



USING COMPLEX MODELS AND SIMULATIONS OF AMM/SG INFRASTRUCTURES FOR PILOTS AND ROLL-OUTS

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Praha





ANSWERS TO QUESTIONS

DOES AMM/AMI COME TO OUR GRID?

Not Simple Questions like that!

WHAT ARE DSOs LOOKING FOR TODAY IN PLC TECHNOLOGY?



We are looking for answers to some complex questions

We know (lessons learned):

- Not every technology fits to each grid or part of it.
- Big testing polygons and huge pilots are expensive and time consuming.
- Good planning is the basis of success for massive actions as rollout is.

We do not know:

- Which technology does fit DSO needs in its specific distribution grid?
- Do we need many different technologies or only few of them (e.g. 1–3)?
- What is the cost effective mix of technologies for our AMM rollout?
- Where does not make sense to install specific technology neither AMM?
- What we can get/reach in specific part of grid with specific technology?
- **How we can get answers and not spend too much time and money?**

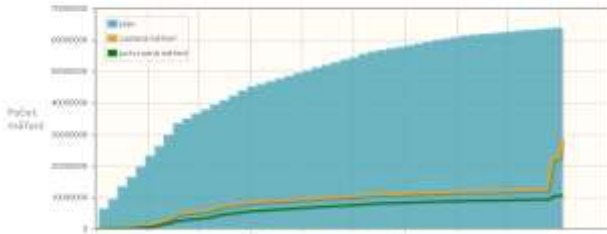
SIMULATIONS - PREVIOUS PROJECTS WERE SUCCESSFUL

WE GOT THE ANSWERS AND DIRECTIONS

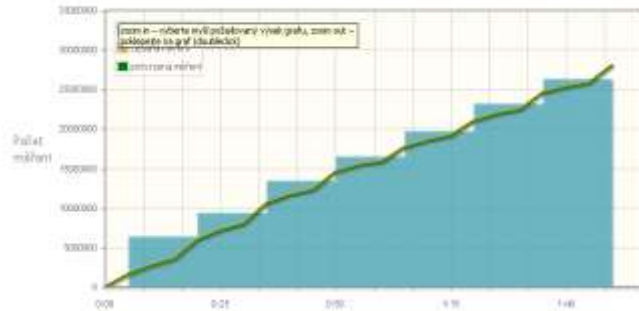


3.5 mil MP in University Data center

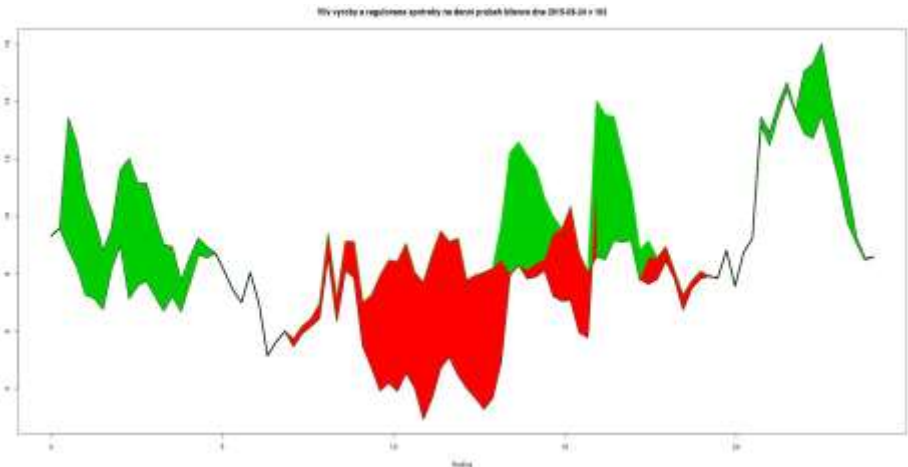
Celostátní IG 701 334 z 900 906 320 měření - § 1 %



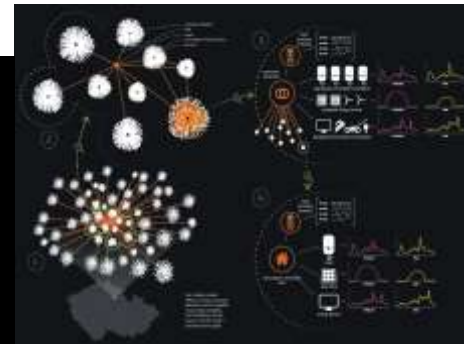
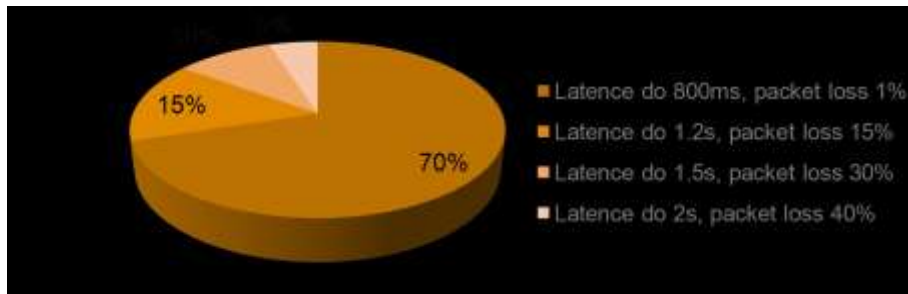
Odstátní 27 933 884 z 959 986 320 měření - § 3 %



PV day ahead optimization on DTS



Communication simulation of different technologies





DSO requirements for simulation model

- Low voltage distribution grid topology and parameters
 - data from GIS or generated from grid examples
- Specific for each simulated technology (e.g. PRIME, G3, BPL, S-FSK)
- Simulate smart meters and data concentrators behavior based on inputs and scenarios
- Define different application scenarios (e.g. readings of various measurements, sending TOU tables, firmware upgrades)
- Evaluate expected readout rate, command delivery reliability, etc.

HEY, GIVE THE FLOOR!

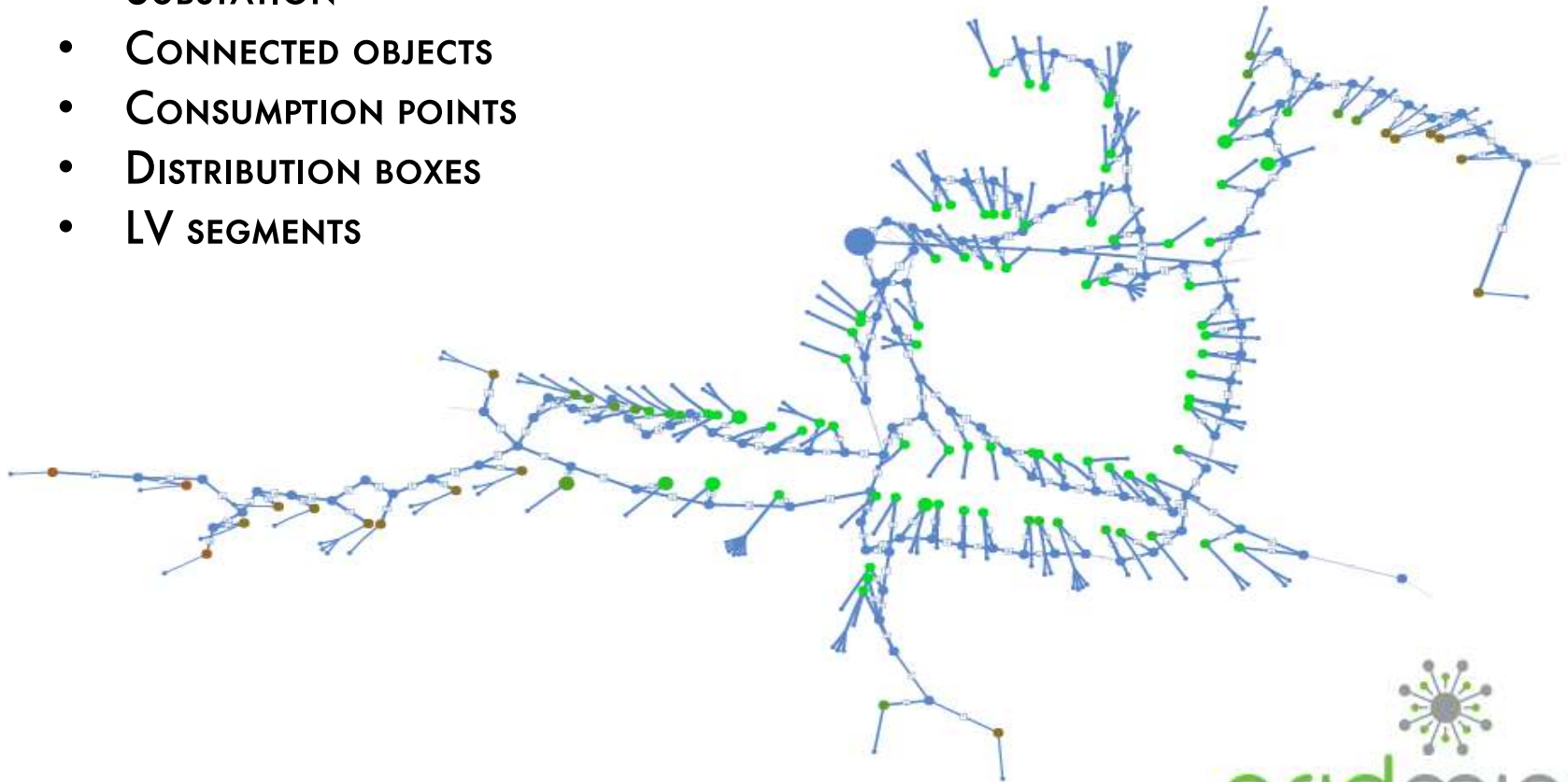


- ON THE INITIATIVE OF DSOs, MYCROFT MIND COMPANY HAVE DEVELOPED A SOFTWARE TOOL CALLED GRIDMIND FOR CREATING COMPLEX MODELS AND SIMULATIONS OF AMM/SG INFRASTRUCTURES
- IT ALLOWS
 - TO IMPORT/GENERATE LOW VOLTAGE DISTRIBUTION GRID TOPOLOGY
 - TO CHOOSE SPECIFIC PLC TECHNOLOGY (PRIME, G3, BPL, S-FSK)
 - TO DEFINE BEHAVIOUR MODELS OF SMART METERS AND DATA CONCENTRATORS
 - TO DEFINE APPLICATION SCENARIOS (READINGS OF VARIOUS MEASUREMENTS, SENDING TOU TABLES, FIRMWARE UPGRADES, ...)
 - TO EVALUATE EXPECTED READOUT RATE, COMMAND DELIVERY RELIABILITY, ...

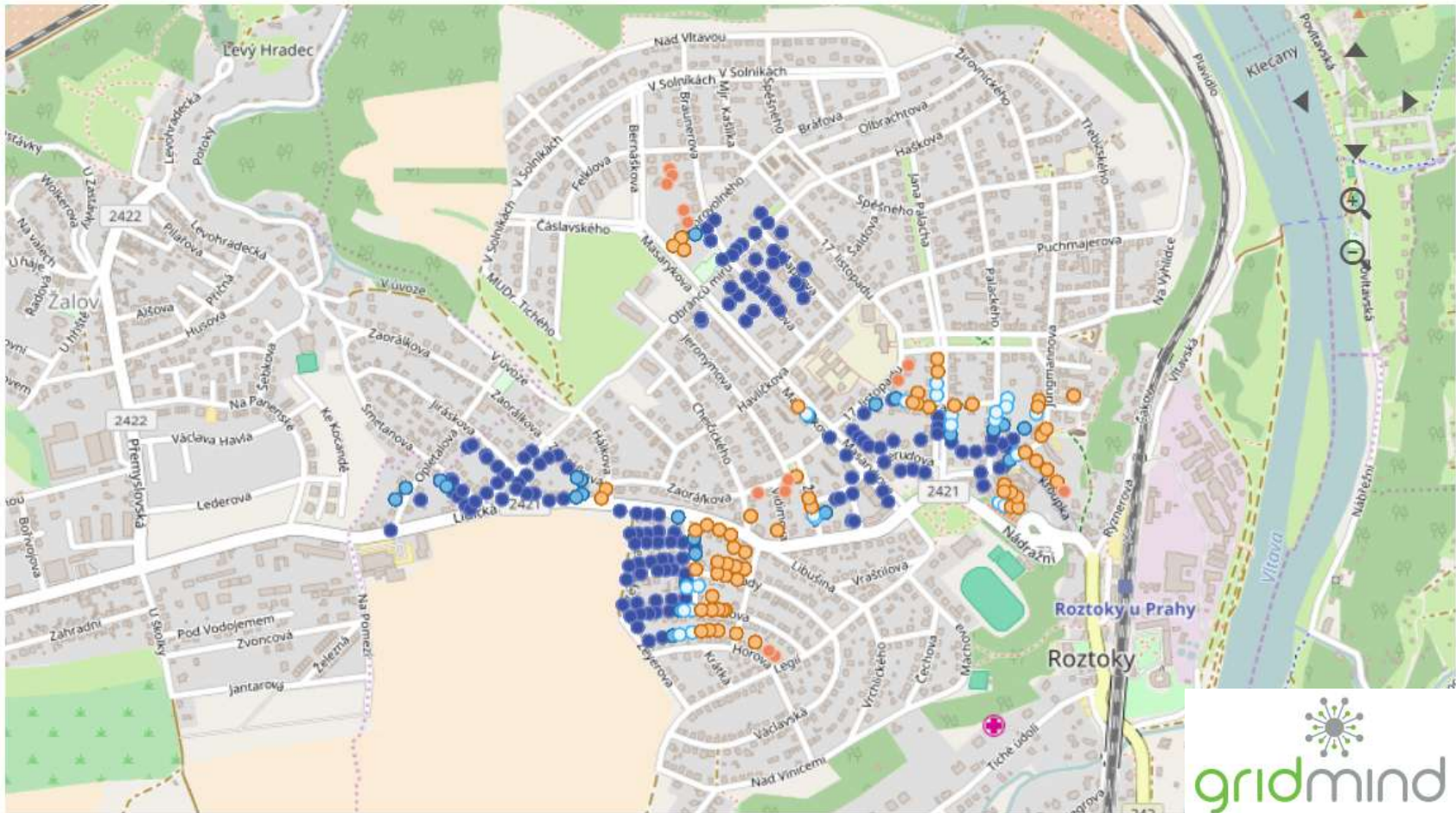
LOW VOLTAGE TOPOLOGY – ONE SUBSTATION



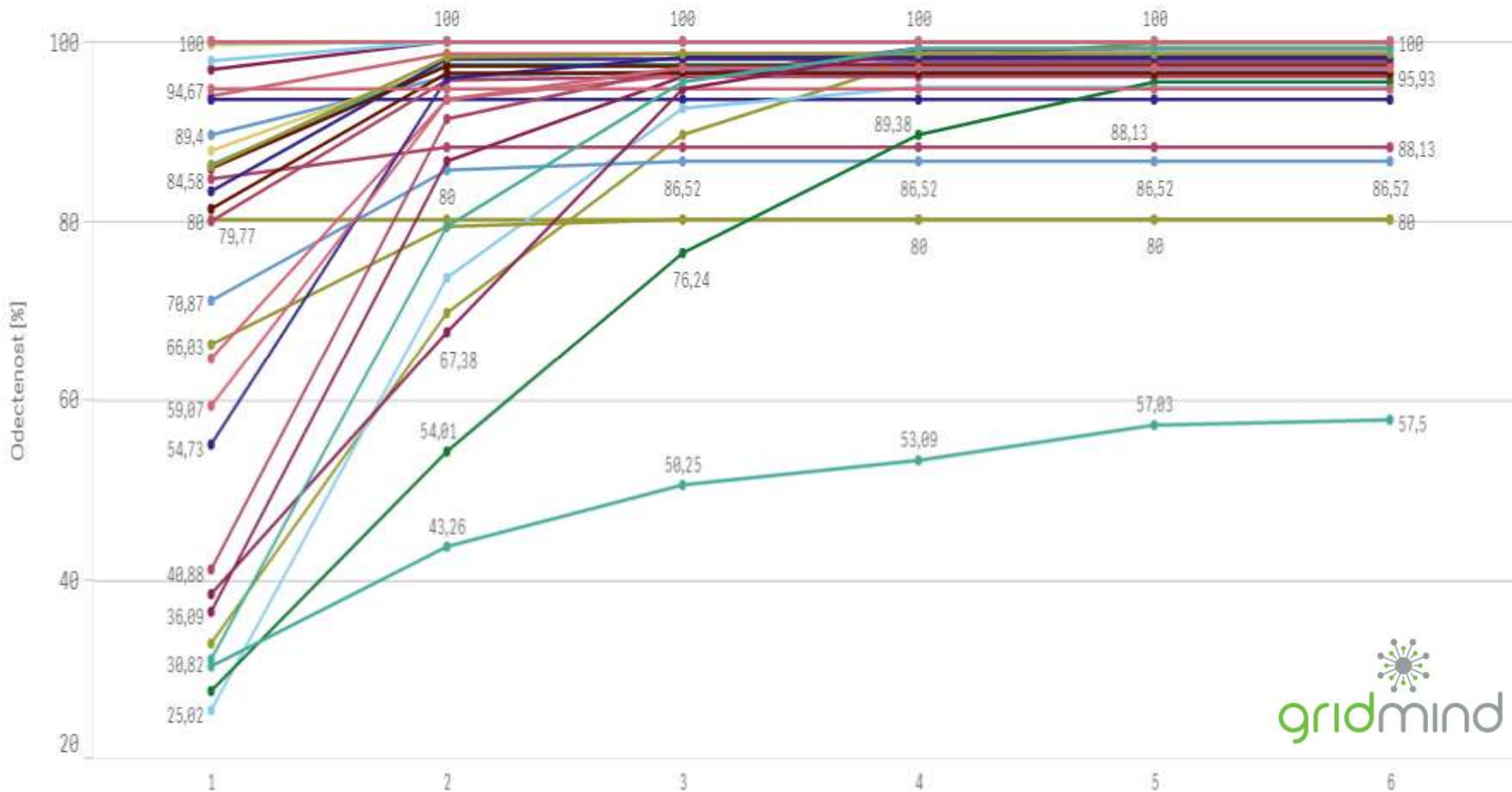
- SUBSTATION
- CONNECTED OBJECTS
- CONSUMPTION POINTS
- DISTRIBUTION BOXES
- LV SEGMENTS



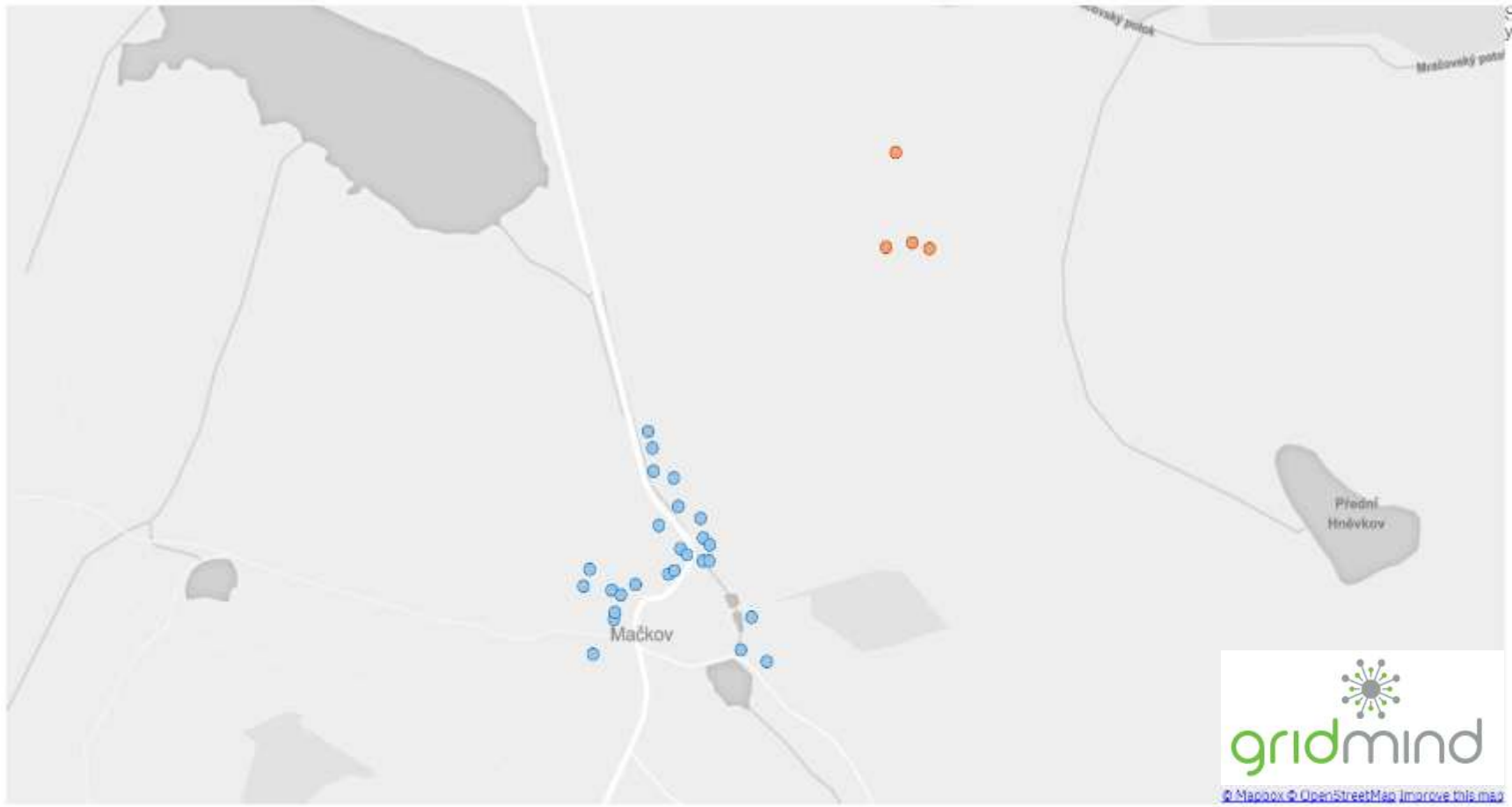
ESTIMATED COMMUNICATION SPEED OF INDIVIDUAL SMART METERS



COMPARISON OF ESTIMATED READING PROGRESS OF DIFFERENT SUBSTATIONS FOR THE CHOSEN TECHNOLOGY



IDENTIFICATION OF DEVICES INACCESSIBLE VIA PLC



MODELS AND SIMULATIONS IN ACTUAL SITUATION



- LET'S ASSUME DSO CHOOSE SOME PLC TECHNOLOGY FOR PILOT PROJECT
 - HOW CAN MODELS AND SIMULATIONS HELP DURING THE REALISATION AND OPERATION PHASE?
- 1) IDENTIFY AREAS IN LOW VOLTAGE TOPOLOGY, WHERE RESULTS IN FIELD ARE SIGNIFICANTLY WORSE THAN IN MODEL – NOISE SOURCES, CABLE JOINTS, ...
 - 2) HELP TO ESTIMATE COMMUNICATION CAPACITY FOR EACH SUBSTATION AND HELP TO COLLECT AS MUCH MEASUREMENTS AS POSSIBLE





- **FACT: WE CAN NEVER COLLECT ALL DATA THAT WE CAN MEASURE**
- **BILLING DATA HAVE TO BE COLLECTED BUT THERE IS A SPACE FOR TECHNICAL DATA, TOO (E.G. VOLTAGE PROFILES)**
- **EACH LOCATION HAS ITS OWN LIMITED COMMUNICATION CAPACITY**
 - **DERIVED FROM LV NETWORK TOPOLOGY, MOBILE NETWORK COVERAGE**
 - **THERE ARE BIG DIFFERENCES AMONG LOCATIONS**
 - **COMMUNICATION CAPACITY CAN BE ESTIMATED FROM COMMUNICATION MODELS**



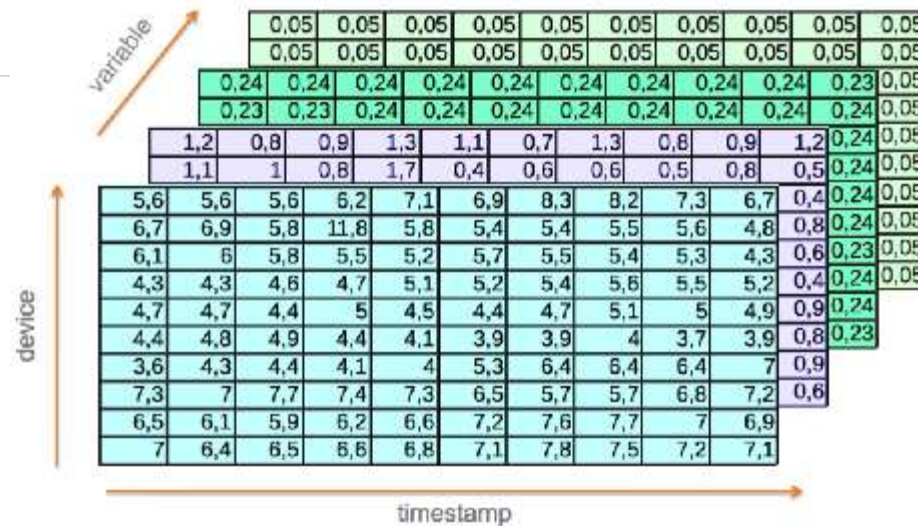
Unified and fixed scope of collected measurements

- When all metering points generates data with same value
- When we identify minimal scope, which can be collect from all points

Differentiated and configurable scope

- There are differences in data value from different metering points
- If there is communication capacity available, we want to utilize it

MEASURED DATA VALUE METRICS



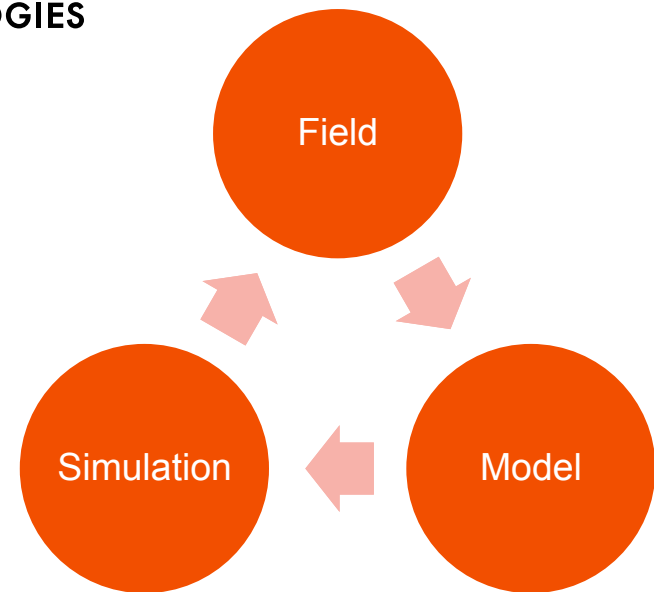
- TAKE INTO ACCOUNT
 - IMPORTANCE OF PROCESSES WHICH UTILIZE THE DATA (BILLING, BALANCES, OPERATIONAL PROBLEM DETECTION, ...)
 - IT AFFECTS IMPORTANCE OF MEASURED QUANTITIES (P, Q, U, I, ...)
 - IMPORTANCE OF INDIVIDUAL METERING POINTS
 - POSSIBILITY TO ESTIMATE MISSING VALUES (SAMPLING)
 - PROBABILITY OF SUCCESSFUL READING
- THIS METRICS IS USED TO CONFIGURE INDIVIDUAL METERS AND CONCENTRATORS



COMPLEX MODELS AND SIMULATIONS ALLOW

- TO COMPARE SUITABILITY OF DIFFERENT PLC TECHNOLOGIES
- TO IDENTIFY PROBLEMATIC GRID PARTS IN ADVANCE
- TO DETECT NON-OBVIOUS COMMUNICATION ISSUES
- TO CONFIGURE READING SCOPE IN ADVANCE
- TO ANSWER VARIOUS OTHER SPECIFIC QUESTIONS

- TO LEARN BY TRIAL AND ERROR THE EASIER WAY





SIMULATIONS CAN GIVE THE ANSWERS FASTER WITH LOWER COSTS AND EFFORTS IN THE FIELD.

SIMULATIONS CAN HELP TO GET CORRECT EXPECTATIONS FROM FIELD IMPLEMENTATIONS IN TERMS OF COSTS AND TIME.

SIMULATIONS CAN GIVE YOU INSIGHTS INTO WHAT IS COMING TO YOU.

THANK YOU



THANK YOU FOR YOUR ATTENTION!

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