Telecommunications and Information Exchange Between Systems

ISO/IEC JTC 1/SC 6

Document Number:	N14040
Date:	2009-07-13
Replaces:	
Document Type:	National Body Contribution
Document Title:	NB of Korea's contribution on 6N14013 FPDAM ballot, Draft Amendment 2 to ISO/IEC 16512-2:2008(X.603.1)
Document Source:	NB of Korea
Project Number:	
Document Status:	For your information.
Action ID:	FYI
Due Date:	
No. of Pages:	33

ISO/IEC JTC1/SC6 Secretariat Ms. Jooran Lee, KSA (on behalf of KATS)

Korea Technology Center #701-7 Yeoksam-dong, Gangnam-gu, Seoul, 135-513, Republic of Korea ;

Telephone: +82 2 6009 4808 ; Facsimile: +82 2 6009 4819 ; Email : jooran@kisi.or.kr

Title: Revised text of 6N14013, “FPDAM ballot, Draft Amendment 2 to ISO/IEC 16512-2:2008(X.603.1)”

Source: Korea

Korea submits comments on 6N14013 which is currently being circulated for four weeks review for consistency with relevant document as follows:

- Type of comments: Editorial
- Proposed comments and changes: The descriptions about the message formats are not consistent with ISO/IEC 16512-2/DAM.1 document. Therefore, editorial updates are proposed as attached.

INTERNATIONAL STANDARD 16512-2:2008/PDAM2
ITU-T RECOMMENDATION X.603.1(2007)/Amd.2

INFORMATION TECHNOLOGY –Relayed multicast protocol: Specification for simplex group applications

DRAFT AMENDMENT 2

Messages and code values

Summary

This Amendment 2 of the Recommendation X.603.1 (2007) | ISO/IEC 16512-2 is revision of messages and code values in the Recommendation X.603.1 (2007) | ISO/IEC 16512-2.

Contents

1 Clause 2. Normative references 4

2 Clause 4. Abbreviations 4

3 Sub-clause 6.1.2 4

4 Sub-clause 7.3. 4

5 Sub-clause 8.3. 29

INTERNATIONAL STANDARD 16512-2:2008/PDAM2
ITU-T RECOMMENDATION X.603.1(2007)/Amd.2

INFORMATION TECHNOLOGY – Relayed multicast protocol: Specification for simplex group applications

AMENDMENT 2

Messages and code values

1 Clause 2. Normative references

Delete the following references:

– 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*

2 Clause 4. Abbreviations

Delete the following abbreviation

'AUTH Authentication'

3 Sub-clause 6.1.2

At the end of the first paragraph, delete the following: 'and authentication information'

4 Sub-clause 7.3.

Replace 7.3 with the following text:

7.3 Messages

This sub-clause defines each message used in RMCP-2. RMCP-2 defines seven sets of request and answer messages and one heartbeat message. The message types and corresponding values for the messages are listed in Table 3.

7.3.1 SUBSREQ

The SUBSREQ message is used to subscribe to a RMCP-2 session. Issuing SUBSREQ message each MA can obtain bootstrapping information from the SM when it is acceptable. The message format is shown in Figure 40.

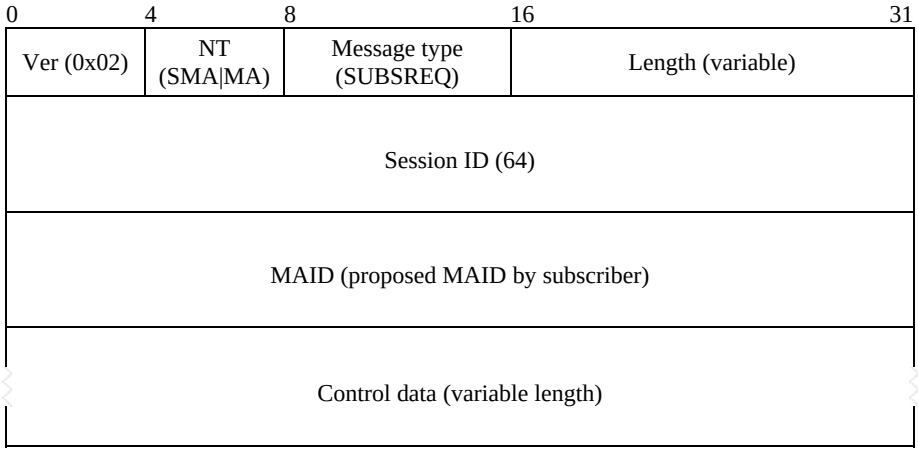

Figure 40 – SUBSREQ message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.

b) *NT* – denotes the message issuer's node type. The value shall be set to one of coded value for SMA or MA in Table 2.

c) *Message type* – denotes the type of the message. Its value shall be set to 0x01 (see Table 3).

d) *Length* – shall be set to the total length of SUBSREQ message including control data (in bytes).

e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.

f) *Proposed MAID* – shall be set to the proposed MAID created by the SUBSREQ originator. Its value shall be formatted as defined in 7.1.2.

g) *Control data* – The Control data field may include the following information:

• SYSINFO

This control tells the system power of MA, such as in/out bandwidth, controllable number of CMA.

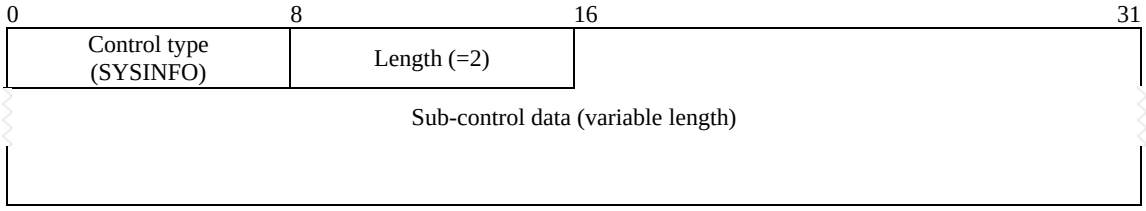

Figure 41 – SYSINFO control

a) *Control type* – denotes the SYSINFO control. It shall be set to 0x08 (see Table 4).

b) *Length* – denotes the length of control. The value shall be set to 0x02 which means 2-byte.

c) *Sub-control data* – The Sub-control data field includes includes one of sub-controls defined in Table 7.

The sub-controls shown in Figures 42 and 43 are sub-controls that follow the SYSINFO control shown in Figure 41. If needed, other sub-controls described in clause 7.3.11 can be used in SUBSREQ message.

Figure 42 shows the report format of the SI_ROOM_CMA sub-control. The description of each field is as follows:

a) *Sub-control type* – denotes the SI_ROOM_CMA sub-control. Its value shall be set to 0x14 (see Table 7)

b) *Length* – denotes the length of sub-control. Its value shall be set to 0x06 which means 6-byte.

c) *Number of CMAs allocated* – shall be set to number of CMA places that have been allocated by the MA.

d) *Total CMA capacity* – shall be set to the total number of CMA places that the MA is able to support.

NOTE – The available number of CMAs will be the difference between the number of CMAs reserved and the number of CMAs allocated.

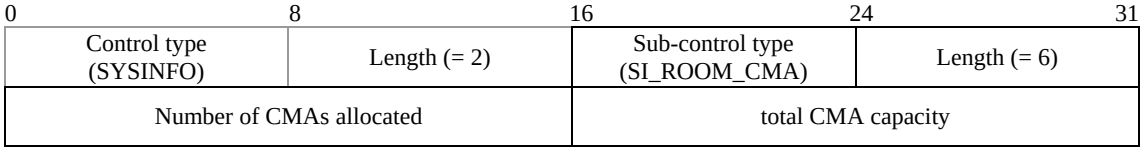

Figure 42 – SI_ROOM_CMA sub-control

Figure 43 shows a SYSINFO control followed by a SI_POSS_BW sub-control. The description of each field is as follows:

a) *Sub-control type* – denotes the SI_POSS_BW sub-control. Its value shall be set to 0x25 (see Table 7).

b) *Length* – denotes the length of sub-control. Its value shall be set to 0x06 which means 6-byte.

c) *Value* – shall be set to the possible forwarding bandwidth which MA can afford.

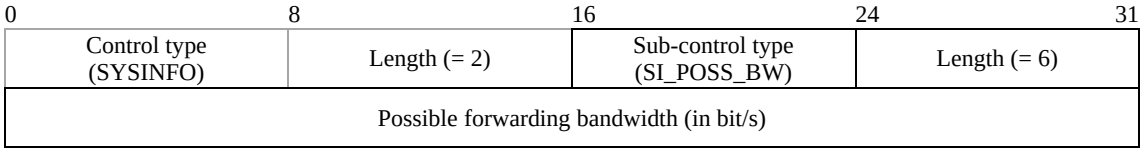

Figure 43 – SI_POSS_BW sub-control

Note – Two bytes length control frame precedes each sub-control.

- DATAPROFILE

DATAPROFILE control delivers controllable data profile of each MA. The purpose of this DATAPROFILE control is to make SM able to keep the classified neighbour list when the SM is aware of QoS.
Whenever MA does not include this control within SUBSREQ message, the SM is not concerned about QoS management for the MA. The description of each field is as follows:

a) *Control type* – denotes the DATAPROFILE control. It shall be set to 0x03 (see Table 4).

b) *Length* – denotes the length of the control. The value shall be set to n/8 in hexadecimal which means the total length of the DATAPROFILE control in byte. Since the length of this field is 8-bit, maximum value of this field is 0xFF which means the length of the DATAPROFILE control is 255-byte including 253-byte of the "Data profile" field. But, since the length of the Data profile field is aligned to multiple of 4-byte, maximum value of the Length field can be 0xFE.

c) *Data profile* – It contains the data profile that MA wants to use.

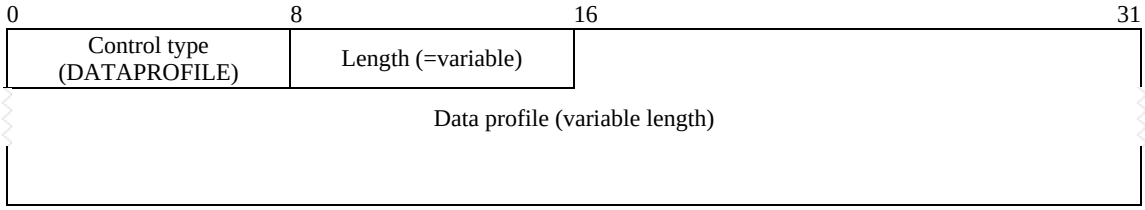

Figure 44 – DATAPROFILE control

Because DATAPROFILE control consists of text-based variable message, the size may vary. To align 4-byte length, each data profile pads zero or more 1-byte zero padding as shown in Figure 45. The description of each field is as follows:

a) *Data profile* – denotes the data profile that MA wants to use. Data profile is the description of the characteristics of the data channel. It follows the SDL-like encoding scheme.

b) *Zero or more zero padding* – It contains zero or more zero padding to adjust the length of data profile.

Figure 45 – DATAPROFILE control and its padding

7.3.2 SUBSANS

The SUBSANS message is used by SM to give the results of subscription request and bootstrapping information for the session. The message format is shown in Figure 46.

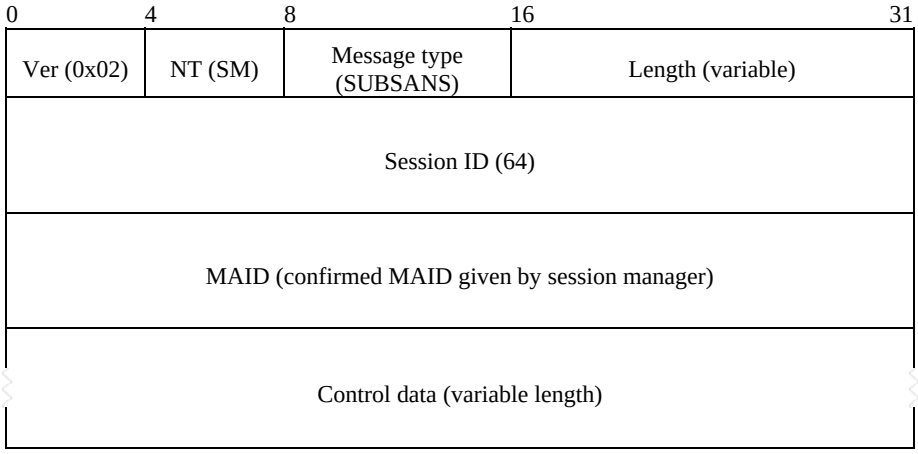

Figure 46 – SUBSANS message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.

b) *NT* – denotes the message issuer's node type. The value shall be set to the coded value for SM in Table 2.

c) *Message type* – denotes the type of type message. Its value shall be set to 0x02 (see Table 3).

d) *Length* – shall be set to the total length of the SUBSANS message including control data (in bytes).

e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.

f) *Confirmed MAID* – shall be set to the confirmed MAID of the subscriber (Confirmed by SM).

g) *Control data* – The Control data field may include the following information:

- RESULT

This control tells whether MA's subscription request is successful or not. If successful, it gives OK code within result code. If not, it gives appropriate error code such as resource exhaustion, destination unreachable. Figure 47 shows the control message format of RESULT control. The following controls are used to deliver the necessary information to join RMCP-2 tree. When subscription is disallowed, the following control cannot be included. The description of each field is as follows:

a) *Control type* – denotes the RESULT control. It shall be set to 0x06 (see Table 4).

b) *Length* – denotes the length of control. The value shall be set to 0x04.

c) *Result code* – denotes the result of the request. The codes and their meaning are listed in Table 5.

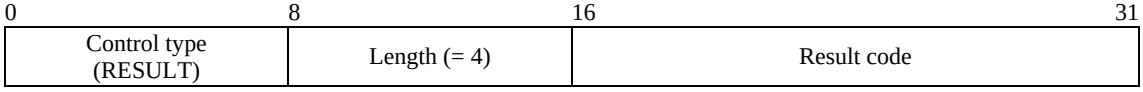

Figure 47 – RESULT control

- DATAPROFILE

DATAPROFILE control is used by SM to confirm data profile back to the subscriber. DATAPROFILE control is meaningful when SM affords extra session data information to each subscriber. The format of DATAPROFILE control is shown in Figure 44 and the content is in Figure 84.

- NEIGHBORLIST

When a subscription is successful, SM sends a list of MAs back to the subscriber. The NEIGHBORLIST control may be used as bootstrapping information by each subscriber. Figure 48 shows the format of NEIGHBORLISTcontrol. The description of each field is as follows:

a) *Control type* – denotes the NEIGHBORLIST control. Its value shall be set to 0x04 (see Table 4).

b) *Length* – denotes the length of control. The value shall be 4-byte, the length of header, plus total length of MAIDs which can be calculated by multiplying the value of the Number of NLs field by 8-byte

c) *Reserved* – Reserved for the further use.

d) Number of NLs – denotes the number of MAIDs. Since the length of the Number of NLs field is 8-bits, maximum value of this field is 0xFF which means that there are 255 MAID of neighbors. However the maximum value of this field is 0x1F because of length limitation.

e) MAID(s) – shall be set to the MAID of n-th neighbor.

Figure 48 – NEIGHBORLIST control

7.3.3 PPROBREQ

It is used to perform *Map discovery* procedure to discover actual network condition and to explore network neighbouring. It is also used to check whether its counterpart is still alive. Figure 49 illustrates the message format.

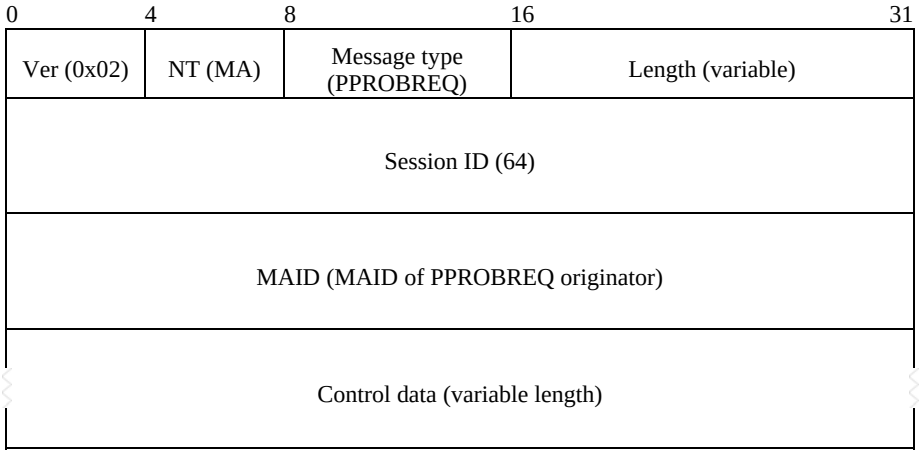

Figure 49 – PPROBREQ message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.

b) *NT* – denotes the message issuer's node type. The value shall be set to the coded value for MA in Table 2.

c) *Message type* – denotes the type of type the message. Its value shall be set to 0x03 (see Table 3).

d) *Length* – shall be set to the total length of the PPROBREQ message including control data (in bytes).

e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.

f) *MAID* – shall be set to the MAID of the PPROBREQ message sender.

g) *Control data* – The Control data field may include the following information:

• TIMESTAMP

Figure 50 shows a TIMESTAMP control which is used to examine the distance between two MAs. The description of each field is as follows:

a) *Control type* – denotes the TIMESTAMP control. Its value shall be set to 0x09 (see Table 4).

b) *Length* – denotes the length of control. The value shall be set to 0x10 which means 16-byte.

c) *Reserved* – Reserved for the further use.

d) *Time 1* – shall be set to the time when the sender of the message is sent to its counterpart.

e) *Time 2* – shall be set to the time when the message appears to the counterpart.

f) *Time 3* – shall be set to the time when the receiver of message sends the TIMESTAMP control in response.

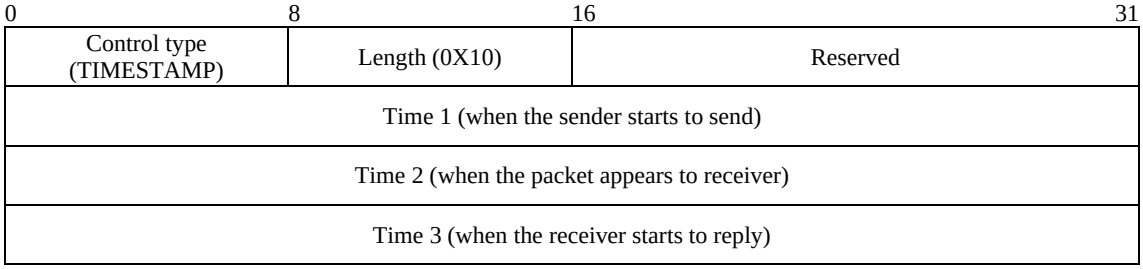

Figure 50 – TIMESTAMP control

• NEIGHBORLIST

To explore RMCP-2 participants, each MA may exchange information about their neighbour by using NEIGHBORLIST control. The control format and usage are shown in Figures 48.

• ROOTPATH

To prevent loop and solve triangular problem, probing MA may include its *from_root path* by using the ROOTPATH control which is shown in Figure 51. The description of each field is as follows:

a) *Control type* – denotes the ROOTPATH control. Its value shall be set to 0x07 (see Table 4).

b) *Length* – denotes the length of control. The value shall be set to 0x02 which means 2-byte.

c) *Sub-control data* – The Sub-control data field includes rootpath information. The following are the format and usage.

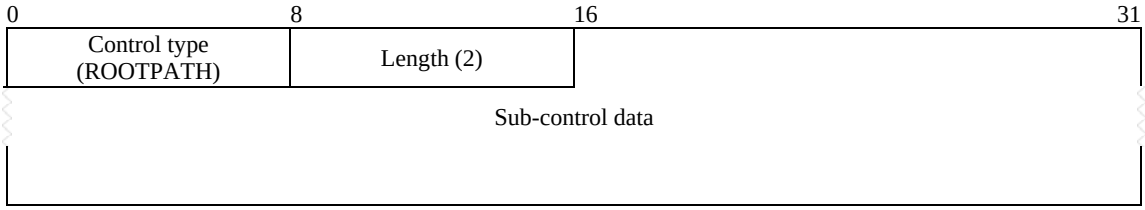

Figure 51 – ROOTPATH control

Figure 52 shows the general format of the RP_XXX sub-control. RP_XXX stands for one of the appropriate ROOTPATH types from the first six ROOTPATH types listed in Table 6 (see note). These ROOTPATH types represent different combinations of fields for MAIDs, bandwidth and delay. If the ROOTPATH type indicates that any of the MAIDs, bandwidth or delay fields are not needed, these fields shall not be present in the ROOTPATH control. The length of the rootpath element, in bytes, for each of the ROOTPATH types is indicated in Table 6.

NOTE – RP_PSEUDO is a special ROOTPATH type used to indicate a pseudo HB message used in network partitioning, detection and recovery (see 6.2.5.3.b and 7.3.16) and applies only the RP_COMMAND for the HB message.

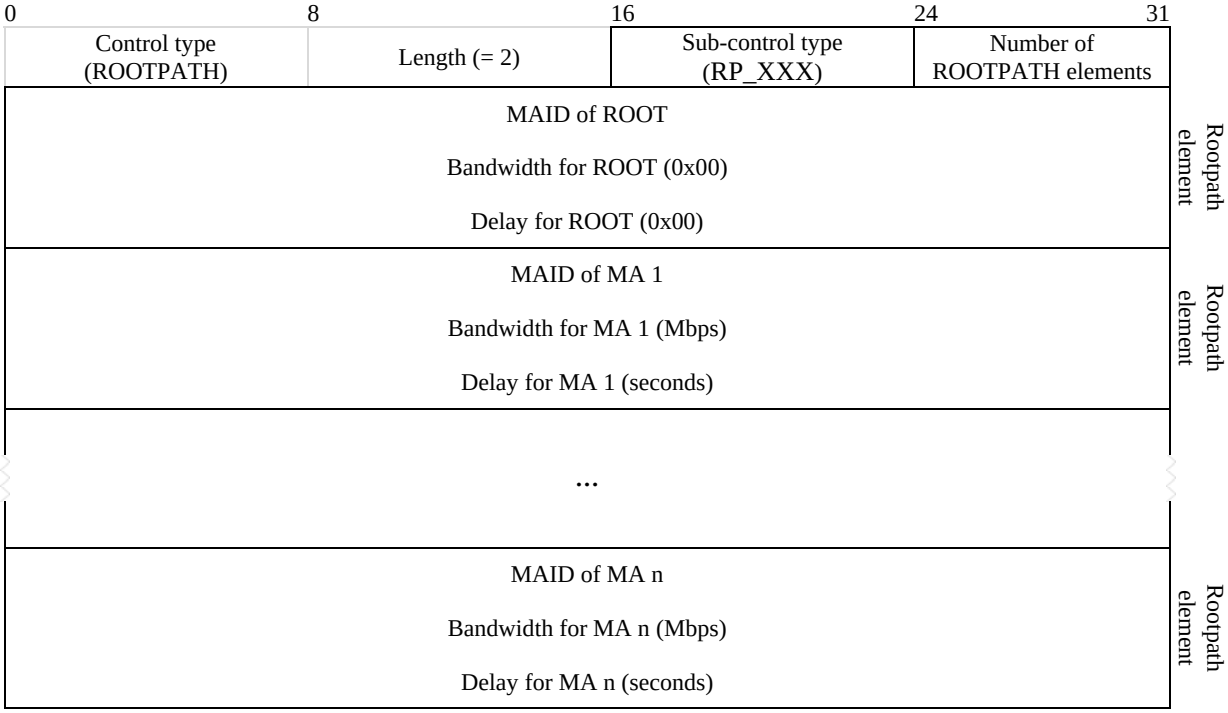

Figure 52 – General format for RP_XXX sub-control.

RP_XXX stands for one of the first six ROOTPATH types listed in Table 6. The description of each field of the RP_XXX sub-control is as follows:

- RP_XXX

  a) *Sub-control type* – denotes the RP_XXX sub-control. Its value shall be set to one of the first six code values in Table 7.
  b) *Number of ROOTPATH nodes* – shall be set to the number of ROOTPATH elements in the RP_XXX message.
  c) *MAID* – shall be set to that of the MAID corresponding to that element, if present. This field is for each element in the ROOTPATH, listed in order from the ROOT .
  d) *Bandwidth* – shall be set to the bandwidth, in Mbps, between the MA and its parent, as perceived by the MA for each element in the ROOTPATH, listed in order from the ROOT, if present. In the case of the ROOT element the value for the bandwidth shall be set to 0x00.

e) *Delay* –shall be set to the delay in seconds from the ROOT as perceived by the MA for each element in the ROOTPATH, listed in order from the ROOT, if present. In the case of the ROOT element the value for the bandwidth shall be set to 0x00.

NOTE – The values for the perceived bandwidth and delay for the ROOT node are set to 0x00 as the ROOTPATH is assumed to start at the ROOT.

• SYSINFO

To prevent only-leaf node or slow node may be positioned high within the tree hierarchy; it includes system information such as in-and-out bandwidth, affordable number of CMA, etc. Figure 41 shows SYSINFO control format. All of sub-controls in clause 7.3.1 and clause 7.3.11 can be used, if necessary.

• DATAPROFILE

DATAPROFILE control is used to verify whether the probed MA can afford the data delivery scheme which the probing MA wants to receive. Figure 44 shows the DATAPROFILE control format and Figure 84 shows its contents.

7.3.4 PPROBANS

It is an answer to the PPROBREQ message for performing the *map discovery* procedure and confirming if it is alive. It may contain actual network condition, and a series of its Neighbour information. Figure 53 illustrates the format of the PPROBANS message.

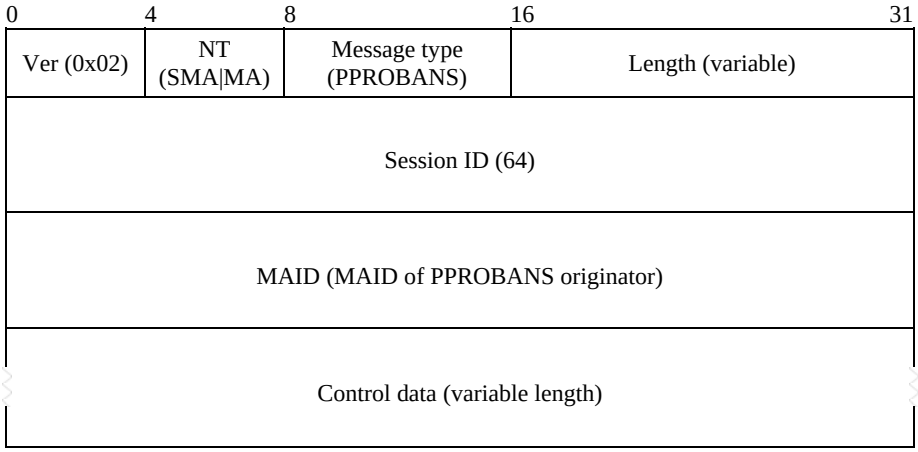

Figure 53 – PPROBANS message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.

b) *NT* – denotes the message issuer's node type. The value shall be set to one of coded value for SMA or MA in Table 2.

c) *Message type* – denotes the type of the message. Its value shall be set to 0x04 (see Table 3).

d) *Length* – shall be set to the total length of PPROBANS message including control data (in bytes).

e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.

f) *MAID* – shall be set to the MAID of the PPROBANS message sender.

g) *Control data* – The Control data field may include the following information:

• TIMESTAMP

This control is used to examine the distance between two MAs during the sequence of parent probing. Figure 50 shows the format of TIMESTAMP control.

• NEIGHBORLIST

This NEIGHBORLIST control is designed to explore RMCP-2 participants. Each MA may gather information of its neighbour by using NEIGHBORLIST control as shown in Figures 48.

- ROOTPATH

This ROOTPATH control is used by each MA to prevent loop and solve triangular problem. The probing MA may include its information of *from_root path* by using ROOTPATH control. Figures 51 and 52 show the control format of ROOTPATH and sub-control format.

- SYSINFO

To prevent only-leaf node or slow node may be located in the high position within the tree hierarchy. PPROBANS message may include system information such as in-and-out bandwidth, affordable number of CMA, etc., by using SYSTEMINFO control. Figure 41 shows the SYSINFO control format. All of sub-controls in clause 7.3.1 and clause 7.3.11 can be used, if necessary.

- DATAPROFILE

DATAPROFILE control is used to verify whether the probed MA can afford data which the probing MA wants to use during data delivery. Figure 44 shows the DATAPROFILE control format and Figure 84 shows its contents.

7.3.5 HSOLICIT

HSOLICIT message is used to process self-organizing in a local network. The purpose of this is to find the HMA inside a local network. Figure 54 illustrates the message format of HSOLICIT.

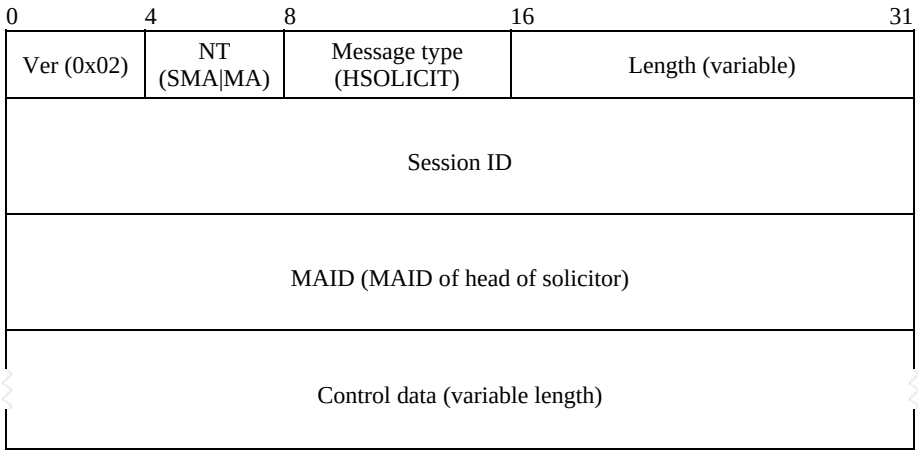

Figure 54 – HSOLICIT message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.

b) *NT* – denotes the message issuer's node type. The value shall be set to one of coded value for SMA or MA in Table 2.

c) *Message type* – denotes the type of the message. Its value shall be set to 0x05 (see Table 3).

d) *Length* – shall be set to the total length of HSOLICIT message including control data (in bytes).

e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.

f) *MAID* – shall be set to the MAID of the HSOLICIT message sender.

g) *Control data* – The HSOLICIT message does not have any control.

7.3.6 HANNOUNCE

As a reply of HSOLICIT, it is used to announce the HMA's existence in a local network. Figure 55 shows the format of this message.

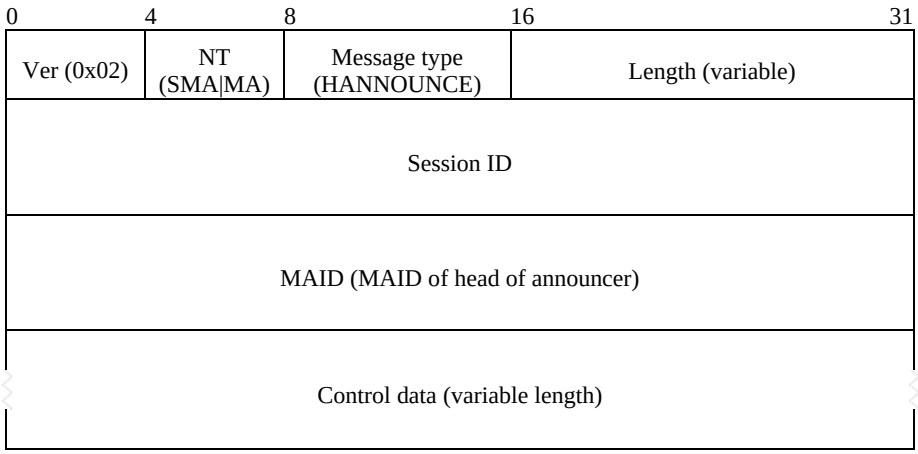

Figure 55 – HANNOUNCE message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.

b) *NT* – denotes the message issuer's node type. The value shall be set to one of coded value for SMA or MA in Table 2.

c) *Message type* – denotes the type of the message. Its value shall be set to 0x06 (see Table 3).

d) *Length* – shall be set to the total length of HANNOUNCE message including control data (in bytes).

e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.

f) *MAID* – shall be set to the MAID of the HANNOUNCE message sender.

g) *Control data* – The Control data field may include the following information:

- SYSINFO

To inform the non-HMAs in the same multicast area with the system power of HMA, HMA may include system power of MA, such as in-and-out bandwidth, controllable number of CMA. Also HMA may include additional information such as MA uptime to recover from HANNOUNCE collision. All of sub-controls in clause 7.3.1 and clause 7.3.11 can be used, if necessary.

- NEIGHBORLIST

To share explored information by HMA with non-HMA in the same multicast-enabled area, HMA may include neighbour list as shown in Figure 48.

7.3.7 HLEAVE

It is used to announce the HMA's leaving from RMCP-2 session to its local network. Figure 56 illustrates the format of this message.

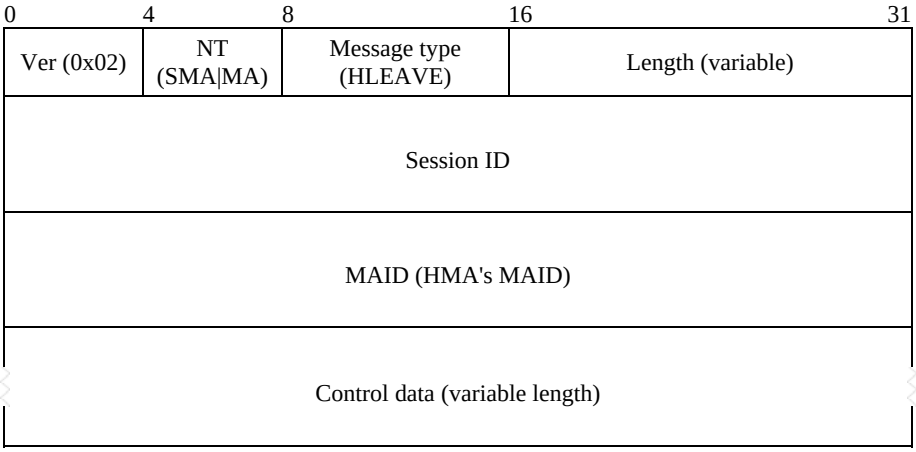

Figure 56 – HLEAVE message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.

b) *NT* – denotes the message issuer's node type. The value shall be set to one of coded value for SMA or MA in Table 2.

c) *Message type* – denotes the type of the message. Its value shall be set to 0x07 (see Table 3).

d) *Length* – shall be set to the total length of HLEAVE message including control data (in bytes).

e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.

f) *MAID* – shall be set to the MAID of the HLEAVE message sender.

g) *Control data* – The Control data field may include the following information:

- CANDIDATEHMA

When an HMA leaves a session, every non-HMA in the multicast-enabled area may compete to become an HMA. This may drive the multicast-enabled area be filled with HANNOUNCE message. To prevent HMA selection collision, HMA may use CANDIDATEHMA control which is shown in Figure 57. The description of each field is as follows:

a) *Control type* – denotes the CANDIDATEHMA control. Its value shall be set to 0x0A (see Table 4).

b) *Length* – denotes the length of control. The value shall be 4-byte, the length of header, plus total length of MAIDs which can be calculated by multiplying the value of the Number of NLs field by 8-byte.

c) *Reserved* – Reserved for the further use.

d) *Number of MAIDs* – denotes the number of MAIDs. Since the length of the Number of NLs field is 8-bits, maximum value of this field is 0xFF which means that there are 255 MAID of neighbors. However the maximum value of this field is 0x1F because of length limitation.

e) *MAID(s)* – shall be set to the MAID of candidate HMAs provided by the leaving HMA.

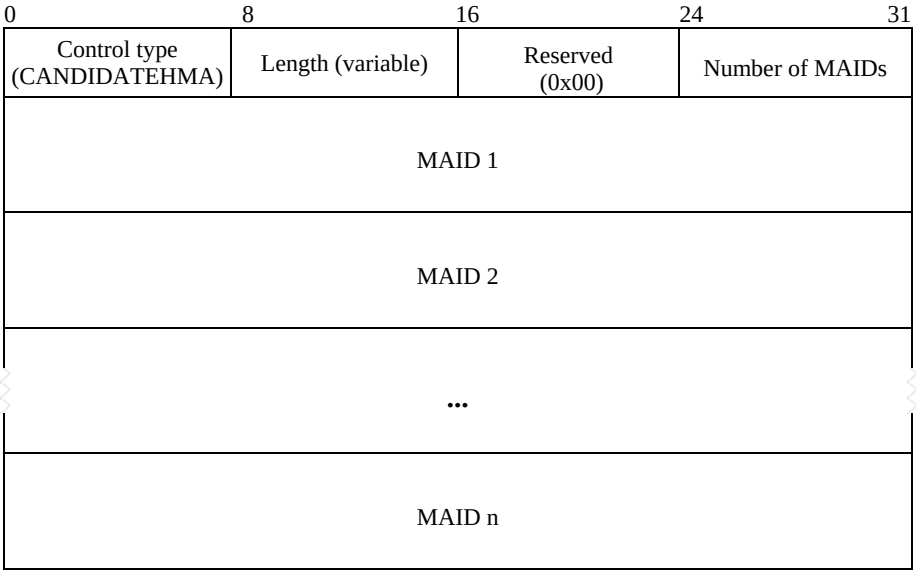

Figure 57 –CANDIDATEHMA control

• NEIGHBORLIST

To share explored information by HMA with non-HMA in the same multicast-enabled area, HMA may include NEIGHBORLIST control as shown in Figure 48.

• ROOTPATH

The leaving HMA may include its *from_root path* by using ROOTPATH control so that newly selected HMA can follow the same root path. The control data type is shown in Figures 51 and 52.

• REASON

The reason for HMA's leaving may vary according to the situation. For example, HMA may leave the session either of its own will or because the session has terminated. In the latter case, every non-HMA in the multicast-enabled area should leave the session promptly.
To give the reason why HMA leaves a session, HLEAVE message must include REASON control as shown in Figure 58. The description of each field is as follows:

a) *Control type* – denotes the REASON control. Its value shall be set to 0x05 (see Table 4).

b) *Length* – denotes the length of control. The value shall be set to 0x04 which means 4-byte.

c) *Reason code* – denotes an integer value to indicate the specific reason for leaving. The encoded value and its meaning follow the codes specified in Table 9.

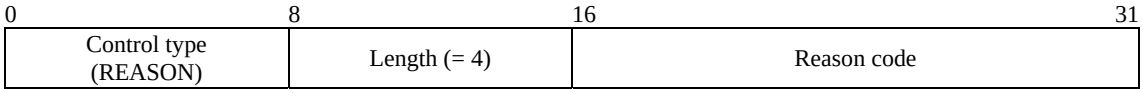

Figure 58 – REASON control

7.3.8 RELREQ

This message is used by the CMA to request to the PMA of data forwarding. It usually includes a data profile which can be negotiated through the message exchanges of RELREQ and RELANS. Figure 59 depicts the format of this message.

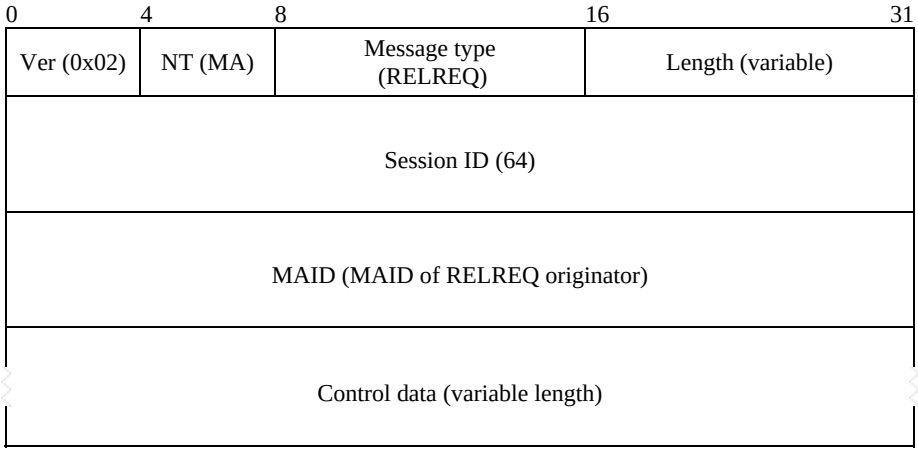

Figure 59 – RELREQ message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.

b) *NT* – denotes the message issuer's node type. The value shall be set to the coded value for MA in Table 2.

c) *Message type* – denotes the type of the message. Its value shall be set to 0x08 (see Table 3).

d) *Length* – shall be set to the total length of RELREQ message including control data (in bytes).

e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.

f) *MAID* – shall be set to the MAID of the RELREQ message sender.

g) *Control data* – The Control data field may include the following information:

- RP_COMMAND

When CMA needs some information on PMA's rootpath, it can ask PMA by using RP_COMMAND control within RELREQ message.
For example, whenever a MA connects to PMA during joining or parent switching procedure, the MA needs information *from_root path* of its new PMA for network diagnosis and loop detection. In this case, the MA uses then RP_COMMAND control for ROOTPATH of newly attached PMA.
Figure 60 shows the RP_COMMAND control format. The description of each field is as follows:

a) *Control type* – denotes the RP_COMMAND control. Its value shall be set to 0x01 (see Table 4).

b) *Length* – denotes the length of control. The value shall be set to 0x04 which means 4-byte.

c) *RP_Command code* – denotes the value to indicate the specific command. The encoded value and its meaning are same as specified in Table 6.

d) *Reserved* – Reserved for the further use.

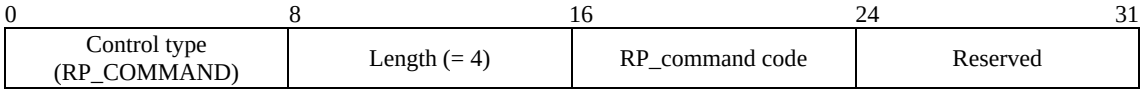

Figure 60 – RP_COMMAND control

- DATAPROFILE

Whenever CMA connects to PMA, both MAs should agree on a data delivery scheme. To make it feasible, each CMA uses DATAPROFILE control to negotiate with its PMA. Figures 44 and 45 show DATAPROFILE control format, and Figure 84 shows its contents.

- TIMESTAMP

Each CMA should measure hop-by-hop delay between PMA and itself. For this purpose, CMA includes TIMESTAMP control as shown in Figure 50 within RELREQ message.

7.3.9 RELANS

As a reply of RELREQ message, RELANS message is issued by the PMA to the CMA. The purpose of this message is to notify whether the relay request is allowed. It may also contain additional information which is necessary to negotiate the data channel between the PMA and itself. The message format of RELANS is shown in Figure 61.

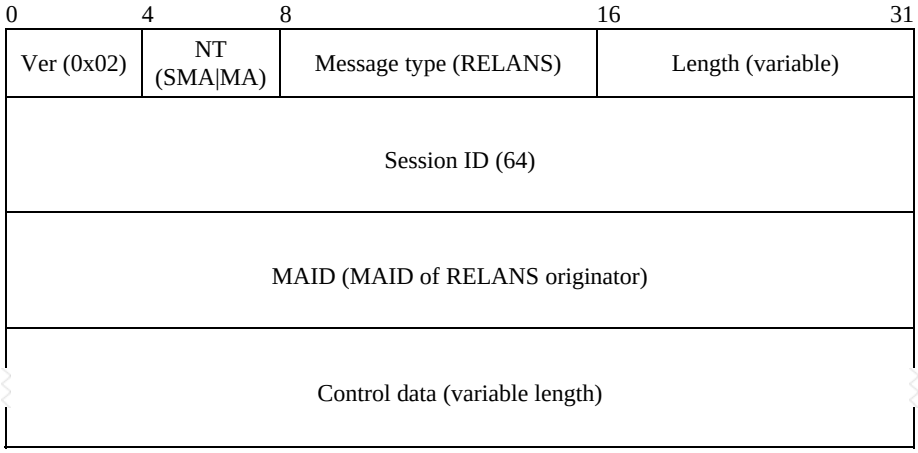

Figure 61 – RELANS message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.

b) *NT* – denotes the message issuer's node type. The value shall be set to one of coded value for SMA or MA in Table 2.

c) *Message type* – denotes the type of the message. Its value shall be set to 0x09 (see Table 3).

d) *Length* – shall be set to the total length of RELANS message including control data (in bytes).

e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.

f) *MAID* – shall be set to the MAID of the RELANS message sender.

g) *Control data* – The Control data field may include the following information:

- RESULT

To tell whether CMA's RELREQ message is successful, PMA uses RESULT control inside every RELANS message. If the relay request is successful, it gives OK as a result code of RESULT control. If not, it gives an appropriate error code, such as relay denial because of policy or resource exhaustion. Figure 47 shows the RESULT control format.

- DATAPROFILE

Whenever CMA connects to PMA, it sends RELREQ message with DATAPROFILE control to negotiate data delivery scheme. Figures 44 and 45 show DATAPROFILE control format, and Figure 84 shows its contents.

- TIMESTAMP

Figure 50 shows a TIMESTAMP control. TIMESTAMP control is used to examine the distance between two MAs.

- ROOTPATH

Whenever CMA asks *from_root path* with RP_COMMAND control, PMA answer its CMA with its ROOTPATH information. Figure 51 and figure 52 show ROOTPATH control.

7.3.10 STREQ

STREQ message is used for monitoring the status of MAs in the session. Figure 62 shows the format of this message.

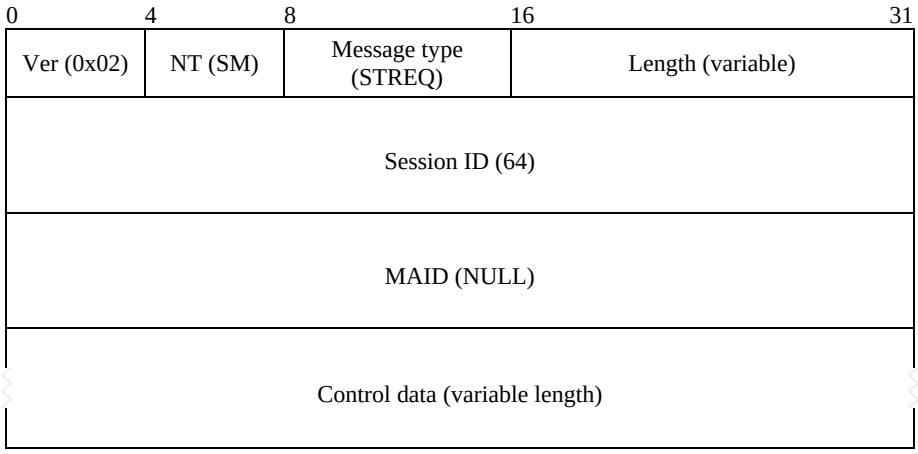

Figure 62 – STREQ message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.

b) *NT* – denotes the message issuer's node type. The value shall be set to the coded value for SM in Table 2.

c) *Message type* – denotes the type of the message. Its value shall be set to 0x0A (see Table 3).

d) *Length* – shall be set to the total length of STREQ message including control data (in bytes).

e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.

f) *MAID* – shall be set to zero because SM does not have a MAID.

g) *Control data* – The Control data field may include the following information:

- SI_COMMAND

STREQ message should include the SI_COMMAND control shown in Figure 63 to express what status report it requires. To get MA's status, SM uses SI_COMMAND control within STREQ message. Table 8 summarizes considerable commands for status monitoring and its expected reports.
Figure 63 shows the format of the SI_COMMAND control. The description of each field is as follows:

a) *Control type* – denotes the SI_COMMAND control. Its value shall be set to 0x02 (see Table 4).

b) *Length* – denotes the length of control. The value shall be set to 0x04 which means 4-byte.

c) *SI_Command code* – denotes the value to indicate the specific command. The encoded value and its meaning are same as specified in Table 8.

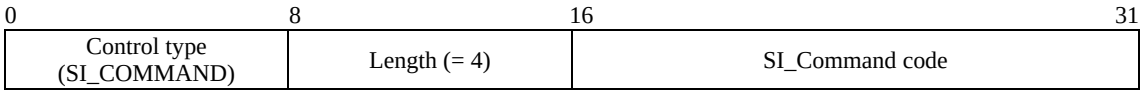

Figure 63 – SI_COMMAND control

- TREEEXPLOR

Inspecting whole tree status can cause hazards because of report implosion. So it is very important to limit the scope of tree to be inspected. Figure 64 shows TREEEXPLOR control which is used to limit the scope of tree. The fields of TREEEXPLOR control are as follows:

a) *Control type* – denotes the TREEEXPLOR control. Its value shall be set to 0x0B (see Table 4).

b) *Length* – denotes the length of control. The value shall be set to 0x04 which means 4-byte.

c) *Reserved* – Reserved for the further use.

d) *Tree depth* – shall be set to the value to specify the scope of tree inspection.

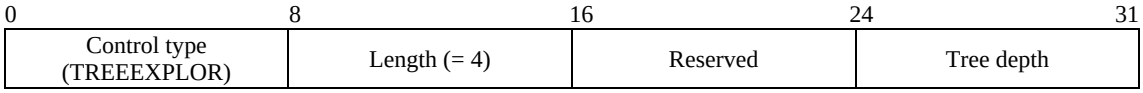

Figure 64 – TREEEXPLOR control

7.3.11 STANS

This message is used for monitoring the status of MAs in the session. Figure 65 shows the format of STANS message.

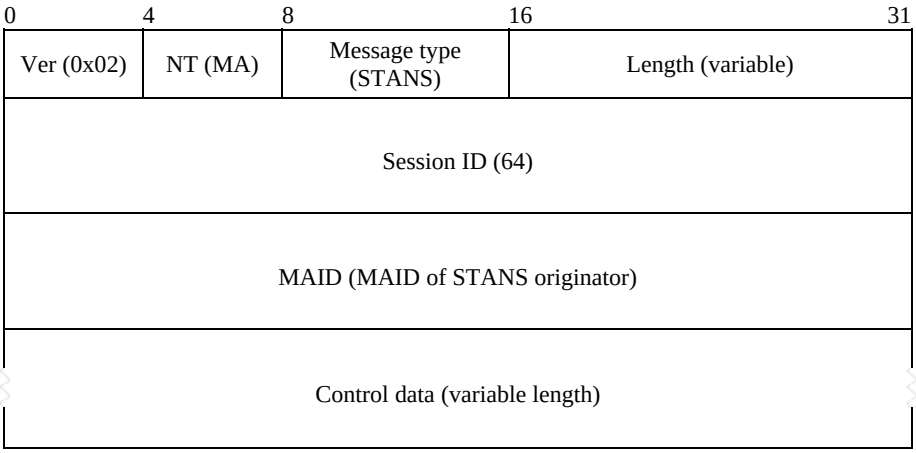

Figure 65 – STANS message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.

b) *NT* – denotes the message issuer's node type. The value shall be set to the coded value for MA in Table 2.

c) *Message type* – denotes the type of the message. Its value shall be set to 0x0B (see Table 3).

d) *Length* – shall be set to the total length of STANS message including control data (in bytes).

e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.

f) *MAID* – shall be set to the MAID of the STANS message sender.

g) *Control data* – The Control data field may include the following information:

• SYSINFO

According to SM's request, the MA should answer with an appropriate report. The format of each report has {control type, control subtype} form.

According to SM's request, listed in Table 7, each MA sends the appropriate report back to SM. Figure 66 through Figure 76 show the corresponding reports. All of sub-controls in clause 7.3.1 can be used, if necessary.

Figure 66 shows the report on the bandwidth that can be provided by a system. The description of each field is as follows:

a) *Sub-control type* – denotes the SI_PROV_BW sub-control. Its value shall be set to 0x15 (see Table 7).

b) *Length* – denotes the length of sub-control. Its value shall be set to 0x06 which means 6-byte.

c) *Incoming BW of NIC* – shall be set to the maximum incoming bandwidth of network interface card.

d) *Outgoing BW of NIC* – shall be set to the maximum outgoing bandwidth of network interface card.

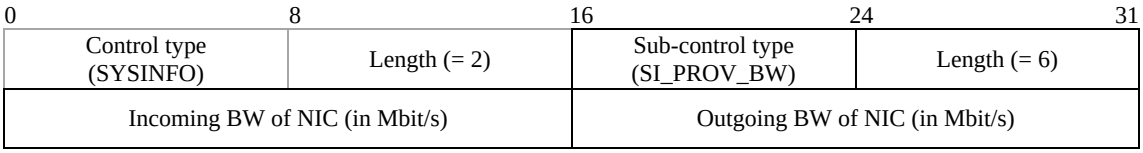

Figure 66 – SI_PROV_BW sub-control

Figure 67 shows the report on the system uptime after the MA joins the session. The description of each field is as follows:

a) *Sub-control type* – denotes the SI_UPTIME sub-control. Its value shall be set to 0x12 (see Table 7).

b) *Length* – denotes the length of sub-control. Its value shall be set to 0x06 which means 6-byte.

c) *Value* – shall be set to the time after the node joins the RMCP-2 session (in seconds).

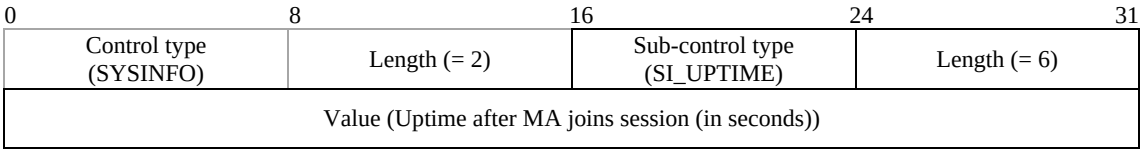

Figure 67 – SI_UPTIME sub-control

Figure 68 shows the report on the status of tree. The description of each field is as follows:

a) *Sub-control type* – denotes the SI_TREE_CONN sub-control. Its value shall be set to 0x68 (see Table 7).

b) *Number of MAIDs* – denotes the number of MAIDs in the list. The value shall be set to n+1 in hexadecimal. Since the length of this field is 8-bit, maximum value of this field is 0xFF which means that 255 MAIDs, one for PMA and 254 MAIDs for CMAs, are included in the SI_TREE_CONN sub-control.

c) *MAID of PMA* – shall be set to the MAID of PMA attached directly.

d) *MAID of CMA n* – shall be set to the MAID of n-th directly attached CMA.

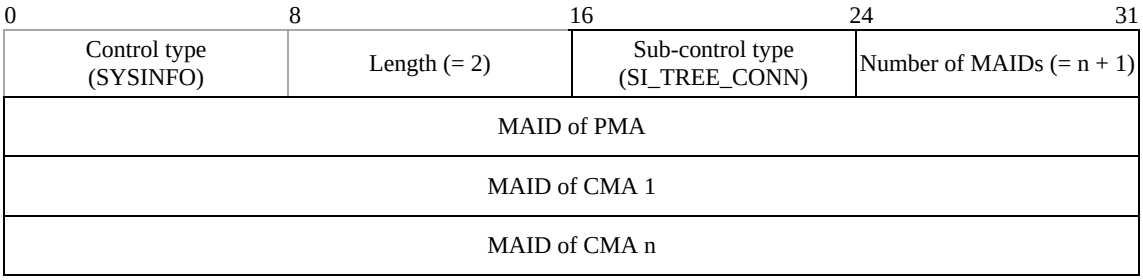

Figure 68 – SI_TREE_CONN sub-control

Figure 69 shows the report on the members of the tree. The description of each field is as follows:

a) *Sub-control type* – denotes the SI_TREE_MEM sub-control. Its value shall be set to 0x69 (see Table 7).

b) *Number of MAIDs* – denotes the number of MAIDs in the list. The value shall be set to n in hexadecimal. Since the length of this field is 8-bit, maximum value of this field is 0xFF which means that there are 255 members in the tree.

c) *MAID of member n* – shall be set to the MAID of n-th tree member.

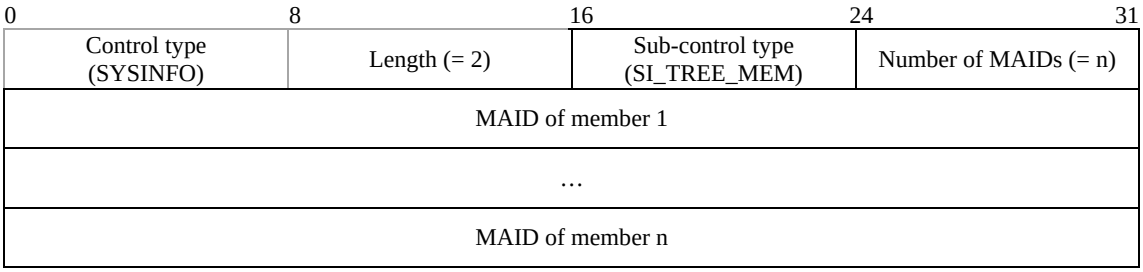

Figure 69 – SI_TREE_MEM sub-control

NOTE – Every report is preceded by a 2-byte long appropriate control.

Figure 70 shows the format of the SI_DELAY sub-control. The description of each field of the SI_DELAY sub-control is as follows:

- SI_DELAY

a) *Sub-control type* – denotes the SI_DELAY sub-control. Its value shall be set to 0x13 (see Table 7).
b) *Length* – denotes the length of sub-control. Its value shall be set to 0x06 which means 6-byte.
c) *Delay* – shall be set to the delay in seconds from the ROOT, as perceived by the MA.
d) *Reserved* – Reserved for the future use.

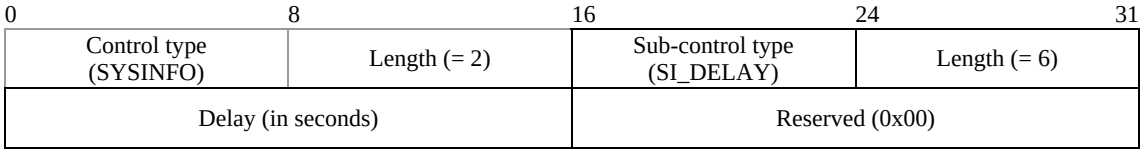

Figure 70 – SI_DELAY sub-control

Figure 71 shows the format of the SI_SND_BW sub-control. The description of each field of the SI_SND_BW sub-control is as follows:

- SI_SND_BW

a) *Sub-control type* – denotes the SI_SND_BW sub-control. Its value shall be set to 0x35 (see Table 7).
b) *Length* – denotes the length of sub-control. Its value shall be set to 0x06 which means 6-byte.
c) *Bandwidth* – shall be set to the total bandwidth in Mbps consumed by the MA to serve its CMAs.
d) *Reserved* – Reserved for the future use.

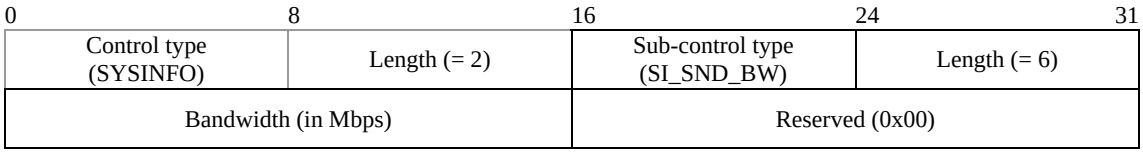

Figure 71 – SI_SND_BW sub-control

Figure 72 shows the format of the SI_SND_BW sub-control. The description of each field of the SI_SND_BW sub-control is as follows:

- SI_SND_PACKET

a) *Sub-control type* – denotes the SI_SND_PACKET sub-control. Its value shall be set to 0x36 (see Table 7).
b) *Length* – denotes the length of sub-control. Its value shall be set to 0x06 which menas 6-byte.
c) *Number of packets* – shall be set to the total number of packets sent by the MA from startup.
d) *Reserved* – Reserved for the future use.

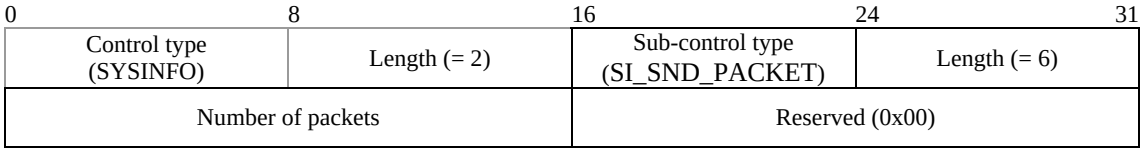

Figure 72 – SI_SND_PACKET sub-control

Figure 73 shows the format of the SI_SND_BW sub-control. The description of each field of the SI_SND_BYTES sub-control is as follows:

- SI_SND_BYTES

a) *Sub-control type* – denotes the SI_SND_BYTES sub-control. Its value shall be set to 0x37 (see Table 7).
b) *Length* – denotes the length of sub-control. Its value shall be set to 0x06 which means 6-byte.
c) *Number of packets* – shall be set to the total number of bytes sent by the MA from startup.
d) *Reserved* – Reserved for the future use.

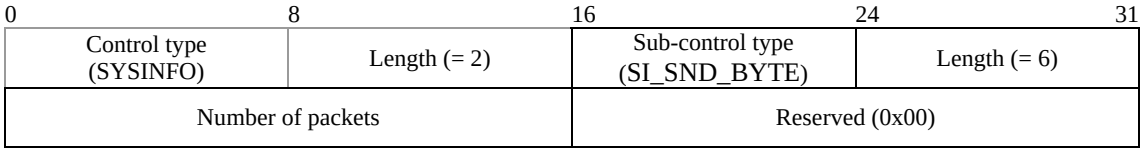

Figure 73 – SI_SND_BYTES sub-control

Figure 74 shows the format of the SI_RCV_BW sub-control. The description of each field of the SI_SND_BW sub-control is as follows:

- SI_RCV_BW

a) *Sub-control type* – denotes the SI_RCV_BW sub-control. Its value shall be set to 0x46 (see Table 7).
b) *Length* – denotes the length of sub-control. Its value shall be set to 0x06 which means 6-byte.
c) *Number of packets* – shall be set to the bandwidth in Mbps perceived by the MA between its PMA.
d) *Reserved* – Reserved for the future use.

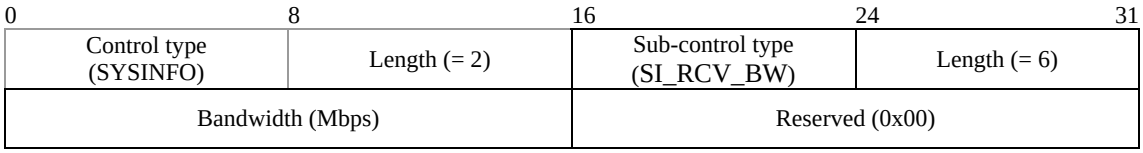

Figure 74 – SI_RCV_BW sub-control

Figure 75 shows the format of the SI_RCV_PACKET sub-control. The description of each field of the SI_RCV_PACKET sub-control is as follows:

- SI_RCV_PACKET

a) *Sub-control type* – denotes the SI_RCV_PACKET sub-control. Its value shall be set to 0x47 (see Table 7).
b) *Length* – denotes the length of sub-control. Its value shall be set to 0x06 which means 6-byte.
c) *Number of packets* – shall be set to the number of packets received by the MA from startup.
d) *Reserved* – Reserved for the future use.

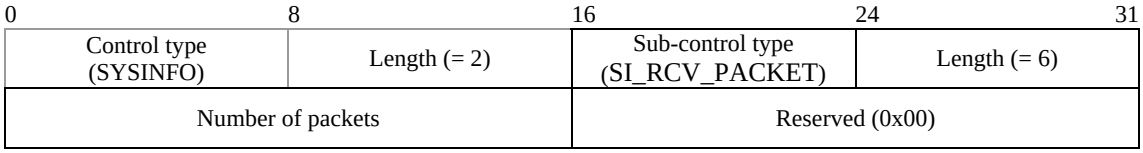

Figure 75 – SI_RCV_PACKET sub-control

Figure 76 shows the format of the SI_RCV_BYTES sub-control. The description of each field of the SI_RCV_BYTES sub-control is as follows:

- SI_RCV_ BYTES

a) *Sub-control type* – denotes the SI_RCV_ BYTES sub-control. Its value shall be set to 0x45 (see Table 7).
b) *Length* – denotes the length of sub-control. Its value shall be set to 0x06 which means 6-byte.
c) *Number of packets* – shall be set to the number of bytes received by the MA from startup.
d) *Reserved* – Reserved for the future use.

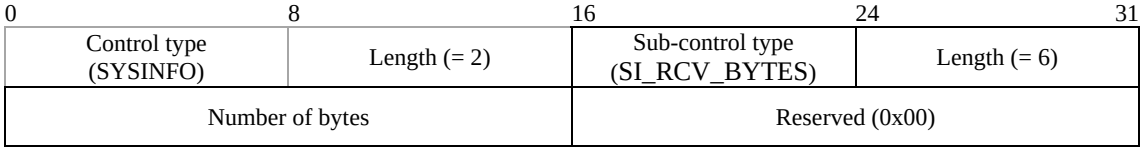

Figure 76 – SI_RCV_BYTES sub-control

7.3.12 STCOLREQ

STCOLREQ message is used for monitoring a RMCP-2 session similarly to STREQ message. But the difference is that firstly the scope of STREQ message is restricted to only one MA but that of STCOLREQ message can be expanded to a part or all the session. Secondly, STREQ message can be issued by SM only but STCOLREQ message is issued by PMA.
When a MA receives STCOLREQ message from the PMA, it starts the *status collection procedure* and forwards this message to its CMAs of limited area which is confined by the TREEEXPLOR control. Figure 77 shows the format of the STCOLREQ message.

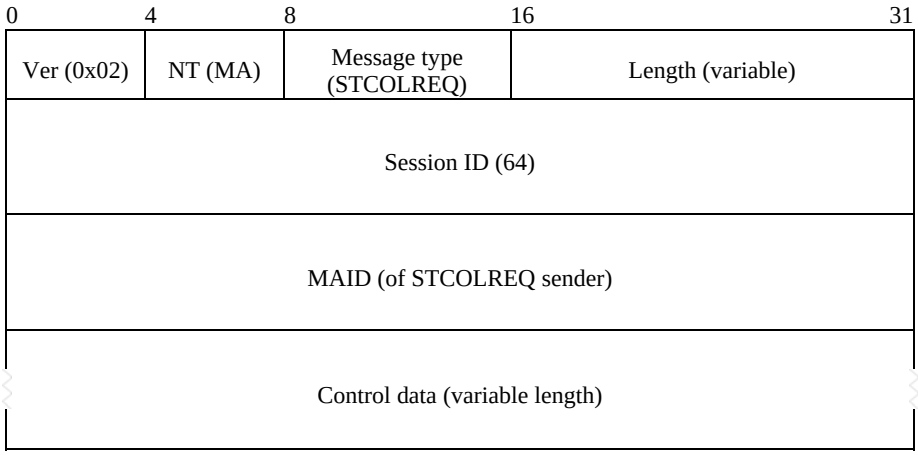

Figure 77 – STCOLREQ message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.
b) *NT* – denotes the message issuer's node type. The value shall be set to the coded value for MA in Table 2.
c) *Message type* – denotes the type of the message. Its value shall be set to 0x1A (see Table 3).
d) *Length* – shall be set to the total length of STCOLREQ message including control data (in bytes).
e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.
f) *MAID* – shall be set to the MAID of the STCOLREQ message sender.
g) *Control data* – The Control data field may include the following information:

- SI_COMMAND

When PMA asks its CMAs of its status, it includes the SI_COMMAND control in its STCOLREQ message. The SI_COMMAND control is specified in 7.3.10 and the format is shown in Figure 63.

- TREEEXPLOR

Inspecting whole tree status can cause hazards because of report implosion. So it is very important to limit the scope of tree to be inspected. Figure 64 shows TREEEXPLOR control which is used to limit the scope of tree.

7.3.13 STCOLANS

Figure 78 illustrates the format of the STCOLANS message which is used to respond to the STCOLREQ message. It informs the collected status of its downstream to its upstream. STCOLANS message follows the tree hierarchy back to reach the final destination which sends STCOLREQ message.

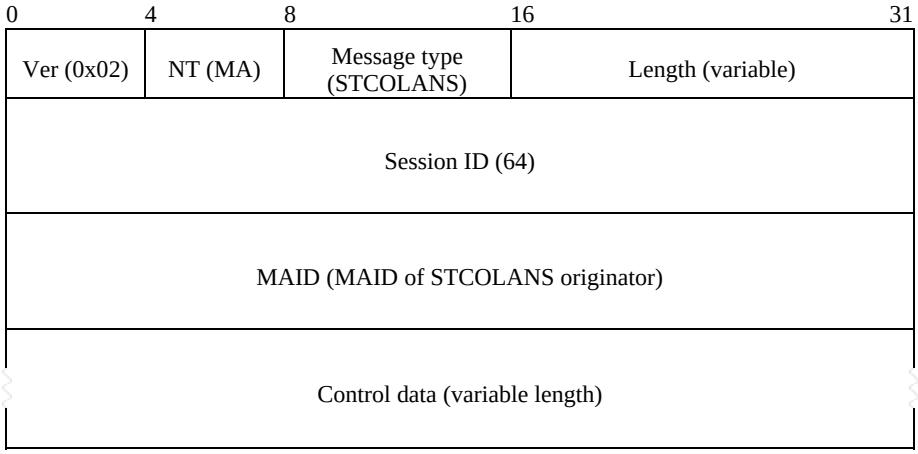

Figure 78 – STCOLANS message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.

b) *NT* – denotes the message issuer's node type. The value shall be set to the coded value for MA in Table 2.

c) *Message type* – denotes the type of the message. Its value shall be set to 0x1B (see Table 3).

d) *Length* – shall be set to the total length of STCOLANS message including control data (in bytes).

e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.

f) *MAID* – shall be set to the MAID of the STCOLANS message sender.

g) *Control data* – The Control data field may include the following information:

- SYSINFO

According to PMA's request, CMA should answer with an appropriate report. The format of each report has {control type, control subtype} form.
According to the request listed in Table 7 each CMA sends appropriate reports to its PMA. Figure 42 through Figure 43 and Figure 66 through Figure 76 in clause 7.3.11 show the corresponding reports. All of sub-controls in clause 7.3.1 and clause 7.3.11 can be used, if necessary.

7.3.14 LEAVREQ

This message is used for three different purposes. The first is for leaving. When an MA leaves from the RMCP-2 session or when an MA leaves from its PMA for parent switching, it sends LEAVEQ message to the corresponding MAs by the leaving procedure.
SM and PMA may use this message but their targets are different. The target of the SM is any MA in the session, but that of PMA is only its own CMA.

The last purpose is for terminating a session. When the SMA leaves the session, this message should be forwarded to the end-most MA in the tree hierarchy. Figure 79 illustrates the format of LEAVREQ message.

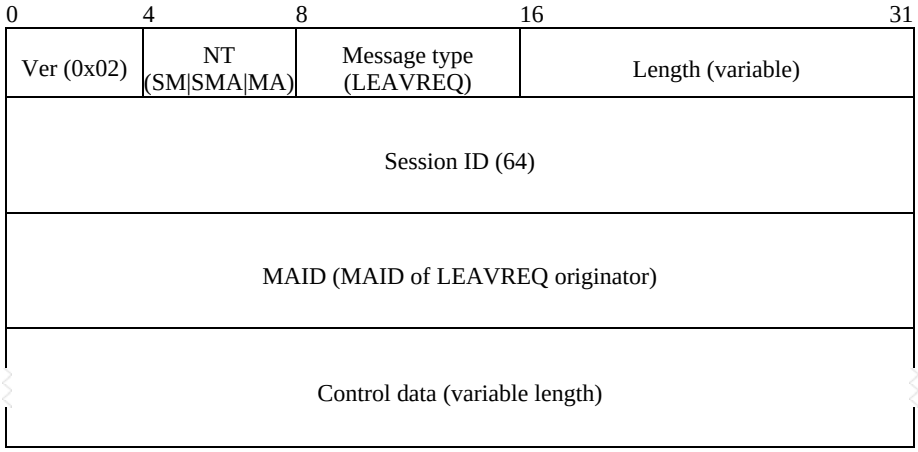

Figure 79 – LEAVREQ message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.

b) *NT* – denotes the message issuer's node type. The value shall be set to one of coded value for SM, SMA, or MA in Table 2.

c) *Message type* – denotes the type of the message. Its value shall be set to 0x0C (see Table 3).

d) *Length* – shall be set to the total length of LEAVREQ message including control data (in bytes).

e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.

f) *MAID* – shall be set to the MAID of the LEAVREQ message originator (set to zero for SM).

g) *Control data* – The Control data field may include the following information:

- REASON

To give the reason why MA tries to leave a session, LEAVREQ message must include REASON control. Figure 58 shows REASON control format.

7.3.15 LEAVANS

As a confirmation of the LEAVREQ message, the MA, which receives LEAVREQ message, sends a LEAVANS message back. Figure 80 illustrates the format of LEAVANS message.

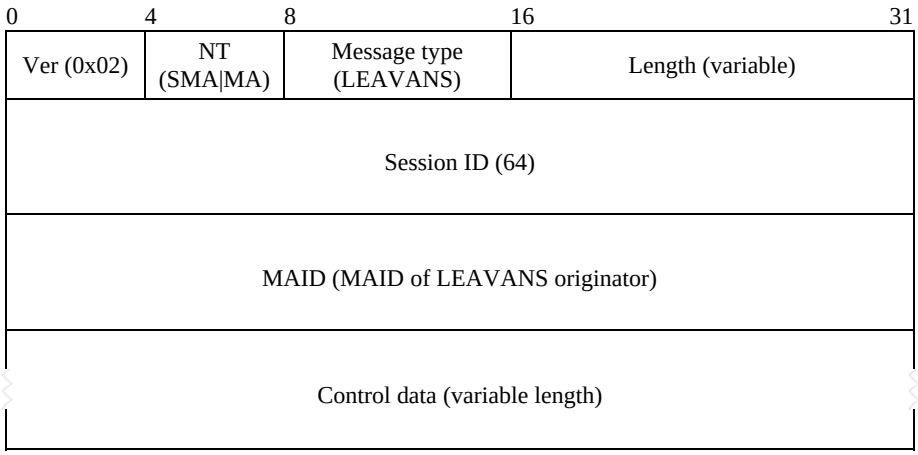

Figure 80 – LEAVANS message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.

b) *NT* – denotes the message issuer's node type. The value shall be set to one of coded value for SMA or MA in Table 2.

c) *Message type* – denotes the type of the message. Its value shall be set to 0x0D (see Table 3).

d) *Length* – shall be set to the total length of LEAVANS message including control data (in bytes).

e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.

f) *MAID* – shall be set to the MAID of the LEAVANS message originator.

g) *Control data* – The Control data field may include the following information:

- RESULT

LEAVANS message is used to indicate whether leaving MA's LEAVREQ message has successfully arrived. So the result code in RESULT control should always have the meaning of OK.

7.3.16 HB

The HB message is issued periodically by the SMA to give clock information through the RMCP-2 session. With the HB message, each MA can diagnose network condition. Figure 81 illustrates the format of HB message.

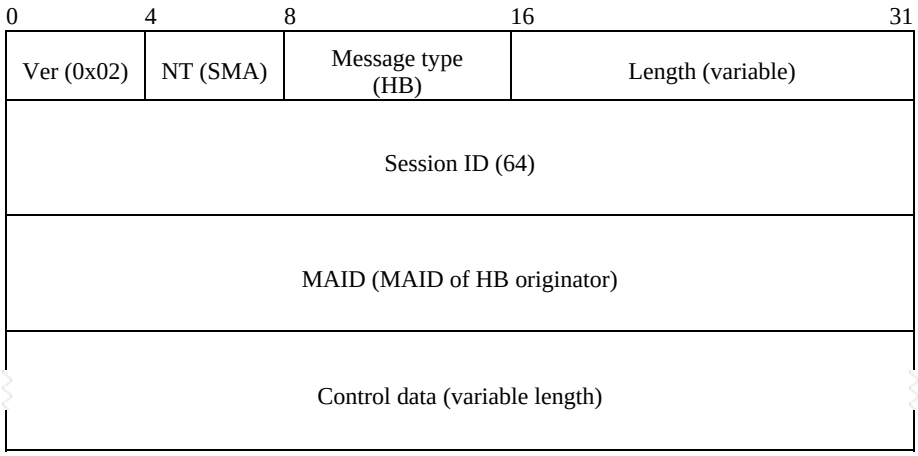

Figure 81 – HB message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.

b) *NT* – denotes the message issuer's node type. The value shall be set to the coded value for SMA in Table 2.

c) *Message type* – denotes the type of the message. Its value shall be set to 0x10 (see Table 3).

d) *Length* – shall be set to the total length of HB message including control data (in bytes).

e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.

f) *MAID* – shall be set to the MAID of the HB message sender.

g) *Control data* – The Control data field may include the following:

- ROOTPATH

ROOTPATH control is updated by each MA. Beginning from the root, each MA who relays HB message appends its MAID as well as subsidiary information such as hop-by-hop delay, hop-by-hop bandwidth, according to its preceding session configuration. Figure 51 and figure 52 show ROOTPATH control and sub-control.

- RP_COMMAND

When a PMA tries to recover from network partition, its descendants may start network fault recovery procedure due to HB expectation timeout. In other words, a single point of partitioning may cause a fault recovery chain effect.
So it is necessary to generate a pseudo-HB message to delay its descendants' fault recovery procedure and means of notifying its pseudo-HB message to its descendants.
RP_PSEUDO command code in Table 6 is used to indicate that the ROOTPATH control in HB message with this RP_COMMAND control is a pseudo ROOTPATH. The format of the RP_COMMAND control is shown in Figure 60.

7.3.17 TERMREQ

TERMREQ message is used to terminate an existing RMCP-2 session. It is issued by the SM and then it is forwarded by the SMA to the end-most MAs along the tree hierarchy. Figure 82 shows the format of TERMREQ message.

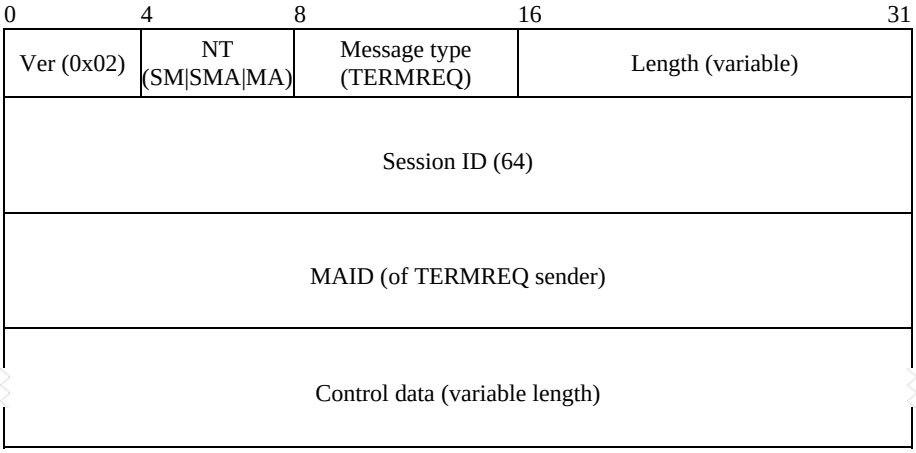

Figure 82 – TERMREQ message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.

b) *NT* – denotes the message issuer's node type. The value shall be set to one of coded value for SM, SMA, or MA in Table 2.

c) *Message type* – denotes the type of the message. Its value shall be set to 0x0E (see Table 3).

d) *Length* – shall be set to the total length of TERMREQ message including control data (in bytes).

e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.

f) *MAID* – shall be set to the MAID of the TERMREQ message sender (set to zero for SM).

g) *Control data* – The Control data field may include the following information:

- REASON

To give the reason why a session is to be terminated, TERMREQ message should include REASON control as shown in Figure 58. The reason for session termination will be either SMA's non-existence or the termination by session owner.

7.3.18 TERMANS

Figure 83 illustrates the format of the TERMANS message.

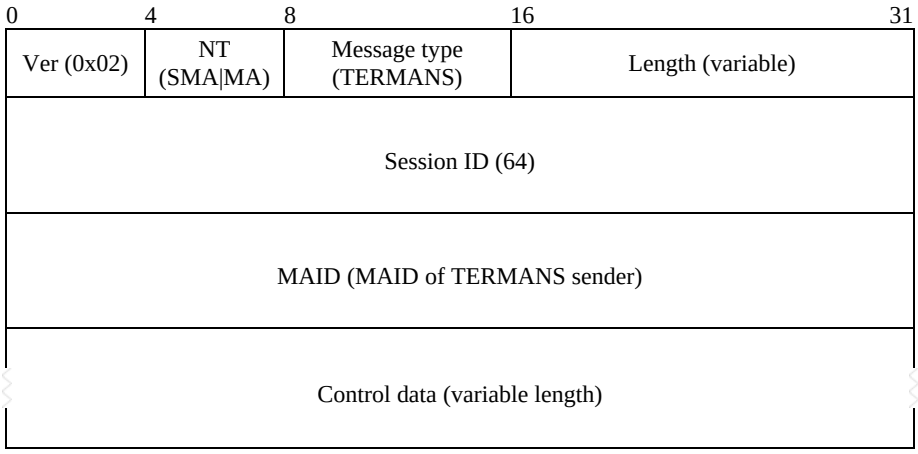

Figure 83 – TERMANS message

The description of each field is as follows:

a) *Ver* – denotes the current version of RMCP. Its value shall be set to 0x02.

b) *NT* – denotes the message issuer's node type. The value shall be set to one of coded value for SMA or MA in Table 2.

c) *Message type* – denotes the type of the message. Its value shall be set to 0x0F (see Table 3).

d) *Length* – shall be set to the total length of TERMANS message including control data (in bytes).

e) *Session ID* – shall be set to the 64-bit value of Session ID as defined in 7.1.1.

f) *MAID* – shall be set to the MAID of the TERMANS message sender.

g) *Control data* – The Control data field may include the following information:

- RESULT

TERMANS message is used to indicate whether TERMREQ message has successfully arrived. So the result code in Figure 47 should always be OK.

5 Sub-clause 8.3.

Delete the current sub-clause 8.3 and replace with the following text:

8.3 Code values used in RMCP-2

8.3.1 Codes values for basic RMCP-2 node types

Table 2 lists the node types (NT) for the basic RMCP-2 protocol and their corresponding 4-bit code values.

NOTE – The code value for the MA node type applies only to the basic RMCP-2 protocol defined in clauses 5 – 7 of this Recommendation | International Standard. The secure RMCP-2 protocol in Amendment 1 does not use the code value for MAs: it has its own code values for DMA and RMA node types.

Table 2 – Node type code values for basic RMCP-2

Node type	Code value (4 bits)
SM	0x1
SMA	0x2
MA	0x4

8.3.2 Code values for RMCP-2 message types

Table 3 lists the RMCP-2 message types and their corresponding code values.

Table 3 – Code values for RMCP-2 message types

Message type	Code value (Hexadecimal)
SUBSREQ	0x01
SUBSANS	0x02
PPROBREQ	0x03
PPROBANS	0x04
HSOLICIT	0x05
HANNOUNCE	0x06
HLEAVE	0x07
RELREQ	0x08
RELANS	0x09
STREQ	0x0A
STANS	0x0B
STCOLREQ	0x1A
STCOLANS	0x1B
LEAVREQ	0x0C
LEAVANS	0x0D
HB	0x10
TERMREQ	0x0E
TERMANS	0x0F

8.3.3 Code values for RMCP-2 control types

Table 4 lists the RMCP-2 control types and their corresponding code values

Table 4 – Code values for RMCP-2 control types

Control type	Value (Hexadecimal)
RP_COMMAND	0x01
SI_COMMAND	0x02
DATAPROFILE	0x03
NEIGHBORLIST	0x04
REASON	0x05
RESULT	0x06
ROOTPATH	0x07
SYSINFO	0x08
TIMESTAMP	0x09
CANDIDATEHMA	0x0A
TREEEXPLOR	0x0B

8.3.4 RMCP-2 return value

Table 5 lists the encoded values and meaning of the result codes, which are normally used as the return codes for an RMCP-2 request such as SUBSREQ message and RELREQ message.

Table 5 – Result codes

Result Code	Meaning
0x10	OK
0x20	System Problem
0x30	Administrative Problem

8.3.5 Values related to the ROOTPATH control

Table 6 lists the code values for both the sub-control types of the ROOTPATH and RP_command code of RP_COMMAND control. The length in bytes of each rootpath element is indicated for each ROOTPATH type.

Table 6 – Sub-control type codes for ROOTPATH control

Sub-control type	Code (8-bit)	Meaning	Length of rootpath element in bytes
The following six code values apply both to ROOTPATH and RP_COMMAND controls.			
RP_ID	0x11	The ROOTPATH control contains only the MAID for each node	8
RP_ BW	0x12	The ROOTPATH control contains only the bandwidth in Mbps as perceived by the MA for each node.	4
RP_ DL	0x14	The ROOTPATH control contains only the delay in seconds from the ROOT node as perceived by the MA for each node	4
RP_ID_BW	0x13	The ROOTPATH control contains the MAID and bandwidth in Mbps as perceived by the MA for each node.	12
RP_ID_DL	0x15	The ROOTPATH control contains the MAID and the delay in seconds from the ROOT node as perceived by the MA for each node.	12
RP_ID_BW_DL	0x17	The ROOTPATH control contains the MAID, bandwidth in Mbps and the delay in seconds as perceived by the MA for each node.	16

The following code value applies only to the RP_COMMAND control in HB messages.			
RP_PSEUDO	0x10	Indicates that the ROOTPATH control in the HB message is a pseudo-ROOTPATH for fault recovery	N/A

NOTE – The code values for RP_ID_BW, RP_ID_DL and RP_ID_BW_DL sub-controls are calculated by 0x10 plus the arithmetic sums of last four bits of the individual codes of the RP_ID, RP_BW and RP_DL components.

8.3.6 Values related to SYSINFO control

A single control may include zero or more sub-control. This clause defines codes for RMCP-2 sub-control.
SYSINFO control is used for exchange information related to MA. Table 7 lists the sub-control types, its code, and meaning.

Table 7 – Sub-control types for SYSINFO

Type	Code (8 bit)	Meaning
SI_UPTIME	0x12	Time of MA's uptime.
SI_DELAY	0x13	Status of delay as perceived by MA from ROOT.
SI_ROOM_CMA	0x14	The room for CMAs.
SI_PROV_BW	0x15	Maximum incoming / outgoing bandwidth of MA's network interface card.
SI_POSS_BW	0x25	The possible forwarding bandwidth that the MA can afford.
SI_SND _BW	0x35	Total bandwidth consumed by PMA to serve its CMAs.
SI_SND_PACKET	0x36	Total number of packets sent by MA from startup.
SI_SND _BYTES	0x37	Total number of bytes sent by MA from startup.
SI_RCV_BW	0x45	Bandwidth perceived by MA between its PMA.
SI_RCV_PACKET	0x46	Number of packets received by MA from startup.
SI_RCV_BYTES	0x47	Number of bytes received by MA from startup.
SI_TREE_CONN	0x68	PMA and CMA(s) of MA.
SI_TREE_MEM	0x69	List of tree members.

Table 8 lists the command codes corresponding to the sub-controls for the SYSINFO control. Combinations of different sub-control may be indicated by adding together the corresponding individual SI_Command codes.

NOTE 1 – Table 8 only contains the sub-control types that require a SI_COMMAND control for their initiation. There is, therefore no one-to-one correspondence with the sub-control in Table 7.

NOTE 2 – The 16-bit format column in Table 8 demonstrates how the SI_Command code values may be added together to give unique combinations. The bit positions can be considered as representing individual sub-control types and the 1 or 0 values can be interpreted as presence or absence of these sub-control types.

Table 8 – SI_Command codes for SYSINFO

Sub-control Type	Sub-control Code	Command Code	16-bit format
SI_UPTIME	0x12	0x00 02	0000 0000 0000 00**1**0
SI_DELAY	0x13	0x00 04	0000 0000 0000 0**1**00
SI_ROOM_CMA	0x14	0x00 08	0000 0000 0000 **1**000
SI_PROV_BW	0x15	0x00 10	0000 0000 000**1** 0000
SI_POSS_BW	0x25	0x00 20	0000 0000 00**1**0 0000

SI_SND _BW	0x35	0x00 40	0000 0000 0**1**00 0000
SI_SND_PACKET	0x36	0x00 80	0000 0000 **1**000 0000
SI_SND _BYTES	0x37	0x01 00	0000 000**1** 0000 0000
SI_RCV_BW	0x45	0x02 00	0000 00**1**0 0000 0000
SI_RCV_PACKET	0x46	0x04 00	0000 0**1**00 0000 0000
SI_RCV_BYTES	0x47	0x08 00	0000 **1**000 0000 0000
SI_TREE_CONN	0x68	0x10 00	000**1** 0000 0000 0000
SI_TREE_MEM	0x69	0x20 00	00**1**0 0000 0000 0000

8.3.7 Values related to the leave

Table 9 lists the reason codes for leaving. The four most significant bits of the code specify the main cause of leaving, and the four least significant bits specify further details for leaving, such as exhaustion of system resources or termination by the user's request.

Table 9 – Leave reason code

Category	Code	Meaning
Leave	0x10	Leave initiated by MA
	0x11	Leave of SMA
Kick out	0x20	Expulsion by SM
	0x21	Expulsion by PMA
Parent switching	0x40	Parent switching by MA

8.3.8 Values related to the session termination

Table 10 lists the reason codes for the session termination. The four most significant bits of the code specify the main reason for the session termination, and the four least significant bits specify the detailed reason for session termination.

Table 10 – Termination reason code

Category	Code	Meaning
Normal session termination	0xE0	Session is terminated normally
Abnormal session termination	0xF0	Session is terminated abnormally without reason
	0xF1	Session is terminated abnormally by user request