

On the Study of Effective Capacity in Two-tier Wireless Heterogeneous Networks

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Abstract. Wireless heterogeneous Networks (HetNet) is a new technology currently been studied in LTE-Advanced standards. In LTE-Advanced HetNet system, to better utilize the radio resources, cognitive ability is introduced to femto-cells. In this paper, we first give an architecture to study the performance of femto-cell with cognitive capability in a two-tier HetNet system. Then effective capacity (EC) is analyzed for the three different spectrum cognitive approaches with various traffic QoS constraints, which can be used for the design of two-tier HetNet with femto-cells.

Keywords: Effective capacity, heterogeneous networks

1 Introduction

For current wireless networks, its developments have been severely limited by the heterogeneity of wireless networks (HetNet, Heterogeneous Networks)[1][2], which causes that the transmission capacity and end-to-end performance for the wireless systems cannot be improved fundamentally. In recent years the concept of cognition and cooperation have been studied and discussed from both academia and industrial communities.

For cognitive radio system, according to the schemes which the radio resources are shared between primary and secondary users, three kinds of cognitive approaches are mostly utilized, namely, interweave, underlay and controlled underlay. For interweave approach, the femto-BS identifies if a resource is occupied, and thus can simply avoid to allocate the occupied resource to eliminate the interference (known as interweave approach). To achieve spatial reuse, underlay approach is proposed where concurrent two tier transmissions may occur as long as the aggregated cross-interference incurred by femto-BSs is below some acceptable constraint. If the femto-BS is capable of cognizing user level information, for example, the specific macro-MS allocated to a resource or the location in which the assigned macro-MS will use a resource, controlled underlay approach is adopted where femto-BS prevents using the resources allocated for the macro-MS in vicinity and spatial reuse is further improved.

For a two-tier wireless heterogeneous network with femto-cells, analysis of traffic capacity for such system is very important for the design of HetNet with femto-cells. In this paper, we first give an architecture to study the performance of femto-cell with cognitive capability in a two-tier HetNet system. Then effective capacity (EC) is analyzed for the three different spectrum cognitive approaches with various traffic QoS constraints, which can be used for the design of two-tier HetNet with femto-cells.

References

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