Gesellschaft für
Systems Engineering e.V.
GERMAN CHAPTER OF INCOSE

SpecIF Introduction

Quick Start Guide

Content

Acknowledgement: Parts of the text have been translated with www.DeepL.com/Translator (free version)

1. SpecIF Goals

SpecIF stands for "Specification Integration Facility". Process and system descriptions from various sources are brought together in an open format and can be published independently of the authoring tools.

The initiators assume that

- there will always be different tools for the disciplines involved;
- It is not sensible to oblige everyone involved to use a certain tool;
- and that there is nevertheless a high level of interest in reading, searching through and checking the work results of all those involved in a common context.

The following use cases are considered:

1. System engineering collaboration in the supply chain
    - Automotive: „ReqIF for system models with linked requirements“
    - Aerospace
    - Utilities: Planning and maintaining renewable energy parks
2. Model exchange between system modeling tools
    - SysML: Enterprise Architect®, Cameo®, Rhapsody® and others
    - Other notations
3. Integration of models from different notations and tools
    - Navigate, search and audit partial models in a common context

SpecIF offers a cross-method and cross-manufacturer solution for this purpose. Existing formats and vocabularies are used as far as possible. The motivation of the GfSE working group PLM4MBSE is summarized in a position paper.

Further literature can be found on the SpecIF homepage, including motivation, examples with online demos and conference papers.

2. Quick Start Guide

SpecIF data can be read with a web browser (preferably Firefox, new Edge or Chrome) using the SpecIF viewer or SpecIF editor. In contrast to a document format, models in SpecIF format can be easily checked because they do not only contain the model elements, but also their semantic relationships can be traced.

Install the SpecIF Viewer/Editor

Install Viewer/Editor on a Web-Server

Download the last released program version "specIF-apps.vX.Y.zip" from https://github.com/GfSE/SpecIF-Viewer/releases, to be found in the collapsible "assets" section, and unzip the file in the file system of the web server of your choice. Enter "*http: //domain.tld/path/view*" or "*http: //domain.tld/path/edit*" in the address line of your web browser to start the respective app. Of course, "*domain.tld/path*" has to be replaced according to your installation.

Use the Installed SpecIF-Viewer/Editor

If the guidelines of your network permit, you can use the viewer/editor, which is installed for demonstration at https://specif.de/apps/view or https://specif.de/apps/edit. So you always benefit from the latest version.

Prepare the Model-data

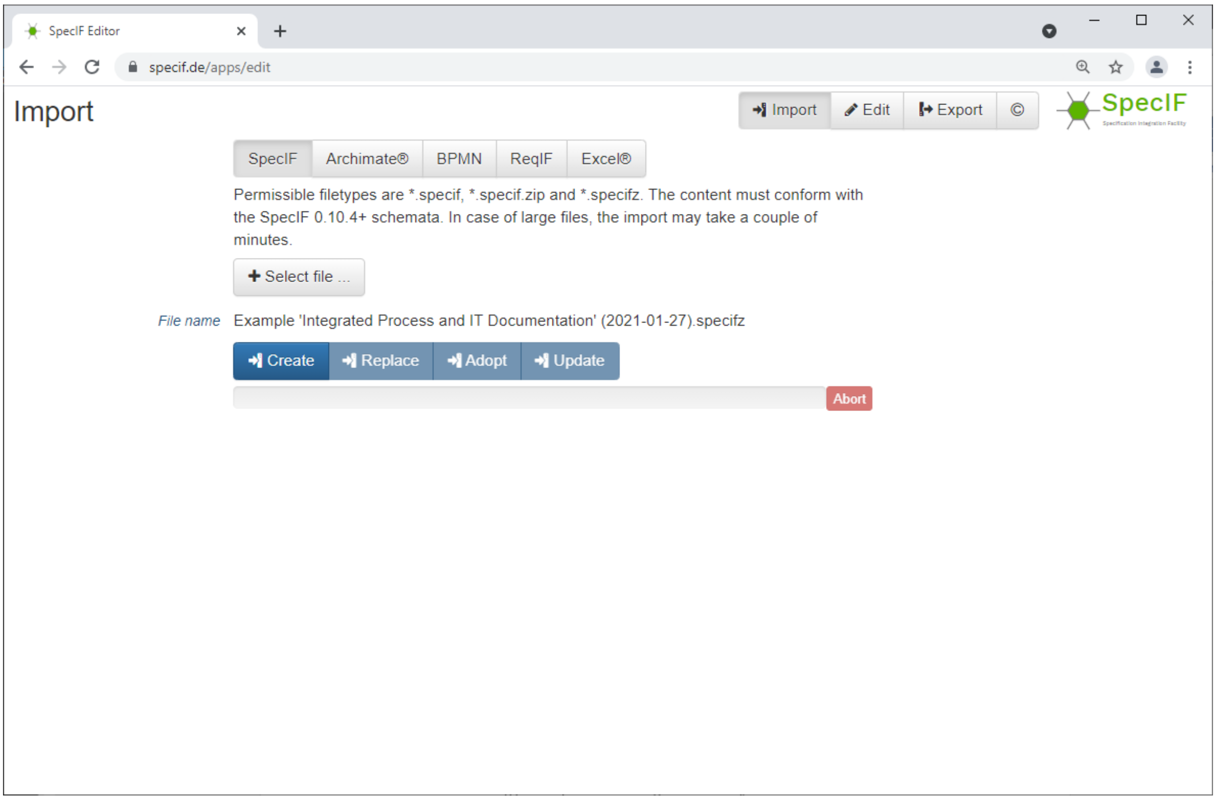
Currently the formats SpecIF, ReqIF, BPMN (BPMN-XML), ArchiMate (Open-Exchange XML) and MS Excel® (XLSX. XLS and CSV) are supported.

In case of SpecIF, ReqIF, BPMN and ArchiMate, no further preparations are required; files of this type can be imported directly.

In Excel® files, the assignment of meaning to resources and their attributes can be supported by applying certain conventions; see Chap. 3.

Import a Model

The start page of the viewer / editor lets you first select the data format and gives you some specific information. Any formats other than SpecIF are converted into the SpecIF format during import.



Permissible filetypes are *.specif, *.specif.zip and *.specifz. The content must conform with the SpecIF 0.10.4+ schemata. In case of large files, the import may take a couple of minutes.

File name Example 'Integrated Process and IT Documentation' (2021-01-27).specifz

To import a file, after selecting the relevant type, click on ↗ **+ Select file** and the familiar file picker of your web browser will open. Select the desired model file.

Then, click on an action button:

- ↗ **Create** loads the selected model.
- ↗ **Replace** discards previously loaded models and loads the selected one.
- ↗ **Adopt** adds the selected submodel to the already loaded one. In this case, resources that have already been imported adopt those of the new submodel if they have a compatible type and the same title; the identifier is ignored. This import mode is useful when partial models from different authoring tools are to be merged. For example, if a data object occurs in a BPMN process diagram and at the same time in an ArchiMate information model, then in the resulting semantic network the resource loaded first remains and all relations of the adopted resource are additionally adopted.

  It should be noted that all attribute values of the adopted resource are lost if the corresponding one of the adopting resource already has a value. In other words: An attribute value of the adopted resource is taken over only if the adopting resource has no corresponding value.

- ↗ **Update** also adds the selected submodel to the previously loaded ones. In this case, existing resources, such as diagrams or model elements with the same identifier, are updated if the creation date of the new resource to be imported is more recent. The same applies to all other elements such as relations, files and hierarchies. For data types and classes, a check is made beforehand to ensure that the consistency of the entire semantic network is maintained. For example, it is always possible to add another attribute to a resource class, but an attribute can only be removed if no instance of the class has a value for that attribute.

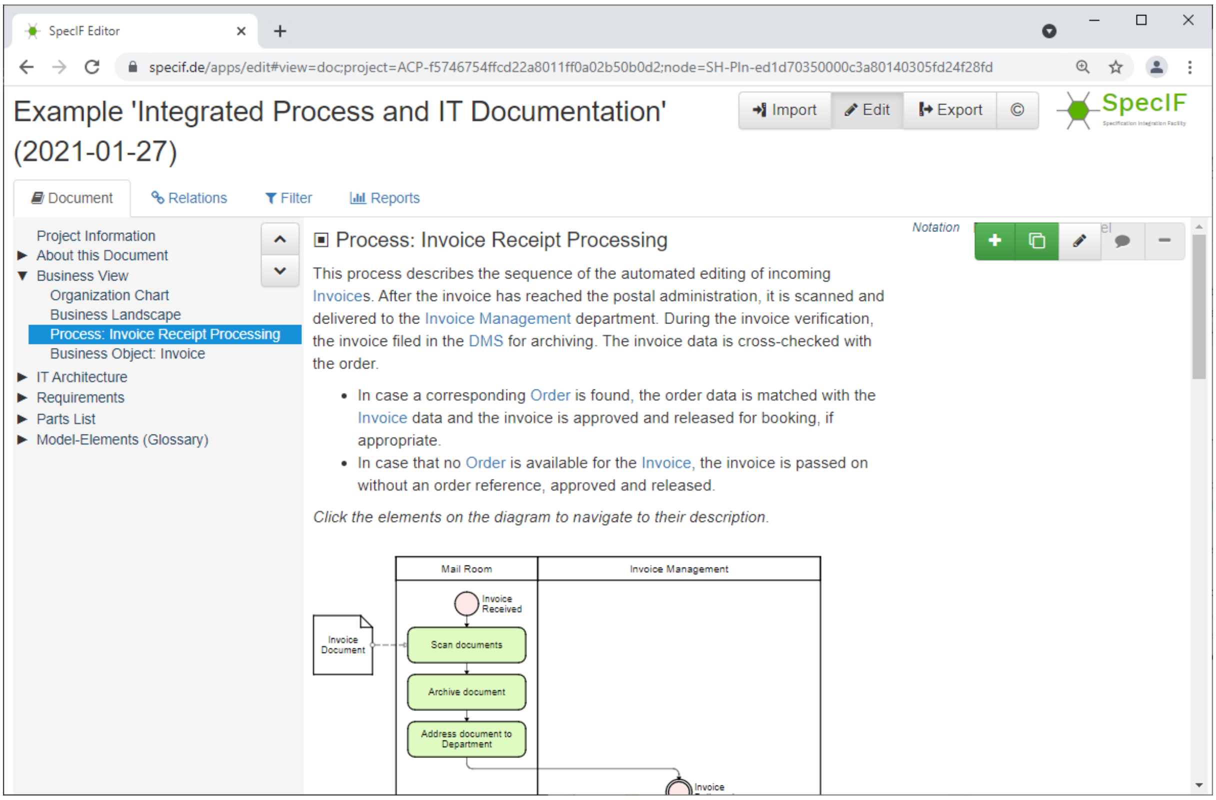
  The relationships of both the existing and new revisions of the model element are associated with the latter, the now current revision.

After successful loading, the view changes to "Read" resp. "Edit".

Note: If you load data from your local file system, it will be processed locally by your web browser. The SpecIF viewer or editor does not send any user data over the Internet and does not save any user data on a server. All user data remain local in your web browser.

Read a SpecIF-Model

In the ↗ **Document** tab, the model is presented in a structure or outline chosen by the author.



Example 'Integrated Process and IT Documentation' (2021-01-27)

- Project Information
- About this Document
- Business View
  - Organization Chart
  - Business Landscape
  - Process: Invoice Receipt Processing
  - Business Object: Invoice
- IT Architecture
- Requirements
- Parts List
- Model-Elements (Glossary)

Process: Invoice Receipt Processing

This process describes the sequence of the automated editing of incoming Invoices. After the invoice has reached the postal administration, it is scanned and delivered to the Invoice Management department. During the invoice verification, the invoice filed in the DMS for archiving. The invoice data is cross-checked with the order.

- In case a corresponding Order is found, the order data is matched with the Invoice data and the invoice is approved and released for booking, if appropriate.
- In case that no Order is available for the Invoice, the invoice is passed on without an order reference, approved and released.

Click the elements on the diagram to navigate to their description.

You can open and close the structural levels on the left; the respective contents are shown on the right. In the main column, the properties designated as title, description and diagram are shown, plus any other properties in a narrow column on the right.

With certain SVG model diagrams, e.g. with FMC- or BPMN-notation created by ARCWAY Cockpit, the diagram elements are linked to the corresponding data elements such that their title and description are displayed when the mouse is hovered over them. The element is jumped to with a double click. Here is a small example.

Edit a Model Element

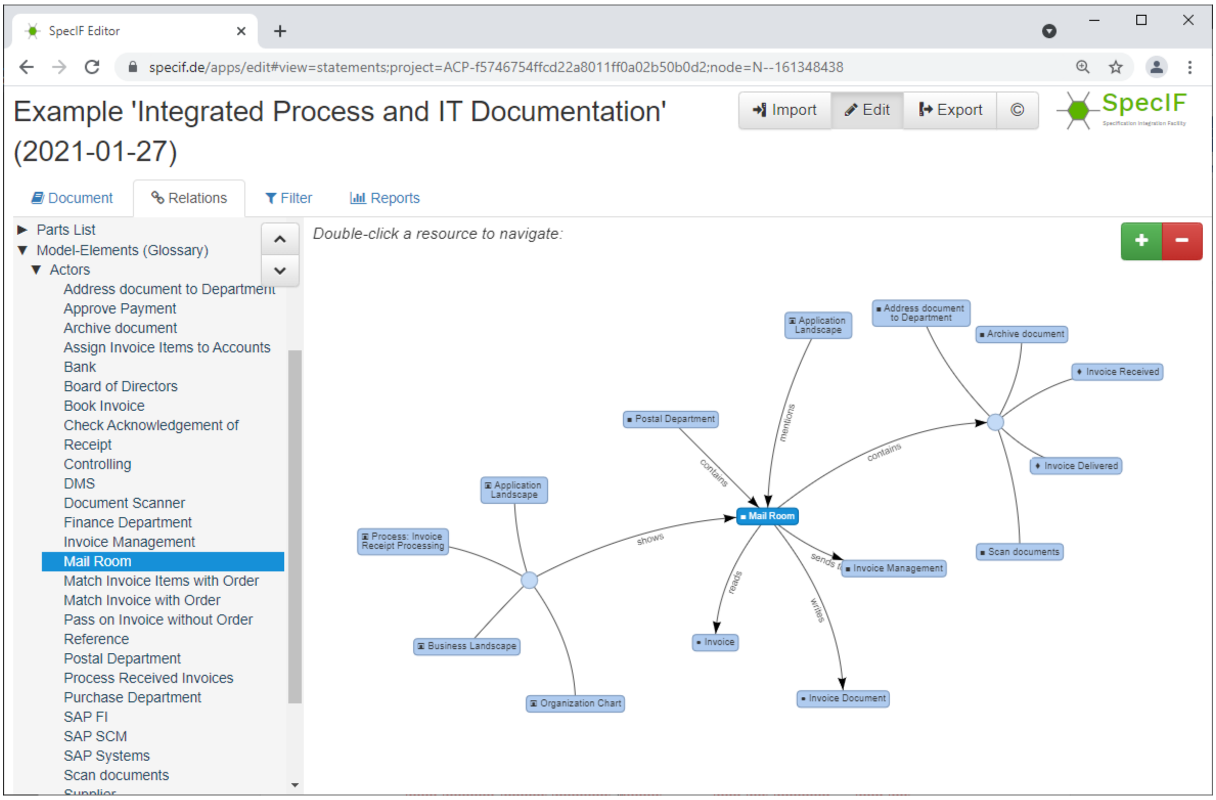
If the permissions allow it, a pen icon ↗ ✎ is active at the selected model element in the upper right corner. Clicking opens an editing window whose fields are determined by the current element type. Entries are checked key by key for correctness; for example, a red frame immediately indicates when a letter is entered in a number field.

Fields of type text (data type xs:string) allow formatting by means of XHTML or markdown, which is interpreted accordingly during display or document generation.

By the way, texts can also be formatted using XHTML and markdown in many authoring tools, including Excel®, Archi and Camunda Modeler. The formatting is preserved during import.

Investigate Semantic Relationships

In the ↗ **Relations** tab, the semantic relationships of the element selected in the outline to the left are shown. Most relationships are automatically created by graphically analyzing the model diagrams, such as “component XY *contains* function FR” when the block representing function FR is spatially contained in the block representing component XY. Some relationships have to be created manually as part of the analysis and system design, for example "Component XZ *satisfies* requirement 134".



Example 'Integrated Process and IT Documentation' (2021-01-27)

▶ Parts List
▼ Model-Elements (Glossary)
▼ Actors
Address document to Department
Approve Payment
Archive document
Assign Invoice Items to Accounts
Bank
Board of Directors
Book Invoice
Check Acknowledgement of Receipt
Controlling
DMS
Document Scanner
Finance Department
Invoice Management
Mail Room
Match Invoice Items with Order
Match Invoice with Order
Pass on Invoice without Order Reference
Postal Department
Process Received Invoices
Purchase Department
SAP FI
SAP SCM
SAP Systems
Scan documents
Supplier

Double-click a resource to navigate:

The selected element is a little darker and shown in the center of the spider. This example expresses the following dependencies:

- the "Mail Room" is shown on 4 diagrams,
- it is included in the organization "Postal Department",
- is mentioned by another element „Application Landscape“ in the text,
- itself contains several elements (please double-click the diamond so that the individual elements are shown),
- reads a document „Invoice“,
- writes a document „Invoice Document“ and finally
- sends messages to an organization „Invoice Management“.

The relationships shown are the *entirety* of all statements relating to the selected element in the present model. For example, if one diagram shows that component A is contained in component B and another diagram shows the opposite situation, then it is clearly a contradiction. While it is hardly possible to look through the entire model with all its diagrams and check for consistency, such contradictions are quite easily uncovered when inspecting the statements of individual elements. Current work deals with automatic model testing using hard and empirical rules in order to improve model quality in the long term.

In this view, you can also double-click any element and navigate through the semantic network using the relationships.

Create or Delete a Relation

Likewise on tab ↗ **Relations**, two buttons for creating and deleting relations become active – if permissions are granted.

To create a relation ↗ +, a dialog box is displayed, in which a valid relation type for the given model element and a suitable target element as subject or object can be selected. Here, only those options are offered that correspond to the ontology, so that only meaningful semantic relations are created.

To delete a relation ↗ ✖, all relation targets of the selected model element are colored red. Double-clicking on a target element deletes the respective relation.

Export a Model

Once the document has the desired structure and content, it can be saved in various formats by pressing ↗ **Export** at the top right:

- ↗ **SpecIF** creates a ZIP file with the semantic network in SpecIF format and all referenced images and files. It can be easily read back into the SpecIF editor at a later time.
- ↗ **HTML with embedded SpecIF** generates a file to be displayed in the web browser. All views and semantic relationships can be easily tracked and reviewed. The file contains Javascript and therefore some environments prohibit execution.
- ↗ **ReqIF** generates an XML file according to the OMG Requirement Interchange Format, which can be read by several Requirement Management (RM) and Application Lifecycle Management (ALM) tools.
- ↗ **Turtle** creates a file for reading into graph databases; it is a compact representation of the Resource Description Framework (RDF).
- ↗ **Epub** generates a file for electronic document readers.
- ↗ **MS Word® (Open XML)** creates a file that can be read and further edited by MS Word. Edited files are best saved in the compressed format DOCX. As is well known, Word files in change mode are a popular means of collaboration and adding content within a team.

3. Special Authoring Tools

The term authoring tool is used here to describe software that is used to create partial models or compile other information related to a target system to be designed and specified.

Microsoft Excel®

Folder

When importing Excel® files, a folder with the file name as title is created in the hierarchy of the SpecIF data-set. For each worksheet a subfolder is created with it's name as a title.

Resources

If there is a term in brackets in the name of a worksheet, it is used as the title of the resource class (SpecIF resourceClass, type of all resources/objects found on this worksheet). If the worksheet name does not contain a term in brackets, a term in brackets in the file name is used as a substitute. If no type designation is found there either, a generic title without a particular meaning is used for the resource class of the worksheet.

Unfortunately, no vocabulary term ready to be interpreted by the system can be used in the filename, as certain characters (e.g. the colon) may not appear in filenames. However, the terms “requirement”, “feature”, “annotation”, “user-story” and “pain-point“ are interpreted correctly by the viewer or editor and replaced by a vocabulary term.

For example, if an Excel file has the file name "Project-name (Requirement).xslx" and it contains two worksheets with the names "Functions (User Story)" and "Constraints", a resource-class with the title "User-Story" replaced by "SpecIF:UserStory" forthe first worksheet and a resource-class with the title "Requirement" replaced by "IREB:Requirement" for the second worksheet are created.

Properties

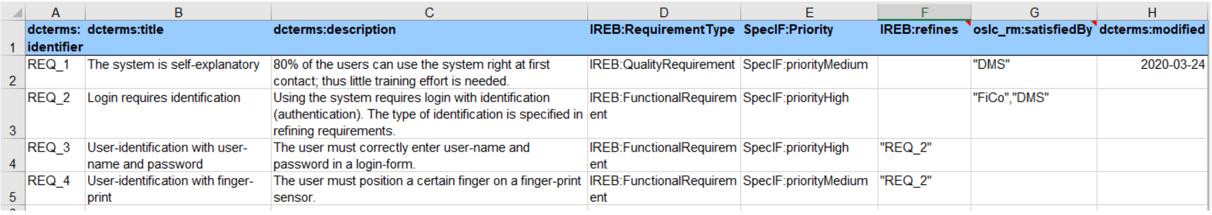
Now for the contents of each worksheet. The property names (SpecIF property titles) are expected in the first table line of each worksheet and the resources ("instances") follow from the second line. Defined vocabulary terms are best used as attribute names, e.g. *dcterms:title* and *dcterms:description* from the Dublin Core Metadata Initiative. The use of agreed terms conveys the meaning of the respective attributes so that, just one of the potential benefits, the user interface knows how to display the properties. For example, the title (denoted by *dcterms:title*) comes first in larger letters, underneath the description (denoted by *dcterms:description*) in the main column plus the remaining attributes in a narrower column on the right. However, there are many more benefits in the entire product development.

By the way, formatting in text fields using markdown is preserved during import so that, for example, text passages can be highlighted in bold or key points can be enumerated in a bullet list.

Relations

The same goes for the names of relationships (SpecIF statements); for example *oslc_rm:refinedBy* between two requirements or *oslc_rm:satisfies* between a system component and a requirement. In order to successfully create relationships, the user-defined IDs (*dcterms:identifier*) or titles (*dcterms:title*) of the respective elements must be given between double or single quotation marks. Multiple resources can be specified separated by commas. See columns "*IREB: refines*" and "*oslc_rm:satisfiedBy*" in the following figure.

By the way, the target of a relation like "DMS" in the figure does not have to be found in the same file. The relation is also established to a resource that originates from a different source, as long as the title resp. ID are identical.

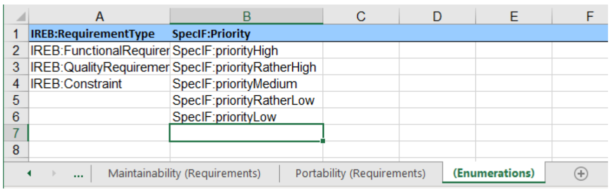


	A	B	C	D	E	F	G	H
1	**dcterms: identifier**	**dcterms:title**	**dcterms:description**	**IREB:RequirementType**	**SpecIF:Priority**	**IREB:refines**	**oslc_rm:satisfiedBy**	**dcterms:modified**
2	REQ_1	The system is self-explanatory	80% of the users can use the system right at first contact; thus little training effort is needed.	IREB:QualityRequirement	SpecIF:priorityMedium		"DMS"	2020-03-24
3	REQ_2	Login requires identification	Using the system requires login with identification (authentication). The type of identification is specified in refining requirements.	IREB:FunctionalRequirem ent	SpecIF:priorityHigh		"FiCo","DMS"	
4	REQ_3	User-identification with user-name and password	The user must correctly enter user-name and password in a login-form.	IREB:FunctionalRequirem ent	SpecIF:priorityHigh	"REQ_2"		
5	REQ_4	User-identification with finger-print	The user must position a certain finger on a finger-print sensor.	IREB:FunctionalRequirem ent	SpecIF:priorityMedium	"REQ_2"		

Suitable terms are defined in the SpecIF Ontology, namely for property names (propertyClasses), property values (propertyValues) and for statement names (statementClasses).

Enumerated Values

To define an attribute with enumerated values, a worksheet with name *(Enumerations)* including the brackets is created. Here all values of a certain attribute are specified column by column. Here again, the first line specifies the attribute name and the values below that are taken over up to the next blank line. In worksheets with user data, these values are provided for attributes with the same name; in the example given to the left, these are the attributes named *IREB:RequirementType* and *SpecIF:Priority*. While Excel® also allows the specification of deviating values, this is not possible in case of SpecIF, therefore all values that do not correspond to those in the worksheet *(Enumerations)* are ignored.



	A	B	C	D	E	F
1	**IREB:RequirementType**	**SpecIF:Priority**				
2	IREB:FunctionalRequirer	SpecIF:priorityHigh				
3	IREB:QualityRequiremer	SpecIF:priorityRatherHigh				
4	IREB:Constraint	SpecIF:priorityMedium				
5		SpecIF:priorityRatherLow				
6		SpecIF:priorityLow				
7						
8						

Note: Excel® assists the user in entering values through a selection box when the values listed in the "(Enumerations)" worksheet are selected for the column in question using the menu Data > Data Tools > Data Validation.

This example shows the described conventions. Here vocabulary terms have also been chosen for the enumerated attribute values. These are replaced in SpecIF Editor/Viewer by terms of the active national language, for example *SpecIF:priorityHigh* becomes *high* if German is selected in the browser. Of course, any terms can be used in the Excel worksheet, which will then be used directly in SpecIF Editor/Viewer regardless of the active browser language.

Archi

Archi is a freely available modeling tool that supports the ArchiMate 3.0 notation of the Open Group. It can be obtained from https://www.archimatetool.com/download/.

A model created with Archi can be transformed into the SpecIF format or integrated with models from other sources as follows:

1. In the Archi tool, export all diagrams individually as an image in PNG or SVG format. To do this, right-click on the diagram to open the context menu and select ↗ **Export**, ↗ **View As Image**, then select the destination folder in the dialog and press ↗ **Save**.
2. Export the model in the "Open Exchange" format by selecting ↗ **File**, ↗ **Export** and ↗ **Export Model To Open Exchange File** from the main menu while the model is selected; then select the destination folder in the dialog and press ↗ **Save**.
3. Now switch to the web browser and select or load the SpecIF editor as described in the previous chapter. First select the ↗ **ArchiMate** format in the top button bar. Using ↗ **+ Select file**, choose the previously exported model in the Open Exchange format, which usually has the file extension '.xml'. The permitted action buttons ↗ **Create**, ↗ **Replace** and ↗ **Adopt** are activated (see Chapter 2).
4. After the import is completed, the display automatically jumps to the ↗ **Edit** page in the ↗ **Document** tab. The sub-views and functions described in the previous chapter can be selected.
5. All entries in the outline that are not required can be deleted by clicking the delete icon ↗ ❌ on the right side of the screen.
6. The entries in the outline can also be moved using drag'n'drop.
7. Now select all the diagrams in the outline one after the other. The texts have been taken over, but the images have to be added manually. To do this, click the pencil icon ↗ ✎ on the right edge of the screen when the diagram is selected. A modal dialog window opens with all the attributes of the element. For the ↗ **Diagram** attribute, click the pencil icon again to open the file selection dialog and select the respective image file; the usual web formats SVG, PNG and JPG are supported. Finally, click ↗ **Update** at the bottom of the modal editing dialog. The document view now shows the model diagram in the main column.

Also for Archi, formatting in diagram or element descriptions using markdown is preserved during import so that, for example, text passages can be highlighted in italics or key points can be enumerated in a bullet list.

ADOIT

ADOIT is a modeling tool licensed from the BOC Group, which supports the ArchiMate 3.0 notation of the Open Group. It can be obtained from https://www.boc-group.com.

A model created with ADOIT can be transformed into SpecIF format or integrated with models from other sources as follows:

1. In the ADOIT tool, export all desired diagrams individually as an image in PNG or SVG format. To do this, open the diagram by double-clicking in the model structure on the left and then save it in the menu bar directly above the diagram by ↗ ⭳ **Export** and selecting the desired format. The file will be saved according to the settings of the browser; often in the folder "Downloads".
2. In the model structure, select all diagrams to be considered. Via context menu follow ↗ **Import/Export**, ↗ **ArchiMate exchange** and ↗ **Export**. A dialog window opens, in which the diagram selection is checked/changed if necessary and a name for project and file is assigned.
3. From the third step on, the procedure is the same as described above for Archi.

Also for ADOIT, formatting in diagram or element descriptions using markdown is preserved during import so that, for example, text passages can be highlighted in bold or key points can be enumerated in a bullet list.

4. Terms of Use

License

Both SpecIF as a format with schema and consistency checker as well as the SpecIF viewer/editor are open source and are subject to the Apache 2.0 license, which also allows free use for commercial applications. If used in your own product, the source must be given.

No Guarantee and No Liability

SpecIF and the SpecIF viewer are provided "as-is" and without guaranteed characteristics. Use is always at your own risk. Any liability and guarantee are excluded. The installations at http://specif.de and https://github.com/GfSE are reference implementations and currently not designed for high loads and high availability.