Umbrella Project

Innovative Tools for the Future Coordinated Operation of the Pan-European Electricity Transmission System

Toolbox Requirements based on TSO Demands and Testing Environment

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ELES ELEKTRO-SLOVENIJA, d.o.o.

Polskie Sieci Elektroenergetyczne Operator S.A.

swissgrid

ČEPS, a.s.

TenneT Taking power further

TRANSNET BW

APG AUSTRIAN POWER GRID WE KEEP IT GOING

amprion

UNIVERSITÄT DUISBURG ESSEN

EWL

RWTH AACHEN UNIVERSITY

ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich

TU Delft Delft University of Technology

TU Graz Graz University of Technology

FGH Forschungsgemeinschaft für Elektrische Anlagen und Stromwirtschaft e.V.

Toolbox Requirements – Agenda

I. Objectives and overview

II. Challenges

III. Preliminary results and publications

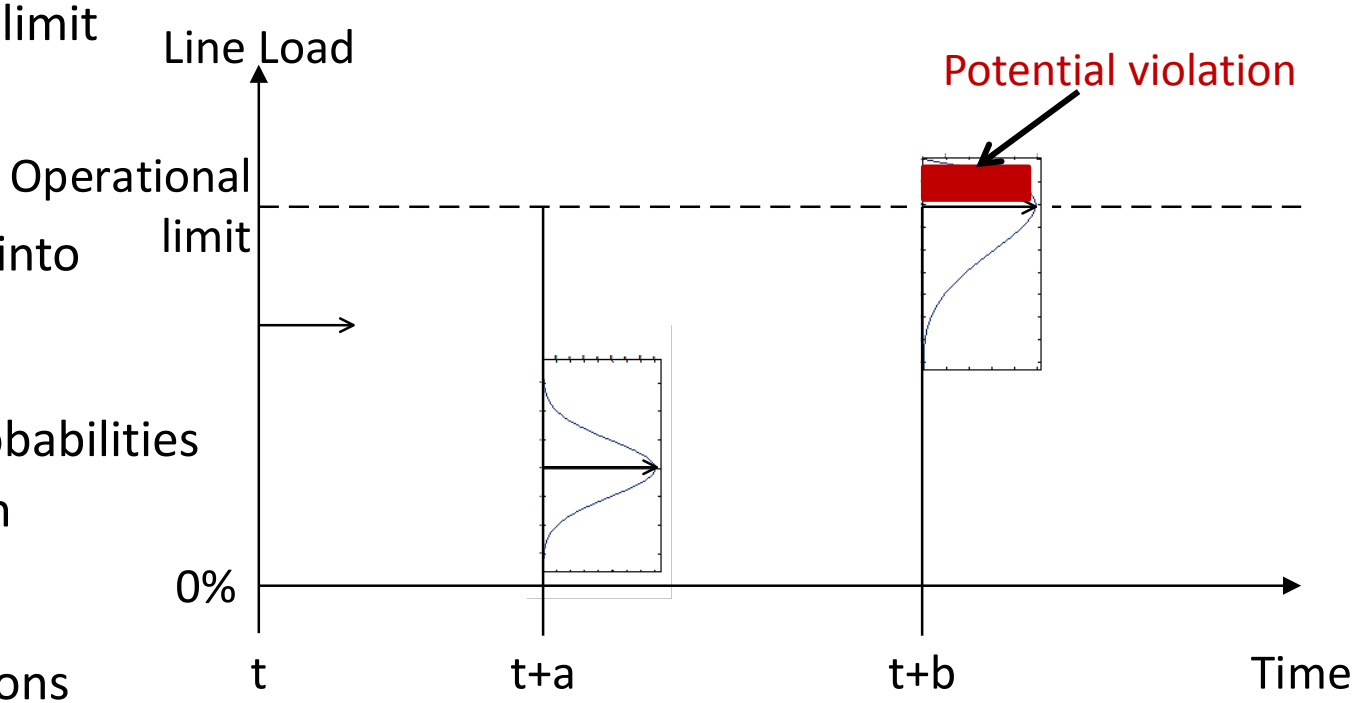
IV. Key messages

Objectives (1/2)

- Development and provision of a toolbox for TSOs
  - State-of-the-art methods for operational planning and real-time operation face new challenges
- Enhancement of existing approaches and addition of new methodologies
  - Usage and visualisation concepts of toolbox to be integrated in existing processes and platforms of system operation to take full advantage of application
- Synchronisation of research carried out by forecasting, optimisation and risk-based-assessment with the requirements and expectations by TSOs
- Transfer and synthesis of results obtained and concepts developed

Objectives (2/2)

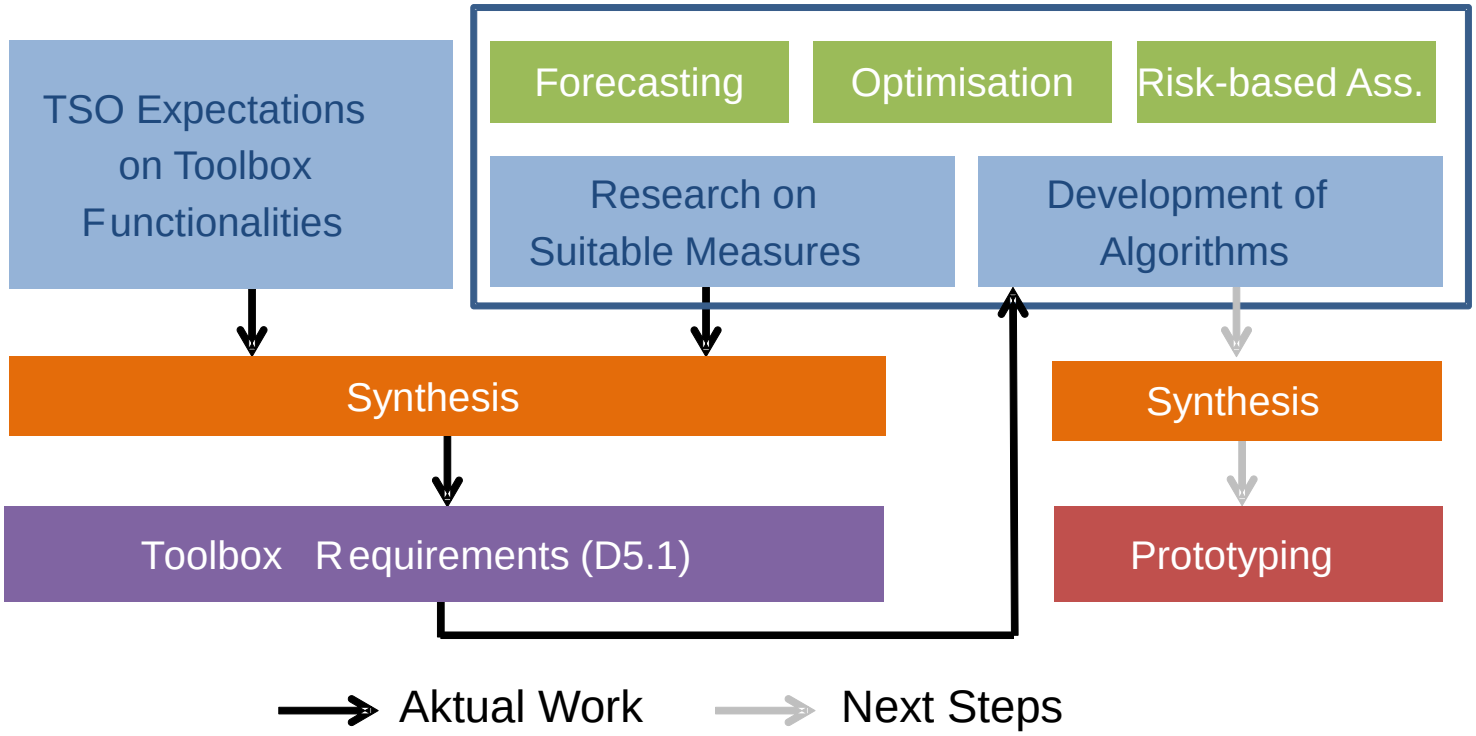
- Consideration of stochastic information on system state
  - Example: Line Loading at different times
  - Operational limit determined taking risk-based assessment into account
  - Forecasting provides probabilities
  - Optimization provides measures to avoid violations



➔ Toolbox comprises the different functionalities

Overview

- Structure and interfaces



Agenda

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Challenges

- Alignment of academic research and TSO expectations
  - Transfer of results provided by academic work packages into functionalities usable in daily TSO business
- Interdependencies between academic work packages
  - Sequence of operational steps including functionalities from different work packages
- Aligment of available and required data
  - Differences in terms of data availability to be identified and adressed

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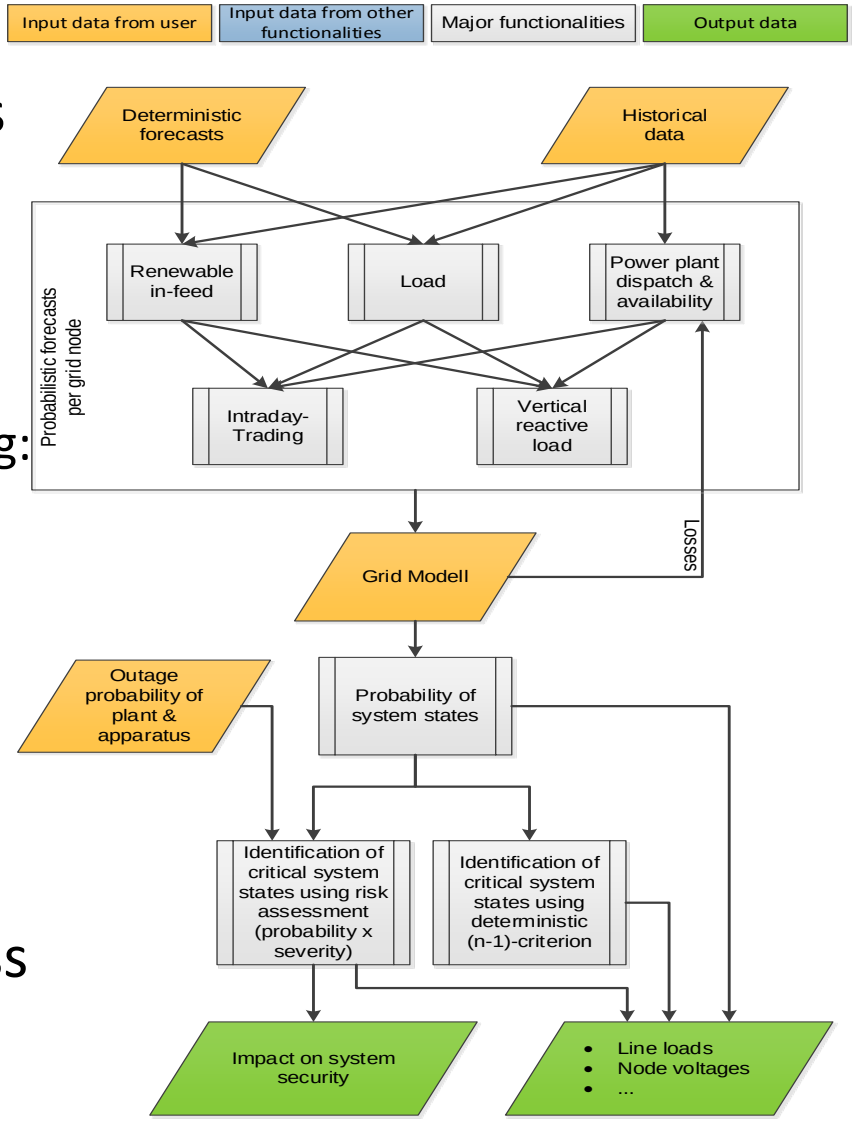
Publications

- Deliverable D5.1 «Toolbox Requirements» (restricted)
  - Definition of requirements for network forecasting, system optimisation and risk-based assessment based on TSO demand
  - Distinction between functional and data requirements
  - Review of first scientific results of work packages 2, 3 and 4
  - Enquiry on demands and expectations by TSOs
  - Description of interfaces and -dependencies
  - Identification of key success factors for toolbox

Toolbox Requirements (1/3)

- Functional and data requirements for «network forecasting»
  - Probability forecast models for the five relevant influencing factors needed
  - Data specification essential regarding:
    - Type of data,
    - Data format,
    - Data granularity,
    - Interval of data update,
    - Interface(s) to other parts of the toolbox

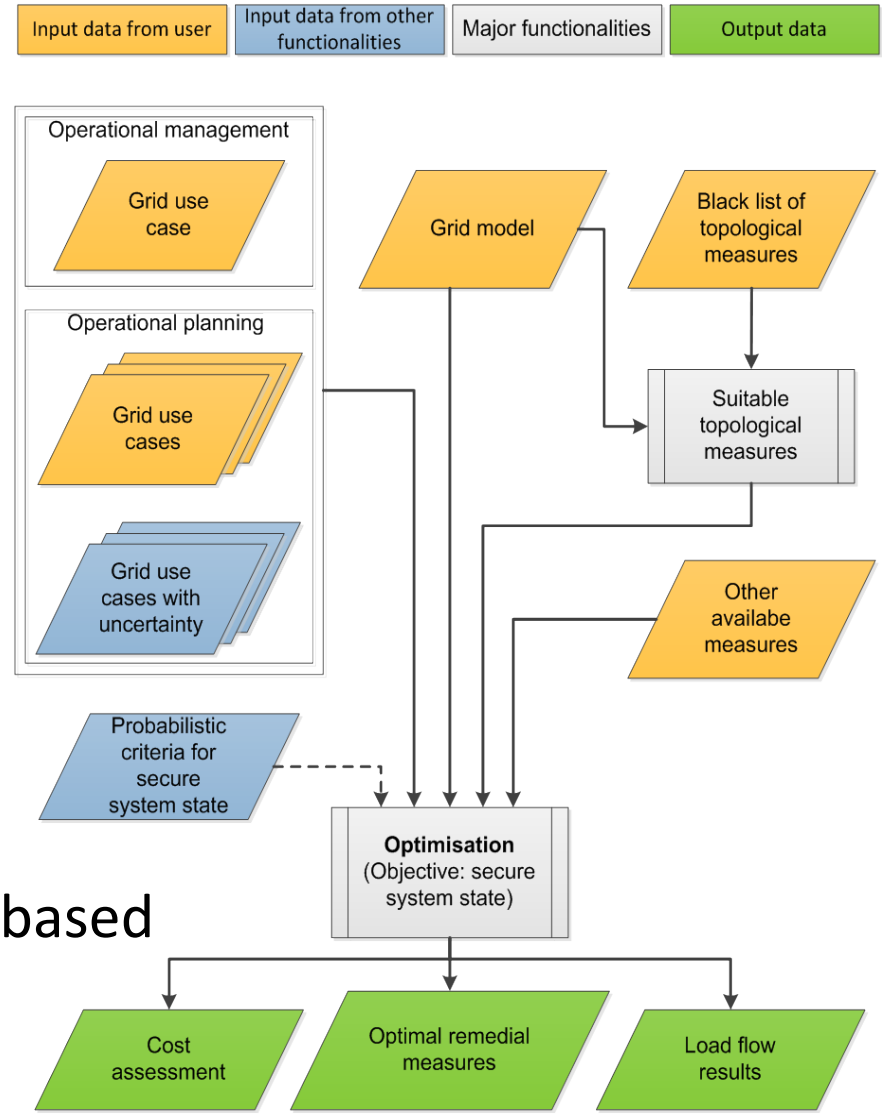
➔ Interfaces identified as key success factor



Toolbox Requirements (2/3)

- Functional and data require-ments for «system optimisation»
  - Output data has to cover
    - Cost assessment
    - Optimal remedial actions/measures
    - Results of load flow calculations
  - Data requirements
    - Grid model
    - Grid use cases
    - Technical & operational constraints
    - Contingencies
    - Available remedial measure
    - List of forbidden measures (black list)

➔ Input data from forecasting, risk-based assessment and user essential



Toolbox Requirements (3/3)

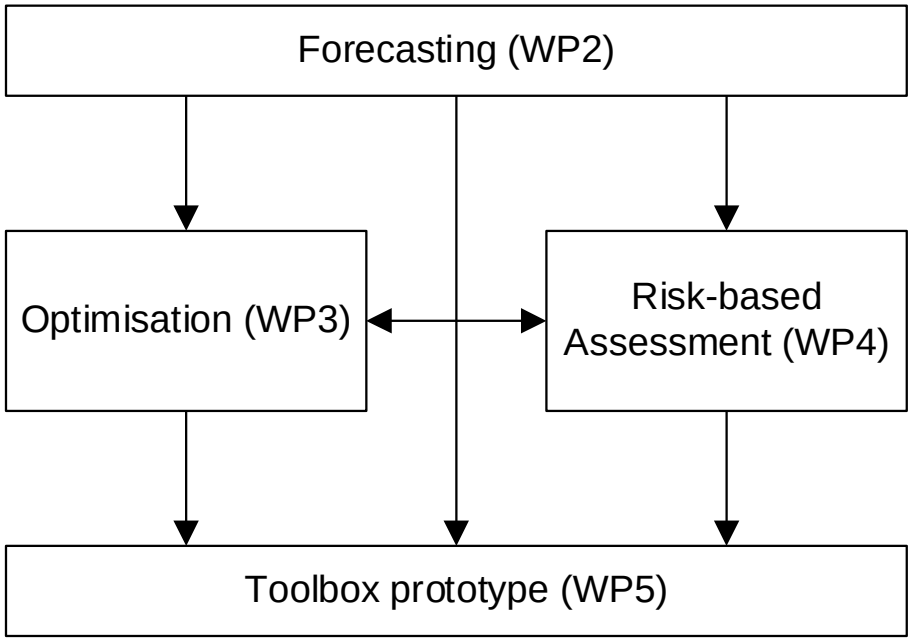
- Functional and data requirements for «risk-based assess.»
  - Provision of a model for risk assessment which can be integrated in operation planning and real-time operation processes of TSO
    - Upgrading todays' well-known and used N-1 criterion with a methodology combining the probability and the severity of contingencies
  - Data requirements:
    - Grid model with all necessary data to perform load flow calculations
    - Data on stochastic grid use cases
    - Technical and operational constraints
    - Outage probabilities of plant & apparatus
    - Historical data regarding asset availability (incl. cascading events)

➔ Adequate modelling of severity of contingencies

➔ Adequate method for risk-based assessment within operational planning

Interfaces and -dependencies

- Interfaces and –dependencies require close cooperation and exchange of information
- Consistent definition of interfaces vital:
  - Transfer of results
  - Exchange and interdependencies between Optimisation and RbA
  - Based on developed algorithms a common prototype toolbox will be developed in WP5



➔ Due to ongoing scientific work definitions are not finalised yet

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Key messages

- Distinction between functional and data requirements

➔ Different functionalities require specific input data

- Data provision and exchange between functionalities (i.e. WPs) is major challenge and key success factor

➔ Intensive communication and meetings with forecasting, optimization and risk-based-assessment set up

- Specification of data characteristics (format, granularity etc.) to be provided

➔ Research work still in progress

Testing Environment – Agenda

I. **Objectives and overview**

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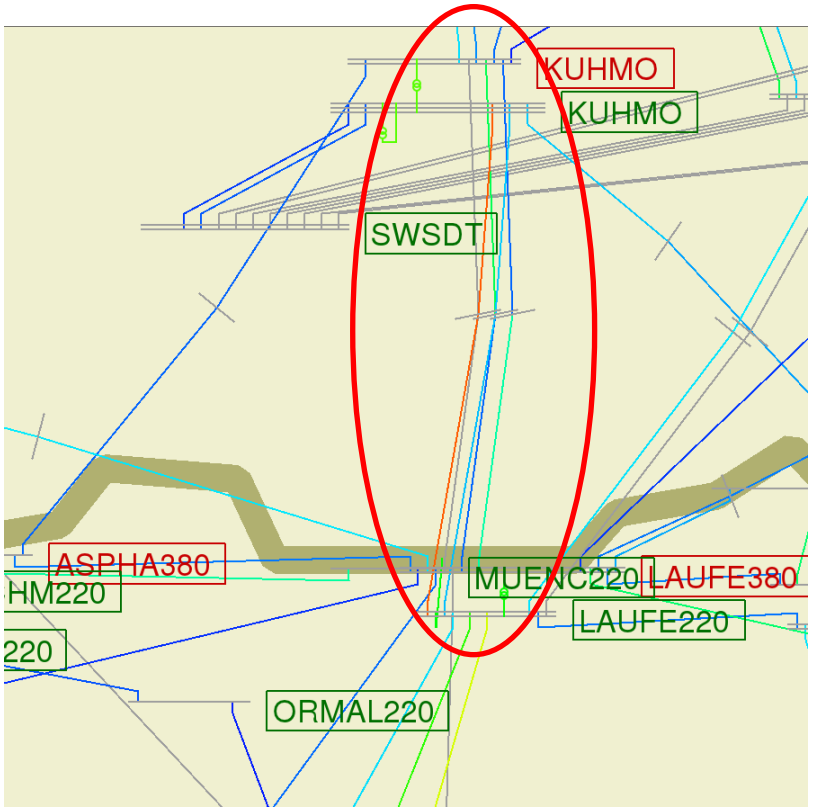
Objective

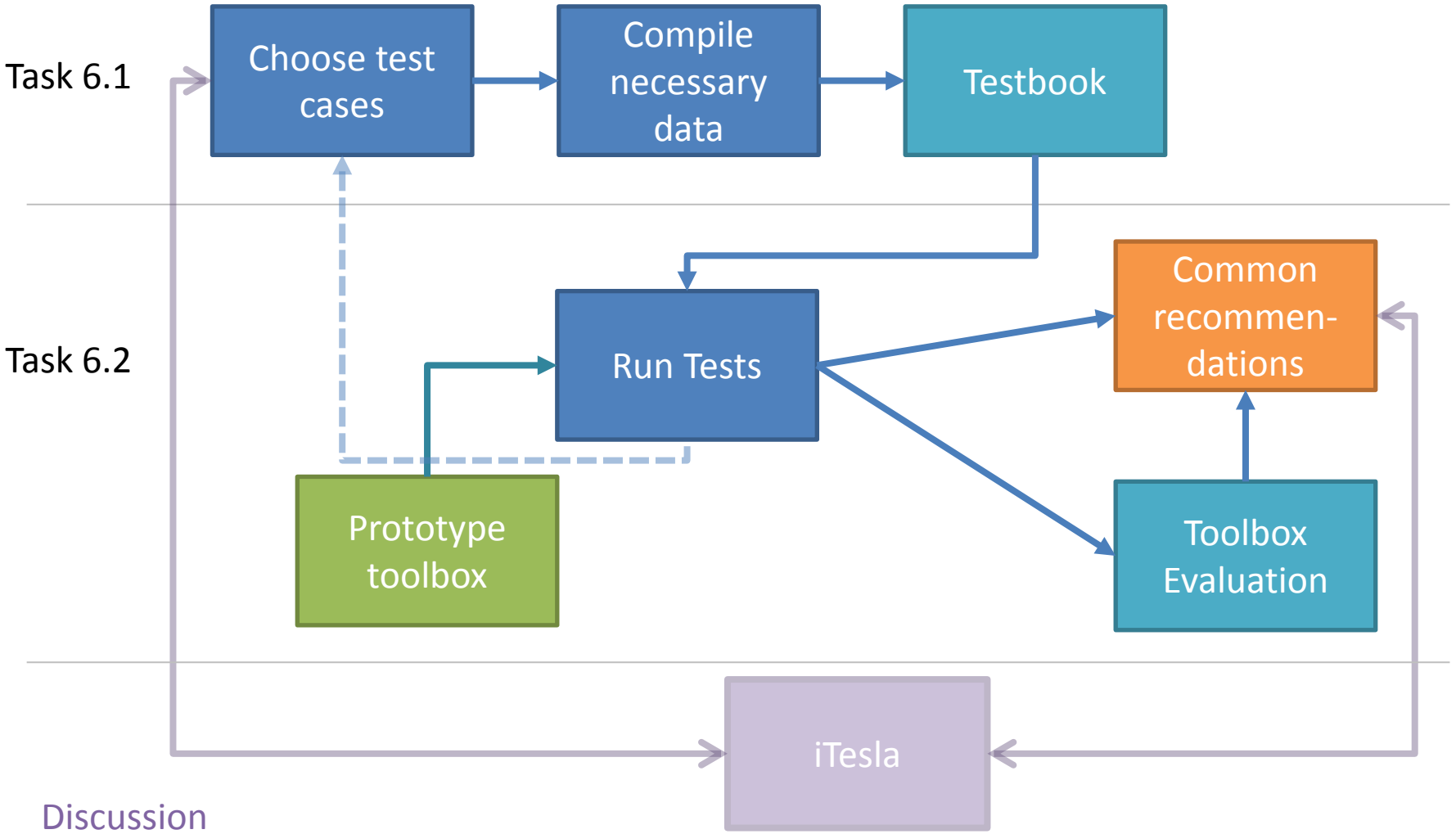
- **Goal:**
  - Test the developed toolbox and derive conclusions regarding TSO operating principals
- **Approach:**
  - Using the toolbox on historic test cases

- Collect/create proper test cases & harmonization with iTesla
- Assessment of the toolbox
- Common recommendations regarding operating rules



N-1-violation detected on 220kV tie-line
→What is the optimal remedial action?

Overview


Task 6.1
Choose test cases
Compile necessary data
Testbook
Task 6.2
Run Tests
Common recommen-dations
Prototype toolbox
Toolbox Evaluation
iTesla
Discussion

Agenda

I. Objectives and overview of WP6

II. Challenges

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Challenges

- Technical:
  - Determination of appropriate test cases
  - Collect necessary data
  - Data storage / data handling
  - Evaluation of remedial actions
- Organizational:
  - Which data can/cannot be used (legal/regulatory issues)

	AT	BE	CH	CZ	DE	DE	DE	DE	FR	HR	HU	IT	NL	PL	SI
	APG	Coreso	Swissgrid	CEPS	Amprion D7	TransnetBW D4	TenneT D2	50HzT D5, D8	Coreso	HEP	MAVIR	Coreso	TenneT	PSE-O	ELES
03:30															
07:30															
10:30															
12:30															
17:30															
19:30															
worst															

Compact representation of the DACF as indicator for stressed grid situations

Agenda

I. Objectives and overview

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Preliminary results

- Demonstrating and testing still in an early stage
- Yet some first implications are possible:
  - Compiling a complete dataset has proven difficult due to the necessity to get many data from many sources
    → Common TSO storage???
  - Data not or only implicitly modelled in current data sets & different data-formats (e.g. information on power plants, compensation elements; UCTE, DTF, RAW, …)
    → CIM-format???
  - Different definitions about the grid and fundamental parameters (TSO-internal and due to legal/regulatory reasons, e.g. load, vertical grid load, …)
    → Further harmonization on European level
- Which amount of extended data interchange and harmonization is necessary and feasible?
  → After the test & discussion with iTesla

Agenda

I. Objectives and overview of WP6

II. Challenges

III. Preliminary results

IV. Key messages

Key messages

- Demonstrating and testing is still in an early stage
- Even in this early stage further European harmonization seems preferable, especially regarding
  - data definitions
  - data formats
  - data handling

Thank you very much for your attention!

Questions?
Comments?

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