Network model validation

Based on IEC 62559-2 edition 1
Generated from UML Use Case Repository with Modsarus® (EDF R&D Tool)

1. Description of the use case

1.1. Name of use case

Use case identification		
ID	***Area(s)/Domain(s)/Zone(s)***	***Name of use case***
	Long-term planning	Network model validation

1.2. Version management

Version management				
Version No.	***Date***	***Name of author(s)***	***Changes***	***Approval status***
1	2018-09-27	Nejc Petrovic		Approved Version

1.3. Scope and objectives of use case

Scope and objectives of use case	
Scope	The scope of this system use case is the validation of the combined network model of the TSO and the DSO used for long-term planning studies. A successful validation means that common planning simulations such as load-flow, state estimation, etc. can be performed successfully.
Objective(s)	Obtain more detailed insight into network conditions at responsibility area borders
Related business case(s)	

1.4. Narrative of Use Case

Narrative of use case
Short description
This system use case describes the process of validating a combined representative network equivalent in observability area which means it includes network information from both the TSO and the DSO.
Complete description
This system use case describes the process of validating a combined representative network equivalent in observability area which means it includes network information from both the TSO and the DSO. When combining two different network models a validation of the combined model has to be carried out in order to guarantee the successful merger of the two models which can, in turn be used for complex and precise planning studies. The validation is done two-fold. First the Common Observability Area is verified. This Common Observability Area is defined in a way that both the TSO and the DSO represent it in the same manner. Therefore, the overlapping area should be represented by the same network elements and the same connectivity in both the TSO's and the DSO's planning systems. If the areas are not an exact match, the validation is unsuccessful. Upon successfully validating the Common Observability Area the consistency of the combined

network model is verified. This is done with an Iterative Numerical Analysis which are very common in planning applications or systems. For example a load flow analysis or a state estimation analysis uses this kind of approach. In order for the Iterative Numerical Analysis to be successful the nodes have to meet the mismatch tolerance, meaning that combined model converges. If the nodes do not meet the mismatch tolerance the validation process is considered unsuccessful. If the validation is unsuccessful, the combined model must be further examined in order to find the discrepancies which are then sent to the sender of the change model for reconstruction. If the validation is successful, a notice of a successful validation is sent to the sender of the change model.

1.5. Key performance indicators (KPI)

Key performance indicators			
ID	***Name***	***Description***	***Reference to mentioned use case objectives***
1	Load-flow converges		Obtain more detailed insight into network conditions at responsibility area borders
2	Common Observability Area is consistent		Obtain more detailed insight into network conditions at responsibility area borders

1.6. Use case conditions

Use case conditions	
Assumptions	
1	DSO and TSO utilize CIM for network model exchange
2	Observability area between DSO and TSO is defined
Prerequisites	
1	System Development Planning system is capable to perform load-flow analysis

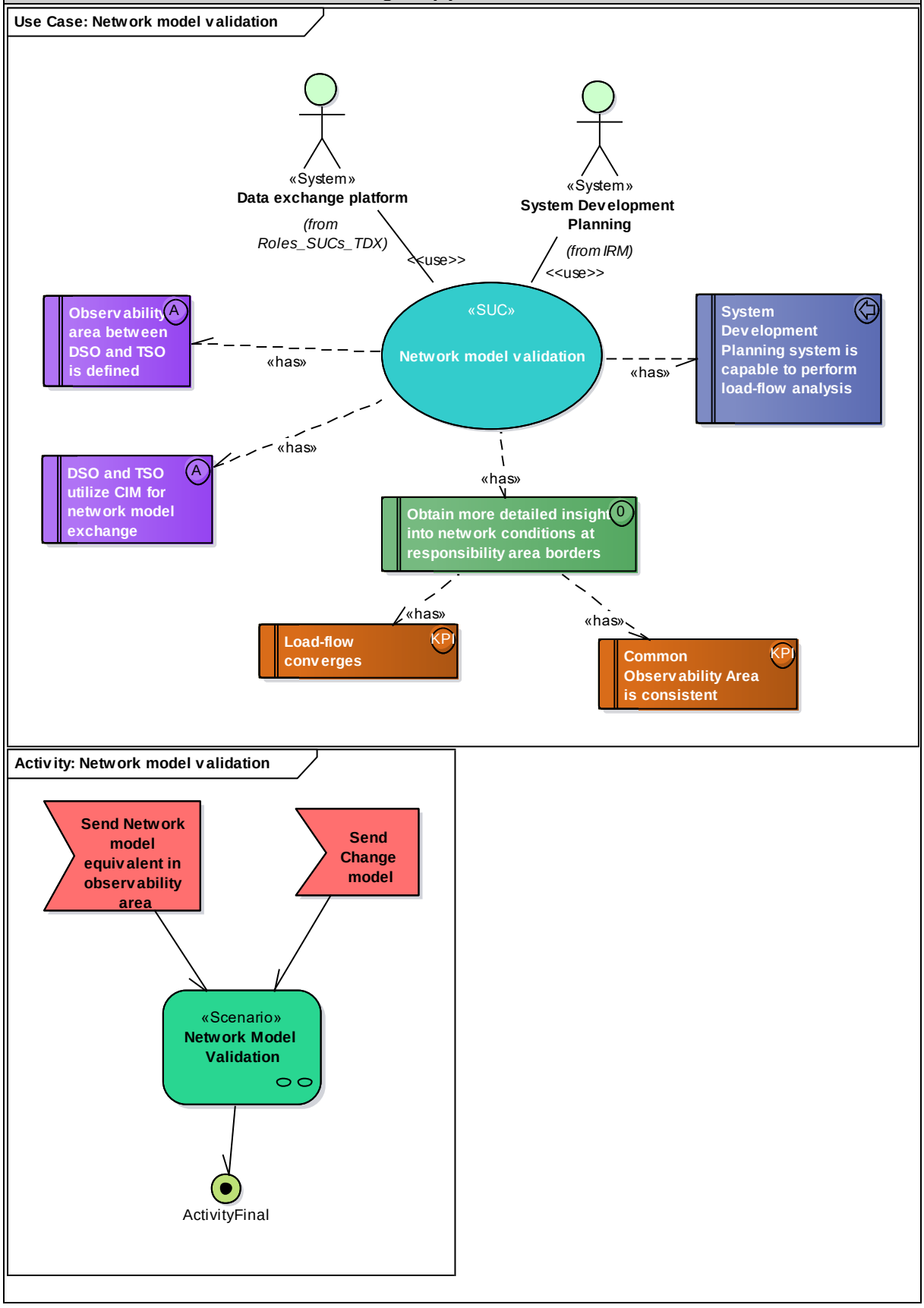
1.7. Further information to the use case for classification/mapping

Classification information
Relation to other use cases
<<BUC>> Coordination of long-term network planning between TSO and DSO. <<SUC>> Update of Network models representation <<SUC>> Information exchange using a collaborative platform
Level of depth
Prioritisation
Generic, regional or national relation
Generic
Nature of the use case
SUC
Further keywords for classification
Network Model Validation, Observability area

1.8. General remarks

2. Diagrams of use case

Diagram(s) of use case



3. Technical details

3.1. Actors

Actors			
Grouping (e.g. domains, zones)		***Group description***	
Actor name	***Actor type***	***Actor description***	***Further information specific to this use case***
System Development Planning	System	The System Development Planning (SDP) business function involves network development and long term planning. The business function support cooperation and coordination to develop of a secure, environmentally sustainable and economic network system aimed at an adequate grid for the purpose of a well-functioning network operation and market operation. This is done through good planning with focus on future infrastructure characteristics, efficient asset management, critical infrastructure protection and system operability perspective.	
Data exchange platform	System	Platform used by several entities to exchange information for different proposes. The 3 type of data (Real-time; scheduled and structural data) can be exchanged in this platform. The operational/control data are not included in real-time type. The exchange of information related with the markets are included in the scheduled data. Data-agnostic ICT infrastructure that enables secured and reliable information exchange for different purposes and within different time scales.	

3.2. References

4. Step by step analysis of use case

4.1. Overview of scenarios

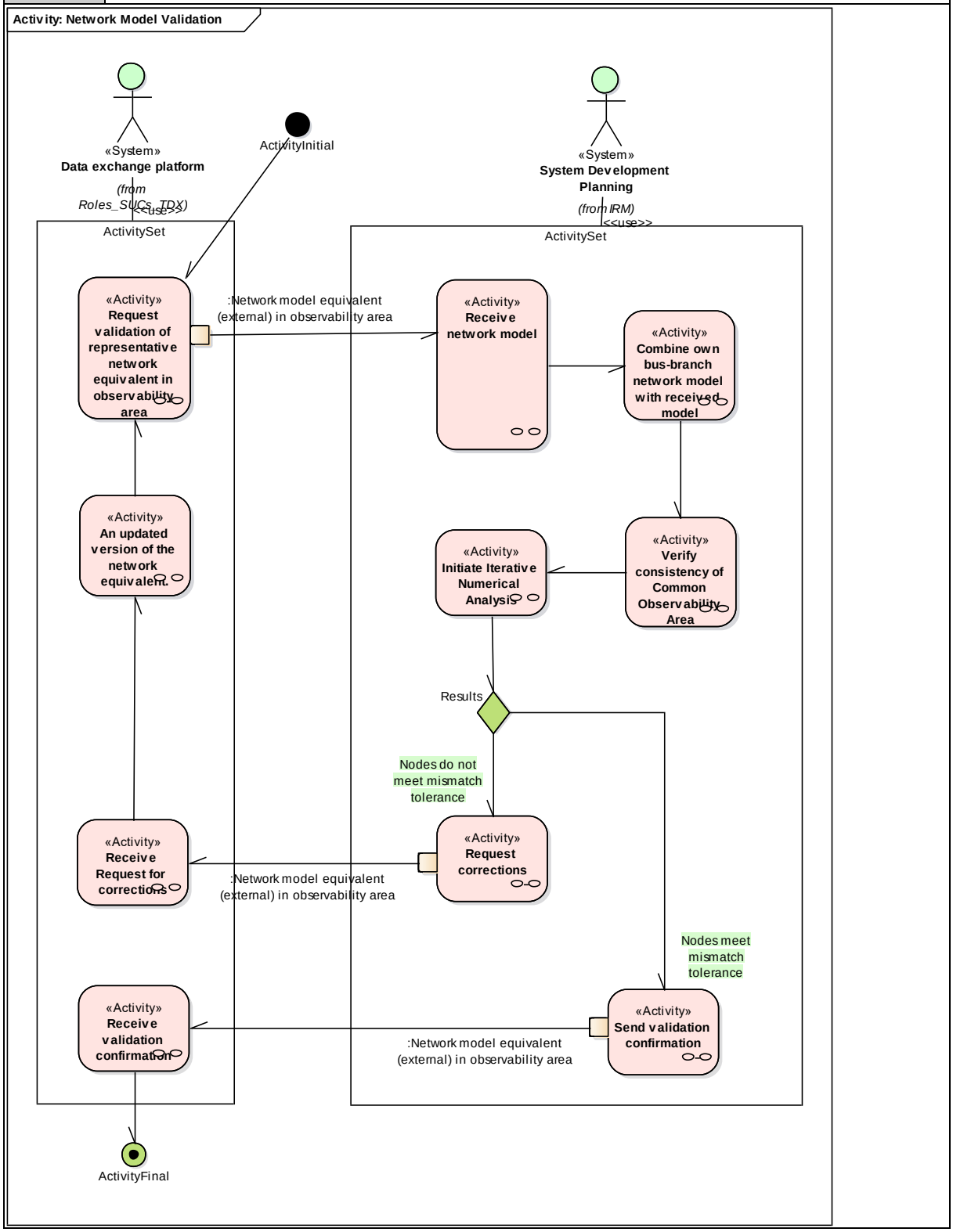
Scenario conditions						
No.	***Scenario name***	***Scenario description***	***Primary actor***	***Triggering event***	***Pre-condition***	***Post-condition***
1	Network Model Validation			Send Network model equivalent in observability area Send Change model		

4.2. Steps - Scenarios

4.2.1. Network Model Validation

Scenario step by step analysis

Scenario	
Scenario name	Network Model Validation



Step No	Event	Name of process/activity	Description of process/activity	Service	Information producer (actor)	Information receiver (actor)	Information exchanged (IDs)	Requirement, R-IDs
1.1		Request validation of representative network equivalent in observability area	The System Development Planning department of the Interconnected Partner sends the constructed Network model equivalent in observability area in CIM format through the Data Exchange Platform to the internal System Development Planning department who initiated the request.		Data exchange platform	System Development Planning	Info1-Network model equivalent (external) in observability area	
1.2		Receive network model	The internal System Development Planning department who initially requested the representative network equivalent in observability area from the interconnected partner receives the model through the Data Exchange Platform		System Development Planning			
1.3		Combine own bus-branch network model with received model	The System Development Planning department has to combine the recently received representative network equivalent in observability area from the interconnected partner or changes to the		System Development Planning			

			interconnected partners representative network equivalent in observability area with the internal network model used for planning studies.					
1.4		Verify consistency of Common Observability Area	The System Development Planning department should verify the structural information in the common observability area. This is done by confronting the internal network model used for planning studies with the representative network equivalent in the observability area from the interconnected partner and verifying his consistency. This means that the structural information in both models should generally be the same, except for the changes to structural information, which have been properly communicated.		System Development Planning			
1.5		Initiate Iterative Numerical Analysis	This process is part of virtually all kinds of power flow or load flow analysis		System Development Planning			

			nowadays. In order to perform this kind of numerical analysis, different methods can be used, e.g. Gauss-Siedel, Newton-Raphson, Holomorphic embedding load flow method, etc… If the combined model converges by one of these methods, the joint model is considered valid.					
1.6		Receive Request for corrections	The required corrections as a result of the validation process of the representative network equivalent are received by the interconnected partner.		Data exchange platform			
1.7		Receive validation confirmation	The interconnected partner received information about successful of the validation process.		Data exchange platform			
1.8		Request corrections	The validation process is unsuccessful meaning that there are inconsistencies in the combined models. These should be identified and communicated with the interconnected partner for correction.		System Development Planning	Data exchange platform	Info1-Network model equivalent (external) in observability area	

1.9		An updated version of the network equivalent.	The System Development Planning department of the Interconnected Partner sends the update to the representative network equivalent in observability area in the form of a Change model in CIM format through the Data Exchange Platform to the internal System Development Planning department who initiated the request. This process is described in the SUC "Update of Network models representation".		Data exchange platform			
1.10		Send validation confirmation	The validation process is successful. A confirmation of this is sent to the interconnected partner.		System Developme nt Planning	Data exchange platform	Info1-Network model equivalent (external) in observabilit y area	

5. Information exchanged

Information exchanged			
Information exchanged, ID	***Name of information***	***Description of information exchanged***	***Requirement, R-IDs***
Info1	Network model equivalent (external) in observability area	Representation of network equivalent model in observability are using a CIM format using bus-branch representation. According the European grid-codes, the information object should include at least: Request ID Period Observability area ID Status [In validation, Validated, Changes Request] (a) Substation ID by voltage; (b) line that connect substations referred to in point (a); (c) transformers from the substations referred to in point (a); (d) SGUs; and (e) reactors and capacitors connected to the substations referred to in point (a). Type of information [Complete / Partial*] *The type of information "Partial" means that only some parts of the network are exchanged. This is useful to update the network information models.	

6. Requirements (optional)

7. Common terms and definitions

8. Custom information (optional)