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Amendment 1
X.233
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DATA NETWORKS AND OPEN SYSTEM COMMUNICATIONS OPEN SYSTEMS INTERCONNECTION – CONNECTIONLESS-MODE PROTOCOL SPECIFICATIONS

INFORMATION TECHNOLOGY – PROTOCOL FOR PROVIDING THE OSI CONNECTIONLESS-MODE NETWORK SERVICE: PROTOCOL SPECIFICATION

AMENDMENT 1: MULTICAST EXTENSION

Amendment 1 to

ITU-T Recommendation X.233
Superseded by a more recent version

(Previously “CCITT Recommendations”)

FOREWORD

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The approval of Recommendations by the Members of ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, 1993). In addition, the World Telecommunication Standardization Conference (WTSC), which meets every four years, approves Recommendations submitted to it and establishes the study programme for the following period.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC. The text of ITU-T Recommendation X.233, Amendment 1, was approved on 10th of April 1995. The identical text is also published as ISO/IEC International Standard 8473-1.

NOTE

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

Superseded by a more recent version

ITU-T X-SERIES RECOMMENDATIONS

DATA NETWORKS AND OPEN SYSTEM COMMUNICATIONS

(February 1994)

ORGANIZATION OF X-SERIES RECOMMENDATIONS

Subject area	Recommendation Series
PUBLIC DATA NETWORKS	
Services and Facilities	X.1-X.19
Interfaces	X.20-X.49
Transmission, Signalling and Switching	X.50-X.89
Network Aspects	X.90-X.149
Maintenance	X.150-X.179
Administrative Arrangements	X.180-X.199
OPEN SYSTEMS INTERCONNECTION	
Model and Notation	X.200-X.209
Service Definitions	X.210-X.219
Connection-mode Protocol Specifications	X.220-X.229
Connectionless-mode Protocol Specifications	X.230-X.239
PICS Proformas	X.240-X.259
Protocol Identification	X.260-X.269
Security Protocols	X.270-X.279
Layer Managed Objects	X.280-X.289
Conformance Testing	X.290-X.299
INTERWORKING BETWEEN NETWORKS	
General	X.300-X.349
Mobile Data Transmission Systems	X.350-X.369
Management	X.370-X.399
MESSAGE HANDLING SYSTEMS	X.400-X.499
DIRECTORY	X.500-X.599
OSI NETWORKING AND SYSTEM ASPECTS	
Networking	X.600-X.649
Naming, Addressing and Registration	X.650-X.679
Abstract Syntax Notation One (ASN.1)	X.680-X.699
OSI MANAGEMENT	X.700-X.799
SECURITY	X.800-X.849
OSI APPLICATIONS	
Commitment, Concurrency and Recovery	X.850-X.859
Transaction Processing	X.860-X.879
Remote Operations	X.880-X.899
OPEN DISTRIBUTED PROCESSING	X.900-X.999

Summary

This amendment provides changes to Recommendation X.233 to support the identification of PDUs sent via multicast transfer.

Introduction

ITU-T Recommendation X.233 | ISO/IEC 8473 is one of a set of Recommendation | International Standards produced to facilitate the interconnection of open systems. The set of Recommendations and International Standards covers the services and protocols required to achieve such interconnections. ITU-T Rec. X.233 | ISO/IEC 8473-1 specifies the Connectionless Network protocol that provides the Network Service as described in CCITT Rec. X.213 | ISO/IEC 8348.

The material contained in this addendum shall be incorporated into the body of ITU-Rec. X.233 | ISO/IEC 8473-1 when the next revision of ITU-Rec. X.233 | ISO/IEC 8473-1 is produced. The addendum has a structure which is similar to that of ITU-T Rec. X.233 | ISO/IEC 8473-1 in order to facilitate cross-reference between the two documents and eventual incorporation of the addendum into ITU-Rec. X.233 | ISO/IEC 8473-1.

This addendum provides changes to ITU-Rec. X.233 | ISO/IEC 8473-1 to support the identification of PDUs sent via multicast transfer.

INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – PROTOCOL FOR PROVIDING THE OSI CONNECTIONLESS-MODE NETWORK SERVICE: PROTOCOL SPECIFICATION

AMENDMENT 1
(to ITU-T Rec. X.233 | ISO/IEC 8473-1)

MULTICAST EXTENSION

1 Scope

***The paragraph on the first point a) of this clause should be replaced with the following paragraph*:**

a) procedures for the connectionless transmission of data and control information from one network-entity to one or more peer network-entities;

2 Normatives references

This amendment makes no changes to clause 2.

3 Definitions

Add the following referenced definition to 3.4:

d) individual Network address;

Add the following additional two definition clauses:

"**3.7.8 multicast**: Data transmission to one or more destinations in a selected group in a single service invocation."

"**3.7.9 multicast capable intermediate system**: An Intermediate System which incorporates the multicast features of the Network layer."

4 Abbreviations

Add the following abbreviation at the end of 4.2:

MD PDU Multicast Data Protocol Data Unit

5 Overview of the protocol

5.3.1 Addresses

Add this paragraph at the end of 5.3.1:

"A Network entity may send Multicast PDUs using the optional multicast capabilities incorporated into this Recommendation | International Standard. The destination address parameter of a multicast PDU shall contain a group Network address as described in CCITT Rec. X.213 | ISO/IEC 8348. The source address parameter shall not be a group Network address."

6 Protocol functions

6.1 PDU Composition function

Replace the words "and NS-Quality-of-Service" in the second paragraph, second sentence of 6.1 with:

"NS-Quality-of-Service and (for multicast transmission) the Scope Control"

Add the third paragraph, first sentence of 6.1, after the words "particular destination Network service user":

"or users"

6.3 Header Format Analysis function

Add to the first paragraph, last sentence of 6.3, after the first word "If":

"multicast transfer is not supported and if".

Add a new paragraph to the end of 6.3:

"If a Network entity supports multicast transmission, then the header format analysis function shall provide checking to ensure that a PDU does not contain a group Network address in the source address field. Any PDU header analyzed to have a group address in the source address field shall be discarded."

Add this new clause:

"6.3.1 Multicast transfer

The header format analysis function optionally provides capabilities to Network entities which support multicast transfer to supply applicable PDUs directly to end systems served by such a Network entity as well as to forward such PDUs on to other Network entities. This optional functionality is realized through a Network entity with multicast capability identifying a PDU as using multicast transfer via the PDU type and the PDU's destination address field."

6.5 Route PDU functions

Add to the first paragraph of 6.5 (in three places) after the words, "Network entity":

or Network entities

Add a new paragraph and a Note at the end of 6.5:

The route PDU function optionally provides capabilities to Network entities which support multicast transfer for determining multiple Network entities to which a single PDU shall be forwarded to. This may result in multiple invocations of the forward PDU function and hence the need to make multiple copies of the PDU. For PDUs that are received from a different Network entity, the optional functionality for the route PDU function is realized as a result of the header format analysis function's recognition of the PDU as being a multicast PDU. A Network entity attached to more than one subnetwork when originating a multicast PDU is permitted to originate the PDU on more than one subnetwork.

NOTE – The purpose in allowing an originating Network entity to originate a multicast PDU on multiple subnetworks is to support the development of multicast IS-IS protocols which will need to determine on which subnetworks a multicast PDU has visited. This behaviour is predicated on the assumption that the Intermediate Systems in the OSI environment performing multicast forwarding form a connected set.

6.6 Forward PDU function

Replace the first paragraph in 6.6 with the following paragraph:

This function issues an SN-UNITDATA request primitive (see 5.5), supplying the subnetwork or SNDCF identified by the route PDU function with the protocol data unit as user data to be transmitted, the address information required by that subnetwork or SNDCF to identify the "next" system or systems within the subnetwork-specific addressing domain (this may be one or more intermediate systems and/or one or more destination end systems), and quality of service constraints (if any) to be considered in the processing of the user data.

6.9 Discard PDU function

Add an additional reason for discard at the end of Note 1 in 6.9:

j) A PDU is received with an unknown type code.

Add the following note at the end of 6.9:

NOTE 3 – In general, different implementations can analyse received PDUs in different ways and could therefore consider the same PDU as giving rise to different situations from the list a)–j) above. For example, an implementation receiving a PDU with unknown PDU type code could consider that as an occurrence of situation a) or d) as well as situation j). When generating an Error Report PDU, the implementation could use a "reason for discard" (see 6.10 and Table 8) chosen from (at least) "header syntax error", "protocol procedure error", "unknown PDU type" and "reason not specified".

6.10 Error reporting function

6.10.1 Overview

Add this third Note to 6.10.1:

3 It is important to carefully control the use of the error reporting capability in the case of mulicast transfers. The primary concern is to avoid the occurrence of broadcast storms and thus a multicast PDU may not cause the origination of another multicast PDU. This is the primary reason that the source address is not permitted to be a group address. In addition, a multicast PDU with error reporting permitted can result in flooding the source network-entity (as well as the networks used) with Error Report PDUs.

Add a sentence into the third paragraph of 6.10.1, between the first and second sentences:

Such Data PDUs may be either normal Data (DT) PDUs or Multicast Data (MD) PDUs.

6.10.2 Requirements

Add this paragraph at the end of 6.10.2:

While error reports are permitted on multicast PDUs, a PDU with a group Network address in the source address field shall not be responded to with an Error Report. This is to ensure that a multicast PDU does not generate another multicast PDU. If the source address is identified as a group address, then an error report PDU shall not be generated and the original PDU shall be discarded.

6.14 Source routeing functions

Add this paragraph to the end of 6.14:

No source routeing capability is provided for multicast PDU transfer. The NS provider shall not accept a multicast PDU with source route parameters.

Add the following new subclause as 6.21, renumber the present 6.21 as 6.22:

6.21 Scope control function

6.21.1 Overview

The scope control function is an option for multicast PDU forwarding only. The scope control function allows the originator to limit the forwarding of the multicast PDU. The scope control function provides the capability to limit the relaying of a particular PDU based on the individual Network addressing hierarchy and/or limit the amount of multicast expansion which can take place. In cases where both forms of scope control are applied to the same PDU, forwarding will cease once either has reached its scope control limit.

6.21.2 Prefix Based Scope Control

The prefix based scope control function allows the originator to specify a specific set of address prefixes where the multicast forwarding of a PDU by an Intermediate System occurs only if one of the prefixes matches the Network Entity Title (NET) of the Intermediate System. Prefix based scope control may be selected only by the originator of a PDU. Prefix based scope control is accomplished using one or more address prefixes held in a parameter within the options part of the PDU header. The length of this parameter is determined by the originating network entity, and does not change during the lifetime of a PDU.

When an Intermediate System receives a multicast PDU containing a prefix based scope control parameter, forwarding is only performed if every octet of one of the prefixes contained in the prefix based scope control parameter matches that Intermediate System's NET, starting from the beginning of its NET. If no such prefix match exists, the Intermediate System discards the PDU. The error reporting function shall not be invoked upon PDU discard.

6.21.3 Radius Scope Control

The radius scope control function allows the originator to specify a maximum logical distance where multicast expansion can occur. It is closely associated with the header format analysis function. Each IS receiving a multicast PDU which is capable of expanding and which contains a Radius Scope Control parameter, decrements the Radius Scope

Control field in the PDU by an administratively set amount between 0 and the maximum value of the field. An IS, when it decrements the Radius Scope Control field, shall place a value of 0 into this field if its current value is less than the amount it is to decrement by. This function determines whether the PDU received may be forwarded or whether its Radius has been reached, in which case it shall be discarded. An Intermediate System shall not forward a multicast PDU containing a Radius Scope Control parameter with a value of 0. The error reporting function shall not be invoked upon PDU discard.

Add an entry to the end Table 3 (Categorization of protocol functions) in the current 6.21 (but which will be renumbered as 6.22):

Scope Control | 3 | 3 | N/A

7 Structure and Encoding of PDUs

7.2.7 Type code

Table 4.

Add a line to Table 4:

MD PDU 1 1 1 0 1

Replace the first paragraph in 7.3.2 with:

The source address used by this protocol is a Network Service Access Point address or a Network entity title as defined in CCITT Rec. X.213 I ISO/IEC 8348. In the case of the unicast PDUs: the DT, ER, ERQ and ERP PDUs, the destination address used by this protocol is a Network Service Access Point address or a Network entity title as defined in CCITT Rec. X.213 | ISO/IEC 8348. In the case of a multicast PDU: the MD PDU, the destination address used by this protocol is a group Network address as defined in CCITT Rec. X.213 ISO/IEC 8348.

The following three new clauses are added for the two new optional parameters after the present clause 7.5.7:

7.5.8 Prefix Based Scope Control

The prefix based scope control parameter specifies one or more address prefixes for which Intermediate System forwarding requires a match of one of the contained prefixes with the beginning of the Intermediate System's NET.

Parameter Code:	1100 0100
Parameter Length:	variable
Parameter Value:	a concatenation of address prefix entries

The parameter value contains an address prefix list. The list consists of variable length address prefix entries. The first octet of each entry gives the length of the address prefix denominated in bits that comprises the remainder of the entry. If the length field does not specify an integral number of octets then the prefix entry is followed by enough trailing zeroes to make the end of the entry fall on an octet boundary. The list must contain at least one entry.

The prefix shall end on a boundary that is legal in the abstract syntax of the address family from which it is derived. For example, the encoding of a prefix whose DSP is expressed in decimal syntax must end on a semi-octet boundary, while the encoding of a prefix whose DSP is expressed in binary syntax can end on an arbitrary bit boundary. If the end of the prefix falls within the IDP, then the prefix must end on a semi-octet boundary and must not contain any padding characters.

NOTE – The length of the prefix based scope control parameter is determined by the originator of the PDU and is not changed during the lifetime of the PDU.

7.5.8.1 Prefix matching

A prefix that extends into the DSP shall be compared directly against the encoded NET address, including any padding characters that may be present. A prefix which does not extend into the DSP shall be compared against the derived quantity NET', which is obtained from the NET address by removing all padding characters (as defined by the binary encoding process of CCITT Rec. X.213 | ISO/IEC 8348).

The existence of a match shall be determined as follows:

a) If the encoded NET (or NET') contains fewer bits than the prefix, then there is no match.

b) If the encoded NET (or NET') contains at least as many bits as the prefix, and all bits of the prefix are identical to the corresponding leading bits of the encoded NET (or NET'), there is a match.

Otherwise, there is no match.

7.5.9 Radius Scope Control

The radius scope control parameter specifies the logical distance that a multicast PDU can be forwarded.

Parameter Code: 1100 0110

Parameter Length: two octets

Parameter Value: two octets which represents the remaining distance, that the PDU can be forwarded, in administratively set units.

Figure 10.

Retitle Figure 10 as follows:

Data and Multicast Data PDU

Change "Data PDU" in 7.9.2 to:

Data or Multicast Data PDU.

Add a new entry in Table 8:

0000 1000 | (General) | Unknown PDU type

Add the following new clause at the end of clause 7:

7.12 Multicast Data (MD) PDU

The MD PDU has the same format as the DT PDU (see 7.7).

8 Provision of the Underlying Service

Add this paragraph at the end of 8.1:

For a subnetwork that provides an inherent multicast capability, it is the functionality of the SNDCF to provide the mapping between group Network addresses and the corresponding addressing capability of the subnetwork.

9 Conformance

Add an entry to the end of Table 9 (Static Conformance Requirements):

Scope Control | 6.21 | O | N/A (Note 5)

Add a fifth Note to the end of the Notes after Table 9:

5 The scope control function is mandatory for multicast capable intermediate systems and not relevant for intermediate systems which are not multicast capable. See 9.1.3 for additional conformance requirements if the intermediate system is multicast capable.

Add clause 9.1.3:

9.1.3 Multicast Capability

All of the extensions provided to the functions within this Recommendation | International Standard to support multicast capability are optional. For an End System or Intermediate System which is not multicast capable these extensions are not applicable. An implementation claiming conformance to this Recommendation | International Standard as a multicast capable end system shall meet all of the requirements provided in 9.1.1, and also provide all of the multicast extensions provided to the protocol functions listed in Table 9 as mandatory for end systems. An implementation claiming conformance to this Recommendation | International Standard as a multicast capable intermediate system shall meet all of the requirements provided in 9.1.2, and also provide all of the multicast extensions provided to the protocol functions listed in Table 9 as mandatory for intermediate systems which includes the scope control function.

Add a Note to the end of clause 9.3:

NOTE – No PICS proforma is available for the multicast extensions provided in this Recommendation | International Standard.