Scheduling Schemes for Carrier Aggregation in LTE-Advanced Scenarios

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Abstract:

This work updates and proposes integrated Common Radio Resource Management (iCRRM) for inter-band Carrier Aggregation (CA) between band 7 (2.6 GHz) and band 20 (800 MHz), in the context of Long Term Evolution-Advanced (LTE-A) scenarios. The iCRRM entity performs Component Carrier (CC) scheduling and increases user's quality of service and experience. Two multi-band schedulers are implemented, an updated General Multi-Band Scheduling (GMBS) algorithm which performs User Equipment (UE) allocation to only one of the CCs at a time by using integer programming optimization, and a new Enhanced MBS (EMBS), which allocates UEs to one or both CCs simultaneously with reduced optimization scheduling complexity. Follow ing the current and upcoming trend of growth from mobile applications usage, video traffic is addressed. The performance from iCRRM is compared with the one from a simpler CRRM, where scheduling is performed by first allocating UEs in one of the two CCs until it is fully loaded and the case of the summed capacity of two bands system without CA. Simulations results have shown that, for a cell radius equal to 1000 m, with EMBS and GMBS, 3GPP and ITU-T's 1 % Packet Loss Ratio (PLR) threshold is only exceeded above 58 UEs while CRRM 54 UEs are supported, with PLRs of 0.88 %, 1.03 % and 0.99, respectively. Without CA the minimum obtained PLR is approximately 2 %. The corresponding average cell goodput is 7500, 7400 and 6900 kbps for EMBS, GMBS and CRRM, respectively. It has been found that a minimum value of 2.5 for the Quality of Experience can only be supported up to approximately 70, 68 and 36 UEs, with a corresponding supported cell goodput of 8800, 8450, 7950 and 3500 kbps with EMBS, GMBS, CRRM and without CA, respectively. Finally, costs and revenues are analysed rom the operator/service provider's point of view, for two fixed MByte prices, i.e., equal to 0.005 and 0.01 AC/MByte. An optimal operating point that maximizes expected profits is sought. Results have shown substantial improvements by using CA. For R = 1000 m and MByte price of 0.01 AC/MByte profits of 440, 416, 385 and 173 % have been obtained for the EMBS, GMBS, CRRM and without CA respectively.