A Framework for RAN Performance Evaluation based on Software Defined Radio

M. Einhaus, I. Kim, M. B. Charaf, J. Klinger

Overview

- Framework Description
- Potential Use Cases
- Performance Evaluation Examples
- Summary and Outlook

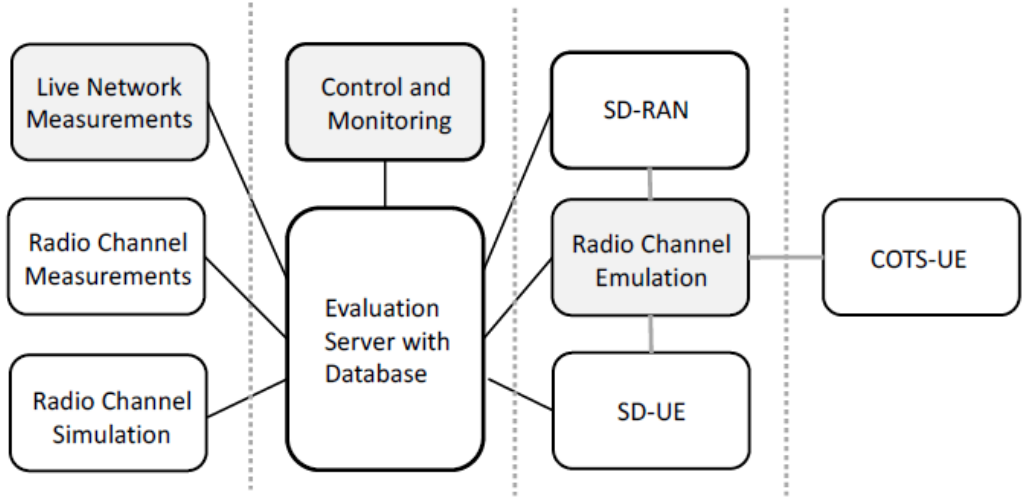
Framework Description

- Live Network Measurements
- Radio Channel and Propagation Measuremei

- System Level Simulations
- Radio Channel and Propagation Simulations

- Software Defined Radio and
  Radio Access Network Virtualization

- Data Analytics in Combination with
  Machine Learning Strategies



Measurement
Simulation

Data Analytics
Evaluation

Optimization
Prediction

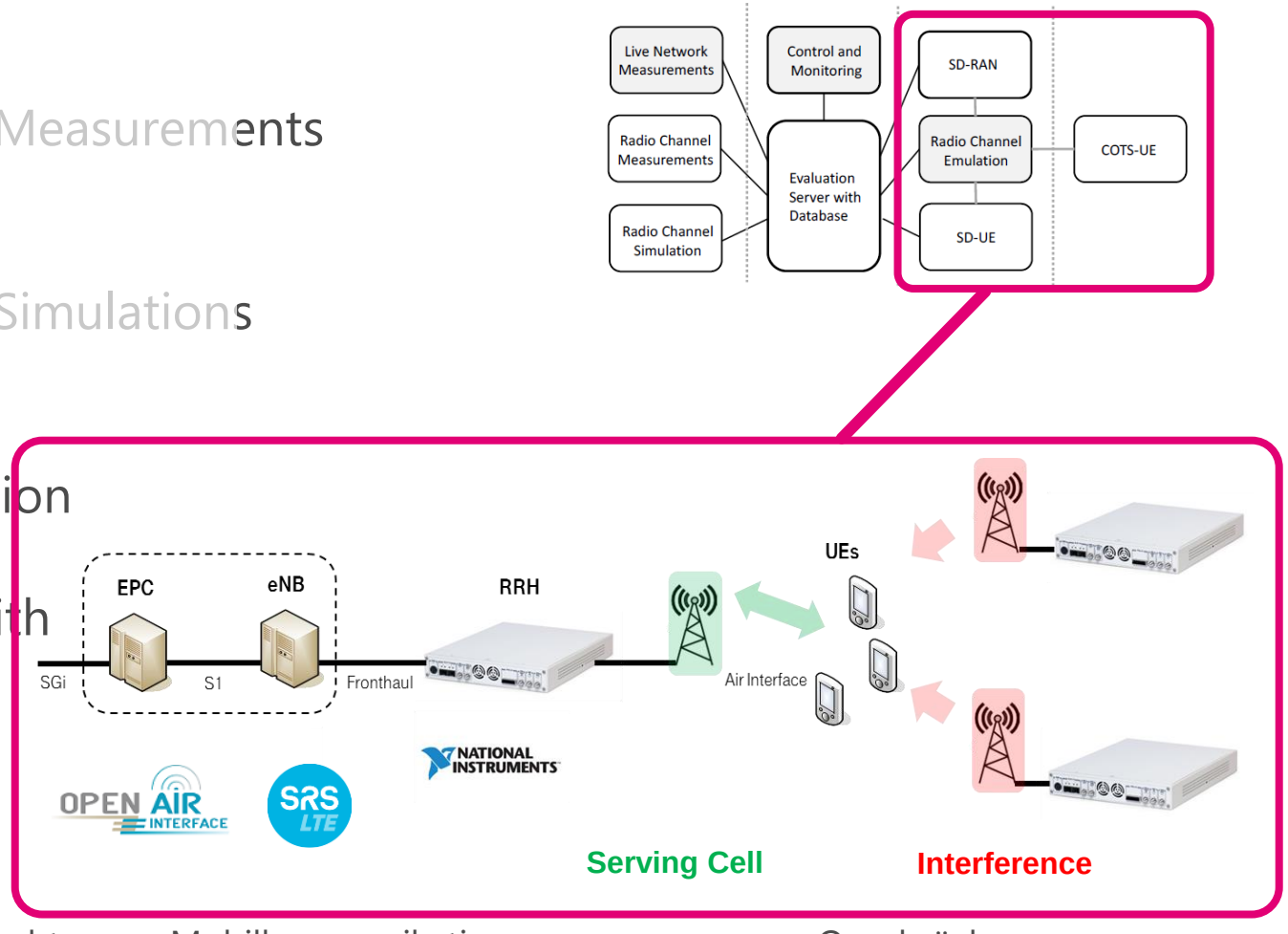
Framework Description

- Live Network Measurements
- Radio Channel and Propagation Measurements

- System Level Simulations
- Radio Channel and Propagation Simulations

- Software Defined Radio and Radio Access Network Virtualization

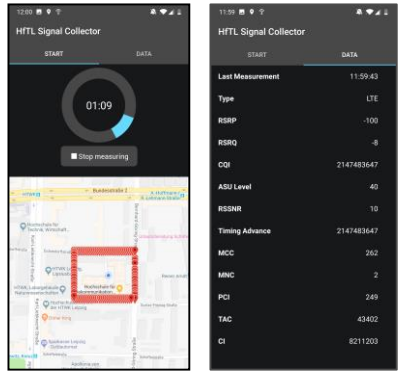
- Data Analytics in Combination with Machine Learning Strategies



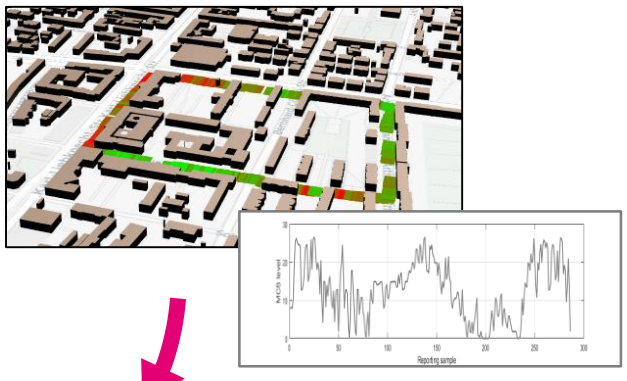
Performance Evaluaition Procedure

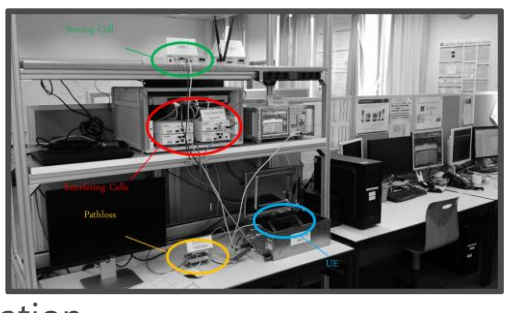
1. Live network measurements
2. Reporting to data base
3. Postprocessing
4. Trace reproduction

Measurement App

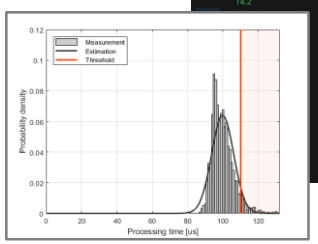


Data Base and Simulations





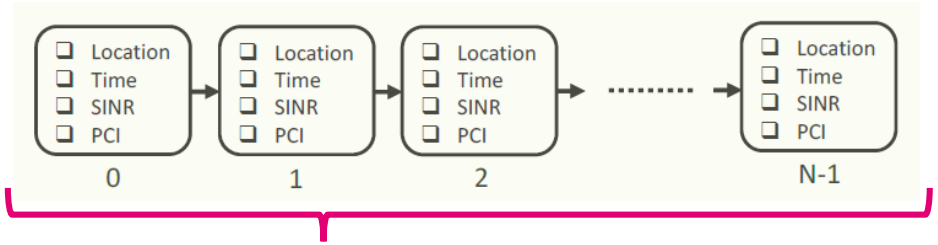
SDR at HfTL Radio Lab Osnabrück

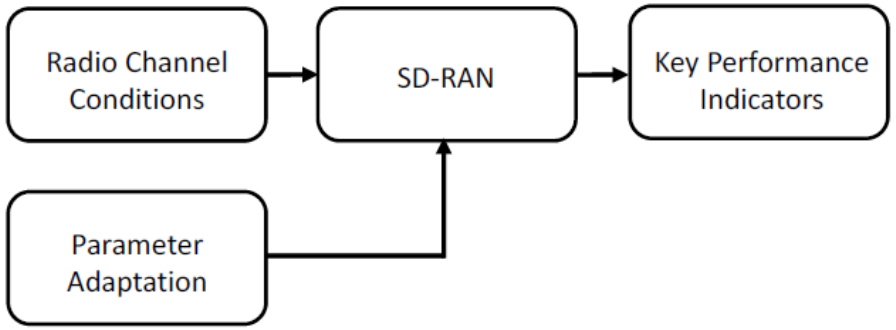


KPI Monitoring and Parameter Optimization

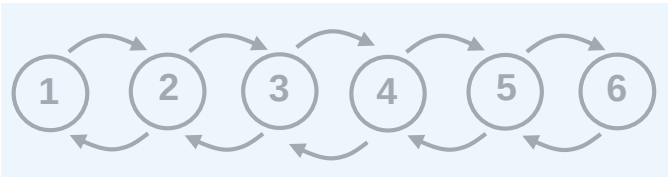
Performance Evaluaition Procedure

Measurement / Simulation



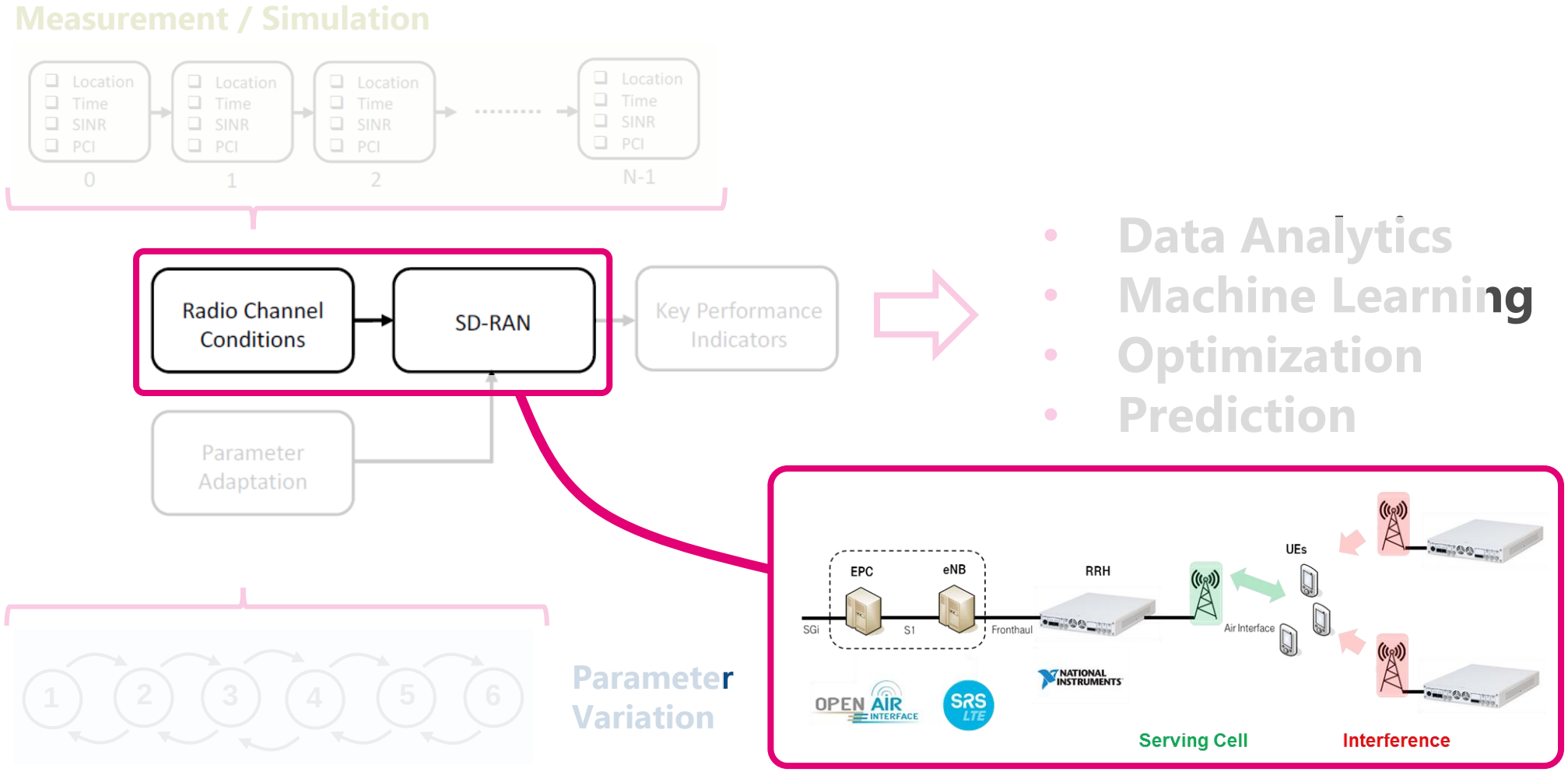


- **Data Analytics**
- **Machine Learning**
- **Optimization**
- **Prediction**



Parameter Variation

Framework Description

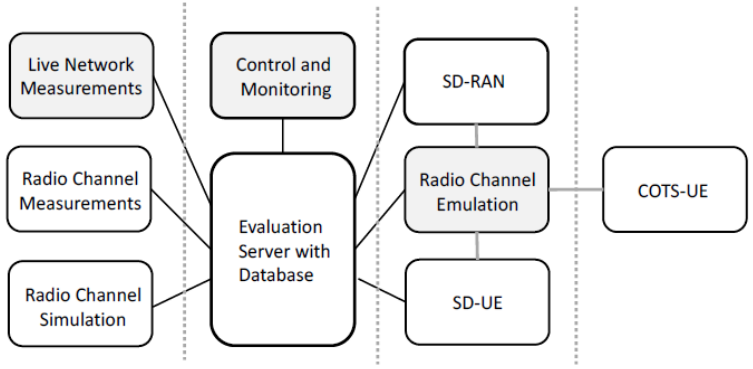


Potential Use Cases

- Performance Prediction
- Parameter Optimization
- Concept Development and Evaluation
- Education and Training

Exemplary Scenario

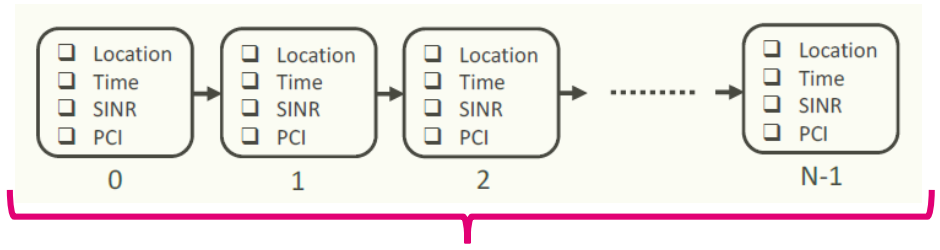
Southern area of Leipzig, Germany

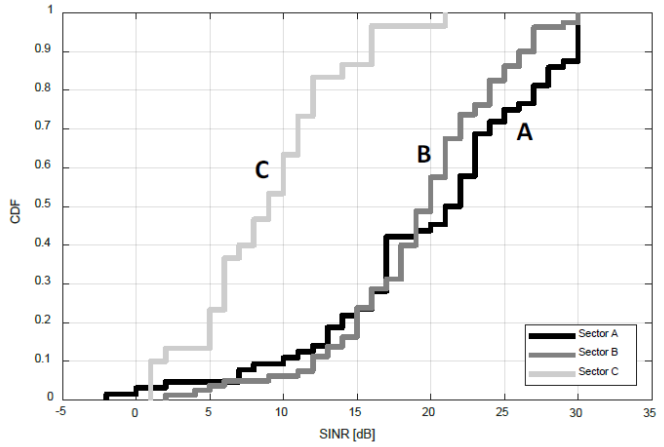


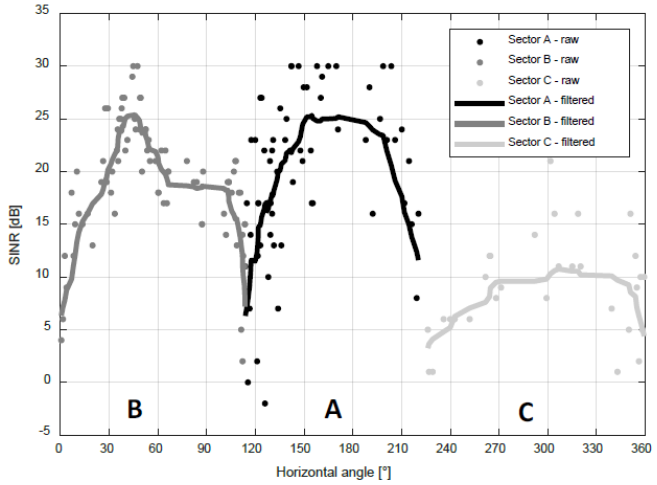
HfTL

Example A - Antenna Pattern Evaluation

Live Network Measurement

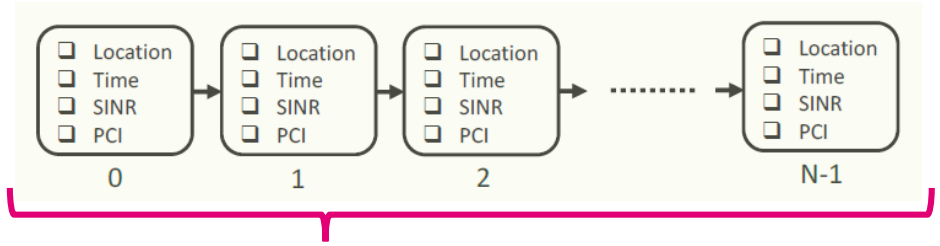


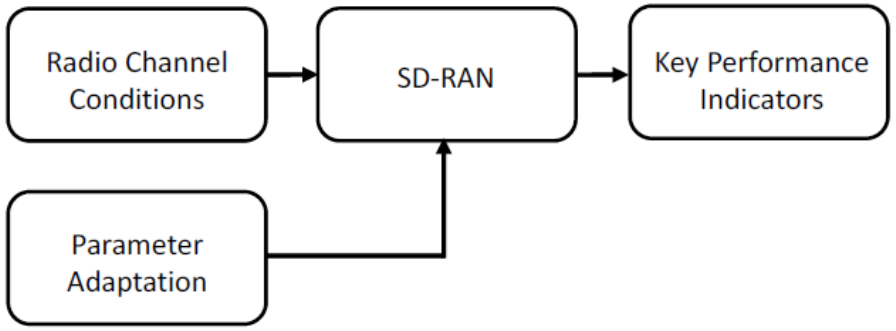


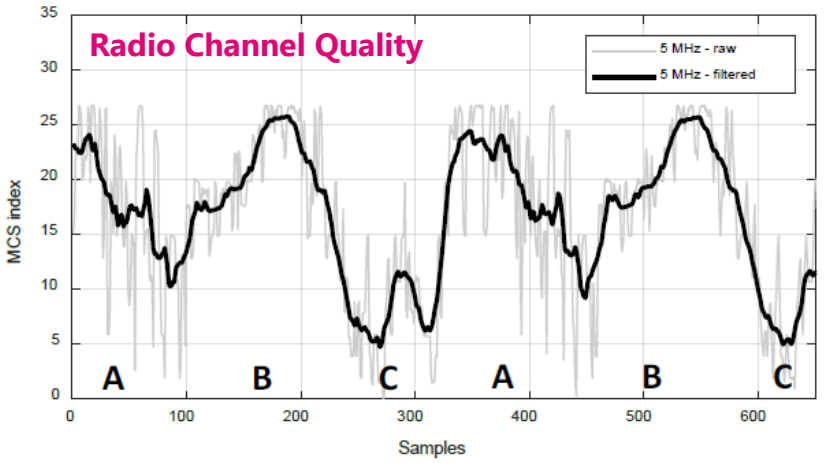


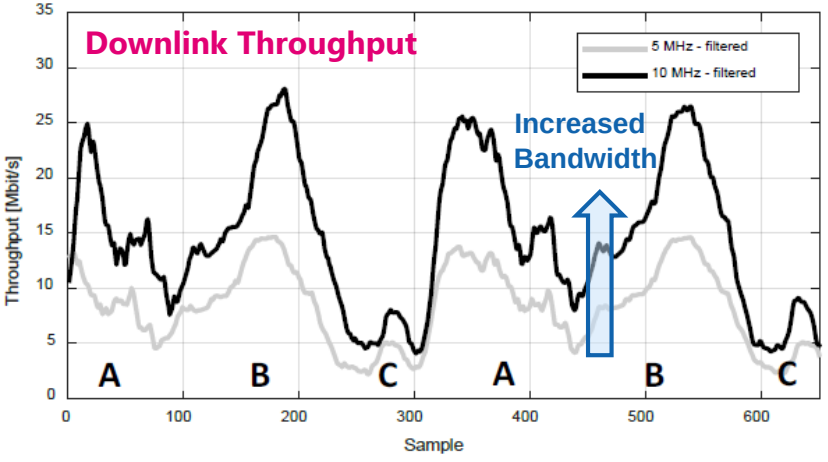
Example B – Throughput Evaluation

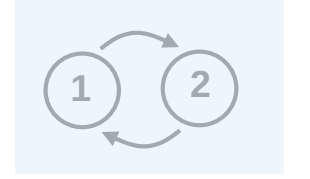
Live Network Measurement



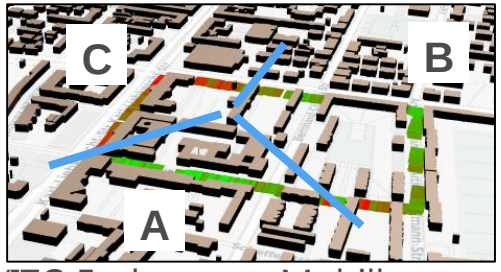






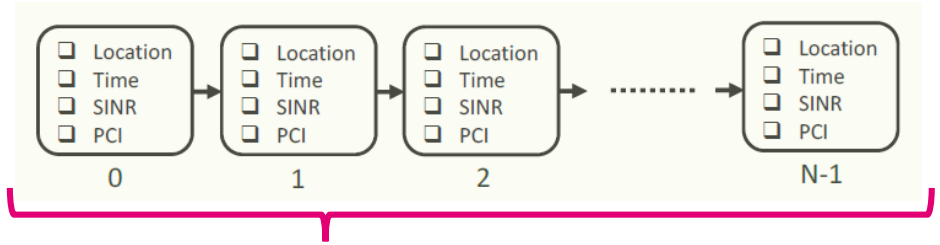


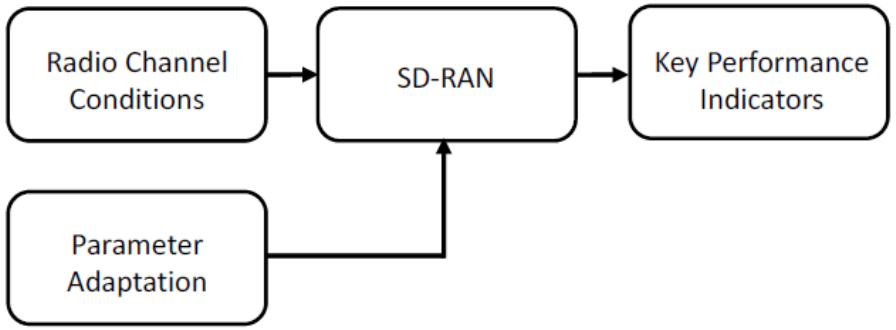
System Bandwidth



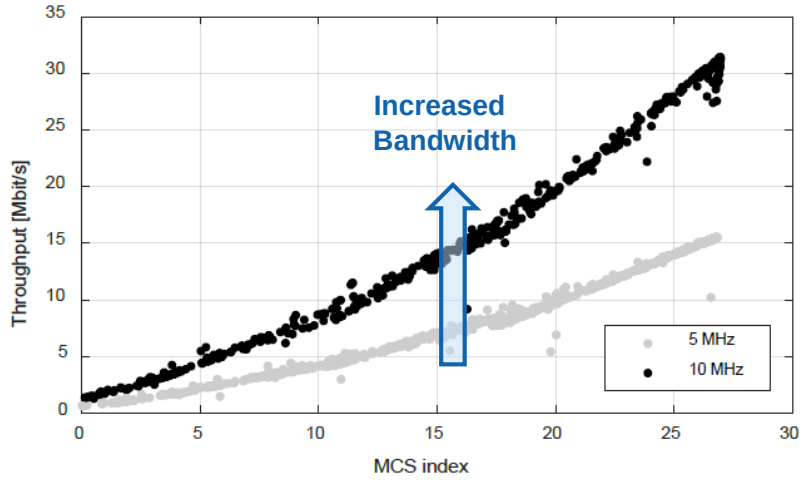
Example B – Throughput Evaluation

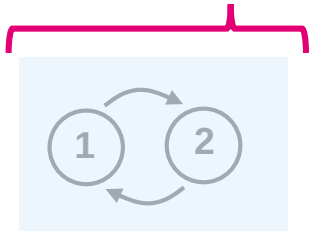
Live Network Measurement





Derived Prediction Model





System Bandwidth

Example C – RAN E2E Latency Evaluation

Fixed SINR

- Location
- Time
- SINR
- PCI

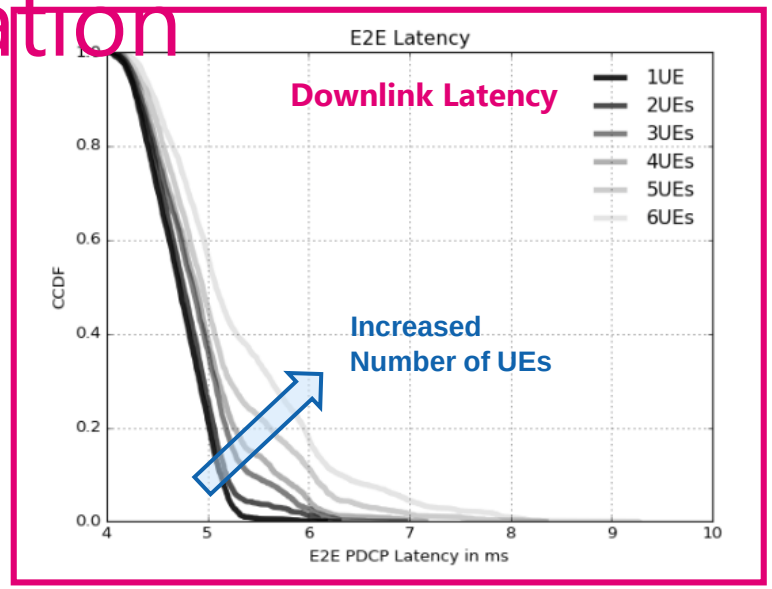
0

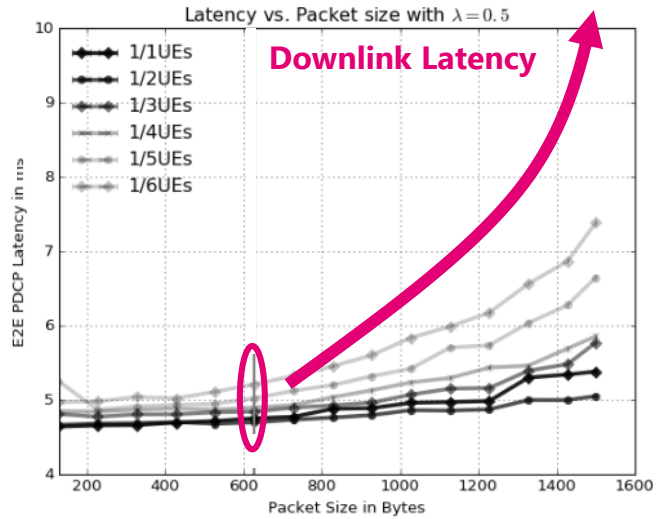
Radio Channel Conditions → SD-RAN → Key Performance Indicators

Parameter Adaptation → SD-RAN

1 2 3 4 5 6

Number of UEs, Traffic Load



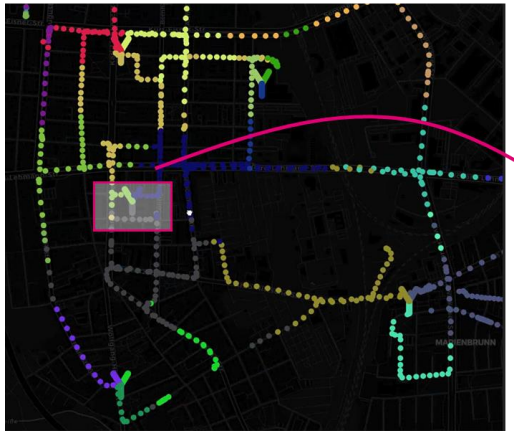


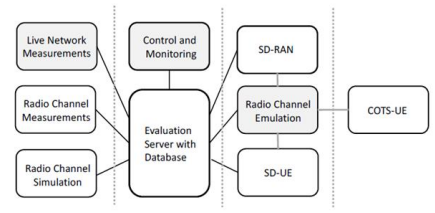
Current Activities and Next Steps

- 5G New Radio
- Network Slicing

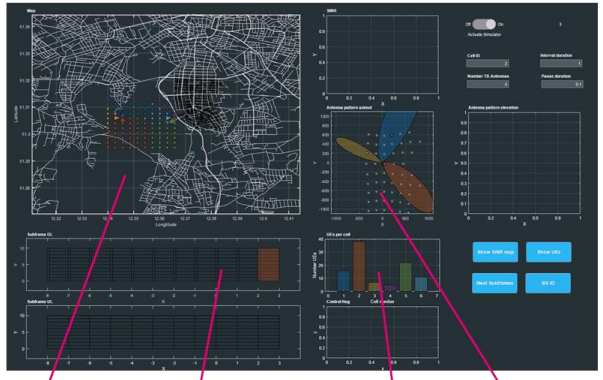
- Mobility Models
- Traffic Models

- Radio Propagation Models
- Impact of Massive MIMO
- Impact of Beam Coordination





System Level Simulator



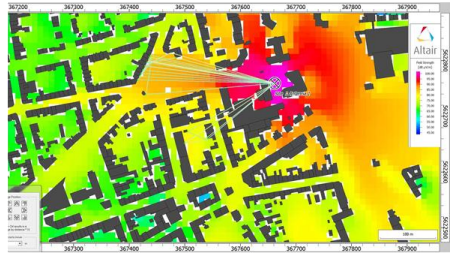
Buildings
Streets
BS Sites

Resource Allocation

User Distribution

Massive MIMO
Beamforming

Ray Tracer



Thanks for the attention!

„Everything counts in large amounts“
Depeche Mode