Recommendations on IEEE 802.16j

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Gang Shen, Xiaobing Leng, Wei Zou, Wei Ni, Kaibin Zhang, Shan Jin, Torsten Fahldieck, Roland Muenzner

	Voice:	+86 21 58541240 8194
Research & Innovation, Alcatel	Fax:	+86 21 50554550
388#, Ningqiao Road, Shanghai, P. R. C.	E-mail:	gang.a.shen@alcatel-sbell.com.cn

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.   Comments on IEEE 802.16j

Recommendations on IEEE 802.16j

Gang Shen, Xiaobing Leng, Wei Zou, Wei Ni, Kaibin Zhang,
Shan Jin, Torsten Fahldieck, Roland Muenzner

Research & Innovation, Alcatel

Outline

- Relay station strategies

- Frame structure

- Traffic processing at RS

- Network entry and initialization

RS Strategies: Throughput Enhancement & Coverage Extension

MS is located inside BS coverage

DL broadcast control

MS

RS

RS coverage

BS
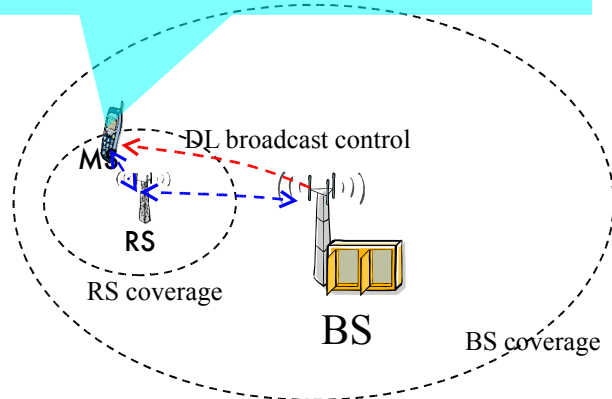
BS coverage

Fig. Throughput Enhancement Relay

MS is located out-of BS coverage

MS

RS

RS coverage

BS
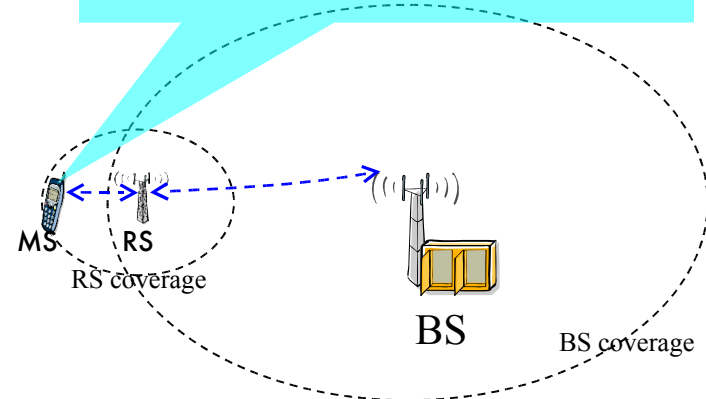
BS coverage

Fig. Coverage Extension Relay

> ## DL broadcast information directly reach MS

- Refer to C80216mmr-05_023 in session #40
- DL Preamble and MAP are transmitted from BS to MS directly. Data and other control messages are relayed

> ## No direct link between MS and BS

- All the information exchange between BS and MS should be relayed
- Two approaches to relay broadcast messages
  - Asynchronous: RS transmits preamble and MAP after BS does
  - Synchronous: RS and BS transmit preamble and MAP simultaneously

Considerations on Relay

- Broadcast messages relay: RS need to transmit preamble and MAP for MSs out of BS coverage

- Data and control message relay
  - Forwarding process at RS
  - Low latency and low complexity are expected

- Backward compatibility

Frame structure 1 for Asynchronous Scheme

- Extension on C80216mmr-05_023
- BS and RS transmit preambles and MAP asynchronously
- A dedicated area (relay zone) is for RS-BS UL control information relaying
  - MSs' signal quality report to BS (CINR, timing advance, power level, etc.)
  - Forwarding some MS's messages, such as ranging request, BW-request and etc.
- One ranging sub-channel for all MSs and RS
  - Located preceding the relay zone.
- Bearer data relay within one frame
  - No extra delay after the relay
  - In UL, the period of RS transmission and MS transmission can not overlap.
    - In MS transmission period, RS is keeping receiving or monitoring.

For Multiple RSs or Multihop (Hop Counts >2)

- For multiple RSs
  - RSs could transmit preamble and MAP at the same time
    - May cause interference problem
  - Or transmit them at different slots
- For multihop
  - Preamble and MAP information must transmitted one by one
  - Bearer data is still relayed to the destination within one frame
    - No extra delay after the introduction of relay

Frame Structure 2 for Synchronous Scheme

- BS and RS transmit the preamble and MAP simultaneously
- Private preamble and broadcast messages inserted to let RS synchronize with BS and also get MAP
- Features
  - All MSs are synchronized to one preamble
  - No intra-BS HO process between RS and BS, or RS and RS

Frame structure 2 with Multi-hop Support

- Easily extended to multi-hop scenario

Variation of Frame Structure 2 Definition

- BS sends private preamble and MAP for RS just before the start of the frame
- RS retransmit preamble and broadcast messages at the same time of BS does
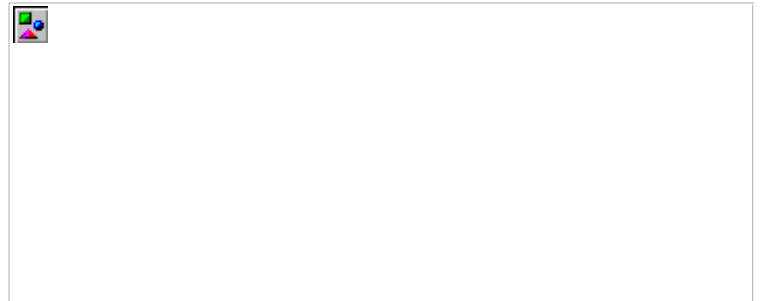
Forwarding Processing at RS

- Define mapping relation between BS-RS and RS-MS connection

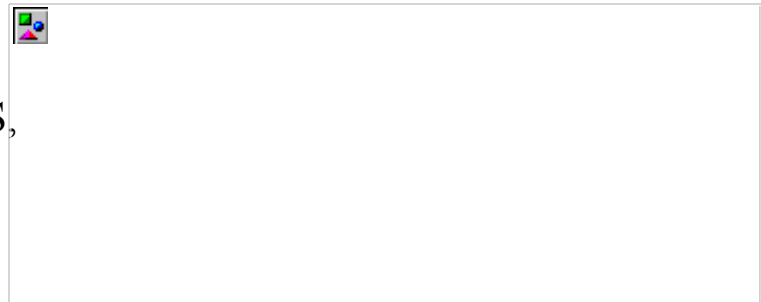- Three potential types of schemes:
  - Case 1: Simple PDU copy
    - RS receives PDU without any change

  - Case 2: PDU encapsulation
    - In DL, BS packs relayed PDUs into one with CID of RS
    - In UL, RS packs relayed PDUs into one

  - Case 3: CID translation
    - Two CID for each service flow, one over BS-RS, the other over RS-MS
    - Mapping relations in RS to accomplish traffic forwarding

Network Entry and Initialization

- RS and MS network entry and initialization
  - Share one ranging sub channel

- RS entry and initialization process
  - Similar to that of a conventional MS, except that
    - RS identifies itself as a relay by:
    - BS recognizes it and consequently allocate special CIDs to it

- MS entry and initialization process
  - In MS initialization, BS should decide whether RS or which RS is required for the MS.
  - Determination based on MS ranging signal

MS Network Entry with RS involvement
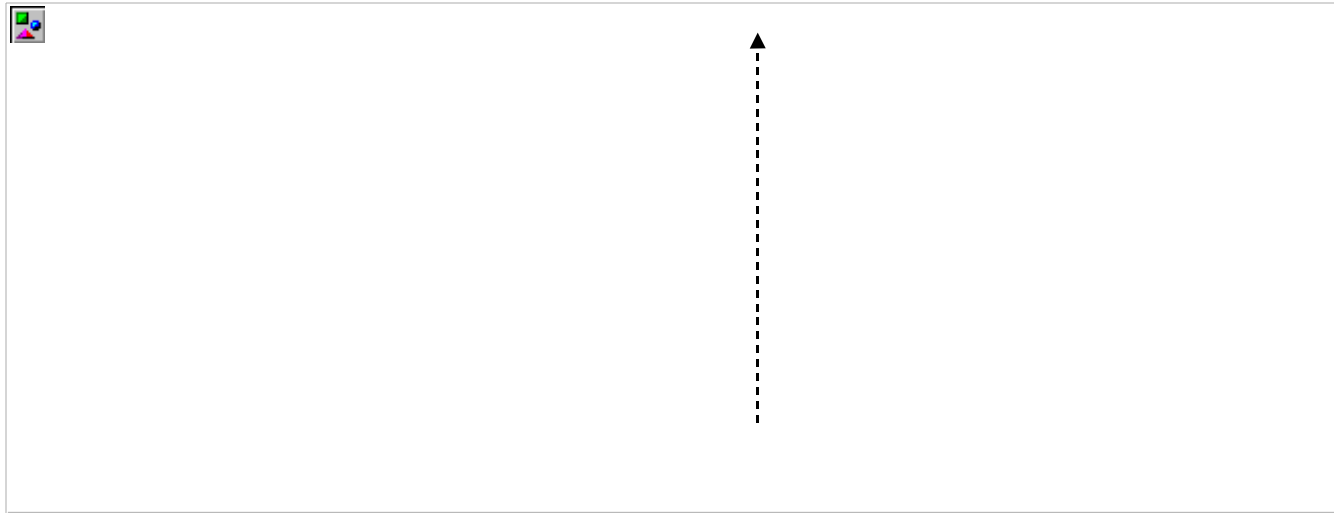
- One ranging sub-channel allocated by BS
- RS monitor ranging requests
  - Measure the signal quality.
  - RS only report measurement results and forward ranging request to BS
    - Forwarded to BS in the dedicated relay zone (no extra delay)
    - Other weaker ranging requests are omitted by RS.
- BS measures ranging request directly from MS and compare it with the reports from RS
  - Make a decision of RS selection

Summary

- Two approaches to relay broadcast messages
  - Asynchronous: RS transmits Preamble and MAP after BS does
  - Synchronous: RS and BS broadcast preambles and messages simultaneously
- Dedicated relay zone reserved for UL control information
- Data and control message are relayed within one frame
  - No extra latency
- Traffic processing at RS
  - PDU copy, PDU encapsulation, CID translation
- Network entry and initialization with RS involvement
  - No impact to MS initialization
- All controls and schedules are located in BS