

5G Wireless Communication over Heterogeneous Networks: Solutions for Hardware and Software Fallacies

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Abstract

Proliferating use of mobile communications have urged the need to develop networks able to cater to higher bandwidth, speeds and support a plethora of upcoming technologies. Introduction of 5G networks in a heterogeneous network architecture has been chosen as a viable solution to persistent issues in current implementations. However, these network designs lack several fundamental software and hardware pitfalls associated with problems in designing: associated cell optimizations, schemes on simultaneous base station associations and cooperation between tiers in the architecture. Therefore, this research will focus in fine tuning these software and hardware fallacies for the successful implementation of proposed 5G networks.

A main software drawback in current networks is persistence of lazy caching themes. As shown in figure 1, currently user requests are often matched to arbitrary locations without the use of pre-enabled caching mechanisms. To overcome this issue proactive caching where base stations (BS) identify external clients possessing cached information and dynamic Device-to-Device (D2D) connection creation could be implemented. As shown in figure 2, significant improvements in successful requests could be achieved both under high load and under low load as users are efficiently matched to potential targets.

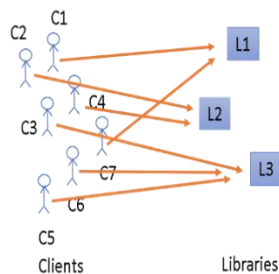


Figure 1 – Reactive loading

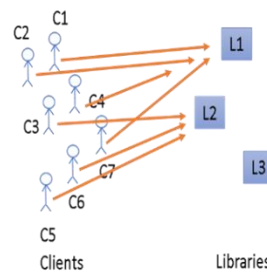


Figure 2 – Proactive loading

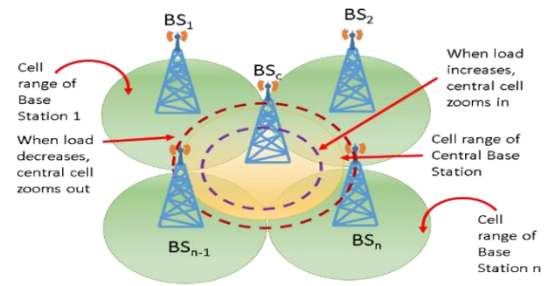


Figure 3 – Cell zooming

A main drawback in mobile network hardware design is high energy consumption proportional to increasing user requests. To overcome this issue cell zooming could be introduced to 5G implementations. As shown in figure 3, the central cell could use an algorithmic approach to identify the network request density around it and zoom its range in or out to efficiently serve while neighboring cells could be switched off for a predetermined interval and vice versa. T-tests carried under this paradigm proved that significant cost savings in efficient use of energy in these cells could be achieved under this solution.

Keywords: Proactive caching, Heterogeneous networks, 5G communication