

A 60GHz Indoor Wireless TDMA Network

This model of a prototype indoor TDMA-system operating at 60GHz. The system is located on one floor of a building subdivided into offices. Base stations are distributed throughout the floor area to provide coverage for all offices and hallways. Users periodically use mobile stations to access a base station and make a call.

The model demonstrates dependence of the resulting interferences on the parameter frequency reuse factor, traffic load, and a possible time offset of frame starts in different cells. The average outage probability of all connections is calculated and can be observed during run-time. A Tcl animation script visually demonstrates network behavior.

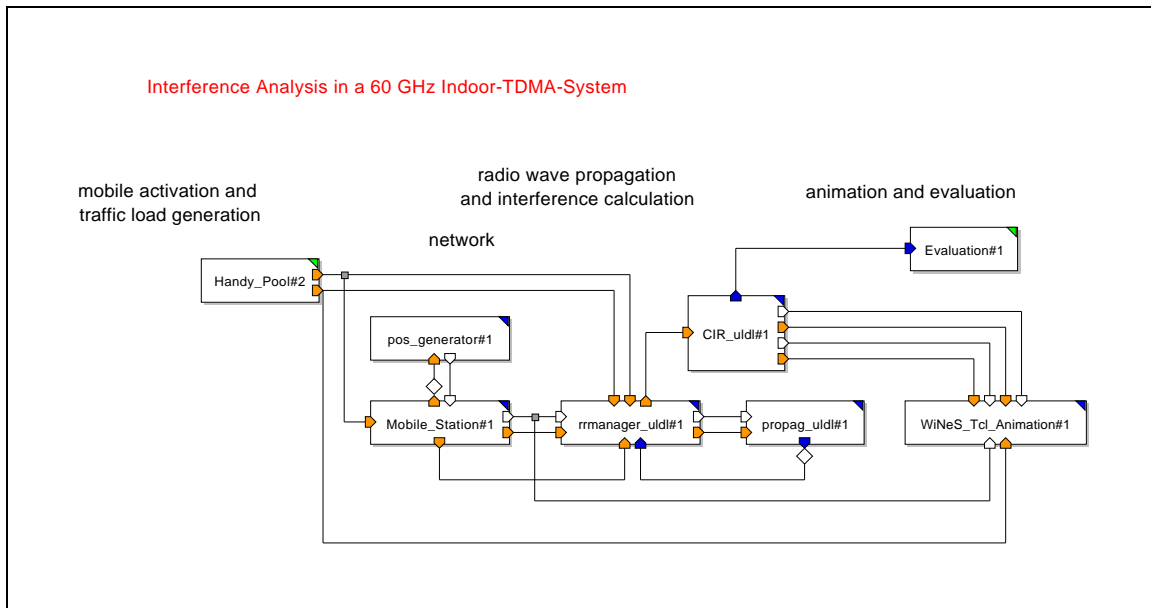


Figure 1: Top-level block diagram

The model is fairly simple. Most of the blocks are primitives (designated by a blue upper right corner). The blocks use particles to pass values rather than data structures.

The model consists of eight main blocks: a Handy (user) pool, a mobile station block, a position generator (pos generator) block, a manager block, an interference generator block (CIR_uld#1), a block to calculate path loss (propag.uld#1), an animation block (WiNeS_Tcl_Animation#1) that demonstrates network operations, and an evaluation block that generates statistics documenting network operations.

tions are shown at their position; all connections are denoted by yellow arrows. Orange arrows show interferences which are caused by other mobile stations, while red arrows show interferences which are caused by transmissions from other base stations. All interferences are measured in the uplink, so the receiving station is always the base station. This animation can be used for debugging and demonstration reasons.

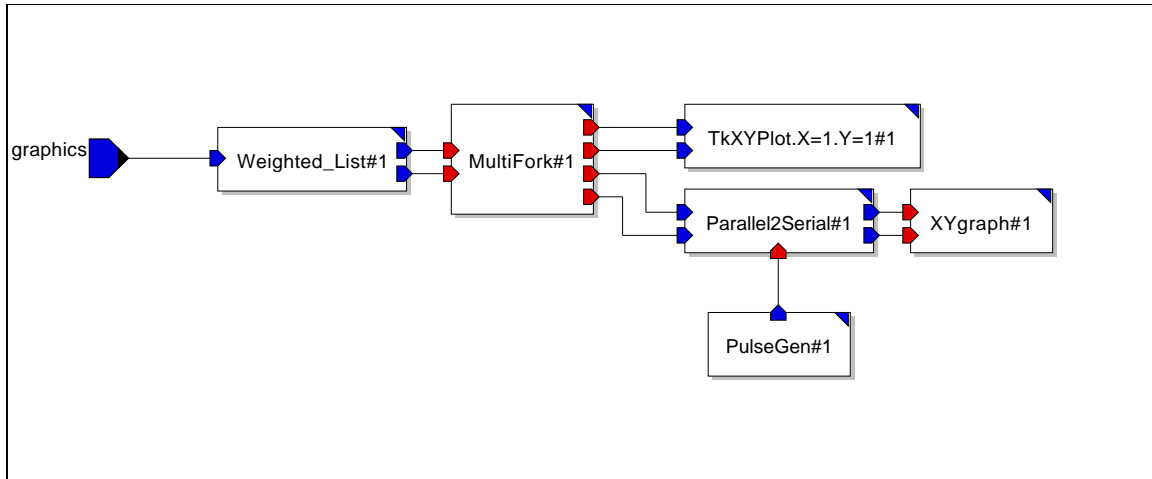


Figure 3: Evaluation block

The evaluation block collects data and generates two graphs showing the probability of outage for the network—a dynamic graph (TkXYPlot.X) that displays while the simulation is executing and a summary graph (XYgraph#1) that displays when the simulation is completed.

Outputs

The animation is shown below. In operation, the mobile stations appear, make connections with base stations (and generate interferences that are displayed on the map) and then disappear when their calls are completed. At the instant this animation was captured one station is connected to a base station (connection shown in yellow) and interference (red lines) is coming from three adjoining base stations.

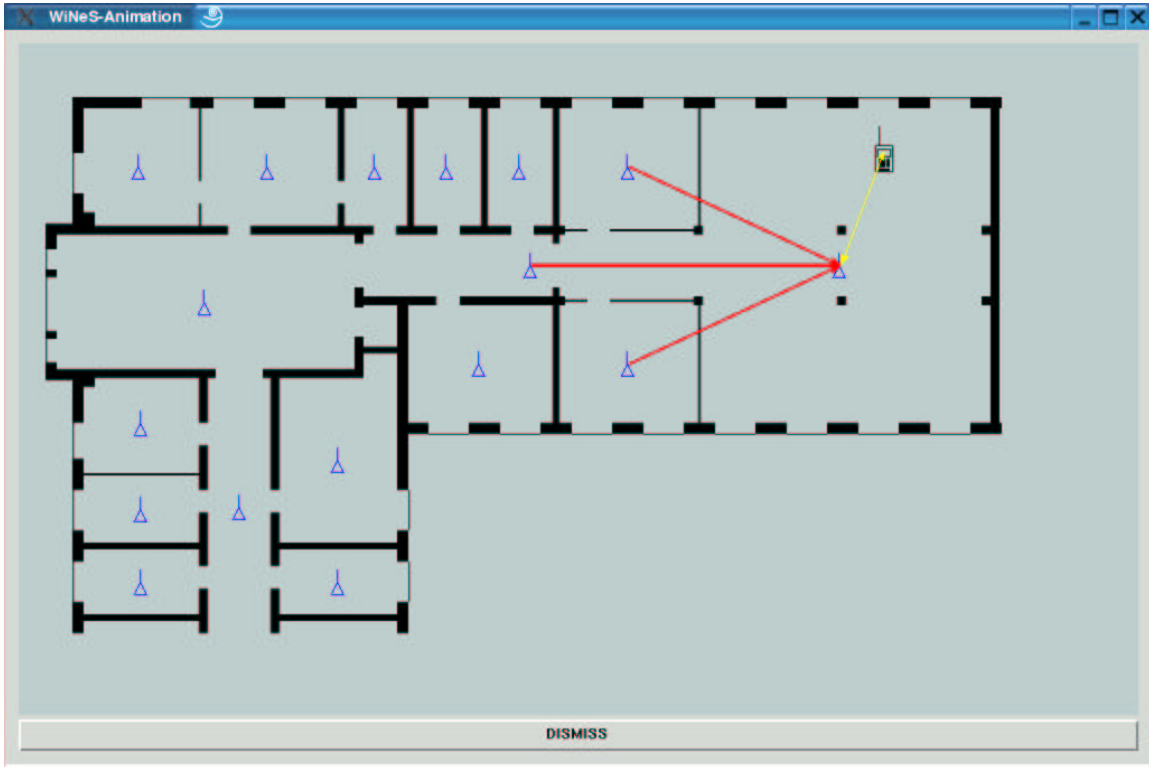


Figure 4: Animation of network operations

In addition to the animation, the model generates a dynamic report showing the probability of outage as shown below.

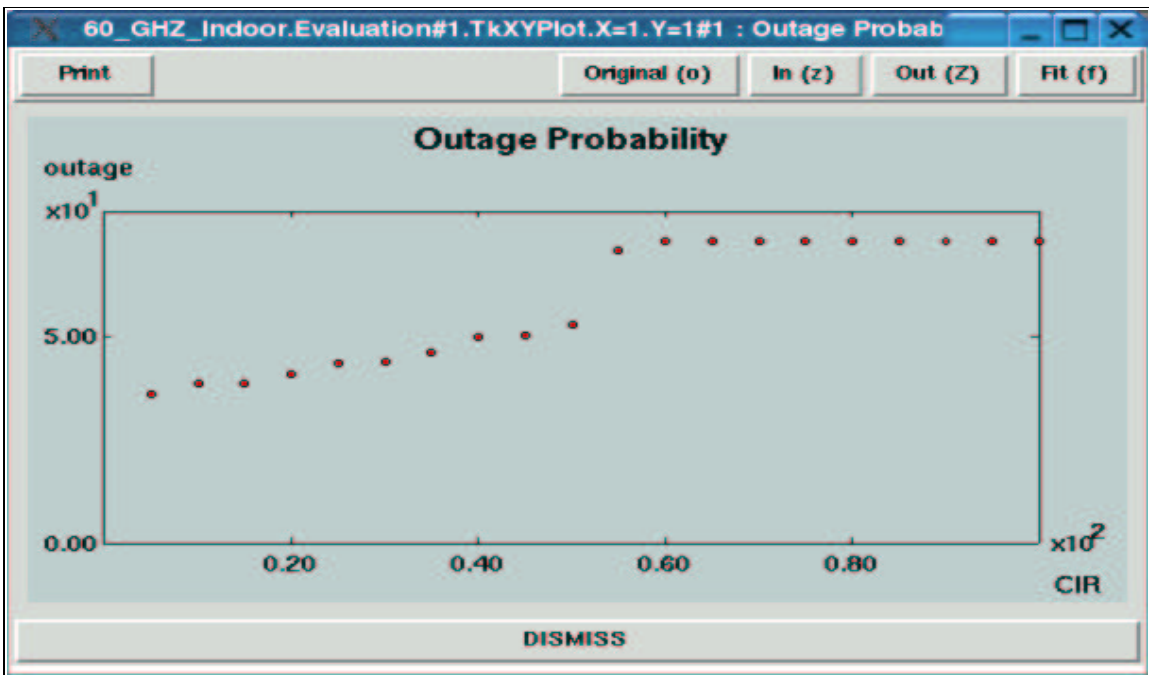


Figure 5: Dynamic report on probability of outage

The summary outage report is shown below.

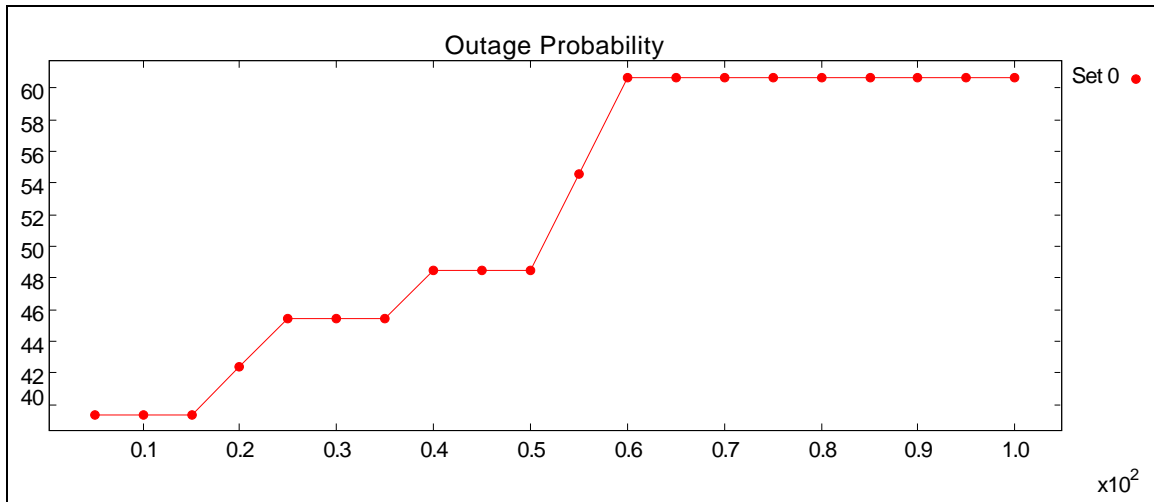


Figure 6: Probability of outage (summary)

Note: This model was developed as a case study for a "Wireless Network Simulator (WiNeS)", a joint research project of the Center for Mobile Communications Systems at Dresden University of Technology and Mannesmann Mobilfunk, a German cellular network operator.