Project title: Content Caching in MCPs

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1 Scope of the project:

We would like to work on stochastic geometry-based approaches for the modeling, and deriving analytical expressions of different types of hit probability metrics for content caching in clustered wireless networks which is an important metric in Device to Device (D2D) networks. Although the expression for cache hit probability with Base Stations (BS) modelled as Homogeneous Poisson Point Process are available in literature, but similar expressions for Poisson Cluster Process remain largely unexplored. Particularly, we would like to focus on deriving expressions for Cache-Aided Throughput [1] and/or Density of Successful Receptions [2] in Matern Cluster Process (MCP). [3] derived expression for cache hit probability which was defined as probability that at least k neighbors are in the communication range of a typical node. This definition of cache hit probability ignores the interference from neighbouring users, which is quite important in D2D networks. [4] derives expression for hit probability for 2 cases when the user is served by – (a) closest BS having requested file or (b) BS with requested file and maximum instantaneous received power. We would like to extend these techniques to develop expressions for Cache-Aided Throughput and/or DSR.

We will first read and understand these papers well. We will make appropriate assumptions on the caching model and then would try to generalize the existing expression for HPPP to MCP using techniques from [1, 2]. If time permits, we will also try to verify the results using simulations.

References

[1] Z. Chen, N. Pappas, and M. Kountouris, "Probabilistic caching in wireless d2d networks: Cache hit optimal vs. throughput optimal," 2016.

[2] D. Malak, M. Shalash, and J. G. Andrews, "Optimizing content caching to maximize the density of successful receptions in device-to-device networking," *IEEE Transactions on Communications*, p. 1–1, 2016. [Online]. Available: http://dx.doi.org/10.1109/TCOMM.2016.2600571

[3] K. Pandey and A. K. Gupta, "kth distance distributions of n-dimensional matérn cluster process," 2020.

[4] S. M. Azimi-Abarghouyi, M. Nasiri-Kenari, and M. Debbah, "Stochastic design and analysis of wireless cloud caching networks," 2019.