Definition of representative network equivalent in observability area

Based on IEC 62559-2 edition 1
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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	Definition of representative network equivalent in observability area

1.2. Version management

Version management				
Version No.	***Date***	***Name of author(s)***	***Changes***	***Approval status***
1	2018-09-06	Nejc Petrovic		Approved Version

1.3. Scope and objectives of use case

Scope and objectives of use case	
Scope	This system use case defines the information required for exchange between the TSO and the DSO for optimal long-term network development planning. The information is limited to the defined observability area between TSO and DSO.
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
Definition of representative network equivalent in observability area. This process can be generic for TSO and DSO and can be used in the TSO/DSO interface or in DSO/DSO interface. In this case is assumed that the Observability area is already defined. This process is a generic process that can be used for different purposes. In the presented project this SUC is used to update the network models in a long-term planning.
Complete description
This system use case describes the steps necessary in the process of defining a network model suitable for exchange between the TSO and the DSO which includes expected network development plans in the future. The exchange itself is not part of this system use case. According to ENTSO-E's network codes, the DSO and TSO should exchange expected network development plans and the current status of their respected network every 6 months. This is step forward in the current planning practice as no such formal information exists. In order to successfully perform network studies the network models are usually constructed in the bus-branch representation. On the other hand, network models in Network Model Management Systems are usually constructed in the node-breaker representation. The challenge for this use case is to perform the required transformation from one representation to the other while keeping a high

level of detail and extracting the necessary information only for the defined observability area. Additionally, the information regarding the expected network development plans for the future either have to be preserved if the plans are part of the Network Model Management system or added subsequently if part of any other system. Also, the foreseen network development plans have to be constructed in the bus-branch representation of the model. The transformation is achieved through Network Topology Processing which is functionality present in many wide-spread planning application or systems in DSO's and TSO's. The functionality calculates the connectivity of the network and eliminates all unnecessary network elements for planning studies. For example, it treats closed switches as branches and eliminates any branches with open switches. The bus-branch representation serves as a representative network equivalent which is further limited to the observability area. This process is triggered by a related use case, update of Network models representation.

1.5. Key performance indicators (KPI)

Key performance indicators			
ID	***Name***	***Description***	***Reference to mentioned use case objectives***
1	Successful validation of combined network model in observability area		Obtain more detailed insight into network conditions at responsibility area borders

1.6. Use case conditions

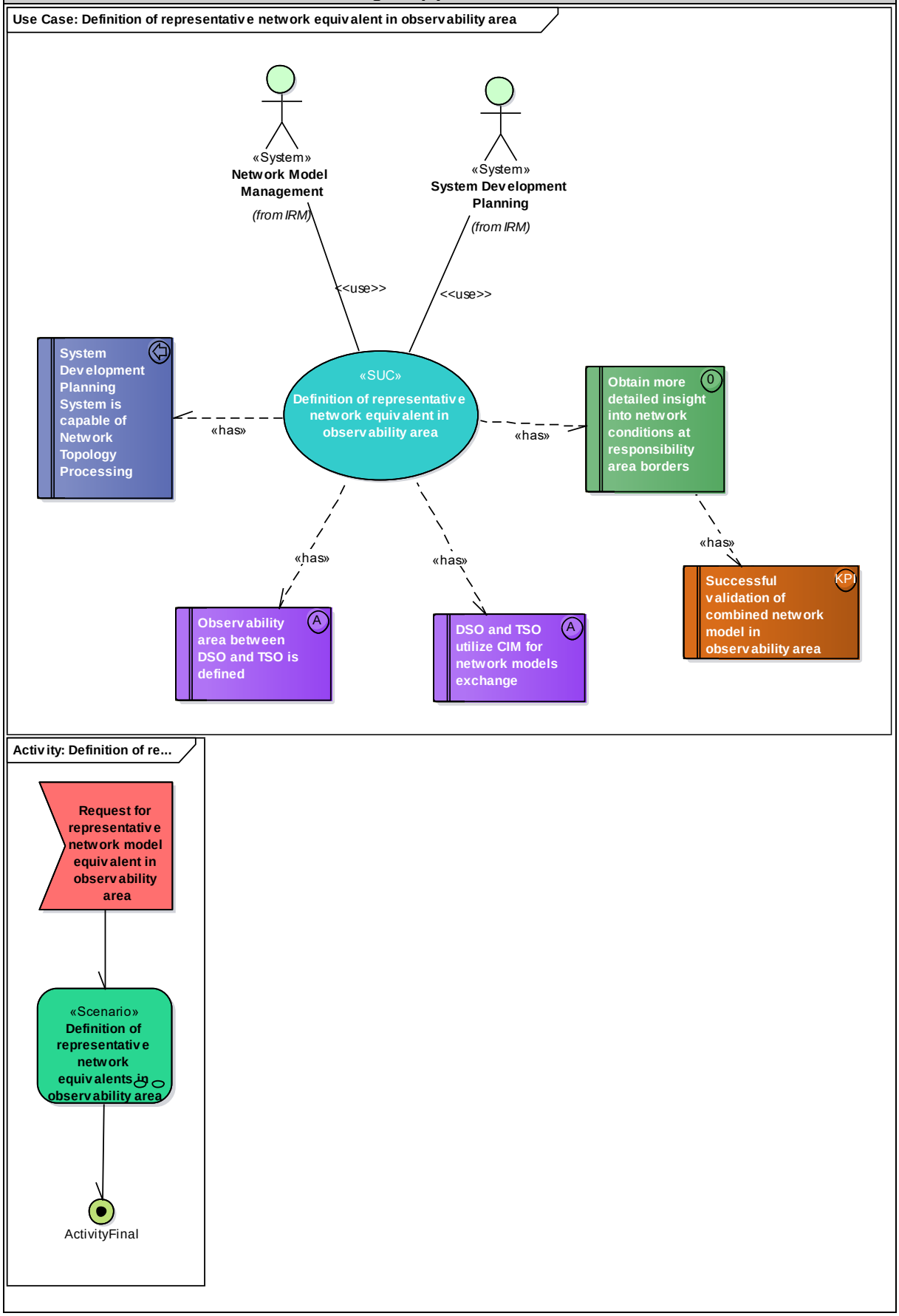
Use case conditions	
Assumptions	
1	Observability area between DSO and TSO is defined
2	DSO and TSO utilize CIM for network models exchange
Prerequisites	
1	System Development Planning System is capable of Network Topology Processing

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
Level of depth
Prioritisation
High
Generic, regional or national relation
Generic
Nature of the use case
SUC
Further keywords for classification
Network Equivalent, Observability area

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***
Network Model Management	System	The Network Model Management (NMM) manages information for establishing and maintenance of the functional description of the network grid that is provided by current installed asset (as-built model), planned installed asset (future model) or potential installation (what-if/ hypothetical model). The focus is to provide a mathematical model of the network grid that can be used in different analysis of the grid, including but not limited to steady state power flow, state estimation, contingency analysis as part of security assessment and stability analysis. It maintains master representations of the power system for network analysis functions, so that all analysis shares the same source information. Network Model Management (NMM) handles both internal enterprise element and cross entity both in the horizontal and vertical domain, e.g. TSOs-TSOs and TSOs-DSOs coordination.	
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.	
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.	

3.2. References

4. Step by step analysis of use case

4.1. Overview of scenarios

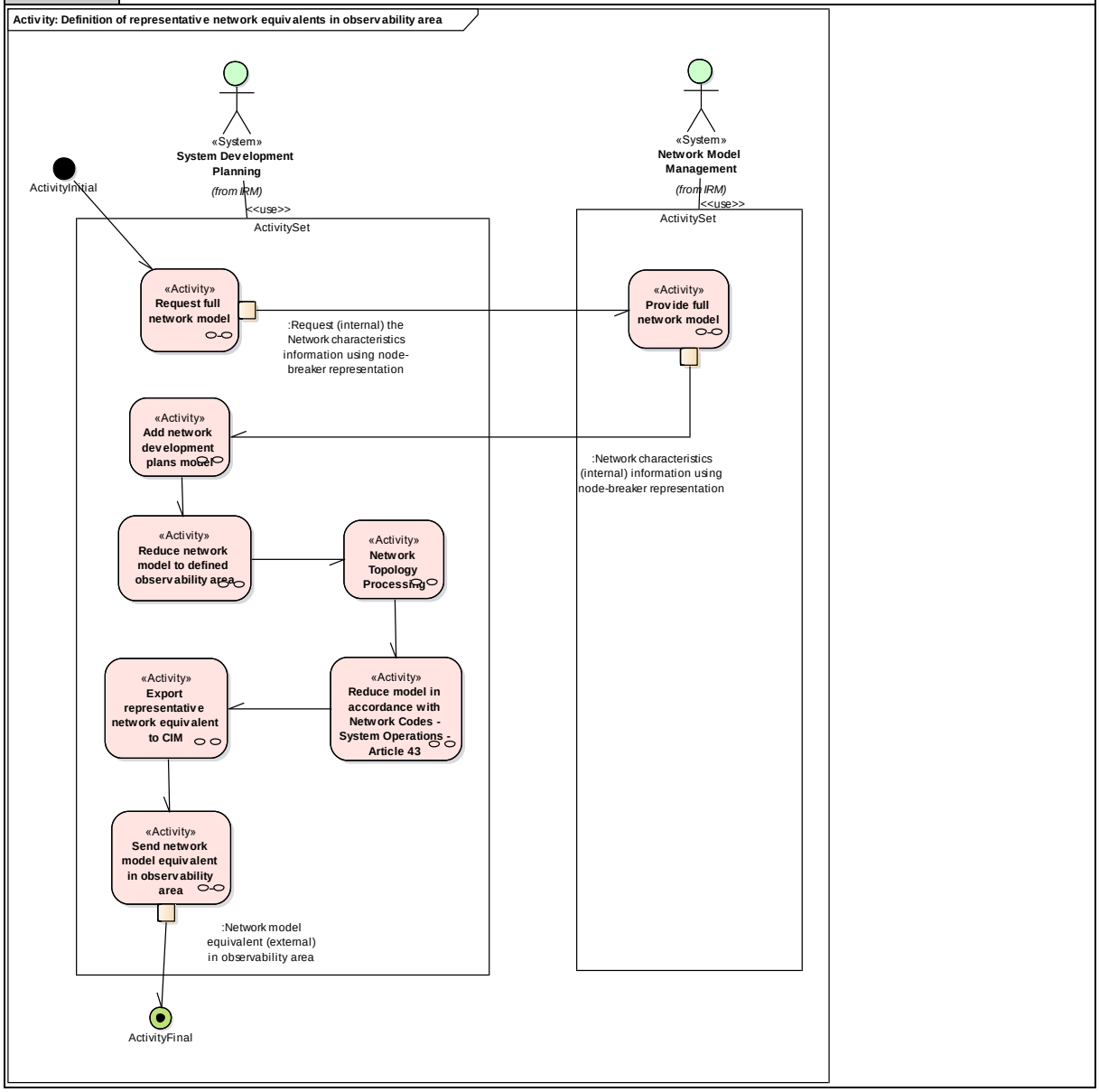
Scenario conditions						
No.	***Scenario name***	***Scenario description***	***Primary actor***	***Triggering event***	***Pre-condition***	***Post-condition***
1	Definition of representative network equivalents in observability area			Request for representative network model equivalent in observability area		

4.2. Steps - Scenarios

4.2.1. Definition of representative network equivalents in observability area

Scenario step by step analysis

Scenario	
Scenario name	Definition of representative network equivalents in observability area



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 full network model	The System Development Planning department has to create a fresh representative network equivalent in observability area. To do that it first has to obtain a full network model in a node-breaker representation from the Network Model Management department.		System Development Planning	Network Model Management	Info1-Request (internal) the Network characteristics information using node-breaker representation	
1.2		Provide full network model	The Network Model Management department receives a request from the System Development Planning department for a full network model in a node-breaker representation. It provides the requested model.		Network Model Management	System Development Planning	Info2-Network characteristics (internal) information using node-breaker representation	
1.3		Add network development plans model	Upon receiving the current state of the network represented as a node-breaker model the System Development Planning department has to add information regarding planned structural changes to the network, meaning e.g.		System Development Planning			

			new substation, lines, transformer, or removal of existing ones, etc... as this will have an influence on long-term plans and operations of interconnected partners.					
1.4		Reduce network model to defined observability area	It is not necessary to exchange full networks and planned structural changes with interconnected partners. Only information inside an observability area should be exchanged since only this information is relevant for long-term plans and/or operations of interconnected partners. If it is determined that a structural change outside the defined observability area might have a significant effect on long-term plans, and/or operations of interconnected partners then the observability area is not defined correctly. The observability area should be defined in such a way that it		System Development Planning			

			encompasses all network elements that might have an effect on long-term plans and/or operation of interconnected partners.					
1.5		Network Topology Processing	Network Topology Processing is a process which deals with network connectivity and in essence transforms a node-breaker representation of a network (which is mostly used in Network Model Management application) into a bus-branch representation (which is mostly used in planning studies).		System Development Planning			
1.6		Reduce model in accordance with Network Codes - System Operations - Article 43	In network codes for System Operations, Article 43, Paragraph 3 it is stated that the structural information related to the defined observability area provided by each DSO to the TSO* shall include at least: (a) substation by voltage; (b) the line that connects substations referred to in point (a); (c)		System Development Planning			

			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). It is assumed that any additional information related to the defined observability area is therefore unnecessary and should, therefore, be omitted from the information exchange. * the same procedure can be adopted in the DSO/DSO interfaces					
1.7		Export representative network equivalent to CIM	In preparing to exchange the representative network equivalent this has to be transformed in a mutually recognizable, preferably standardized format for network model representation. The utilization of IEC 61970, IEC 61968, IEC 62325 series of standards is the most appropriate for this task.		System Development Planning			
1.8		Send network model equivalent in	The System Development Planning		System Development Planning		Info3-Network model	

		observability area	department sends the constructed Network model equivalent in observability area in CIM format through the Data Exchange Platform to the partner who initially requested the model.				equivalent (external) in observability area	

5. Information exchanged

Information exchanged			
Information exchanged, ID	***Name of information***	***Description of information exchanged***	***Requirement, R-IDs***
Info1	Request (internal) the Network characteristics information using node-breaker representation	In the presented business object is requested all the information of the whole network in a node-breaker representation*. Structural network information request: Int. Request ID Type of request All [Includes all the information available in the system] Substation [Includes all the information available about the substation and of the network downstream of this substation] Transformer [Includes all the information available about the transformer and of the network downstream of this transformer] Feeder [Includes all the information available about the feeder and of the network downstream of this feeder] *The node-breaker representation of the network includes very detailed information about all the elements in the network. The elements can be from HV lines and substations to the very last metering point at the far corner of our network. It will include all the disconnectors, breakers, ground disconnectors, ACLineSegments, energy sources and consumers, even current and potential transformers among others.	
Info2	Network characteristics (internal) information using node-breaker representation	In the presented business object is described all the information of the whole network in a node-breaker representation*. *The node-breaker representation of the network includes very detailed information about all the	

		elements in the network. The elements can be from HV lines and substations to the very last metering point at the far corner of our network. It will include all the disconnectors, breakers, ground disconnectors, ACLineSegments, energy sources and consumers, even current and potential transformers among others.	
Info3	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)