Location-aware MAC scheduling in Mobile and Dense Networks
WiSHFUL Open Call 4

Organisation:
IMDEA Networks, Spain

Goals:
Experiment on context-awareness capable MACs, from our WiFi indoor positioning system which uses Commercial off-the-Shelf based hardware. The positioning system has to be integrated in the WiSHFUL testbed as well.

Main challenge:
Elaborate a MAC resource allocation based on position estimations that effectively improves the performance of a network with high-load from stations at different positions and deployed in a harsh environment.

Description of setup:
The orchestrating CLU entity requests raw ToF measurements to each of the APs for the intended target, processes the responses and generates position estimates that are available on the DB. {
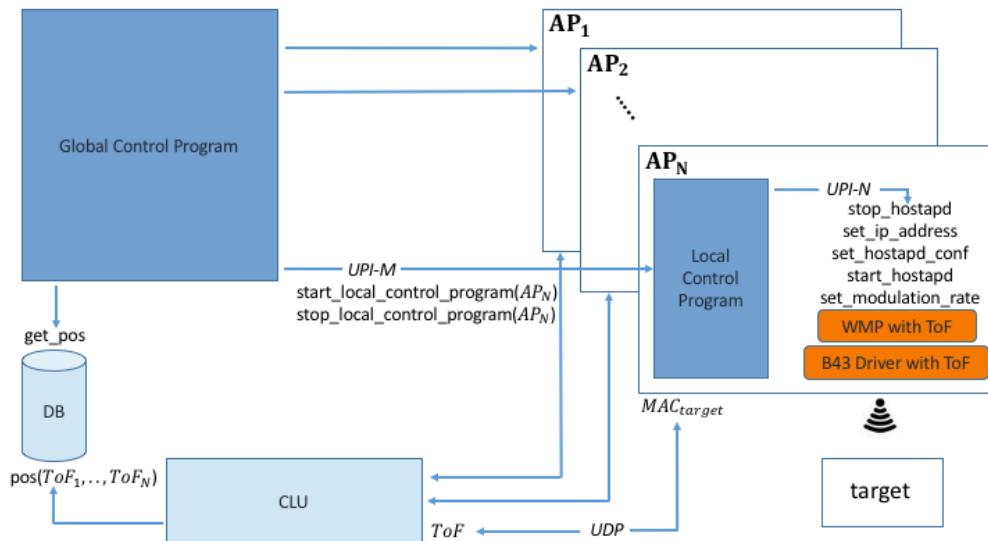

Figure 1: Location system setup

The AP allocates the MAC resources depending on the estimated position of the mobile targets. The problem is challenged by the harsh environment used for the Experiment, full of metallic objects and walls, as in typical industrial scenarios.
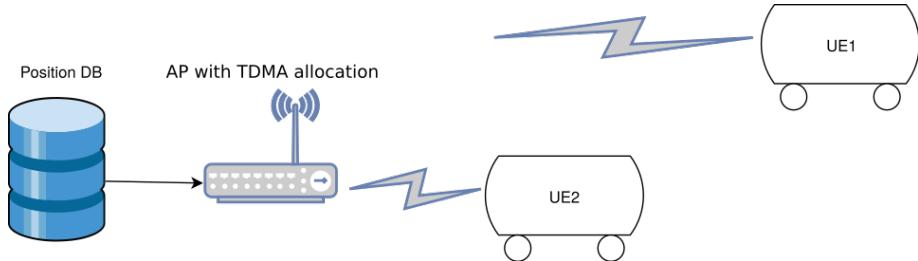
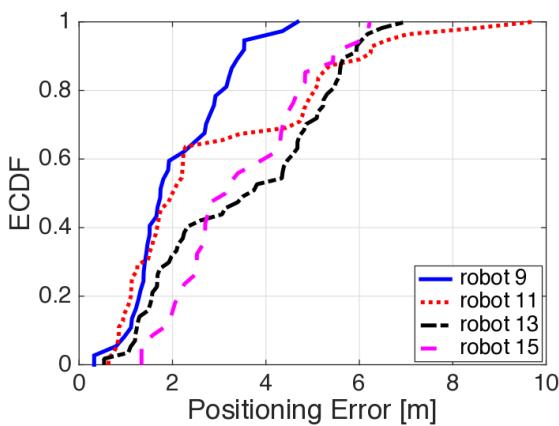*Figure 2: Context-aware MAC management scenario*

Main results:

Figure 3: Accuracy for multiple moving targets

Good accuracy for the positioning error with 4 mobile robots tracked in parallel, while the best average error of state-of-the-art systems in the same environment was 6-7 m of average error for a single target device. We obtain a result of ~3 m median error, with cases better than 2 m.
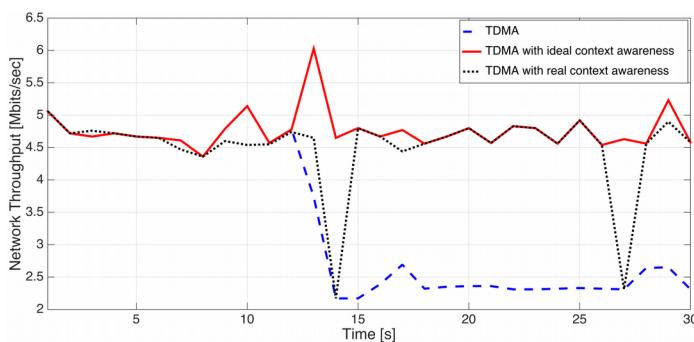

Figure 4: Throughput comparison for TDMA

Overall network throughput maintained by the MAC resource allocation in presence of signal blockage from metals by exploiting statistical context information.

For CSMA/CA we obtain a gain of 27% throughput. For TDMA we obtain a gain of 49%.

Conclusions:

We prove that positioning mobile targets in harsh environments is possible and that the usage of context information can be used in the design of network protocol stack to optimize the overall network performance.

Feedback:

Thanks to the framework provided by WiSHFUL, we have been able to accelerate our understanding of how well our positioning system works in industrial-like environment and make a first step toward demonstrating that context information derived from positioning data can be exploited in the design of wireless network protocol stack and improve wireless network performance.