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Horizon 2020

National Institute of Information and Communications Technology

THOR

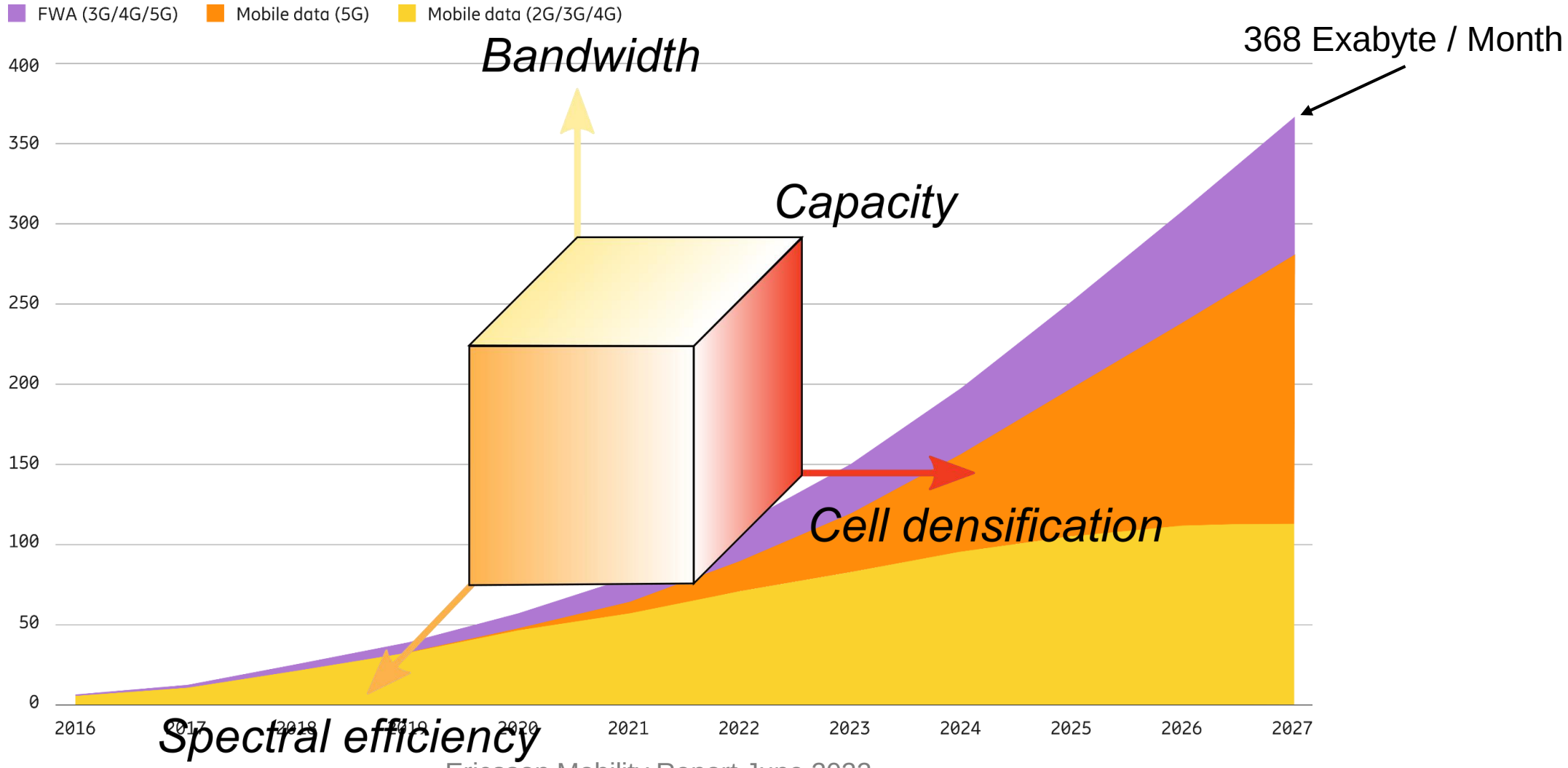
Automatic Planning of 300 GHz Backhaul Links

H2020 EU-Japan Project ThoR Final Workshop
Bo Kum Jung, Braunschweig, 29-30 June 2022

Agenda

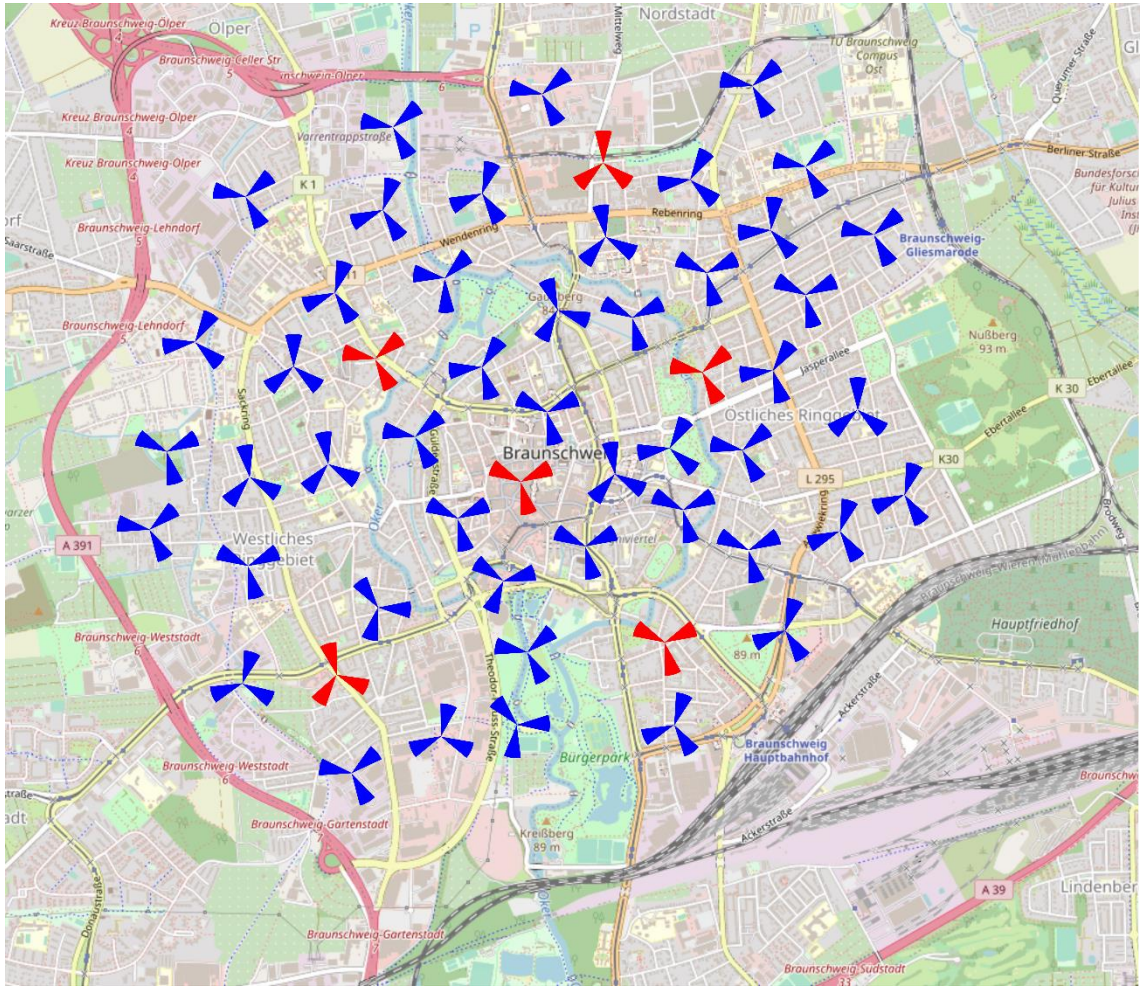
1. Introduction
2. Automatic Planning Approaches
3. Simulation Scenarios
4. Simulation Results
5. Conclusion

Introduction
Why and how increase network capacity



Ericsson Mobility Report June 2022

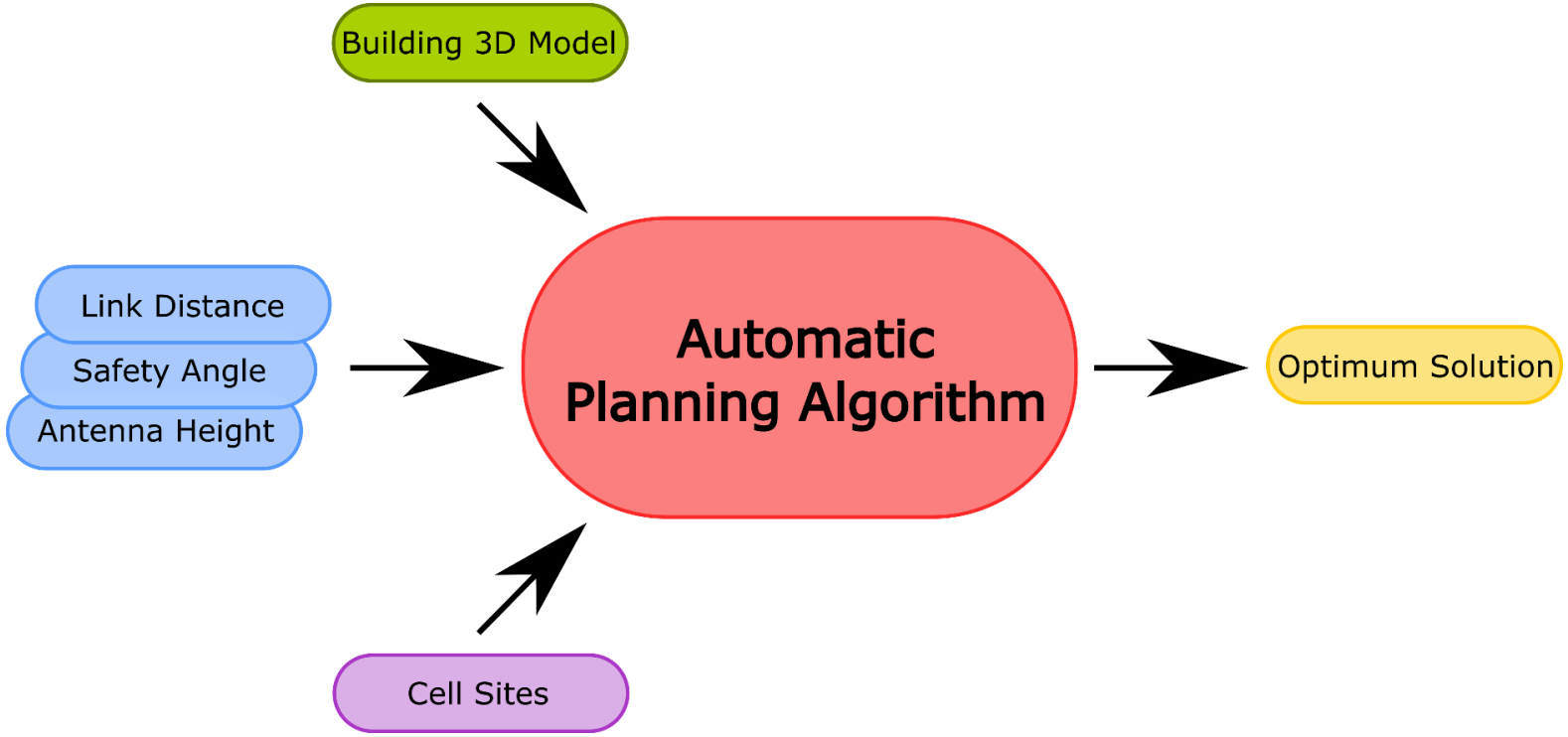
Introduction
Motivation for automatic planning algorithm of 300 GHz backhaul links



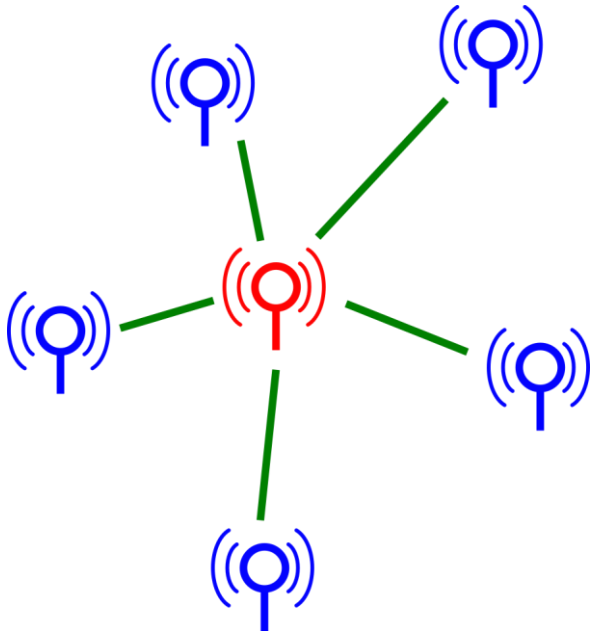
- Cable backhaul
  - Time & Cost intensive
  - Man‘s labour
  - Geographical limits
  - Poor maintenance performance
- Alternative
  - Wireless backhaul operating at 300 GHz
- Tool
  - planning wireless backhaul links

Automatic Planning Approaches
Basic structure of automatic planning algorithm

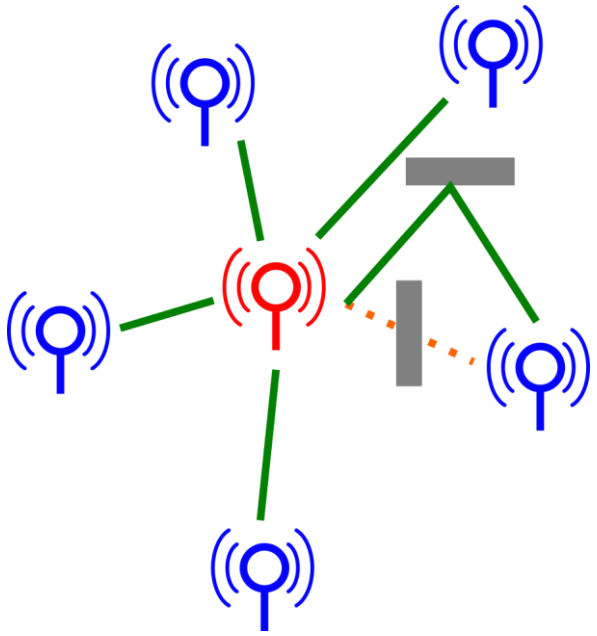
- Provision of wireless backhaul network through automatic planning algorithm
  - Decision of possibly less fibre backhaul connection based on random selection



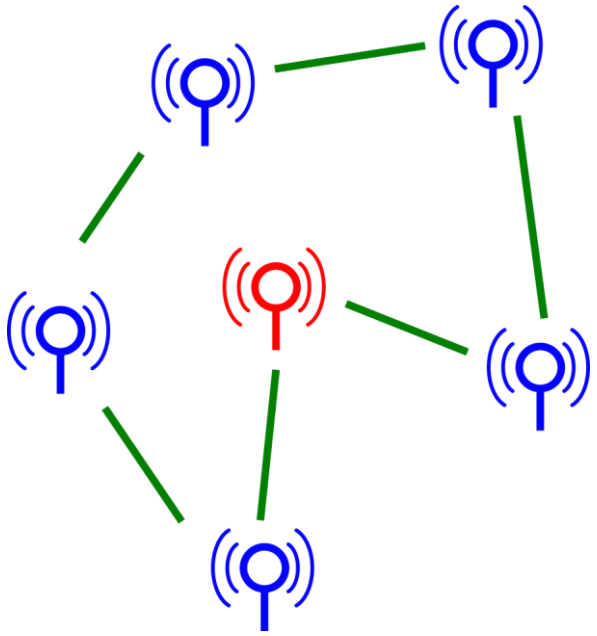
Automatic Planning Approaches
Developed algorithms with different network configuration



Star topology considering only LoS

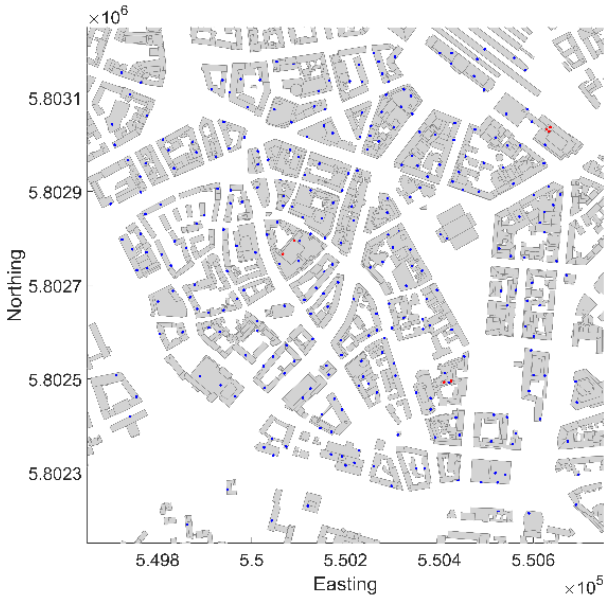


Star topology considering both LoS and NLoS

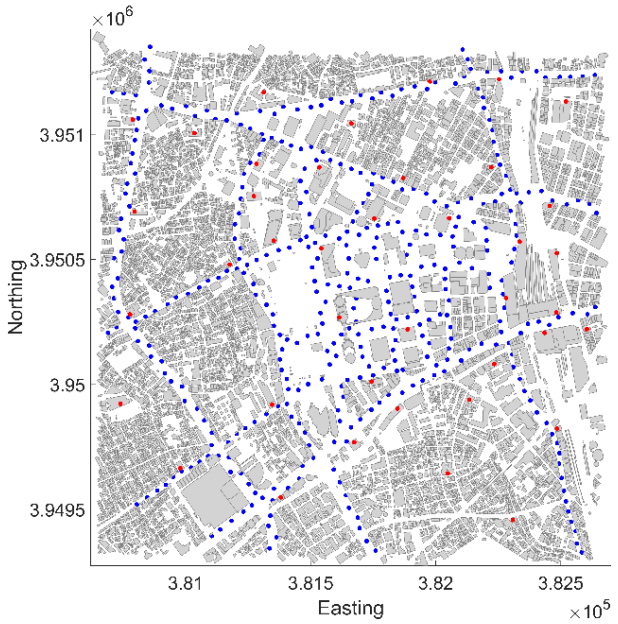


Ring topology considering only LoS

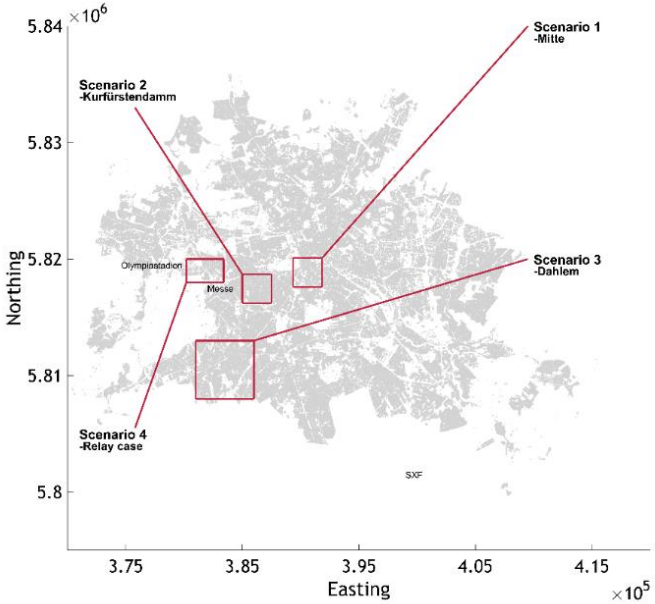
Simulation Scenarios
Overview of designed scenarios



Hanover

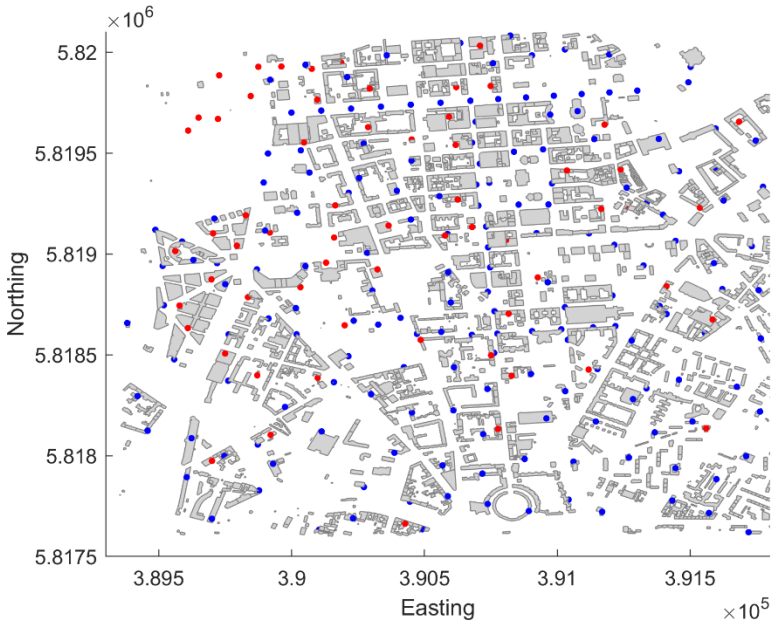


Shinjuku

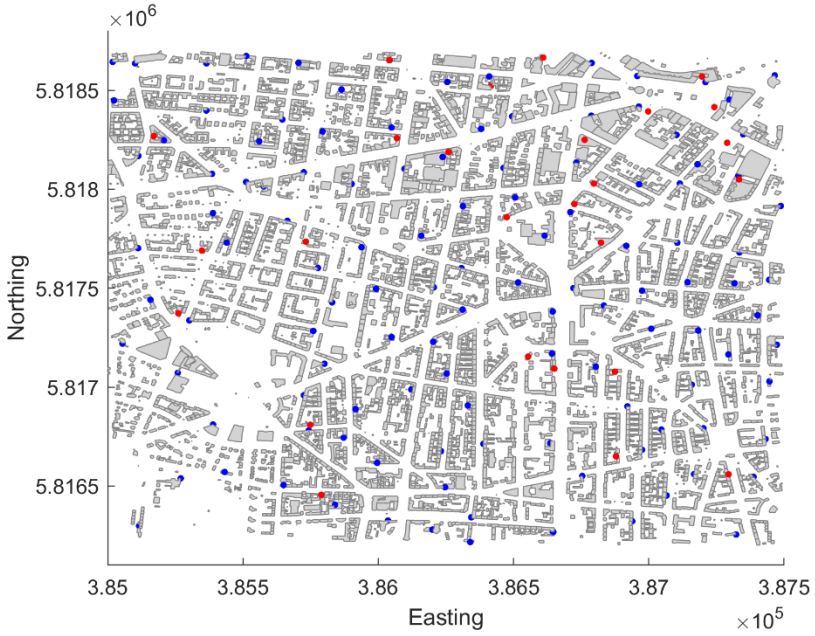


Berlin
(Scenarios 1-3 used in this study)

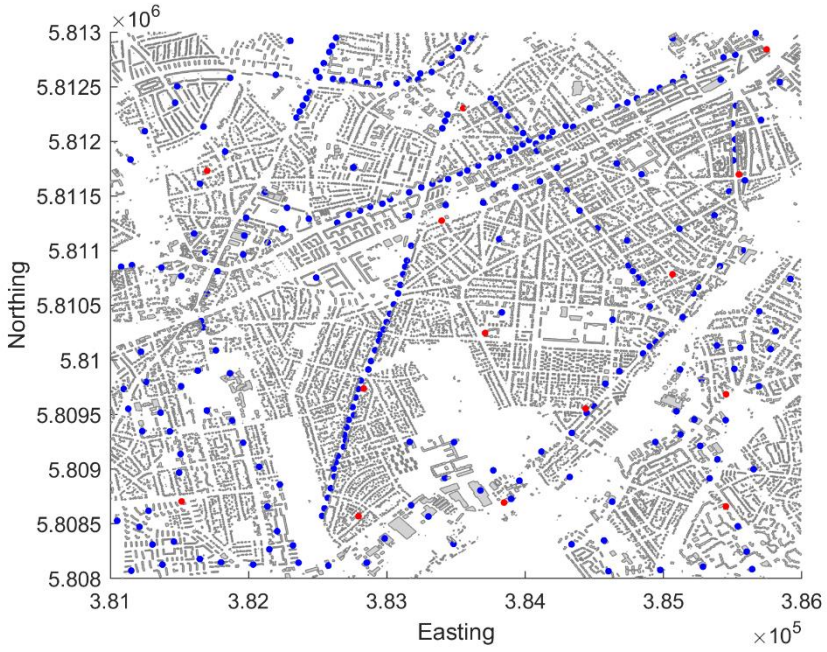
Simulation Scenarios
Overview of designed scenarios



Berlin 1
(Mitte)



Berlin 2
Kurfürstendamm



Berlin 3
Dahlem

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Simulation Scenarios
Comparision of scenarios

	Location	Category	Dimension	MCS density	SCS density
Hannover Scenario	Hannover	High population density	1 km x 1 km	Low	Ultrahigh
Berlin Scenario 1	Berlin Mitte	High population density	2.5 km x 2.5 km	High	Relative high
Berlin Scenario 2	Berlin Kurfürstendamm	Middle population density	2.5 km x 2.5 km	Middle	Middle
Berlin Scenario 3	Berlin Dahlem	Low population density	5 km x 5 km	Low	Low
Shinjuku Scenario	Shinjuku	High population density	2.1 km x 2.1 km	High	High

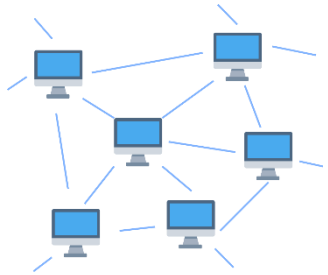
Simulation Scenarios
Simulation configurations

Scenario

- Hannover (1)
- Berlin (3)
- Shinjuku (1)

X

Topology



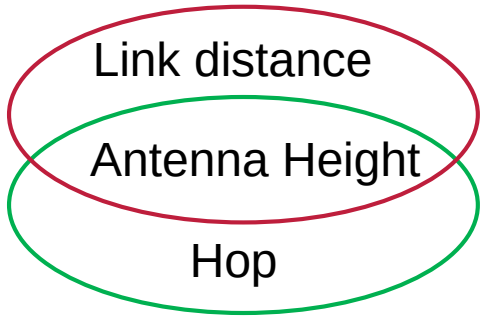
- Star (LoS)
- Star (NLoS)
- Ring (LoS)

X

Input configuration

star

ring



- 5 link distance
  - 100, 200, 300, 400, 500m
- 5 antenna height
  - 1, 2, 3, 4, 5m
- 5 ring candidates
  - 4, 5, 6, 7, 8

X

Weather

Clear
Extreme

- Clear weather
  - 1013.25 hPa air pressure
  - 17 °C temperatur
  - 7.5 g/m water vapour denstiy
- Extreme weather
  - Clear weather +
  - 50 mm/h rain rate
  - 20 m/s north wind

X

Bandwidth

4.32 GHz
51.84 GHz

- Totally 1500 simulation combinations

Conclusion

- Automatic planning algorithms of 300 GHz backhaul links have been developed
  - Three topologies: star LoS, star NLoS, and ring LoS

- Algorithms have been applied to five scenarios
  - Three in Berlin, one in Hanover, and one in Shinjuku

- Analyses of backahul networks have been completed with the help of a holistic tool (SiMoNe)

- Two different bandwidths (5.32 GHz, 51.84 GHz) and two weather conditions (clear, extreme) were considered for performance analyses

- Interference profile is scenario dependent not simulation parameters

- Data transmission with large bandwidth under extreme weather conditions is a challenging task

Thank you for your attention!

ご清聴ありがとうございました

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