Handover Schemes in IEEE802.16j

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Propose handover schemes for IEEE802.16j

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Outline

- Handover scenarios with RS involvement
- Classification of handover scenarios
- Handover target selection
- RS mobility
- Summary
Handover Scenarios with RS involvement

- Intra-BS handover with RS involvement
  - Within one BS coverage
  - \( \text{BS} \rightarrow \text{RS} \), \( \text{RS} \rightarrow \text{BS} \), \( \text{RS} \rightarrow \text{RS} \)
- Inter-BS handover with RS involvement
  - Across BS
  - \( \text{BS} \rightarrow \text{RS} \), \( \text{RS} \rightarrow \text{BS} \), \( \text{RS} \rightarrow \text{RS} \)
- Different relay frame structure definition leads to different handover procedures
Possible Relay Frame Structure Definition

- Two strategies of relay frame structure
  - Synchronous-broadcast frame structure
    - No broadcast info. relay: RS does not relay broadcast information
      - Refer to C80216mmr-05_023 in session #40
    - Synchronized broadcast info. relay: RS and BS send the same broadcast information at the same time
  - Asynchronous-broadcast frame structure
    - RS and BS send the broadcast information at the different time
Classification of Handover Scenarios

• Synchronous-broadcast frame structure
  – Intra-BS roaming
    • Synchronized to the same preamble
    • BS selects suitable RS for relaying
    • This RS selection or termination process is invisible to MS
  – Inter-BS roaming
    • MS first performs legacy inter-BS handover procedure
    • The target BS evaluates and selects suitable RS for relaying at network re-entry

• Asynchronous-broadcast frame structure
  – RS has its own preamble at the different time from BS
    • MS regards RS as a BS
  – For any roaming between RS and BS, MS has to re-synchronize to the target preamble.
    • MS performs legacy handover procedures in both Intra-BS and Inter-BS roaming
Handover Target Selection with RS Involvement

- **What is handover target selection**
  - BS decides whether RS or BS, and which RS is required for a specified MS relaying

- **Target selection strategies**
  - Comparison between MS-BS and MS-RS is not sufficient to decide the handover target
  - Possible complete paths comparison (e.g. MS-RS-BS vs. MS-BS)

- **Target selection metrics**
  - Link quality (CINR, …)
  - MS power level
  - Multi-hop bandwidth efficiency
  - QoS requirement
  - Traffic load
  - etc.
Handover Target Selection
(Synchronous-broadcast relay, intra-BS roaming)

- Handover target selection is transparent to MS.

1. Link quality monitoring
   - MS signal quality monitored by RS, and also by BS if the signal can reach BS
     - UL data burst, ranging
   - RS selects MSs with high signal quality and reports related measurement results to BS

2. Handover target selection
   - BS makes the decision as to handover target selection based on the comparison of possible paths
     - E.g. MS<->BS, MS<->RS1<->BS, MS<->RS2<->BS

3. Notification to MS and RS
   - RNG-RSP for MS adjustment
     - Power level, timing offset, etc.
   - BS notifies RS the handover target selection
Handover Target Selection
(Synchronous-broadcast relay, inter-BS roaming)

- MS first performs legacy inter-BS handover procedures
- The target BS evaluates and selects suitable RS for relay at network re-entry

1. Link quality monitoring of MS ranging signal at re-entry of TBS
   - MS ranging signal quality monitored by TRS, and also by TBS if the signal can reach TBS
   - TRS forward MS ranging request and also report measurement results to TBS
2. Handover target selection decision
3. Notification to MS and RS
Handover Decision
(Asynchronous-broadcast relay, intra-BS roaming)

- MS performs legacy handover procedures in intra-BS roaming
- BS evaluates and selects handover target in HO decision period.

1. Link quality monitoring
2. Handover trigger and decision
   - Considering RS measurement reports, BS compares possible paths with / without RS to select suitable handover target in handover decision
3. Complete the legacy handover process
   - Synchronization to target, ranging, and network re-entry
   - If the handover target is RS, MS just takes it as a BS to conduct legacy handover process

Handover Target selection in HO decision phase
Handover Decision
(Asynchronous-broadcast relay, inter-BS roaming)

- MS performs legacy handover procedures
- BS evaluates and selects handover target in HO decision period.

1. Neighbor BS reports to serving BS
   - Channel information of RSs in its coverage
   - RS-BS link quality

2. Handover trigger and decision
   - Considering neighbor BS reports, and also MS trigger information, BS compares possible paths with / without RS to select suitable handover target in handover decision

3. Complete the legacy handover process
Example: Intra-BS handover (BS->RS)  
(Synchronous-broadcast Frame Structure)
RS mobility

- RS roam among BSs acts as a legacy MS does
- In roaming, RS exercise the same handover procedure as MS does except that target BS allocates a specific CID to RS for identification
- MS in RS coverage
  - Not move with RS
    - Exercise handover from RS to serving BS
  - Move with RS
    - Exercise inter-BS handover after RS handover
Summary

• Different frame structure schemes introduce different handover procedures
  – Handover target selection for synchronous-broadcast relay frame structure
    • Intra-BS handover: RS-BS, or RS-RS handover is transparent to MS
    • Inter-BS handover: MS performs a legacy inter-BS handover, and then a intra-BS handover for suitable RS selection occurs in re-entry phase
  – Handover target selection for asynchronous-broadcast relay frame structure
    • For any handover between RS-BS or RS-RS, MS has to perform a legacy inter-BS handover.
    • BS compares possible paths and conducts target selection in handover decision.