DISCERN SGAM Template_v4.vsd User Guide

DISCERN SGAM Template_v4.vsd is the new version of the DISCERN SGAM template compatible with MS Visio 2013-2010. This new version was enhanced with an XML export to represent the SGAM models in XML files valid against DISCERNSgam.xsd schema, which is aligned with the standard IEC 62559-3.

Section 1.1 introduces the SGAM framework. Section 1.2 and provides relevant information about DISCERN SGAM templates in MS Visio. Section 1.3 describes the best modelling approach to develop SGAM architectures with *DISCERN SGAM Template_v4.vsd*. Section 1.4 presents the main features of *DISCERN SGAM Template_v4vsd* highlighting those that were not included in the previous versions. Finally, Section 1.6 compares the features of the three versions of DISCERN SGAM Template: that is, *DISCERN SGAM Template Pre-2010_v2.vsd*, *DISCERN SGAM Template_v3.vsd*, and *DISCERN SGAM Template_v4.vsd*.

1.1. SGAM framework

The Smart Grid Architecture Model (SGAM) is a common framework developed by CEN-CENELEC-ETSI for representing Smart Grid architectures.

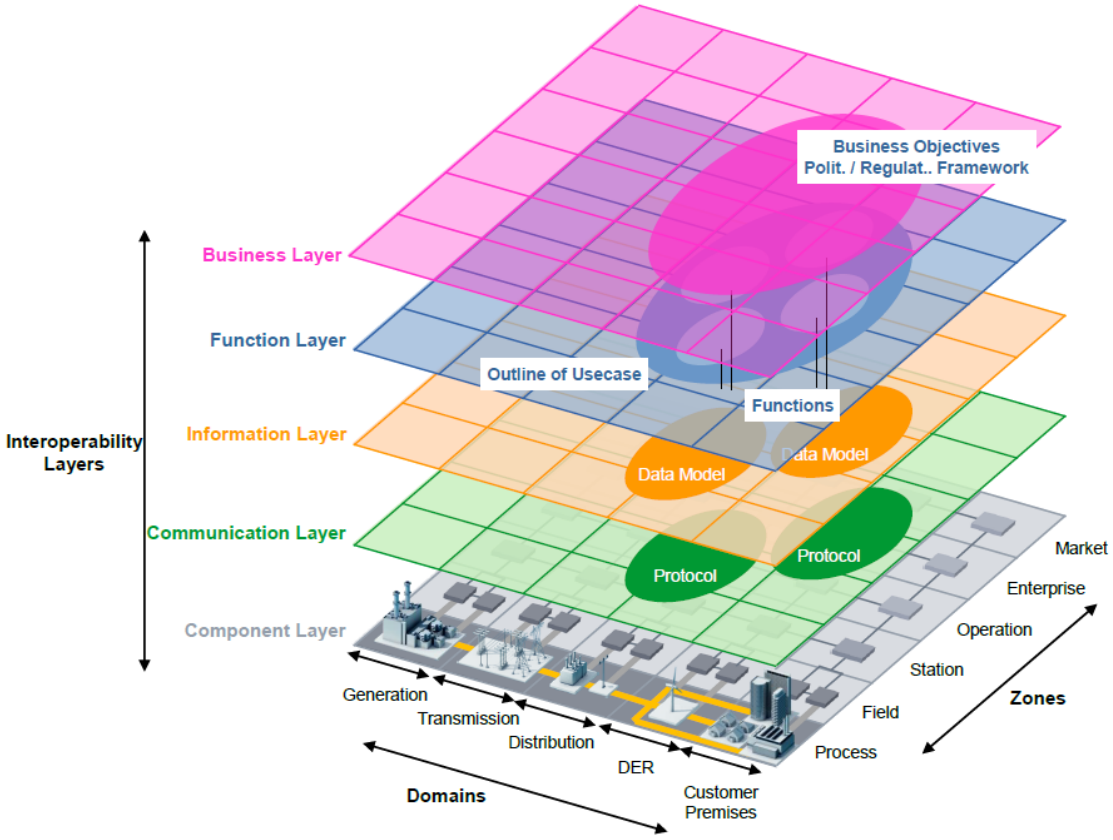

Figure 0-1. Smart Grid Architecture Model (SGAM) [SGCG-SGAM]

As shown in Figure 0-1, the SGAM comprises five layers covering different interoperability aspects:

- Business Layer (defining concepts related to the business architecture, such as business actors, objectives, and business processes),
- Function Layer (describing the technical functions that are realised by the Smart Grid solution that is being modelled),
- Information Layer – Canonical Data Model View (showing the canonical data models that shall be used to achieve semantic interoperability within the solution),
- Information Layer – Business Context View (representing the information objects that must be exchanged within the solution in order to realize the technical functions),
- Communication Layer (proposing communication standards to enable the exchange of information objects),
- Component Layer (presenting the physical distribution of the components that implement the technical functions).

Each of these layers is represented in a SGAM plane, which is structured in *Domains* and *Zones*, with *Domains* being the physical domains of the electrical energy conversion chain (that is, Generation, Transmission, Distribution, DER and Customer Premises), and with *Zones* being are hierarchical levels of power system management following IEC 62357 standard [IEC 62357-1], that is: Process, Field, Station, Operation, Enterprise and Market.

1.2. DISCERN SGAM Visio Templates

Deliverable D1.3 “Architecture templates and guidelines” presented two versions of MS Visio templates developed in DISCERN for representing Smart Grid architectures according to the SGAM framework: *DISCERN SGAM Template Pre-2010_v2.vsd*, which is compatible with MS Visio 2007 and earlier, and *DISCERN SGAM Template_v3.vsd*, which is compatible with MS Visio 2010 and later [D1.3].

Deliverable D2-3.2 “Tool support for managing Use Cases and SGAM models” presents the new release of the DISCERN SGAM Template compatible with **MS Visio 2010 and later**, the ***DISCERN SGAM Visio Template_v4.vsd***.

All DISCERN SGAM Visio templates consist of:

- ***5 Stencils*** (containing symbols for each SGAM layer):
    - Business.vss
    - Function.vss
    - Information.vss
    - Communication.vss
    - Component.vss
- ***6 Pages*** (representing the SGAM planes):
    - Business Layer
    - Function Layer
    - Information Layer – Canonical Data Model View
    - Information Layer – Business Context View
    - Communication Layer
    - Component Layer

When the installation of the suitable version of MS Visio is done, the folder "My Shapes" is automatically created in your PC. The DISCERN SGAM Visio Stencils must be saved in "My Shapes" folder. **It is worth noting that *DISCERN SGAM Template_v4.vsd* has new stencils**, which enable to include meta-data in the SGAM elements according to the *DISCERNSgam.xsd* schema**.** Therefore, in order to utilise the new version of the template, **users must save the new stencils in "My Shapes" folder**.

1.3. Modelling approach in DISCERN SGAM Template_v4.vsd

Deliverable D1.3 described three alternatives to develop SGAM models [D1.3]. The alternative recommended for *DISCERN SGAM Template_v4.vsd* is the **Bottom-up approach**. In this modelling approach, users start developing the SGAM Component Layer, which is used as a background view for the other layers (see sections 1.4.2 and 1.4.3), and continue with the SGAM Communication Layer, SGAM Information Layer – Business Context View, SGAM Information Layer – Canonical Data Model, SGAM Function Layer, and, finally, SGAM Business Layer.

The Bottom-up approach is the best option for *DISCERN SGAM Template_v4.vsd*, because (as will be further explained in 1.4.5), the new version of the template infers meta-data associated with the SGAM symbols represented in the SGAM planes, and most of the inferences rely on the physical distribution of the components at the Component Layer. For instance, the template infers the Information Producer and Information Receiver of an information object represented in the Information Layer – Business Context View by comparing the coordinates of the information object with the coordinates of the communication links shown in the Component Layer.

1.4. Main features of DISCERN SGAM Template_v4.vsd

In the previous versions of DISCERN SGAM Template most of the features were activated by saving the file. However, the new template *DISCERN SGAM Template_v4.vsd* includes additional features and includes an additional Tab "SGAM" containing buttons to activate each of them (Figure 0-2).

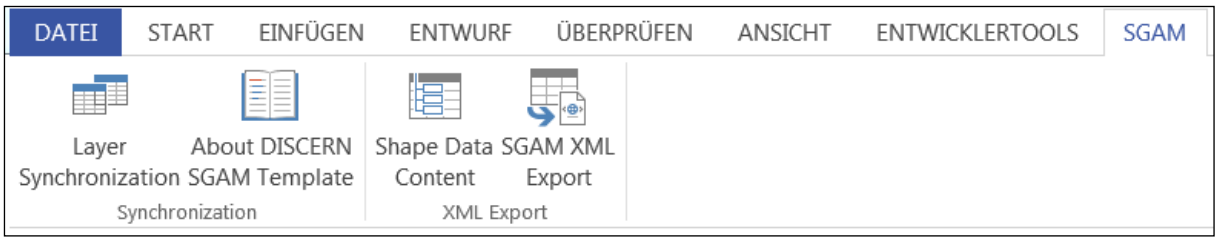

Figure 0-2. SGAM Tab in *DISCERN SGAM Template_v4.vsd*

The following sub-sections describe the main features of *DISCERN SGAM Template_v4.vsd*.

1.4.1. Resizing SGAM Cells

This feature was already implemented in *DISCERN SGAM Template_v3.vsd* [D1.3]. It enables users to resize SGAM Cells in each layer in order to enable more detailed descriptions in a specific domain and zone. This can be done by placing the mouse cursor on the cell border that shall be moved and dragging it to the desired position. Symbols that are located inside of a cell (e.g. components) are moved with the cell when it is resized in order to maintain the contents within the cells. This feature is also included in *DISCERN SGAM Template_v4.vsd*.

In *DISCERN SGAM Pre-2010_v2.vsd*, however, the SGAM plane is an Excel Table. Therefore, the resizing is not as easy as in the template developed for MS Visio 2010 and later. Moreover, only the "Component Layer" and "Business Layer" can be resized directly in *DISCERN SGAM Pre-2010_v2.vsd*. In order to resize the other layers, users must resize the "Component Layer" first and then save the file.

1.4.2. Layer Synchronization

The "Layer Synchronization" was already implemented in *DISCERN SGAM Template_v3.vsd*. It was activated when the file was saved. This feature sets the Component Layer as the background view for the other layers (except the Business Layer) and synchronises the SGAM planes at different layers. That is, if the user has resized the SGAM plane of a layer, the "Layer Synchronization" feature will resize the other layers accordingly, which enables users to freely resize the SGAM planes while maintaining the consistency between the SGAM layers.

In *DISCERN SGAM Template_v4.vsd* this feature is activated by clicking on the "Layer Synchronization" button of the SGAM tab (see Figure 0-2). Although, in principle, the Layer Synchronisation can be activated from all SGAM layers, it is recommended to activate this feature when the SGAM Component Layer is selected.

1.4.3. Background off/on

The "Background off/on" was already implemented in *DISCERN SGAM Template_v3.vsd*. As explained previously, the Component Layer becomes the background of Communication, Information (both views) and Function Layers when the layers are synchronised. The "Background off/on" feature enables users to de-activate (and activate again) this background. In *DISCERN SGAM Template_v4.vsd* (the same as in the previous *DISCERN SGAM Template_v3.vsd*) this feature is activated by using "CTRL + b" (Figure 0-3)

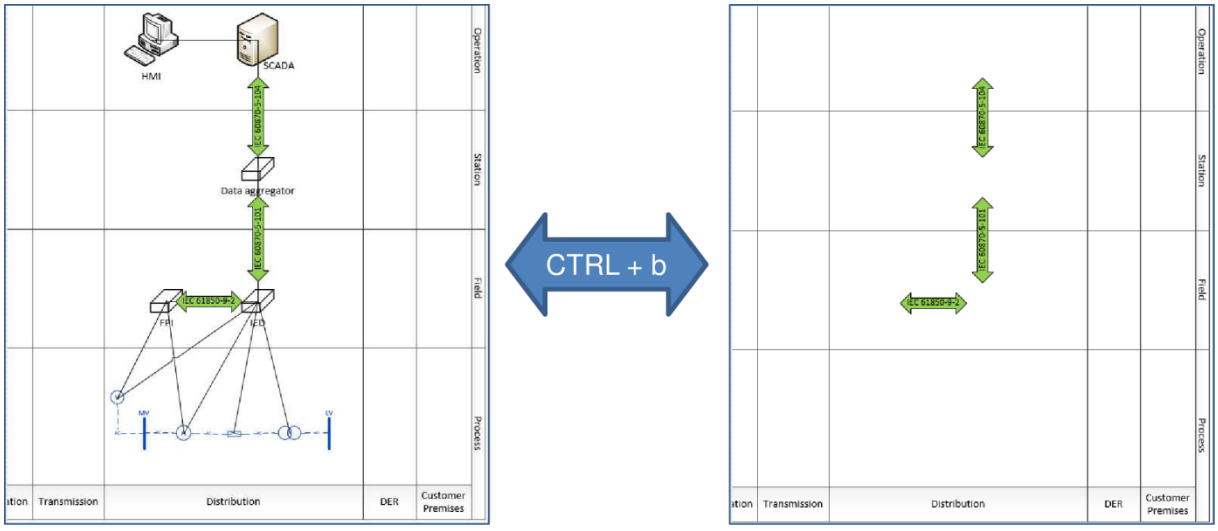

Figure 0-3. Background off/on in Communication Layer

1.4.4. Optimal Layout

During the edition of the SGAM planes, users might modify the zoom and position of the SGAM plane in each layer. In that way, SGAM layers will have completely different layouts, which might hinder the understanding and developing of the models. For that reason, the same as in the previous *DISCERN SGAM Template_v3.vsd*, *DISCERN SGAM Template_v4.vsd* enables users to set the same layout (zoom and position) of all the SGAM layers by using "CTRL + I".

1.4.5. Shape Data Content

The main improvement of *DISCERN SGAM Template_v4.vsd* compared with the previous *DISCERN SGAM Template_v3.vsd* is that the former automatically infers meta-data based on DISCERNSgam.xsd schema from the SGAM elements represented in the template. These meta-data is the information that will be included in the XML file that is generated by the SGAM XML Export (see 1.4.6). The generation of meta-data is carried out by the "Shape Data Content" feature, which is activated with the "Shape Data Content" button included in the SGAM tab (Figure 0-2).

Users can visualise the meta-data that is being generated by the template by showing the "Shape Data" window of MS Visio. This can be done by selecting "View / Task Panes / Shape Data". The "Shape Data" window enables users to manage the meta-data associated with each SGAM element. Thus, if the "Shape Data Content" has been activated, the "Shape Data" window shows the meta-data of the selected SGAM elements (Figure 0-4).

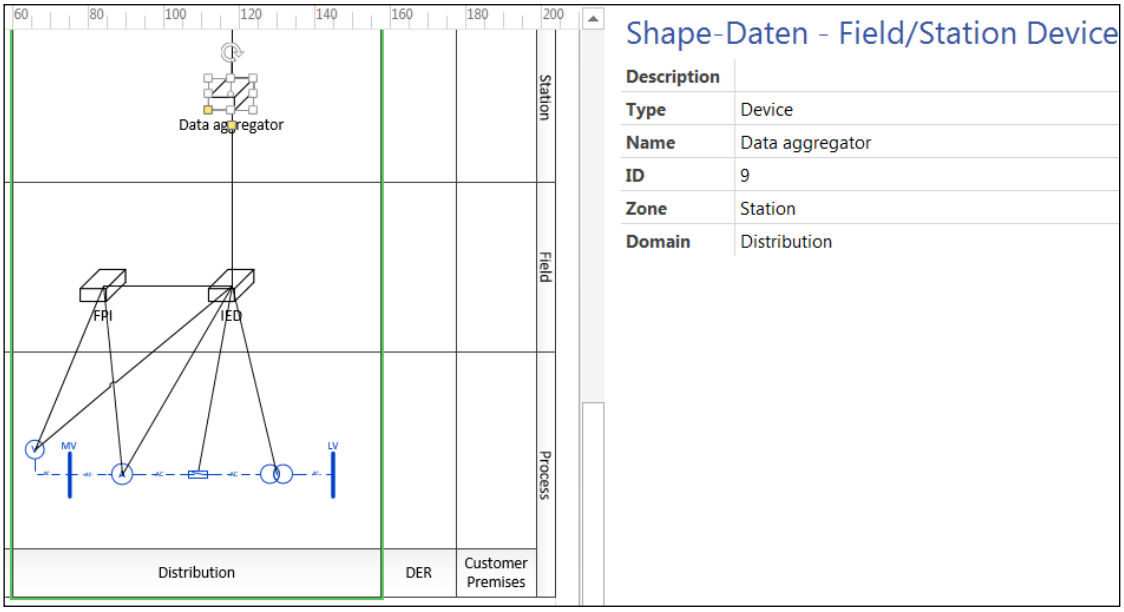

Figure 0-4. Shape Data Window in *DISCERN SGAM Template_v4.vsd*

It is worth noting that the "Shape Data Content" feature does not only extract data regarding the position of an element within the SGAM plane (such as *Domains,* or *Zones*), but it also infers relationships between elements placed at different SGAM layers by comparing the coordinates of the elements in the planes. In the previous version of the template, information objects, for instance, were just arrows drawn in a SGAM plane with some label indicating its name. Humans might be able to extract more knowledge about the information object from that representation (e.g. which component produces that information object, and which component receives it) by leveraging the background view. Nevertheless, that information was not explicitly represented in the template and, therefore, it

was not possible to exchange it with other software applications. On the contrary, *DISCERN SGAM Template_v4.vsd* has more knowledge about the information object. It is not just a drawing in the SGAM plane anymore. By using the "Shape Data Content" feature, the template infers the Information Producer, Information Receiver (components at the Component Layer), and Canonical Data Model (represented at the Information Layer – Canonical Data Model View) associated with the information object (Figure 0-5).

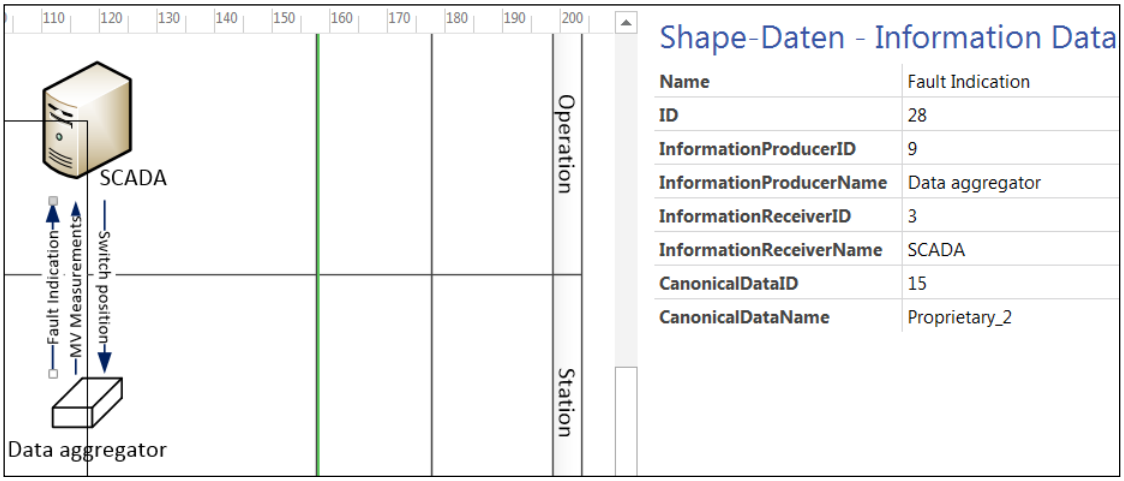

Figure 0-5. Shape Data Content – Inferring links between elements at different SGAM layers

1.4.6. SGAM XML Export

The *DISCERN SGAM Template_v4.vsd* enables users to export the SGAM model represented in the MS Visio template as an XML file valid against the *DISCERNSgam.xsd* schema. The XML file will contain the meta-data generated by the "Shape Data Content" feature described below. Therefore, before exporting the XML file, users must click on the "Shape Data Content". The XML export can be then activated by clicking on the "SGAM XML Export" button of the SGAM tab (Figure 0-2).

What follows provides a set of recommendations that should be followed in order to successfully generate the XML file:

1) Make sure that all the elements are connected to each other. For instance, Figure 0-6 shows a typical mistake that might result in an error during the generation of the meta-data that will be exported in the XML file (see warning message in Figure 0-7). In the drawing, the Voltage Sensor seems to be connected to electrical network. However, it is not really connected to any equipment (see the target point as a white box, instead of a green circle).

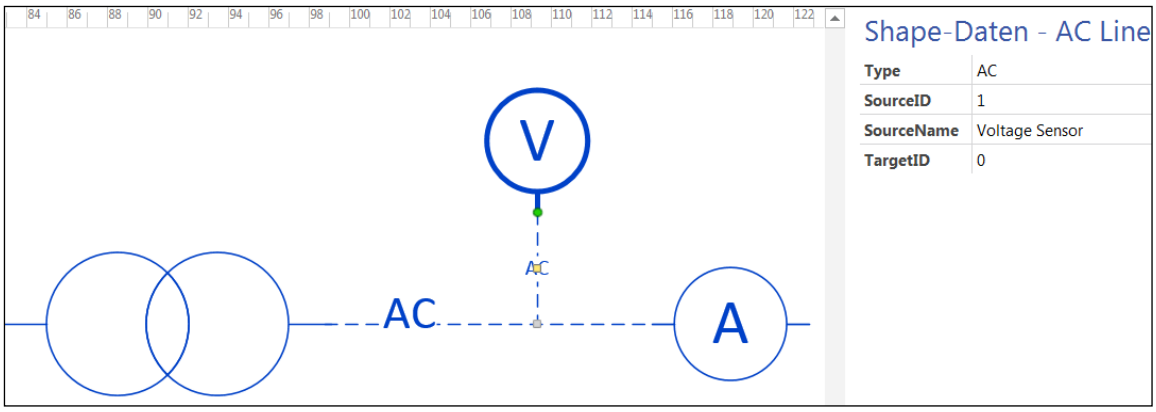

Figure 0-6. Wrong connection between Voltage Sensor and the network

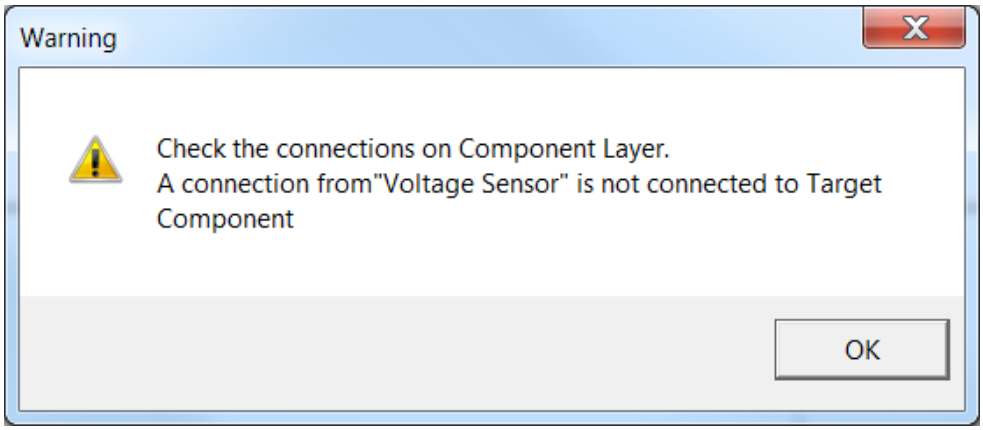

Figure 0-7. Warning generated during the extraction of meta-data

Figure 0-8 shows how this element must be connected to other equipment in the network (in this case the Power Transformer). Now, the application knows that the Voltage Sensor is linked to the Power Transformer as shown in the Data Shape Window.

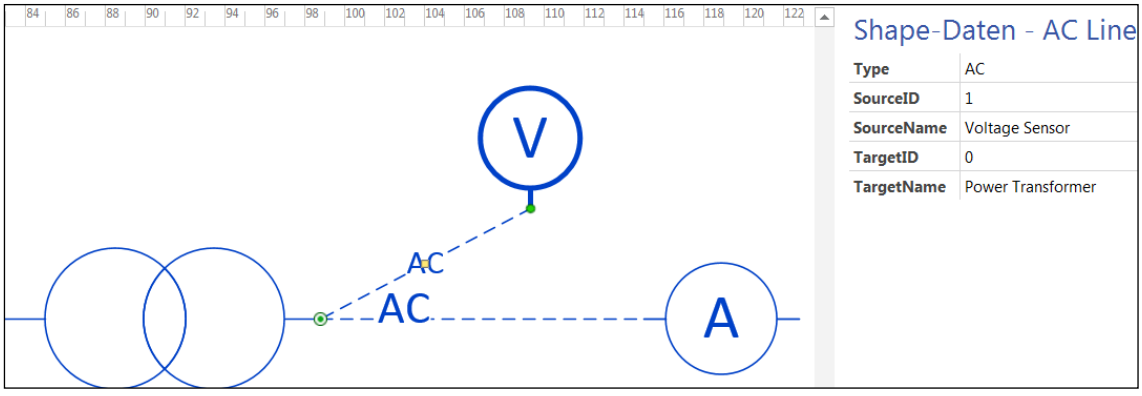

Figure 0-8. Connection established between the Voltage Sensor and the Power Transformer

2) Avoid copying elements from other models with “Copy & Paste”. This might result in problems related to the generation of the meta-data of the copied elements.
3) Avoid removing rows or columns of the SGAM planes. As explained in 1.4.1, SGAM cells can

be resized. Nonetheless, removing rows or columns might result in errors during the XML export.

4) Avoid using the “Communication Protocol Area” symbol, as the template will not generate meta-data for these elements (Figure 0-9).

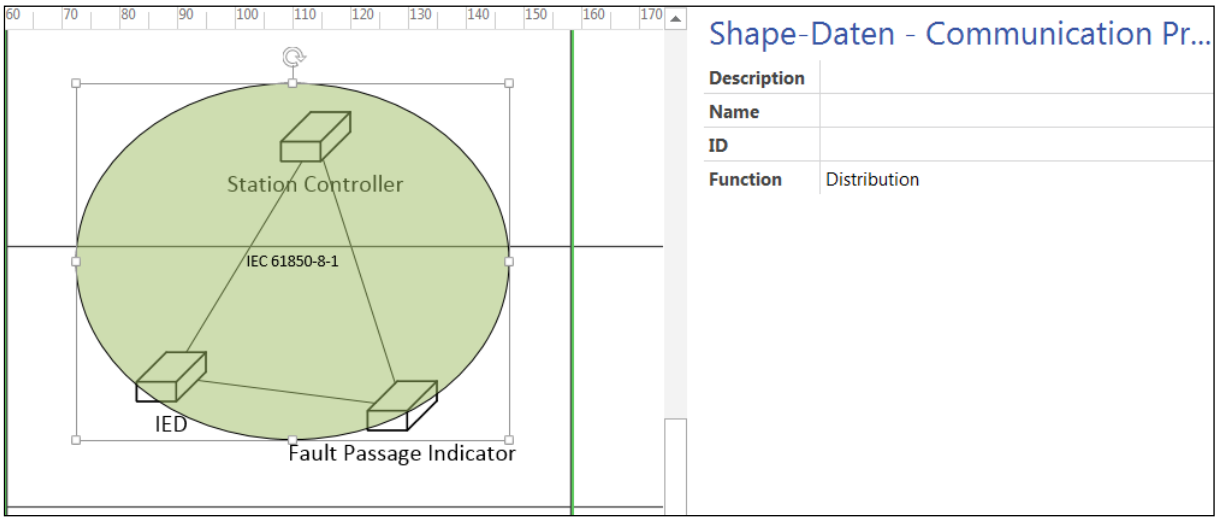

Figure 0-9. Communication Protocol Area (wrong meta-data generated)

Therefore, it is recommended to use the “Communication Protocol Points”; that is, the arrows (Figure 0-10).

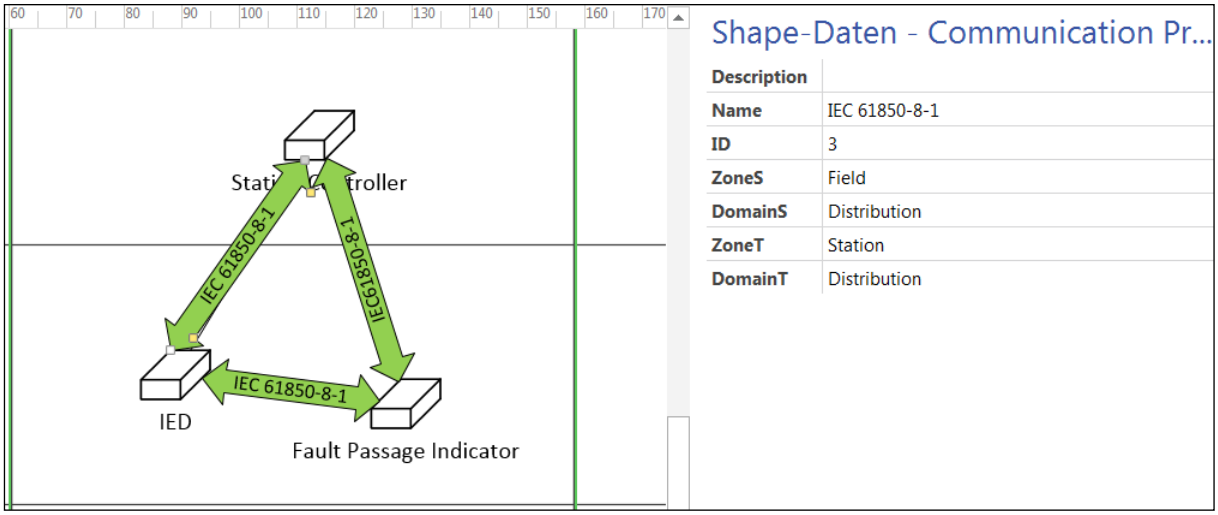

Figure 0-10. Communication Protocol Points (correct meta-data generated)

1) Avoid connecting “Organisation” to a “Business Process” within the Business Layer. The way to represent this relationship according to the *DISCERNSgam.xsd* schema is through a Business Actor (e.g. “DSO”) that belongs to the organisation and takes part of the business process (Figure 0-11)

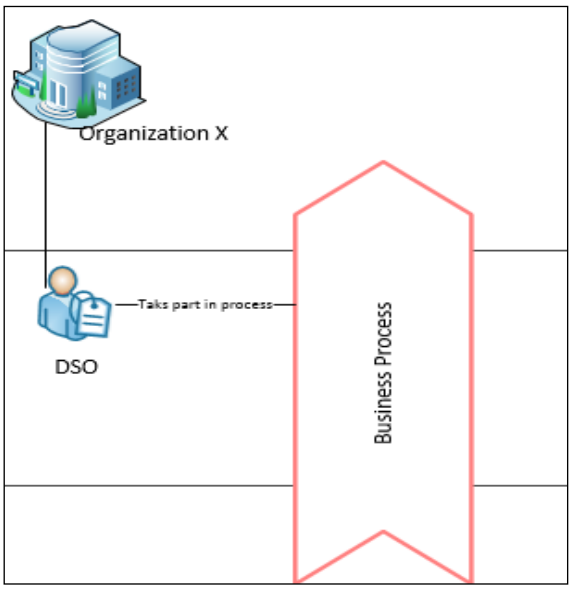

Figure 0-11. Link between an organisation and a business process

1.5. Planned features for the next version

Even though *DISCERN SGAM Template v4.vsd* is a complete version that has been successfully tested by DISCERN DSOs for exporting their SGAM models as XML files valid against the DISCERNSgam.xsd schema, it is planned to improve the XML export functionality during the project. The final version will be presented in [D2-3.4] and will include additional features based on the feedback provided by users. Possible additional features are:

- Better management of elements (areas) covering several SGAM cells. For instance, the current version cannot export Communication Protocol Areas (see 1.4.6).
- More detailed warning messages to help users identify errors. The current version generates warnings when a symbol is placed in a wrong layer, or when two elements have not been connected correctly. However, there are other errors (e.g., regarding the relationships between elements at different layers) that are not explained in detail. Thus, the template generates warning messages providing a set of recommendations to the user, but without identifying the specific error. In the final version more detailed messages will be generated to help users create valid XML files containing all the information of the SGAM.

1.6. Comparison of DISCERN SGAM Templates

Table 0-1 summarises the features of *DISCERN SGAM Template_v4.vsd* and compares it with previous versions of the templates that were presented in [D1.3].