Analysis of "AmorFi: Amorphous WiFi Networks for High-density Deployments"

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April 2018

For this assignment we reviewed the paper "AmorFi: Amorphous WiFi Networks for High-density Deployments", details of which can be found in [1].

Summary

In [1] the usage of mobile network techniques in high density WiFi networks is investigated. Typical WiFi networks in places like convention venues have to be greatly over provisioned to be able to serve a higher than average number of users in one area. The paper proposes to use the core idea of C-RAN, which is to separate the RF transmissions from the baseband processing. The system is composed of three parts. The BPU cluster, which performs the baseband processing, the RRHs, which are the antennas, and connecting the two is the optical front-haul, which is configurable. Through a recursive algorithm using the data from the previous time slot the RRHs are distributed over the BPUs. Depending on the load in each RRH area, multiple BPUs can be assigned to one RRH (one antenna using multiple processors and channels) or one BPU is assigned to multiple RRHs, thereby creating a bigger cell. The influence of multicast traffic is also discussed, as the different constraints result in a different algorithm, and a compromise has to be made. If enough BPUs are avaible, it's be as simple as assigning one BPU to multiple/all RRHs, next to the BPUs that where already assigned for unicast traffic. The paper ends with a performance evaluation. They perform traffic surge and migration tests with unicast only, as well as network-level video broadcast with background unicast traffic. The AmorFi setup was not only compared to a traditional WiFi setup, but also with a load-balance enabled setup. All of the tests showed varing levels of throughput increase compared to even the load-balanced WiFi setup.

Pros

- Clearly written and comprehensible

- Solves WLAN provisioning, not by just improving channel management and load-balancing, but by using a novel architecture which eliminates bottlenecks that come with finite distributed resources.

- Good variety of tests

Cons

- 2.4 Ghz range only has 3 orthogonal channels, while 5Ghz has 9. This means that when using the 5Ghz band, it is always possible to distribute the channels without causing interference. (think of it as a cellular network, you would have hexagons (6 neighbours)). However, it is clear that this wouldn't always be possible with the 3 orthogonal channels of the 2.4Ghz band.
When this is the case, they just assign neighbouring clusters the same frequency.
What we think is missing from the paper is a discussion on the usage of the non-orthogonal channels that are available in the 2.4Ghz band.

- There are some measurements missing in section 5.4.1.
They do acknowledge it and say it is in the interest of space, but they don't make it available elsewhere either.

- They fail to provide the NS3 code that was used in section 5.5

- They don't mention what traffic characteristics and/or data rate was used to simulate the users.

References

[1] Ramanujan K Sheshadri, Mustafa Y Arslan, Karthikeyan Sundaresan, Sampath Rangarajan, and Dimitrios Koutsonikolas. Amorfi: Amorphous wifi networks for high-density deployments. In *Proceedings of the 12th International on Conference on emerging Networking EXperiments and Technologies*, pages 161–175. ACM, 2016.