

CS543 - Paper Review Report # VI

Hailu Belay Kahsay - 20155624

Title: Caching at the Wireless Edge: Design Aspects, Challenges, and Future Directions

Author: Dong Liu, Binqiang Chen, Chenyang Yang, and Andreas F. Molisch

In the paper it is indicated that, even though the spectral efficiency (SE) can be improved either by reducing the distance between base stations (BSs) and users or by reducing the unnecessary traffic load, the need for high-speed backhaul to every single BS is mandatory.

It is also indicated that, mobile Internet, by inheriting large portion of wired Internet, such as content delivery, plays a big role to traffic growth of today's wireless network. Due to this issue and the fact that few popular contents account for most of the traffic load, and are requested by many users at different times, the authors argued that it is advantageous to cache popular contents locally before the requests truly arrive, directly at the wireless edge. By precaching at users or enabling device-to-device (D2D) communications, and by caching at small BSs (SBSs), this technique improves both SE and energy efficiency (EE) in addition to reducing latency and energy consumption.

Considering the wired and wireless networks' caching problems, namely: content placement and content delivery, the authors talk about on how local caching improves the quality of experience (QoE) of users or network performance without compromising QoE. In addition to this, they talk about some key facts about content popularity, such as application type, size of the region, and introduce methods to predict the popularity distributions (cumulative views) and user preferences (machine learning), and the impact of erroneous information on the network.

The paper also tries to compare and contrast caching at wireless and wired edge. In wireless network caching could be done either at the BSs (by installing caches in macro BSs or small BSs) or at the user terminals (precaching). Compared to caching at the packet core caching at existing MBSs and SBSs alleviates backhaul congestion (by replaces backhaul links). Moreover, new type of SBS without any backhaul connections, called helpers, enable flexible and cost-effective deployment to deliver popular contents.

The authors also argue that the wireless edge caching policy design should consider, the unique limitations in wireless networks due to architecture and channel, such as low cache-hit probability, topology uncertainty, Fading and interference, users' mobility and limited battery. In addition to this, accurate predictions of popularity distributions and user preferences are also critical.

Finally, the authors conducted a simulation based performance comparison between caching in wired and wireless edges. They consider two representative systems to illustrate the design aspects in content placement and delivery, and quantitative results for some trade-offs, SE and EE gains of caching at wireless and wired edges.

I think, addressing all the key challenges mentioned above, developing a killer application, addressing the caching size issues and privacy and security concerns are part of future works.