Coordination Platform for Handling Emergencies and Restoration of Power Grid

Dušan Popadić[1] and Marko Batić[1]

[1] Institute Mihajlo Pupin, University of Belgrade, Belgrade, Serbia
dusan.popadic@pupin.rs

Abstract. Transmission service operators (TSOs), regional security centres (RSCs), distribution service operators (DSOs), generation units (GUs) and balancing service providers (BSPs) need quick and reliable way of communication in order to secure power grid balance. They need to exchange information about grid stability, problems on the grid and defence plans in an easy and traceable way. This paper presents a software solution for handling these situations efficiently.

Keywords: Power grid, Coordination, Transmission service operator, Generation unit.

1 Introduction

Transmission service operators (TSOs), regional security centres (RSCs), distribution service operators (DSOs), generation units (GUs) and balancing service providers (BSPs) need quick and reliable way of communication in order to secure power grid balance [1, 2]. They need to exchange information about grid stability, problems on the grid and defence plans in an easy and traceable way. This paper covers three separate use cases and their sub-cases:

- Dispatch order
  - Balancing order
  - Availability and readiness
- Critical information exchange
  - Event
  - Warning
- Defence plan coordination

These use cases shall be integrated as a part of the Coordination platform developed in the TRINITY project framework. An overview of actors and use cases can be seen in Figure 1.

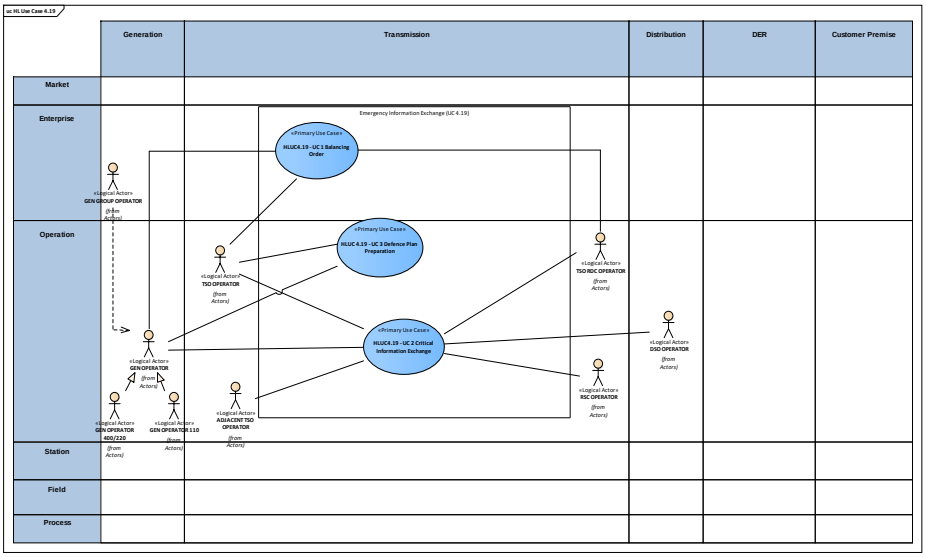

Fig. 1. Overview of use cases

2 Solution

The Coordination platform is based on the OperatorFabric [3] which supports sending notifications to users in form of cards. The platform is web based application for reliable and secure communication and coordination that utilize the OAuth2 protocol [4] for authorization and thus ensure that only authorized people can access this sensitive process.

2.1 Balancing order

TSO operator can use the coordination platform to create and sent balancing (dispatch) orders to generation units or balancing service providers with, for instance, a request to increase or decrease the power production. Balancing orders can be issued manually through the platform using a predefined form or automatically by a third party software used by TSO. A Balancing order contains information about the type and amount of change in the concerned period and, optionally, a comment. The operator can validate or reject the request via GUI as shown in Figure 2.

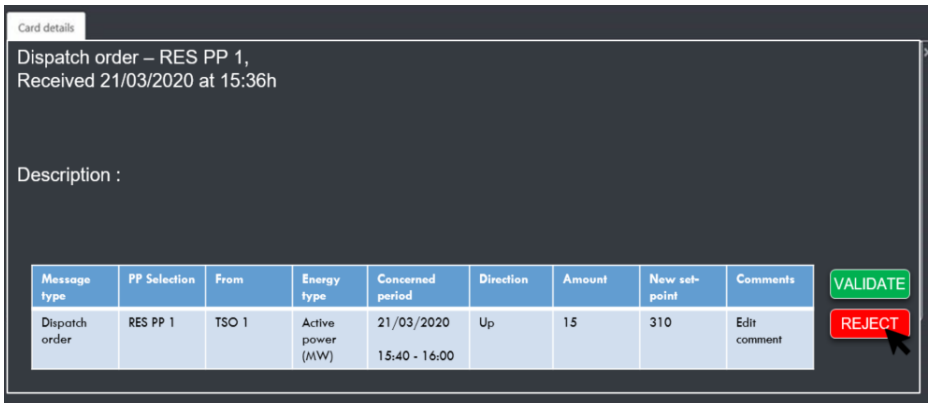

Fig. 2. Balancing order card

In case the order is generated automatically, an xml file containing all relevant information is posted to the file server. The coordination platform downloads the file from the server, parses it (extracts relevant information) and then creates notification for the receiver. The xml file is formatted according to the ENTSO-E[1] standard.

An UML sequence diagram of communication between interested parties is shown in Figure 3.

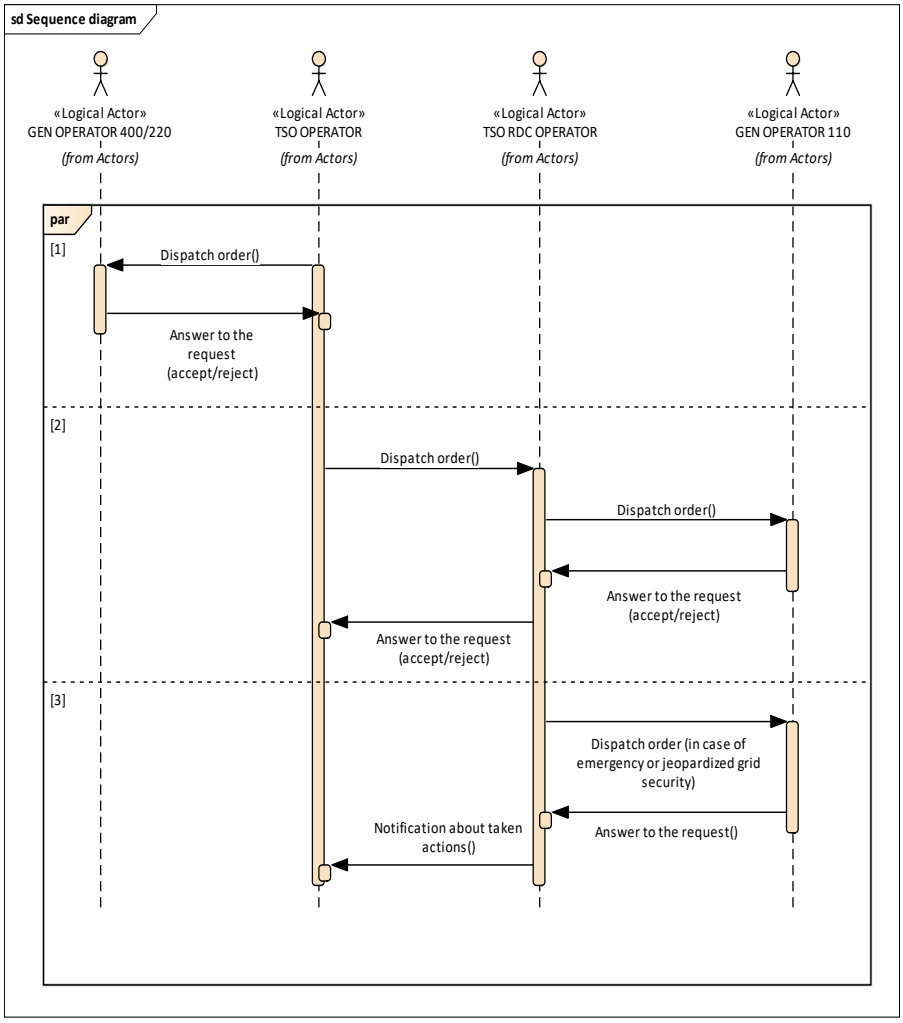

Fig. 3. Balancing order sequence

[1] xmlns=”urn:entsoe.eu:wgedi:errp:activativatondocument:5:0”

2.2 Availability and readiness

Generation units or regional operators as parts of a TSO can inform the TSO operator about availability of generation units in certain periods of time due to planned or unplanned outages (e.g. maintenance). It is done using the coordination platform's predefined form. TSO only acknowledges that the notification is received.

2.3 Critical information exchange

A user of the platform can inform other user(s) about an event that occurred on the grid or warn them about a potentially problematic situation. The user who is providing the information should include the type and the name of element concerned, the type of event/warning and its description.

Types of elements identified:

- Line
- Transformer
- Generator
- Busbar
- Coupler
- Substation

Events identified:

- Tripping
- Power shortfall

Types of warnings:

- Overload due to unexpected high load flow
- Overload due to unexpected disconnection of other element
- Unexpected high flows
- N-1 violation
- Low voltage level
- High voltage level
- Shortage of power reserves
- High wind generation
- Bad weather conditions
- Activation of exceptional contingencies
- Disturbance of control system infrastructure (e.g. IT, building)

The receiving party only acknowledges the receipt of that the notification is received.

2.4 Defence plan

TSO uses predefined form in the coordination platform to inform the generation units about new frequency set point values.

3 Conclusion

In this paper a coordination platform for handling emergencies and restoration in power grid was presented. Coordination platform allows operators to communicate quickly, easily and reliably in critical situation. Since the purpose of the platform is to help during the emergencies, it is planned for it to be further developed to support situations when the grid split or part of the grid goes to the blackout.

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References

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