TSG-RAN Working Group 1 meeting #3 TSGR1#3(99)212
Stockholm, Sweden
22-26 March, 1999

Source: France Télécom

Subject : Considerations for active set choice in soft handover

Document for : Discussion

1. Introduction

In an optimum soft handover process, the base stations in the mobile station active set should be selected according to their associated carrier-to-interference plus noise ratio C/I. The problem with this selection criterion is the difference in uplink and downlink active sets it can lead to. We recall that the present UTRA FDD soft handover process defines only one active set common to uplink and downlink.

2. Active set selection criterion on the uplink

The interference plus noise power I seen at the base station is proportional to noise plus interference floor I_0 in the base station. On the other hand, the average received carrier power is proportional to the mobile station-to-base station path loss (or large-scale fading) L. Consequently, the C/I ratio is always proportional to $1/LI_0$. Choosing the base stations with the best C/I ratio is therefore equivalent to choosing the base stations with the lowest product LI_0.

The noise plus interference floor I_0 is generally different in all base stations in the active set. Let I_{0_i} and L_i denote respectively the noise plus interference floor and the path loss associated with the i th base station. Consider two base stations, i and j, with interference plus noise floors verifying

$$I_{0i} > I_{0j}.$$

For certain values of the path losses L_i and L_j, we can have

$$L_i < L_j,$$

(i.e., the path loss from the i th base station is lower than the path loss from the j th base station) while at the end, the j th base station is chosen because

$$L_i I_{0i} > L_j I_{0j}.$$

As a conclusion, a base station in soft handover in the uplink could be added to the active set even if another base station not in the active set has lower path loss.

3. Active set selection criterion on the downlink

The interference plus noise power I seen at the mobile station is common for all base stations whether they are in the active set or not. Consequently, the path loss L is the only factor that intervene in the comparison of base stations C/I ratios. If one and only one of two base stations, i and j, is to be added to the active set, and

$$L_i < L_j$$

then base station i is selected and added to the active set.

As a conclusion, a base station in soft handover in the downlink could only be added in the active set if all other base stations not in the active set have higher path losses.

4. Conclusion

Whatever the link direction, the best criterion to be used in the selection of active set base stations is the carrier to interference plus noise ratio. This criterion leads generally to different active sets for uplink and downlink. So far, the UTRA FDD associates only one active set for each mobile station in soft handover. The construction of this active set is based exclusively on path loss considerations. Consequently, it is not adapted for soft handover in the uplink. A way out of this problem is either to define two active sets for each mobile in soft handover, one for the uplink and another one for the downlink, or to use a criterion in between the uplink and downlink criteria.