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Abstract	This contribution describes possible soft handover schemes in 802.16 OFDMA system
Purpose	Adoption as part of Handover Adhoc recommendation to IEEE802.16e
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Soft Handover Schemes with frequency reuse 1

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1 Introduction

It is well known that soft handover provides macro-diversity gain through the concurrent communications between mobile station (MS) and multiple base stations (BS's). In OFDMA system, several schemes can be considered for soft handover. In this contribution, we briefly describe the various soft handover schemes in downlink and uplink, and compare advantage and disadvantage of each scheme. Since all of these schemes can be supported by a common MAC, we don't need to exclude any possibility.

2 Possible Schemes for Soft Handover

Following schemes are applied to frequency reuse 1 scenario. In this scenario, the data allocation information such as modulation and coding scheme (MCS) and allocation duration can not be changed dynamically since it is difficult to synchronize such information among active BSs frame by frame.

2.1 Downlink Soft Handover

2.1.1 Soft Handover using the same permutation and the same CID in each cell

This is the soft handover scheme proposed by Nortel [1]. In this scheme, the soft handover zone is defined by setting the IDcell of each BSs in the active set to the same value, so that the permutation of each BS is the same. The serving and target BSs transmit the same data to MS by using the same subchannel, so the MS does not need to know which BSs transmit the data.

The advantage of this scheme is that it does not require additional complexity to MS. MS just receive the data in the same way as in the non-handover case. Also RF-combining gain can be achieved.

The disadvantages are that the dedicated soft handover zone limits the flexibility of resource allocation, and it requires a complex centralized controller to avoid the interference between HO users.

2.1.2 Soft Handover using the different permutation and the same CID in each cell

In this case, MS is required to process the data from all serving BSs separately and apply the maximal ratio combining. Each BS can use the different subchannel. Since all serving BSs should have the same CID, a centralized controller or MAP modification is required to resolve the CID collision between serving BSs.

The advantage of this scheme is that frequency reuse 1 can be fully exploited since there is no need to make separate zone for soft handover users. Also macro diversity can be achieved for handover user.

The disadvantage is the complexity increase in MS because MS should decode MAP information from each cell and perform soft combining.

2.1.3 Soft Handover using the different permutation and the different CID in each cell

In this case, basic requirements for MS and BS are the same as those in section 2.1.2 except that CID is different among the serving BSs, so MS should use the selection diversity instead of soft combining.

The advantage of this scheme is that frequency reuse 1 can be fully exploited and there is no limitation on CID assignment and subchannel position among active BSs.

The disadvantage is the complexity increase in MS and reduced diversity gain.

2.2 Uplink Soft Handover

2.2.1 Soft Handover using the same permutation in each cell

This is the soft handover scheme proposed by Nortel [1]. Similar to the downlink case, the soft handover zone is used for soft handover users. The MS transmits data to serving BS but other BSs in active set can also receive data, which makes the selection diversity possible.

The advantage of this scheme is that it does not require additional complexity to MS. MS just transmit the data in the same way as in the non-handover case. Also, selection diversity gain can be achieved.

The disadvantages are that the dedicated soft handover zone limits the flexibility of resource allocation, and it requires a complex centralized controller to avoid the interference between HO users.

2.2.2 Soft Handover using the different permutation in each cell

In this scheme, all BSs in active set assign uplink data region to MS, and MS sends the uplink data to all active BSs according to the allocation information of each BS. MS should support all the UL-MAP from the BSs in the active set. Another possible way is that a serving or anchor BS sends the UL-MAP with the allocation information of itself and other BSs in the active set. In this case, MS only needs to see the UL-MAP from just anchor BS.

The advantage of this scheme is that frequency reuse 1 can be fully exploited.

The disadvantage is the complexity increase in MS and interference increase.

2.2.3 Soft Handover with best efforts

In this scheme, MS sends uplink data only to serving BS, and other BSs in active set just try to receive the data. In view of target BSs the uplink data from the handover user is received with interference from in-cell users, which degrades receiver performance.

The advantage of this scheme is that frequency reuse 1 can be fully exploited and there is no need to align uplink allocation among active BSs. Also it does not require complexity increase in MS.

The disadvantage is that selection diversity gain is not guaranteed.

3 Proposed Changes in Document

(TBD)

4 Reference

[1] *Soft Handover Procedure, Rev 1*, Hang Zhang, Mo-Han Fong, Jianglei Ma, Peiying Zhu, Wen Tong, Itzik Kitroser, Yigal Leiba, Yossi Segal, Zion Hadad