

IEEE Standard for  
Local and metropolitan area networks—

**Part 21: Media Independent Handover Services**

**Amendment 2: Extension for Supporting  
Handovers with Downlink Only Technologies**

IEEE Computer Society

Sponsored by the  
LAN/MAN Standards Committee

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

10 May 2012

**IEEE Std 802.21b™-2012**  
(Amendment to  
IEEE Std 802.21™-2008  
as amended by  
IEEE Std 802.21a™-2012)



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## **Part 21: Media Independent Handover Services**

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of the  
**IEEE Computer Society**

Approved 29 March 2012

**IEEE-SA Standards Board**

**Abstract:** Extensions to IEEE Std 802.21™-2008 for handovers with downlink only technologies is discussed in the amendment.

**Keywords:** broadcast, downlink only, IEEE 802.21, IEEE 802.21b, media independent handover (MIH)

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## Introduction

This introduction is not part of IEEE Std 802.21b-2012, IEEE Standard for Local and metropolitan area networks—Part 21: Media Independent Handover Service—Amendment 2: Extension for Supporting Handovers with Downlink Only Technologies.

This amendment specifies the enhancements to IEEE Std 802.21-2008 to enable the optimization of handovers between IEEE 802.21 supported technologies and downlink only technologies such Digital Video Broadcasting (DVB), Terrestrial Digital Multimedia Broadcasting (T-DMB) and Advanced Television Systems Committee - Mobile/Handheld (ATSC-M/H).

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IEEE Standard for  
Local and metropolitan area networks—

## Part 21: Media Independent Handover Services

### Amendment 2: Extension for Supporting Handovers with Downlink Only Technologies

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(This amendment specifies enhancements to IEEE Std 802.21™-2008.)

NOTE—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 ~~strike 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.<sup>1</sup>

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<sup>1</sup>Notes in text, tables, and figures are given for information only and do not contain requirements needed to implement the standard.

## 1. Overview

### 1.3 General

*Change text in 1.3 as follows:*

This standard provides link-layer intelligence and other related network information to upper layers to optimize handovers between heterogeneous networks. This includes media types specified by Third Generation (3G) Partnership Project (3GPP), 3G Partnership Project 2 (3GPP2), ~~and~~ both wired and wireless media in the IEEE 802 family of standards, and downlink-only (DO) media such as Digital Video Broadcasting (DVB), Terrestrial Digital Multimedia Broadcasting (T-DMB) and Advanced Television Systems Committee– Mobile/Handheld (ATSC-M/H). In this standard, unless otherwise noted, media refers to the method/mode of accessing a telecommunication system (e.g., cable, radio, satellite), as opposed to sensory aspects of communication (e.g., audio, video).

### 1.5 Media independence

*Change text in 1.5 as follows:*

The intent of this standard is to provide generic link-layer intelligence independent of the specifics of mobile nodes or radio networks. As such, this standard is intended to provide a generic interface between ~~the link layer users~~ in the mobility-management protocol stack and existing media-specific link layers, such as those specified by 3GPP, 3GPP2, ~~and~~ the IEEE 802 family of standards, and downlink-only media.

This standard defines SAPs and primitives that provide generic link-layer intelligence. Individual media-specific technologies thereafter need to enhance their media-specific SAPs and primitives to satisfy the generic abstractions of this standard. Suitable amendments are required to existing link-layer [medium access control (MAC)/ physical layer (PHY)] standards of different media-specific technologies such as IEEE Std 802.3™, IEEE Std 802.11™, IEEE Std 802.16™, 3GPP, ~~and~~ 3GPP2, and DVB to satisfy the requirements of generic link-layer intelligence identified by this standard.

## 3. Definitions

*Insert the following new definitions in alphabetical order:*

**bidirectional network:** A general communication network providing bidirectional transmission such as 802.3, 802.11, 802.16, 3GPP and 3GPP2.

**downlink-only (DO) network:** A broadcasting network providing unidirectional transmission from the PoA to the user device, such as DVB, T-DMB and ATSC-M/H.

**multimedia program (MMP):** An instance of certain content (e.g., voice, data or video) with some specific attributes, e.g., chapter 2 of a TV series.

**multimedia service (MMS):** A sequence of MMPs under the control of a content aggregator and provider, e.g., TV Channel One, TV Channel Two, etc.

**uniform resource identifier (URI):** A compact sequence of characters that identifies an abstract or physical resource including video.

## 4. Abbreviations and acronyms

*Insert the following acronyms in alphabetical order:*

ATSC-M/H	advanced television systems committee – mobile/handheld
DVB	digital video broadcasting
DO	downlink only
MMP	multimedia program
MMS	multimedia service
T-DMB	terrestrial– digital media broadcast
URI	uniform resource identifier

## 6. MIHF service

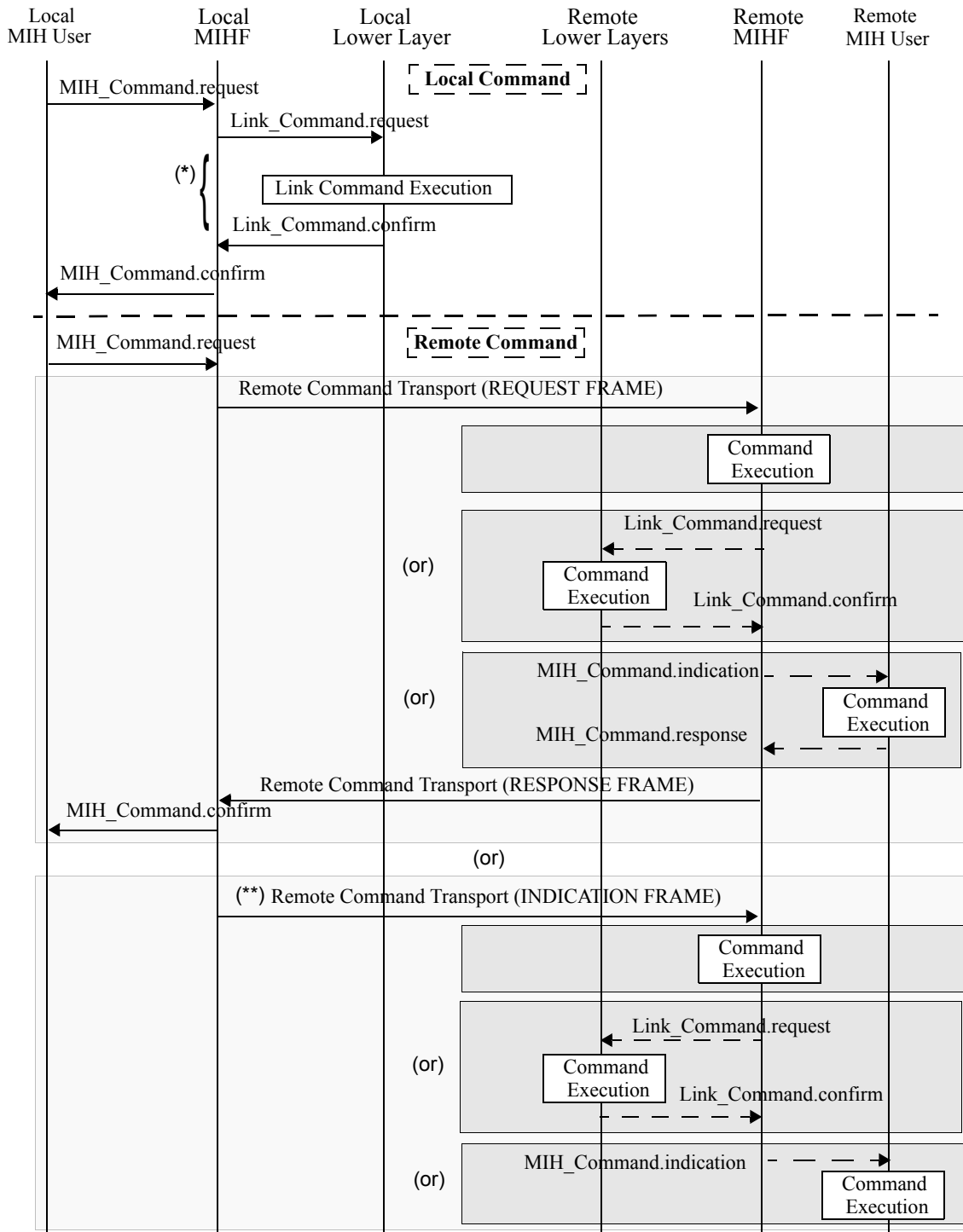
### 6.4 Media independent command service

#### 6.4.2 Command service flow model

*Change the last paragraph in 6.4.2 as follows:*

The MIH commands are generated by the MIH users and sent to the MIHF. MIH commands can be local or remote. Local MIH commands are sent by MIH users to the MIHF in the local protocol stack. Generally, remote commands generate an appropriate response frame from a remote MIH user, however, there are certain remote commands that do not (cf. downlink-only technology related MIH commands).

*Replace Figure 17—Command service flow with following figure:*



(\*) There might be no corresponding Link\_Command primitives, and one or more media-specific link primitives can be used here.

(\*\*) This message applies for downlink-only technologies.

**Figure 17—Command service flow**



**6.4.3 Command list**

**6.4.3.2 MIH commands**

**6.4.3.2.1 General**

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

**Table 7—MIH commands**

MIH command	(L)ocal, (R)emote	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	7.4.29

**7. Service access points (SAPs) and primitives**

**7.2 SAPs**

**7.2.3 Media independent SAP: MIH\_SAP**

*Insert the following row in table 17:*

**Table 17—MIH\_SAP primitives**

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	7.4.29

**7.3 MIH\_LINK\_SAP primitives**

**7.3.9 Link\_Capability\_Discover**

**7.3.9.2 Link\_Capability\_Discover.confirm**

**7.3.9.2.2 Semantics of service primitives**

*Change 7.3.9.2.2 as follows:*

```

Link_Capability_Discover.confirm (
    Status,
    SupportedLinkEventList,
    SupportedLinkCommandList,
    SupportedLinkActionsList
)

```

Parameters:

Name	Data type	Description
Status	STATUS	Status of operation. Code 3(Authorization Failure) is not applicable.
SupportedLinkEventList	LINK_EVENT_LIST	List of link-layer events supported by the link layer.
SupportedLinkCommandList	LINK_CMD_LIST	List of link-layer commands supported by the link-layer.
<u>SupportedLinkActionsList</u>	<u>SUPPORTED_LINK_ACTIONS_LIST</u>	(Optional) This optional parameter is present if bit 5 of SupportedLinkCommandList is set to 1. <u>SupportedLinkActionsList</u> indicates which link actions are supported by the link.

## 7.4 MIH\_SAP primitives

### 7.4.1 MIH\_Capability\_Discover

#### 7.4.1.1 MIH\_Capability\_Discover.request

##### 7.4.1.1.2 Semantics of service primitives

*Change 7.4.1.1.2 as follows:*

```

MIH_Capability_Discover.request (
    DestinationIdentifier,
    LinkAddressList,
    SupportedMihEventList,
    SupportedMihCommandList,
    SupportedIsQueryTypeList,
    SupportedTransportList,
    MBBHandoverSupport,
    SupportedSecurityCapList
    SupportedLinkActionsList
)

```

Parameters:

Name	Data type	Description
DestinationIdentifier	MIHF_ID	This identifies the local or a remote MIHF that will be the destination of this request.
LinkAddressList	LIST(NET_TYPE_ADDR)	(Optional) A list of network type and link address pair on the local MIHF.
SupportedMihEventList	MIH_EVT_LIST	(Optional) List of supported events on the local MIHF.
SupportedMihCommandList	MIH_CMD_LIST	(Optional) List of supported commands on the local MIHF.
SupportedIsQueryTypeList,	MIH_IQ_TYPE_LST	(Optional) List of supported MIIS query types on the local MIHF.
SupportedTransportList	MIH_TRANS_LST	(Optional) List of supported transport types on the local MIHF.
MBBHandoverSupport	LIST(MBB_HO_SUPP)	(Optional) This is used to indicate if a make before break handover is supported on the local MIHF. Break before make handover is always supported.
SupportedSecurityCapList	MIH_SEC_CAP	(Optional) List of supported MIH security capabilities on the local MIHF.
<u>SupportedLinkActionsList</u>	<u>SUPPORTED_LINK_ACTIONS_LIST</u>	<u>(Optional) This optional parameter is present if bit 2 of SupportedMihCommandList is set to 1. SupportedLinkActionsList indicates the list of supported link actions on the local MIHF.</u>

**7.4.1.2 MIH\_Capability\_Discover.indication**

**7.4.1.2.2 Semantics of service primitives**

*Change 7.4.1.2.2 as follows:*

```

MIH_Capability_Discover.indication (
    SourceIdentifier,
    LinkAddressList,
    SupportedMihEventList,
    SupportedMihCommandList,
    SupportedIsQueryTypeList,
    SupportedTransportList,
    MBBHandoverSupport,
    SupportedSecurityCapList
    SupportedLinkActionsList
)
    
```

Parameters:

Name	Data type	Description
SourceIdentifier	MIHF_ID	This identifies the invoker of this primitive, which is a remote MIHF.
LinkAddressList	LIST(NET_TYPE_ADDR)	(Optional) A list of network type and link address pair on the remote MIHF.
SupportedMihEventList	MIH_EVT_LIST	(Optional) List of supported events on the remote MIHF.
SupportedMihCommandList	MIH_CMD_LIST	(Optional) List of supported commands on the remote MIHF.
SupportedIsQueryTypeList,	MIH_IQ_TYPE_LST	(Optional) List of supported MIIS query types on the remote MIHF.
SupportedTransportList	MIH_TRANS_LST	(Optional) List of supported transport types on the remote MIHF.
MBBHandoverSupport	LIST(MBB_HO_SUPP)	(Optional) This is used to indicate if a make before break handover is supported on the remote MIHF. Break before make handover is always supported.
SupportedSecurityCapList	MIH_SEC_CAP	(Optional) List of supported MIH security capabilities on the remote MIHF.
<u>SupportedLinkActionsList</u>	<u>SUPPORTED_LINK_ACTIONS_LIST</u>	<u>(Optional) This optional parameter is present if bit 2 of SupportedMihCommandList is set to 1. SupportedLinkActionsList indicates the list of supported link actions on the remote MIHF.</u>

### 7.4.1.3 MIH\_Capability\_Discover.response

#### 7.4.1.3.2 Semantics of service primitives

*Change 7.4.1.3.2 as follows:*

```
MIH_Capability_Discover.response (
    DestinationIdentifier,
    Status,
    LinkAddressList,
    SupportedMihEventList,
    SupportedMihCommandList,
    SupportedIsQueryTypeList,
    SupportedTransportList,
    MBBHandoverSupport,
    SupportedSecurityCapList
    SupportedLinkActionsList
)
```

Parameters:

Name	Data type	Description
DestinationIdentifier	MIHF_ID	This identifies the remote MIHF that will be the destination of this response.
Status	STATUS	Status of operation.
LinkAddressList	LIST(NET_TYPE_ADDR)	(Optional) A list of network type and link address pair on the local MIHF.
SupportedMihEventList	MIH_EVT_LIST	(Optional) List of supported events on the local MIHF.
SupportedMihCommandList	MIH_CMD_LIST	(Optional) List of supported commands on the local MIHF.
SupportedIsQueryTypeList,	MIH_IQ_TYPE_LST	(Optional) List of supported MIIS query types on the local MIHF.
SupportedTransportList	MIH_TRANS_LST	(Optional) List of supported transport types on the local MIHF.
MBBHandoverSupport	LIST(MBB_HO_SUPP)	(Optional) This is used to indicate if a make before break handover is supported on local MIHF. Break before make handover is always supported.
SupportedSecurityCapList	MIH_SEC_CAP	(Optional) List of supported MIH security capabilities on the local MIHF.
<u>SupportedLinkActionsList</u>	<u>SUPPORTED_LINK_ACTIONS_LIST</u>	<u>(Optional) This optional parameter is present if bit 2 of SupportedMihCommandList is set to 1. SupportedLinkActionsList indicates the list of supported link actions on the local MIHF.</u>

**7.4.1.4 MIH\_Capability\_Discover.confirm**

**7.4.1.4.2 Semantics of service primitives**

*Change 7.4.1.4.2 as follows:*

```

MIH_Capability_Discover.confirm (
    SourceIdentifier,
    Status,
    LinkAddressList,
    SupportedMihEventList,
    SupportedMihCommandList,
    SupportedIsQueryTypeList,
    SupportedTransportList,
    MBBHandoverSupport,
    SupportedSecurityCapList
    SupportedLinkActionsList
)
    
```

Parameters:

Name	Data type	Description
SourceIdentifier	MIHF_ID	This identifies the invoker of this primitive, which can be either the local MIHF or a remote MIHF.
Status	STATUS	Status of operation.
LinkAddressList	LIST(NET_TYPE_ADDR)	(Optional) A list of network type and link address pair on the MIHF identified by SourceIdentifier.
SupportedMihEventList	MIH_EVT_LIST	(Optional) List of supported events on the MIHF identified by SourceIdentifier.
SupportedMihCommandList	MIH_CMD_LIST	(Optional) List of supported commands on the MIHF identified by SourceIdentifier.
SupportedIsQueryTypeList,	MIH_IQ_TYPE_LST	(Optional) List of supported MIIS query types on the MIHF identified by SourceIdentifier.
SupportedTransportList	MIH_TRANS_LST	(Optional) List of supported transport types on the MIHF identified by SourceIdentifier.
MBBHandoverSupport	LIST(MBB_HO_SUPP)	(Optional) This is used to indicate if a make before break handover is supported on the MIHF identified by SourceIdentifier. Break before make handover is always supported.
SupportedSecurityCapList	MIH_SEC_CAP	(Optional) List of supported MIH security capabilities on the remote MIHF.
<u>SupportedLinkActionsList</u>	<u>SUPPORTED_LINK_ACTIONS_LIST</u>	<u>(Optional) This optional parameter is present if bit 2 of SupportedMihCommandList is set to 1. SupportedLinkActionsList indicates the list of supported link actions on the MIHF identified by SourceIdentifier.</u>

*Insert the following new subclause 7.4.29 in 7.4:*

**7.4.29 MIH\_Net\_HO\_Bcst\_Commit**

**7.4.29.1 MIH\_Net\_HO\_Bcst\_Commit.request**

**7.4.29.1.1 Function**

This primitive is used by MIH users on the network to inform the remote MIH users belonging to a specific group of MNs of possible network initiated handovers. This primitive can be used to recommend a handover from either a DO network or a bidirectional network to another network based on the selected choices for candidate networks and PoAs. This primitive includes multimedia service (MMS) or multimedia program (MMP) information to identify a group of MNs to which the DO network recommends the handover. Network initiated handovers from the bidirectional network to the DO network for a single MN would be invoked by using MIH\_Net\_HO\_Commit.

**7.4.29.1.2 Semantics of service primitives**

```
MIH_Net_HO_Bcst_Commit.request (
    DestinationIdentifier,
    TargetMNGroupInfo,
    LinkType,
    TargetNetworksInfoList,
    LinkActionExecutionDelay,
    LinkActionsList
)
```

Parameters:

Name	Data type	Description
DestinationIdentifier	MIHF_ID	The remote MIHF, which is the destination of this request.
TargetMNGroupInfo	GROUP_INFO	Multimedia service (MMS) or multimedia program (MMP) information to identify the group of mobile nodes to which the networks recommend a handover.
LinkType	LINK_TYPE	Contains target link type
TargetNetworksInfoList	LIST(TGT_NET_INFO)	This list contains information of recommended target networks of type LinkType for assisting the mobile node to perform handover.
LinkActionExecutionDelay	UNSIGNED_INT(2)	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.
LinkActionsList	LIST(LINK_ACTION_REQ)	A list of network initiated handover actions for the links.

### 7.4.29.1.3 When generated

The MIH user on the network generates this primitive to recommend a handover action when a specific MMP or MMS will no longer be available on the DO network.

### 7.4.29.1.4 Effect on receipt

Upon receipt of this primitive, the local MIHF generates and sends an MIH\_Net\_HO\_Bcst\_Commit indication message to the remote MIHF. The remote MIHF forwards the indication as an indication to the remote MIH users.

## 7.4.29.2 MIH\_Net\_HO\_Bcst\_Commit.indication

### 7.4.29.2.1 Function

This primitive is used by an MIHF for MIH users to perform a network initiated handover. This primitive is the result of the receipt of an MIH\_Net\_HO\_Bcst\_Commit indication message from a remote MIHF.

### 7.4.29.2.2 Semantics of service primitives

```
MIH_Net_HO_Bcst_Commit.indication (
    SourceIdentifier,
    TargetMNGroupInfo,
    LinkType,
    TargetNetworksInfoList,
    LinkActionExecutionDelay,
    LinkActionsList
)
```

Parameters:

Name	Data type	Description
SourceIdentifier	MIHF_ID	The remote MIHF, which sent the MIH_Net_HO_Bcst_Commit indication message.
TargetMNGroupInfo	GROUP_INFO	Multimedia service (MMS) or multimedia program (MMP) information to identify the group of mobile nodes to which the networks recommend a handover.
LinkType	LINK_TYPE	Contains target link type
TargetNetworksInfoList	LIST(TGT_NET_INFO)	This list contains information of recommended target networks of type LinkType for assisting the mobile node to perform handover.
LinkActionExecutionDelay	UNSIGNED_INT(2)	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.
LinkActionsList	LIST(LINK_ACTION_REQ)	A list of network initiated handover actions for the links.



### 7.4.29.2.3 When generated

This primitive is generated by an MIHF upon receiving an MIH\_Net\_HO\_Bcst\_Commit indication message.

### 7.4.29.2.4 Effect on receipt

The MIH user receiving this primitive generates no response primitive. Only the applicable actions in the Link Actions List are executed.

## 8. Media independent handover protocol

### 8.2 MIH protocol description

#### 8.2.3 MIH protocol transaction state diagram

##### 8.2.3.4 Inter-state-machine procedures

*Change item c) as follow:*

- c) **BOOLEAN IsMulticastMsg(MIH\_MESSAGE)**—This procedure outputs TRUE if the input message has a ~~multicast~~ zero length destination MIHF\_ID. Otherwise, it outputs FALSE.

##### 8.2.3.7 Transaction source and destination state machines

###### 8.2.3.7.1 Intra-state-machine variables

*Change item a) as follows:*

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

### 8.2.4 Other considerations

#### 8.2.4.3 MIHF discovery

##### 8.2.4.3.4 Solicited MIH capability discovery

*Change first paragraph in 8.2.4.3.4 as follows:*

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

*Change last paragraph of 8.2.4.3.4 as follows:*

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 ~~multicast~~ zero length 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.

## 8.3 MIH protocol identifiers

### 8.3.1 MIHF ID

*Change 8.3.1 as follows:*

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.

~~Multicast MIHF ID is defined as an MIHF ID of zero length. A multicast MIHF ID can be used when destination MIHF ID is not known to a source MIHF. The MIHF ID is of type MIHF\_ID. (See F.3.11.) A zero length MIHF ID may be used in an MIH message when destination MIHF ID is not known to a source MIHF. The following MIH messages can use a zero length 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

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

## 8.6 MIH protocol messages

*Change fifth paragraph as follows:*

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. ~~MulticastZero length~~ MIHF ID can be used in MIH\_Capability\_Discover request and response messages as its destination MIHF ID.

### 8.6.1 MIH messages for service management

#### 8.6.1.1 MIH\_Capability\_Discover request

*Change 8.6.1.1 as follows:*

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 ~~multicastzero length~~ MIHF ID to send this capability discover message.

<b>MIH Header Fields (SID=1, Opcode=1, AID=1)</b>
<b>Source Identifier</b> = sending MIHF ID (Source MIHF ID TLV)
<b>Destination Identifier</b> = 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)
SupportedSecurityCapList (optional) (MIH Service Authentication Method list TLV)
<u>SupportedLinkActionsList (optional)</u> (Supported link actions list TLV)

### 8.6.1.2 MIH\_Capability\_Discover response

*Change 8.6.1.2 as follows:*

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 MIHF\_ID or ~~multiple~~ multi-cast ~~zero~~ length MIHF ID.

MIH Header Fields (SID=1, Opcode=2, AID=1)
<b>Source Identifier</b> = sending MIHF ID (Source MIHF ID TLV)
<b>Destination Identifier</b> = receiving MIHF ID (Destination MIHF ID TLV)
Status (Status 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)
SupportedSecurityCapList (optional) (MIH Service Authentication Method List TLV)
<u>SupportedLinkActionsList (optional)</u> (Supported link actions list TLV)

**8.6.3 MIH messages for command service**

*Insert new subclause in 8.6.3 immediately after 8.6.3.22 as follows:*

**8.6.3.23 MIH\_Net\_HO\_Bcst\_Commit indication**

The corresponding MIH primitive of this message is defined in 7.4.29.1.

This message is used by the MIHF on the network to recommend a handover from the DO network or a bidirectional network to a specific link and PoA of another network.

The requesting MIHF entity shall use a zero length MIHF ID to send this message.

MIH Header Fixed Fields (SID=3, Opcode=3, AID=12)
<b>Source Identifier</b> = sending MIHF ID (Source MIHF ID TLV)
<b>Destination Identifier</b> = receiving MIHF ID (Destination MIHF ID TLV)
TargetMNGroupInfo (Target mobile node group info TLV)
LinkType (Link type TLV)
TargetNetworksInfoList (List of target network info TLV)
LinkActionExecutionDelay (Time interval TLV)
LinkActionsList (Link actions list 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:*

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

MIH message name	Reference point
MIH_Net_HO_Bcst_Commit	RP1, RP3

## Annex F

(normative)

### Data type definition

#### F.3 Derived data types

##### F.3.3 Data types for address

*Insert the new rows into Table F.3 as follows:*

**Table F.3—Data type for address**

Data type name	Derived from	Definition
BCST_MMP_ID	OCTET_STRING	A type to represent the uniform resource identifier (URI) of a multimedia program (MMP).
BCST_MMS_ID	OCTET_STRING	A type to represent the URI of a multimedia service (MMS).

##### F.3.4 Data types for link identification and manipulation

*Change Table F.4 as follows:*

**Table F.4—Data types for links**

Data type name	Derived from	Definition
LINK_ACTION	SEQUENCE( LINK_AC_TYPE, LINK_AC_ATTR, LINK_AC_PARAM )	Link action.
SUPPORTED_LINK_ACTIONS_LIST	BITMAP(32)	A list of link actions. <u>Bitmap Values:</u> Bit 0: Reserved Bit 1: LINK_DISCONNECT Bit 2: LINK_LOW_POWER Bit 3: LINK_POWER_DOWN Bit 4: LINK_POWER_UP Bit 5: LINK_CONFIGURE Bit 6-31 (Reserved)
LINK_AC_PARAM	CHOICE(NULL, CHANNEL_CONFIG_SET)	The choice of CHANNEL_CONFIG_SET is used when the LINK_CONFIGURE action is selected in order to provide the configuration to be set up in the interface.

**Table F.4—Data types for links (continued)**

Data type name	Derived from	Definition
LINK_AC_TYPE	UNSIGNED_INT(1)	<p>An action for a link. The meaning of each link action is defined in Table F.5.</p> <p>0: NONE</p> <p>1: LINK_DISCONNECT</p> <p>2: LINK_LOW_POWER</p> <p>3: LINK_POWER_DOWN</p> <p>4: LINK_POWER_UP</p> <p>5: <u>LINK_CONFIGURE</u></p> <p>56-255: (Reserved)</p>
LINK_PARAM_GEN	UNSIGNED_INT(1)	<p>A type to represent a generic link parameter that is applicable to any link type.</p> <p>0: Data Rate-the parameter value is represented as a DATA_RATE.</p> <p>1: Signal Strength-the parameter value is represented as a SIG_STRENGTH.</p> <p>2: Signal over interference plus noise ratio (SINR)-the parameter value is represented as an UNSIGNED_INT(2).</p> <p>3: Throughput (the number of bits successfully received divided by the time it took to transmit them over the medium) - the parameter value is represented as an UNSIGNED_INT(2).</p> <p>4: Packet Error Rate (representing the ratio between the number of frames received in error and the total number of frames transmitted in a link population of interest)-the parameter value is represented as a PERCENTAGE.</p> <p>5: <u>Channel Central frequency-the parameter value is represented as a FREQUENCY.</u></p> <p>6: <u>Channel Central bandwidth-the parameter value is represented as CH_BANDWIDTH.</u></p> <p>7: <u>Channel Central power-the parameter value is represented as TX_POWER.</u></p> <p>8: <u>Higher adjacent channel frequency-the parameter value is represented as a FREQUENCY.</u></p> <p>9: <u>Higher adjacent channel bandwidth-the parameter value is represented as CH_BANDWIDTH.</u></p> <p>10: <u>Higher adjacent channel power-the parameter value is represented as TX_POWER.</u></p> <p>11: <u>Lower adjacent channel frequency-the parameter value is represented as a FREQUENCY.</u></p> <p>12: <u>Lower adjacent channel bandwidth-the parameter value is represented as CH_BANDWIDTH.</u></p> <p>13: <u>Lower adjacent channel power-the parameter value is represented as TX_POWER.</u></p> <p>14--255: (Reserved)</p>



**Table F.4—Data types for links (continued)**

Data type name	Derived from	Definition
LINK_TYPE	UNSIGNED_INT(1)	Represents the link type. <sup>a</sup> Number assignments: 0: Reserved 1: Wireless - GSM 2: Wireless - GPRS 3: Wireless - EDGE 15: Ethernet 18: Wireless - Other 19: Wireless - IEEE 802.11 22: Wireless - CDMA2000 23: Wireless - UMTS 24: Wireless - cdma2000-HRPD 27: Wireless - IEEE 802.16 28: Wireless - IEEE 802.20 29: Wireless - IEEE 802.22 <u>40: DVB</u> <u>41: T-DMB</u> <u>42: ATSC-M/H</u>
<u>CHANNEL_CONFIG_SEQUENCE</u>	SEQUENCE( <u>CENTRAL_CHANNEL_FREQ</u> , <u>CENTRAL_CHANNEL_BW</u> , <u>CENTRAL_CHANNEL_PWR</u> , <u>N_PLUS_ONE_CHANNEL_FREQ</u> , <u>N_PLUS_ONE_CHANNEL_BW</u> , <u>N_PLUS_ONE_CHANNEL_PWR</u> , <u>N_MINUS_ONE_CHANNEL_FREQ</u> , <u>N_MINUS_ONE_CHANNEL_BW</u> , <u>N_MINUS_ONE_CHANNEL_PWR</u> )	Valid Range: N/A
<u>CENTRAL_CHANNEL_FREQ</u>	<u>FREQUENCY</u>	<u>Central channel frequency in kHz</u>  Valid Range: $0 - 2^{32} - 1$
<u>CENTRAL_CHANNEL_BW</u>	<u>CH_BANDWIDTH</u>	<u>Central channel bandwidth in kHz</u>
<u>CENTRAL_CHANNEL_PWR</u>	<u>TX_POWER</u>	<u>Central channel power in dBm</u>
<u>N_PLUS_ONE_CHANNEL_FREQ</u>	<u>FREQUENCY</u>	<u>Higher adjacent channel frequency in kHz</u>  Valid Range: $0 - 2^{32} - 1$
<u>N_PLUS_ONE_CHANNEL_BW</u>	<u>CH_BANDWIDTH</u>	<u>Higher adjacent channel bandwidth in kHz</u>
<u>N_PLUS_ONE_CHANNEL_PWR</u>	<u>TX_POWER</u>	<u>Higher adjacent channel transmit power in units of 1 dBm</u>
<u>N_MINUS_ONE_CHANNEL_FREQ</u>	<u>FREQUENCY</u>	<u>Lower adjacent channel frequency in kHz</u>  Valid Range: $0 - 2^{32} - 1$

**Table F.4—Data types for links (continued)**

Data type name	Derived from	Definition
<u>N_MINUS_ONE_CHANNEL_BW</u>	<u>CH_BANDWIDTH</u>	<u>Lower adjacent channel bandwidth in kHz</u>
<u>N_MINUS_ONE_CHANNEL_PWR</u>	<u>TX_POWER</u>	<u>Lower adjacent transmit power in units of 1 dBm</u>
<u>FREQUENCY</u>	<u>UNSIGNED_INT(8)</u>	<u>Channel frequency (kHz)</u>
<u>CH_BANDWIDTH</u>	<u>UNSIGNED_INT(4)</u>	<u>Channel bandwidth (kHz)</u>
<u>TX_POWER</u>	<u>EIRP</u>	<u>TxPower in units of 1dBm</u>

Change Table F.5 as follows:

**Table F.5—Link actions**

Action name	Description
LINK_DISCONNECT	Disconnect the link connection directly.
LINK_LOW_POWER	Cause the link to adjust its battery power level to be low power consumption.
LINK_POWER_DOWN	Cause the link to power down and turn off the radio.
LINK_POWER_UP	Cause the link to power up and establish L2 connectivity. For UMTS link type, power up lower layers and establish PDP context.
<u>LINK_CONFIGURE</u>	<u>Apply the requested channel configuration to the interface.</u>

### F.3.8 Data types for information elements

Change Table F.14 as follows:

**Table F.14—Network type and subtype representation**

Network	Link type	Network subtype
(Reserved)	0	N/A
Wireless – GSM	1	N/A
Wireless – GPRS	2	N/A
Wireless – EDGE	3	N/A
(Reserved)	4-14	N/A
Ethernet – IEEE 802.3	15	Bit 0: 10 Mb Bit 1: 100 Mb Bit 2: 1000 Mb Bit 3–63: (Reserved) The above bits represent the link speeds that Ethernet supports. The capability information of twisted pair Ethernet link can be obtained via auto-negotiation as defined in Clause 28 of IEEE Std 802.3.
(Reserved)	16-17	N/A
Wireless – Other	18	<del>N/A</del> <u>Bit 0: DVB</u> <u>Bit 1: T-DMB</u> <u>Bit 2: ATSC-M/H</u>
Wireless – IEEE 802.11	19	Bit 0: 2.4 GHz Bit 1: 5 GHz Bit 2: 4.9 GHz Bit 3: 3.65 GHz Bit 4: 316 THz Bit 5-63 (Reserved) The above bits represent the frequency band that IEEE 802.11 link supports. The capability information and extended capabilities information of IEEE 802.11 link can further be represented as defined in 7.3.1.4 and 7.3.2.27, respectively, of IEEE Std 802.11-2007.
(Reserved)	20–21	N/A
Wireless – CDMA2000	22	N/A
Wireless – UMTS	23	Bit 0: Rel-99 Bit 1: Rel-4 Bit 2: Rel-5 (w/ HSDPA) Bit 3: Rel-6 (w/ HSUPA) Bit 4: Rel-7 (MIMO/OFDM) Bit 5: Rel-8 Bit 6.–63: (Reserved)
Wireless – cdma2000-HRPD	24	Bit 0: Rev-0 Bit 1: Rev-A Bit 2: Rev-B Bit 3: Rev-C Bit 4.–63: (Reserved)
(Reserved)	25–26	N/A

**Table F.14—Network type and subtype representation (continued)**

Network	Link type	Network subtype
Wireless – IEEE 802.16	27	Bit 0: 2.5 GHz Bit 1: 3.5 GHz Bit 2–63: (Reserved)  The above bits represent the frequency band that IEEE 802.16 link supports. The system profiles of IEEE 802.16 link can further be represented as defined in clause 12 (12.3 and 12.4) of IEEE Std 802.16e-2005.
Wireless – IEEE 802.20	28	N/A
Wireless – IEEE 802.22	29	N/A
(Reserved)	<del>30–255</del> <u>35</u>	N/A
<u>Wireless – XGP</u>	<u>36</u>	<u>N/A</u>
(Reserved)	<u>37–255</u>	<u>N/A</u>

NOTE 1—The Link type values in Table F.14 are deliberately made consistent with RADIUS network access server (NAS)-Port-Type definitions as specified by Internet Assigned Numbers Authority (IANA).

NOTE 2—The DO technologies which do not have associated any RADIUS NAS-Port-Type are indicated through a subtype of Wireless-Other.

### F.3.9 Data types for information service query

#### F.3.9.1 Binary representation

Change Table F.15 as follows:

**Table F.15—Data types for binary query**

Data type name	Derived from	Definition
NET_TYPE_INC	BITMAP(32)	<p>A type to represent a set of link types.</p> <p>The value is a four octet bitmap:</p> <ul style="list-style-type: none"> <li>Bit 0: Wireless - GSM</li> <li>Bit 1: Wireless - GPRS</li> <li>Bit 2: Wireless - EDGE</li> <li>Bit 3: IEEE 802.3 (Ethernet)</li> <li>Bit 4: Wireless - Other</li> <li>Bit 5: Wireless - IEEE 802.11</li> <li>Bit 6: Wireless - CDMA2000</li> <li>Bit 7: Wireless - UMTS</li> <li>Bit 8: Wireless - cdma2000-HRPD</li> <li>Bit 9: Wireless - IEEE 802.16</li> <li>Bit 10: Wireless - IEEE 802.20</li> <li>Bit 11: Wireless - IEEE 802.22</li> <li>Bit 12: Wireless - DVB</li> <li>Bit 13: Wireless - T-DMB</li> <li>Bit 14: Wireless - ATSC-M/H</li> <li>Bit 15: Wireless - XGP</li> <li>Bit 16–31: (Reserved AND shall be always set to "0")</li> </ul>

### F.3.11 Data type for MIH identification

Change Table F.19 as follows:

**Table F.19—Data type for MIH identification**

Data type name	Derived from	Definition
MIHF_ID	OCTET_STRING	<p>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. <del>A multicast MIHF identifier is defined as an MIHF_ID of zero length. MIHF_ID of zero length may be used when a destination MIHF_ID is not known.</del> When a MIH protocol message with <del>multicast</del> <u>zero length</u> 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.</p>

### 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)	<p>A list of MIH commands.</p> <p>Bitmap Values:</p> <p>Bit 0: MIH_Link_Get_Parameters</p> <p>Bit 1: MIH_Link_Configure_Thresholds</p> <p>Bit 2: MIH_Link_Actions</p> <p>Bit 3: MIH_Net_HO_Candidate_Query  MIH_Net_HO_Commit  MIH_N2N_HO_Query_Resources  MIH_N2N_HO_Commit  MIH_N2N_HO_Complete</p> <p>Bit 4: MIH_MN_HO_Candidate_Query  MIH_MN_HO_Commit  MIH_MN_HO_Complete</p> <p><u>Bit 5: MIH_Net_HO_Best_Commit</u></p> <p>Bit 56-31: (Reserved)</p>

Insert the following new subclause F.3.17 in Annex F:

### F.3.17 Data type for group information

**Table F.25—Data type for group information**

Data type name	Derived from	Definition
GROUP_INFO	CHOICE( BCST_MMP_ID, BCST_MMS_ID )	A type to represent target MN group information.

## Annex L

(normative)

### MIH protocol message code assignments

*Change Table L.1 as follows:*

**Table L.1—AID assignment**

MIH messages	AID
<i>MIH messages for Command Service</i>	
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
<u>MIH_Net_HO_Best_Commit</u>	<u>12</u>

## Annex M

(normative)

### Protocol implementation conformance statement (PICS) proforma<sup>2</sup>

#### M.8 PICS proforma tables

##### M.8.4 PDUs

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

Item number	Item description	References	Status	Support	Mnemonic
M.8.4.41	MIH_Event_Unsubscribe request?	8.6.1.9	M	Yes [ ] No [ ]	PDU41
M.8.4.42	MIH_Event_Unsubscribe response?	8.6.1.10	M	Yes [ ] No [ ]	PDU42
<u>M.8.4.43</u>	<u>MIH_Net_HO_Bcst_Commit indication?</u>	<u>5.3.3.1, 8.6.3.23</u>	<u>MC2:M</u>	<u>Yes [ ] No [ ] N/A [ ]</u>	<u>PDU43</u>

<sup>2</sup>Copyright release for PICS proformas: Users of this standard may freely reproduce the PICS proforma in this annex so that it can be used for its intended purpose and may further publish the completed PICS.