Wide-Area Situational Awareness (WASA)

Link to explanations, examples and the selection list for indicated fields, please refer to document "Use Case Description draft ver0.55"

<http://www.cen.eu/cen/Sectors/Sectors/UtilitiesAndEnergy/SmartGrids/Pages/default.aspx>

Version of Template: 0.55, Sept 2011

# Description of the Use Case

* + *General*
  + *Name of Use Case*

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| --- | --- | --- | --- |
| ***ID*** | ***Domain*** | ***Name of Use Case*** | ***Level of Depth***  *Cluster, High Level Use Case, Detailed Use Case* |
| WGRA-3101 | Bulk Generation | Wide-Area Situational Awareness (WASA) | High-level Use Case |

* + *Version Management*

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| --- | --- | --- | --- | --- | --- | --- |
| ***Changes / Version*** | ***Date*** | ***Name  Author(s) or Committee*** | ***Domain Expert*** | ***Area of Expertise / Domain / Role*** | ***Title*** | ***Approval Status***  *draft, for comments, for voting, final* |
| 0.1 | 04.12.12 | Young-Jin Kim | Primary | Domain expert | - | - |

* + *Basic Information to Use Case*

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| ***Source(s) / Literature*** | ***Link*** | ***Conditions (limitations) of Use*** |
| IEEE C37.118-2005 for synchrophaser data | - | - |
| NASPINet: Phasor Gateway Technical Specifications for North American Synchro-Phasor Initiative Network, http://www.naspi.org/resources/dnmtt/naspinet/naspinet-phasor- gateway--final-spec-20090529.pdf | - | - |
| Increasing the Resolution of Wide-Area Situational Awareness of the Power Grid through Event Unmixing, 44th Hawaii International Conference on System Sciences (HICSS), 2011 | - | - |
| IEC 61850-90-5 â€” for transmitting synchrophasor data | - | - |

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| ***Relation to Higher Level Use Case*** | |
| ***Cluster*** | ***Higher Level Use Case*** |
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| ***Maturity of Use Case*** *- in business operation, realized in demonstration project, realised in R&D, in preparation, visionary* |
| Realized in Research and Development project |
| ***Prioritisation*** |
| WASA has been identified by the US NIST as a high priority |
| ***Generic, Regional or National Relation*** |
| Generic |
| ***View*** *- Technical / Business* |
| Technical |
| ***Further Keywords for Classification*** |
| - |

* + *Scope and Objectives of Use Case*

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| ***Scope and Objectives of Function*** |
| WASA is aimed at broadly and dynamically understanding and optimizing the situation-aware management of overall bulk power systems across large geographic areas. In WASA, high-resolution and time-synchronized data from massive sensors attached in power systems is collected in real-time and sometimes aggregated through in-network processing, and as a result finer-scale state-estimators based on the data can construct complex spatial-temporal situational description as optimized inputs for autonomous closed-loop controls or system operators.  Even while WASA has a similar procedure to FLISR (Fault localization, isolation, and system restoration) on monitoring and control aspects, it is distinguished from FLISR as follows: large number of continual reporting devices vs small number of substation protection devices mostly notifying just fault events, global analysis and action vs local action first and then global adjustment, preventive control based on predictions vs just reactive control to failure events, time synchronization among devices vs no synchronization among devices, one or more administrations vs single administration. |

* + *Narrative of Use Case*

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| ***Narrative of Use Case*** |
| ***Short description*** *- max 3 sentences* |
| The WASA use case is divided into three sequences:  1.   Data collection and aggregation – field sensing devices in the grid continuously send data to control facility  2.        Real-time data analysis and Contingency detection– analyze collected data along with given information such as grid topology and also check if contingency is expected to be occurred to the grid.  Status or Contingency report – continuously report current status to system operators and also notify contingencies of system operators or closed-loop controllers. |
| ***Complete description*** |
| Together with the help of a communicating system, high-resolution data measured from field sensing devices is continuously delivered to control facilities. First checking whether the data is trustworthy, real-time analysis on the data is performed.  The analysis’ result is continuously displayed on GUI tools so that system operators can monitor the overall grid status. Furthermore, a crucial purpose of the analysis is to predict contingencies such as power outages or grid faults in near future.  If a contingency is expected, it must be immediately reported to systems operators.  Also, for emergent cases, highly automated close-loop controls are first triggered, and then the continuation with the next sequence typically requires a system operator interaction. |

* + *Actors: People, Systems, Applications, Databases, the Power System, and Other Stakeholders*

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| ***Actor Name*** | ***Actor Type*** | ***Actor Description*** |
| Grid | System |  |
| Closed-Loop Controller | Application |  |
| Real-time State Estimator (RTSS) | Application |  |
| Wide-area Monitoring (WAMON) | Application |  |
| System Operator | Person |  |
| Field Actuators | System |  |
| Data Aggregator | System |  |
| Field Sensing Devices | System |  |

* + *Issues: Legal Contracts, Legal Regulations, Constraints and others*

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| --- | --- | --- |
| ***Issue -*** ***here specific ones*** | ***Impact of Issue on Use Case*** | ***Reference -*** *law, standard, others* |
| - | - | - |

* + *Preconditions, Assumptions, Post condition, Events*

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| --- | --- | --- | --- |
| ***Actor/System/Information/Contract*** | ***Triggering Event*** | ***Pre-conditions*** | ***Assumption*** |
| ***Grid*** | - | - The Grid is continuously monitored | - |
| ***Field Sensing Device*** | - | - The devices are time synchronized and have communication capabilities. | - |
| ***Wide-are Monitoring (WAMON)*** | - | - The Grid is continuously monitored. | - |
| ***Real-time State Estimator (RTSS)*** | - | - Data used in RTSS is trustworthy and time-synchronized. | - |

* + *Referenced Standards and / or Standardization Committees (if available)*

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| ***Relevant Standardization Committees*** | ***Standards supporting the Use Case*** | ***Standard Status*** |
| IEEE | IEEE C37.118-2005 | - |

* + *General Remarks*

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| ***General Remarks*** |
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# Drawing or Diagram of Use Case

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| ***Drawing or Diagram of Use Case*** ***- recommended "context diagram" and "sequence diagram" in UML*** |
| http://www.lupiupload.de/images/2012/04/25/c14c886ee8ecc512cfdc333061be9723ef324d68.bmp |

# Step by Step Analysis of Use Case

| **S.No** | **Primary Actor** | **Triggering Event** | **Pre-Condition** | **Post-Condition** |
| --- | --- | --- | --- | --- |
| PS1 | Field Sensing Devices | Measured data is sent to control facilities via a communication network for data collection and aggregation | Communication networks are operable and configured correctly | Measured data reaches WAMON |
| PS2 | WAMON | Measured data is passed to real-time data analysis process | Real-time analysis is continuously running | Current grid status is identified |
| PS3 | RTSS | Current grid status ready | RTSS keeps previous grid status and grid modelling | Contingencies can be detected. |
| PS4 | System Operators or Closed-loop Controlled | A contingency is detected. | Communication networks are operable and configured correctly | Appropriate Control commands for preventing the contingency are sent |

* + ***Steps - -***

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| ***Scenario*** ***Name:*** | | ***PS1*** | | | | |
| ***Step No.*** | ***Event*** | ***Description of Process/Activity*** | ***Information Producer*** | ***Information Receiver*** | ***Information Exchanged*** | ***Technical Require-ments ID***  *see* *Annex A Selection List* |
| 1 | Data measured from the grid | 1-data periodically measured the grid is delivered over a communication network | Field Sensing Devices | Wide-area Monitoring (WAMON) |  |  |
| 2 | Data aggregation ready | 2-Correlate data with the same time from different field sensing devices | Data Aggregator | Wide-area Monitoring (WAMON) |  |  |
| 3 | Data collection ready | 3-The WASA application analyses the collected data | Wide-area Monitoring (WAMON) | Real-time State Estimator (RTSS) | Grid State |  |
| 4 | Grid state ready | 4a-The WASA application presents current grid status to the system operator | Wide-area Monitoring (WAMON) | System Operator |  |  |
| 5 | Grid state ready | 4b-The WASA application predicts contingencies | Real-time State Estimator (RTSS) | System Operator |  |  |
| 6 | Contingency is confirmed | 5- preventive action is taken to avoid the contingency | System Operator | Field Actuators |  |  |