

IEEE Standard for Local and metropolitan area networks—

Part 21: Media Independent Handover Services

Amendment 4: Multicast Group Management

IEEE Computer Society

Sponsored by the
LAN/MAN Standards Committee

IEEE
3 Park Avenue
New York, NY 10016-5997
USA

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as amended by IEEE Std 802.21a™-2012,
IEEE Std 802.21b™-2012,
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Approved 11 June 2015

IEEE-SA Standards Board

Abstract: Mechanisms to enable multicast group management for MIH services is specified in this standard. The specification defines management primitives and messages that enable a user to join, leave or update group membership and security mechanisms to protect multicast communication.

Keywords: group, group management, group security, IEEE 802®, IEEE 802.21™, IEEE 802.21d™, multicast

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Participants

At the time this IEEE standard was completed, the Media Independent Handoff Working Group had the following officers:

Subir Das, *Chair*
Hyeong Ho Lee, *Vice Chair*

At the time this amendment was submitted to sponsor ballot, the Multicast Group Management Task Group had the following officers:

Yoshihiro Ohba, *Chair*
Antonio de la Oliva Delgado, *Technical Editor*

When the IEEE 802.21 Working Group approved this amendment, the Working Group had the following members:

Anthony Chan	Subir Das	Hyeong Ho Lee
Charles E. Perkins	Antonio de la Oliva Delgado	Michael Lynch
Lidong Chen	Yoshikazu Hanatani	Yoshihiro Ohba
Clint Chaplin	Sangkwon Peter Jeong	Hyunho Park
Daniel Corujo	Toru Kamibayashi	Karen Randall
	Farrokh Khatibi	

The following members of the individual balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

Thomas Alexander	Akio Iso	Satoshi Oyama
Richard Alfvén	Atsushi Ito	Venkatesha Prasad
Mathild Benveniste	Raj Jain	Karen Randall
William Byrd	Shinkyo Kaku	Robert Robinson
Juan Carreon	Toru Kambayashi	Ruben Salazar Cardozo
Lidong Chen	Hyunduk Kang	Peter Saunderson
Keith Chow	Piotr Karocki	Kapil Sood
Daniel Corujo	Stuart Kerry	Thomas Starai
Subir Das	Farrokh Khatibi	Michael Stelts
Antonio de la Oliva Delgado	Bruce Kraemer	Eugene Stoudenmire
Sourav Dutta	Yasushi Kudoh	Walter Struppler
Richard Edgar	Hyeong Ho Lee	Mark-Rene Uchida
Devon Gayle	Elvis Maculuba	Dmitri Varsanofiev
Gregory Gillooly	Syam Madanapalli	Prabodh Varshney
Randall Groves	Michael Newman	Hung-Yu Wei
Yoshikazu Hanatani	Nick S. A. Nikjoo	Brian Weiss
Robert Heile	Paul Nikolich	Oren Yuen
Werner Hoelzl	Yoshihiro Ohba	Daidi Zhong
Noriyuki Ikeuchi		Zhen Zhou

Major contributions were received from the following individuals:

Stephen Chasko
Michael Demeter
Carlos Guimaraes

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Introduction

This introduction is not part of IEEE Std 802.21d™-2015, IEEE Standard for Local Metropolitan Area Networks–Part 21: Media Independent Handover Services–Amendment 4: Multicast Group Management.

This standard extends the media access independent mechanisms that enable the optimization of handovers between possibly heterogeneous IEEE 802® systems and may facilitate handovers between IEEE 802 systems and cellular systems. The extensions enable mobile devices with single-radio designs to improve handover latencies and avoid packet loss.

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NOTE—The editing instructions contained in this amendment define how to merge the material contained therein into the existing base standard and its amendments to form the comprehensive standard.¹

The editing instructions are shown in **bold italic**. Four editing instructions are used: change, delete, insert, and replace. **Change** is used to make corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed by using ~~striking through~~ (to remove old material) and underscore (to add new material). **Delete** removes existing material. **Insert** adds new material without disturbing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. **Replace** is used to make changes in figures or equations by removing the existing figure or equation and replacing it with a new one. Editing instructions, change markings, and this NOTE will not be carried over into future editions because the changes will be incorporated into the base standard.

¹Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.

2. Normative references

Insert the following normative references into Clause 2 in alphabetical order:

IEEE Std 802.1AR™-2009, IEEE Standard for Local and Metropolitan Area Networks: Secure Device Identity.^{2, 3}

IETF RFC 2627 (1999), Key Management for Multicast: Issues and Architectures.⁴

IETF RFC 5280 (2008), Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile.

NIST SP 800-38C, Recommendation for Block Cipher Modes of Operation: The CCM Mode for Authentication and Confidentiality, 2004.⁵

NIST SP 800-38F, Recommendation for Block Cipher Modes of Operation: Methods for Key Wrapping, 2012.

NIST SP800-108, Recommendation for Key Derivation using Pseudorandom Functions, 2009.

3. Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause.⁶

Insert the following definitions in alphabetical order:

certificate authority (CA): A trusted entity that issues and revokes public key certificates.

device key: A cryptographic key assigned to a device. Each device is provisioned with a set of device keys.

group addressed message: A media independent handover (MIH) message sent to nodes that belong to a group identified by a media independent handover function (MIHF) Group ID. A group addressed message is sent using a multicast transport mechanism, which is out of the scope of this specification. An exception is that a unicast transport mechanism may be used for a two-member group.

group key block (GKB): A data entity carrying an encapsulated group key in such a manner that only those nodes that have the corresponding device keys can decapsulate it.

group key protection method: Security procedure that uses group key block (GKB) as a data element to encrypt group keys.

group management tree: A perfect binary tree used for group management purposes.

group manager (GM): A media independent handover (MIH) User that manages the group by adding, deleting, and updating the group membership information. It also generates the group key when needed. It is also the entity that issues group manipulation commands.

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⁴ IETF RFCs are available from the Internet Engineering Task Force website at <http://www.ietf.org/rfc.html>.

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⁶ *IEEE Standards Dictionary Online* subscription is available at:
http://www.ieee.org/portal/innovate/products/standard/standards_dictionary.html.

group manipulation command: A command, sent to a group of nodes or to an individual node, that instructs the recipient to perform certain operations such as joining and leaving a group, updating group membership and so on. By group manipulation command, we refer to the following commands:

- MIH_MN_Group_Manipulate
- MIH_Net_Group_Manipulate

internal node: A node having two children and one parent node.

leaf key: A node key which is assigned to a leaf node of a group management tree.

leaf node: A node having one parent node without having a child node.

leaf number: The integer representation of the node index assigned to a leaf node.

media independent handover function broadcast identifier (MIHF Broadcast ID): An MIHF Group ID of zero length.

media independent handover function group identifier (MIHF Group ID): An identifier of a group of MIHF peers entities.

node index: A binary string assigned to a node in a group management tree.

node key: A cryptographic key assigned to a node in a group management tree. It is a device key and is shared by multiple devices when the node is not a leaf node.

perfect binary tree: A binary tree with all leaf nodes at the same depth and all internal nodes having two children.

two-member group: A group consisting of exactly two members.

4. Abbreviations and acronyms

Insert the following abbreviations and acronyms in alphabetical order:

CA	certificate authority
GKB	group key block
GM	group manager
MGK	master group key
MIGKVK	media independent group key verification key
MIGSK	media independent group session key
PRF	pseudorandom function

5. General architecture

5.1 Introduction

Insert new subclause 5.1.12 as follows:

5.1.12 Group communications

There are scenarios where a set of nodes moves like a group between network points of attachment. Examples of these scenarios are: networks of sensors/actuators that move between production and management networks, a set of nodes in a mesh network that moves as a group from one gateway node to another, a group of nodes that travels together in a transportation medium while changing the network point of attachment. To manage the handover operation of these nodes in a bandwidth efficient manner when the network is performing failover, failback, configuration and other management operations, multicast-based group communication is required.

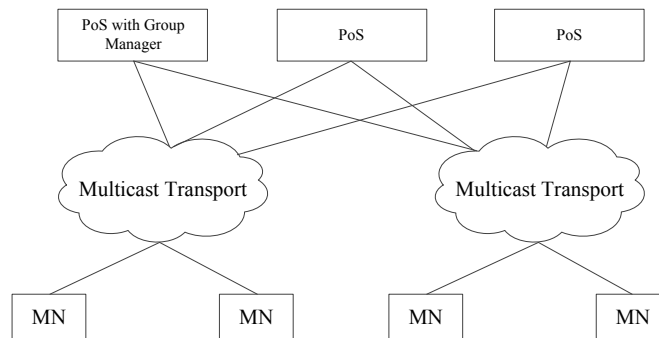


Figure 2—Group communication functional entities

This standard allows network nodes (e.g., PoS with Group Manager) to communicate handover commands to a group of MNs and PoSes via a multicast transport in a secure way. The standard defines primitives and corresponding messages for managing the multicast group membership (e.g., join, leave and update the group membership) and provides mechanisms for managing the multicast group keys. Figure 2 shows the logical view of the functional entities that are involved in a multicast-based group communication. The group manager, as an MIH User in a PoS, is responsible for issuing the group manipulation commands in addition to generating and updating the master group keys and managing the group. PoSes (including the PoS with the group manager) and MNs send group addressed messages (see 8.3.1 and 9.6 for detailed rules on sending group addressed messages) via a multicast transport that is made available by the underlying network. This standard does not specify any transport protocol and the choice of transport protocol is left to the implementers.

6. MIHF services

6.2 Service management

6.2.1 General

Change list after first paragraph as follows:

Prior to providing the MIH services from one MIHF to another, the MIH entities need to be configured properly. This is done through the following service management functions:

- MIH capability discovery
- MIH registration
- MIH service access authentication
- MIH event subscription
- MIH group configuration, manipulation and key distribution

6.2.2 Service management primitives

Insert new rows after last row in Table 3 as follows:

Table 3—Services management primitives

Service management primitive	(L)ocal / (R)emote	Defined in	Comments
MIH_Configuration_Update	R	7.4.34	This command is sent by a PoS to a group of MNs or other PoS(es) to update their configuration.
MIH_MN_Group_Manipulate	R	7.4.35	This command is sent by an MN or a PoS to another PoS to create, delete or update the group membership.
MIH_Net_Group_Manipulate	R	7.4.36	This command is sent by a PoS to a group of MNs or other PoS(es) to create, delete or update a group membership.
MIH_Pull_Certificate	R	7.4.37	This primitive is generated by an MN and it is used to request the sending of a certificate from the PoS to a destination PoS or MN.
MIH_Push_Certificate	R	7.4.38	This command is sent by a PoS to another PoS or an MN and it is used for sending of a certificate.
MIH_Revoke_Certificate	R	7.4.39	This command is sent by a PoS to a group of PoS(es) and/or an MN to revoke a certificate previously issued by the PoS.

Insert the following subclause after 6.2.6

6.2.7 MIH group configuration and manipulation

The MIH group configuration and manipulation mechanisms enable a PoS to manage groups of MNs and/or PoSes in a secure way. These MNs are reachable through a multicast transport. The primitives used to manage the membership to the groups and their security properties are called group manipulation commands throughout this specification. The group manipulation commands include the functionalities required to manage the group membership (join, leave, update operations) and to install the appropriate credentials to MNs and PoSes belonging to a particular group. Details on which MIHF commands can be used for multicast group communication are described in 8.3.1.

6.4 Media independent command service

6.4.1 Command service flow model

Insert the following paragraph after the 1st paragraph:

When a command request or indication frame is sent to a group of MIHF peers, it is transmitted using multicast transport and one or more remote MIHF(s) may receive the frame. When the frame is a command request, each recipient shall answer with a command response frame. When the frame is a command indication, no command response frame shall be returned by any recipient. An exception is that unicast transport may be used for a two-member group where one member of the group is the sender of the message and the other member is the recipient.

7. Service access points (SAPs) and primitives

7.2 SAPs

7.2.3 Media Independent SAP: MIH_SAP

Add the following rows at the end of Table 17:

Table 17—MIH_SAP primitives

Primitives	Service category	Description	Defined in
MIH_Configuration_Update	Service Management	Updates the configuration of one or more MN(s) or PoS(es).	7.4.34
MIH_MN_Group_Manipulate	Service Management	Used by an MN or a PoS to manipulate its group membership.	7.4.35
MIH_Net_Group_Manipulate	Service Management	Used by a group manager to manipulate the group membership of a node.	7.4.36

MIH_Pull_Certificate	Service Management	Request the sending of a certificate from the destination PoS to the requestor.	7.4.37
MIH_Push_Certificate	Service Management	Used to send a certificate to a destination PoS or MN.	7.4.38
MIH_Revoke_Certificate	Service Management	Used to revoke a certificate.	7.4.39

7.4 MIH_SAP primitives

7.4.2 MIH_Register

7.4.2.1 MIH_Register.request

7.4.2.1.2 Semantics of service primitive

Change text as follows:

```
MIH_Register.request      (
                           DestinationIdentifier,
                           LinkIdentifierList,
                           GroupLinkIdentifier,
                           RequestCode
                           )
```

Insert and change the following parameters:

Parameters:

Name	Data type	Description
LinkIdentifierList	LIST(LINK_ID)	(Optional) List of local link identifiers of the <u>remote</u> MIHF. <u>This parameter shall be used if and only if DestinationIdentifier is an MIHF ID.</u>
GroupLinkIdentifier	NET_TYPE_INC	(Optional) Identifier of a group of links. This parameter shall be used if and only if DestinationIdentifier is an MIHF Group ID.

7.4.2.2 MIH_Register.indication

7.4.2.2.2 Semantics of service primitive

Change text as follows:

```
MIH_Register.indication  (
                           SourceIdentifier,
                           LinkIdentifierList,
                           GroupLinkIdentifier,
                           RequestCode
                           )
```

Insert and change the following parameters:

Parameters:

Name	Data type	Description
LinkIdentifierList	LIST(LINK_ID)	(Optional) List of local link identifiers of the remote MIHF. <u>This parameter shall be used if and only if DestinationIdentifier is an MIHF ID.</u>
GroupLinkIdentifier	NET_TYPE_INC	(Optional) Identifier of a group of links. This parameter shall be used if and only if DestinationIdentifier is an MIHF Group ID.

7.4.2.3 MIH_Register.response

7.4.2.3.2 Semantics of service primitives

Change text as follows:

MIH_Register.response
(
DestinationIdentifier,
Status,
ValidTimeInterval,
MulticastCipherSuite,
Certificate
)

Add the following parameters:

Parameters:

Name	Data type	Description
MulticastCipherSuite	MULTICAST_CAP	(Optional) Specifies the group ciphersuite to be used for securing multicast MIH messages. Only one ciphersuite shall be included.
Certificate	CERTIFICATE	(Optional) X.509 certificate

7.4.2.4 MIH_Register.confirm

7.4.2.4.2 Semantics of service primitives

Change the text as follows:

MIH_Register.confirm
(
SourceIdentifier,
Status,
ValidTimeInterval,
MulticastCipherSuite,
Certificate
)

Add the following parameters:

Parameters:

Name	Data type	Description
MulticastCipherSuite	MULTICAST_CAP	(Optional) Specifies the group ciphersuite to be used for securing multicast MIH messages. Only one ciphersuite shall be included.
Certificate	CERTIFICATE	(Optional) X.509 certificate

7.4.4 MIH_Event_Subscribe

7.4.4.1 MIH_Event_Subscribe.request

7.4.4.1.2 Semantics of service primitive

Change the text as follows:

```
MIH_Event_Subscribe.request (
    DestinationIdentifier,
    LinkIdentifier,
    GroupLinkIdentifier,
    RequestedMihEventList,
    EventConfigurationInfoList
)
```

Insert and change the following parameters:

Parameters:

Name	Data type	Description
LinkIdentifier	LINK_TUPLE_ID	(Optional) Identifier of the link for event subscription. For local event subscription, PoA link address need not be present if the link type lacks such a value. <u>This parameter shall be used if and only if DestinationIdentifier is an MIHF ID.</u>
GroupLinkIdentifier	NET_TYPE_INC	(Optional) Identifier of a group of links for event subscription. This parameter shall be used if and only if DestinationIdentifier is an MIHF Group ID.

7.4.5 MIH_Event_Unsubscribe

7.4.5.1 MIH_Event_Unsubscribe.request

7.4.5.1.2 Semantics of service primitive

Change the text as follows:

```
MIH_Event_Unsubscribe.request (
    DestinationIdentifier,
    LinkIdentifier,
    GroupLinkIdentifier,
    RequestedMihEventList
)
```

Insert and change the following parameters:

Parameters:

Name	Data type	Description
LinkIdentifier	LINK_TUPLE_ID	(Optional) Identifier of the link for event unsubscription. For local event unsubscription, PoA address in the Link Identifier need not be present if the link type lacks such a value. <u>This parameter shall be used if and only if DestinationIdentifier is an MIHF ID.</u>
GroupLinkIdentifier	NET_TYPE_INC	(Optional) Identifier of a group of links for event unsubscription. This parameter shall be used if and only if DestinationIdentifier is an MIHF Group ID.

7.4.14 MIH_Link_Get_Parameters

7.4.14.1 MIH_Link_Get_Parameters.request

7.4.14.1.2 Semantics of service primitive

Change the text as follows:

```
MIH_Link_Get_Parameters.request      (
                                     DestinationIdentifier,
                                     DeviceStatesRequest,
                                     LinkIdentifierList,
                                     GroupLinkIdentifier,
                                     GetStatusRequestSet
                                     )
```

Insert and change the following parameters:

Parameters:

Name	Data type	Description
LinkIdentifierList	LIST(LINK_ID)	(Optional) List of link identifiers for which status is requested. If the list is empty, return the status of all available links. <u>This parameter shall be used if and only if DestinationIdentifier is an MIHF ID.</u>
GroupLinkIdentifier	NET_TYPE_INC	(Optional) Identifier of a group of links for which status is requested. This parameter shall be used if and only if DestinationIdentifier is an MIHF Group ID.

7.4.15 MIH_Link_Configure_Thresholds

7.4.15.1 MIH_Link_Configure_Thresholds.request

7.4.15.1.2 Semantics of service primitive

Change the text as follows:

MIH_Link_Configure_Thresholds.request (
DestinationIdentifier,
ResponseFlag,
LinkIdentifier,
GroupLinkIdentifier,
ConfigureRequestList
)

Insert and change the following parameters:

Parameters:

Name	Data type	Description
ResponseFlag ^a	RESPONSE_FLAG	(Optional) Flag that represents whether or not a response is needed.
LinkIdentifier	LINK_TUPLE_ID	(Optional) Identifier of the link to be configured. <u>This parameter shall be used if and only if DestinationIdentifier is an MIHF ID.</u>
GroupLinkIdentifier	NET_TYPE_INC	(Optional) Identifier of a group of links to be configured. This parameter shall be used if and only if DestinationIdentifier is an MIHF Group ID.

^a If the ResponseFlag parameter is not present, the MIHF shall generate a request message, otherwise the MIHF generates either a request or an indication message, based on the ResponseFlag parameter.

7.4.15.1.4 Effect of receipt

Change the text as follows:

If the destination of the request is the local MIHF itself, the local MIHF issues a Link_Configure_Thresholds.request to the lower layer link to set the thresholds for the link according to the specified configuration parameters.

If the destination of the request is a remote MIHF, based on the ResponseFlag parameter, the local MIHF generates and sends an MIH_Link_Configure_Thresholds request or an MIH_Link_Configure_Thresholds indication message to the remote MIHF. Upon the receipt of the message, the remote MIHF then issues a Link_Configure_Thresholds.request to the lower layer link to set the thresholds for the link according to the specified configuration parameters.

7.4.16 MIH_Link_Actions

7.4.16.1 MIH_Link_Actions.request

7.4.16.1.2 Semantics of service primitive

Change the text as follows:

MIH_Link_Actions.request (
DestinationIdentifier,
ResponseFlag,
LinkActionsList,
GroupLinkActionsList
)

Insert and change the following parameters:

Parameters:

Name	Data type	Description
ResponseFlag ^a	RESPONSE_FLAG	(Optional) Flag that represents whether or not a response is needed.
LinkActionsList	LIST(LINK_ACTION_REQ)	(Optional) Specifies the suggested actions. <u>This parameter shall be used if and only if DestinationIdentifier is an MIHF ID.</u>
GroupLinkActionsList	LIST(MULTICAST_ACTION_REQ)	(Optional) Specifies the suggested actions for a group of links. This parameter shall be used if and only if DestinationIdentifier is an MIHF Group ID.

^a If the ResponseFlag parameter is not present, the MIHF shall generate a request message, otherwise the MIHF generates either a request or an indication message, based on the ResponseFlag parameter.

7.4.16.1.4 Effect on receipt

Change the text as follows:

If the destination of the request is the local MIHF itself, the local MIHF issues a Link Configure Thresholds.request to the lower layer link to set the thresholds for the link according to the specified configuration parameters.

If the destination of the request is a remote MIHF, based on the ResponseFlag parameter, the local MIHF generates and sends an MIH_Link_Actions request or an MIH_Link_Actions indication message to the remote MIHF. Upon the receipt of the message, the remote MIHF then issues Link_Action.request(s) to the specified ~~lower layer~~ link layer(s). If ResponseFlag parameter is set, the remote MIHF also generates a response message for the sending MIHF.

7.4.21 MIH_Net_HO_Commit

7.4.21.1 MIH_Net_HO_Commit.request

7.4.21.1.2 Semantics of service primitive

Change the text as follows:

MIH_Net_HO_Commit.request (

- DestinationIdentifier,
- ResponseFlag,
- LinkType,
- TargetNetworkInfoList,
- AssignedResourceSet,
- LinkActionExecutionDelay,
- LinkActionsList,
- GroupLinkActionsList

)

Insert and change the following parameters:

Parameters

Name	Data type	Description
ResponseFlag ^a	RESPONSE_FLAG	(Optional) Flag that represents whether or not a response is needed.
LinkActionExecutionDelay	UNSIGNED_INT(2)	(Optional) Time (in ms) to elapse before an action needs to be taken. A value of 0 indicates that the action is taken immediately. Time elapsed is calculated from the instance the command arrives until the time when the execution of the action is carried out. <u>This parameter shall be used for non-group operation.</u>
LinkActionsList	LIST(LINK_ACTION_REQ)	(Optional) Specifies the suggested actions. <u>This parameter shall be used if and only if DestinationIdentifier is an MIHF ID.</u>
GroupLinkActionsList	LIST(MULTICAST_ACTION_REQ)	(Optional) Specifies the suggested actions for a group of links. This parameter shall be used if and only if DestinationIdentifier is an MIHF Group ID.

^aIf the ResponseFlag parameter is not present, the MIHF shall generate a request message, otherwise the MIHF generates either a request or an indication message, based on the ResponseFlag parameter.

7.4.21.1.4 Effect on receipt

Change the text as follows:

Upon receipt of this primitive an MIHF shall send an MIH_Net_HO_Commit request or indication message to the destination, based on the ResponseFlag parameter.

7.4.21.2 MIH_Net_HO_Commit.indication

7.4.21.2.2 Semantics of service primitive

Change the text as follows:

MIH_Net_HO_Commit.indication (

- SourceIdentifier,
- ResponseFlag,
- LinkType,
- TargetNetworkInfoList,
- AssignedResourceSet,
- LinkActionExecutionDelay,
- LinkActionsList,
- GroupLinkActionsList

)

Insert and change the following parameters:

Parameters:

Name	Data type	Description
ResponseFlag ^a	RESPONSE_FLAG	(Optional) Flag that represents whether or not a response is needed.
LinkActionExecutionDelay	UNSIGNED_INT(2)	(Optional) Time (in ms) to elapse before an action needs to be taken. A value of 0 indicates that the action is taken immediately. Time elapsed is calculated from the instance the command arrives until the time when the execution of the action is carried out. <u>This parameter shall be used for non-group operation.</u>
LinkActionsList	LIST(LINK_ACTION_REQ)	(Optional) Specifies the suggested actions. <u>This parameter shall be used if and only if DestinationIdentifier is an MIHF ID.</u>
GroupLinkActionsList	LIST(MULTICAST_ACTION_REQ)	(Optional) Specifies the suggested actions for a group of links. This parameter shall be used if and only if DestinationIdentifier is an MIHF Group ID.

^aIf the ResponseFlag parameter is not present, the MIHF shall generate a request message, otherwise the MIHF generates either a request or an indication message, based on the ResponseFlag parameter.

Insert 7.4.34 to 7.4.39 at the end of 7.4 as follows:

7.4.34 MIH_Configuration_Update

7.4.34.1 MIH_Configuration_Update.request

7.4.34.1.1 Function

This primitive is generated by a PoS to update the configuration of one or more MN(s) or other PoS(es).

7.4.34.1.2 Semantics of service primitive

```
MIH_Configuration_Update.request    (
    DestinationIdentifier,
    ConfigurationData,
    ResponseFlag
)
```

Parameters:

Name	Data type	Description
DestinationIdentifier	MIHF_ID	Specifies MIHF ID of the remote MIHF(s) to be configured.
ConfigurationData	OCTET_STRING	Configuration data. Examples of this parameter include firmware and management parameters.
ResponseFlag ^a	RESPONSE_FLAG	(Optional) Flag that represents whether or not a response is needed.

^aIf the ResponseFlag parameter is not present, the MIHF shall generate a request message, otherwise the MIHF generates either a request or an indication message, based on the ResponseFlag parameter.

7.4.34.3 MIH_Configuration_Update.response

7.4.34.3.1 Function

This primitive is generated by an MIH User to acknowledge the result of an MIH_Configuration_Update request from a PoS.

7.4.34.3.2 Semantics of service primitive

MIH_Configuration_Update.response (DestinationIdentifier, Status)

Parameters:

Name	Data Type	Description
DestinationIdentifier	MIHF_ID	Specifies the requestor of the configuration update.
Status	STATUS	Status of operation.

7.4.34.3.3 When generated

An MIH User generates this primitive after receipt and processing an MIH_Configuration_Update request.

7.4.34.3.4 Effect on receipt

The status of the configuration update operation is noted.

7.4.34.4 MIH_Configuration_Update.confirm

7.4.34.4.1 Function

This primitive is generated by an MIHF that receives an MIH_Configuration_Update response to indicate the status of the configuration update.

7.4.34.4.2 Semantics of service primitive

MIH_Configuration_Update.confirm (SourceIdentifier, Status)

Parameters:

Name	Data Type	Description
SourceIdentifier	MIHF_ID	Specifies the responder of the configuration update.
Status	STATUS	Status of operation.

7.4.34.4.3 When generated

An MIH User generates this primitive after receipt and processing an MIH_Configuration_Update response.

7.4.34.4.4 Effect on receipt

The status of the configuration update operation is noted.

7.4.35 MIH_MN_Group_Manipulate

7.4.35.1 MIH_MN_Group_Manipulate.request

7.4.35.1.1 Function

This primitive is generated by an MN or a PoS to manipulate its own group membership.

7.4.35.1.2 Semantics of service primitive

MIH_MN_Group_Manipulate.request (
 DestinationIdentifier,
 TargetIdentifier,
 GroupAction
)

Parameters:

Name	Data Type	Description
DestinationIdentifier	MIHF_ID	Specifies group MIHF ID of the remote MIHF peers. DestinationIdentifier may be different from TargetIdentifier.
TargetIdentifier	MIHF_ID	The target MIHF group identifier for the group operation.
GroupAction	GROUP_MGT_ACTION	The action to be taken: Join/Leave the group.

7.4.35.1.3 When generated

The MIH user generates this primitive to request joining or leaving a group.

7.4.35.1.4 Effect on receipt

Upon receipt of this primitive, MIHF on the MN or PoS sends the corresponding MIH_MN_Group_Manipulate request message to the PoS.

7.4.35.2 MIH_MN_Group_Manipulate.indication

7.4.35.2.1 Function

This primitive is used by an MIHF to notify an MIH User that an MIH_MN_Group_Manipulate request message has been received.

7.4.35.2.2 Semantics of service primitive

MIH_MN_Group_Manipulate.indication (
SourceIdentifier,
TargetIdentifier,
GroupAction
)

Parameters:

Name	Data Type	Description
SourceIdentifier	MIHF_ID	Specifies MIHF ID of the remote MIHF that issued MIH_MN_Group_Manipulate.request.
TargetIdentifier	MIHF_ID	The target MIHF group identifier for the group operation.
GroupAction	GROUP_MGT_ACTION	The action to be taken: Join/Leave the group.

7.4.35.2.3 When generated

This primitive is generated by an MIHF on a PoS when receiving an MIH_MN_Group_Manipulate request message from a remote MIHF.

7.4.35.2.4 Effect on receipt

Upon receipt of this primitive, an MIH user on a PoS shall take the required actions as the action specified in GroupAction.

7.4.35.3 MIH_MN_Group_Manipulate.response

7.4.35.3.1 Function

This primitive is generated by an MIH User in a PoS to acknowledge result of an MIH_MN_Group_Manipulate request from an MN or a PoS.

7.4.35.3.2 Semantics of service primitive

MIH_MN_Group_Manipulate.response (
DestinationIdentifier,
TargetIdentifier,
TransportAddress,
MasterGroupKey,
SubgroupRange,
UserSpecificData,
CompleteSubtree,
ComplementSubtreeFlag,
GroupKeyData,
VerifyGroupCode,
GroupStatus
)

Parameters:

Name	Data Type	Description
DestinationIdentifier	MIHF_ID	Specifies the MIHF ID of the destination of the primitive.
TargetIdentifier	MIHF_ID	The target MIHF group identifier for the group operation.
TransportAddress	TRANSPORT_ADDR	(Optional) Multicast or unicast address corresponding with the target group identifier. A unicast address may be used for a two-member group.
MasterGroupKey	MGK	(Optional) The master group key associated with the target MIHF group identifier.
SubgroupRange ^a	SUBGROUP_RANGE	(Optional) Subgroup to process the command.
UserSpecificData ^b	OCTET_STRING	(Optional) Auxiliary data.
CompleteSubtree ^c	COMPLETE_SUBTREE	(Optional) Complete Subtree data.
ComplementSubtreeFlag	SUBTREE_FLAG	(Optional) Flag to interpret the complete subtree data (See 9.5.2)
GroupKeyData	GROUP_KEY_DATA	(Optional) Encrypted group key.
VerifyGroupCode	VERIFY_GROUP_KEY	(Optional) Verification data for group key.
GroupStatus	GROUP_STATUS	Status of the group operation.

^aSubgroupRange parameter shall be present for a fragmented GKB.

^bThe UserSpecificData parameter can be used to convey additional information such as version information of the GKB used or additional credentials.

^cIf CompleteSubtree is Null, no Node Index is matched in the CompleteSubtree.

7.4.35.3.3 When generated

An MIH User at the PoS generates this primitive after receipt and processing of MIH_MN_Group_Manipulate request. This primitive returns the status of the action asked in the request. Optionally, it may respond with the security mechanisms required by the group.

7.4.35.3.4 Effect on receipt

MIH_MN_Group_Manipulate response message is sent back to the requester.

7.4.35.4 MIH_MN_Group_Manipulate.confirm

7.4.35.4.1 Function

This primitive is generated by an MIHF that receives an MIH_MN_Group_Manipulate response to indicate the status of the group manipulation. The status of the group manipulation provides information regarding the result of a group join or leave operation, indicating the status after the command execution.

7.4.35.4.2 Semantics of service primitive

```
MIH_MN_Group_Manipulate.confirm    (
                                   SourceIdentifier,
                                   TargetIdentifier,
                                   GroupStatus
                                   )
```

Parameters:

Name	Data Type	Description
SourceIdentifier	MIHF_ID	Specifies the MIHF ID of the remote MIHF
TargetIdentifier	MIHF_ID	The target MIHF group identifier for the group operation.
GroupStatus	GROUP_STATUS	Status of the group operation

7.4.35.4.3 When generated

This primitive is sent to the MIH User after the MIHF receives an MIH_MN_Group_Manipulate response message.

7.4.35.4.4 Effect on receipt

The status of the group operation is noted.

7.4.36 MIH_Net_Group_Manipulate

7.4.36.1 MIH_Net_Group_Manipulate.request

7.4.36.1.1 Function

This primitive is generated by the MIH User of a PoS to manipulate group membership of one or more MN(s) or other PoS(es).

7.4.36.1.2 Semantics of service primitive

```
MIH_Net_Group_Manipulate.request (
    DestinationIdentifier,
    ResponseFlag,
    GroupKeyUpdateFlag,
    TargetIdentifier,
    TransportAddress,
    MasterGroupKey,
    SubgroupRange,
    UserSpecificData,
    CompleteSubtree,
    ComplementSubtreeFlag,
    GroupKeyData,
    VerifyGroupCode
)
```

Parameters:

Name	Data Type	Description
DestinationIdentifier	MIHF_ID	Specifies group MIHF-ID of the remote MIHF peers. DestinationIdentifier may be different from TargetIdentifier.
ResponseFlag ^a	RESPONSE_FLAG	(Optional) Flag that represents whether or not a response is needed.
GroupKeyUpdateFlag	GROUP_KEY_UPDATE_FLAG	Flag that represents whether or not a group key in GroupKeyData is updated.
TargetIdentifier	MIHF_ID	The target MIHF group identifier for the group operation.
TransportAddress	TRANSPORT_ADDR	(Optional) Multicast or unicast address corresponding with the target group identifier. A unicast address may be used for a two-member group.
MasterGroupKey	MGK	(Optional) The master group key associated with the target MIHF group identifier.
SubgroupRange ^b	SUBGROUP_RANGE	(Optional) Subgroup to process the command
UserSpecificData	OCTET_STRING	(Optional) Auxiliary data.
CompleteSubtree ^c	COMPLETE_SUBTREE	Complete Subtree data.
ComplementSubtreeFlag	SUBTREE_FLAG	(Optional) Flag to interpret the complete subtree data (See 9.5.2)
GroupKeyData	GROUP_KEY_DATA	(Optional) Encrypted group key.
VerifyGroupCode ^d	VERIFY_GROUP_KEY	(Optional) Verification data for group key.

^aIf the ResponseFlag parameter is not present, the MIHF shall generate a request message, otherwise the MIHF generates either a request or an indication message, based on the ResponseFlag parameter.

^bSubgroupRange parameter shall be present for a fragmented GKB.

^cIf CompleteSubtree is Null, no Node Index is matched in the CompleteSubtree.

^dIn case the GroupKeyData parameter is not present, the CompleteSubtree parameter shall be present.

7.4.36.1.3 When generated

The MIH user generates this primitive to create, delete or modify group membership.

7.4.36.1.4 Effect on receipt

Upon receipt of this primitive, MIHF on the PoS sends the corresponding MIH_Net_Group_Manipulate indication message or MIH_Net_Group_Manipulate request message to the MN(s) or other PoS(es). The ResponseFlag TLV indicates which message shall be sent.

7.4.36.2 MIH_Net_Group_Manipulate.indication

7.4.36.2.1 Function

This primitive is used by an MIHF to notify an MIH User that an MIH_Net_Group_Manipulate indication message or an MIH_Net_Group_Manipulate request message has been received.