

New System Analysis Methodology

IEEE 802.16 Presentation Submission Template (Rev. 9)

Document Number: IEEE S802.16m-07/124

Date Submitted:

2007-07-15

Source:

Avi Freedman, Moshe Levin
Hexagon

Voice: +972-52-5620002

E-mail: avif@hexagonltd.com, moshe@hexagonltd.com

Michael Livshitz
Schema

E-mail: michael@schema.com

Baruch Bar
Cellcom

E-mail: baruchba@cellcom.co.il

*<http://standards.ieee.org/faqs/affiliationFAQ.html>>

Venue:

San Francisco, CA, USA

Base Contribution:

IEEE C802.16m-07/124

Purpose:

Adopt the text and changes proposed in IEEE C802.16m-07/124 into the Evaluation Methodology Document

Notice:

This document does not represent the agreed views of the IEEE 802.16 Working Group or any of its subgroups. It represents only the views of the participants listed in the "Source(s)" field above. It is offered as a basis for discussion. It is not binding on the contributor(s), who reserve(s) the right to add, amend or withdraw material contained herein.

Release:

The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.

Patent Policy:

The contributor is familiar with the IEEE-SA Patent Policy and Procedures:

<http://standards.ieee.org/guides/bylaws/sect6-7.html#6>> and <http://standards.ieee.org/guides/opman/sect6.html#6.3>.

Further information is located at <http://standards.ieee.org/board/pat/pat-material.html>> and <http://standards.ieee.org/board/pat> >.

New System Evaluation Methodology

Avi Freedman, Moshe Levin
Hexagon System Engineering Ltd.

Michael Livshitz
Schema

Baruch Bar
Cellcom

Realistic Models for System Analysis

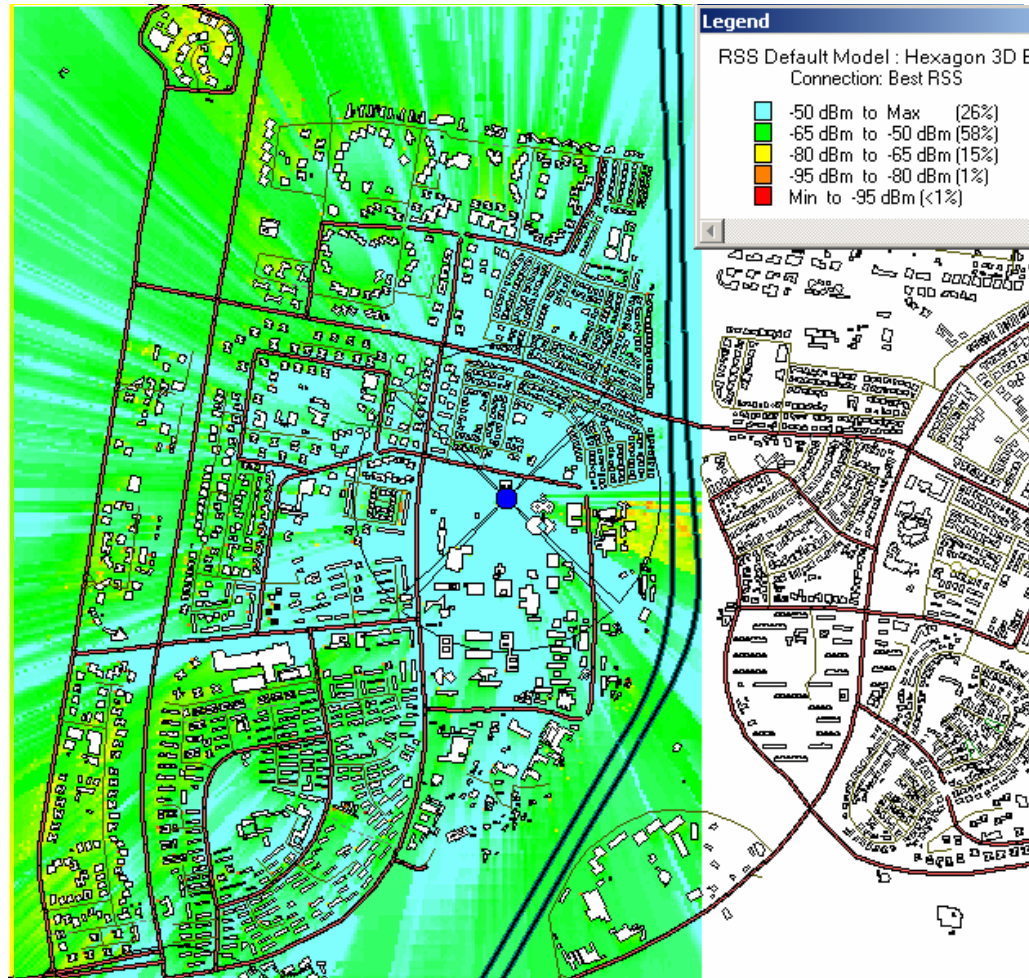
- The 19 wrap around hexagonal cell model is very useful:
 - Symmetric
 - Manageable
 - Used by other bodies
- Path loss and shadowing models suggested for path loss are:
 - Easy to calculate
 - Statistically represents path losses
 - Reproducible

But it is not Realistic!

Real Scenarios

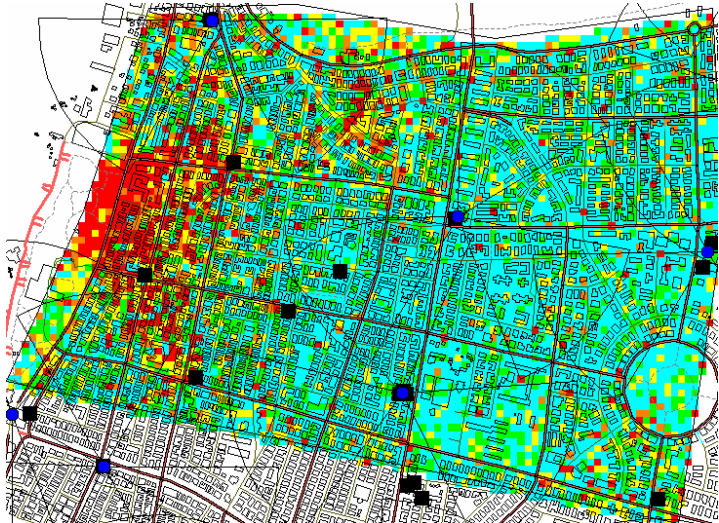
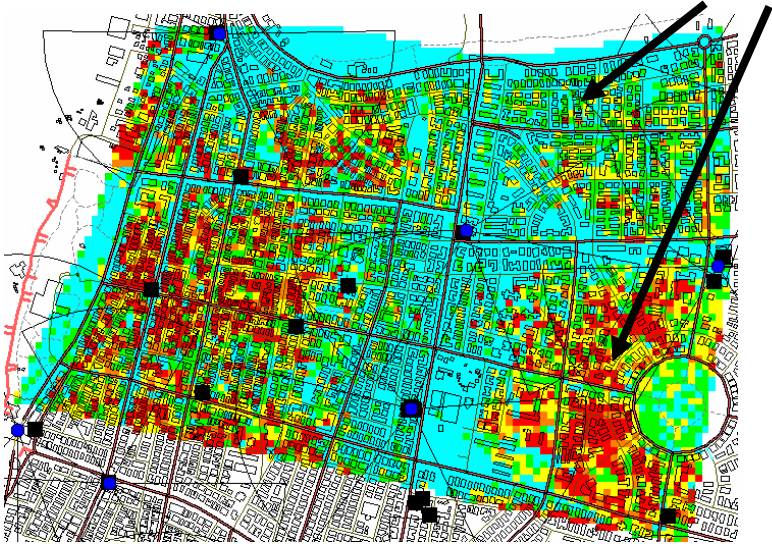
- Cells are not hexagonal
- Cells are not equal
- Cells are not contiguous
- Traffic is not uniform
- Empirical models are pessimistic for propagation but optimistic for interference
- The world is 3D

Realistic Shadowing Effect



Physical Vs. Empirical Model

known interfered areas in current GSM network



Range	Color	Distribution
Min to 50%	Red	12.571 %
50% to 60%	Orange	4.948 %
60% to 75%	Yellow	18.336 %
75% to 85%	Green	20.489 %
85% to Max	Cyan	43.653 %

MKE-526

Probability Legend

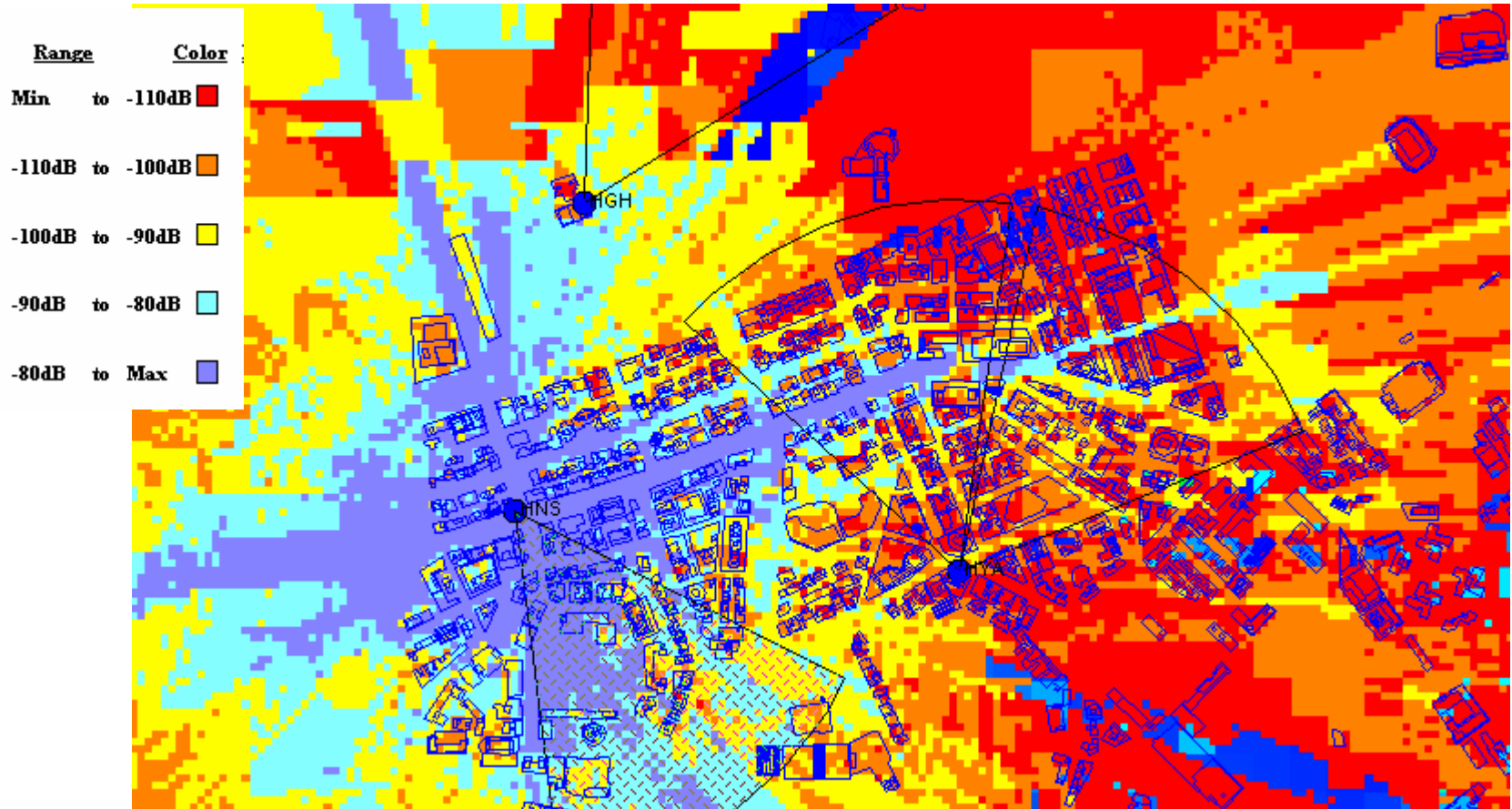
Using Link Matrix

Connection: Best Pilot C/I

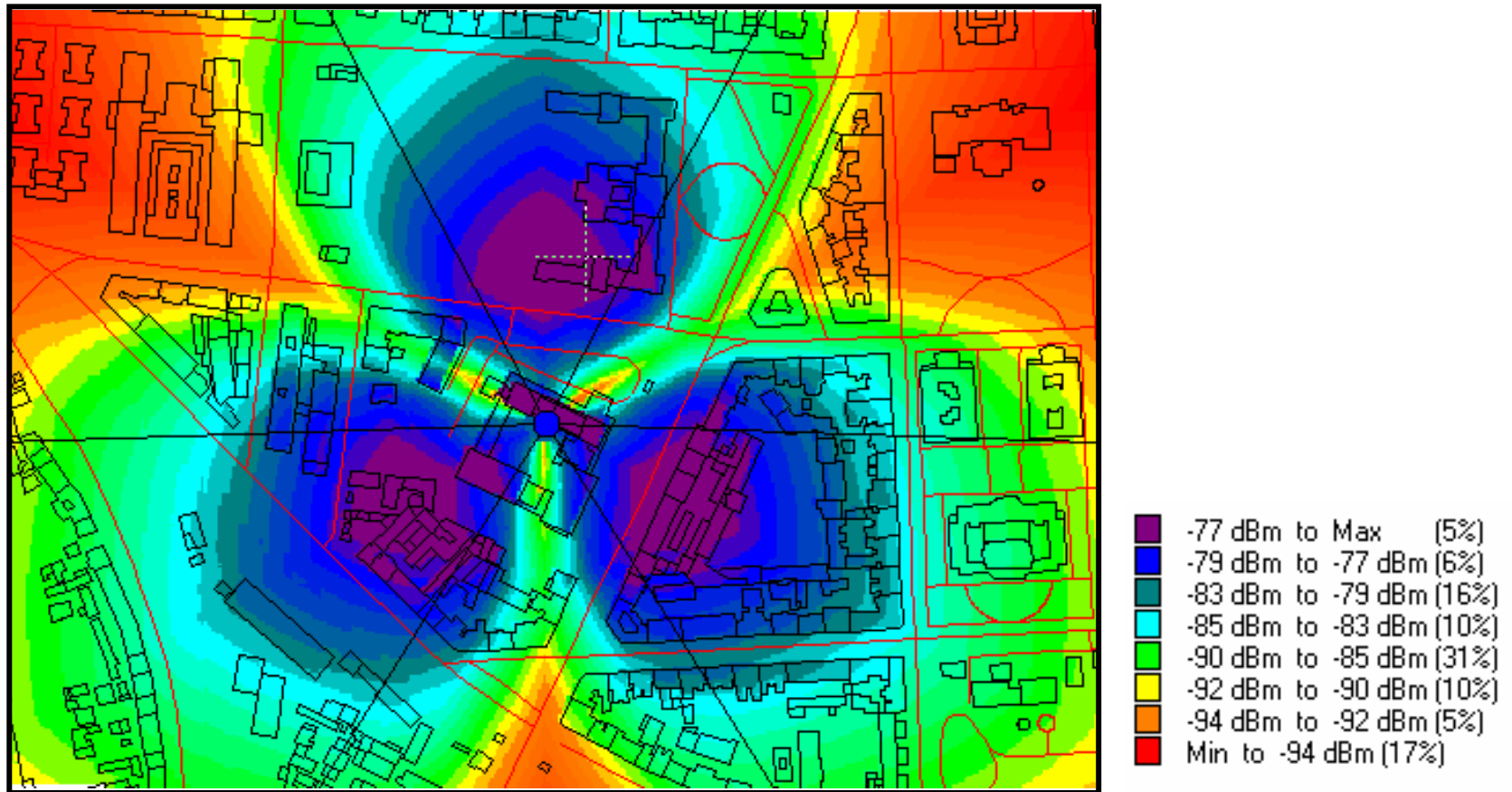
HATA

Range	Color	Distribution
Min to 50%	Red	7.275 %
50% to 60%	Orange	5.452 %
60% to 75%	Yellow	15.176 %
75% to 85%	Green	18.232 %
85% to Max	Cyan	53.863 %

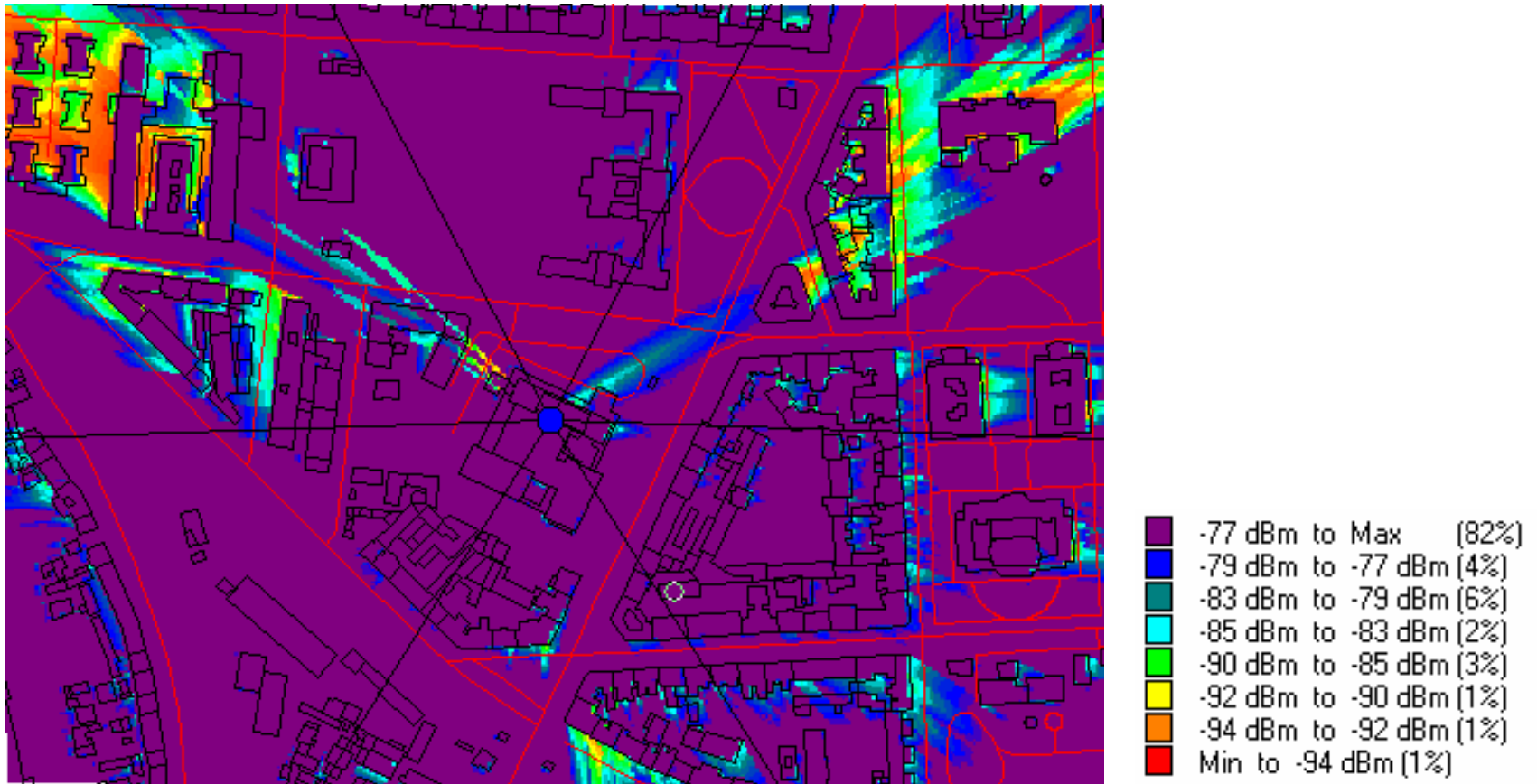
Waveguide Effect



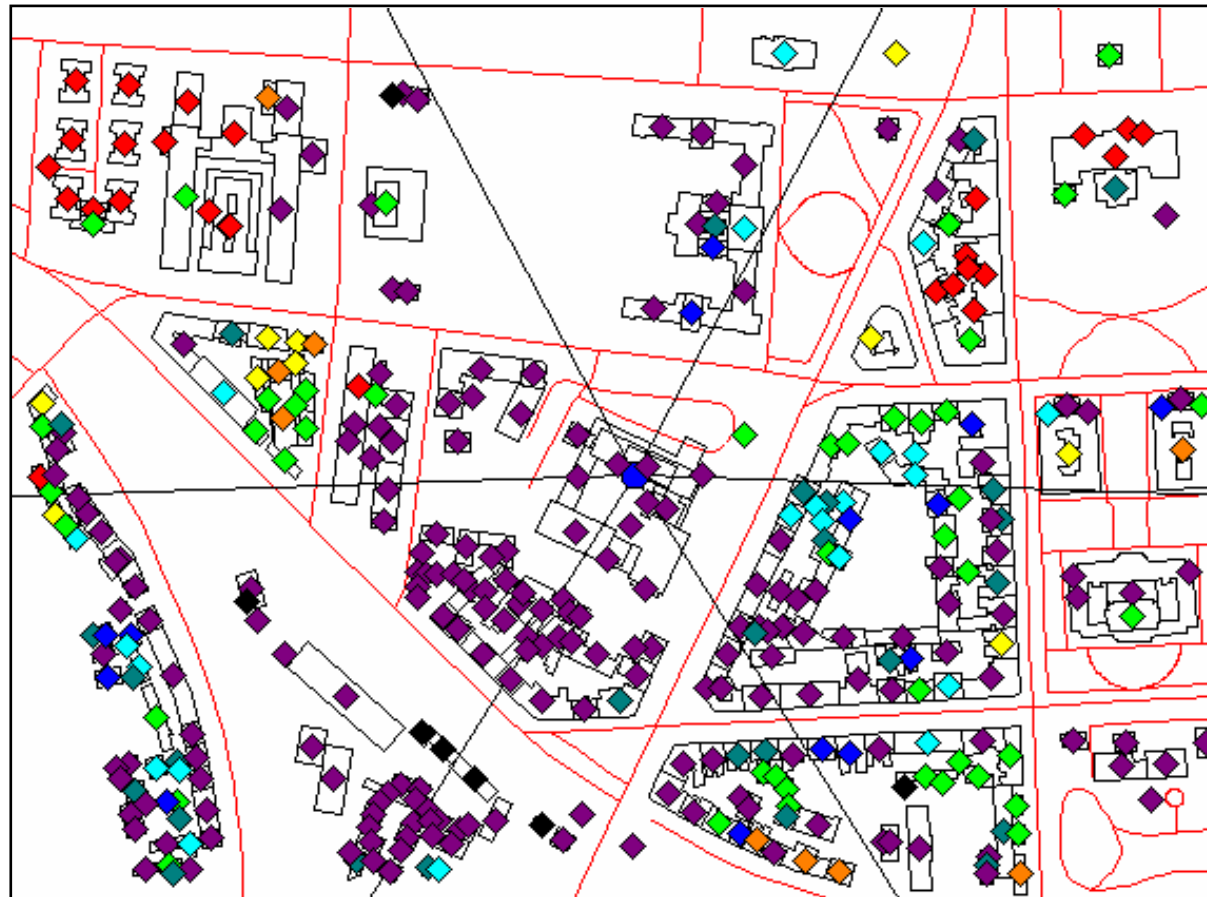
COST-HATA MODEL



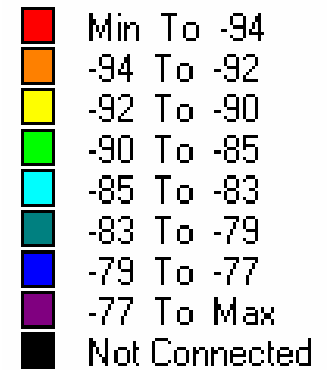
Physical Model - Outdoor



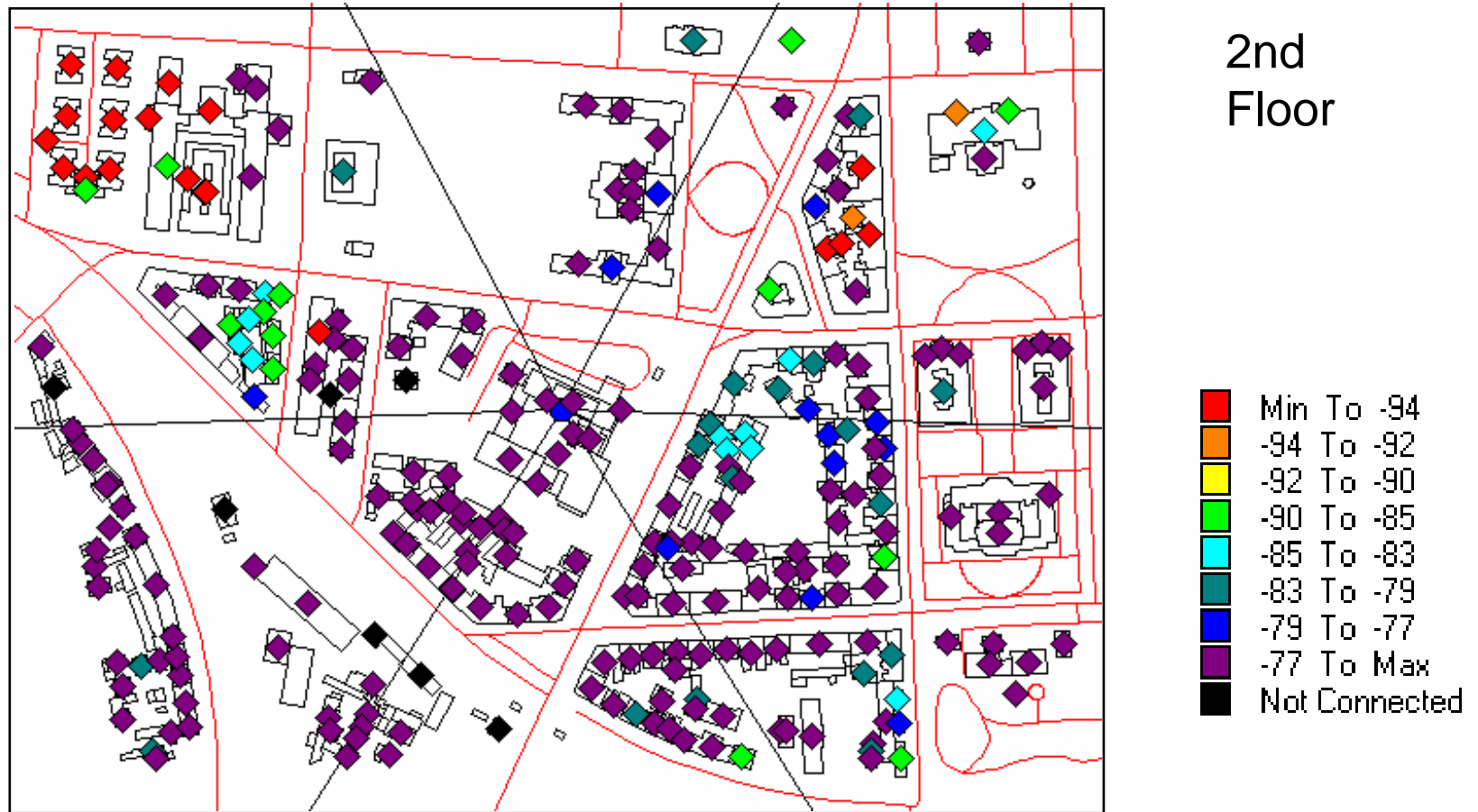
Physical Model - Indoor



Ground
Floor



Physical Model - Indoor



Physical Model - Indoor



Evaluation Errors

- Disadvantage to range-capacity trade off vs. optimization to a given range
- Is a fixed interference cancellation a benefit?
- How applicable is fractional frequency reuse?
- What about antenna tilting?

Proposal for Additional Evaluation

- Add to system evaluation a real scenario for
 - sanity check
 - demonstration of “deployability”
- Select a couple of real regions including
 - Mixed terrain
 - Set of clutters
 - Non-uniform user traffic
 - An existing cellular system base station sites
- Use a high density grid of measurement points, indoor and outdoor
- Use pre-calculated path losses, using a PHYSICAL model (knife-edge...ray tracing)
- NO SHADOW FADING
- Plug and “play” in the existing simulation

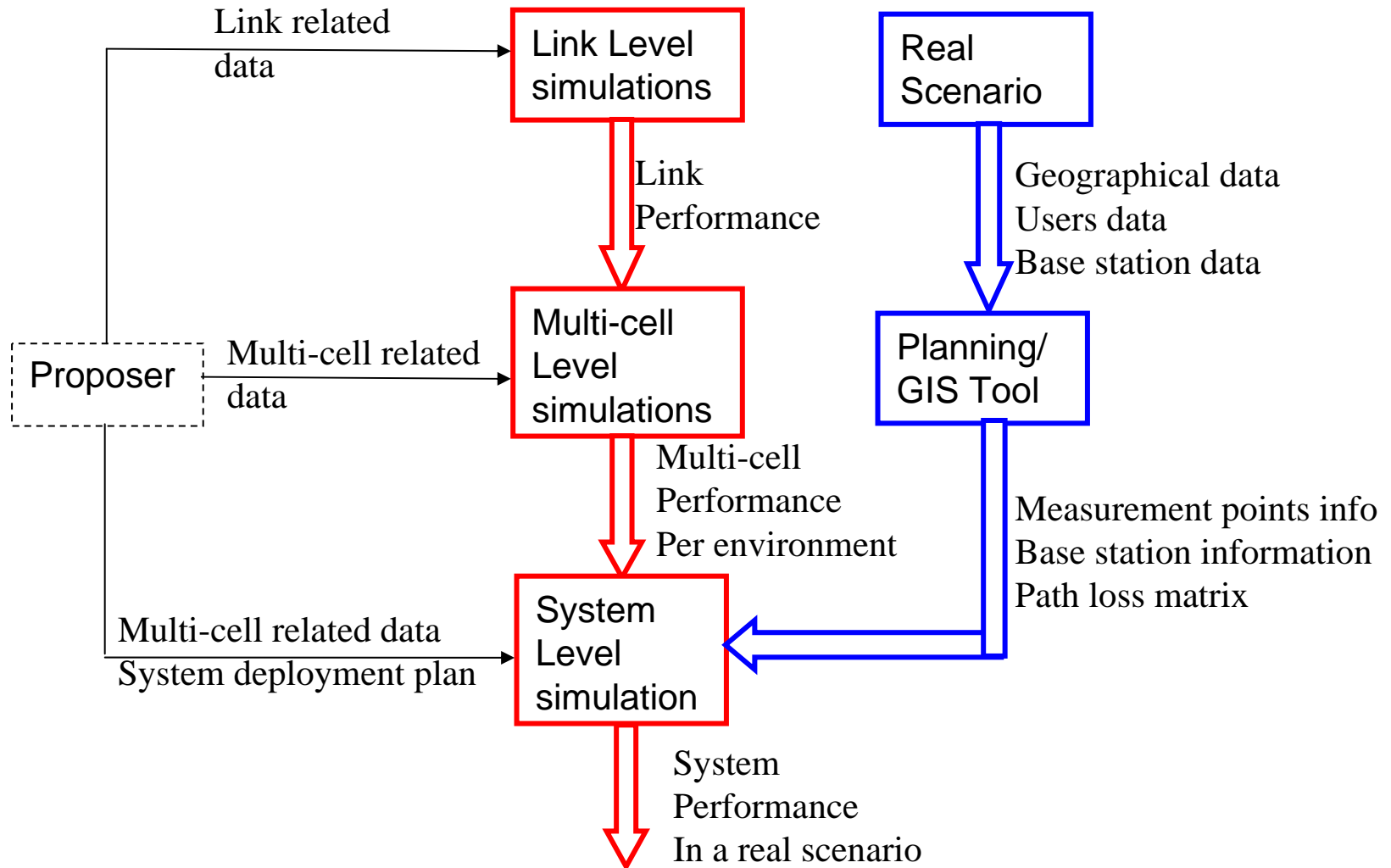
Physical (“deterministic”) models

- Multiple knife Edge as per ITU-R P.526-10
 - Based on diffraction only
 - Finite screen widths for buildings
 - Deygout method for multiple knife-edge case

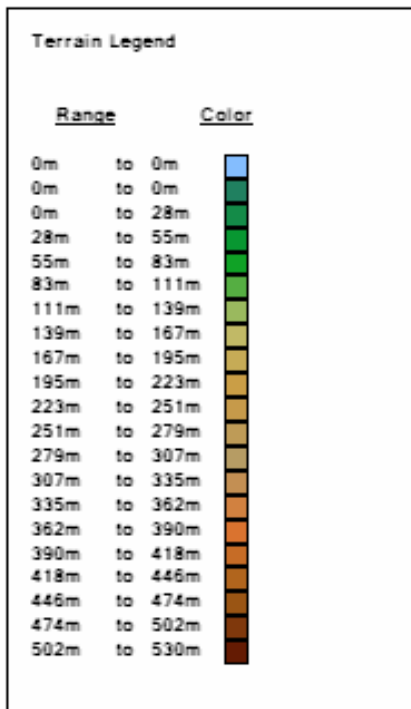
Distinguishes between LOS and NLOS

Replaces Path loss and shadow fading
- Ray tracing
 - Applicable for urban microcell scenarios
 - May replace cluster level randomization

Evaluation Process



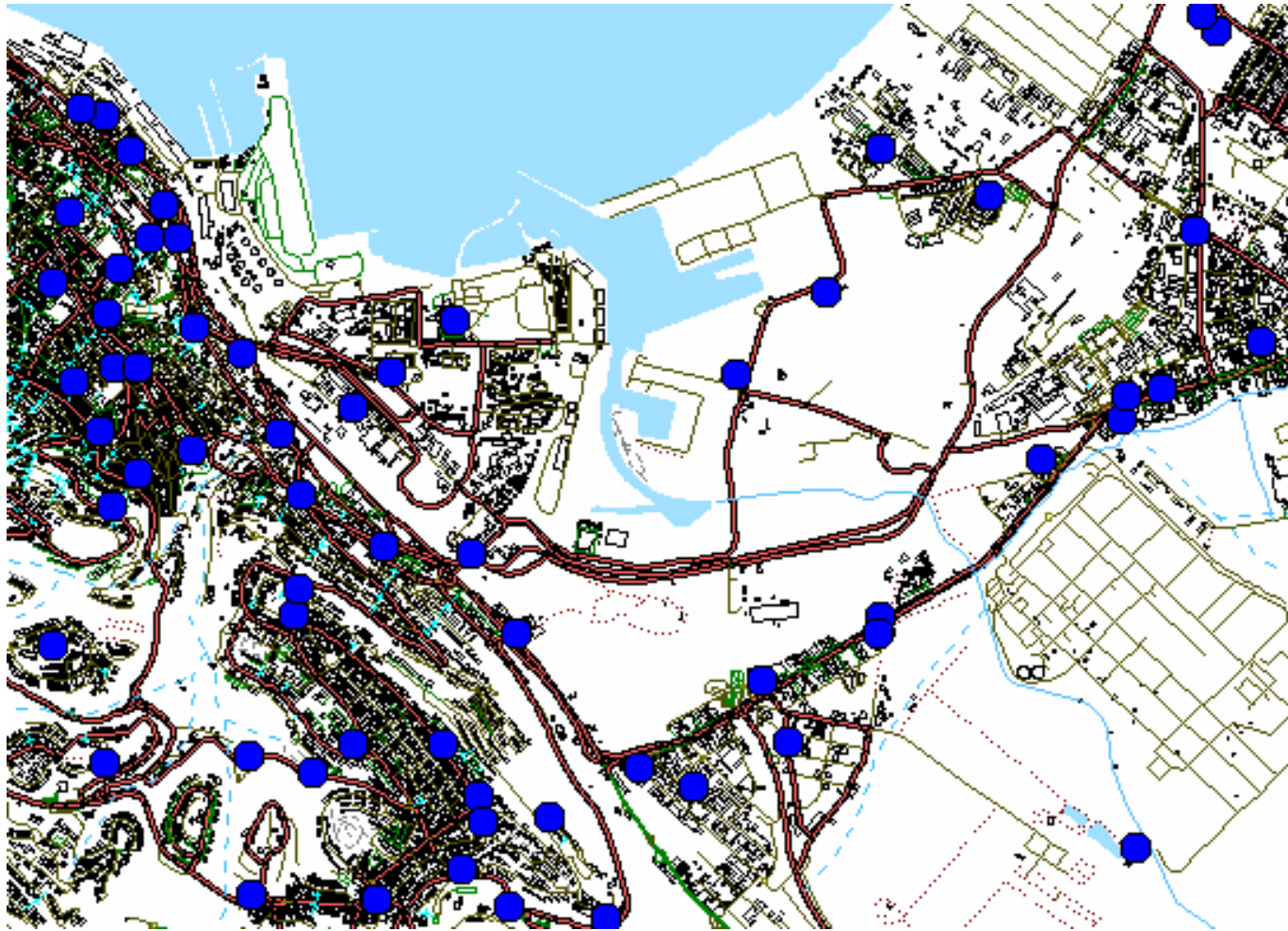
Terrain and Buildings



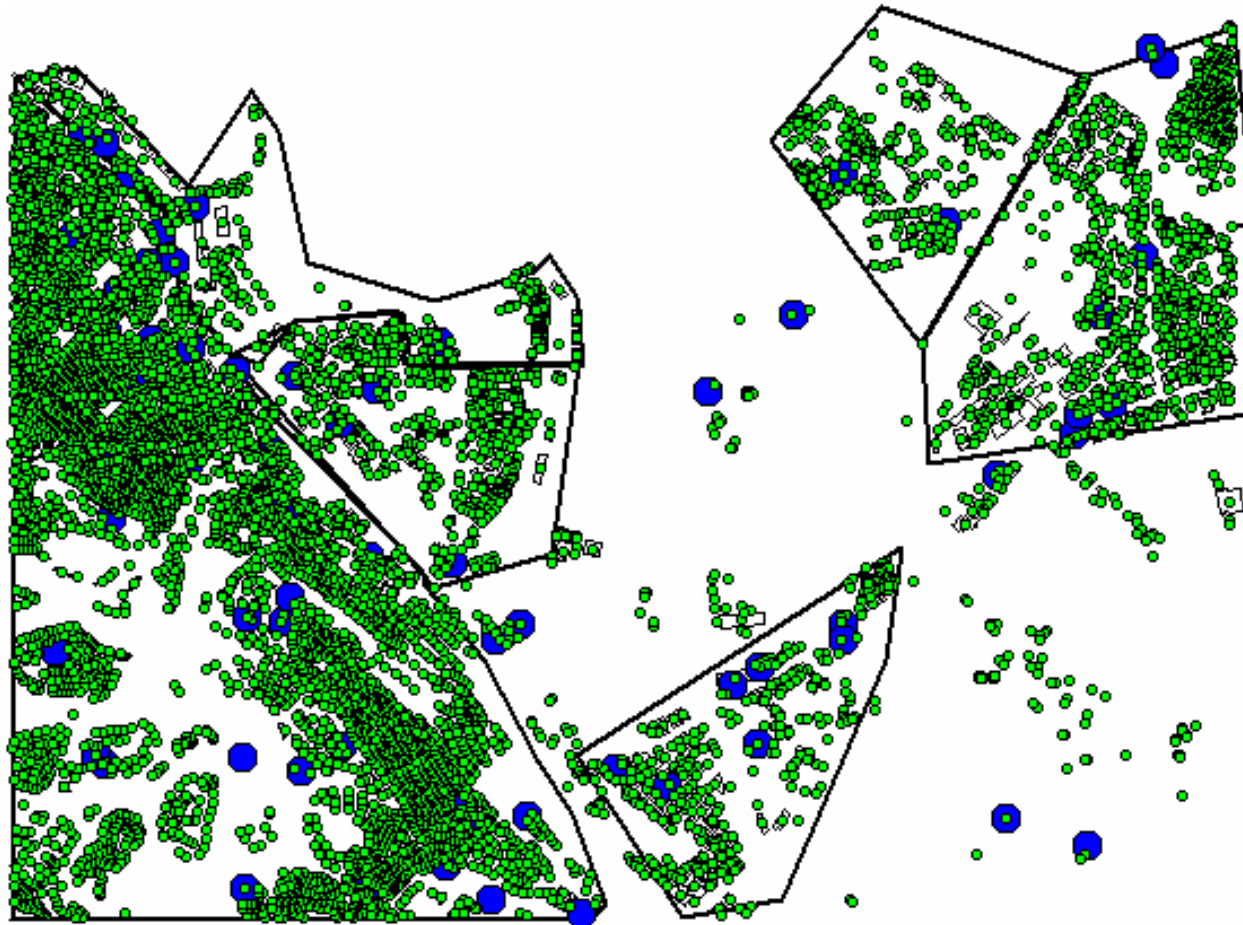
User and Traffic Density



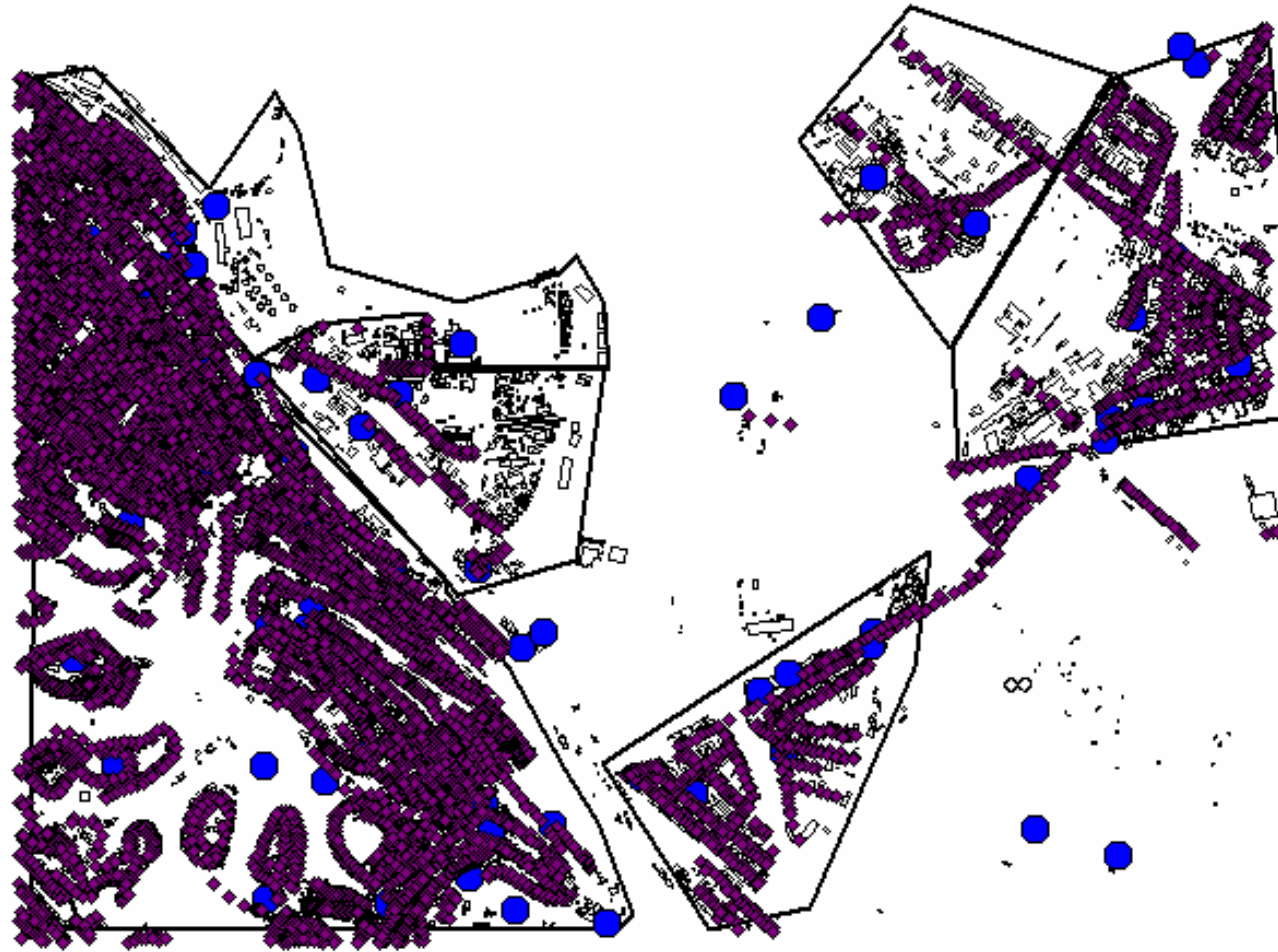
Base Station Locations



Indoor Measurement Points



Outdoor Measurement Points



Multi-cell vs. System level simulations

- MS drops are performed by selecting measurement points
- The number of MS's dropped is per user density data
- The path loss is pre-calculated
- No shadowing should be added to the pathloss
- Channel models are selected for each link individually
- Ray tracing results can be used as a basis for the channel model in urban micro-cellular cases.
- Mobile movement is simulated by selecting a track along actual streets and roads.
- Parameters are evaluated over the entire area

Proposed Text Changes

- Replace current “System Level Simulation” with “Multi-cell level simulation”
- Definition of a deterministic propagation models for system level simulation
- Explicit procedures for system level simulations
- Adding Annex J with scenario description and required data