

3rd International Workshop on OMNeT++

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A System Design Framework for Scalability Analysis of Geographic Routing Algorithms in Large-Scale Mesh Networks

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Agenda

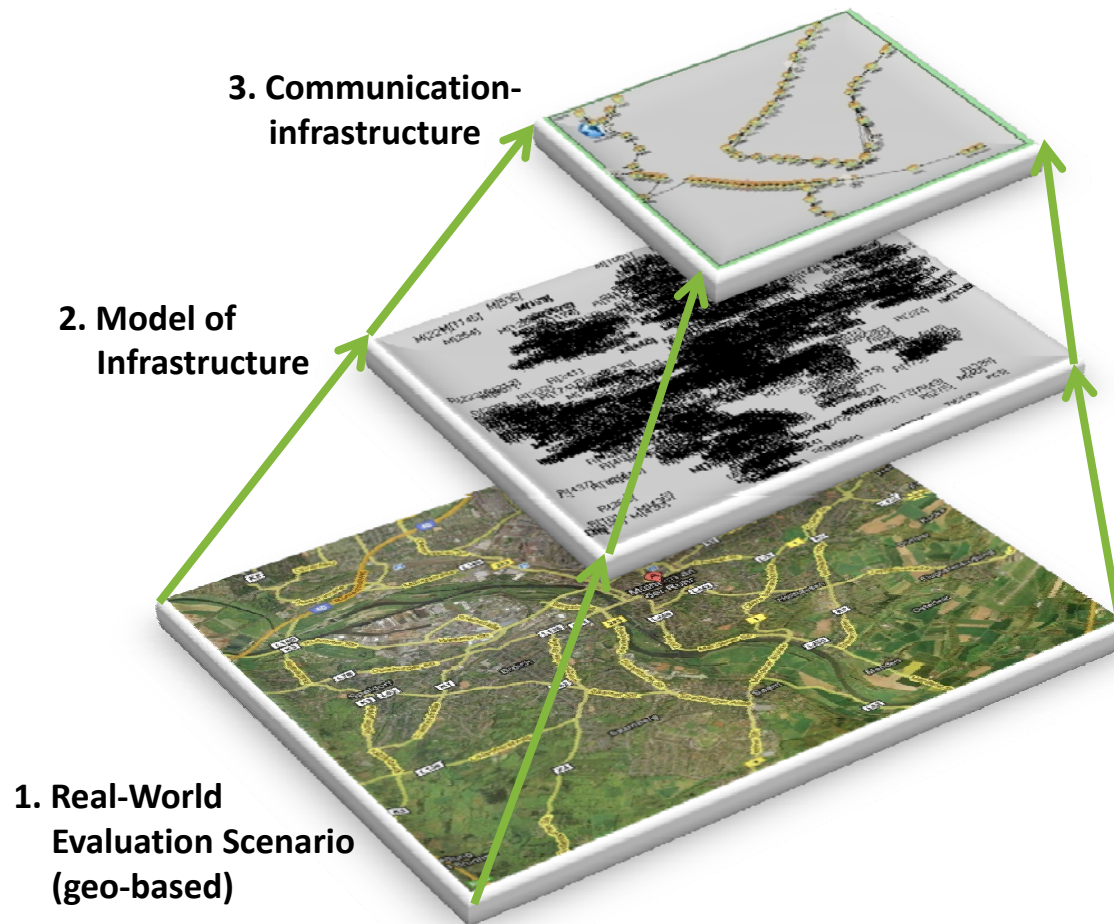
- **Framework Description**
 - Real-World Scenarios
 - Core Simulation
 - Dynamic Node Generation Process

- **Application Scenario**
 - Energy Management System Application
 - System Architecture
 - Communication and Routing Protocols

- **Analysis**

- **Conclusion and Outlook**

System Design Framework Description



The System Design Framework targets:

- Rapid system design by early-stage evaluation
- Performance evaluation of large-scale scenarios
- Real-world scenario generation using geographic positions

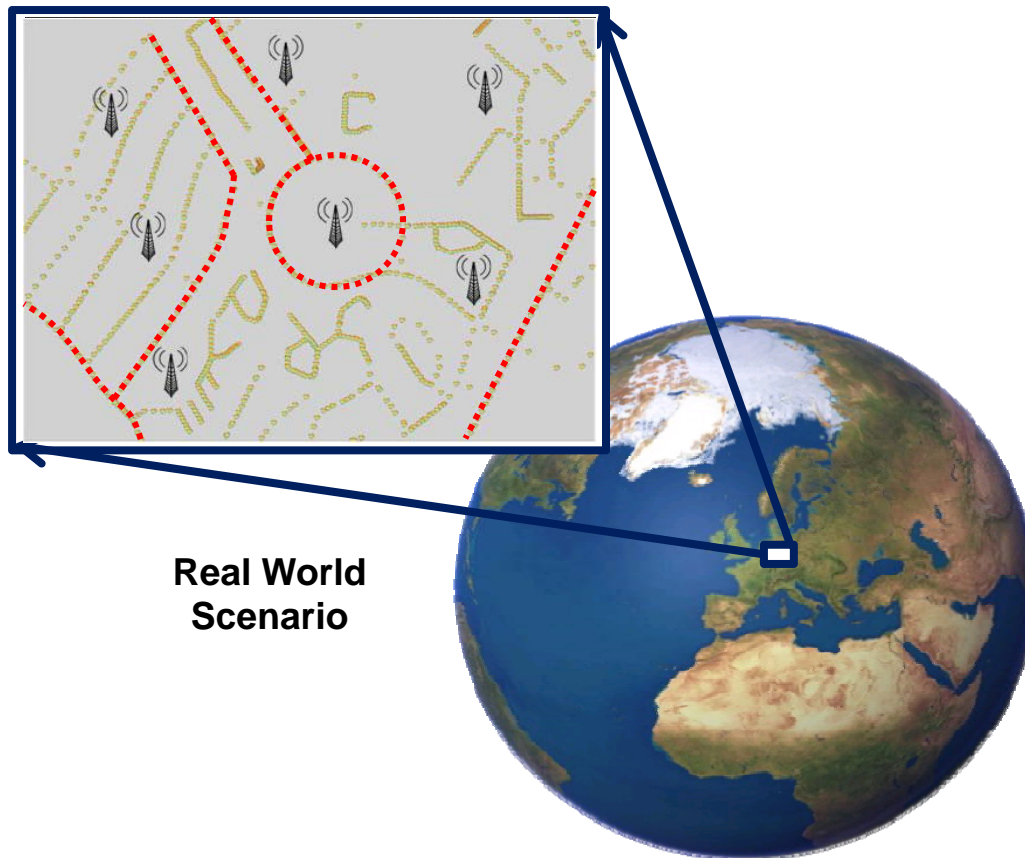
Two additional modules are introduced:

- Geographic Database (geoDB)
- Model Library

Future Components:

- Integration of existing models

Real-World Scenario Generation



Real-world adaption:

- Topology generation based on geographic position (Latitude and Longitude)
- Connection to MySQL Database containing coordinates and node information
- Methods library for accessing data, coordinates transformation, distance calculation and neighbourlist generation.
- Flexible scenario generation

Advantage:

- Early stages evaluation of technologies, e.g. radio technologies and routing algorithms (Application Scenarios) with respect to real-world problems

Core Simulation (CS)

1. Retrieval of Geo-Information

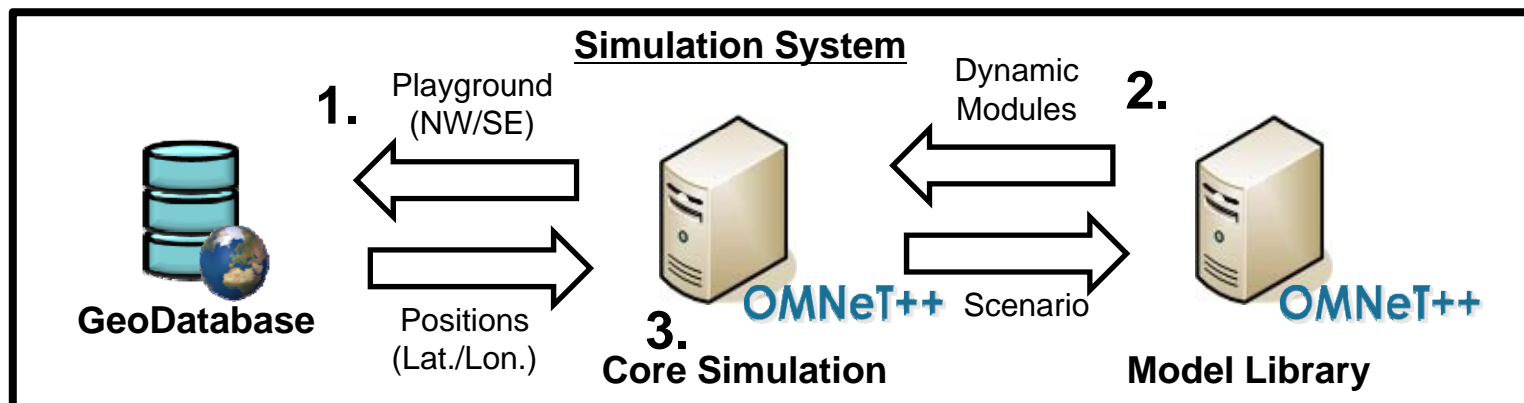
- Reference playground defined by NW and SE coordinates (omnetpp.ini)
- Node types / topology defined by vectors (omntpp.ini)
- Vector of coordinates for different node types
- List of neighbours
- Distance information

2. Preparation of Playground

- CS creates playground
- CS retrieves components (modules and submodules) for each position from Model Library (ML)

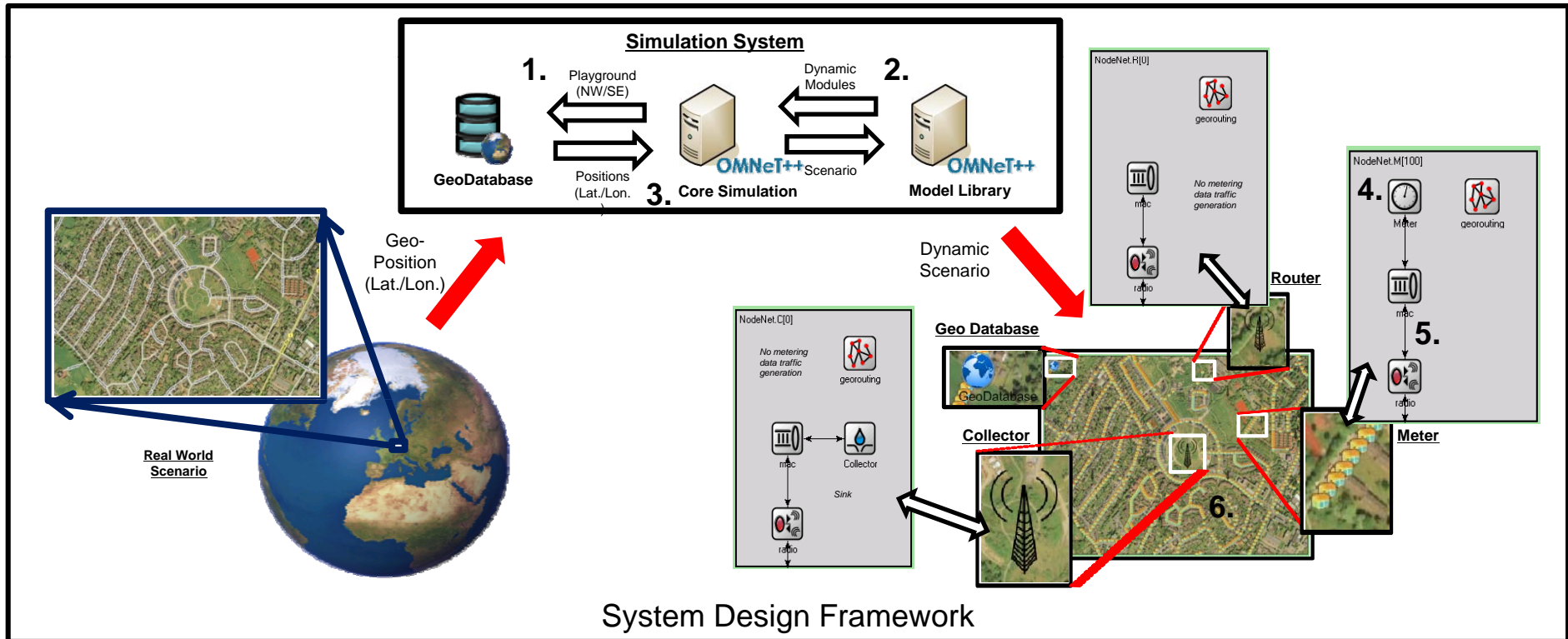
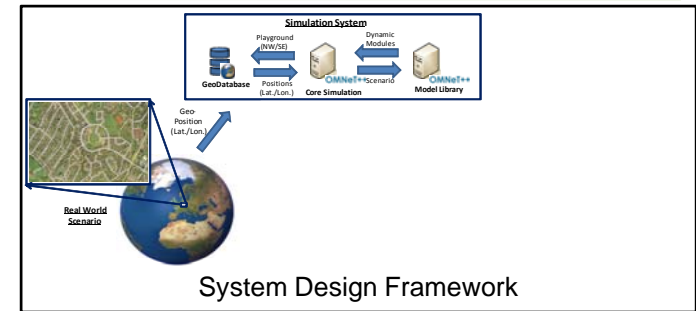
3. Preparation of Connectivity

- Routing tables and connection are defined by neighbour lists



System Design Framework

4. Application specific sub-modules are added depending on node type.
5. Connection of communication and application layers.
6. Positioning of node into playground.



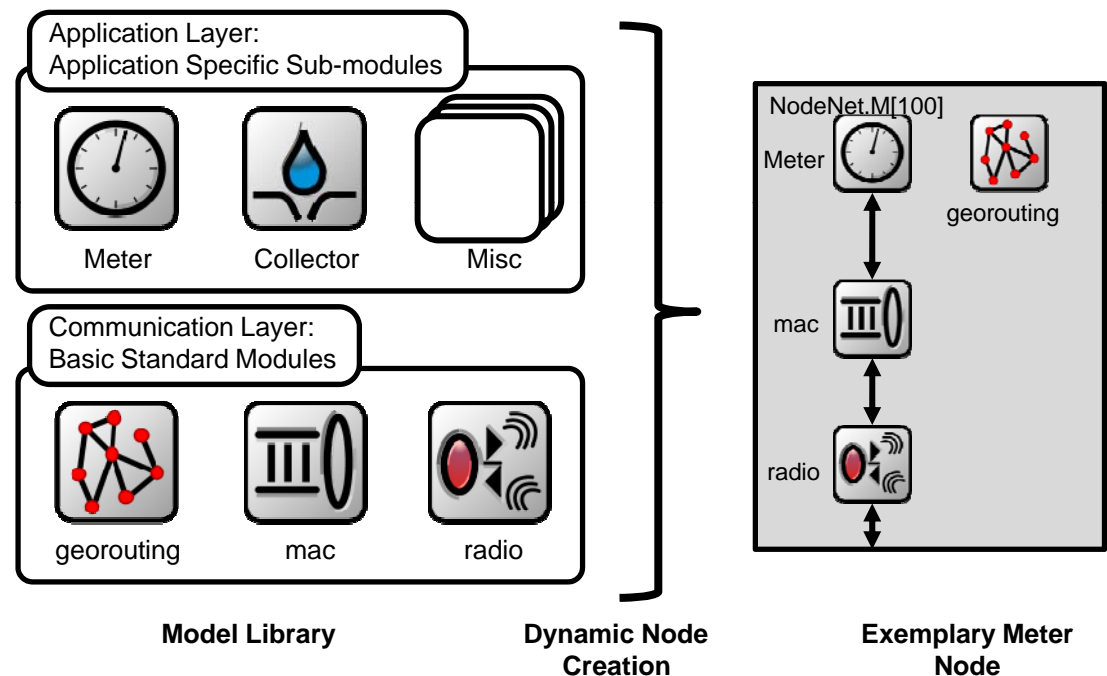
Exemplary Application Scenario

System Components:

- Energy Management Node (Smart Meter):
 - data traffic generator
 - relay unit for mesh network
- Collector:
 - extended radio module
 - statistic
- Routers
 - enhanced transmission range and datarate

Communication and Routing Protocols:

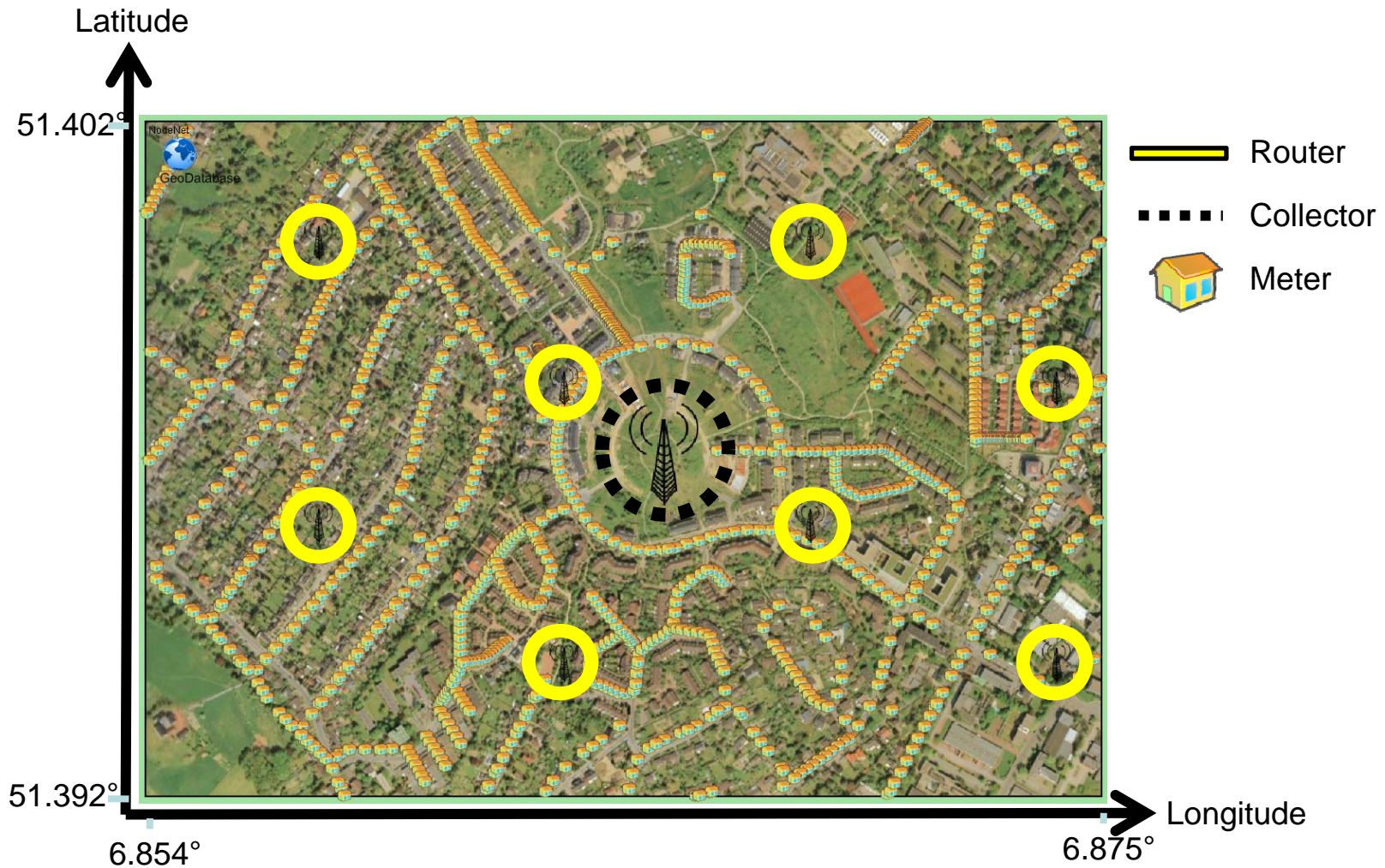
- Greedy Geo-Routing
- Slotted ALOHA MAC
- TX rate 100 kbit/s
- Range up to 100m
- Packet size 2kB
- TTL: 300s
- Max number of Hops: 40



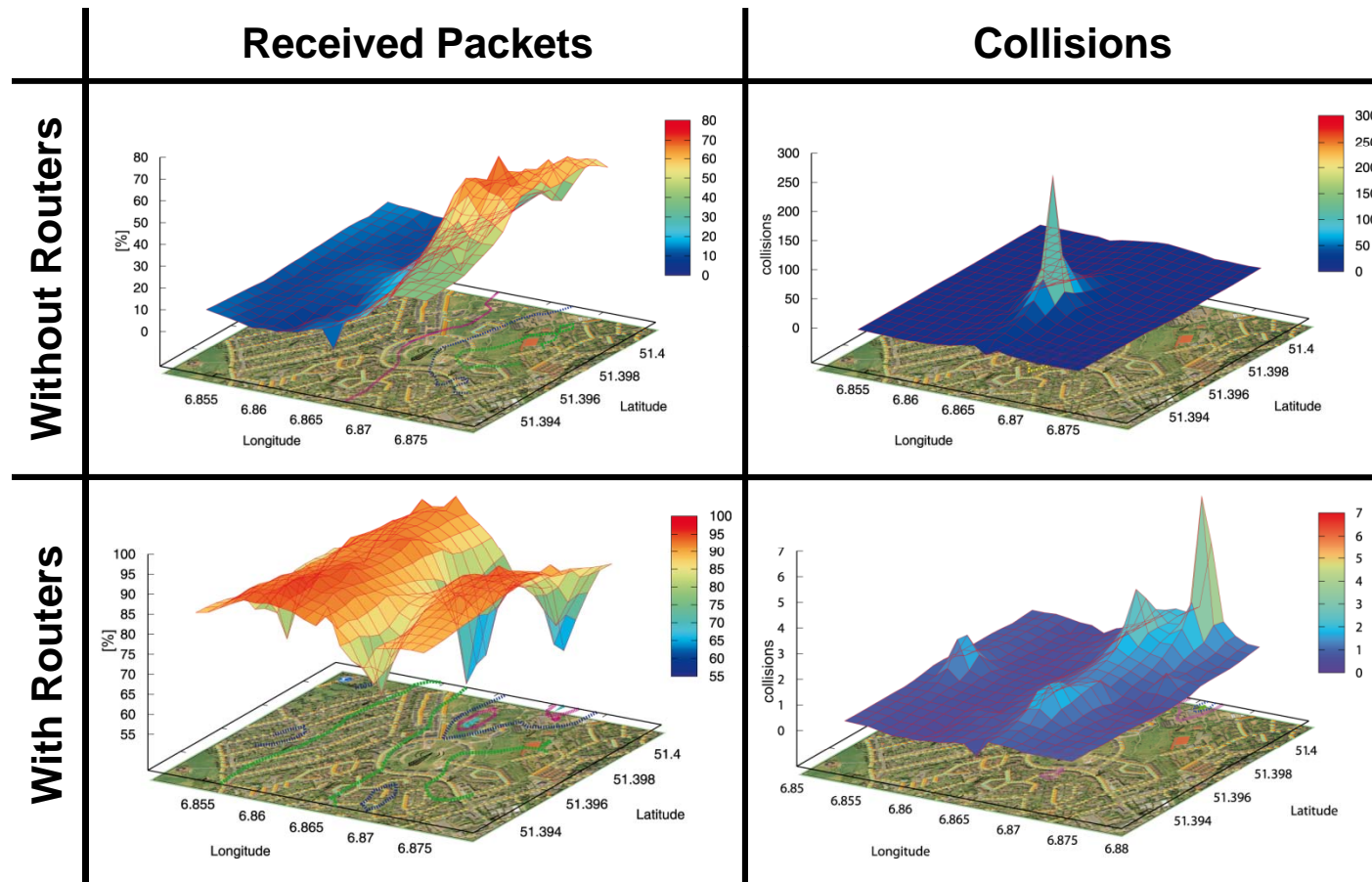
Model Library:

→ Integration of other nodes (INET)

Evaluation Scenario



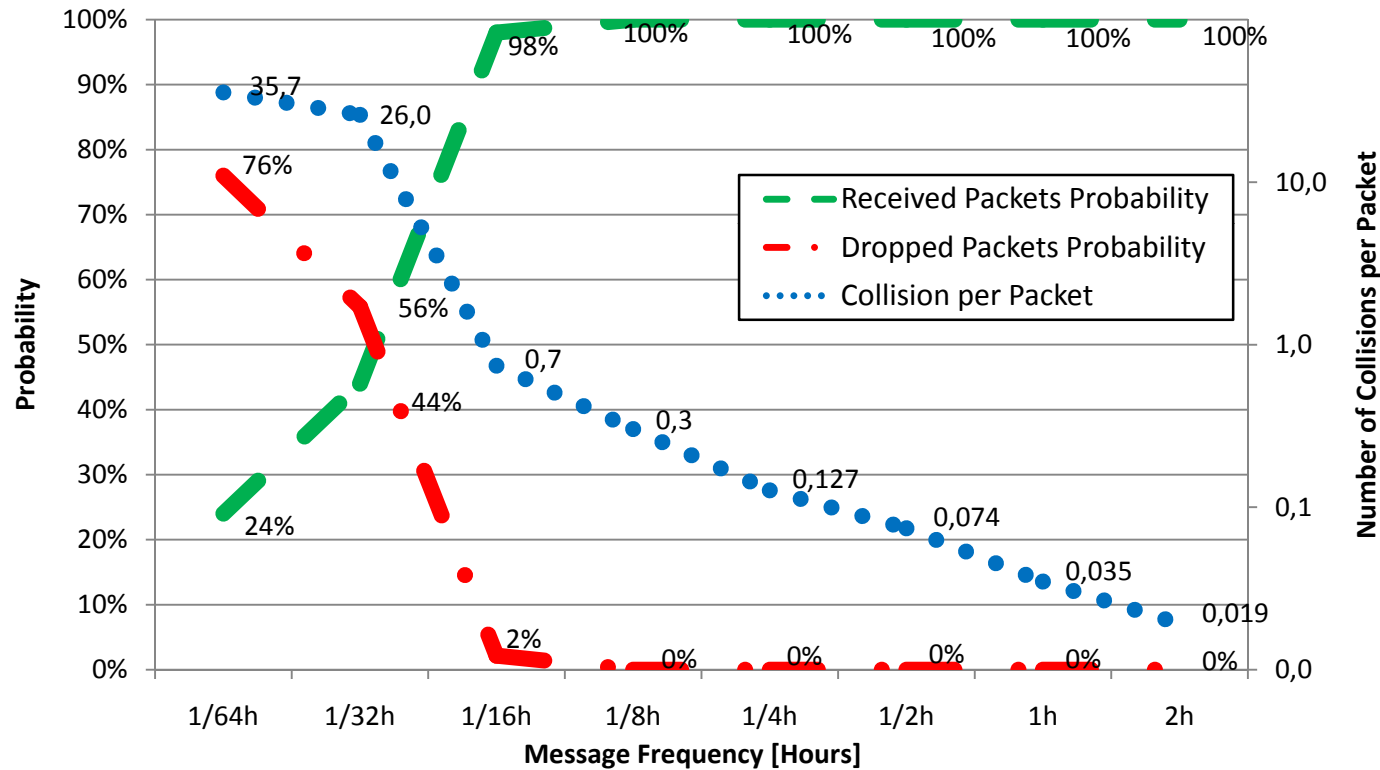
Reachability Analysis and Collision Detection



- Detection of Point of Failure in advance to the field deployment
- Optimisation of location-based topology problems

Performance Tests

Normalized statistics per packet in function of the message frequency
Duration = 1 Day, Area= Active Collector Area



➤ Performance and stress testing for detecting bottlenecks



Thank you for your attention!