IEEE 802.21 MEDIA INDEPENDENT HANDOVER

DCN: 21-06-0614-00-0000

Title: **MIH_Handover primitives and scenarios**

Date Submitted: April, 30, 2006

Presented at IEEE 802.21 session #14 in Jacksonville, FL.

Authors or Source(s):

Richard Rouil and Nada Golmie

Abstract: This document is a review of the MIH_Handover functions present in the P802-21-D01-00 draft. The main purpose is to understand the definitions provided in P802-21-D01-00 and investigate scenarios in which they can be adequately used.

IEEE 802.21 presentation release statements

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.

This is a contribution by the National Institute of Standards and Technology and is not subject to copyright in the US. The contributors do not have the authority to override the NIST policy in favor of the IEEE 802.21 policy.

The contributor is familiar with IEEE patent policy, as outlined in Section 6.3 of the IEEE-SA Standards Board Operations Manual <http://standards.ieee.org/guides/opman/sect6.html#6.3> and in *Understanding Patent Issues During IEEE Standards Development* http://standards.ieee.org/board/pat/guide.html>

Outline

- What are the MIH_Handover primitives?
- Questions regarding the MIH_Handover primitives service category and purpose
- Assumptions regarding their use within the 802.21 scope.
- Scenarios of MN and Network initiated handover illustrating the usage of each primitive.
- Ideas for potential solutions

What are the MIH_Handover primitives?

The following primitives and their descriptions are defined in Table 14.

- MIH Handover Initiate: Initiate handover
- MIH Handover Prepare: Prepare for handover and query available resources
- MIH Handover Commit: Mobile node has committed to handover
- MIH Handover Complete: Handover has been completed

Question about the defined category

- The MIH_Handover primitives are defined as part of the Command Service (see Table 14)

- Given the role of the Command Service defined on page 2: “The Media independent Command service provides a set of commands for the MIH Users to control handover relevant link states.”

=> It is not clear that the MIH_Handover methods should belong to the command service category since
  - they are not used to directly impact the link states
  - they are used to help in buffer management, packet redirection, etc…

Question about the envisioned purpose

- The envisioned purpose for the MIH_Handover primitives is to provide information about the current state of the handover in a heterogeneous environment when the serving and target PoAs can not directly communicate.
- The draft states in section 5.2-c:
  "Handover signaling (as part of handover execution and subsequent updates) may not be part of the standard. Different networks support different intra-roaming handover mechanisms (mobile initiated, network initiated, etc.). Handover initiation trigger may be useful in heterogeneous handovers when not done as per the homogeneous scheme."

-> If the primitives are used to generate handover information triggers (other that the Link Handover triggers), then these triggers should be defined in the 802.21 standard.

Assumptions

Based on the description of the MIH_Handover primitives provided in the 802.21 draft, there are two possible assumptions:

1. The 802.21 specifications only define the primitives to exchange information between two peer MIH Functions. The communication with upper layers is out of the scope of the standard. Therefore, there is no indication on who triggers the generation of the commands and who processes the commands.
2. The 802.21 specifications define the primitives and completely specify the MIH interface with both higher and lower layer entities.

Scenarios

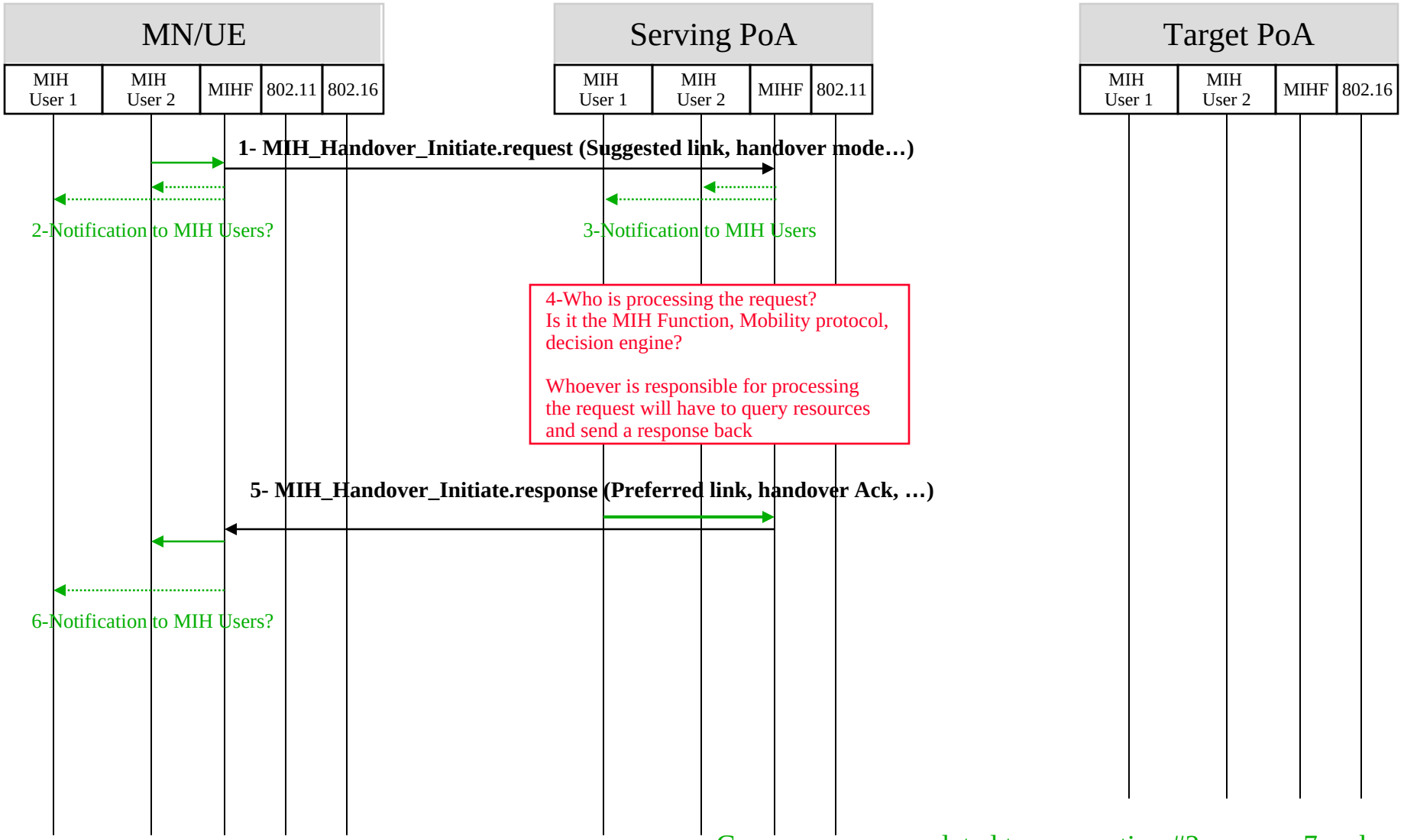
MIH Handover Initiate

messages

- Request parameters
  - Originates at either MN or Network Node
  - Suggests a new Link and PoA
  - Indicates a handover mode
  - Indicates the current link action
  - Indicates if resources must be reserved on the new link
- Response parameters
  - Indicates if the handover must be initiated or aborted
  - Specifies the Link and PoA for the handover (may be different from the request)
  - Indicates the reason if handover is denied
  - Lists the resources available on new link

MIH Handover Initiate

MN initiated handover



Green arrows are related to assumption #2 on page 7 and are not part of the current 802.21 draft.

MIH Handover Initiate

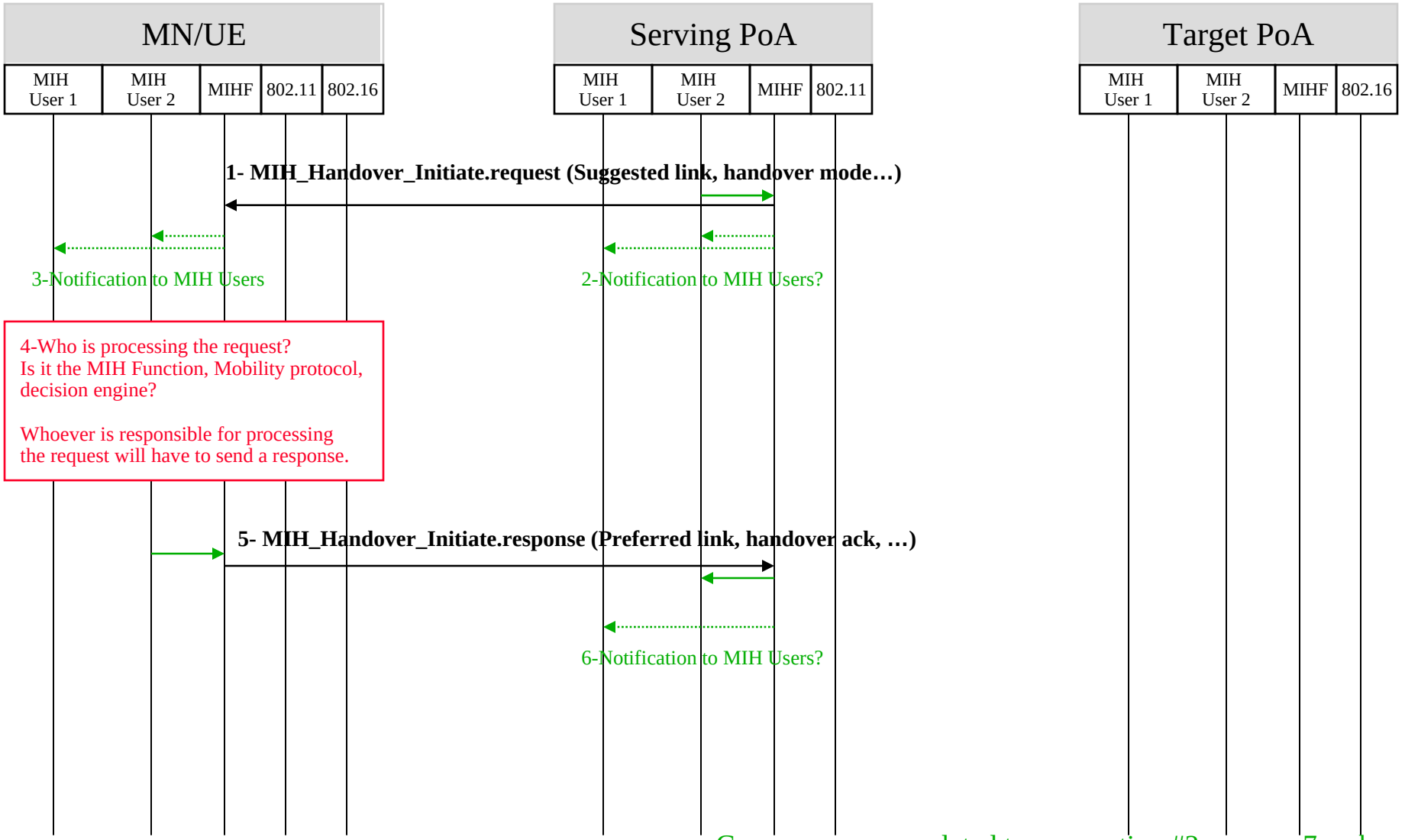
MN initiated handover

1. A MIH User decides that a handover is necessary in order to maintain connectivity. It sends a MIH_Handover_Initiate.request to the network MIHF to inform the serving PoA of its intent to handover.
2. At this stage would it be useful to other MIH Users to be notified of this potential handover?
3. When the MIHF on the PoA receives the request, it needs to notify the MIH Users for further instructions/actions.
4. The processing of the request involves 2 stages:
   - Decide what is the preferred link and PoA for the handover
   - Process resource allocation with target PoA if requested

   Since the MIHF is not responsible for making a decision to handover, it needs to notify the MIH User(s).
5. The MIHF on the PoA receives the response to transmit from an MIH User and sends a MIH_Handover_Initiate.response.
6. At this stage would it be useful to other MIH Users to be notified of this potential handover? It might be more efficient to keep the notification to local MIH Users until this stage (skip item 2).

MIH Handover Initiate

Network initiated handover



Green arrows are related to assumption #2 on page 7 and are not part of the current 802.21 draft.

MIH Handover Initiate

Network initiated handover

1. A higher layer protocol (MIH User) decides that a handover is necessary in order to maintain the communications. It sends a MIH_Handover_Initiate.request to the client MIHF to inform the UE of the intent to handover.
2. Define if it may be useful for other local MIH Users to receive the information that someone is trying to initiate a handover.
3. When the MIHF on the UE receives the request, notify MIH Users (for example Mobility protocol)?
4. The processing of the request involves 1 stage:
   - Decide what is the preferred link and PoA for the handover

   Therefore, if the MIHF handles the request, it will be doing handover decision. Is it the task of the MIHF?

   If a Mobility protocol must decide, then it needs to be informed of the request (ref item 3)
5. The MIHF on the UE either receives the response to transmit from an MIH User or autonomously sends a MIH_Handover_Initiate.response.
6. Define if it may be useful for other MIH Users to receive the response informing if the handover is aborted or will proceed.

MIH Handover Initiate

comments

- Section 7.4.10.1.1: “This primitive is used by the MIH Function on a mobile node or network to communicate with peer MIH Function on a network or mobile node”.
  -> This means the primitive is between peer MIH Functions
- Section 7.4.10.1.2: “Valid Range: MIH_LOCAL, MIH_REMOTE for Destination Identifier”
  -> The destination can be local?
- Section 7.4.10.1.3: “This primitive is generated by an upper layer entity such as a Handover Policy engine, L3 Mobility protocol like MIP, Application or some other entity that may want to cause a change in the current selected link. This command may be sent either to just the local MIH Function or it may be sent to the remote MIH Function as well”.
  -> Can the destination be local? In what case? Furthermore, if assumption 1 is used, then the mention of an upper layer needs to be removed since this primitive is strictly related to the MIHF.
- Section 7.4.10.1.4: “The remote MIH Function responds with MIH_Handover_Initiate.response primitive. If the recipient of the command is a network MIH function, it may perform a MIH_Handover_Prepare message exchange with the MIH Function in the target link under consideration before sending the response message. A corresponding indication (MIH_Handover_Initiate.indication) maybe triggered to send to all registered MIH User entities in the local stack.”
  -> The text implies that the MIH Function is the entity responding thus handling the request. Also this indication message mentioned has never been defined in the draft.
- Same comments apply to the MIH_Handover_Initiate.response

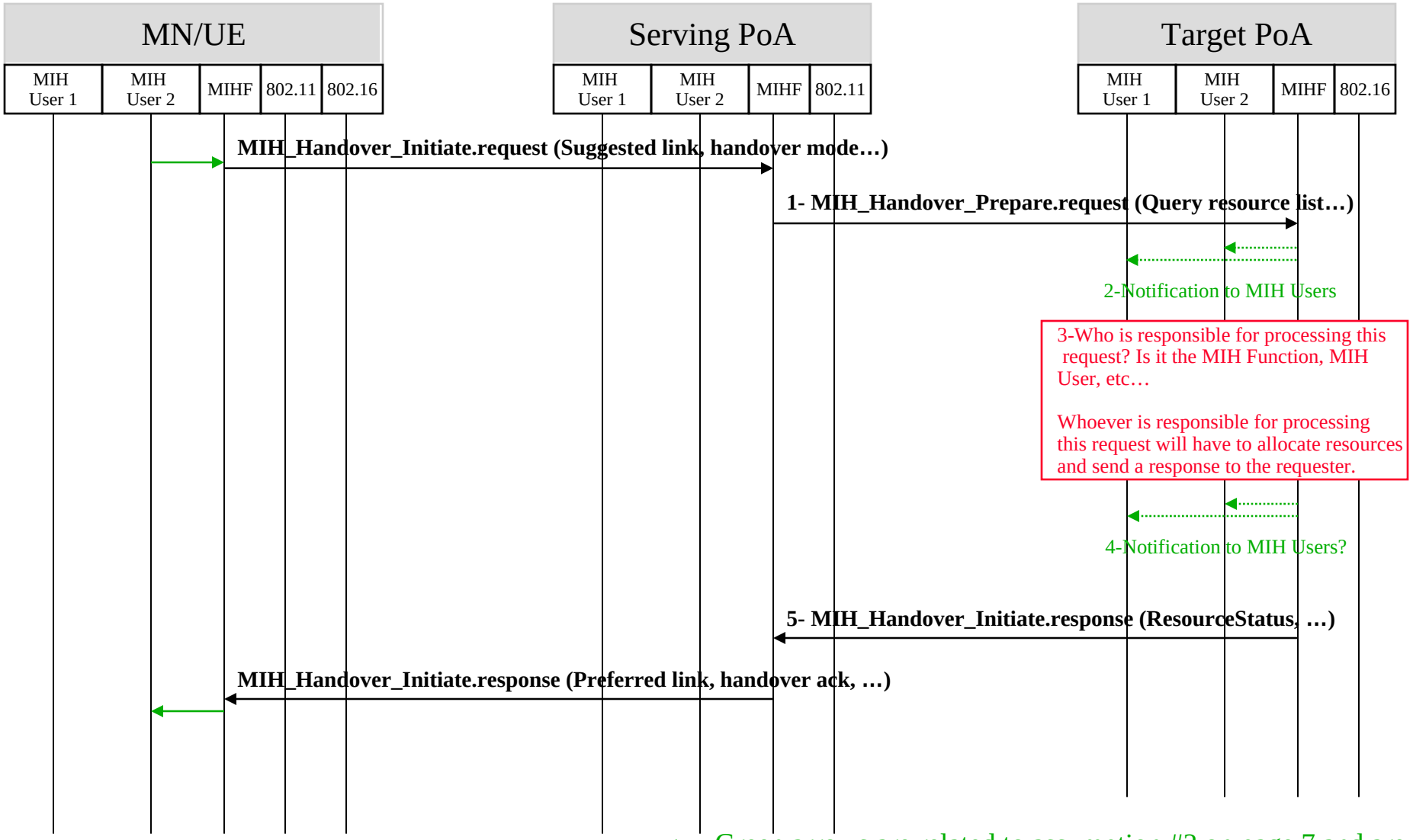
MIH Handover Prepare

messages

- Request parameters
  - Originates at Network Node
  - Indicates the resource to be allocated by the target network
- Response parameters
  - Indicates if the resources have been allocated
  - Contains the list of resources

MIH Handover Prepare

MN initiated handover



Green arrows are related to assumption #2 on page 7 and are not part of the current 802.21 draft.

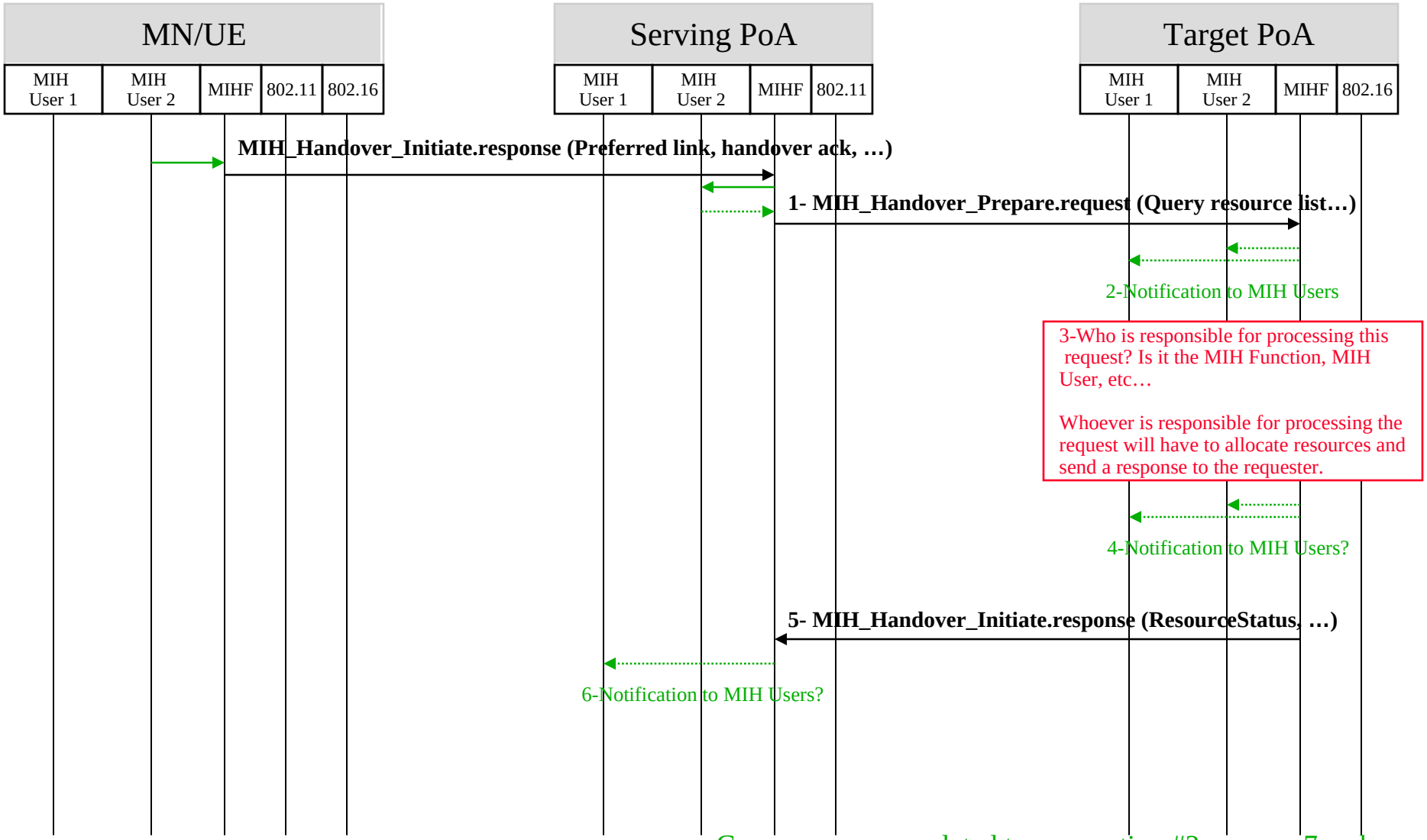
MIH Handover Prepare

MN initiated handover

1. Upon reception of a MIH_Handover_Initiate.request containing a QueryResourceList set to true, the MIHF sends a MIH_Handover_Prepare to the target MIH. The target can be either the Suggested PoA from the request or the Preferred PoA found by the current PoA.
2. Should the MIHF notify the MIH User(s) of the resource allocation request? What action would the MIH User(s) take? In addition, should another notification occur after resources have been allocated?
3. The processing of the request involves the allocation of the resources requested. Will the MIHF be able to handle the request?
4. Should the MIHF notify the MIH Users of the resources allocated? What action would they take?
5. The MIHF sends a response with the result of the resource allocation. The receiving MIHF may then respond to the MIH_Handover_Initiate request.

MIH Handover Prepare

Network initiated handover



Green arrows are related to assumption #2 on page 7 and are not part of the current 802.21 draft.

MIH Handover Prepare

Network initiated handover

1. The MIHF sends a MIH_Handover_Prepare to the target MIH. The target is the preferred PoA contained in the response message from the MN.
2. Should the MIHF notify the MIH User(s) of the resource allocation request? What action would the MIH User(s) take? In addition, should another notification occur after resources have been allocated?
3. The processing of the request involves the allocation of the resources requested. Will the MIHF be able to handle the request?
4. Should the MIHF notify the MIH Users of the resources allocated? What action would they take?
5. The MIHF sends a response with the result of the resource allocation.
6. Should the MIHF notify the MIH Users of the resources allocated? What action would they take?

MIH Handover Prepare

comments

- Section 7.4.11.1.2: “Valid Range: MIH_LOCAL, MIH_REMOTE for Destination Identifier”
  -> Can the destination be local?
- Section 7.4.11.1.4: “A corresponding indication (MIH_Handover_Prepare.indication) maybe triggered to send to all registered MIH User entities in the local stack. The associated parameters for the generated indication are same as those used in the command request.“
  -> There is an indication message that is never defined in the draft
- Section 7.4.11.2.2: “Valid Range: MIH_LOCAL, MIH_REMOTE for Destination Identifier”
  -> Can the destination be local?
- Section 7.4.11.2.4: “After receiving the response, the MIH Function on the serving network may send MIH_Handover_Initiate.response to mobile node.”
  -> This is valid only if the MN sends a MIH_Handover_Initiate.request. In the case of Network Initiated handover, the MIHF may commit the handover.

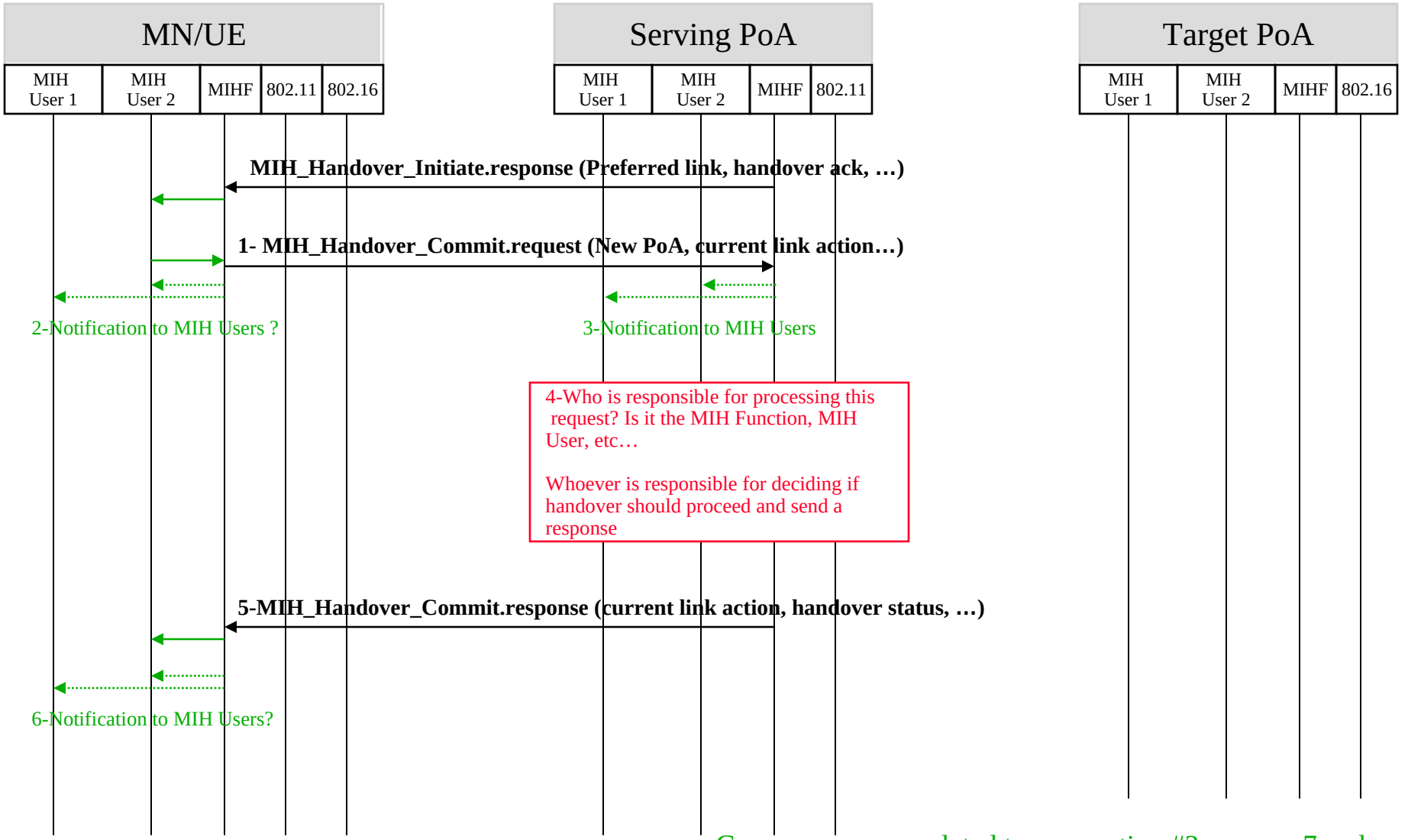
MIH Handover Commit

messages

- Request parameters
  - Originates at the MN or Network node
  - Indicates the target PoA and action to take on the current link
- Response parameters
  - Indicates the action to take on the current link
  - Informs if the handover should continue or abort

MIH Handover Commit

MN initiated handover



Green arrows are related to assumption #2 on page 7 and are not part of the current 802.21 draft.

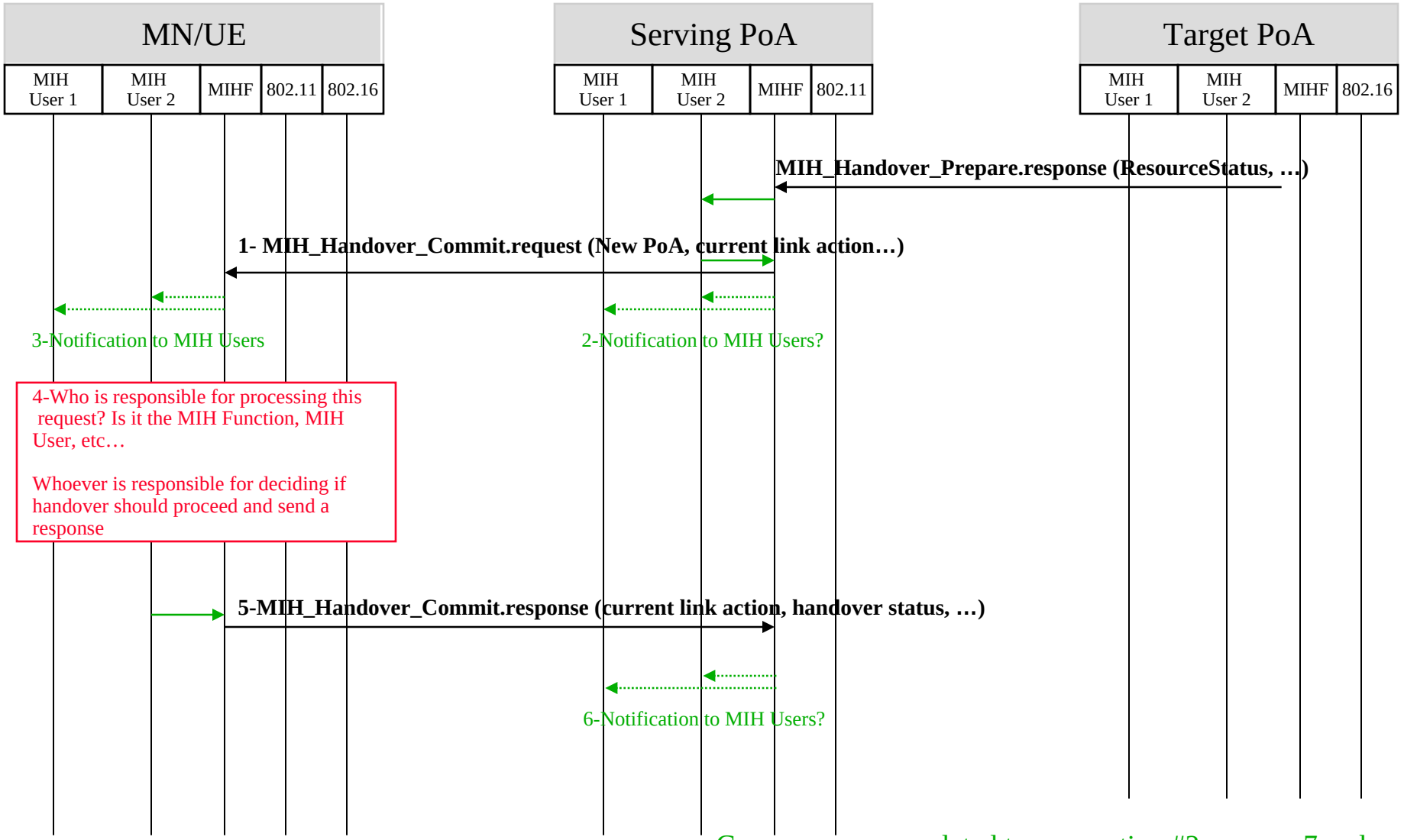
MIH Handover Commit

MN initiated handover

1. Upon reception of an MIH_Handover_Initiate.response containing a HandoverAck set to initiate handover, the MIHF sends a MIH_Handover_Commit to its PoA.
2. Should the MIHF notify other local MIH Users that someone is committed to perform handover?
3. Notify MIH Users of the handover commit message.
4. The processing of the request involves possible modification of the current link action and aborting the handover.
5. The MIHF on the PoA either receives the response to transmit from an MIH User or autonomously sends a MIH_Handover_Commit.response.
6. Should the MIHF notify MIH Users of the commit response? What action would they take?

MIH Handover Commit

Network initiated handover



Green arrows are related to assumption #2 on page 7 and are not part of the current 802.21 draft.

MIH Handover Commit

Network initiated handover

1. Upon reception of an MIH_Handover_Prepare.response, the MIHF on the PoA informs the MN about the commitment to do a handover with the specified PoA.
2. Should the MIHF notify other local MIH Users that someone is committed to perform handover?
3. Notify MIH Users of the handover commit message.
4. The processing of the request involves possible modification of the current link action and aborting the handover.
5. The MIHF on the UE either receives the response to transmit from an MIH User or autonomously sends a MIH_Handover_Commit.response.
6. Should the MIHF notify upper layers of the commit response? What action would the upper layers take?

MIH Handover Commit

comments

- Section 7.4.12.1.2: Valid Range: MIH_LOCAL, MIH_REMOTE for Destination Identifier
  -> Can the destination be local?
- Section 7.4.12.1.3: “This primitive is generated when successful MIH_Handover_Initiate.response is received to allow a mobile node to begin handover and the mobile node decides to perform actual handover based on suggested choices for candidate network and PoA.”
  -> This is true for the MN initiated handover. For the network initiated, this primitive is generated upon receiving the MIH_Handover_Prepare.response
- Section 7.4.12.1.4: “A corresponding indication (MIH_Handover_Commit.indication) maybe triggered to send to all registered MIH User entities in the local stack. The associated parameters for the generated indication are same as those used in command request.”
  -> There is an indication message that is never defined
- Section 7.4.12.2.2: Valid Range: MIH_LOCAL, MIH_REMOTE for Destination Identifier
  -> Can the destination be local?

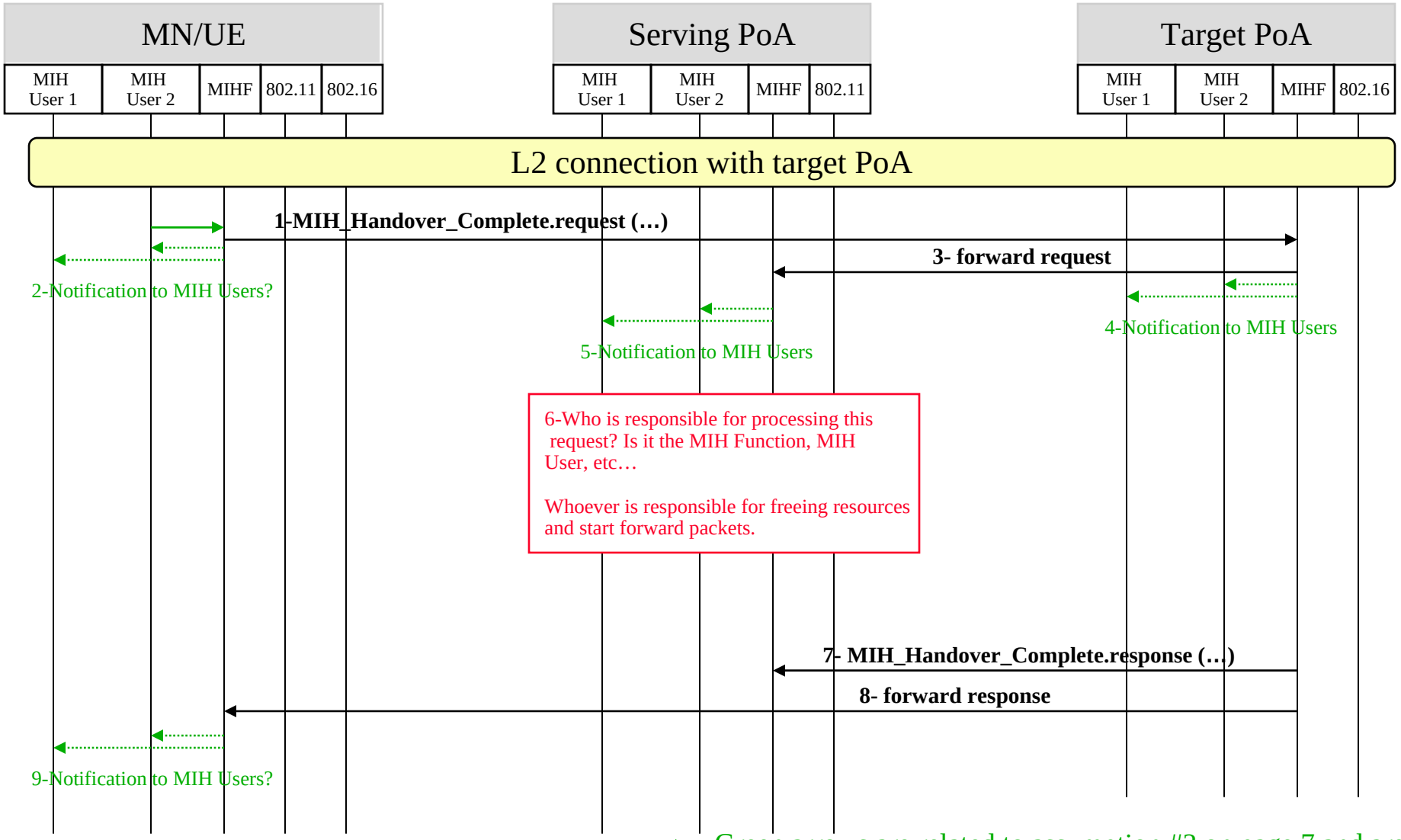
MIH Handover Complete

messages

- Request parameters
  - Includes the link to use to send information
- Response parameters
  - none

MIH Handover Complete

MN and network initiated handover



Green arrows are related to assumption #2 on page 7 and are not part of the current 802.21 draft.

MIH Handover Complete

MN and network initiated handover

1. When the MN detects a new Link Up), the MIH User informs the target PoA that the handover is complete.
2. Should the MIHF notify other local MIH Users that someone is committed to perform handover?
3. The target MIHF forwards the information to the old PoA (how does the new PoA know the address of the old PoA?).
4. The MIHF on the new PoA may generate indications to other local MIH Users.
5. The MIHF on the old PoA may generate indications to MIH Users about the handover completion in order to forward messages.
6. The MIHF on the old PoA or MIH Users need to process the request to forward packets. Should the MIHF be responsible for this? Or should it be the MIH User?
7. The MIHF (or MIH User?) sends a response to the new PoA.
8. The MIHF on the new PoA forwards the message to the client and is now ready to forward messages coming from the old PoA. Is the MIH responsible to setup the forwarding?
9. The client MIHF receives notification the handover request is complete and may inform MIH Users.

MIH Handover Complete

comments

- Section 7.4.13.1.2: “Valid Range: MIH_LOCAL, MIH_REMOTE for Destination Identifier”
  -> The destination can be local? Same as for 7.4.13.2.2
- Section 7.4.11.1.4: “Upon receipt, the receiving MIH Function in the old link may start forwarding any pending or remaining packets and also release any resources in use by the old link. A corresponding indication (MIH_Handover_Complete.indication) may be triggered to send to all registered MIH User entities in the local stack. The associated parameters for the generated indication are same as those used in command request.”
  -> Is it the MIHF responsibility to forward packets or should this be handled by an upper layer entity such as an intermediate buffer manager?
  -> The indication message mentioned in the text is never defined in the Draft.
- Section 7.4.13.2.4: “Upon receipt, the MIH Function in the new network may forward this message to the client.”
  -> Is the forwarding to the client optional? Should the request be acknowledged by the client?
- Is it possible for a target PoA to generate a MIH_Handover_Complete as describe in contribution 21-05-0566-00-0000.ppt? How does target PoA know it is a handover?

MIH Handover messages
Solutions

- Identify the purpose of each message along with a scenario. It is necessary to define which entity can send a message but also which entity cannot. For example, can a target PoA send a MIH_Handover request on its own?
- If some messages are optional, it needs to be mentioned.
- Define the scope of the message: Can it be local or only remote?
- Clarify which entity is generating and handling each message.
- If higher layers must be notified of the message exchange through indications, they must be defined in the standard. It may be necessary to define new MIH events.