3D BSS geometric indicator for WLAN planning

Pr. Alexandre CAMINADA
UTBM / SET and INRIA /ARES
Main topic

- **WLAN planning**: locate transmitters and set their parameters

- Large indoor/outdoor networks (several buildings or floors): **algorithms are required**

- Planning concept issued from mobile networks: **cells are structured** => MODEL
Contents

1. The BSS structure problem
2. The geometric indicator
3. The tests
Radio network planning is

- Selecting several locations (set of \((x,y,z)\))
- To install transmitter pattern (among a set)
- With a given orientation (among 360°)
- At a given transmitting power (among 5)
- And a given frequency channel (among \(F\))

- At the **lower cost** and the **higher QoS**
As for instance in this 3D building

- 252 \((x,y,z)\)
- 2 patterns
- 8 directions
- 4 powers

9,072 transmitter configurations

2^{9,072} networks
Let put a transmitter somewhere in the 2\textsuperscript{nd} floor

3D propagation

3D coverage
Let put several transmitters and look at the best server signal

Transmitter location

Best signal

1st: 3 AP
2nd: 5 AP
3rd: 4 AP

8 neighbours

1
2
3

5 channels

5 channels
Contents

1. The BSS structure problem
2. The geometric indicator
3. The tests
Radio Cellular Concept

Cellular Concept

Frequency Reuse

Cell-Splitting
Avoiding bizarre cells

We want circles
Using the model for WLAN needs a 3D measurement

1. Identify the BSS

\[ C = \left\{ b_{(i,j)} / F_{(i,j)} > S_q \right\} \]

\[ G'(C_k) = \sum_{b_{i,j,k} \in C_k} V(b_{i,j,k}) \]

\[ = \frac{\sum_{b_{i,j,k} \in C_k} V(b_{i,j,k})}{8 \times |C_k| - 6 \times \sqrt{\pi \times |C_k|}} \]

2. Compute BSS geometry on one floor

3. And on 3D

\[ G_{WLAN}(C) = \sum_{k=1}^{k=K} \frac{|C_k|}{|C|} G'(C_k) \]
Contents

1. The BSS structure problem
2. The geometric indicator
3. The tests
Control on BSS geometric

Without control

With control
Impact on neighbourhood

Without control

With control

1st

2nd

3rd

4 channels

4 channels

8 neighbours
Impact on location and cost

Without control
12 AP

With control
12 AP
Impact on interference on GSM bench (C/I)

Without control

With control
Some further steps

- Evolution of networks with and without geometry control
- Frequency assignment to assess its real complexity
- Experiments