

Intra-RAT Mobility Support in 802.16m

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Venue:

IEEE 802.16m-08/024, “Call for Comments and Contributions on Project 802.16m System Description Document (SDD)”.

Target topic: “Upper MAC concepts and methods - mobility”.

Base Contribution:

This is the base contribution.

Purpose:

To be discussed and adopted by TGm for the 802.16m SDD

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Outline

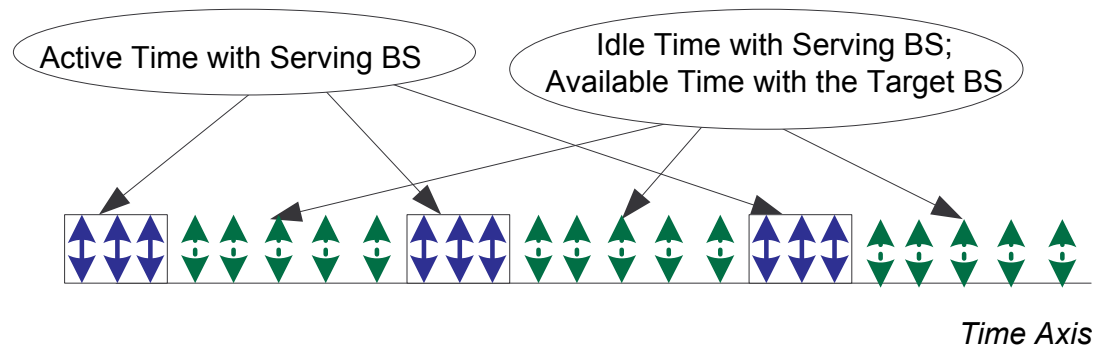
- Intra .16m mobility
- Mobility between .16m and .16e
- Mobility between Femto and Macro BS

Intra .16m Mobility

Intra .16m Mobility

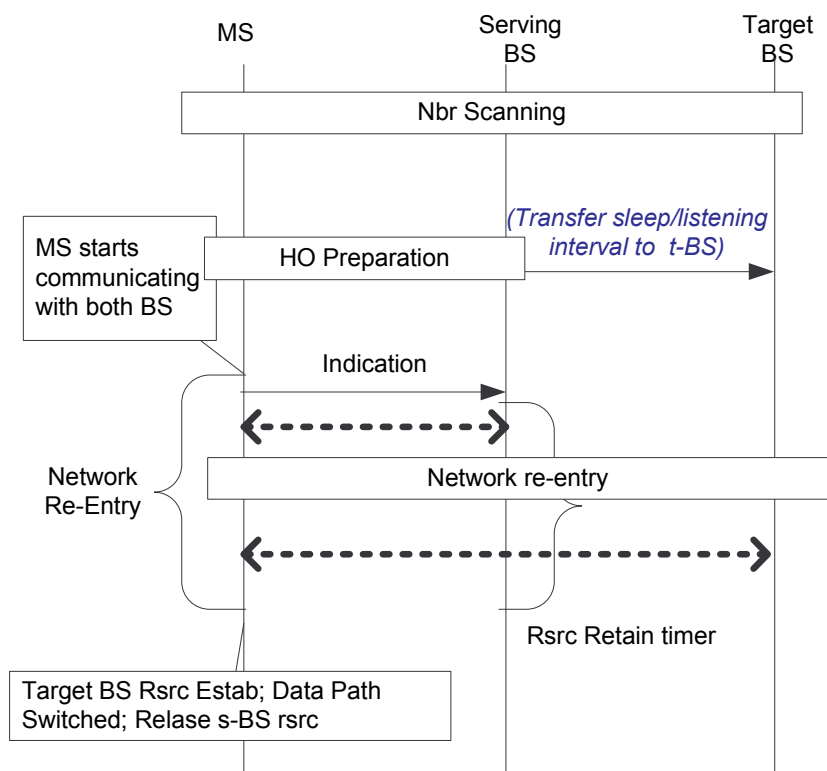
- For intra 16m mobility, we should optimize hard handover and reduce latency according to SRD section 6.2.3
- Latency is any possible break in communication, when an MS switches from one BS to another

Proposed Solution



- Utilize periodic listening/sleep window (sleep mode) with the serving BS
- If sleep mode is not activated yet, then activate it during HO preparation procedure
- Provide MS sleep time schedule with the serving BS to the target BS
- The MS continues exchanging data frames with the serving BS during the listening time
- The MS and the target BS exchange network re-entry signaling during the MS sleep time with the serving BS

Example Signaling Flows and Benefit



- The handoff latency reduction solutions in legacy system are proposed for the best scenario of HO Process Optimization
- This proposal reduces latency in the worst scenario where there is no HO Process Optimization

Proposed SDD Text

Section 10.x: Intra-.16m Mobility

Section 10.x.1: Intra-.16m Handover

An MS utilizes periodic listening/sleep window (sleep mode) with the serving BS during HO. During sleep window, the MS and the target BS exchange network re-entry signaling. During listening window, the MS and the serving BS continue to exchange data frames.

Mobility between .16m and legacy system

Handover Scenarios

- Legacy MS handover from legacy BS to 16m BS
 - Legacy MS handover to legacy zone of 16m BS and follows legacy handover protocol
- Legacy MS handover from 16m BS to legacy BS
 - Legacy MS handover from legacy zone of 16m BS to legacy BS and follows legacy handover protocol
- 16m MS handover from 16m BS to legacy BS
 - 16m BS and MS supports legacy handover protocol with legacy BS
 - 16m BS performs context mapping and protocol interworking from 16m to legacy system
- 16m MS handover from legacy BS to 16m BS
 - Two solutions proposed in the next two slides
 - One requires updates to legacy BS and one doesn't.
 - Updating deployed legacy BS for short period may not be desirable since such HO only happens during transition period when the service provider is upgrading their legacy system to .16m system.

Approach 1: 16m MS handover from legacy BS to 16m zone of 16m BS

- The legacy BS considers the neighbour 16m BS as two systems
 - legacy zone as a legacy BS and 16m zone as a 16m BS
- The legacy BS broadcasts the system information for the legacy zone of its neighbour 16m BS
 - to support legacy MS handover to the legacy zone of 16m BS
- The legacy BS also provides the system information for the 16m zone of its neighbour 16m BS
 - to support 16 MS handover to the 16m zone of 16m BS

Approach 2: 16m MS handover from legacy BS to legacy zone of 16m BS followed by zone switching

- The legacy BS only considers the legacy zone of the neighbour 16m BS as its neighbour.
 - The legacy BS broadcasts the system information for the legacy zone of the neighbour 16m BS in its neighbour advertisement.
- 16m MS handover from legacy serving BS to the legacy zone of the target 16m BS using legacy procedure.
- After handover, the 16m BS detects the MS as a 16m MS using the MAC version value (or MS capabilities context).
- The MS detects the BS as a 16m BS by listening to DCD message broadcast in legacy zone.
- The 16m BS requests MS to switch to 16m zone, or MS initiates the zone switch.
- The MS synchronizes with the 16m BS in the 16m zone and performs a zone switch from legacy to 16m zone, while having user data transmitted in the legacy zone simultaneously.
- Zone switch procedure may include MS/connection identifier allocation, context mapping and update etc.
- After zone switch completes, the MS is only served in the 16m zone, and data transmission starts at the 16m zone.

Benefit

- Approach 1
 - Straightforward, however with the overhead of providing two types of system information for one neighbour.
 - Changes to legacy BSs on both the air interface (R1) and network interfaces (R4 and R6) are required.
- Approach 2
 - No modification is needed to the legacy BS.
 - This is especially beneficial to the service provider providing legacy service to support HO to 16m network without the need to update its legacy BS.
 - System overhead is kept minimum by transmitting one set of system information of one neighbour BS.
 - No extra delay is introduced other than normal inter legacy BS handover delay.
- Recommendation
 - Adopt approach 2

Proposed SDD Text (1)

Section 10.x: Inter legacy and 16m Mobility

Section 10.x.1: Inter legacy and 16m Handover

Section 10.x.1.1: Handover from legacy BS to 16m BS

- The legacy BS advertises the system information for the legacy zone of its neighbour 16m BS.
- When handover is triggered for a legacy MS, the legacy MS handover from legacy serving BS to the legacy zone of 16m target BS using legacy handover protocol.
- When handover is triggered for a 16m MS, the 16m MS handover from legacy serving BS to the legacy zone of the target 16m BS using legacy handover procedure, followed by a zone switch from legacy zone to 16m zone. User data is transmitted in the legacy zone during zone switch process. After zone switch completes, the 16m MS is only served in the 16m zone.

Proposed SDD Text (2)

Section 10.x.1.2: Handover from 16m BS to legacy BS

- The 16m BS advertises the system information for its legacy neighbour BS in both legacy zone and 16m zone.
- When handover is triggered for a legacy MS, the legacy MS handover from legacy zone of the serving BS to the legacy target BS using legacy handover protocol.
- When handover is triggered for a .16m MS, the .16m BS and .16m MS perform handover from .16m BS to legacy BS using legacy handover protocol. 16m BS performs context mapping and protocol inter-working from 16m to legacy system.

Mobility between .16m Femto and Macro BS

Motivation

- There could be different types of BSs in the network e.g. Macro BS, Pico BS and Femto BS
- Femto BS can be deployed by the end user at home or small office to provide closed access to one or few users.
- There could be tens/hundreds of femto BSs deployed under the macro BS coverage area.
- The following slides propose efficient and seamless handover solution between macro BS and femto BS.

Issues to be Considered

- Considering large number of femto BSs in macro coverage area, it is not feasible to list all the femto BSs as neighbors of Macro BS.
 - Also not advisable because any way MSs will not have access to all the femto BSs except home femto BS.
- How MS detects valid femto BS (e.g. Home Femto BS) which can provide access?
 - Continuous searching for home Femto BS could drain MS battery.
 - It is desirable that when MS is in coverage area of its Home Femto BS, it should connect to Home femto BS.
- How to identify Femto BS?

Proposed Solution (1)

- When Femto BS is installed and configured under a macro BS. The femto BS identity is associated with the macro BS identity
 - Femto BS includes overlay Macro BS as its neighbor in order to support seamless HO from Femto to Macro BS.
 - In order for femto to identify whether a BS is a macro BS or another nearby femto BS, one of the following approach can be applied:
 - Femto BS could be deployed under different network ID (e.g. operator ID).
 - BS type indication (e.g, macro, femto)
 - Could check EIRP of BS
- When MS is configured to have access to femto BS, network sends signaling messages and provide the mapping of its own femto-BS and corresponding overlay macro BS(s).
- MS stores the mapping of home femto BS and overlay macro-BS

Proposed Solution (2)

- When MS detects that it is in overlay macro BS coverage area, then MS adds femto BS identity in its neighbor list and start scanning for home femto BS.
 - Because at this point MS knows that it is nearby his home femto BS.
- How MS detect its home femto BS?
 - **Option 1:**
 - Overlay Macro BS may transmit the preamble list used by femto BS or MS can exchange the signaling with network to find the preamble used by its own femto BS.
 - When MS enters into the coverage area of macro BS, receive the “preamble list of femto BS” and start scanning for home femto BS.
 - **Option 2:**
 - MS may store carrier frequency and preamble information of its home femto BS.
- When MS detects that it is outside of overlay macro BS coverage area, then MS removes the femto BS identity from its neighbor list and stop scanning for home femto BS.
- When MS detects good signal strength from its home femto BS, it triggers HO procedure. It provides the femto BS identity as target BS to macro BS.
- After that normal 802.16m HO signaling exchange takes place.

Benefit and Proposed SDD Text

- Benefit
 - Proposed simple and efficient seamless handover solution between macro BS and femto BS
 - Proposed solution conserves MS battery life

- Proposed SDD Text

10.x Mobility between Macro BS and Femto BS

10.x.1 Handover between Macro and Femto BS

Network provide femto BS and corresponding overlay macro BS mapping to MS for supporting handover between macro BS and femto BS.