

**CHENNAI – PONDICHERRY**

**Fast Content Delivery via Distributed Caching and Small Cell Cooperation**

**Abstract:**

The demand for higher and higher wireless data rates is driven by the popularity of mobile video content delivery through wireless devices such as tablets and smartphones. To achieve unprecedented mobile content delivery speeds while reducing backhaul cost and delay, in this paper we propose a new system architecture that combines two recent ideas, distributed caching of content in small cells (FemtoCaching), and, cooperative transmissions from nearby base stations (Coordinated Multi-Point). A key characteristic of the proposed architecture is the interdependence between the caching strategy and the physical layer coordination. Specifically, the caching strategy may cache different content in nearby base stations (BSs) to maximize the cache hit ratio, or cache the same content in multiple nearby BSs such that the corresponding BSs can transmit concurrently, e.g. to multiple users using zero-forcing beamforming, and achieve multiplexing gains. Such interdependency allows a joint cross-layer optimization. Given the popularity distribution of the content, the available cache size, and the network topology, devise near-optimal strategies of caching such that the system throughput is maximized or the system delay is minimized. Under realistic scenarios and assumptions, our analytical and simulation results show that our system yields significantly faster content delivery, which can be one order of magnitude faster than that of legacy systems.

**Existing System:**

Deploying a dense network of low power nodes. One such challenge that service providers consistently rank high is the deployment cost associated with connecting all the small cells to the backbone with fast links. Motivated by this, there is a growing interest to cache popular content to those low power nodes in a distributed manner, effectively trading off fast backhaul capacity with storage capacity. Specifically, the authors in have introduced the concept of Femto- Caching, which is the idea of embedding femto-BSs with high storage capacity to store popular video files. When a user requests a video file, the user may be served by a nearby femto-BS that has the requested file in its cache over a high rate short-range wireless link. If the requested file is not in the cache of any nearby femto-BS, the user will be served directly by the macro-BS over a low rate long-range wireless link. Since the popularity distribution of video files changes at a much slower pace than that of user requests, cache updates (downloading popular video files via backhaul into the caches) can be done at off-peak hours, which results in a significant reduction of backhaul cost and delay while maintaining the performance benefits of a dense deployment of low power BSs.

**Proposed System:**

We propose a new system architecture that combines FemtoCaching and femto-BS cooperation. The proposed cooperation scheme is cache-driven in the sense that if a typical user requests a video file, only the neighboring femto-BSs that have the requested video file in their caches will participate in the cooperative transmission. In other words, the cluster of cooperating femto-BSs is dynamically formed on a per-request basis. An important aspect of our system architecture is the joint cross-layer optimization of the cache allocation (content placement) in the application layer and the cooperative transmission techniques (MRT for diversity and ZFBF for multiplexing) in the physical layer.We jointly optimize these aspects of the system because caching different content in nearby caches increases hit ratio, but caching the same content increases the chances to get diversity and multiplexing gains. In general, the optimal cache allocation depends on a number of parameters, including the file popularity distribution, the cache size, the number of neighboring femto-BSs, and the transmission rate of the macro-BS in comparison to that of a femto-BS.