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| Re: | IEEE 802.16-08/007: “IEEE 802.16 Working Group Letter Ballot Recirc #28b: Announcement” |
| Abstract | This contribution proposes MS context transfer method for optimized HO process. |
| Purpose | Text proposal for 802.16j Draft Document. |
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# MS Context Transfer for optimized HO process

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# Introduction

In 16e networks, when an MS handovers from one BS (serving BS) to another BS (target BS), target BS can omit some of network re-entry processes if it has received MS context from the serving BS over the backbone network. WiMAX Forum NWG specifies backbone messages to transfer MS context from the serving BS to the target BS.

An MR network shall also support this capability, i.e. optimized HO, to minimize network re-entry latency. In centralized scheduling and security mode, the MR-BS controls all MS context and RS has not to possess MS context. On the other hand, in distributed scheduling and security mode, the access RS possesses MS security parameters (e.g. TEK) and SF parameters. So, those parameters should be transferred to the target RS for optimized HO process.

However, the current D3 does not specify messages and call flows to transfer MS context between RSs through the MR-BS (and backbone). Thus, it is not clear whether and how an MR network can support optimized HO in an MR network.

This contribution proposes new messages and call flows to transfer MS context on relay link.

# Proposed Method

There are two scenarios to transfer MS context, Serving station initiated transfer and Target station initiated transfer.

(1) Serving station initiated transfer

The figure 1(a) and 1(b) show the basic call flows of the Serving station initiated transfer in Intra-MR and Inter-MR handover, respectively.

A message of MS context notification may be initiated by the serving RS or MR-BS when the serving RS or MR-BS receives MOB_MSHO-REQ or MOB_HO-IND from an MS.

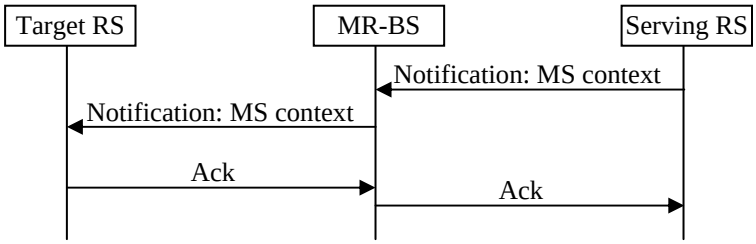


Figure 1(a) serving station initiate transfer (Intra-MR)

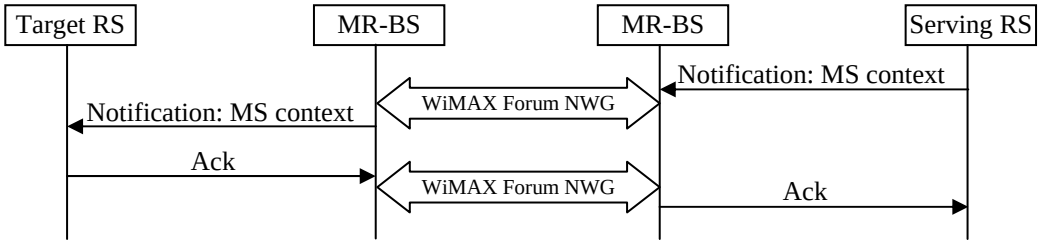


Figure 1(b) Serving station initiate transfer (Inter-MR)

(2) Target station initiated transfer

The figure 2(a) and 2(b) show the basic call flows of the Target station initiated transfer in Intra-MR and Inter-MR handover, respectively.

A message of MS context request may be initiated by the target RS or MR-BS when the target RS or MR-BS receives RNG-REQ from an MS and does not have context of the MS.

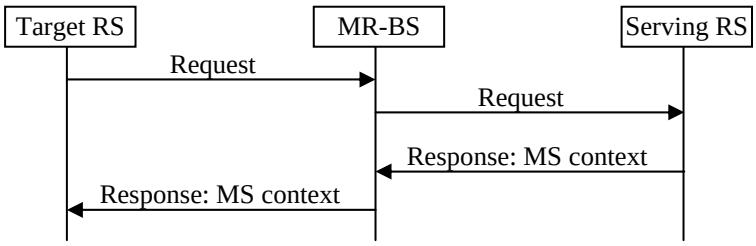


Figure 2(a) Target station initiate transfer (Intra-MR)

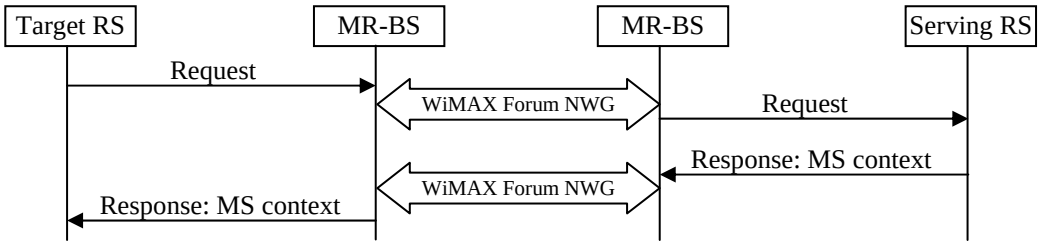


Figure 2(b) Target station initiate transfer (Inter-MR)

# Specification Changes

*[Insert the following new rows at the end of table 38 in 6.3.2.3]*

Table 38 — MAC management messages

| Type | Message name | Message description | Connection |
|---|---|---|---|
| TBA | MS_Context-REQ | MS Context Transfer Request | RS Basic |
| TBA | MS_Context-RSP | MS Context Transfer Response | RS Basic |

*[Insert the following new subclause at the end of 6.3.2.3:]*

6.3.2.3.X MS_Context-REQ message

This message is used to notify or request MS context to MR-BS or RS. This message is transmitted by RS or MR-BS with using the RS's basic CID.

Table xx MS_Context-REQ message Format

| Syntax | Size | Note |
|---|---|---|
| MS_Context-Request Information Format(){ | | |
| Management Message Type = xx | 8 bits | TBA |
| Transaction ID | 16 bits | |
| Type | 1 bits | 0x0: serving station initiated transfer<br>0x1: target station initiated transfer |
| Reserved | 7 bits | Shall be set to 0 |
| TLV Encoded Information | variable | TLV Specific |
| } | | |

The following parameters shall be included in the MS_Context-REQ of type=0 (notification) message:
- SS MAC address TLV
- BSID TLV

The following parameters may be included in the MS_Context-REQ of type=0 (notification) message:
- SBC-RSP encodings TLV
- REG-RSP encodings TLV
- AK context TLV
- SA Descriptors TLV
- Service Flow information TLV

The following parameters shall be included in the MS_Context-REQ of type=1 (request) message:
- SS MAC address TLV
- BSID TLV

The MS_Context-REQ message shall include the following parameter encoded as TLV tuples:
- HMAC/CMAC Tuple (See 11.1.2.)

*[Insert the following new subclause at the end of 6.3.2.3:]*

6.3.2.3.Y MS_Context-RSP message

This message is used to response an MS_Context-REQ sent by MR-BS or RS. This message is transmitted by RS or MR-BS with using the RS's basic CID.

Table xx MS_Context-RSP message Format

| Syntax | Size | Note |
|---|---|---|
| MS_Context-Response Information Format(){ | | |
| Management Message Type = xx | 8 bits | TBA |
| Transaction ID | 16 bits | |
| Type | 1 bits | 0x0: serving station initiated transfer<br>0x1: target station initiated transfer |
| Reserved | 7 bits | Shall be set to 0 |
| TLV Encoded Information | variable | TLV Specific |
| } | | |

The following parameters may be included in the MS_Context-RSP of type=0 (serving station initiated transfer) message:
- SS MAC address TLV
- BSID TLV

The following parameters may be included in the MS_Context-RSP of type=1 (target station initiated transfer) message:
- SS MAC address TLV
- BSID TLV
- SBC-RSP encodings TLV
- REG-RSP encodings TLV
- AK context TLV
- SA Descriptors TLV
- Service Flow information TLV

The MS_Context-RSP message shall include the following parameter encoded as TLV tuples:
- HMAC/CMAC Tuple (See 11.1.2.)

*Add the following subclause to 6.3.22.2.11 (MR-BSs and RSs behavior during HO process).*

6.3.22.2.11.3 MS Context Transfer for HO optimization in MR

When an MS performs optimized HO in an MR network with RSs operating in distributed scheduling mode, MS context, such as MS supporting physical parameters and MAC features, Service Flow parameters and Security context (if operating in distributed security mode), should be transferred from the serving station to the

target station. There are two ways to transfer MS context, Serving station initiated transfer and Target station initiated transfer.

In the Serving station initiated transfer, the serving station may send MS_Context-REQ with type=0 (serving station initiated transfer) to the target station, when it receives MOB_MSHO/BSHO-REQ or MOB_HO-IND message. Then, the target station sends MS_Context-RSP with type=0 (serving station initiated transfer) to the serving station.

The figure xxx-1 and xxx-2 show examples of serving station initiate transfer in Intra-MR and Inter-MR handover, respectively. The MS_Context-REQ message sent by the serving station shall contain SS MAC Address TLV and BSID TLV and should contain TLVs related to MS context. The BSID TLV represents the target station. Therefore, when the MR-BS receives the MS_Context-REQ from the serving RS, it examines the BSID TLV. If the BSID TLV indicates the MR-BS itself, the MR-BS sends back MS_Context-RSP to the serving RS. If it indicates a subordinate RS of the MR-BS, the MR-BS sends MS_Context-REQ with type=0 to the subordinate RS. Then the subordinate RS sends back MS_Context-RSP to the serving RS through the MR-BS. If the BSID does not indicate a station within the MR cell, the MR-BS sends a message to the backbone network to inform the target station of MS context. The message sent to the backbone is out of scope of this standard.

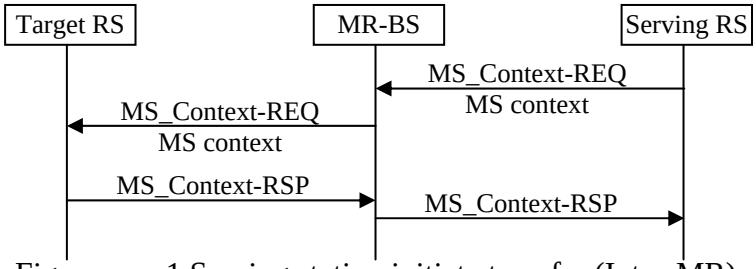


Figure xxx-1 Serving station initiate transfer (Intra-MR)

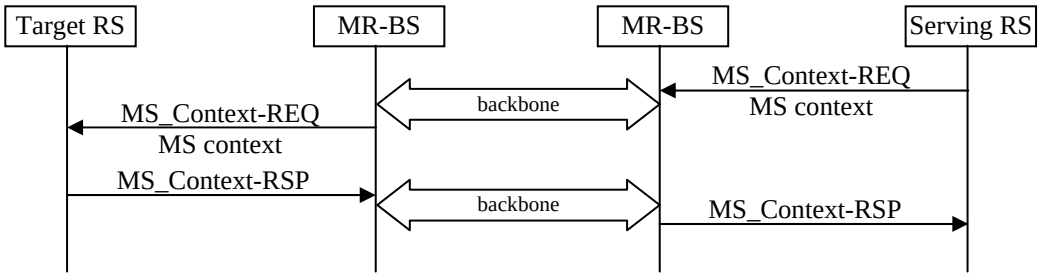


Figure xxx-2 Serving station initiate transfer (Inter-MR)

In the Target station initiated transfer, the target station may send MS_Context-REQ with type=1 (target station initiated transfer) to the serving station, when it receives a RNG-REQ message containing the Serving BSID TLV from an MS and does not possess context of the MS. Then, the serving station sends MS_Context-RSP with type=1 (target station initiated transfer) to the target station.

The figure yyy-1 and yyy-2 show examples of target station initiate transfer in Intra-MR and Inter-MR handover, respectively. The MS_Context-REQ message sent by the target station shall contain SS MAC Address TLV and BSID TLV. The BSID TLV represents the serving station. Therefore, when the MR-BS receives the MS_Context-REQ from the target RS, it examines the BSID TLV. If the BSID TLV indicates the MR-BS itself, the MR-BS sends back MS_Context-RSP to the target RS. If it indicates a subordinate RS of the MR-BS, the MR-BS sends MS_Context-REQ with type=1 to the subordinate RS. Then the subordinate RS sends back MS_Context-RSP to the target RS through the MR-BS. The MS_Context-RSP should contain TLVs related to MS context. If the BSID does not indicate a station within the MR cell, the MR-BS sends a message to the backbone network to inform the target station of MS context. The message sent to the backbone is out of scope of this specification.

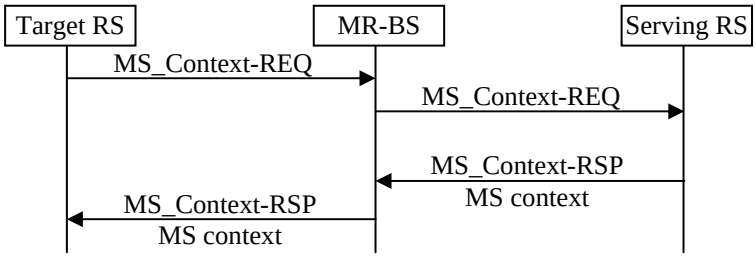


Figure yyy-1 Target station initiate transfer (Intra-MR)

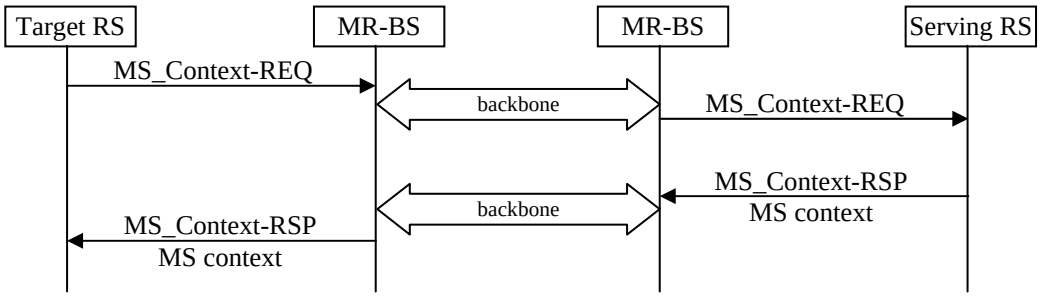


Figure yyy-2 Target station initiate transfer (Inter-MR)

*Add the following subclause to 11 (TLV encodings).*

11.26 MS_Context-REQ/RSP management message encodings

Table xxx—MS_Context-REQ/RSP message encodings

| Name | Type (1 byte) | Length | Value (variable-length) | PHY Scope |
|---|---|---|---|---|
| SS MAC Address | 1 | 6 | SS MAC Address in MAC-48 format | OFDMA |
| SBC-RSP encodings | 2 | *variable* | SBC-RSP TLV items for HO optimization. | OFDMA |
| REG-RSP encodings | 3 | *variable* | REG-RSP TLV items for HO optimization. | OFDMA |
| AK context | 4 | *variable* | See table aaa. | OFDMA |
| SA Descriptors | 5 | *variable* | See table bbb. | OFDMA |
| Service Flow Information | [145/146] | *variable* | Service flow management encodings (11.13) | OFDMA |
| BSID | 6 | 6 | BSID of Target or Serving station | OFDMA |

Table aaa—AK Context encodings

| Name | Type (1 byte) | Length | Value (variable-length) |
|---|---|---|---|
| AK | 4.1 | 20 | Encrypted AK Value. See 7.5.2.5 for detail of AK encryption. |
| AK ID | 4.2 | 8 | Identifies the AK that used for protecting the message. |
| AK Lifetime | 4.3 | 4 | The remaining time period during which the AK will be valid. |
| AK SN | 4.4 | 1 | The Sequence number of root keys (PMK) for the AK. |
| CMAC Key Count | 4.5 | 2 | Value of the Entry Counter that is used to guarantee freshness of computed CMAC_KEY_* with every entry and provide replay protection. |

Table bbb—SA Descriptor encodings

| Name | Type (1 byte) | Length | Value (variable-length) |
|---|---|---|---|
| SAID | 5.1 | 2 | Security association identifier is a 16-bit identifier for the SA. |
| SA type | 5.2 | 1 | Type of security association. See table 570. |
| SA Service type | 5.3 | 1 | Service type of the corresponding security association type. This shall be defined only when SA type is Static SA or Dynamic SA. |
| Cryptographic suite | 5.4 | 3 | Cryptographic suite employed within the SA. See 11.9.14. |

| | | | |
|---|---|---|---|
| Older TEK parameters | 5.5 | *variable* | TEK parameters. See table ccc. |
| Newer TEK parameters | 5.6 | *variable* | TEK parameters. See table ccc. |

Table ccc—TEK parameters encodings

| Name | Type (1 byte) | Length | Value (variable-length) |
|---|---|---|---|
| TEK | [5.5/5.6].1 | *variable* | Traffic Encryption Key encrypted with the negotiated TEK encryption algorithm. See 7.5.2. |
| TEK sequence number | [5.5/5.6].2 | 1 | 2-bit TEK Sequence Number. |
| TEK Lifetime | [5.5/5.6].3 | 4 | The remaining TEK Lifetime in seconds. Zero means that the corresponding TEK is not valid. |
| PN Counter | [5.5/5.6].4 | 4 | Last value of PN Counter used on DL (for AES CCM cipher suite) |
| RxPN Counter | [5.5/5.6].5 | 4 | Last value of PN Counter used on UL (for AES CCM cipher suite) |

# References

[1] P80216Rev2_D3
[2] P802.16j/D3
[3] WiMAX Forum Network Architecture – Stage 3, Release 1, Version 1.2