# IMPROVING ASSET KNOWLEDGE USING SYSTEM MANAGEMENT BASED ON IEC-61850

Maxime GILLAUX
EDF – France
maxime.gillaux@edf.fr

Florent LEMENAGER
EDF – France
florent.lemenager@edf.fr

Thierry COSTE
EDF - France
thierry.coste@edf.fr

## *ABSTRACT*

*In order to deal properly with a fast evolving number of smart grid automation devices and avoid significant OPEX, network operators are facing a growing need for an improved and more automatic way to facilitate the integration, monitoring and maintenance of these equipment.*

*One key problem is to build and maintain an accurate knowledge of the automation and electrotechnical assets present on the field. A reliable database is essential to achieve an efficient maintenance management, whether preventive or corrective.*
*This is one of the fundamental justification for the concept of System Management, which refers to functionalities that are not directly linked to the operational role of the equipment but allow it to perform its operational functions in the best conditions possible.*

*Moreover, these functions are not limited to automation equipment but may apply to any distributed IED (Intelligent Electronic Device), for example those with telecom or cybersecurity features.*

*This paper presents EDF's ongoing work on asset knowledge improvement using system management. To face the challenge of a widespread deployment of heterogeneous IEDs, EDF R&D is building an interoperable and vendor independent system, homogenous with the core 61850 operational functions of the devices, to enable an efficient management of its inventory of equipment.*

## INTRODUCTION

### The System Management Concept

In the new paradigm of energy and digital transition, the system automation designed for smart grid applications must be ready to adapt to new functionality and reliability needs.
To avoid significant increasing operating expenditure (OPEX), the devices will therefore need to be updatable, configurable, and supervisable remotely. This is a cornerstone of the solution we call "System Management", but it also encompasses other functions, starting with the improvement of Asset Knowledge.

The System Management use cases can be summarized in four categories, as described in the following figure:


Figure 1- System Management main functionalities

For more detail on this concept, please refer to the CIRED 2016 article "How to facilitate the integration of a huge number of heterogeneous smart grid devices?" [1].

### Enhanced Asset Management through System Management

This paper will concentrate on the asset knowledge issue, but it is crucial to consider all the use cases together to provide a good approach to the subject.

Indeed, an appropriate knowledge of the assets includes in particular an accurate monitoring of configuration and firmware versions description and deployment status.
More specifically, prior to any updating, it is crucial to ensure compatibility between the new versions to be deployed and the hardware / software description of the targeted device.

Furthermore, all kind of functioning or ageing parameters involved in the "Supervise" or "Maintain the system" use

cases see their value increased if they can be enriched by a more precise and reliable description of the assets to which they are related.
For example, the calculation of the health index of a considered equipment will be more accurate, if it can be based on ageing criteria that take into account a precise identification of the considered equipment. Like for instance hardware-specific criteria.
Reciprocally, the development of these ageing criteria and maintenance rules via feedback on the retrieved information will be greatly improved if endured events and equipment faults can be correlated taking into account a satisfactory level of description of the affected equipment in the system at the timing of the events.

## ASSET KNOWLEDGE IMPROVEMENT USE CASE

### Use Case Objectives

The purpose of this use case is to improve one's knowledge of its assets. It consists in collecting patrimonial data from system automation devices and transferring it to the asset management and maintenance information systems.

From an IEC-61850 point of view, the concerned information that could be targeted is essentially that which is stored in the Device Name Plate common data class (DPL: cf. IEC 61850-7-3 [2]) like for example:

| Data attribute name | Description |
|---|---|
| vendor | Vendor name |
| owner | Owner name |
| hwRev | Hardware revision |
| swRev | Software revision |
| serName | Serial number |
| location | Location of the equipment |
| model | Vendor specific product name |
| primeOper | Primary operator of device |

This information can be easily retrieved by using the IEC-61850 services allowing to read and send dataset structures.
This list of data is of course not exhaustive, and one interesting development will be to challenge what is standardized at present, and if necessary to supplement it with the desired missing data. For example the date of commissioning of a device, or specific informations about of sub parts of the devices.

### Use Case Description

The goal being to ensure remotely a reliable and up to date knowledge of one's automation systems' assets used on the network, it is assumed that these assets have the necessary means of communication. And of course, that they embed the required patrimonial information.

From a System Management point of view, the asset knowledge problematic can be considered in the sense of putting in place means of recovery and storage of information relating to the equipment constituting the patrimony to be managed in order to provide them to the other functions: maintenance, configuration…

The action of retrieving asset information from the automation system can be triggered by several categories of events during its life cycle:

- Asset commissioning
- Asset decommissioning
- Modification operation on the asset.

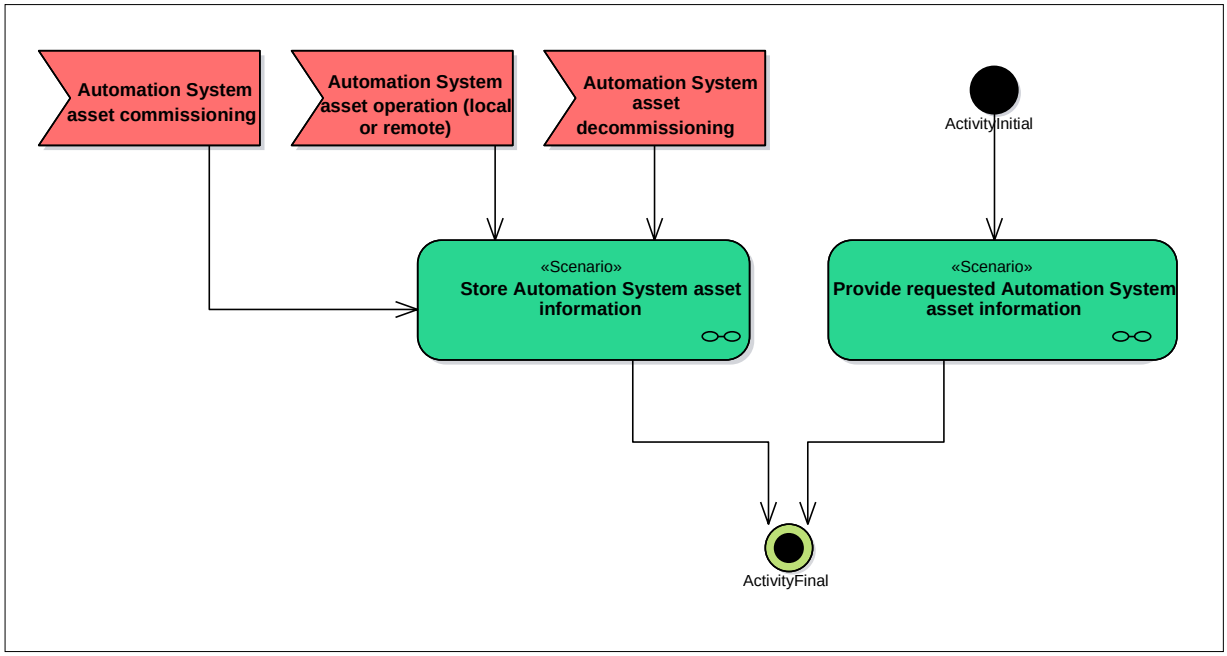


Figure 2- Store and provide asset information use case diagram

## Detail on information retrieval process

One key point is to highlight that the asset information that is gathered concerns not only the knowledge of the automation itself, but also the electrotechnical equipment to which it corresponds.
Considering this, if an electrotechnical asset information is to be retrieved, the nominal case today is that the electrotechnical asset information is modeled inside the corresponding IED. The communication established between the IED and the System Management can be used to transfer this information which needs to be typed into the IED.

But a more reliable possibility can be considered for future intelligent electrotechnical assets. Indeed, the electrotechnical asset information could be modelled inside the electrotechnical device itself. Given that there is still an IED whose mission is to interface the equipment, there would still be only a communication established between the IED and the System Management. But the IED would in this situation only be acting as some kind of proxy, transferring reliable information coming from the electrotechnical device itself.

Then, once the information is retrieved from the equipment, it can be distributed to feed the interested information systems. For instance, towards the asset-patrimonial, asset-operations, or asset-location information systems.
This process is summarized in the following activity diagram:

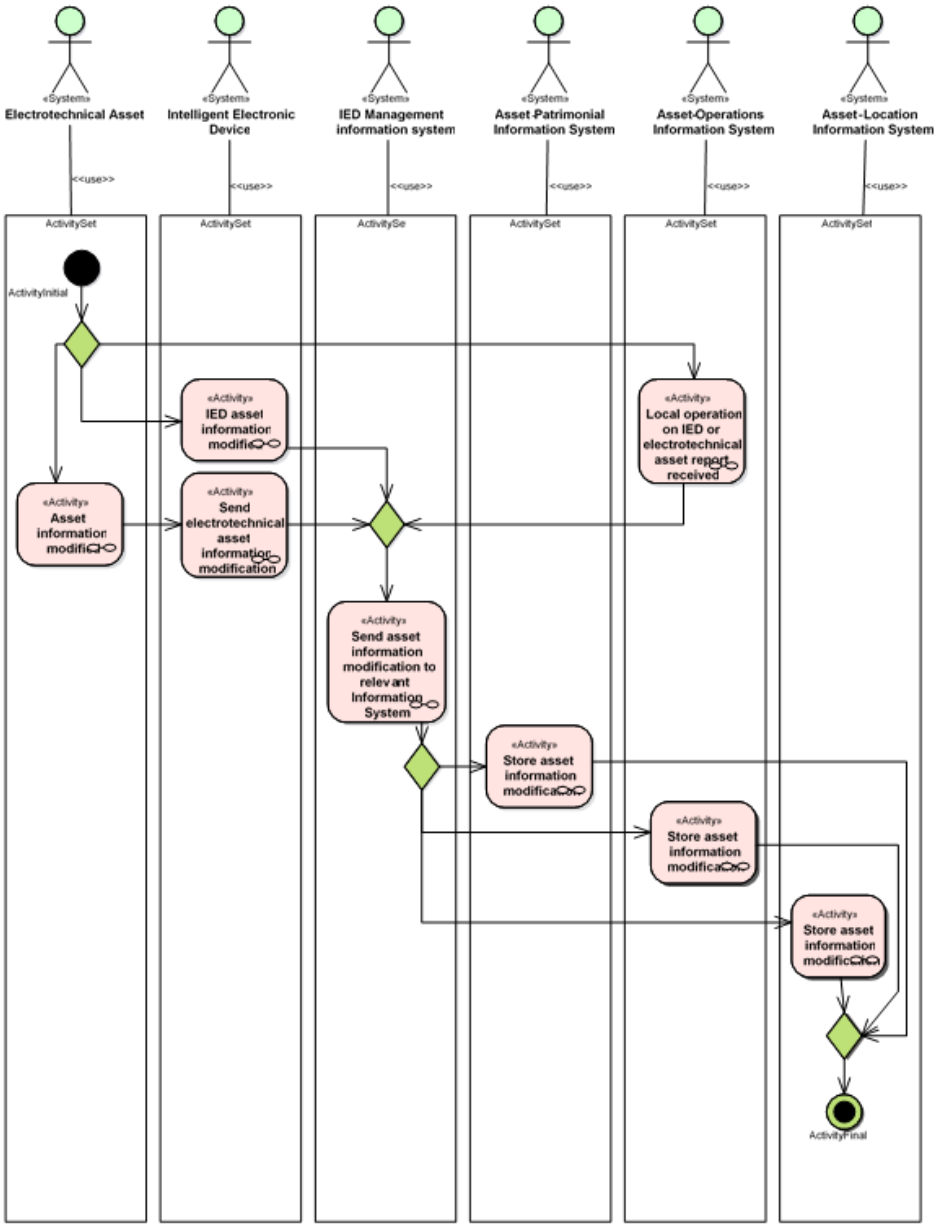


Figure 3- Store asset information Activity diagram

## USE CASE METHODOLOGY AND STANDARDIZATION

As we see it, this issue will be of major importance for the upcoming smart grid solutions and therefore must be standardized in coordination with the IEC 61850 standard specifying data and communication for the grid automation equipment.

After launching the task force relative to System Management in the IEC TC57 WG 17 in 2015 EDF R&D has been developing use cases compliant with the IEC 62559 methodology to describe the involved interactions. The use cases will be poured into standardization works in order to come up with consensual workflows to be standardized in IEC TR/TS 61850-90-16 "Using IEC 61850 for System Management purposes" ([3]).

On the one hand, these use cases describe the workflows relying on IEC 61850 services allowing to interact with distributed equipment to complete the different System Management functionalities, in order for all IEDs to be addressed by an interoperable and vendor independent Information System.
On the other hand are also described the Information System processes and exchanges between standardized system roles, which can be exchanged thanks to CIM (Common Information Model), in order to define optimized processes at Information System level to deliver the addressed needs.

## COMPLETE SYSTEM PARADIGM

The previous sections of this paper have mainly considered the Asset Knowledge improvement issues for pure system automation and electrotechnical objects.
But the emerging smart grid devices can not only be considered as such. They are in fact a combination of those core business objects with telecommunication and cyber-security devices.
Therefore, the previously described use cases will also have to be considered for these categories of equipment.

As these categories comprise different kinds of devices, using heterogeneous technologies, and possibly based on various standards, it is obvious that their Asset Knowledge use case, and its implementation could be significantly different. But at least their specification should be conducted jointly to ensure a full system integration.

## CONCLUSION

From our point of view, considering the need for a more accurate and up-to-date knowledge of its assets on the network, electricity grid operators should consider new solutions of improvement using System Management capabilities.
Indeed, new communication possibilities and standardised data exchanges make it now possible to envisage remote processes to retrieve and store asset information, and provide it to other interested functions.

We can see that an important point will be to connect the Asset Knowledge functionalities of a System Management solution with the proper interested information system. Beyond identifying which ones would be relevant, a major challenge will be to advocate appropriate solutions to implement such communications. Which means, choosing the proper data models, protocols and messaging architectures.

This is the reason why the theoretical works presented in this article are currently challenged by a System Management prototype in which EDF R&D is implementing the use cases defined. Its purpose is not only to validate their feasibility, but also to identify which technical and architecture solutions are the most adequate to bring out new simplified business processes.

Moreover, the implementation of these new functionalities allows us to discover new ways of exploiting the recovered data by confronting them with new processing technologies such as data analytics.

## REFERENCES

[1] M. Gillaux, F. Lemenager, T. Coste, 2016, "How to facilitate the integration of a huge number of heterogeneous smart grid devices?", C*IRED 2016*, Helsinki, Paper 0315
[2] IEC-61850 part 7-3: Basic communication structure - Common data classes
[3] IEC TR-61850-90-16: Using IEC 61850 for System Management purpose