|  |  |
| --- | --- |
| Project | **IEEE 802.21 Media Independent Handover Services**  **IEEE 802.21d: Multicast Group Management**  **<**[**http://www.ieee802.org/21/**](http://www.ieee802.org/21/)**>** |
| Title | **Proposal for IEEE 802.21d solution** |
| Date Submitted | January, 2013 |
| Source(s) | **21-13-0003-00-MuGM** |
| Re: | IEEE 802.21d TG |
| Authors: | Antonio de la Oliva (UC3M), Daniel Corujo (ITAv), Carlos Guimarães (ITAv) |
| Abstract | This contribution provides a solution for the IEEE 802.21d |
| Purpose | Task Group Discussion and Acceptance |
| Notice | This document has been prepared to assist the IEEE 802.21 Working Group. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein. |

**Introduction**

This contribution enables the use of multicast for MIH signaling purposes. A specific set of messages can be sent to a group of users which are addressed at the MIHF\_ID space through a new multicast MIHF\_ID definition. The discrimination of these users in groups is performed by the use of L2/L3 multicast mechanisms. Users join a certain multicast group, which is then used to command these users to perform handover.

The new primitives included in this document enable the share of information about the existing groups and the creation of groups. The information exchanged encompass the L2/L3 address used by the group, so any MIH User can join it and receive the signaling specific to this group.

All changes are explicitly marked in bold.

**Here starts the contribution:**

**Definition of multicast MIHFID:**

|  |  |  |
| --- | --- | --- |
| Data type name | Derived from | Definition |
| MIHF\_ID | OCTET\_STRING | The MIHF Identifier: MIHF\_ID is a network access identifier (NAI). NAI shall be unique as per IETF RFC 4282. If L3 communication is used and MIHF entity resides in the network node, then MIHF\_ID is  the fully qualified domain name or NAI-encoded IP address (IP4\_ADDR or IP6\_ADDR) of the entity that hosts the MIH Services.  If L2 communication is used then MIHF\_ID is the NAI-encoded linklayer address (LINK\_ADDR) of the entity that hosts the MIH services.  In an NAI-encoded IP address or link-layer address, each octet of binary-encoded IP4\_ADDR, IP6\_ADDR and LINK\_ADDR data is encoded in the username part of the NAI as .“\.” followed by the octet value. A **broadcast** MIHF identifier is defined as an MIHF ID of zero length. **A multicast MIHF identifier is defined as a NAI-encoded multicast linklayer address in the case L2 communication is used or a NAI-encoded IP address (IP4\_ADDR or IP6\_ADDR) in case L3 communication is used.**  When an MIH protocol message with **broadcast** MIHF ID is transmitted over the L2 data plane, a group MAC address (01-80-C2-00-00-0E) shall be used (see IEEE P802.1aj/D2.2). The maximum length is 253 octets. |

8.3.1 MIHF ID

MIHF Identifier (MIHF ID) is an identifier that is required to uniquely identify an MIHF entity for

delivering the MIH services. MIHF ID is used in all MIH protocol messages. This enables the MIH protocol to be transport agnostic.

MIHF ID is assigned to the MIHF during its configuration process. The configuration process is outside the scope of the standard.

**Broadcast** MIHF ID is defined as an MIHF ID of zero length. A **broadcast** MIHF ID can be used when destination MIHF ID is not known to a source MIHF, such as for discovering an MIH peer, or when there are multiple receivers for the message, such as in a broadcast scenario. The following MIH messages can use a broadcast MIHF ID:

**a)MIH Messages for Management Service:**

1) MIH\_Capability\_Discover request

**b)MIH Messages for Command Service:**

1) MIH\_Link\_Get\_Parameters request

2) MIH\_Link\_Configure\_Thresholds request

3) MIH\_Net\_HO\_Bcst\_Commit indication

**c)MIH Messages for Information Service:**

1) MIH\_Push\_Information indication

**If an MIH signaling message must be processed by a set of MNs, the MIHF ID used as destination in such messages corresponds to the zero-length MIHF\_ID. The discrimination of users for MIH signaling purposes, is accomplished by the use of L2 or L3 multicast mechanisms (See subclauses 7.4.28 to 7.4.30).**

The MIHF ID is of type MIHF\_ID. (See F.3.11.)

8.6 MIH protocol messages

The following subclauses specify different MIH protocol messages in TLV form. The shaded areas represent the MIH protocol header, while the unshaded areas represent the MIH protocol payload. The payload consists of a set of identifiers in TLV form.

The TLV Type assignment for each TLV can be found in Annex L, Table L.2.

TLV type values ranging from 101 to 255 are reserved for experimental TLVs. These values are used by different implementations to evaluate the option of using TLVs not defined by the specification.

When a TLV type value is in the range of experimental TLVs and the data type of the TLV value is unknown or the TLV value is not in the range of valid values, the TLV should be ignored and the rest of the message should be processed. Also, experimental TLVs can be ignored, based on the MIHF information that is communicating with another MIHF with different experimental TLVs implementation.

All MIH messages carry a source MIHF ID followed by a destination MIHF ID as the first two TLVs of the MIH protocol payload part of the message. **Broadcast** MIHF ID can be used in MIH\_Capability\_Discover request and response messages as its destination MIHF ID.

All .“Optional.” fields are optionally sent but the receiver shall properly operate on them if present, i.e., these fields are mandatory in the implementation, but optional in their use.

On receipt of an MIH request message the MIHF shall respond with a corresponding response message.

Any message received that has an invalid MIH header, or does not contain the source/destination MIHF IDs, or has an unrecognizable or invalid MIH Message ID shall be discarded without sending any indication to the source MIH node. Any undefined or unrecognizable TLVs in a received message shall be ignored by the receiver.

8.6.1 MIH messages for service management

8.6.1.1 MIH\_Capability\_Discover request

The corresponding MIH primitive of this message is defined in 7.4.1.1.

If a requesting MIHF entity knows the destination MIHF entity.’s MIHF ID, the requesting MIHF entity fills its destination MIHF ID and sends this message to the peer MIHF over the data plane, either L2 or L3.

If a requesting MIHF entity does not know the destination MIHF entity.’s MIHF ID, the requesting MIHF entity may fill its destination MIHF ID with a **broadcast** MIHF ID to send this capability discover message.

8.6.1.2 MIH\_Capability\_Discover response

The corresponding MIH primitive of this message is defined in 7.4.1.3. This message is sent in response to an MIH\_Capability\_Discover request message that was destined to a single or **broadcast** MIHF ID.

8.2.3.4 Inter-state-machine procedures

a) BOOLEAN Process(MIH\_MESSAGE).—This procedure processes the incoming message passed

as an input variable. A value of TRUE is returned if an outgoing message is available in response to

the incoming message. Otherwise, a value of FALSE is returned.

b) void Transmit(MIH\_MESSAGE).—This procedure transmits the message passed as the input

variable.

c) BOOLEAN IsMulticastMsg(MIH\_MESSAGE).—This procedure outputs TRUE if the input

message has a **multicast** destination MIHF\_ID. Otherwise, it outputs FALSE.

d) MIHF\_ID SrcMIHF\_ID(MIH\_MESSAGE).—This procedure obtains a Source Identifier TLV

from the message passed as the input and returns the value of the TLV.

e) MIHF\_ID DstMIHF\_ID(MIH\_MESSAGE).—This procedure obtains a Destination Identifier

TLV from the message passed as the input and returns the value of the TLV.

f) void SetMIHF\_ID(MIH\_MESSAGE, MIHF\_ID, MIHF\_ID).—This procedure inserts a Source

Identifier TLV and a Destination Identifier TLV into the MIH message. The first MIHF\_ID is used

as the value of the Source Identifier TLV. The second MIHF\_ID is used as the value of the

Destination Identifier TLV.

**g) BOOLEAN IsBroadcastMsg(MIH\_MESSAGE).—This procedure outputs TRUE if the input**

**message has a broadcast destination MIHF\_ID. Otherwise, it outputs FALSE.**

8.2.3.7.1 Intra-state-machine variables

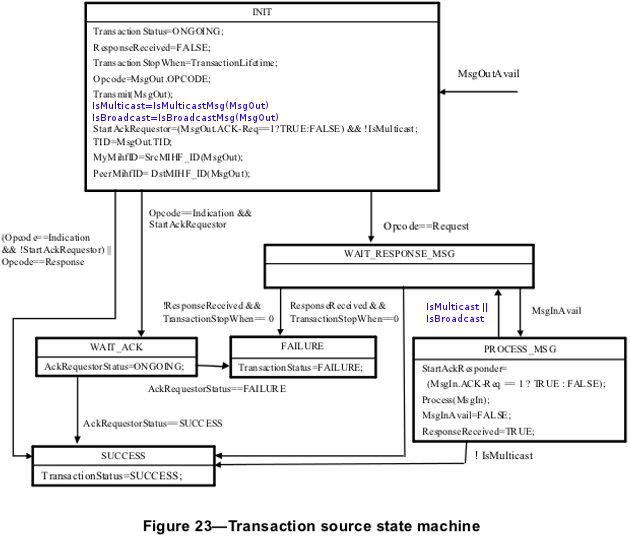
a) IsMulticast.—This variable’s type is BOOLEAN. When its value is TRUE, it indicates that a message has a **multicast** destination MIHF\_ID. Otherwise, its value is FALSE.

**b) IsBroadcast.—This variable’s type is BOOLEAN. When its value is TRUE, it indicates that a message has a broadcast destination MIHF\_ID. Otherwise, its value is FALSE.**

8.2.3.7.3 Transaction source state machine



8.2.3.7.4 Transaction destination state machine



8.2.4.3.4 Solicited MIH capability discovery

An MIHF (the requestor) discovers its peer MIH functions and capabilities by multicasting or unicasting an MIH\_Capability\_Discover request message to either its multicast domain or a known MIHF ID, respectively. Only MIH network entities respond to a multicast MIH\_Capability\_Discover request.

When a peer MIH function (the responder) receives the MIH\_Capability\_Discover request message, it sends MIH\_Capability\_Discover response message back to the requestor. The response is sent by using the same transport type over which the request message was received. When the requestor receives the unicast MIH\_Capability\_Discover response message, it learns the responder.’s MIHF ID by checking the source ID of MIH\_Capability\_Discover response.

For complete operation, the requestor sets a timer at the time of sending an MIH\_Capability\_Discover

request during which time the requestor is in waiting state for a response from the responder. When the

response message is received while the timer is running, the requestor stops the timer and finishes the MIH function and capability discovery procedure. When the timer expires without receiving a response message, the requestor tries the combined MIH function discovery and capability discovery procedure by using a different transport or terminates the MIH function and capability discovery procedure.

If the MIH capability discovery is invoked upon receiving MIH capability advertisement in unauthenticated state through media specific broadcast messages, such as beacon frames and DCD, destination MIHF ID is filled with **broadcast** MIHF ID and this message is transmitted over the control plane using an L2 management frame, such as an IEEE 802.11 management action frame or an IEEE 802.16 MAC management message. This message contains the SupportedMihEventList, SupportedMihCommandList, SupportedISQueryTypeList, SupportedTransportList, and MBBHandoverSupport TLVs to enable the receiving MIHF to discover the sending MIHF.’s capability. Therefore, peer MIHF entities can discover each other.’s MIH capability by one MIH protocol message transaction. When the requestor receives the unicast MIH\_Capability\_Discover response message, which is embedded in the media specific control message, it retrieves the responder.’s MIHF ID by checking the source of the MIH\_Capability\_Discover response

message.

**Append to Figure 17.**

**6.4.2 Command service flow model**

Figure 17 shows the flow for a local command and an example of a remote command, respectively. **Additionally, the flow for a unicast command is also illustrated, where each recipient of a multicast command sends a unicast response, which is collected by the command originator.** Example handover procedures using the commands defined in 6.4.3 can be found in Annex C. Remote commands are transported over network layer protocols or link-layer protocols.

****

6.4.3.2.1 General

***Insert the following rows to the end of Table 7:***

|  |  |  |  |
| --- | --- | --- | --- |
| *MIH Command* | (L) Local  (R) Remote | Comments | Defined in |
| MIH\_Net\_HO\_Bcst\_Commit | R | |  | | --- | | Command used by the network to notify the spe­cific group of MNs of the decided target network information | | |  | | --- | | 7.4.27 | |
| **MIH\_Mcast\_Join** | **L** | **Command the MIHF to join a multicast group for MIHF signaling** | **7.4.28** |
| **MIH\_Net\_Mcast\_Join** | **R** | **Command a remote MIHF to join a group for MIHF signaling** |  |

7. Service access points (SAPs) and primitives

7.2 SAPs

7.2.3 Media independent SAP: MIH\_SAP

***Insert the following rows in table 17; making these rows the last ones under the service category of*** *Command:*

|  |  |  |  |
| --- | --- | --- | --- |
| *Primitives* | Service Category | Description | Defined in |
| MIH\_Net\_HO\_Bcst\_Commit | Command | |  |  | | --- | --- | | |  | | --- | | Command a specific group of mobile nodes to handover from DO network to other net­works | | | |  | | --- | | 7.4.27 | |
| **MIH\_Mcast\_Join** | **Command** | **Command the MIHF to join a multicast group for MIHF signaling** | **7.4.28** |
| **MIH\_Net\_Mcast\_Join** | **Command** | **Command a remote MIHF to join a multicast group for MIHF signaling** |  |

***Insert the following row in table 17; making this row the last one under the service category of Commands:***

**7.4.2 MIH\_Register**

**7.4.2.1 MIH\_Register.request**

**7.4.2.1.1 Function**

This primitive is used by an MIH user to register the local MIHF with remote MIHF.

**7.4.2.1.2 Semantics of service primitive**

MIH\_Register.request (

DestinationIdentifier,

LinkIdentifierList,

RequestCode,

**MulticastGroupList**)

|  |  |  |
| --- | --- | --- |
| Name | Data type | Description |
| DestinationIdentifier | MIHF\_ID | This identifies the local MIHF that will be the destination of this request. |
| LinkIdentifier | LIST(LINK\_ID) | List of link identifiers of the remote MIHF |
| RequestCode | REG\_REQUEST\_CODE | Registration request code. Depending on the request code, the MIH user can choose to either register or re-register with the remote MIHF. |
| **MulticastGroupsList** | **LIST(MULTICAST\_GRP)** | **(optional) List of multicast groups.** |

**7.4.2.1.3 When generated**

This primitive is invoked by the MIH user when it needs to register the local MIHF with a remote MIHF.

**7.4.2.1.4 Effect on receipt**

On receipt, the local MIHF sends an MIH\_Register request message to the destination MIHF.

**7.4.2.2 MIH\_Register.indication**

**7.4.2.2.1 Function**

This primitive is used by an MIHF to notify an MIH user that an MIH\_Register request message has been received.

**7.4.2.2.2 Semantics of service primitive**

MIH\_Register.indication (

SourceIdentifier,

LinkIdentifierList,

RequestCode,

**MulticastGroupList**)

Parameters:

|  |  |  |
| --- | --- | --- |
| Name | Data type | Description |
| SourceIdentifier | MIHF\_ID | This identifies the invoker of this primitive, which is a remote MIHF. |
| LinkIdentifier | LIST(LINK\_ID) | List of link identifiers of the remote MIHF |
| RequestCode | REG\_REQUEST\_CODE | Registration request code. Depending on the request code, the MIH user can choose to either register or re-register with the remote MIHF. |
| **MulticastGroupsList** | **LIST(MULTICAST\_GRP)** | **(optional) List of multicast groups.** |

**7.4.2.2.3 When generated**

This primitive is generated by the remote MIHF when an MIH\_Register request message is received.

**7.4.2.2.4 Effect on receipt**

The remote MIH user will perform necessary actions to process the registration request and respond with an MIH\_Register.response.

**7.4.2.3 MIH\_Register.response**

**7.4.2.3.1 Function**

This primitive is used by an MIH user to send the processing status of a received registration request.

**7.4.2.3.2 Semantics of service primitive**

MIH\_Register.response (

DestinationIdentifier,

Status,

ValidTimeInterval,

**Group\_Status**)

Parameters:

|  |  |  |
| --- | --- | --- |
| **Name** | **Data type** | **Description** |
| DestinationIdentifier | MIHF\_ID | This identifies the local MIHF that will be the destination of this request. |
| Status | Status | Status of operation |
| ValidTimeIntervala | UNSIGNED\_INT(4) | Time interval in seconds during which the registration is valid. Parameter applicable only when the status parameter indicates a successful operation. A value of 0 indicates an infinite validity period. |
| **Group\_Status** | **LIST(**  **SEQUENCE(MIHF\_ID,**  **STATUS,**  **VALID\_TIMEa))** | **(optional) Status of operation per multicast group.** |

a This parameter is not included if Status does not indicate “Success”

**7.4.2.3.3 When generated**

This primitive is invoked by the MIH user to report back the result after completing the processing of a registration request.

**7.4.2.3.4 Effect on receipt**

Upon receipt, the local MIHF sends an MIH\_Register response message to the destination MIHF.

**7.4.2.4 MIH\_Register.confirm**

**7.4.2.4.1 Function**

This primitive is used by the local MIHF to convey the result of a registration request to an MIH user.

**7.4.2.4.2 Semantics of service primitive**

MIH\_Register.confirm (

SourceIdentifier,

Status,

ValidTimeInterval,

**Group\_Status)**

|  |  |  |
| --- | --- | --- |
| **Name** | **Data type** | **Description** |
| DestinationIdentifier | MIHF\_ID | This identifies the local MIHF that will be the destination of this request. |
| Status | Status | Status of operation |
| ValidTimeIntervala | UNSIGNED\_INT(4) | Time interval in seconds during which the registration is valid. Parameter applicable only when the status parameter indicates a successful operation. A value of 0 indicates an infinite validity period. |
| **Group\_Status** | **LIST(**  **SEQUENCE(MIHF\_ID,**  **STATUS,**  **VALID\_TIMEa))** | **(optional) Status of operation per multicast group.** |

a This parameter is not included if Status does not indicate “Success”

**7.4.2.4.3 When generated**

This primitive is used by an MIHF to notify an MIH user the result of an MIH registration request.

**7.4.2.4.4 Effect on receipt**

Upon receipt, the MIH user can determine the result of the registration request.

**7.4.28 MIH\_Mcast\_Join**

**7.4.28.1 MIH\_Mcast\_Join.request**

**7.4.28.1.1 Function**

This primitive is used by an MIH user at the MN in order to ask the local MIHF to join a certain multicast MIHF\_ID group.

**7.4.28.1.2 Semantics of service primitive**

MIH\_Mcast\_Join.request (

DestinationIdentifier,

MulticastGroupList

)

Parameters:

|  |  |  |
| --- | --- | --- |
| Name | Data type | Description |
| DestinationIdentifier | MIHF\_ID | This identifies the local MIHF that will be the destination of  this request. |
| MulticastGroupList | LIST(MULTICAST\_GRP) | List of multicast groups to join |

**7.4.28.1.3 When generated**

This primitive is invoked by the MIH user when it wants to join a certain MIHF\_ID multicast group.

**7.4.28.1.4 Effect on receipt**

On receipt, the local MIHF takes the required steps to join the MIHF\_ID multicast groups identified by MULTICAST\_GRP.

**7.4.28.2 MIH\_Mcast\_Join.confirm**

**7.4.28.2.1 Function**

This primitive is used by the local MIHF to convey the result of a MIH\_Mcast\_Join.request to an MIH user.

7.4.28.2.2 Semantics of service primitive

MIH\_Mcast\_Join.confirm (

SourceIdentifier,

Group\_Status,

)

Parameters:

|  |  |  |
| --- | --- | --- |
| Name | Data type | Description |
| SourceIdentifier | MIHF\_ID | This identifies the invoker of this primitive, which is the local  MIHF. |
| Group\_Status | LIST(  SEQUENCE(MIHF\_ID,  STATUS,  VALID\_TIMEa)) | Status of operation per multicast group. |

aThis parameter is not included if Status does not indicate .“Success..”

**7.4.28.2.3 When generated**

This primitive is used by an MIHF to notify an MIH user the result of an MIH\_Mcast\_Join request.

**7.4.28.2.4 Effect on receipt**

Upon receipt, the MIH user can start receiving messages from a MIHF\_ID multicast group.

**7.4.29 MIH\_Net\_Mcast\_Join**

**7.4.29.1 MIH\_Net\_Mcast\_Join.request**

**7.4.29.1.1 Function**

This primitive is used by an MIH user at the PoS in order to ask the remote MIHF to join a certain multicast MIHF\_ID group.

**7.4.29.1.2 Semantics of service primitive**

MIH\_Net\_Mcast\_Join.request (

DestinationIdentifier,

MulticastGroupList

)

Parameters:

|  |  |  |
| --- | --- | --- |
| Name | Data type | Description |
| DestinationIdentifier | MIHF\_ID | This identifies the remote MIHF that will be the destination of  this request. Note that this MIHF\_ID might be a unicast, broadcast or multicast MIHF\_ID. |
| MulticastGroupList | LIST(MULTICAST\_GRP) | List of multicast groups to join |

**7.4.29.1.3 When generated**

This primitive is invoked by the MIH user at the PoS when it wants to command remote MIHFs to join a certain MIHF\_ID multicast group.

**7.4.29.1.4 Effect on receipt**

On receipt, the local MIHF takes the required steps to join the MIHF\_ID multicast groups identified by the MulticastGroupList.

**7.4.29.2 MIH\_Net\_Mcast\_Join.confirm**

**7.4.29.2.1 Function**

This primitive is used by the local MIHF to convey the result of a MIH\_Net\_Mcast\_Join.request to an MIH user at the PoS. In case the MIH\_Net\_Mcast\_Join.request message was sent to a multicast/broadcast destination MIHF\_ID, then multiple MIH\_Net\_Mcast\_Join.confirm messages will be sent to the MIH User.

7.4.29.2.2 Semantics of service primitive

MIH\_Net\_Mcast\_Join.confirm (

SourceIdentifier,

Group\_Status,

)

Parameters:

|  |  |  |
| --- | --- | --- |
| Name | Data type | Description |
| SourceIdentifier | MIHF\_ID | This identifies the invoker of this primitive, which is the local  MIHF. |
| Group\_Status | LIST(  SEQUENCE(MIHF\_ID,  STATUS,  VALID\_TIMEa)) | Status of operation per multicast group. |

aThis parameter is not included if Status does not indicate .“Success..”

**7.4.29.2.3 When generated**

This primitive is used by an MIHF to notify an MIH user the result of an MIH\_Net\_Mcast\_Join request.

**7.4.29.2.4 Effect on receipt**

Upon receipt, the MIH user at the PoS knows the status of the registration of the MNs to the multicast MIHF\_ID.

CHANGE SECTION 8.6.1.1 ACCORDINGLY

**8.6.1 MIH messages for service management**

**8.6.1.1 MIH\_Capability\_Discover request**

The corresponding MIH primitive of this message is defined in 7.4.1.1.

If a requesting MIHF entity knows the destination MIHF entity’s MIHF ID, the requesting MIHF entity fills its destination MIHF ID and sends this message to the peer MIHF over the data plane, either L2 or L3.

If a requesting MIHF entity does not know the destination MIHF entity’s MIHF ID, the requesting MIHF entity may fill its destination MIHF ID with a multicast MIHF ID to send this capability discover message.

|  |
| --- |
| MIH Header Fields (SID=1, Opcode=1, AID=1) |
| Source Identifier = sending MIHF ID (Source MIHF ID TLV) |
| Destination Identifier = receiving MIHF ID (Destination MIHF ID TLV) |
| LinkAddressList (optional) (Link address list TLV) |
| SupportedMihEventList (optional) (MIH event list TLV) |
| SupportedMihCommandList (optional) (MIH command list TLV) |
| SupportedISQueryTypeList (optional) (MIIS query type list TLV) |
| SupportedTransportList (optional) (Transport option list TLV) |
| MBBHandoverSupport (optional) (MBB handover support TLV) |
| MulticastGroupsList (Optional)  (Multicast Groups list TLV) |

8.6.1.2 MIH\_Capability\_Discover response

The corresponding MIH primitive of this message is defined in 7.4.1.3. This message is sent in response to an MIH\_Capability\_Discover request message that was destined to a single or multicast MIHF ID.

|  |
| --- |
| MIH Header Fields (SID=1, Opcode=2, AID=1) |
| Source Identifier = sending MIHF ID (Source MIHF ID TLV) |
| Destination Identifier = receiving MIHF ID (Destination MIHF ID TLV) |
| Status (Status TLV) |
| Link Address List (optional) (Link address list TLV) |
| SupportedMihEventList (optional) (MIH event list TLV) |
| SupportedMihCommandList (optional) (MIH command list TLV) |
| SupportedISQueryTypeList (optional) (MIIS query type list TLV) |
| SupportedTransportList (optional) (Transport option list TLV) |
| MBBHandoverSupport (optional) (MBB handover support TLV) |
| MulticastGroupsList (Optional)  (Multicast Groups list TLV) |

**8.6.1.3 MIH\_Register request**

The corresponding MIH primitive of this message is defined in 7.4.2.1. This message is transmitted to the remote MIHF to perform a registration or re-registration.

|  |
| --- |
| **MIH Header Fixed Fields (SID=1, Opcode=1, AID=2)** |
| **Source Identifier =** sending MIHF ID  (Source MIHF ID TLV) |
| **Destination Identifier** = receiving MIHF ID  (Destination MIHF ID TLV) |
| LinkIdentifierList  (Link identifier list TLV) |
| RequestCode  (Register request code TLV) |
| **MulticastGroupList**  **(Multicast Groups list TLV)** |

**8.6.1.4 MIH\_Register response**

The corresponding MIH primitive of this message is defined in 7.4.2.3. This message is sent in response to a registration or re-registration request.

|  |
| --- |
| **MIH Header Fixed Fields (SID=1, Opcode=2, AID=2)** |
| **Source Identifier =** sending MIHF ID  (Source MIHF ID TLV) |
| **Destination Identifier** = receiving MIHF ID  (Destination MIHF ID TLV) |
| Status  (Status TLV) |
| ValidTimeInterval (not included if Status does not indicate “Success”)  (Valid time interval TLV) |
| **Group\_Status**  **(Group\_Status TLV)** |

**8.6.3 MIH messages for command service**

***Insert following new subclauses in clause 8.6.3:***

**8.6.3.24 MIH\_Net\_Mcast\_Join request**

The corresponding MIH primitive of this message is defined in 7.4.29.1

This message is used by the MIHF on the PoS to query the MIHF at the MN to join a multicast group for MIHF signaling.

|  |
| --- |
| **MIH Header Fixed Fields (SID=TBD, Opcode=TBD, AID=TBD)** |
| **Source Identifier =** sending MIHF ID  (Source MIHF ID TLV) |
| **Destination Identifier** = receiving MIHF ID  (Destination MIHF ID TLV) |
| MulticastGroupList  (Multicast Groups list TLV) |

**8.6.3.25 MIH\_Net\_Mcast\_Join response**

The corresponding MIH primitive of this message is defined in 7.4.29.2

This message is used by the MIHF on the MN to reply the PoS with the status of the join operation

|  |
| --- |
| **MIH Header Fixed Fields (SID=TBD, Opcode=TBD, AID=TBD)** |
| **Source Identifier =** sending MIHF ID  (Source MIHF ID TLV) |
| **Destination Identifier** = receiving MIHF ID  (Destination MIHF ID TLV) |
| |  | | --- | | Group\_Status  (Group\_Status TLV) | |

**Annex D**

(normative)

**Mapping MIH messages to reference points**

Table D.1 maps the MIH messages to the MIH communication model reference points.

***Insert the following row in Table D.1; making these rows the last ones:***

**Table D.1—Mapping MIH messages to reference points**

|  |  |
| --- | --- |
| **MIH message name** | **Reference point** |
| MIH\_Net\_HO\_Bcst\_Commit | RP1, RP3 |
| MIH\_Mcast\_Join | RP1 |
| MIH\_Net\_Mcast\_Join | RP3 |

ANNEX F

Table F.13.—Data types for information elements **(continued)**

|  |  |  |
| --- | --- | --- |
| Data type name | Derived from | Definition |
| NET\_CAPS | BITMAP(32) | These bits provide high level capabilities supported  on a network.  Bitmap Values:  Bit 0: Security .– Indicates that some level of security  is supported when set.  Bit 1: QoS Class 0 .– Indicates that QoS for class 0 is  supported when set.a  Bit 2: QoS Class 1 .– Indicates that QoS for class 1 is  supported when set. a  Bit 3: QoS Class 2 .– Indicates that QoS for class 2 is  supported when set; Otherwise, no QoS for class 2  support is available.  Bit 4: QoS Class 3 .– Indicates that QoS for class 3 is  supported when set; Otherwise, no QoS for class 3  support is available.  Bit 5: QoS Class 4 .– Indicates that QoS for class 4 is  supported when set; Otherwise, no QoS for class 4  support is available.  Bit 6: QoS Class 5 .– Indicates that QoS for class 5 is  supported when set; Otherwise, no QoS for class 5  support is available.  Bit 7: Internet Access .– Indicates that Internet access  is supported when set; Otherwise, no Internet access  support is available.  Bit 8: Emergency Services .– Indicates that some level  of emergency services is supported when set; Otherwise,  no emergency service support is available.  Bit 9: MIH Capability .– Indicates that MIH is supported  when set; Otherwise, no MIH support is available.  Bit 11: MIH multicast signaling support  Bit 11–31: (Reserved) |

**F.3.12 Data type for MIH capabilities**

***Change Table F.20 as follows:***

**Table F.20—Data type for MIH capabilities**

|  |  |  |
| --- | --- | --- |
| **Data type name** | **Derived from** | **Definition** |
| MIH\_CMD\_LIST | BITMAP(32) | A list of MIH commands.  Bitmap Values:  Bit 0: MIH\_Link\_Get\_Parameters  Bit 1: MIH\_Link\_Configure\_Thresholds  Bit 2: MIH\_Link\_Actions  Bit 3: MIH\_Net\_HO\_Candidate\_Query  MIH\_Net\_HO\_Commit  MIH\_Net\_HO\_Bcst\_Commit  MIH\_N2N\_HO\_Query\_Resources  MIH\_N2N\_HO\_Commit  MIH\_N2N\_HO\_Complete  Bit 4: MIH\_MN\_HO\_Candidate\_Query  MIH\_MN\_HO\_Commit  MIH\_MN\_HO\_Complete  Bit 5: MIH\_Mcast\_Join  MIH\_Net\_Mcast\_Join  Bit 6-31: (Reserved) |

ADD TO APPENDIX F

|  |  |  |
| --- | --- | --- |
| Data type name | Derived from | Definition |
| MULTICAST\_GRP | SEQUENCE(  CHOICE(IP\_ADDR, LINK\_ADDR,),  MIHF\_ID,  ) | List of multicast L3 or L2 addresses being used for multicast MIHF signaling.  The second parameter corresponds to the multicast MIHF\_ID used by the group. |
| VALID\_TIME | UNSIGNED\_INT(4) | Time interval in seconds during which the multicast group will be valid.  Parameter applicable only when the status parameter indicates a  successful operation. A value of 0 indicates an infinite validity  period. |

**Annex L**

(normative)

**MIH Protocol message code assignments**

***Change Table L.1 as follows:***

**Table L.1—AID assignment**

|  |  |
| --- | --- |
| **MIH messages** | **AID** |
| MIH messages for Command Service | |
| MIH\_Link\_Get\_Parameters | 1 |
| MIH\_Link\_Configure\_Thresholds | 2 |
| MIH\_Link\_Actions | 3 |
| MIH\_Net\_HO\_Candidate\_Query | 4 |
| MIH\_MN\_HO\_Candidate\_Query | 5 |
| MIH\_N2N\_HO\_Query\_Resources | 6 |
| MIH\_MN\_HO\_Commit | 7 |
| MIH\_Net\_HO\_Commit | 8 |
| MIH\_N2N\_HO\_Commit | 9 |
| MIH\_MN\_HO\_Complete | 10 |
| MIH\_N2N\_HO\_Complete | 11 |
| MIH\_Net\_HO\_Bcst\_Commit | 12 |
| **MIH\_Mcast\_Join** | **13** |
| **MIH\_Net\_Mcast\_Join** | **14** |
| *MIH messages for Information Service* |  |
| MIH\_Get\_Information | 1 |
| MIH\_Push\_Information | 2 |

***Change Table L.2 as follows:***

**Table L.2—Type values for TLV encoding**

|  |  |  |
| --- | --- | --- |
| **TLV type name** | **TLV**  **type value** | **Data type** |
| Requested resource set | 63 | REQ\_RES\_SET |
| Broadcast multimedia program ID | 76 | BCST\_MMP\_ID |
| Broadcast multimedia service ID | 77 | BCST\_MMS\_ID |
| Target MN group information | 78 | GROUP\_INFO |
| Supported link actions list | 79 | SUPPORTED\_LINK\_ACTIONS\_LIST |
| **Multicast Groups list TLV** | **80** | **LIST(MULTICAST\_GRP)** |
| **Group\_Status TLV** | **81** | LIST(  SEQUENCE(MIHF\_ID,  STATUS,  VALID\_TIMEa)) |
| (Reserved) | ~~64~~ 82- 99 | (Reserved) |
| Vendor specific TLV | 100 | (Vendor specific) |
| (Reserved for experimental TLVs) | 101 - 255 | (Used for experimental purposes) |

**Annex M**

(normative)

**Protocol implementation conformance statement (PICS) proforma14**

**M.8 PICS proforma tables**

**M.8.4 PDUs**

***Change PICS proforma table by adding new rows to the end of the table as indicated:***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Item**  **number** | **Item description** | **References** | **Status** | **Support** | **Mnemonic** |
| M.8.4.41 | MIH\_Event\_Unsubscribe re-quest? | 8.6.1.9 | M | Yes [ ] No [ ] | PDU41 |
| M.8.4.42 | MIH\_Event\_Unsubscribe re-sponse? | 8.6.1.10 | M | Yes [ ] No [ ] | PDU42 |
| M.8.4.43 | MIH\_Net\_HO\_Bcst\_Commit indication? | 5.3.3.1, 8.6.3.23 | MC2:M | Yes [ ] No [ ] N/A [ ] | PDU43 |
| M.8.4.44 | **MIH\_Net\_Mcast\_Join request?** | **8.6.3.24** | MC2:M | Yes [ ] No [ ] N/A [ ] | **PDU44** |
| M.8.4.45 | **MIH\_Net\_Mcast\_Join response?** | **8.6.3.25** | MC2:M | Yes [ ] No [ ] N/A [ ] | **PDU45** |

MODIFICATIONS TO CAPABILITIES DISCOVERY

ADD TO ALL TABLES IN CLAUSES 7.4.1 THE FOLLOWING ROW

|  |  |  |
| --- | --- | --- |
| MulticastGroupsList | LIST(MULTICAST\_GRP) | (Optional) This is used to indicate the remote MIHF of the MIHF\_ID multicast groups the local MIHF is head of. This parameter is only used by messages originated by a PoS. |

ADD HERE MODIFICATIONS TO MIIS

**6.5.4 Information elements**

***Table 10***

|  |  |  |
| --- | --- | --- |
| Name of information element | Description | Data type |
| General information elements | | |
| IE\_NETWORK\_TYPE | Link types of the access networks that are available in  a given geographical area. | NETWORK\_TYPE |
| IE\_OPERATOR\_ID | The operator identifier for the access network/core  network. | OPERATOR\_ID |
| IE\_SERVICE\_PROVIDER\_ID | Identifier for the service provider. | SP\_ID |
| IE\_COUNTRY\_CODE | Indicate the country. | CNTRY\_CODE |
| Access network specific information elements | | |
| IE\_NETWORK\_ID | Identifier for the access network. | NETWORK\_ID |
| IE\_NETWORK\_AUX\_ID | An auxiliary access network identifier. As an example  for IEEE 802.11 this refers to the homogenous  extended service set ID (HESSID). | NET\_AUX\_ID |
| IE\_ROAMING\_PARTNERS | Roaming Partners.  Network Operators with which the current network  operator has direct roaming agreements. | ROAMING\_PTNS |
| IE\_COST | Cost.  Indication of cost for service or network usage. | COST |
| IE\_NETWORK\_QOS | QoS characteristics of the link layer. | QOS\_LIST |
| IE\_NETWORK\_DATA\_RATE | Data Rate. The maximum value of the data rate supported  by the link layer of the access network. | DATA\_RATE |
| IE\_NET\_REGULAT\_DOMAIN | Regulatory classes supported by the access network. | REGU\_DOMAIN |
| IE\_NET\_FREQUENCY\_BANDS | Frequency bands supported by the network. | FREQ\_BANDS |
| IE\_NET\_IP\_CFG\_METHODS | IP Configuration Methods supported by the access  network. | IP\_CONFIG |
| IE\_NET\_CAPABILITIES | Bitmap of access network capabilities. | NET\_CAPS |
| IE\_NET\_SUPPORTED\_LCP | List of location configuration protocols supported by  the access network. | SUPPORTED\_LCP |
| IE\_NET\_MOB\_MGMT\_PROT | Type of mobility management protocol supported. | IP\_MOB\_MGMT |
| IE\_NET\_EMSERV\_PROXY | Address of the proxy providing access to public safety  answering point (PSAP). | PROXY\_ADDR |
| IE\_NET\_IMS\_PROXY\_CSCF | Address of the proxy providing access to IMS  P-CSCF. | PROXY\_ADDR |
| IE\_NET\_MOBILE\_NETWORK | Indicator whether the access network itself is mobile. | BOOLEAN |
| **IE\_L3\_Multicast\_Groups** | **List of existing L3 multicast groups in the access network.** | **LIST(MULTICAST\_GRP)** |
| PoA-specific information elements | | |
| IE\_POA\_LINK\_ADDR | Link-layer address of PoA. | LINK\_ADDR |
| IE\_POA\_LOCATION | Geographical location of PoA. Multiple location types  are supported including coordinate-based location  information, civic address, and cell ID. | LOCATION |
| IE\_POA\_CHANNEL\_RANGE | Channel Range/Parameters.  Spectrum range supported by the channel for that  PoA. | CH\_RANGE |
| IE\_POA\_SYSTEM\_INFO | System information supported by the link layer of a  given PoA. | SYSTEM\_INFO |
| PoA-specific higher layer service information elements | | |
| IE\_POA\_SUBNET\_INFO | Information about subnets supported by a typical PoA. | IP\_SUBNET\_INFO |
| IE\_POA\_IP\_ADDR | IP Address of PoA. | IP\_ADDR |
| **IE\_L2\_Multicast\_Groups** | **List of L2 multicast groups provided by a given PoA.** | **LIST(MULTICAST\_GRP)** |
| Other information elements | | |
| Vendor specific IEs | Vendor-specific services. | N/A |

**Add in the Figure 18 the two Information Elements defined previously.**

**6.5.6.2.1 IE containers**

***Table 13***

|  |  |
| --- | --- |
| Information element ID = (see Table G.1) | Length= *variable* |
| IE\_NETWORK\_TYPE | |
| IE\_OPERATOR\_ID | |
| IE\_SERVICE\_PROVIDER\_ID (optional) | |
| IE\_COUNTRY\_CODE (optional) | |
| IE\_NETWORK\_ID (optional) | |
| IE\_NETWORK\_AUX\_ID (optional) | |
| IE\_ROAMING\_PARTNERS (optional) | |
| IE\_COST (optional) | |
| IE\_NETWORK\_QOS (optional) | |
| IE\_NETWORK\_DATA\_RATE (optional) | |
| IE\_NET\_REGULAT\_DOMAIN (optional) | |
| IE\_NET\_FREQUENCY\_BANDS (optional) | |
| IE\_NET\_IP\_CFG\_METHODS (optional) | |
| IE\_NET\_CAPABILITIES (optional) | |
| IE\_NET\_SUPPORTED\_LCP (optional) | |
| IE\_NET\_MOB\_MGMT\_PROT (optional) | |
| IE\_NET\_EMSERV\_PROXY (optional) | |
| IE\_NET\_IMS\_PROXY\_CSCF (optional) | |
| IE\_NET\_MOBILE\_NETWORK (optional) | |
| **IE\_L3\_Multicast\_Groups (optional)** | |
| IE\_CONTAINER\_POA #1 (optional) | |
| IE\_CONTAINER\_POA #2 (optional) | |
| … | |
| IE\_CONTAINER\_POA #k (optional) | |
| Vendor Specific Network IE (optional) | |

***Table 14***

|  |  |
| --- | --- |
| Information element ID = (see Table G.1) | Length= *variable* |
| IE\_POA\_LINK\_ADDR | |
| IE\_POA\_LOCATION | |
| IE\_POA\_CHANNEL\_RANGE | |
| IE\_POA\_SYSTEM\_INFO | |
| IE\_POA\_SUBNET\_INFO #1 | |
| IE\_POA\_SUBNET\_INFO #2 (optional) | |
| ... | |
| IE\_POA\_SUBNET\_INFO #k (optional) | |
| IE\_POA\_IP\_ADDR #1 (optional) | |
| ... | |
| IE\_POA\_IP\_ADDR #k (optional) | |
| **IE\_L2\_Multicast\_Groups (optional)** | |
| Vendor Specific PoA IE (optional) | |

**Annex G – Information elements identifiers**

***Insert the following rows in table G.1; insert these rows after the “IE\_POA\_IP\_ADDR” information element***

|  |  |
| --- | --- |
| IE\_L3\_Multicast\_Groups | 0x10000206 |
| IE\_L2\_Multicast\_Groups | 0x10000207 |

**Annex H – MIIS basic schema**

<owl:ObjectProperty rdf:ID="ie\_l3\_multicast\_groups">

<mihbasic:ie\_identifier>0x10000206</mihbasic:ie\_identifier>

<rdfs:domain rdf:resource="#NETWORK"/>

<rdfs:range rdf:resource="#MULTICAST\_GROUP"/>

</owl:ObjectProperty>

<owl:ObjectProperty rdf:ID="ie\_l2\_multicast\_groups">

<mihbasic:ie\_identifier>0x10000207</mihbasic:ie\_identifier>

<rdfs:domain rdf:resource="#POA"/>

<rdfs:range rdf:resource="# MULTICAST\_GROUP "/>

</owl:ObjectProperty>

Missing the MULTICAST\_GROUP definition schema