
**Information technology —
Telecommunications and information
exchange between systems — Intermediate
system to Intermediate system intra-domain
routeing information exchange protocol for
use in conjunction with the protocol for
providing the connectionless-mode
Network Service (ISO 8473)**

**AMENDMENT 2: Extensions for group
composition and related MST multicast
routeing**

*Technologies de l'information — Communication de données et échange
d'informations entre systèmes — Protocole intra-domaine de routage d'un
système intermédiaire à un système intermédiaire à utiliser conjointement
avec le protocole fournissant le service de réseau en mode sans connexion
(ISO 8473)*

*AMENDEMENT 2: Extensions pour la composition de groupe et routage de
la diffusion sélective de MST liée*



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Printed in Switzerland

Foreword

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In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Amendment 2 to ISO/IEC 10589:1992 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*.

Information technology — Telecommunications and information exchange between systems — Intermediate system to Intermediate system intra-domain routeing information exchange protocol for use in conjunction with the protocol for providing the connectionless-mode Network Service (ISO 8473)

AMENDMENT 2: Extensions for group composition and related MST multicast routeing

Add the following new annex G.

Annex G
(normative)

Extensions for group composition and related MST multicast routeing

Introduction

The main intention of this annex is the specification of mechanisms for the distribution and handling of Minimum Spanning Tree (MST) multicast address information within the level 1 routeing area as well as the specification of the computation of the MST used for routeing of multicast NPDUs. The mechanisms specified herein enforce that each Intermediate system has the complete information about all existing address groups and their composition, that is the NSAP addresses of all members belonging to a particular address group. Since the distribution of this group information on larger networks would use a not negligible network bandwidth, the restriction on the level 1 area as mentioned above has been done. In a future step the MST multicasting mechanisms specified herein shall be expanded for the level 2 routeing area. This kind of multicasting is referred to as MST multicasting within the document.

In ISO/IEC 10589:1992 there is no mean for using multicast addresses. This annex proposes the usage of multicast addresses, as defined in ISO 8348:1987 and the replication of NPDUs making use of a computed MST in those Intermediate systems, where the destination addresses divert to multiple links. This new definition can be used on all types of subnetworks and is downward compatible with the specification in the main body of this International Standard.

This Annex also refers to Annex D of ISO 9542, Addition of group composition information, which specifies a mechanism for the distribution of group composition information between Intermediate systems and End systems.

G.1 Scope

This annex describes procedures for the distribution and interpretation of MST multicast information between network entities residing in Intermediate Systems within a single routeing domain.

G.2 Normative references

ISO 9542:1988/Annex D, Information technology - Telecommunications and information exchange between systems - End system to Intermediate system routeing exchange protocol for use in conjunction with the protocol for providing the connectionless-mode Network Service (ISO 8473) - Annex D: Addition of group composition information

C.-H. Chow; On Multicast Path Finding Algorithms; Proc. of Infocom. '91; pp 1274-1283

G.3 Definitions

For the purposes of this annex the following definition applies.

group: a set of systems, which can be identified by their network addresses.

G.4 Abbreviations

For the purposes of this annex, the following abbreviations apply in addition to those defined in the main body of the specification

ESGC PDU	End System Group Composition Protocol Data Unit (ISO 9542 Annex D)
GSP	Group State Protocol Data Unit
ISGC PDU	Intermediate System Group Composition Protocol Data Unit (ISO 9542 Annex D)
ID	Identification
L	Level
MO	Managed Object
MST	Minimum Spanning Tree
SPF	Shortest Path First

G.5 Overview of the protocol

G.5.1 Subnetwork independent functions

As a new subnetwork independent function the multicast routeing is introduced as follows:

- Group addresses are handled between Intermediate systems as a set of unicast addresses.
- The mechanism of handling NPDUs with a group address as the target address of this NPDU is available within all Intermediate systems of this routeing domain.
- For routeing of multicast NPDUs from the entry Intermediate system to the target Intermediate systems a minimum spanning tree (see annex C) is constructed. This routeing algorithm guarantees that in the case where non-broadcast subnetworks are used for connecting two adjacent Intermediate systems, NPDUs are only replicated at those Intermediate systems, where more than one subtree is used towards the target unicast NSAP addresses.
- MST multicast information is flooded within the intradomain routeing area using a new type of PDUs, called "Group State PDUs (GSPs)". These GSPs are handled like LSPs and are exchanged on all types of subnetwork connections, as proposed in Amendment 2 for LSPs (especially for exchanging LSPs and GSPs on DA circuits).
- Group addresses are either created, modified or deleted by systems operations at every Intermediate system or at an End system, exchanging group address information between End systems and their designated Intermediate system using additional PDU types "End System Group Composition PDU (ESGC)" and "Intermediate System Group Composition PDU (ISGC)" (extended operation). In the case the option is not used, End systems are not informed about the members of a group, only about the existence of a group. In this case End systems are only able to use group addresses (e.g. as target addresses for multicast NPDUs), to subscribe to an existing group address or to unsubscribe itself from a group address.

G.5.2 Design goals

This annex supports the following design goals:

- *Replication*: The replication function determines the number of different outgoing paths depending on the decomposition of the multicast addresses within a NPDU. Based on this number of different paths the NPDU is then replicated n times within an Intermediate System and these replicated NPDUs are sent once per determined outgoing path.
- *MST multicastness*: Exchange of group composition information in the optional or mandatory mode between End Systems and Intermediate Systems using ESGC PDUs and ISGC PDUs (see ISO 9542 Annex D), exchange of group composition information in the basic or extended mode among Intermediate Systems using GSPs (see mechanisms described in this amendment) and replication of NPDUs with multicast addresses in the basic or extended mode (see mechanisms described in this amendment).

G.5.3 Design non-goals

It is not a design goal of the procedures defined in this annex to guarantee delivery of all offered NPDU's to all defined destination addresses.

G.5.4 Enhancements to the Decision Process

If the decision process has recognised that a NPDU is to be routed to a group address, the following actions are needed:

- expand the group to all addresses contained in the group - (15) in figure G-1.
- create the routing decision according to the link state database for each of the group members and store it until replicated NPDU(s) are removed in the next step - (16) in figure G-1.

G.5.5 Enhancements to the Update Process

This process constructs, receives and propagates Link State PDUs and Group State PDUs. Each Link State PDU contains information about the identity and routing metric values of the adjacencies of the IS that originated the Link State PDU. Each Group State PDU contain a (new) group definition (or a part of it), that is just known at the adjacent IS.

The Update Process receives Link State, Group State and Sequence Numbers PDUs from the Receive Process - (4) in figure G-1. It places new routing information in the routing information base - (6) and propagates routing information to other Intermediate systems - (7) and (8).

General characteristics of the Update Process are:

- Link State PDUs are generated as a result of topological changes, and also periodically. They may also be generated indirectly as a result of System Management actions (such as changing one of the routing metrics for a circuit).
- Group State PDUs are generated as a result of changes in the Group State or based on Systems Management actions.
- Level 1 Link State PDUs are propagated to all Intermediate systems within an area, but not propagated out of an area.
- Level 2 Link State PDUs are propagated to all Level 2 Intermediate systems in the domain.
- Link State PDUs are not propagated outside of a domain.
- The update process, through a set of System Management parameters, enforces an upper bound on the amount of routing traffic overhead it generates

G.5.6 Enhancements to the Forwarding Process

After the decision process has resolved to which adjacencies the multicast NPDU is to be send, the NPDU has to be replicated and sent to these adjacencies with the group address as the destination address - (18) in figure G-1.

G.5.7 Enhancements to the Receive Process

Additionally the Receive Process obtains its inputs from the group information handed to the group state database (both from ESs and ISs).

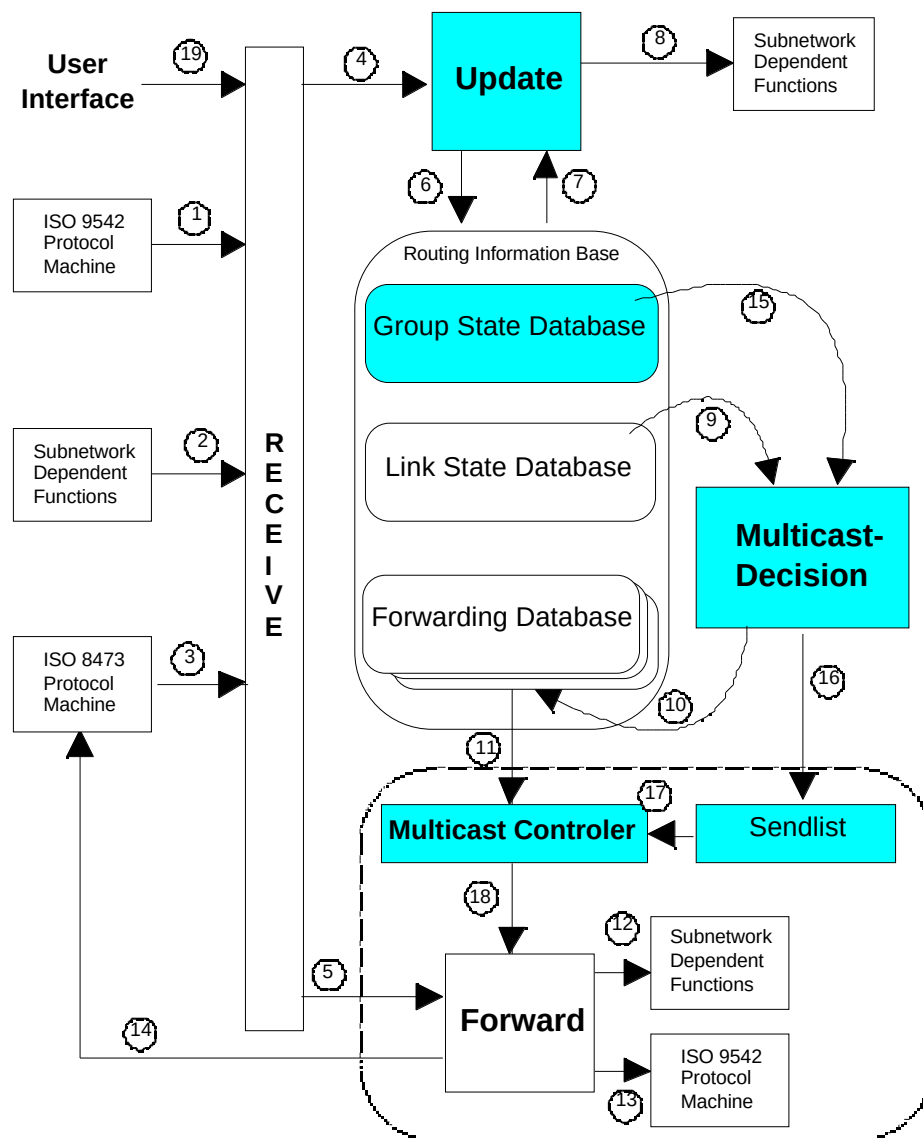


Figure G-1 — Decomposition of Subnetwork Independent Functions

G.6 Subnetwork independent functions

This Annex introduces a new process, the Sendlist Creation Process (L2, L1), and a new database, the Group State data base (L2, L1).

G.6.1 Decision process

This process uses the databases of Link State information and Group State information to calculate the forwarding database(s), from which the forwarding process can know the proper next hop(s) for each (replicated) NPDU. The Level 1 Link State Database is used for calculating the Level 1 Forwarding Database(s), and the Level 2 Link State Database is used for calculating the Level 2 Forwarding Database(s). The Group State Database is used to calculate in addition both the Level 1 and Level 2 Forwarding Database(s).

G.6.1.1 Input for the Decision Process

As a new input for the Decision Process this annex makes use of the Group State Database, which is a set of MST multicast information from the latest Group State PDUs from all known Intermediate Systems (within this