# Grid-Enabled Real-Time 3D Ray Tracing for Wireless Network Simulation and Planning

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CONTEXT

- 3D Ray Tracing Algorithms are used in wireless propagation deterministic models. Much literature has investigated this area and yet the time spent on simulating rays is still high.
- grid, as an emerging technique, can aggregate resources from all over the world and benefit the wireless network propagation simulator.
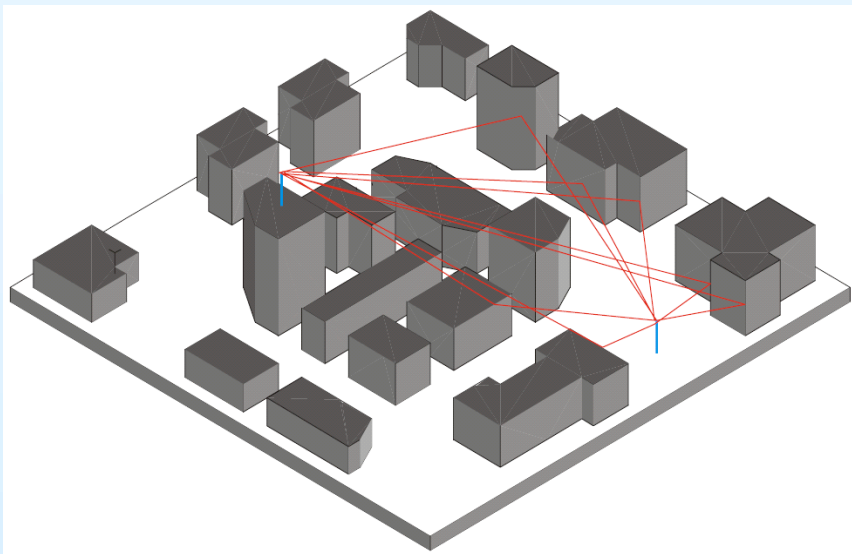
Propagation Scenario in a Typical Urban Environment

OBJECTIVES

- to Improve the speed and accuracy of the 3D Ray Tracing Algorithm used in wireless propagation model
- to Apply the algorithm in Grid Environment
- to Develop a grid-enabled wireless propagation simulator
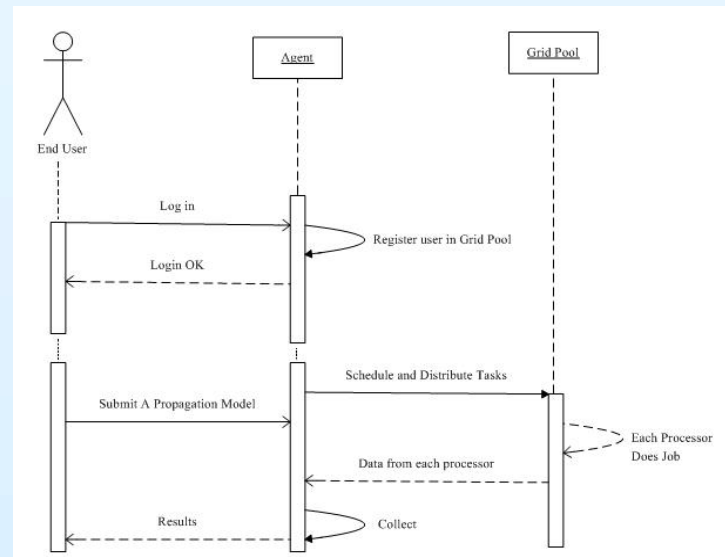
Grid-Enabled Propagation Simulator Sequence Diagram

PROBLEMS

- an Environment Database which contains too many polygons (e.g. thousands) slows down the simulating process.
- too many unnecessary rays slow down the simulating process.
- objects far away from the transmitter will usually be less covered by rays.
- grid benefits the storage of huge propagation environments, which can be fast indexed and accessed, while parallel computation schemes are not well defined.
- parallel schemes can incur lower communication overheads.

SOME THOUGHTS

- an accumulated ray which has nearly the same energy as in Free Space should be marked and further rays are neglected.
- rays that have lost a lot of energy (e.g. 1/6) should be neglected. This usually happens when a ray has reached several levels of reflections or diffractions.
- intersection between lines (rays) and polygons (objects in the scene) lies at the core of the simulation, which is very time-consuming, and could be improved.
- data structures that represent polygons, as well as the environment database should be concise, fast indexed, preventing unnecessary calculations.

References

[1] WinProp Propagation Model and Background Information, AWE Communications GmbH, Germany, 2002.

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[3] Nik Bessis, Tim French, and Zhihua Lai, "Using Grid Technologies to Support Intelligence by Providing a Higher Level of Accuracy in Financial Decision Making", e-Society, IADIS 2007, to be published.

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