

**CHENNAI – PONDICHERRY**

**DCAP: Improving the Capacity of WiFi Networks with Distributed Cooperative Access Points**

**Abstract:**

This paper presents Distributed Cooperative Access Points (DCAP) system that can simultaneously serve multiple clients using cooperative beamforming to increase the capacity of WiFi-type wireless networks. The distributed APs are connected by Ethernet and driven by independent low-cost local oscillators. To facilitate cooperative beamforming, we address three major challenges: phase synchronization, channel state information (CSI) measurement and user selection. Specifically, we develop 1) a cooperative tracking scheme to track signal phase drifts at symbol level without adding extra hardware complexity; 2) an incremental CSI estimation mechanism that removes the per-frame CSI measurement overhead of previous approaches; and 3) a simple random user selection algorithm that scales the network capacity linearly and delivers over 70% performance compared to the optimal but complex greedy algorithm. We implement DCAP on the Sora software radio platform and evaluate it in a wireless network with nine nodes. Experimental results show that the cooperative beamforming is feasible in practice, and our cooperative phase tracking can ensure strict phase alignment (\_ 0.03 radian) among APs during the entire beamforming period (1.2 ms). Otherwise, without tracking, the phase may drift by 0.3 radian over merely 600 \_s, causing that the symbol SNR decreases as large as 20 dB.

**Existing System:**

With the popularization of smart-phones and tablets, more and more applications rely on WiFi to deliver media-rich contents, resulting in the exponentially growing of wireless traffic demand. Intuitively, increasing the number of WiFi access points (APs) will accordingly increase the network capacity. However, the capacity of WiFi networks is mainly limited by interferences. Therefore, deploying more APs does not guarantee the improvement of the total network throughput; even worse, it may decrease the network throughput because these transmitters may contend with each others and cause mutual interferences.

From the information theory perspective, this problem can be solved if all transmitters can concurrently transmit their signals in a cooperative manner, such that each receiver only hears its desired signal, while the interference is canceled out. This idea is similar to the multi-user beamforming (MUBF) that allows a multi-antenna AP to serve multiple receivers simultaneously. However, the capacity gain of MUBF is limited by the number of antennas on one AP.

**Proposed System:**

A novel cooperative tracking scheme that allows us to estimate and track signal phase drift of each data symbol and feedback the results to all transmitting APs in real time over Ethernets. Based on the feedback, APs can dynamically adjust their signal phases to ensure strict alignment.

A novel incremental CSI estimation mechanism. In DCAP, the channels are measured implicitly. A client exchanges one pair of frames with a coordinator AP to obtain CSI, without any explicit feedback. Channel needs to be updated only once during the channel coherence time, and each client can perform this measurement independently at different time instance. Thus, it removes the per-frame CSI measurement overhead of previous approaches.

A simple random user selection algorithm. Our algorithm has a constant computational complexity, but scales the network capacity linearly with the number of APs, and deliver similar performance (\_70%) compared to the greedy user-selection algorithm for multi-user beamforming. The latter, however, has a computation complexity of O(NM), where M is the total number of active clients.