

REMEDIAL ACTION OPTIMIZATION AS PART OF THE COORDINATED SECURITY ANALYSIS SERVICE AT NORDIC RCC

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Background

The Nordic power system is highly interconnected as well as weather-dependent due to the continuously increasing renewable energy in the grid. The increasing complexity of grid management makes it important to anticipate risks and incorporate uncertainty to ensure effective and economically efficient operational planning. The Coordinated Security Analysis Service (CSA) performed by the Nordic Regional Coordination Center is comprised of several steps aiming to characterize operational security risks both in the Day-Ahead and Intraday electricity market timeframe. The service aims to provide a regional and cross-regional security overview to enhance coordination of system operation.

Objective

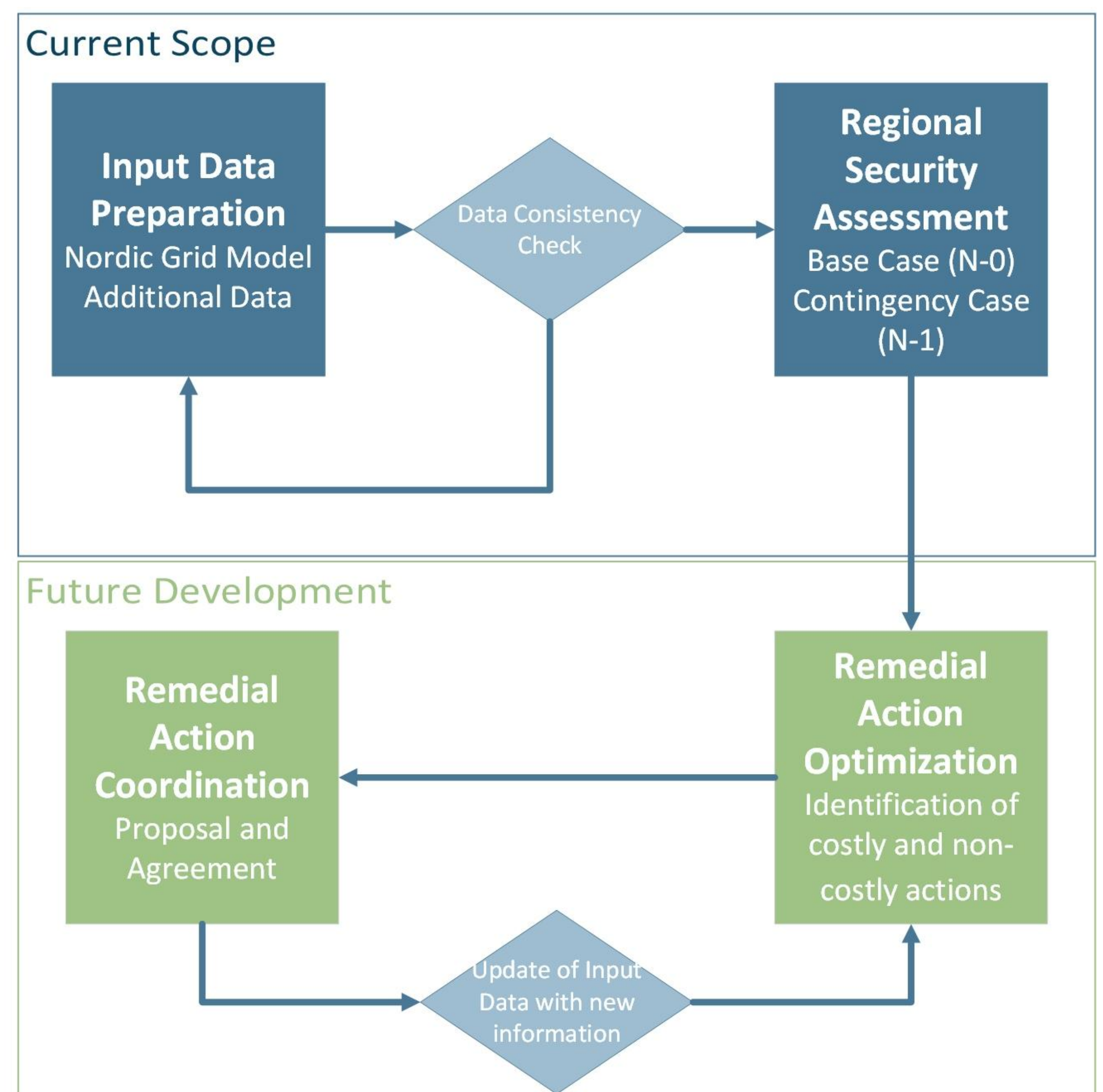
The next step is to include Remedial Action Optimization (RAO) in the CSA Service. The objective of RAO is to design remedial actions at a regional level and to coordinate these with the Nordic TSOs and neighboring regions. To support this new task a decision-making model will be developed aiming to:

Identify efficient and cost-effective remedial actions

- ✓ Optimize remedial action choice based on the lowest overall cost for all parties
- ✓ Model risk and uncertainties in the grid

Support TSO operational planning in Day-Ahead and Intraday timeframes

- ✓ Model decisions to be made in each timeframe
- ✓ Run several times per day
- ✓ Prepare for real time operational risks



Methodology

In the Regional Security Assessment violations of operational security limits are recorded both in the base case grid situation (N-0) and in the application of contingencies to the base case grid situation (N-1).

RCC solves RAO problem both to relieve violations in:

- N-0 scenario by proposing curative actions;
- N-1 scenario by proposing preventive actions.

Objective

Minimize the cost of remedial actions both in Base Case and Contingency Case

Constraints

Operational, Technical and Procedural

Decision Variables

Available remedial actions:

1. Modification of planned outages
2. Actions impact active power flow
3. Actions to control of voltage and reactive power
4. Recalculation of cross-zonal capacities
5. Redispatch
6. Countertrading
7. HVDC setpoint adjustment
8. Activation of frequency reserves
9. Load curtailment

Challenges



Modelling of uncertainty and associated risk

Assessing and dealing with uncertainties of generation and load.
Probability and impact of contingencies.



How to deal with problem complexity and time constraints

Service running in a tight schedule will require relaxations and well-defined exit conditions.



Data Quality and Availability

Grid Model quality key to ensure proper decision making



Cost Sharing and Cost uncertainty

Cost sharing based on proportional to the impact of the remedial actions on different network elements.
Cost of remedial actions might be uncertain.

Expected Results

- ✓ Enhance grid security and aid in the further integration of renewables in the Nordic Grid.
- ✓ Reducing operational costs in the Nordic region by improving coordination and interoperability.
- ✓ Enhance transparency and reliability of operational planning information.