Umbrella Project

Workshop on System State Modelling and Toolbox Design

Demonstration & Testing

23rd of October 2014, Brussels

Patrick Wajant (TransnetBW GmbH)

ELES ELEKTRO-SLOVENIJA, d.o.o.

PSE Polskie Sieci Elektroenergetyczne

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

TU Graz Graz University of Technology

FGH Forschungsgemeinschaft für Elektrische Anlagen und Stromwirtschaft e.V.

ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich

TU Delft Delft University of Technology

Agenda “Demonstration & Testing”(WP6)

I. **Background and overview**

II. Challenges

III. Scientific Approach

IV. Outlook

WP6: Background and overview

Current TSO practice:

- Deterministic datasets
- Remedial actions implemented manually, based on operator experience

→ Today already hardly sufficient

→ Umbrella-Toolbox

WP6-Objectives:

- Collect / create test cases
- Run tests & assess the toolbox
- Derive conclusions regarding TSO operating principals

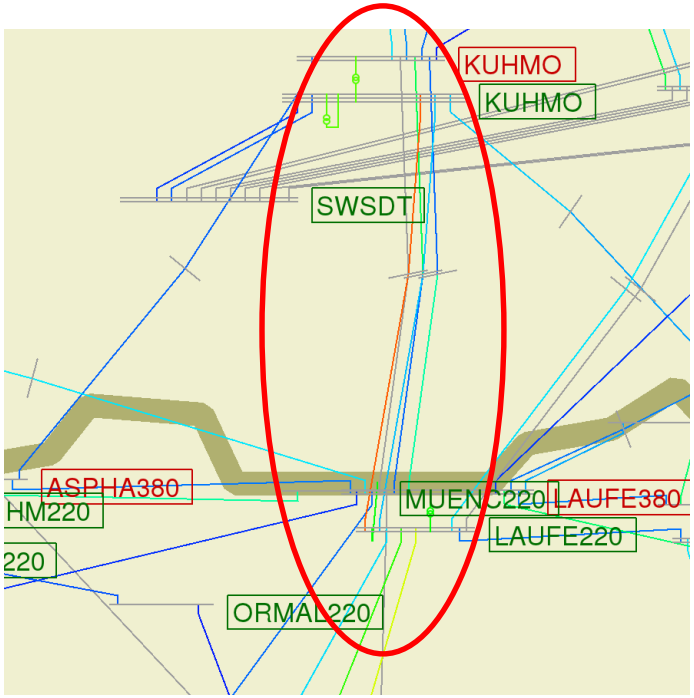

Figure 1: (n-1)-violation detected on 220kV tie-line → What is the optimal remedial action in a densely meshed grid?

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WP6: 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)

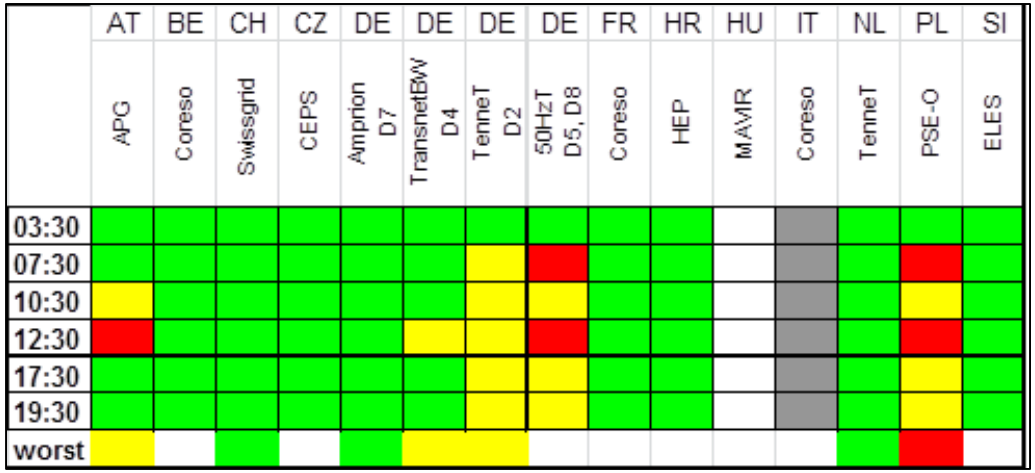

Figure 2: Compact representation of the day ahead congestion forecast as indicator for stressed grid situations.

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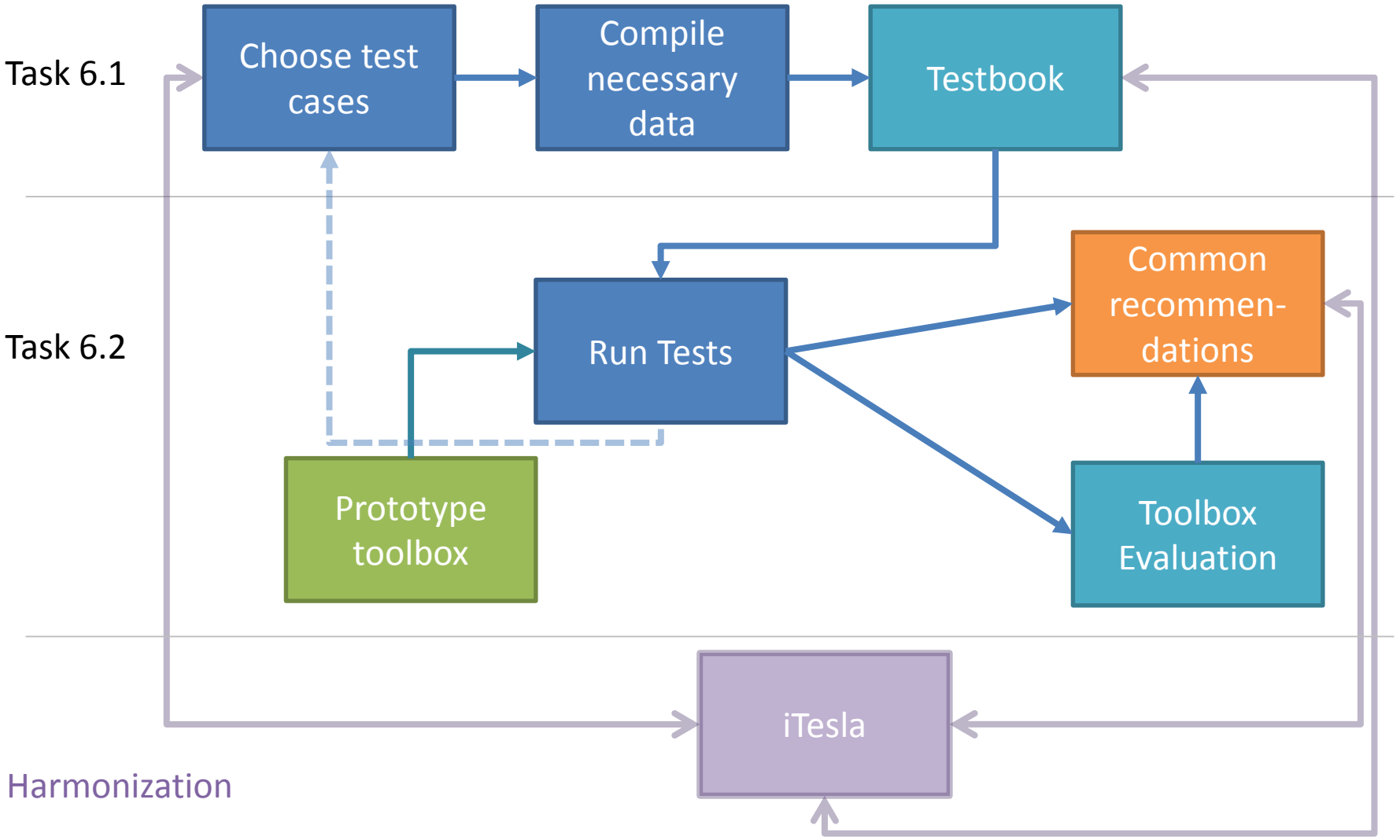
WP6: Scientific Approach

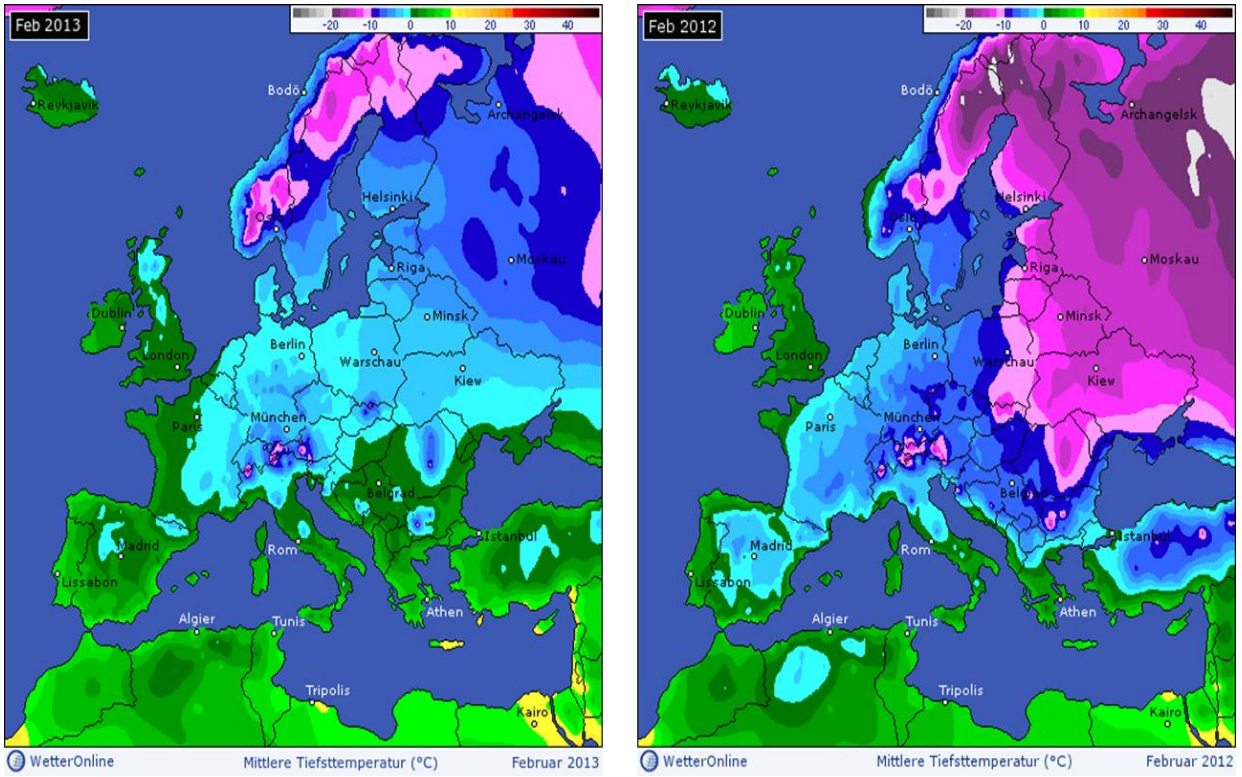


WP6: Selecting Test Cases

- Each TSO identifies several stressed grid situations
- The most common dates are selected

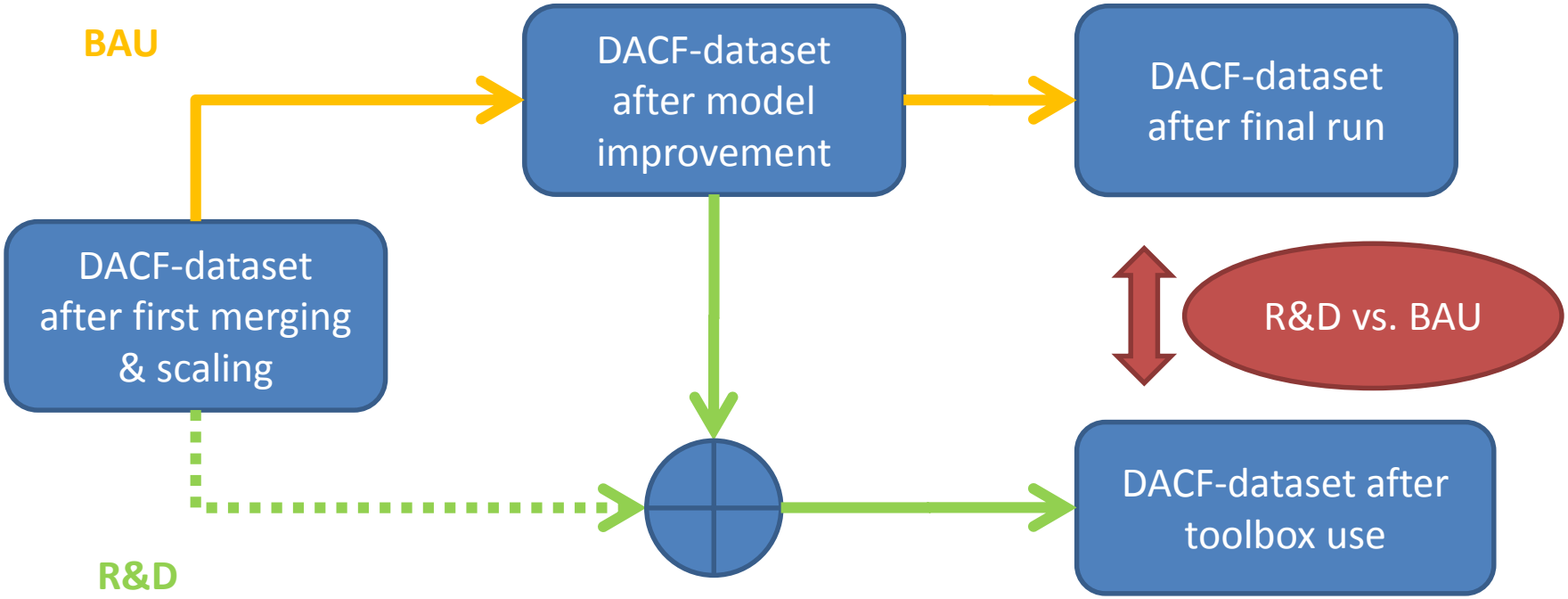
Requirements:

- Common Test Case with iTesla (8th of February 2012)
- Incorporate situations with summer/winter seasonal current limits
- Data provision causes lot of work



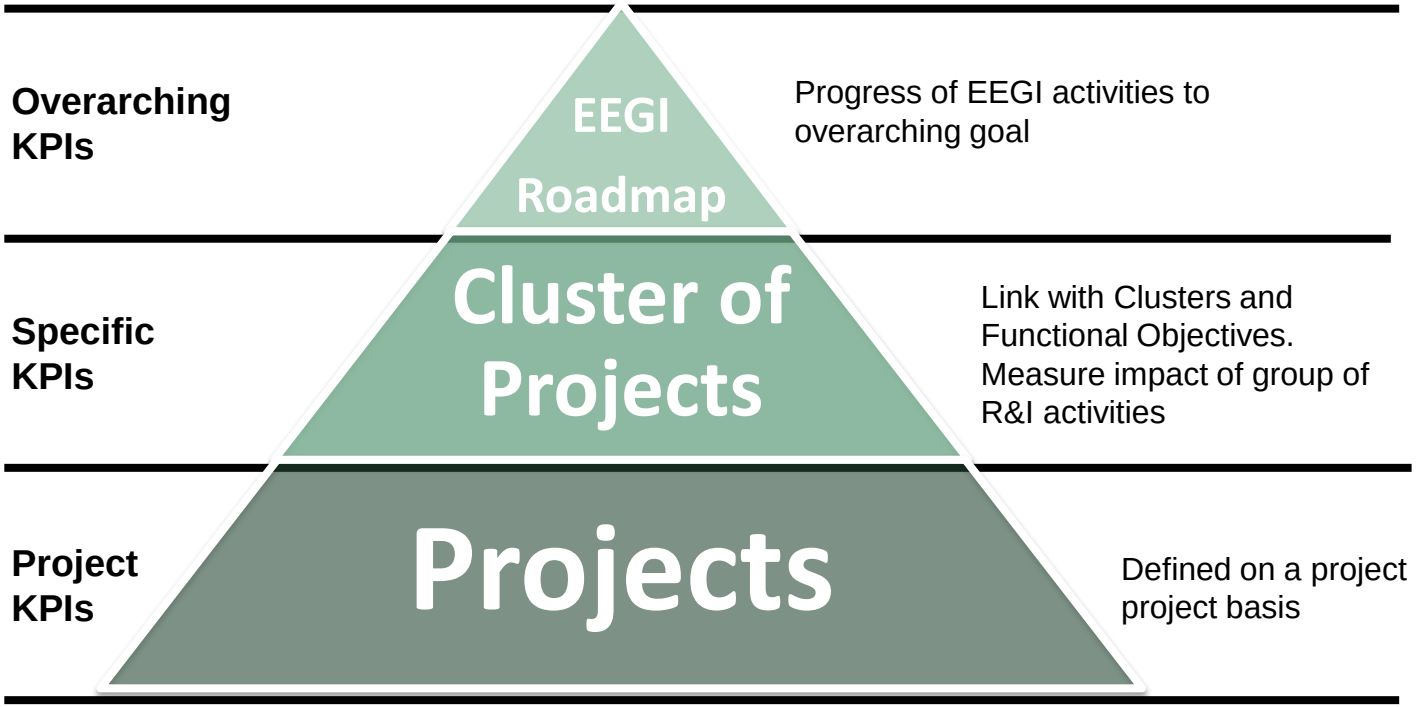
Graphical presentation of the average temperature minimum in February 2012 & 2013 (source: www.wetteronline.de)

WP6: Creating more test cases



- A comparison between DACF-datasets with toolbox-remedies can be performed.
- Different versions of DACF-datasets available in TSC CTDS-system (merged, with model improvements, with remedials)

WP6: KPIs - Overview



Source: Methodological Guide on EEGI KPIs

- A KPI usually is calculated by comparing the “business as usual (BAU)” case versus the “research and innovation (R&I)” case
  → Approach: Automatic calculation within the prototype-toolbox (work in progress!!!)

Overarching KPIs (1/2)

Overarching Goal:

"To allow European electricity networks continuously deliver effective flexible capacities in order to integrate actions of grid users at affordable costs"

Source: EEGI/GRID+

A.1 Increased network capacity at affordable cost

A.2 Increased network flexibility at affordable cost

Overarching KPIs (2/2)

- A.1 „Increased network capacity at affordable cost" proposal by GRID+:

$$\Delta NCAC = NCAC_{R\&I} - NCAC_{BAU}$$

with

ΔNCAC = Variation of Network Capacity at Affordable Cost [W/EUR]

$NCAC_{R\&I/BAU}$ = Network Capacity at Affordable Cost in R&I/BAU situation [W/EUR]

- Due to the fact that it is impractical to determine a "network capacity" in a densely meshed grid, the alternative GRID+-calculation-method can be applied:

$$\Delta C = C_{R\&I} - C_{BAU} \qquad [EUR]$$

$$\Delta C_{\%} = ((C_{R\&I} - C_{BAU}) / C_{BAU}) * 100 \qquad [\%]$$

- → The calculation is feasible for UMBRELLA, but the actual implementation within the toolbox is still to be determined!

Specific KPIs - power quality and quality of supply (1/2)

- B.3 proposal by GRID+:
  - $AIT(\%) = \frac{AIT_{BAU} - AIT_{R\&I}}{AIT_{BAU}}$ with

    $AIT_{\text{BAU/R\&I}} = \text{Average Interruption Time under BAU/R\&I}$
  - *Average Interruption Time (AIT)* represents the interrupted minutes per year and is calculated as the energy not supplied (ENS) per year via the average power during the period of interruption
  - Under the conditions of the previous slide this value can be calculated
  - Strongly dependent upon boundary between TSO/DSO and grid structure and operation strategy:

    E.g. in Germany: 110 kV-grids are often meshed and operated under a “softened” (n-1)-criterion and even more important: 110 kV belongs to the DSO → low significance of AIT for German TSO (at least in operational planning and real time operation) → Alternative/additional definition necessary?

Specific KPIs - power quality and quality of supply (2/2)

- Alternative/additional B.3 proposal:
  - $AST(\%) = \frac{AST_{BAU} - AST_{R\&I}}{AST_{BAU}}$ with
    $AST_{BAU/R\&I}$ = Average number of (n-1)-Secure Timestamps (power flow datasets in hourly resolution) under BAU/R&I
  - TSO operational planning processes utilize an hourly resolution (00:30, 01:30, …, 23:30)
  - For every timestamp the (n-1)-criterion has to be fulfilled in order to be able to guarantee the quality of supply from TSO point of view.

    → How does the toolbox (semi-) automatic work perform compared to (time consuming and error prone) manual daily work?
  - Additional info about the actual security level can be gained by using the probabilistic functions of the toolbox.

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WP6: Outlook

- The actual tests are commencing in November/December.
- Output from the actual tests can be expected next year.

Thank you very much for your attention!

Questions?
Comments?

This research work has been carried out within the scope of the project UMBRELLA, supported under the 7th Framework Programme of the European Union, grant agreement 282775.

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