An Actual Implementation of a UML Profile for Developing Airworthiness-Compliant (RTCA DO-178B) Software.

by Jan van Oort

Excerpts of a Talk held at SWISSED14, September 1, ETH Zürich

Getting all the stakeholders in a software development project to "speak the same language" can be a serious issue, and misunderstandings – the later they occur in the software's development lifecycle – may be anything from trivial to very costly.

To this end, we implemented the principal concepts from DO178B, "Software Considerations in Airborne Systems and Equipment Certification", as a UML profile; each concept occurring in DO178B has its counterpart in a UML stereotype. The base structure of the profile is visible in Figure 1.

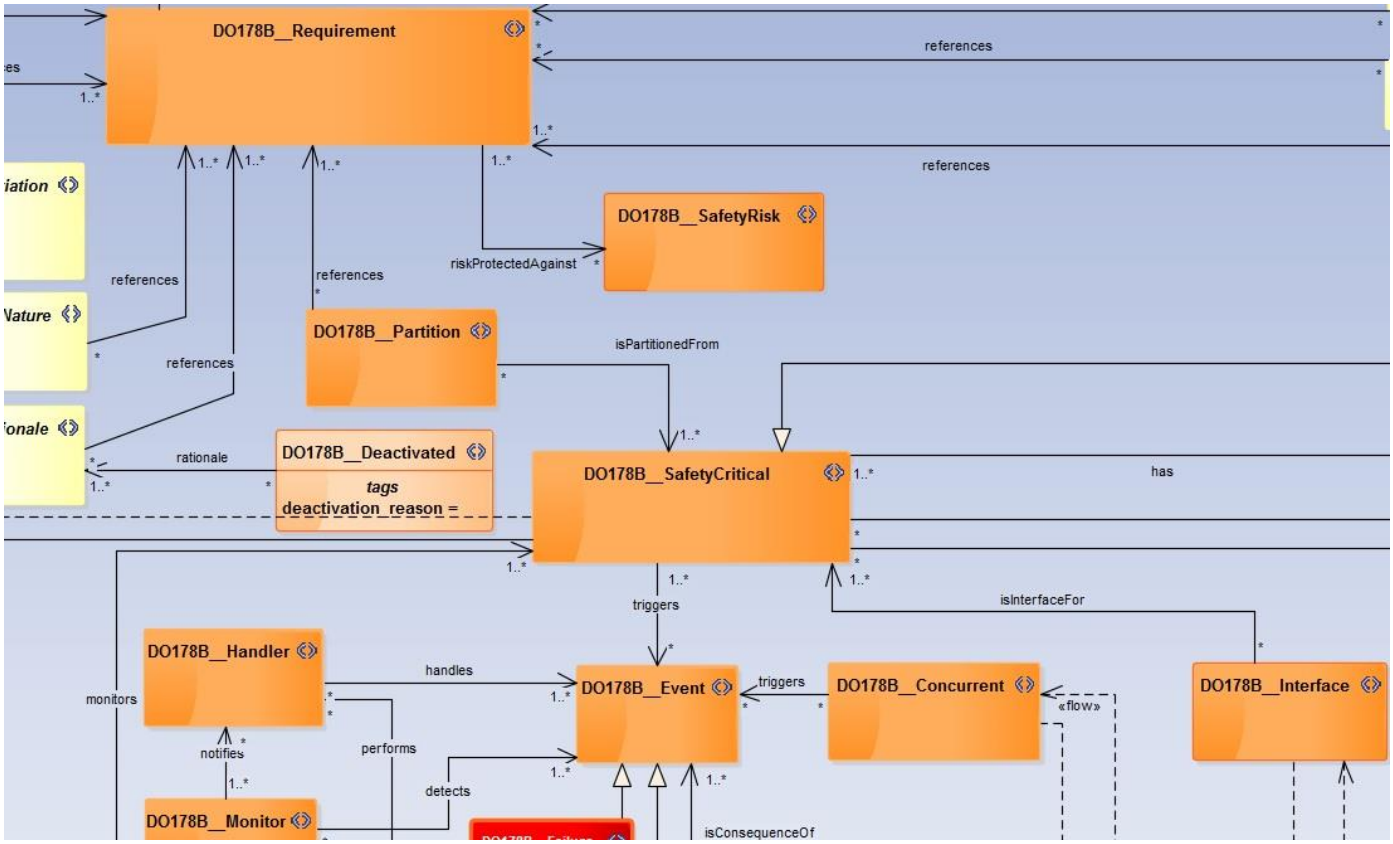

Figure 1: basic DO178B profile structure

The profile, which we provide as an XML file, can be imported into any Enterprise Architect project, via the Project | Resources window: right-click on the "UML Profiles" tree element, select "Import Profiles", and then select the appropriate .xml file. After import, the profile will appear in the Project Resources window as a new node under "UML Profiles" (Figure 2). The profile's various stereotypes are now available for application on any element and / or connector in your Enterprise Architect project; an application is shown in Figure 3.

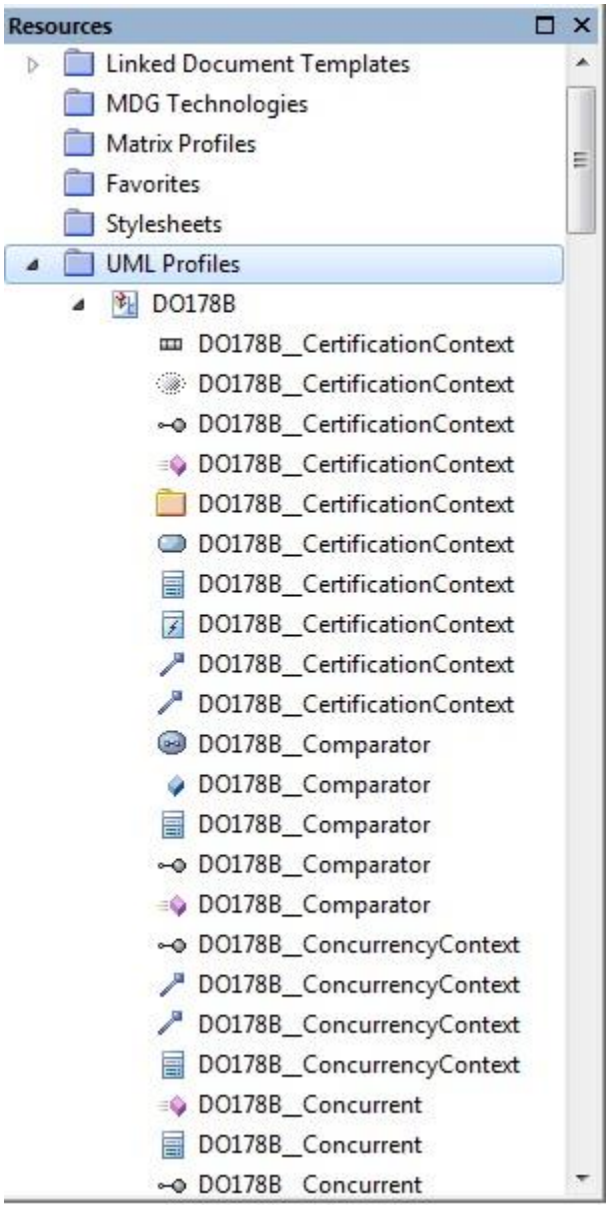

Figure 2: the Project Resources window showing the imported DO178B profile

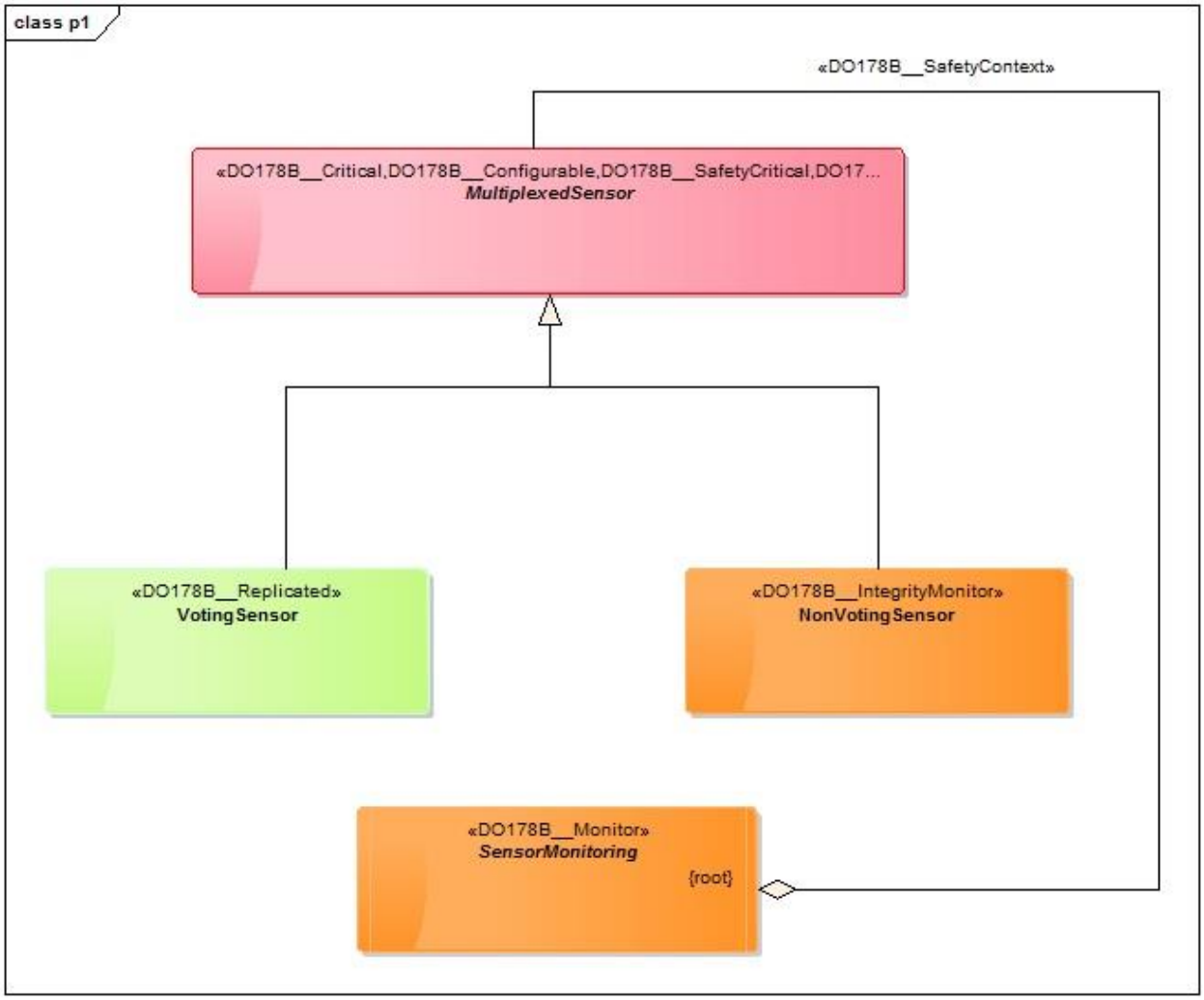

Figure 3: an example use of the DO178B profile

Yet another way to use all or only parts of a profile is by registering the original Enterprise Architect project (the one in which the profile was created) as a Reusable Asset, via the Reusable Asset Service. Remote stakeholders can then simply browse the various packages in the project, and even view diagrams contained in it and then decide which parts they are interested in (Figure 4).

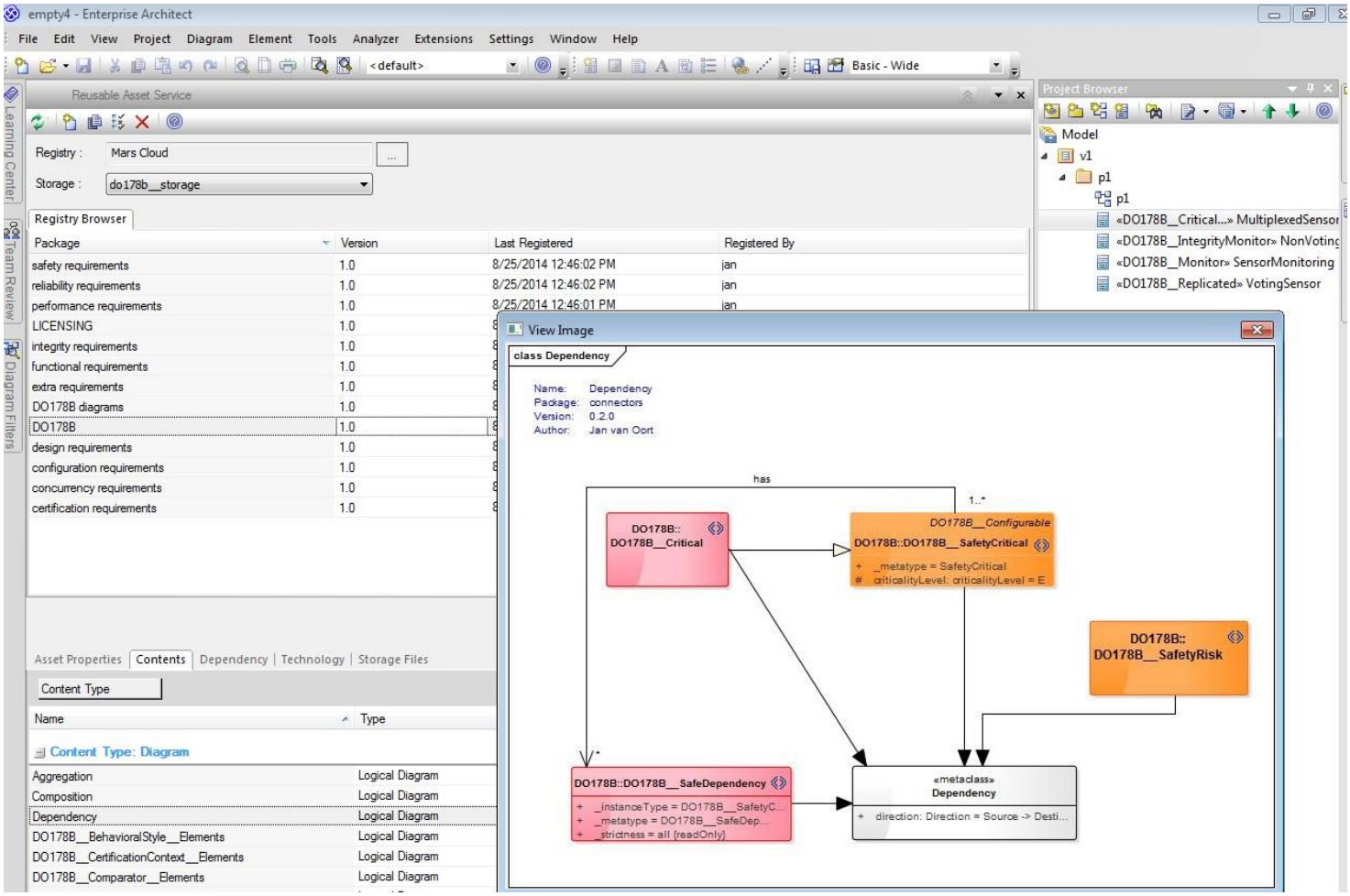

Figure 4: accessing a profile's original project as a Reusable Asset, via a Cloud Service

Moreover, we created an Enterprise Architect project glossary (figure 5) with both a list of keywords "may, must, must not, … " as specified by IETF 2119, and a list of keywords from the actual DO178B standard document, such as "Safety-Critical". The glossary is a powerful Enterprise Architect feature, which can greatly help in providing shared understanding of shared principle. It can be exported separately from all other project data as so-called reference data (figure 6), for re-use in other projects; when generating project HTML documentation, including the glossary is also an option.

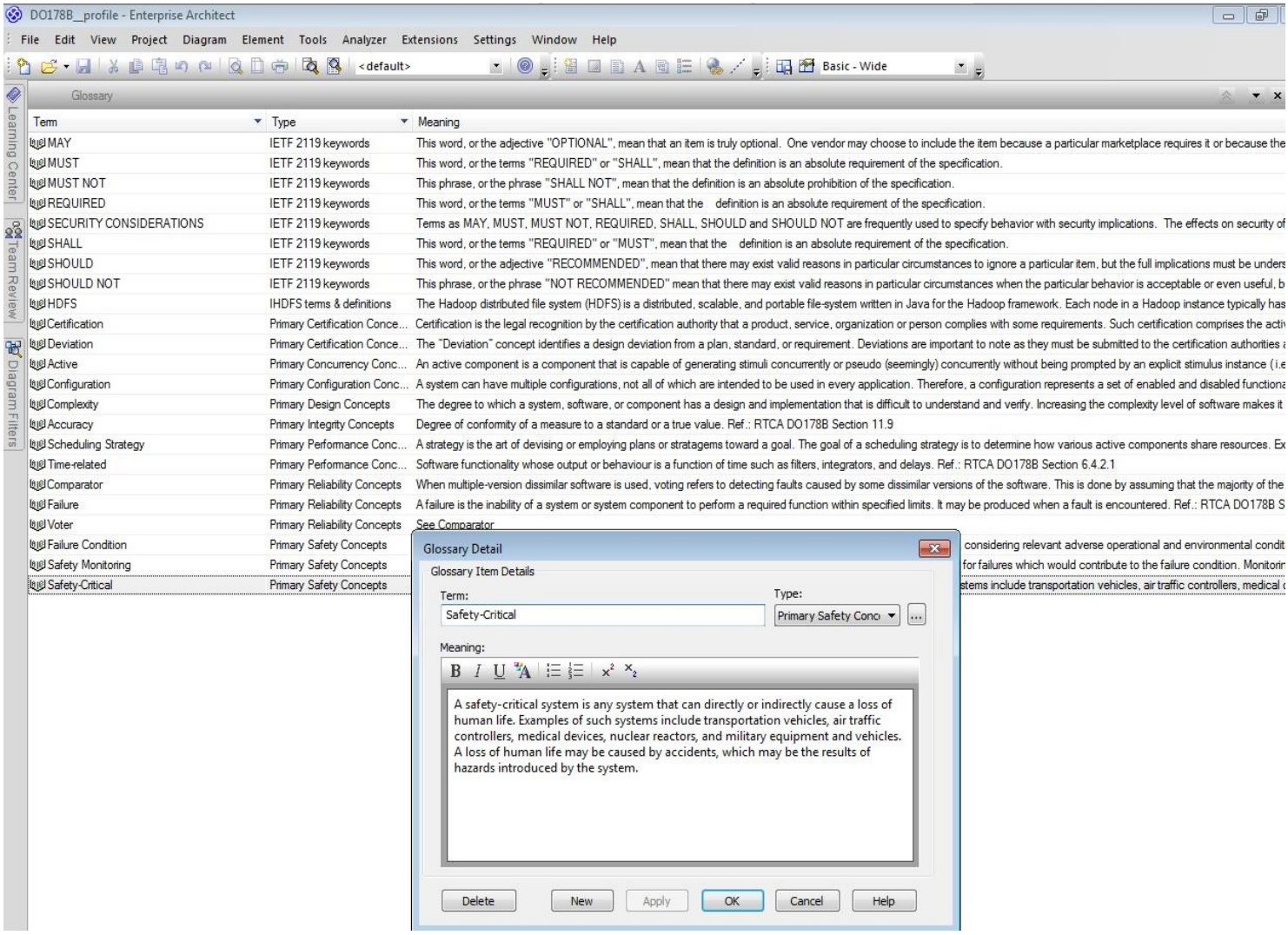

Figure 5: the DO178B profile Glossary

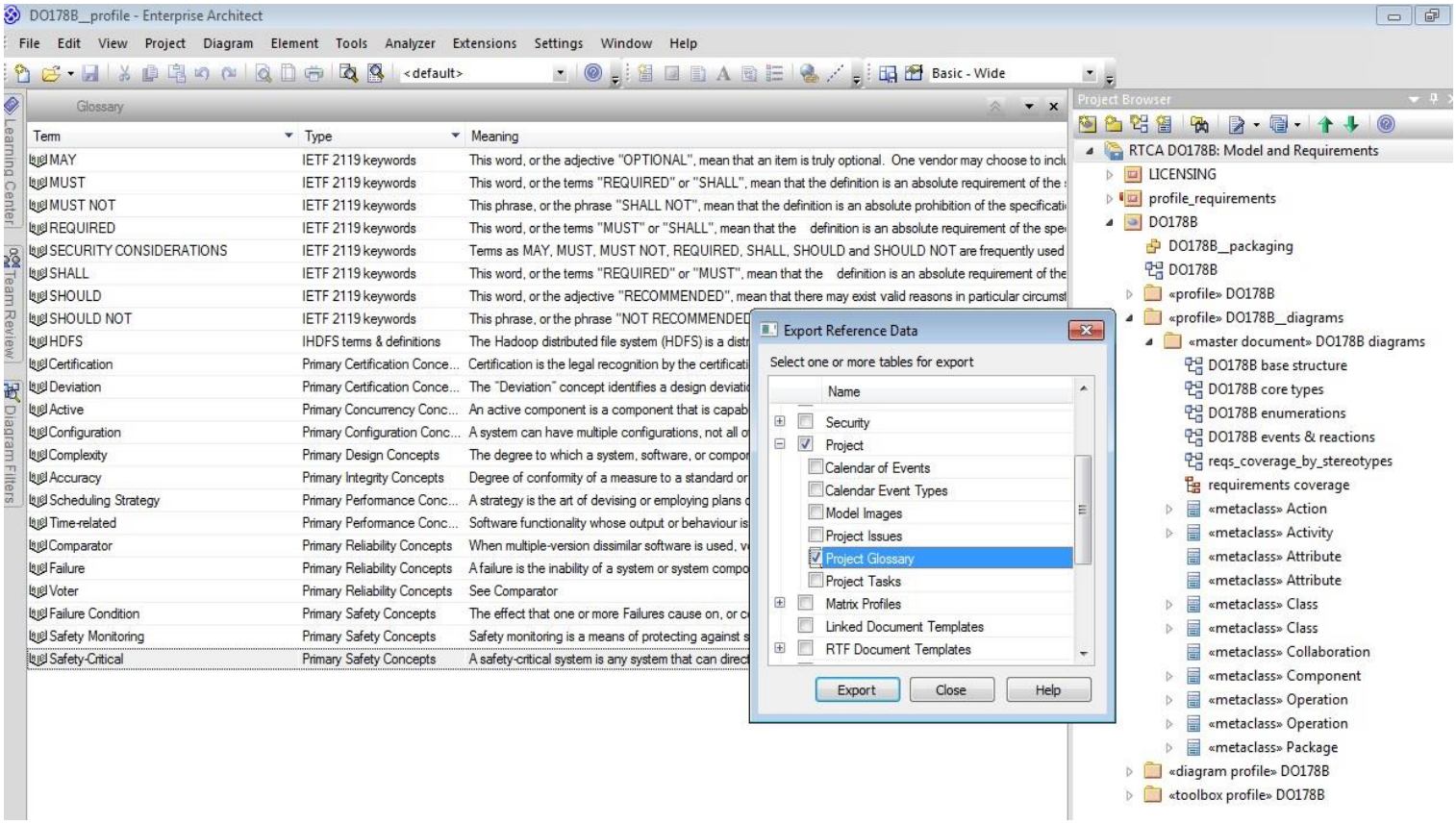

Figure 6: exporting a Project Glossary

The original work upon which this DO178B profile implementation is based, was a 2006 paper by Zoughbi *et al.* [Zoughbi 2006]. Interestingly, Zoughbi *et al.* also provided detailed lists of requirements an implementation of their work should realize. Using the "requirements" diagramming possibility in Enterprise Architect, we modeled the paper's list of core requirements, which enabled us to provide graphically interesting overviews of requirement coverage aspects (Figure 7).

The associated Project Glossary and the DO178B Profile are available at

do178b_glossary
http://www.sparxsystems.de/fileadmin/user_upload/Ressources/DO178B_profile/do178b_glossary.xml

do178b_profile
http://www.sparxsystems.de/fileadmin/user_upload/Ressources/DO178B_profile/do178b_profile.xml

under the terms of the MIT license: http://opensource.org/licenses/MIT

If you are interested in obtaining the entire, original Enterprise Architect project as an .eap file free from charges, please contact the author Jan van Oort at exercitussolus@gmail.com

The current work is a preparation of a planned effort, by the author, to also implement DO178C (see [Nordhoff2014] as a UML profile), with the kind support of Sparx Systems Central Europe GmbH.

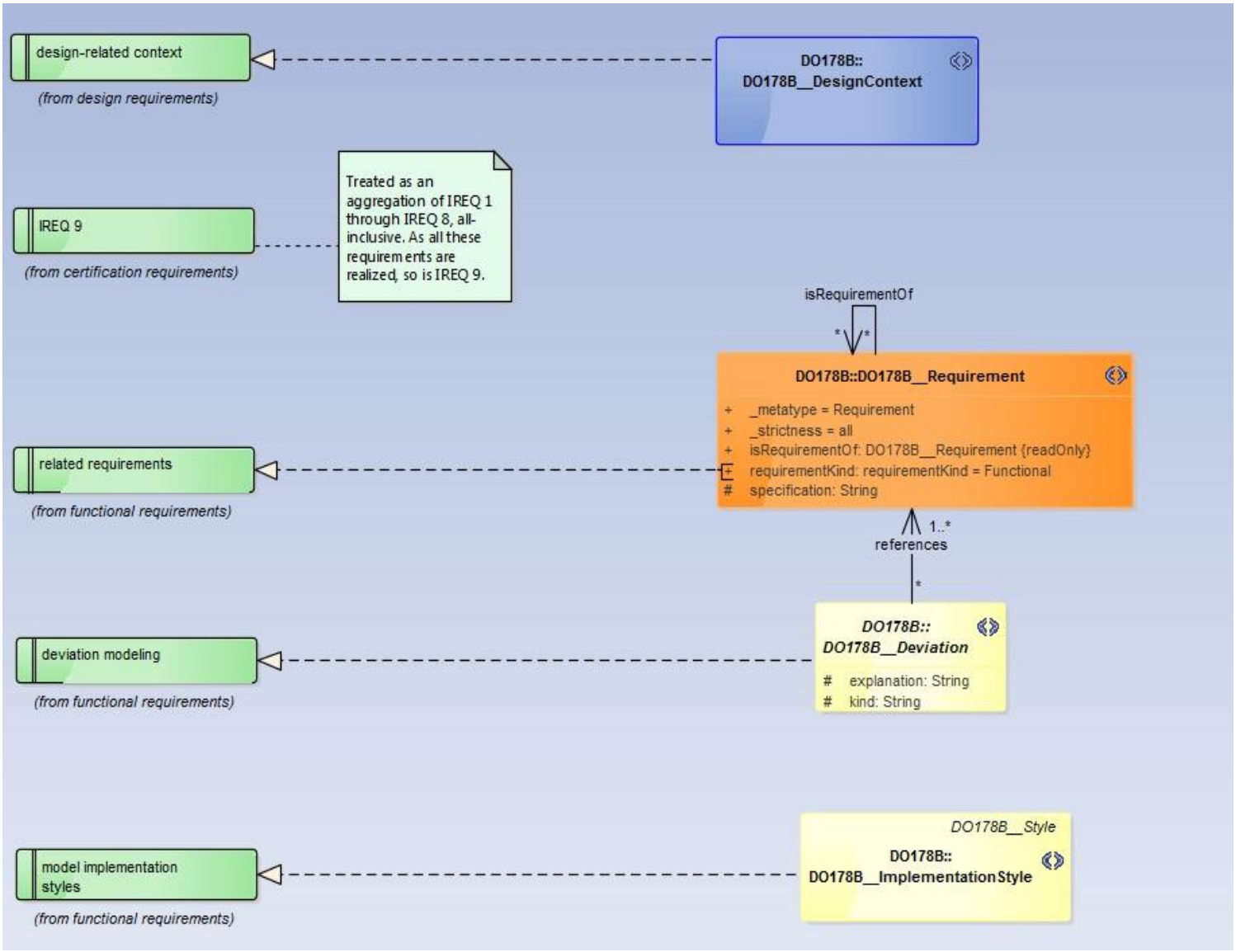

Figure 7: DO178B requirements coverage example

References

[Zoughbi 2006] Gregory Zoughbi, Lionel Briand and Yvan Labiche, "A UML Profile For Developing Airworthiness-Compliant (RTCA DO-178B) Safety-Critical Software", Carlton University, Ottawa CA, 2006.

[Nordhoff2014] Sven Nordhoff, "DO-178C/ED-12C, The new software standard for the avionic industry: goals, challenges and techniques", whitepaper, SQS Software Quality Systems AG, Cologne DE, 2014:
http://www.sqs.com/en-group/_download/DO-178C_ED-12C.pdf