entity titles (with or without associated timestamps) be a complete and accurate record of all intermediate systems visited by a PDU (including Derived PDUs), except when a shortage of space in the record route option field causes termination of recording of route, as described above. When complete route recording is selected, PDU reassembly at intermediate systems may be performed only when the Derived PDUs that are reassembled all took the same route.

The second form is referred to as partial route recording. It also requires a record of intermediate systems visited by a PDU. When partial route recording is selected, PDU reassembly at intermediate systems may be performed whether or not the Derived PDUs that are reassembled all took the same route; the route recorded in any of the Derived PDUs may be placed in the PDU resulting from the reassembly.

NOTE — The record route function is intended to be used in the diagnosis of subnetwork problems and/or to provide a return path that could be used as a source route in a subsequent PDU.

7 Structure and encoding of PDUs

7.5 Options part

7.5.1 General

Replace the entire paragraph immediately following Figure 8, which begins "The parameter code field is...", with the following:

The parameter code field is encoded in binary and provides for a maximum of 252 different parameters. The high-order two bits of the parameter code field contain a processing requirement code, which is used to classify the parameter with respect to whether or not it can be ignored, or must be processed, by end and intermediate systems. The processing requirement codes are shown in Table 5, in which "may be ignored" means that the end system or intermediate system is permitted, but is not required, to process the PDU containing the option exactly as though the option were not present, and "shall be processed" means that the end system or intermediate system is required to process the parameter identified by the remainder of the parameter code in accordance with the specification of the parameter.

Processing Requirement Code	Processing Requirements
00	May be ignored by ESs and ISs
01	May be ignored by ESs
10	May be ignored by ISs
11	Shall be processed by ESs and ISs

Table 5 — Processing requirement codes

NOTE — The purpose of the processing requirement code is to permit the future extension of this Recommendation | International Standard by the definition of new option parameters, while permitting the continued use of implementations that pre-date the extensions (by permitting them to ignore a new option parameter, when it is possible to do so, without knowing what the option is).

An option identified by a processing requirement code of 00 represents information that is not essential for either the relaying or the delivery of PDUs containing the option; end systems and intermediate systems are permitted to process the PDU as if it did not contain the option.

An option identified by a processing requirement code of 01 represents information that is not essential for the delivery of PDUs containing the option, but is essential for the relaying of those PDUs; end systems are permitted to process the PDU as if it did not contain the option, but an intermediate system that cannot process an option with a processing requirement code of 01 shall discard the PDU.

An option identified by a processing requirement code of 10 represents information that is not essential for the relaying of PDUs containing the option, but is essential for the delivery of those PDUs; intermediate systems are permitted to process the PDU as if it did not contain the option, but an end system that cannot process an option with a processing requirement code of 10 shall discard the PDU.

An option identified by a processing requirement code of 11 represents information that is essential for both the relaying and the delivery of PDUs containing the option; an end system or intermediate system that cannot process an option with a processing requirement code of 11 shall discard the PDU.

7.5.5 Recording of route

Replace the text to the right of "Parameter Value:" at the beginning of the clause with the following:

2 octets of control information followed by a concatenation of entries, each of which consists of either a Network entity title or a 32-bit timestamp followed by a Network entity title, ordered from source to destination.

Add the following two entries to the list of type codes:

0000 0010	partial recording of route in progress (with timestamps)
0000 0011	complete recording of route in progress (with timestamps)

In the paragraph that immediately follows the type code list, replace the term "Network entity title" *with the term* "entry", *and replace the term* "Network entity titles" *with the term* "entries".

Replace the second paragraph after the type code list with the following:

The third octet begins the list of recorded route entries. Entries are always added to the end of the list. The first octet of each entry gives the length in octets of the remainder of the entry. For type codes 0000 0001 and 0000 0010, the remainder of each entry consists of a Network entity title. For type codes 0000 0010 and 0000 0011, the remainder of each entry consists of a fixed-length 32-bit timestamp followed by a Network entity title.

7.5.6 Quality of service maintenance

Amend Table 6 so that code 00 *(which is currently reserved) is assigned to a new "Type of* QoS*" field named "Globally unique with strong forwarding", and rename the "Type of* QoS*" field to which code* 11 *is assigned (currently "Globally unique") "Globally unique with weak forwarding".*

Change the first two sentences of the paragraph immediately following Table 6 to read as follows:

For QoS format codes 00 and 11, the remainder of the first octet is reserved for use by the globally unique QoS format, as described in 7.5.6.3. If any other QoS format code is selected, bits 5-1 of the first octet shall be zero(0).

7.5.6.1 Source address specific

Add the following new paragraph at the end of the clause:

A value of 1 in bit 6 of the QoS format code indicates that the PDU has at some point been forwarded on a path that did not support the specified source address specific QoS parameter.

7.5.6.2 Destination address specific

Add the following new paragraph at the end of the clause:

A value of 1 in bit 6 of the QoS format code indicates that the PDU has at some point been forwarded on a path that did not support the specified source address specific QoS parameter.

7.5.6.3 Globally unique QoS

Replace the first paragraph of the clause with the following:

The QoS format code value of binary 11 indicates that the remainder of the parameter value field specifies a globally unique with weak forwarding QoS maintenance field, and that this parameter shall be treated as a Type 3 function (see 6.21). The QoS format code value of binary 00 indicates that the remainder of the parameter value field specifies a globally unique with strong forwarding QoS maintenance field, and that this parameter shall be treated as a Type 2 function (see 6.21). When the value of the QoS format code is 00 or 11, the parameter value field shall have a total length of one octet, which is assigned the values shown in Table 7.

In Table 7, replace the entry in the "Usage" column of the row for bits 8 and 7 with the following:

QoS format codes of binary 00 or 11

In Table 7, replace the entry in the "Usage" column of the row for bit 6 with the following:

QoS unavailable

Add the following text as a new paragraph immediately after Table 7:

When the value of the QoS format code is 11, bit 6 is set to one to indicate that at some point an intermediate system could not forward the PDU in accordance with the QoS maintenance field value contained in bits 5, 3, 2, and 1, but forwarded the PDU anyway (as it is permitted to do in the case of Type 3 options, such as QoS maintenance). When the value of the QoS format code is 00, bit 6 is reserved.

8 Provision of the underlying service

This Amendment makes no changes to clause 8 of CCITT Rec. X.233 | ISO/IEC 8473-1.

9 Conformance

This Amendment makes no changes to clause 9 of CCITT Rec. X.233 | ISO/IEC 8473-1.