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Information technology — Relayed Multicast Control Protocol (RMCP) —

Part 1: **Framework**

Technologies de l'information — Protocole de multidiffusion relayé (RMCP) —
Partie 1: Cadre général

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Foreword

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ISO/IEC 16512 consists of the following parts, under the general title *Information technology — Relayed Multicast Control Protocol (RMCP)*:

— *Part 1: Framework*

Introduction

This Recommendation | International Standard specifies the Relayed Multicast Protocol (RMCP) used for realizing relayed multicast. Relayed multicast, also known as overlay multicast or application-layer multicast, is a data-delivery scheme for group communications applications over unicast. RMCP employs intermediate Multicast Agents for relaying application data from one or more senders to many receivers.

The design of RMCP has been motivated from the following observations:

In the marketplaces, diverse group applications and services have been provisioned commercially all over the world. Their examples include Internet TV, remote education, real-time streaming media applications, live broadcasting of special events such as the Victoria Show, stock-tickers, and so on.

At present, most of the group applications mentioned above use a replicated IP unicast method to realize multicast services. As a result, those applications have problems about degradation of service quality due to the limitation in the number of simultaneous service users. In the business model that means less revenue or profit.

IP multicast has been known as an effective transport technology for providing multicast services. Nevertheless, the IP multicast has not been deployed widely over the Internet due to several reasons, including the following:

- high deployment cost along with an uncertain Return-on-Investment model;
- IP multicast alone cannot support all kinds of group applications.

Network services which offer, for example, group file transfer or network games, need a reliable multicast transport mechanism. However, even current reliable multicast transport mechanisms still have unresolved problems including that of scalability, flow control, congestion control, etc. Until an appropriate multicast transport mechanism is laid down, group communications applications requiring reliable data transfer will continue to depend on the server-based replicated unicast method.

Although IP multicast has not deployed globally, a lot of local networks have already been equipped with IP multicast transport. For example, Ethernet-based LANs and private networks such as corporate and campus networks substantially provide the multicast transport capability within their local subnet or administrative domains.

Recognizing these observations, there is a crucial need to develop an alternative multicast delivery scheme. RMCP is one of such schemes to realize multicast delivery over the current Internet. It makes good use of existing unicast, multicast and/or multicast tunnelling schemes. In addition, RMCP is designed as several separate forms to support well any kind of group service type. RMCP is expected to provide a substantial solution for group applications over the real-world Internet.

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Information technology – Relayed multicast protocol: Framework

1 Scope

RMCP is a protocol which is used to realize a relayed multicast data transport scheme. Differently from the conventional IP multicast, RMCP can configure a relayed multicast path that multicast traffic flows by using intermediate end-hosts. RMCP can be applied to the current unicast based Internet where IP multicast has not been deployed completely without any modifications.

This Recommendation | International Standard addresses the basic concepts needed to specify RMCP for relayed multicast. It defines the related terminology and proposes a framework for the future development of RMCP. The framework covers network topology including network entities and the relationship between them, service scenarios, basic operations, and message encoding rules.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

- ITU-T Recommendation X.601 (2000), *Multi-peer communications framework*.
- ITU-T Recommendation X.605 (1998) | ISO/IEC 13252:1999, *Information technology – Enhanced Communications Transport Service definition*.
- ITU-T Recommendation X.606 (2001) | ISO/IEC 14476-1:2002, *Information technology – Enhanced Communications Transport Protocol: Specification of simplex multicast transport*.
- ITU-T Recommendation X.606.1 (2003) | ISO/IEC 14476-2:2003, *Information technology – Enhanced Communications Transport Protocol: Specification of QoS management for simplex multicast transport*.

3 Definitions

For the purposes of this Recommendation | International Standard, the following definitions apply:

3.1 **multicast**: A data delivery scheme where the same data unit is transmitted from a single source to multiple destinations in a single invocation of service.

3.2 **IP multicast**: Realizes a multicast scheme in the IP network with the help of multiple multicast-enabled IP routers.

3.3 **relayed multicast**: A multicast data delivery scheme within unicast environments.

3.4 **relayed multicast protocol (RMCP)**: A protocol to realize the relayed multicast scheme using end hosts.

3.5 **RMCP session**: A set of MAs which configures the data delivery path using RMCP.

3.6 **session ID (SID)**: Corresponds to group name and identifies RMCP session uniquely.

3.7 **multicast agent (MA)**: An intermediate node which relays group application data.

3.8 **sender multicast agent (SMA)**: An MA attached to a sender in the same system or local network.

3.9 **receiver multicast agent (RMA)**: An MA other than SMA.

3.10 **session manager**: An RMCP entity that is responsible for the management of session membership and session tree.

3.11 **parent multicast agent (PMA)**: A next upstream MA in the RMCP data delivery path.

3.12 **child multicast agent (CMA)**: A next downstream MA in the RMCP data delivery path.

3.13 **simplex:** Wherein only one sender is send only and all others are receive only.

3.14 **N-plex**: Wherein anyone can send something, and, if someone does so, all others may receive it.

4 Abbreviations

For the purposes of this Recommendation | International Standard, the following abbreviations apply:

CMA	Child Multicast Agent
CP	Contents Provider
ID	Identificator
IP	Internet Protocol
IPC	Inter-Process Communication
IPIP	IP in IP encapsulation
MA	Multicast Agent
PMA	Parent Multicast Agent
RMA	Receiver Multicast Agent
RMCP	Relayed Multicast Protocol
RMT	Reliable Multicast Transport
SCTP	Stream Control Transport Protocol
SID	Session ID
SM	Session Manager
SMA	Sender Multicast Agent
T/TCP	TCP extensions to Transactions
TCP	Transmission Control Protocol
TP	Transport Protocol
UDP	User Datagram Protocol

5 Framework of RMCP

5.1 Introduction

Relayed Multicast Protocol (RMCP) is an application-level control protocol. It constructs and manages a *relayed multicast network* to support Internet group application services over the current unicast-based Internet. After a series of RMCP control messages are exchanged, a *multicast data delivery path* is constructed by using multiple end hosts, such as even a personal desktop computer. Along the delivery path, real-time or reliable data transport channels are inter-connected between upstream and downstream MAs. Only after the data delivery path and data channel are established can group applications work as if they were in a native IP multicast network.

RMCP aims to support various kinds of Internet group applications. Table 1 categorizes the types of communications and the characteristics of data delivery.

Table 1 – Considerable Internet group application services

Characteristics / Type of communications	Real-time data	Reliable data
Simplex	Internet live TV, Internet live banner, etc.	Stock-ticker, file dissemination, software live update, etc.
N-plex	Videoconference, inter-domain multicast proxy, etc.	Distributed virtual environment, network game, data mirroring and caching, etc.

5.2 Basic concept of RMCP

Each RMCP session configures relayed multicast data delivery model with the following entities as shown in Figure 1:

a) One session manager;

b) SMA per sender application;

c) One or more RMAs;

d) Group applications sending or receiving group data.

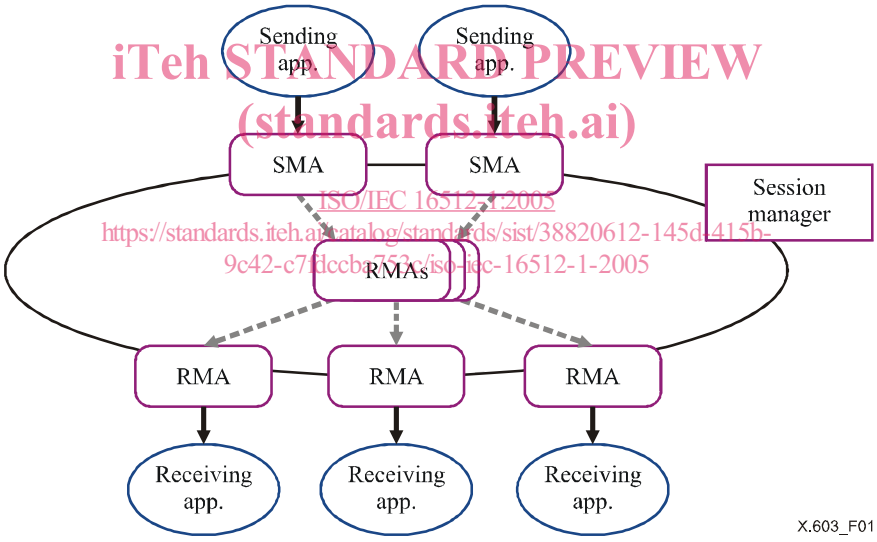

Figure 1 – RMCP entities

The SM (session manager) is just involved in session configuration and maintenance. A single SM can handle one or multiple sessions simultaneously. An SM can be implemented within one of other RMCP session entities or not. An SM can provide the following functionalities:

a) Session initialization;

b) Session release;

c) Session membership management;

d) Session status monitoring.

The *MA (Multicast Agent)*, which covers both SMA and RMA, constructs a relayed multicast delivery path and forwards data along the constructed path from PMA to CMAs and receivers if any. An MA consists of a *RMCP control module* and a *data transport module*. The main function of the former is to establish a relayed data delivery path and that of the latter to set up a data channel along the path constructed by the control module and a relay data through the channel. Figure 2 shows protocol stacks for each module inside of an MA.