Simulation and Automatic Planning of 300 GHz Backhaul Links

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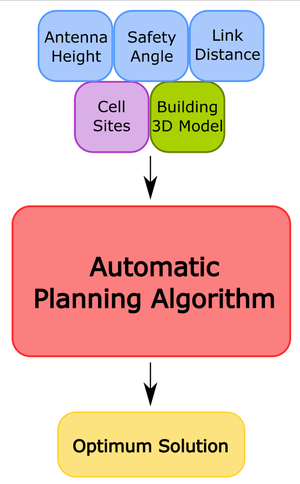
Motivation

- Need of software simulation for proving the possibility of deploying IEEE 802.15.3d Standard
- Modelling of the propagation effect at 300 GHz using 3D ray tracing method including additional atmospheric effects
- Developing proper algorithms for the automatic planning of 300 GHz wireless backhaul links

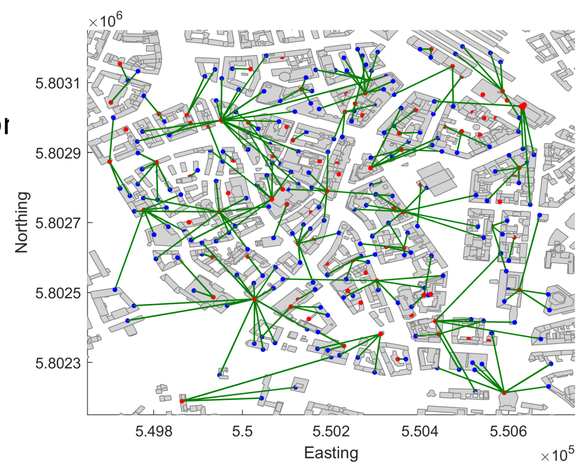
Algorithm development approach

- Identify backhaul required cell sites and create neighbour lists considering link distance and building structures
- Find all possible sets of anchor and remote cell sites
- Sequentially eliminate backhaul required cell sites by assigning a set consecutively until every cell sites possess a backhaul link
- Identify optimum solution depending on operator's policy

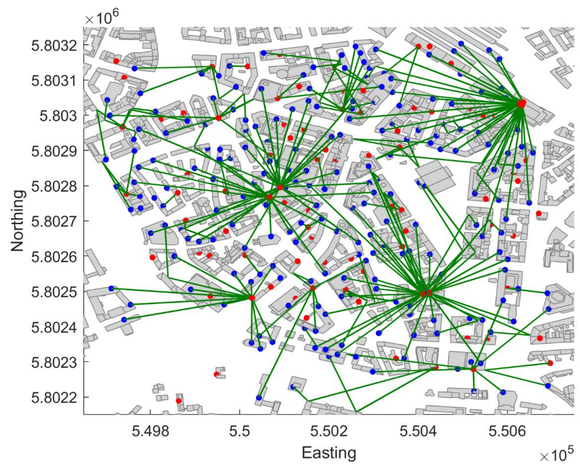


Backhaul Planning Result

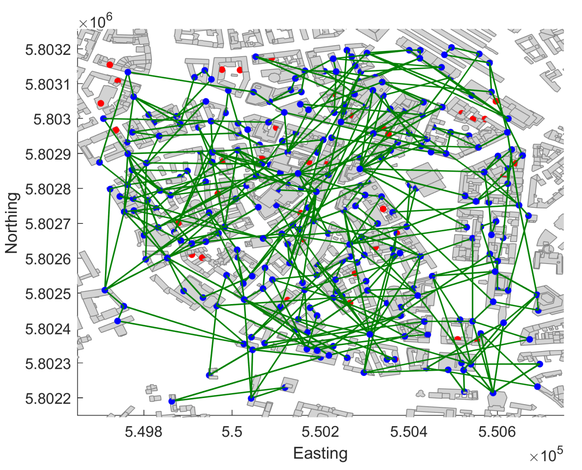
- Hanover scenario
  - 1 km × 1 km throughput-hungry regio
  - 300 new deployed cell sites
  - 1 m antenna height
  - 4 degree safety angle margin of adjacent wireless links
  - 400 m maximum link distance
  - Three topologies



Planned backhaul network using star topology considering only LoS



Planned backhaul network using star topology considering both LoS and NLos

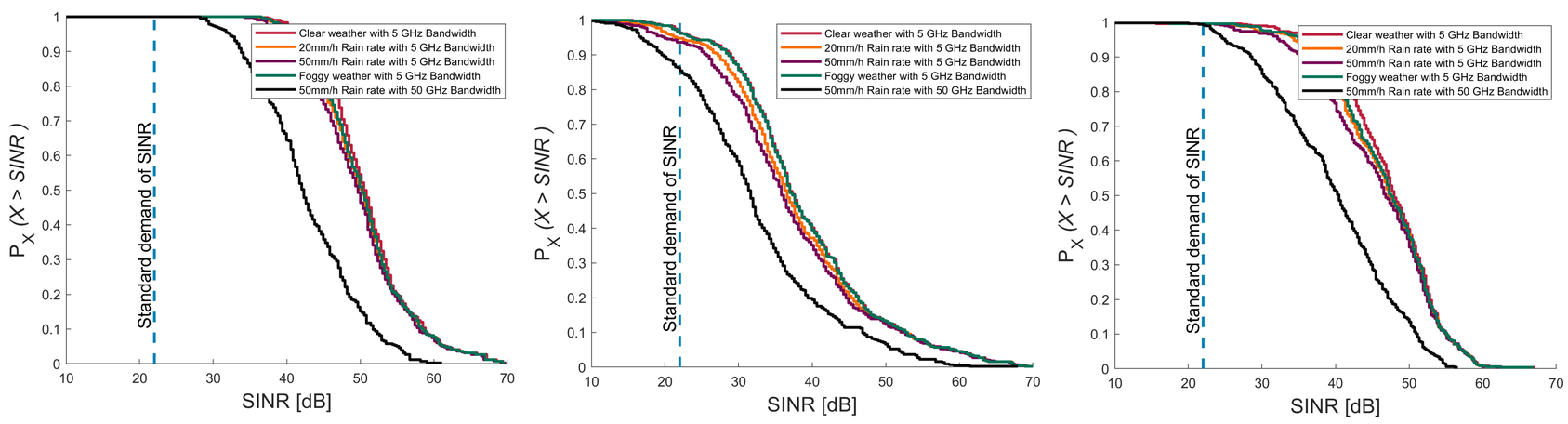


Planned backhaul network using ring topology considering only LoS

- Results
  - Number of anchor sites
    - 88 using star LoS
    - 81 using star LoS and NLoS
    - 143 using ring LoS (orthogonal redundant)
  - Number of wireless links
    - 212 using star LoS
    - 219 using star LoS and NLoS
    - 410 using ring LoS
  - Proportion of fibre backhaul cell sites
    - 29 %
    - 27 %
    - 48 %

SINR Comparison

- Standard demand of SINR stated as 22 dB in IEEE Standard 802.15.3d for the highest modulation and coding scheme (64 QAM and 14/15 FEC)
- Most of THz links planned through star LoS and ring LoS topologies are not threatened applying the highest modulation and coding scheme
- From 3.6 % up to 14.6 % of THz links using star Los & NLoS could not exceed 22 dB depending on the weather conditions



SINR values of THz backhaul links using different types of networking topologies under various atmospheric conditions: Star LoS (left), Star LoS & NLoS (center), Ring LoS (right)

Summary & Outlook

- The developed algorithm can automatically carry out cost optimized wireless backhaul solution
- Most links of the planned backhaul network can apply the highest modulation and coding scheme defined in IEEE standard
- Further simulations will be done using the scenarios explained in ThoR deliverable D2.4 (Definition of Scenarios for Demonstration and Simulation) in Berlin and Shinjuku

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