FP7-PEOPLE-2008-IAPP: iPLAN: Indoor radio network PLANning and optimization

Indoor radio network PLANning and optimization

http://iplan.project.citi-lab.fr/

It is estimated that 2/3 of the calls (voice services) and 90% of data services (e.g., Internet access) using wireless technologies take place indoors. How to plan and design good indoor radio networks has become a paramount issue. However, the vast majority of the work on Radio Access Network (RAN) Planning and Optimisation (P&O) has been done for outdoor rather than indoor. As a result, there lack good indoor RAN P&O tools.

In this project, indoor radio network P&O methods and tools have been developed. The tools may provide up to some 20-30% performance improvements, reduce power usage and radio wave pollutions (thus reduce the health concerns) of indoor radio systems, and improve information security (due to the reduction of signal leakage).

The results of the project are as follows:

1. Research and develop fast and accurate radio propagation models that can be used for indoor radio network planning and optimisation.
2. Investigate various issues arising from the use of femtocells, for example, the study of interference between femtocells, between femto and outdoor macrocells.
3. Investigate how to effectively reduce power usage and radio wave pollutions in indoor environment.
4. Develop an automatic indoor radio network planning and optimization tool suite that will fill the gap in the indoor RAN P&O market.
5. Facilitate knowledge integration and transfer between project partners, to enable cross-fertilization between radio propagation modeling, wireless communications, operations research, computing, and software engineering.
6. Strengthen existing and create new strategic long-term collaborations between the participants and reduce the fragmentation in EU research in this vital area.

The objectives have been implemented by 138 PMs (Person Month) staff exchange and 114 PM new recruitments.

Achievement of these objectives lead to fast and accurate indoor radio propagation models and advanced indoor radio network P&O tools that can be used to plan and optimize WiFi, UMTS/HSPA/LTE, WiMAX for indoor coverage and in interaction with outdoor systems. During the first period we developed two methods respectively based on finite elements and ray-tracing (T1.1, T1.2). These methods were coupled for indoor-outdoor simulations during period 2 (T1.3).

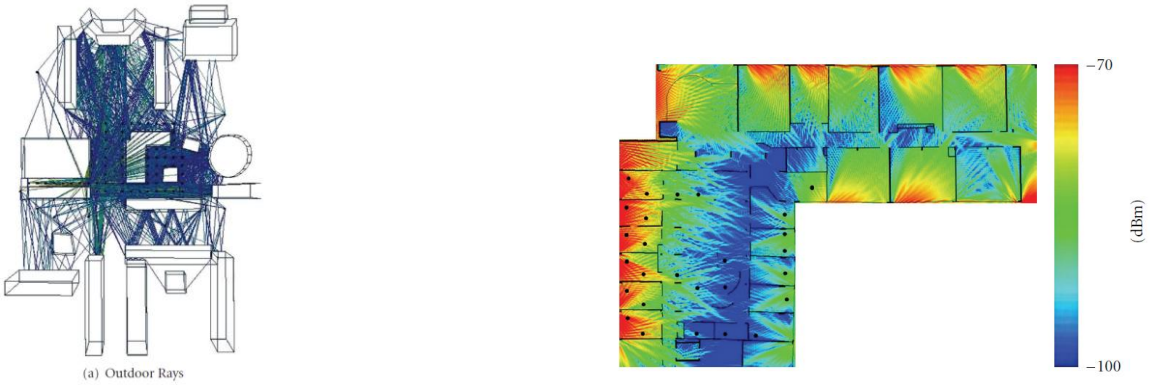

Figure 1: (a) outdoor rays (b) associated Indoor coverage in the central building

Experimental measurements were also conducted during second period (T1.4). These methods were integrated in unique software (T3.2). An LTE system level simulator (T2.1) has been developed which exploits simulation predictions of small cells efficiency. Interference models between femtocells and cellular networks have been studied (T2.2). Algorithms for distributed femtocell optimization has been investigated as well as handover techniques (T2.3 and T2.4)

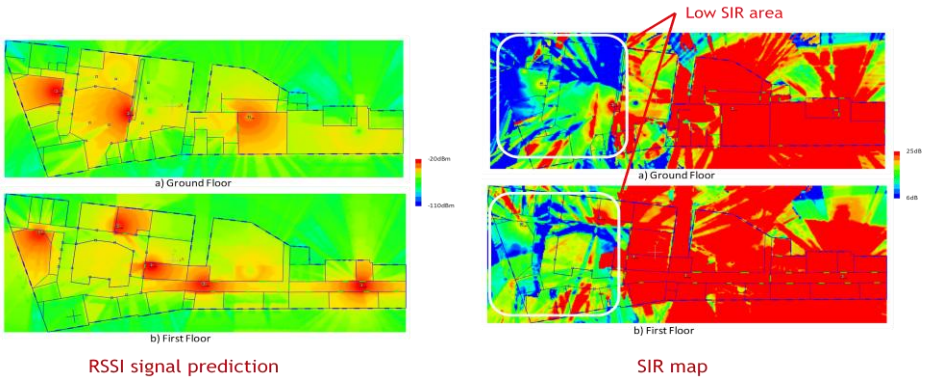

Figure 2: Downlink system-level simulation when using closed access

Last but not least, iBuildNetTM, an in-building radio network planning and optimization (P&O) tool (T3.1) has been developed during first period and has been consolidated and extended for network planning in period 2 (T3.3).

Figure 3: screenshot from iBuildNet providing a 3D view of coverage simulation in a building