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| Project | **IEEE 802.21 Media Independent Handover Services**  **IEEE 802.21c: Single Radio Handover**  **<**[**http://www.ieee802.org/21/**](http://www.ieee802.org/21/)**>** |
| Title | **TGc\_Proposal\_Hyunho\_Park** |
| Date Submitted | March 15, 2012 |
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| Re: | IEEE 802.21c draft |
| Abstract | This document specifies the header format and network discovery of IEEE 802.21c Single Radio Handover Optimization. It revises document no. 21-12-0004-01-srho. |
| Purpose | Task Group Discussion and Acceptance |
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**Proposal 1**

Update the Table 23 in the clause 8.4.1 IEEE 802.21-2008:

### 8.4.1 General frame format

**Table 23—Description of MIH protocol header fields**

|  |  |  |
| --- | --- | --- |
| Field name | Size (bits) | Descriptions |
| Version |  | This field is used to specify the version of MIH protocol used.  0: Not to be used  1: First version  2: IEEE 802.21c  3–15: (Reserved)  The version number will be incremented only when a fundamental  incompatibility exists between a new revision and the prior edition  of the standard. An MIH node that receives an MIH message with a  higher version number than it supports will discard the frame without  indication to the sending MIH node. |
| ACK-Req | 1 | This field is used for requesting an acknowledgement for the message. |
| ACK-Rsp | 1 | This field is used for responding to the request for an acknowledgement for the message. |
| Unauthenticated information  request (UIR) | 1 | This field is used by the MIH Information Service to indicate if the protocol message is sent in pre-authentication/pre-association state so that the length of the response message can be limited. The UIR bit should be set to '1' by the originator when making an MIH information service request over a certain link in the un-associated/unauthenticated  or unregistered state.  In all other cases, this bit is set to '0'. |
| More fragment (M) | 1 | This field is used for indicating that the message is a fragment to be followed by another fragment. It is set to '0' for a message that is not fragmented and for the last fragment. The two 0 valued conditions are differentiated by the FN field. It is set to '1' for a fragment that is not the last one. |
| Fragment number (FN) | 7 | This field is used for representing the sequence number of a fragment.  The fragment number starts from 0. The maximum fragment number is 127. This field is set to '0' for a message that is not fragmented. |
| Reserved1 | 1 | This field is intentionally kept reserved. When not used, this bit is  set to '0'. |
| MIH message ID (MID)  -- Service identifier (SID)  -- Operation code (Opcode)  -- Action identifier (AID) | 16  4  2  10 | Combination of the following 3 fields.  Identifies the different MIH services, possible values are as follows:  1: Service Management  2: Event Service  3: Command Service  4: Information Service  Type of operation to be performed with respect to the SID, possible values are as follows:  1: Request  2: Response  3: Indication  This indicates the action to be taken with regard to the SID (see Table L.1 for AID assignments). |
| Reserved2 | 4 | This field is intentionally kept reserved. When not used, all the bits of this field are to be set to '0'. |
| Transaction ID | 12 | This field is used for matching Request and Response, as well as  matching Request, Response and Indication to an ACK. |
| Variable payload length | 16 | Indicates the total length of the variable payload embedded in this MIH protocol frame. The length of the MIH protocol header is NOT included. |

**Proposal 2**

Add the following clause into document no. 21-12-0004-01-srho

## Securing Single-Radio messages using SFF

The IEEE 802.21c protocol header (see Figure 1) carries the essential information that is present in every frame and is used for parsing and analyzing the IEEE 802.21c protocol frame.

|  |  |  |  |
| --- | --- | --- | --- |
| Version (4)  2: IEEE 802.21c | Interworking Protocol Types (2bits) | BM  (1) | MTI  (1) |
| SrcID (6 bytes) | | | |
| DstID (6bytes) | | | |
| SID (4) | Opcode (2) |  | |
| AID (10) | | | |
| SRCF protocol payload | | | |

Figure 1 – IEEE 802.21c protocol header format

Table 1 shows the description of the header fields.

Table 1 – Description of IEEE 802.21c protocol header fields

|  |  |
| --- | --- |
| Interworking Protocol Types | Indicates types of interworking protocols   * 0: IEEE 802.21c single radio handover content * 1: ANQP of IEEE 802.11u * 2: WiMAX interworking (E.g. R9 protocol) * 3: ANDSF message |
| BM | Indicates if the BSID or MGID field will be included in this message |
| MTI | Indicates the type of Message   * 0: Interworking message * 1: Encapsulated target L2 message |
| SrcID (6 bytes) | Source MAC address, e.g., MAC address of MS   * MAC address of MS when messages are transmitted from MS to target PoA * MGID for Mobility GW when messages are transmitted from Mobility GW to MS |
| DstID (6 bytes) | Destination MAC address, e.g.,   * BSID for target PoA when messages are transmitted from MS to target PoA * MAC address of MS when messages are transmitted from Mobility GW to MS |
| SID | Service identifier (SID):  1: Service Management, 2: Event Service, 3: Command Service, 4: Information Service |
| Opcode | Operation code (Opcode):  1: Request, 2: Response, 3: Indication |
| AID | Indicates the action to be taken with regard to the SID |

**Proposal 3**

Add the following clause into document no. 21-12-0004-01-srho

## Introduction

### Need for single radio handover

Single radio handover has limitation in network discovery because of interference and power consumption problem of the network interfaces. This means that a mobile node is not free to use the target radio when the source radio is operating. Considering the problem, there are possible network discovery methods as follows.

The first method is listening to the target link. Although the single radio handover recommends keeping from simultaneous use of source and target interfaces, it permits listening the target link with lower priority than the source link. When the mobile node can listen to the target link and signal strength of the source link decrease, the mobile node can scan candidate links and then can find the target link. Moreover, periodic scanning for the target link can support network discovery. This method serves the accurate detection of the target links, but the mobile node should be careful to keep from interference between source and target links and have power dissipation problem from multiple interfaces.

The second one is network discovery based on the location information of the mobile node. This mechanism finds the target network using GPS (Global Positioning System) location information and interaction with the IR (Information Repository). This mechanism can solve the interference problem. Although location information from global positioning system (GPS) can enhance network detection, the GPS also dissipates power in the mobile node which is often limited by the power capability of its battery. Also, the GPS systems performance is often degraded with the weak signals in an indoor environment. In the event of GPS signal loss, such as when entering a building, the last known location could be used. Moreover, it can be a huge load to the network to invoke a network information repository to support network discovery for the mobile nodes which are equipped with the GPS.

The third method is user schedule based network discovery. The multi-radio MN can possess a lightweight software that includes schedule program, e.g., Google calendar, and many users are already managing their schedule through the use of a schedule program such as Google calendar. The schedule program usually shows the user’s location at the dedicated time. Based on user’s location information, the multi-radio MN can determine its available networks and the target radio. For example, if Mr. Sam is scheduled to stay meeting room from 9AM to 11AM, the Mr. Sam’s multi-radio MN can discover a WLAN AP at the meeting room.

In order to enhance this network discovery mechanism, the scheduled information can include the network access information of available network such as its type of network technology (WLAN, LTE, UMTS, WiMAX, etc.), its frequency band of operation, and its security information. Using the network access information, the network discovery can be mobile node centric. If the MN knows the network access information, it can try to connect to the network using that information.

As another method to enhance the network discovery, the network discovery can be supplemented by an information repository that is populated with location and network access information. The network discovery is then achieved through use of the information repository combined with schedule of time and location from the MN, which may or may not have GPS information.

In addition, records of user’s network access can enhance network discovery with or without the Information Repository. For example, if Mr. Sam had visited “Room #1” and accessed WLAN at some time. When Mr. Sam is scheduled to visit “Room #1” again, the recorded network access information will show that Mr. Sam’s MN can connect the WLAN using the recorded WLAN access information.