

Requirement Management

- RM9 -



User Guide – V1

BPA Delivery 7 for V5R19 (V5.7)

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1. Introduction

This document describes the user guide for the BPA Requirement Management.

This document is divided into the following sections:

- Requirement Management overview
- Requirement Management Using the Collaborative System Engineering Solution

The need for effective Requirements Management is one of the priorities in product development process.

This manual is provides to **Requirements Engineers and system engineers** an advanced description of the **Collaborative Systems Engineering solution capabilities**.

It provides a detailed description of the targeted processes as well as a detailed description of the solution capabilities.

The objective of the Requirements Management activity is to take the customer's/marketing specific, written requirements and proliferate them into a clear and unambiguous set of derived requirements to control the design, development, implementation and testing of the final system. The purpose is to deliver a product that meets customer/marketing expectations. The Requirements Management application objective is to support this extensive requirements engineering capability and to provide the ability to maintain requirements traceability back to the original customer/marketing (source) documents.

The CSE-RM solution leverages the advanced capabilities of **ENOVIA SmarTeam's** product Lifecycle management product to provide the overall combination of capabilities to support advanced Requirements Engineering processes.

1.1. Scope and purpose

The Requirements Management BPA solution provides the infrastructure and processes to:

- Integrate the supply chain around a unified and consistent product requirement definition
- Fully manage the requirements Lifecycle including generation, capture, analysis, qualification, allocation, verification and reporting
- Coordinate cross disciplines team activities related to product architecture definition
- Support optimal design architecture definition by supporting trade-off studies to balance functionalities, performance and cost
- Support quick requirement impact analysis and propagation

The overall Systems Engineering process can be easily covered by complementing this solution by additional modules provided by Dassault Systèmes.

1.2. Related Documentation

These documents give complementary useful information for daily use of the BPA.

- Collaborative Systems Engineering – Installation Guide
- Collaborative Systems Engineering – License Use Management (CSE_LicenseUseManagement_R19D7.doc)
- Collaborative Systems Engineering – Data Model Documentation (CSE_DataModel_Documentation_R19D7.doc)
- Collaborative Systems Engineering – Requirement Management Implementation guide (RM9_ImplementationGuide_R19D7.doc)

- ENOVIA SmarTeam - Editor Installation Guide
- ENOVIA SmarTeam - Editor Administrator Guide
- ENOVIA SmarTeam - Editor User Guide

- ENOVIA SmarTeam - Foundation Installation Guide
- ENOVIA SmarTeam - Foundation Administrator Guide
- ENOVIA SmarTeam - Foundation User Guide

1.3. Definitions

1.3.1. Glossary

Term	Definition
Allocate	To map or assign to.
Decompose	To break down into component parts. For example, ABCD decomposes to AB and CD. AB then decomposes to A and B, and CD decomposes to C and D.
Derived	After some design, new requirements may be identified as a result of the design. These are derived requirements. Interfaces with other systems are an example. Some authors use the term <i>derive</i> interchangeably with the term <i>decompose</i> .
Design	Design requirements address how the system will accomplish the functional requirements.
Functional Primitive	In a data flow diagram, the bottom-most bubble, this is reached when further decomposition would yield the function's logic (if then or case, case) rather than child functions.
Gap Analysis	An analysis of the gap between requirements that are met and not met; a deficiency assessment.
Inverse	A requirement stated as a negative proposition (shall not). An inverse requirement is not testable.
Non-Functional	These requirements include areas such as performance, reliability, design and implementation constraints.
Non-Technical Requirements	Agreements, conditions, and/or contractual terms that affect and determine the management activities of a project.
Process Specification	Describes what is happening inside the functional primitive.
Proxy	May be used in place of a requirement that is not testable. For example, the requirement to be "user friendly" could have a proxy that online helps be available.
Requirements Definition	An assessment of the needs a system is to fulfill, including why the system is needed; what features will service or satisfy the need; and how the system is to be constructed.

System Level	Requirements that address an entire system, a major system division (e.g., hardware or software), or more than one subsystem; global requirements. It is not the breadth of the wording that makes a requirement system-level, but the extent of its impact on the system.
Systems Requirements	usually used as shorthand for "system functional requirement" but, depending on the speaker's perspective, could also mean "system-level," operating system, or something else. Clarify what the speaker means to avoid miscommunication.
System Functional Requirements	What a system must do to satisfy user requirements. System functional requirements include functional and non-functional requirements.
User Requirements	The origin of each requirement or requirement satisfier is clear (backwards trace); the allocation or satisfier of a requirement is clear (forwards trace).
	Address what the users need to do their jobs. These requirements are implementation independent and are sometimes called "business requirements."
Validation	Includes what is commonly thought of as testing and comparing test results to expected results.
Verification	Uses reviews, inspections, and demonstrations throughout development to ensure the quality of the product of that phase, including that it meets the requirements from the previous phase. Various authors define verification and validation somewhat differently.

Table 1 – Glossary

Acronym	Definition
BPA	Business Process Accelerator
PDIR	Program Directory
CSE	Collaborative System Engineering

Table 2 – Acronyms

1.3.2. Pictograms




















Symbol	Usage
	Create primary requirement
	Creating primary requirements from MS Clipboard
	Decomposing requirements
	Derived Requirement
	Updating requirements
	View requirements change history
	Provide requirement history report
	Requirements Module
	Requirements Chapter
	Trace to original document
	Allocate requirement to test and validation plan
	Allocate requirement to function
	Allocate a requirement to a system
	Declare a requirement to requirement dependency
	Publishing a report matrix
	Publishing a requirements document into Word
	Reordering
	Capture Requirements
	Markup requirement for capture
	Automatic capture requirements
	Reset Globals
	Requirement Folder
	Unallocated objects
	Traceability Matrix
	RIF export of requirements
	Un Markup Requirements

Table 3 - Pictograms

2. Requirement Management overview

2.1. Functional overview

2.1.1. Introduction to Systems Engineering Process

The **System Engineering** process is based on an **iterative**, top down, hierarchical decomposition of system requirements, supported by trade studies that record the basis for significant decisions and the options considered for functional and system architecture. The iterative, top-down, hierarchical decomposition methodology includes the parallel activities of **Requirements Management** (Requirement Analysis), **Functional Design** (Functional Analysis), **Allocation**, and **Logical Design** (Synthesis).

This figure represents an academic overview of the Systems Engineering process:

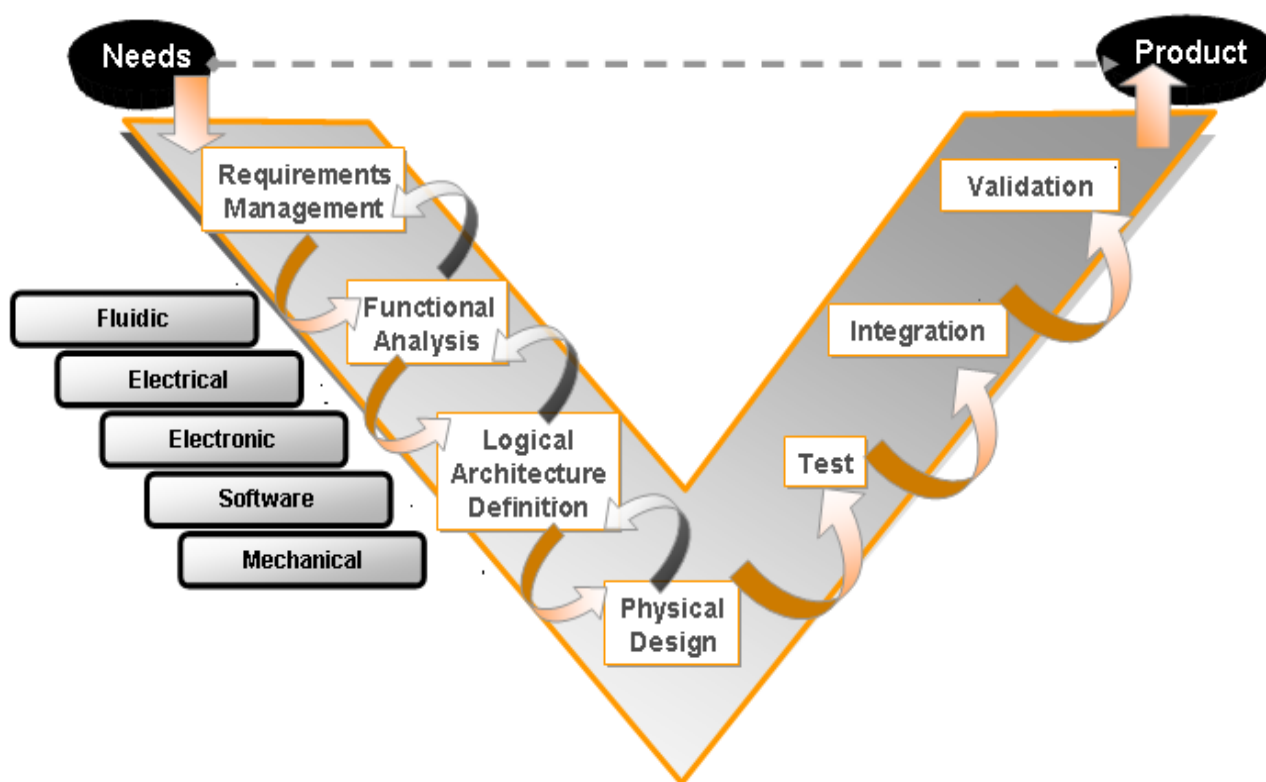


Figure 1 – “Systems Engineering” Process.

2.1.2. Requirements Management Process



Formal Requirements Management is the first “**Systems Engineering**” activity that needs to be introduced to address design to target/quality objectives and to formally control the overall product development process.

It's also important to notice that Systems Engineering is more and more used in any industries to meet design to target objectives and to help companies handling increasing product complexity that more and more combine hardware, mechanical, software, and electronic components.

The Requirements Management activity is defined as a systematic approach to eliciting, organizing and documenting the requirements of the system, as well as a process that establishes and maintains agreement between the customer and the project team on the changing requirements of the system. Requirements Management is the ongoing process of identifying the needs of the end user, and balancing them against the time and budget of the project, resulting in a system that satisfies the needs of the end user.

The objective of Requirements Management is to take the customer's/marketing specific, written requirements and proliferate them into a clear and unambiguous set of derived requirements to control the design, development, implementation and testing of the final system so that we deliver a product that meets customer/marketing expectations.

Requirements Management involves establishing and maintaining agreement between customer and developer on both technical and non-technical requirements. This agreement forms the basis for estimating, planning, performing, and tracking project activities throughout the project, and for maintaining and enhancing developed systems.

Key activities of Requirements Management include: **Needs Identification** phase, **Requirements Source Capture** and **Requirement Analysis and Decomposition**, **Requirement Allocation and Formalization**, **Requirement Verification** and final product **Acceptance**.

The following figure represents an overview of the requirements management iterative process:

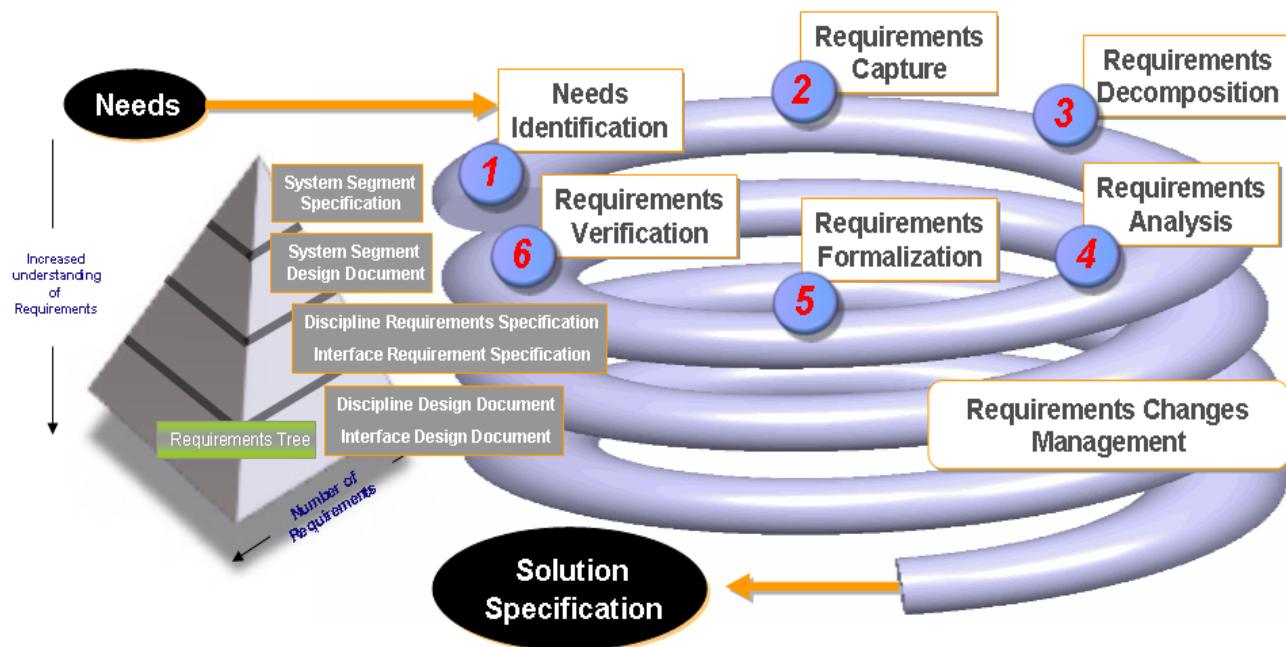


Figure 2 – Requirements Management Iterative Process.

2.1.3. Requirements Management benefits

Any industry that deals with design for customer or handling requirements across a distributed design team can benefit from a Requirements Management approach.

Experience has shown that the benefits of effective Requirements Management include:

Simplify compliance with standards and regulations. Standard and regulation have an increasing impact on the product development process. Compliance with standards and regulations require from companies to perfectly control the Requirements Management process.

Better control of complex projects. Lack of knowledge of the intended behavior of the system, as well as requirements creep, are common factors in out-of-control projects. Requirements Management provides the development team with a clear understanding of what has to be delivered, when and why. Resources can be allocated based on customer-driven priorities and relative implementation effort. And the impacts of changes are better understood and managed.

Improved product quality and customer satisfaction. The fundamental measure of product quality is “does this product do what it is supposed to do?” Higher quality can result only when engineers and test personnel have a concise understanding of what must be built and tested.

Reduced project costs and delays. Research demonstrates that errors in requirements are the most pervasive and most expensive errors to fix. Decreasing these errors early in the development cycle lowers the total number of errors and cuts project costs and time-to-market.

Improved team communications. Requirements Management facilitates early involvement of customers to ensure the application meets their needs. A central repository builds a common understanding between the designers, suppliers, management, analysts, and test personnel of project needs and commitments.

Other values of formal Requirements Management are:

- Fewer Requirements defects
- Reduced development rework
- Fewer unnecessary features
- Lower enhancement costs
- Faster development
- Fewer miscommunication
- Reduce scope creep
- Reduced project chaos

3. User Interface presentation

3.1. User Interface overview

The toolbars below represent the main functions of the CSE Application.

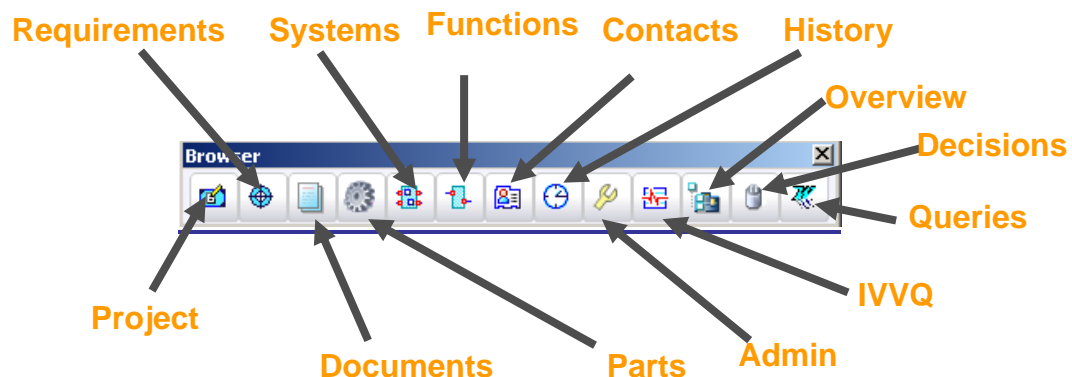
The icons in these toolbars are contextual, meaning that their activation depends on the context (selected element)

Ex: It's not possible to decompose a requirement when selecting a project.

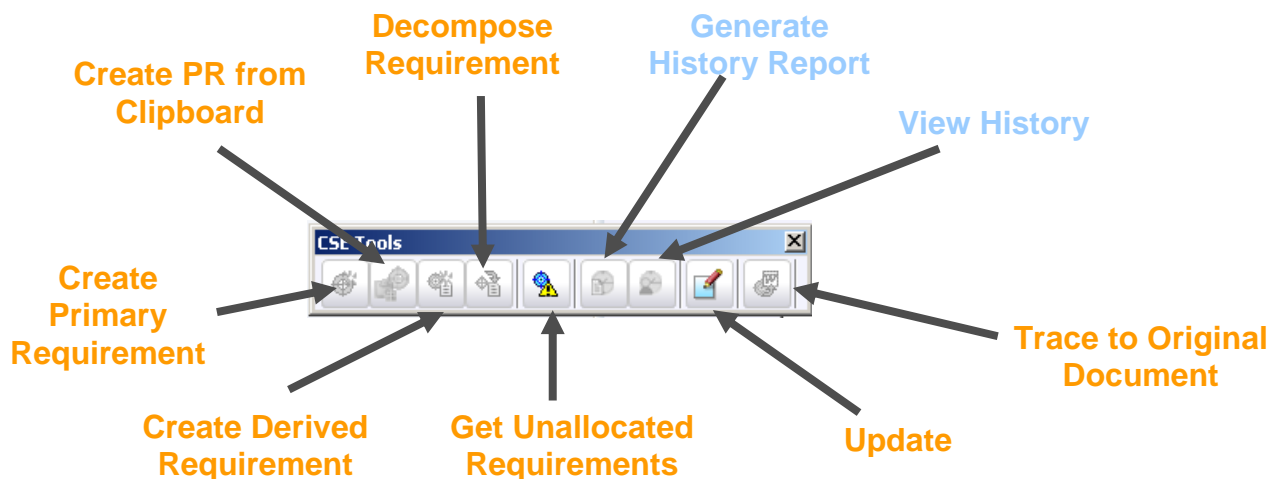
Note

Functionalities depicted in blue are not part of the requirements management BPA but are part of the complementary BPAs that make up CSE

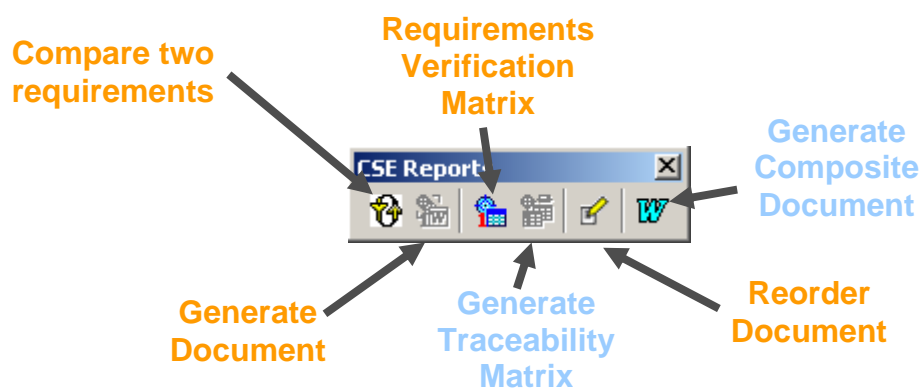
'CSE Browser' Toolbar



'CSE Tools' Toolbar



'CSE Reports' Toolbar



'CSE Export' Toolbar



3.2. Operations performed from the Collaborative Systems Engineering environment

The following section describes the tools and buttons in use by the CSE Solution along with their practical meaning:

Creating primary requirements



CSE provides the capability to directly introduce new requirements in the database and to control the quality of these requirements definitions. The quality of the requirement statement is supported by attributes control.

The requirement can be freely defined by the user.

Creating primary requirements from MS Clipboard



CSE provides the capability to create new requirements in the database from the content of the MS Clipboard (the supported content is limited to text, tables, images and a combination of them) and to control the quality of these requirements definitions. The quality of the requirement statement is supported by attributes control.

Decomposing requirements



CSE provides the capability to manage the requirement decomposition process.

Decomposing requirements means breaking down a requirement into component parts. For example, ABCD decomposes to AB and CD. AB then decomposes to A and B, and CD decomposes to C and D.

The Breakdown of Requirements is directly connected to the question of Atomicity or Granularity of Requirements.

Every Requirement has to be atomic, that means it may not obviously be composed of two or more distinguishable Requirements. Atomic Requirements are (linguistically) not further divisible without loss of meaning.

As a result of this decomposition, source and resulting requirements have a logical relationship managed within the requirements management application.

Updating requirements



Each requirement can be directly updated into the CSE environment according to the user's access rights. CSE also provides the capability to track and log all modification and update on requirements to support later requirements audit and trail operations (History & Audit).

View requirements change history



CSE can track any requirements modification so and enable access at any time to the requirements modification.

Provide requirement history report



CSE tracks any requirements modification so we can make requirements audit and trail reports through the SMARTQUICKREPORT tool.

Requirements Module and Requirements Chapter

In CSE, requirements can be organized by Requirements Modules and Chapters. These entities provide the capability to define a specific view of the requirements and can be used to define the structure of final requirements documents. Requirements module and Chapter objects can also be used to group requirements by themes and categories such as Safety Requirements, User requirements, Functional Requirements and Performance Requirements.

Requirements Modules are top level objects in the tree structure and cannot have sub-modules. Requirements Chapters, on the other hand, can be organized in a tree structure containing Chapters and Sub-Chapters.

A Requirements Module will often contain Requirements Chapters and sub-chapters, that will in turn contain specific requirements..

Trace to original document



Source Requirement can be accessed from CSE. This process allows, starting from a captured requirement, to retrieve and highlight the original requirement in the source document.

Allocate requirement to test and validation plan



It's possible to allocate requirements to test and validation plan, in CSE such allocation can be performed by simply creating a relation between objects.

Allocate requirement to function



It's possible to allocate requirements to functions, in CSE such allocation can be performed by simply creating a relation between objects.

Allocate a requirement to a system



It's possible to allocate requirements to systems, in CSE such allocation can be performed by simply creating a relation between objects.

Declare a requirement to requirement dependency



CSE provides the capability to formally declare dependencies between requirements to allocate requirements to requirements, in such allocation can be performed by creating a relation between objects.

Requirements Lifecycle

CSE implements Requirements Lifecycle, which ensures that validated requirements modules cannot be altered after their validation. Using requirements Lifecycle enable controlling and registering requirements evolutions.

Information

All the following publishing operations can be configured dependently on company processes and automatically formatted by using documents template.

Publishing a report matrix



The report matrix button allows user accessing to the three pre defined report matrix that are :

- Requirements Allocation Matrix :

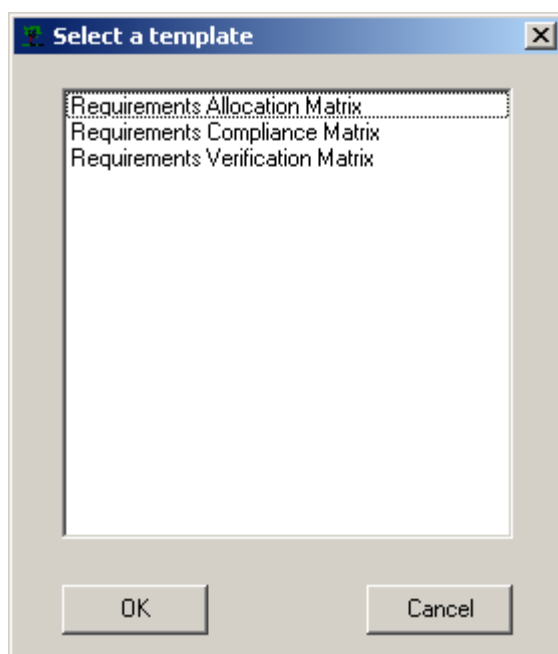
The requirements allocation matrix is providing with an overview of the requirement to function, requirement to system and function to system allocations. These allocations are represented here by a matrix.

- Requirements Compliance Matrix :

The requirements compliance matrix is providing with an overview of the requirement to test allocations. These allocations are represented here by a matrix.

- Requirements Verification Matrix :

The requirements verification matrix is providing in a compact form all the information related to the requirements list and their related requirements. This matrix is required during the validation loop.



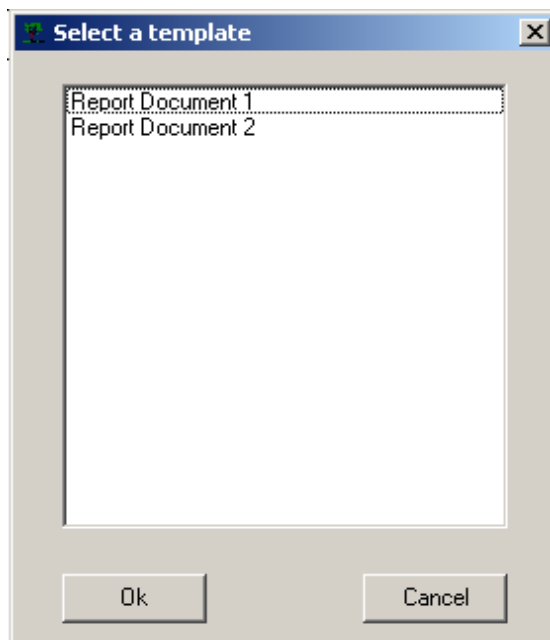
Publishing a requirements document into Word



CSE allows the generation of a MS Word based requirements document directly from the database.

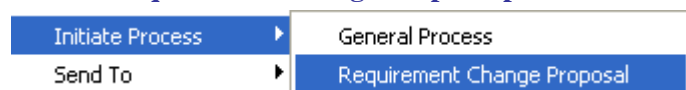
This report capability can be generated from a module, and represents all the chapters and requirements under the root module.

In addition, the administrator can defined as many templates as he wants to provide the end users. One of those templates can be selected from the following GUI.



Different kinds of report can be defined. The user chooses interactively the number representing the type of report he wants to generate.

Initiate Requirement Change Proposal process.



The Requirement Change Proposal is implemented in CSE as a generic flow process intended to manage the changing of a requirement, including review, impact analysis and the issuing of a requirements change order. Using this workflow as a basis, The CSE Administrator can configure and modify this process according to company regulation and methodology.

Reordering



CSE Requirements Management allows re-ordering the Requirements in a Requirement Tree. By default in Smarteam, members of a tree are ordered by creation date. This is not agreeable in the case of requirements. Therefore, CSE manages this order and allows the user to change it with a special GUI.

Export Requirements



RIF export allows providing requirements from original equipment manufacturer (OEM) to suppliers. This format is independent from a special Requirements Management tool and supported by most vendors of Requirements Management tools


Import Requirements

RIF import allows providing requirements from suppliers to original equipment manufacturer (OEM). This format is independent from a special Requirements Management tool and supported by most vendors of Requirements Management tools.

3.3. Operations performed from Microsoft Word text authoring application

The following functionality is embedded in MS Word via the CSE Add-On Tool Bar

Capture Requirement,

 With CSE and its integration with Microsoft Word™ requirement capture is as simple as highlighting the area of the text, picture or all you need to capture and clicking "Capture Requirement." A database entry is automatically created, including the requirement text and a set of attributes with default values. This database can be queried on any combination of attributes, and reports can be easily generated. The requirements are created under a "Capture module".

In case of you have the complete CSE solution (with the MS InfoPath integration), you can capture a requirement composed of rich text, tables and images.


Markup requirement for capture

 To capture quickly requirements, you can markup all the requirements you want to capture just by highlighting the text or image you want to capture and clicking on the Markup requirement icon.


Automatic capture requirements

 Once you have Marked up your all the requirements you want to capture, to effectively capture theses requirements in the database, click on the 'Automatic Capture Requirements' icon.

Reset Globals

 On the first capture operation the user is presented with a screen allowing him/her to select some default values that will be applicable to all captured objects. If the user wants to re-select these default values, this is accomplished by clicking on the "Reset Globals" Icon.

Un Markup requirements for capture

 You can unmark up the requirements you don't want to capture by selecting the marked requirement and click on the UnMarkup Requirement icon.

4. Requirement Management Using the Collaborative System Engineering Solution

4.1. Starting the Collaborative System Engineering Solution

4.1.1. Function description

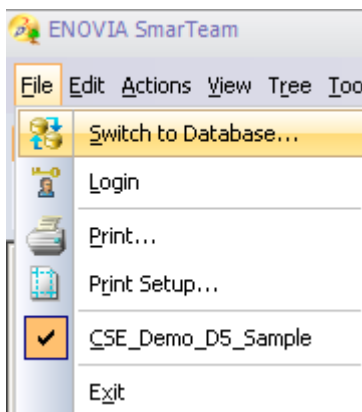
After the CSE Installation (refer to the CSE Installation Guide).



Launch the ENOVIA SmarTeam client application by going on your Windows Desktop, and click **Start → Programs → SmarTeam → SmartTeam.**



The default login used for demo purpose is “joe” without any password.



If CSE is not your default database, then switch to CSE database using **File → Switch to Database...**



4.2. *Creating a new project*

4.2.1. *Function description*

Requirements Management activities usually start by the creation of a new project that is going to be used to store and manage all the features relative to systems engineering activities (Documents, Requirements, Test and Validation plans...).



To **create a new project**, click on the project button , then fill all the needed attributes, and click OK to validate.

The project is defined as the main CSE Object.

Recommendation

Refer to ENOVIA SmarTeam documentation for further detail about projects and project creation.

4.3. Needs Identification

4.3.1. Function overview

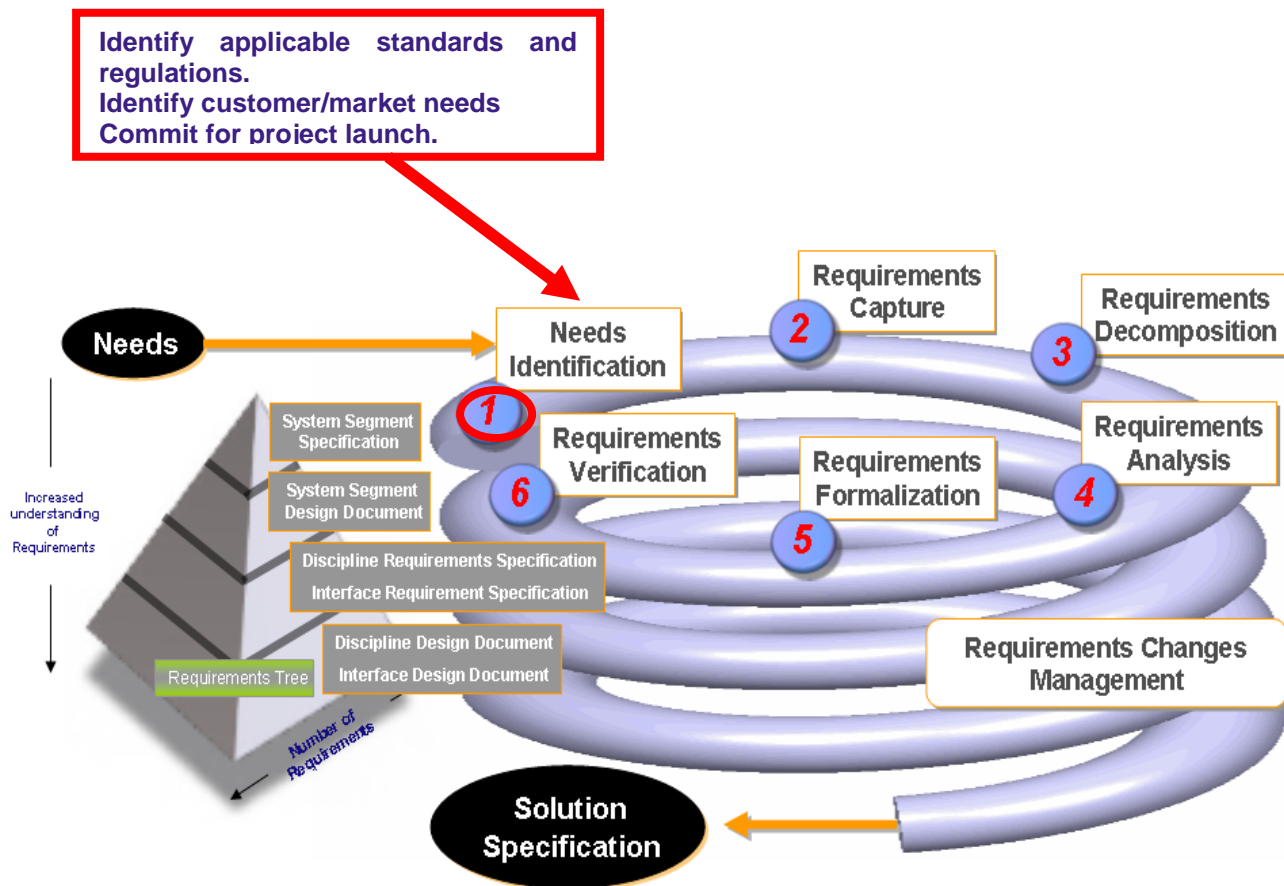


Figure 3 – Requirements Needs Identification activity overview.

Needs identification is the initial activity to be performed which consists of collecting the customer's needs, objectives, requirements and project constraints. These inputs can include, but are not restricted to, missions, measures of effectiveness, environments, available technology base, output requirements from prior application of the systems engineering process, program decision requirements, and requirements based on "corporate knowledge."

The purpose of the Needs Identification phase is to gain agreement among the stakeholders on what is to be done, who should do what, and by when things should be accomplished.

The requirements sources will form the basis of the agreement between the customer and those who provide the system. They are generally in a simple form which is understandable to non-technical customers.

4.3.2. Function description

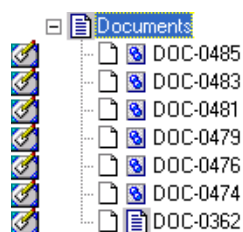


4.3.2.1. Identifying product needs

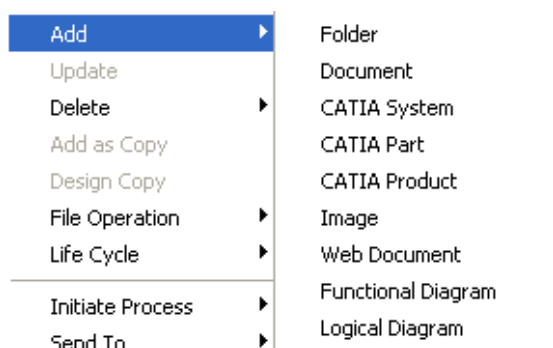
After creating a new project, you can associate to it all the documents that are defining the product needs (regulations, mission needs...).

Recommendation

Refer to ENOVIA SmarTeam documentation for further detail about project.



Now, to have the ability to manage documents, switch to documents view by clicking on documents button  and then add a new document by doing the following:



- Right-click on the documents root in the tree view, or on a folder then **Add → Document**. The document profile card is displayed, full fill the attributes of the document then click OK to validate.
- Select the documents root in the tree view or on a folder then **Menu → Action → Add → Document**. The document profile card is displayed, full fill the attributes of the document and click OK to validate.

Note

From Microsoft Word, you can also save your document in the database by using the standard ENOVIA SmarTeam Integration. Remember to **Check In** the document after the save in order to be able to capture requirements from it

It's possible to store and organize your documents in a Folder: Switch to the documents view to have the ability to manage documents, then to create folders use the contextual menu on the documents root in the tree view or on another folder then **Add → Folder**.

Recommendation

Refer to ENOVIA SmarTeam documentation for further detail about document management into ENOVIA SmarTeam.

4.4. Requirements Capture

4.4.1. Function overview

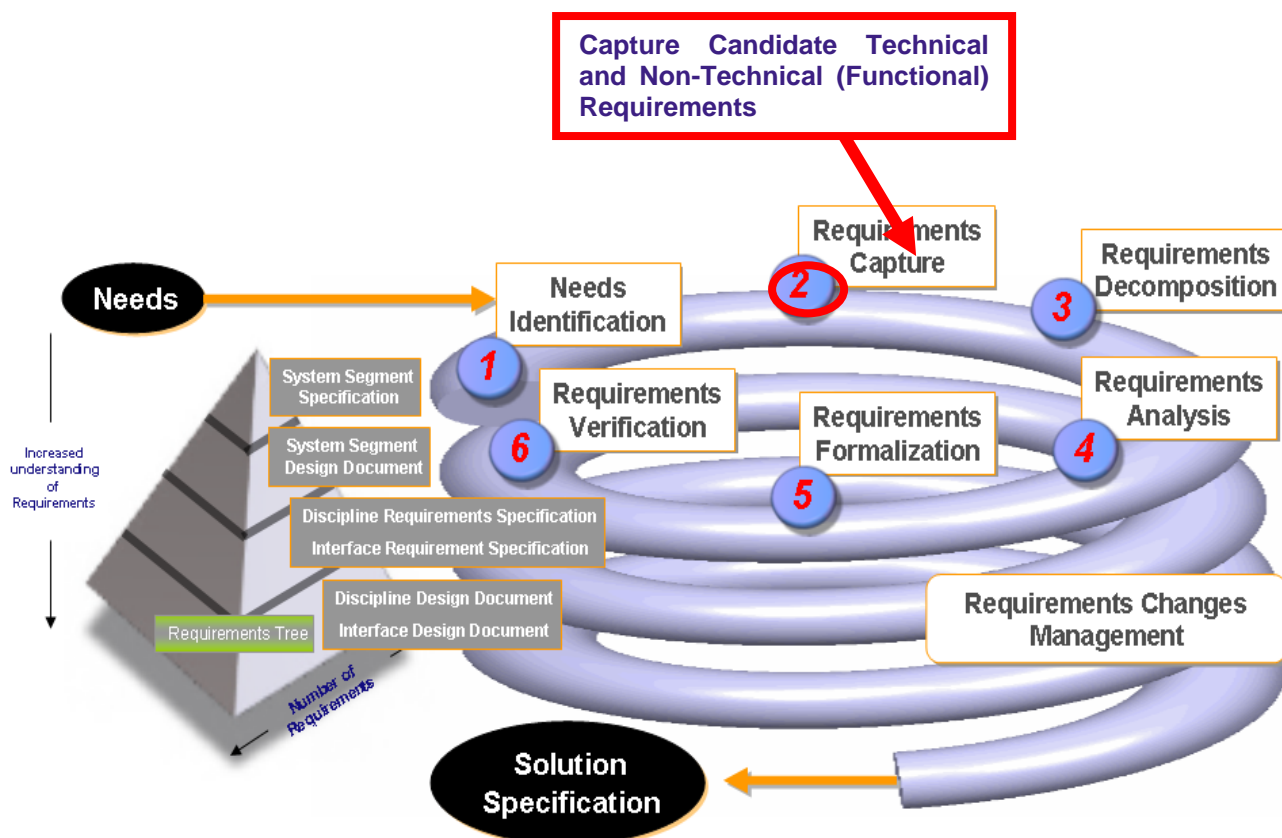


Figure 4 – Requirements Capture activity overview.

The purpose of requirements capture phase is to gather information from the source requirement documents (e.g., issues, needs, higher-level requirements) and capture each individual primary requirement into a database as candidate requirements (both technical and non-technical). These captured requirements are identified as primary requirements.

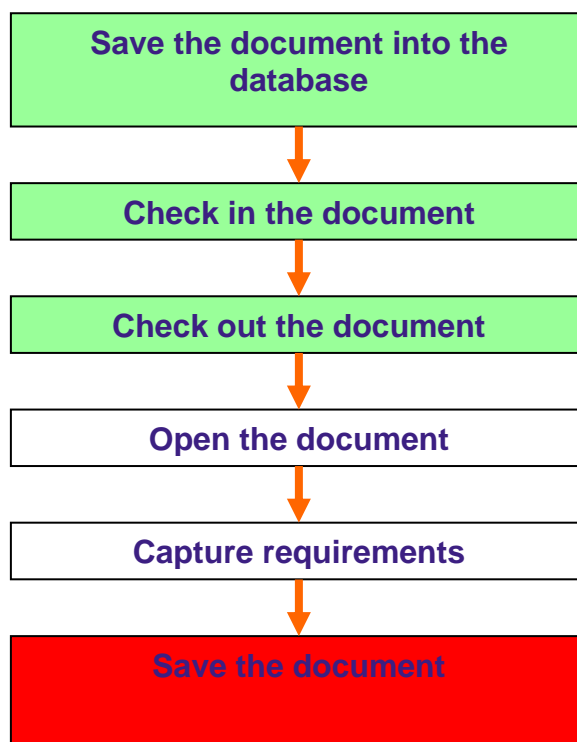
4.4.2. Function description

4.4.2.1. Capturing requirements from a source document

Information

Before capturing requirements from a document, this document must be stored in the database and checked in. Then check out the document before opening it and capturing requirements.

To capture requirements from a new document, please follow these steps:

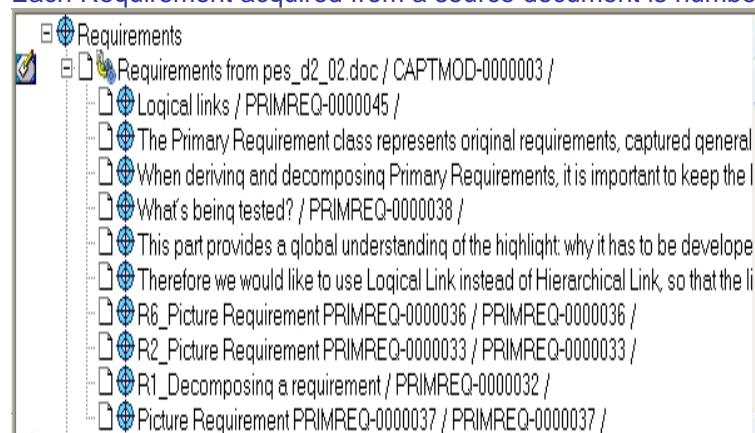


Recommendation

These steps can either be performed directly using ENOVIA SmarTeam Editor, or they can be performed using the ENOVIA SmarTeam Microsoft Word Integration. Please Refer to ENOVIA SmarTeam documentation for further detail adding documents and performing lifecycle operations (Check-in/Check-Out)

CSE is able to import text, images, and tables manually and to store them as requirements. Nevertheless depending of the CSE configuration (with or without InfoPath integration), you can capture into a primary requirement a combination of text, images and tables (configuration with InfoPath) or just simple text or images (configuration without InfoPath)

Each Requirement acquired from a source document is numbered and organized in a breakdown structure in



order to have an exhaustive set of Requirements. Requirements from the same document will be organized under a "Capture Module".

When capturing requirements from a Microsoft Word document, a new "Capture Module" is created and all the primary requirements captured from this document are linked to the "Capture Module", thus you can see in the same tree under the same node all the primary requirements coming from the source document.

A “Capture Module” is used to group and retrieve Primary Requirements according to a source document, a set of requirements coming from a stakeholder, norms and standards regulation.

A “Capture Module” is having its own life cycle. At given time, a Primary Requirement is attached to a Capture Module.

A “Capture Module” is composed of “Primary Requirement” objects.

CSE provides Microsoft Word extension to manage requirements capture. Following the CSE Installation this CSE toolbar can be seen when opening word, or can be activated by selecting the CSE_RM.dot Requirements Capture Template in word.

In the latter case the user needs to activate launch (Office 2007):

Tools → Templates and Add-Ins

And select the CSE_RM.dot template file, located in the CSE Installation Directory.

The toolbar appears as follows in the Add-In menu:



With CSE and its integration with Microsoft Word™ requirement identification is as simple as highlighting the area of the text and clicking on one of the "**Capture Requirements**".

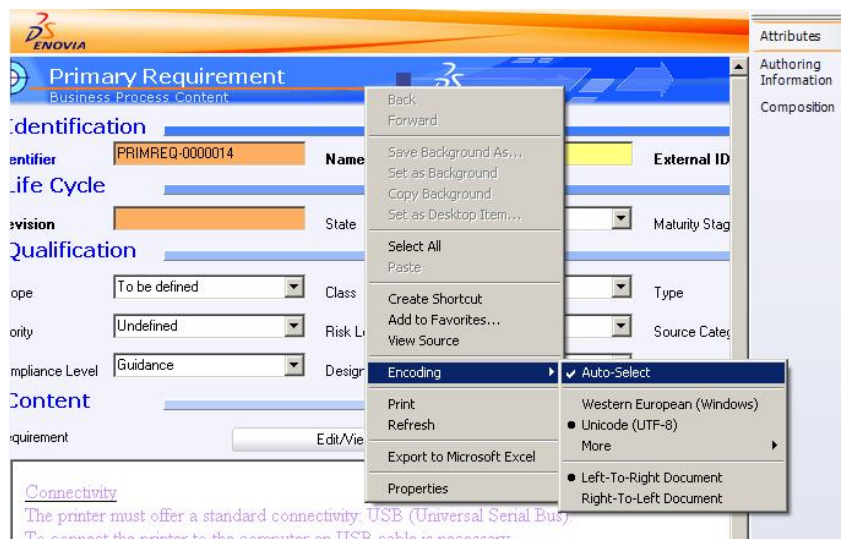
A database entry is automatically created, including the requirement text and a set of attributes with default values.

The database can be queried on any combination of attributes, and a report can be easily generated.

Note 1

To display the special characters text on the Profile Card of Requirement objects, it is mandatory to use the “Auto-Select” encoding

To verify the encoding format, right click on the Requirement or IVVQ display field :



Note 2

The format of captured requirement is correctly managed in InfoPath if the font of source requirement exists in InfoPath.

Note 3

In the preview area of the profile cards, format can be slightly different from InfoPath edition. This is due to the HTML format used by the preview area.
Of course, the content of the object is not altered.

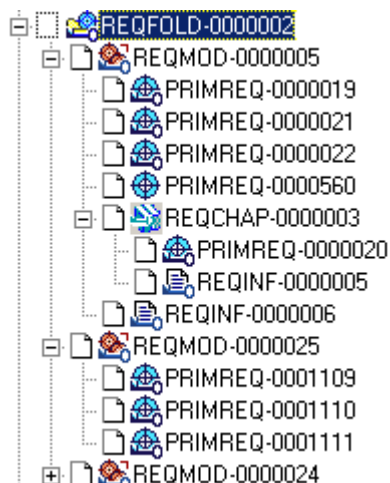


Using requirements folders

The requirement folder provides the way:

- To logically group requirements modules or capture modules.
- To organize requirements module depending on industry taxonomy (automotive, electronics, aero...).

To create a requirement folder, do one of the following:




- Right-click on the root or requirements folder in the tree view then choose **Add → Requirements Folder**. When the requirement folder profile card is displayed, full fill all the needed attributes of the folder and click OK to validate.

- Select the requirements folder in the tree view then **Menu → Action → Add → Requirements Folder**. When the requirement folder profile card is displayed, full fill all the needed attributes of the folder and click OK to validate.



Capturing a single requirement

In the Word document, highlight the requirement (the selection must be more than 2 characters) then click on 'Capture requirements' icon . The highlighted section will appear as below.

10 [PRIMREQ-0001175] Connectivity

The printer must offer a standard connectivity: USB (Universal Serial Bus).

To connect the printer to the computer an USB cable is necessary.



The Universal Serial Bus (USB) combines all of the advantages of a multiplatform standard, including decreased cost, increased compatibility, and a greater number of available peripherals, with the more specific advantages of a very Apple-like blend of advanced functionality and flair.

It's easy to use and powerful, and it works with numerous devices.

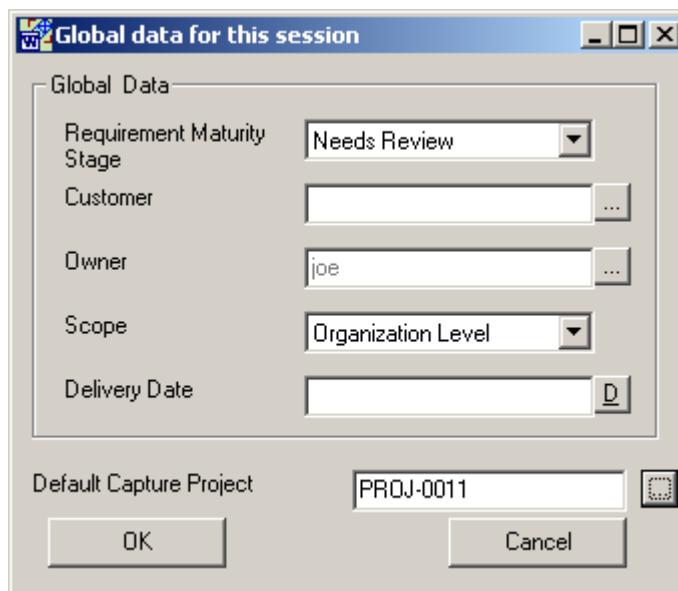
It's Hot-Pluggable, USB peripherals deliver on the promise of plug and play convenience by eliminating the need to turn off or restart the computer when attaching a new peripheral. Users can connect USB peripherals whenever they need them.

Simple Installation, When a USB peripheral is first attached; the user installs a device driver by running a simple installer application. This only needs to be done once and the device is then available, since USB supports dynamically loading drivers.

Easy Connections, USB connections require no terminators, memory addresses or ID numbers. They also use a new kind of cable, small, simple, inexpensive, and easy to attach. There's only one style of cable (USB A-B), with different connectors at each end, so they can't be plugged in incorrectly.

Greater Expandability, USB supports simultaneous connection of up to 127 devices by attaching peripherals through interconnected external hubs. When a computer's ports fill up, users simply attach a device called a hub, which provides additional ports (usually four or seven), and keep on plugging in more peripherals and hubs as needed.

If it is the first requirement captured in the session then the global data panel is displayed. In the displayed form you can select default for selected requirements fields (Administrator Defined). Select values that you wish to have for all captured requirements and click Add to validate.



Global data for this session

Global Data

Requirement Maturity Stage: Needs Review

Customer:

Owner: joe

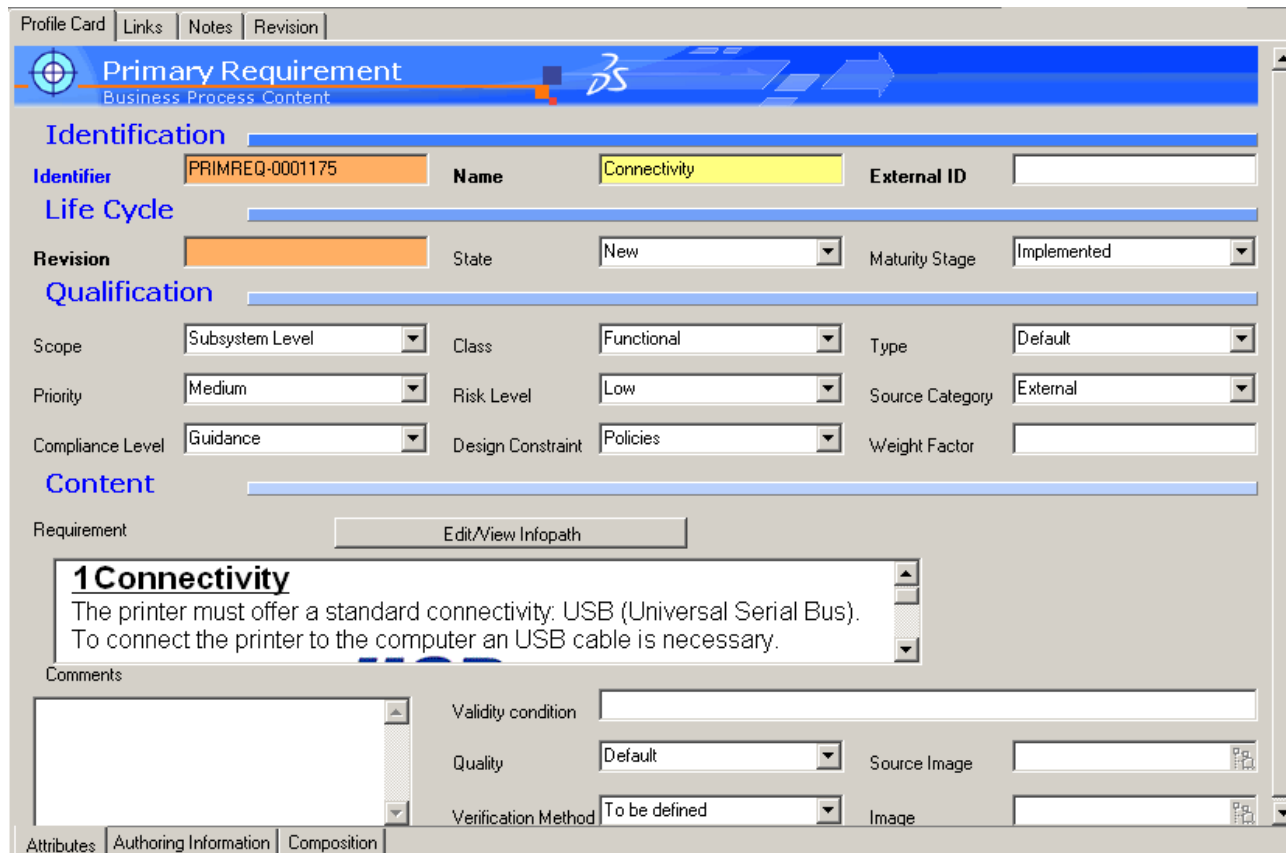
Scope: Organization Level

Delivery Date:

Default Capture Project: PROJ-0011

OK Cancel

Then the primary requirement profile card is displayed, fill all the needed attributes of the requirement and click OK to validate.



Profile Card | Links | Notes | Revision

Primary Requirement
Business Process Content

Identification

Identifier: PRIMREQ-0001175 Name: Connectivity External ID:

Life Cycle

Revision: State: New Maturity Stage: Implemented

Qualification

Scope: Subsystem Level Class: Functional Type: Default

Priority: Medium Risk Level: Low Source Category: External

Compliance Level: Guidance Design Constraint: Policies Weight Factor:

Content

Requirement: Edit/View Infopath

1 Connectivity
The printer must offer a standard connectivity: USB (Universal Serial Bus).
To connect the printer to the computer an USB cable is necessary.

Comments:

Validity condition:


Quality: Default Source Image:

Verification Method: To be defined Image:

Attributes | Authoring Information | Composition



Automatic capture requirements

In the Word document highlight the requirement (the selection must be more than 2 characters) that you need and click on '**Markup Requirement**' icon .

Do the same with all the requirements that you need, mark-up all the requirements that you want to capture into CSE.

In case of mistake, you can un marked-up requirement by selecting the unwanted requirement and click on '**Un Markup Requirement**' icon .

Then, to effectively capture all the marked-up requirements into CSE, click on the '**Automatic Capture Requirements**' icon .


- The surfaces of the controls shall not contain chromium, nickel or other material which may cause an allergic reaction.
- [Controls shall be placed so that they can easily be reached by, for example, a short person or a person sitting in a wheelchair.]
- The size, shape and surface of controls shall be designed so that they are easily grasped when they are used as intended.
- [Controls operated by keys shall have an operating force and a travel characteristic. The operating force shall not exceed 2.0 Newton.]
- Controls shall be located (grouped), designed and marked in a way that is logical for their intended use.
- [Legends on operating controls shall be easy detectable by use of contrast and symbols. It shall be possible to arrange controls with tactile symbols (such as Braille for visually disabled persons).]



Tracing-back to original document

Source Requirement can be accessed from CSE. This process allows, starting from a captured requirement, to retrieve and to highlight the original requirement in the source document.

This process is allowing to better understand the context related to a requirement formulation.

To retrieve a source requirement into Word Document, select a requirement in ENOVIA SmartTeam, then Activate the Trace Back Command by clicking on the '**Back Trace to Original Document**' icon .

CSE is going to open Microsoft Word (if necessary) with the right document and to highlight the originating requirement into the word source document.

4.4.2.2. Capturing requirements from the MS Windows clipboard

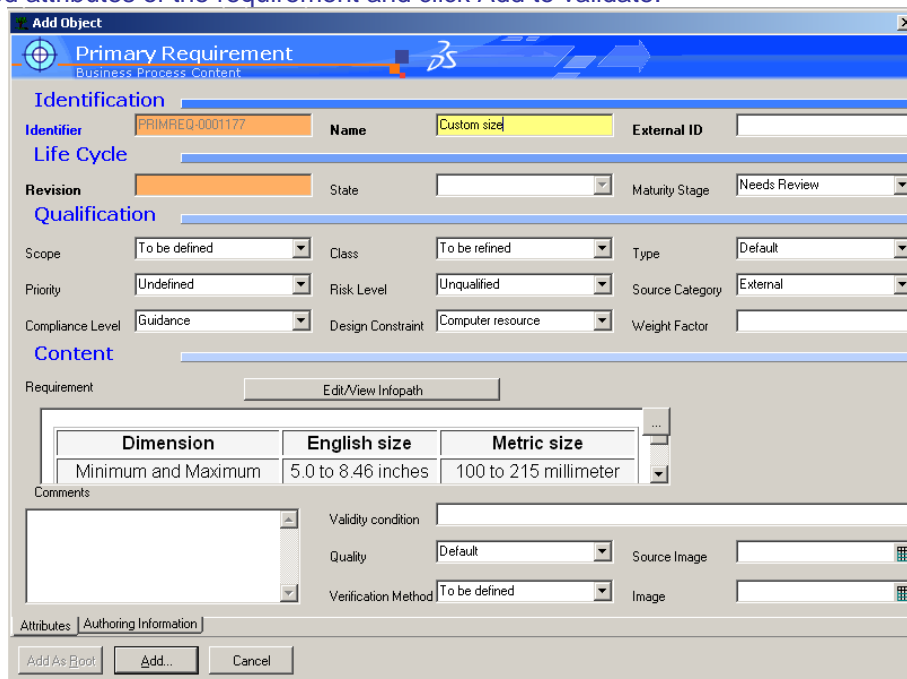


Capturing a primary requirement from the MS Windows Clipboard

CSE configuration with InfoPath integration (RX9 BPA):

Since the MS Windows clipboard has been filled with any supported content (text, images, tables or a combination of them), select the location where you want to create a primary requirement (requirements module or chapter). Then select the User Defined Tools menu (part of contextual menu) and choose function "Create Prim Req from Clipboard".

Then the primary requirement profile card is displayed with the requirement field filled with clipboard content, fill all the needed attributes of the requirement and click Add to validate.



Add Object

Primary Requirement
Business Process Content

Identification

Identifier: PRIMREQ-0001177 Name: Custom size External ID:

Life Cycle

Revision: State: Maturity Stage: Needs Review

Qualification

Scope: To be defined Class: To be refined Type: Default

Priority: Undefined Risk Level: Unqualified Source Category: External

Compliance Level: Guidance Design Constraint: Computer resource Weight Factor:

Content

Requirement: Edit/View Infopath

Dimension	English size	Metric size
Minimum and Maximum	5.0 to 8.46 inches	100 to 215 millimeter

Comments:

Validity condition:

Quality: Default Source Image:

Verification Method: To be defined Image:

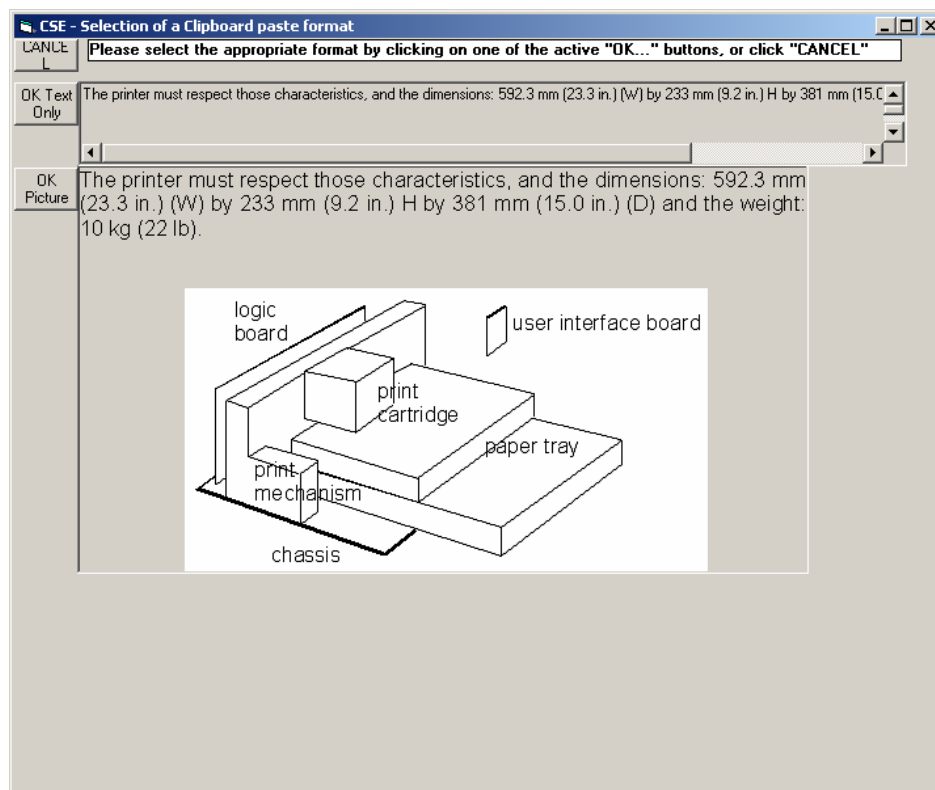
Attributes | Authoring Information

Add As Root Add... Cancel

CSE configuration without InfoPath integration:

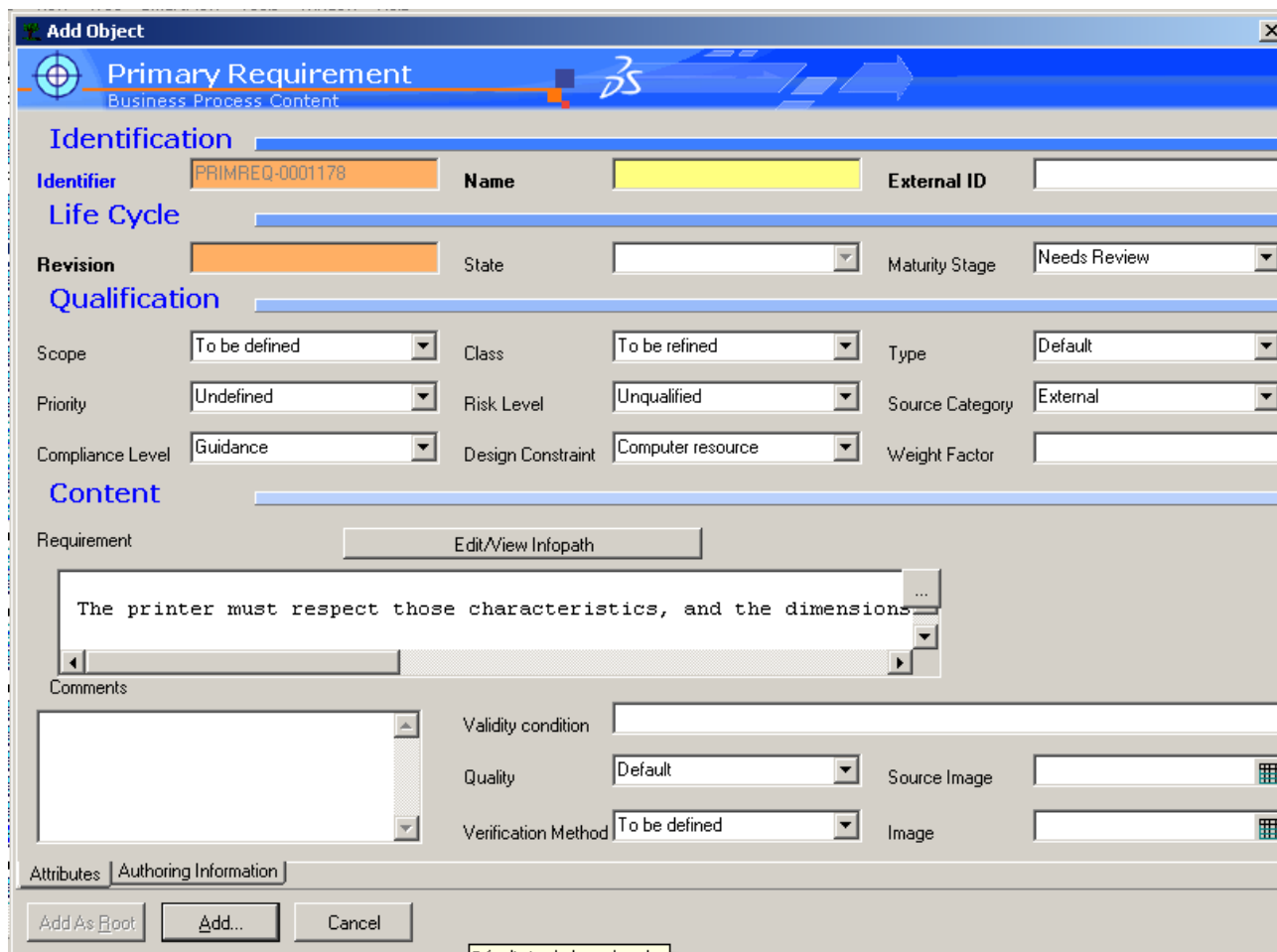
Since the MS Windows clipboard has been filled with any supported content (text, images, tables or a combination of them), select the location where you want to create a primary requirement (requirements module, capture module or chapter). Then select the User Defined Tools menu (part of contextual menu) and choose function "Create Prim Req from Clipboard".

A GUI is displayed asking for a target format as presented below:



Text mode allows capturing the clipboard content as simple text losing tables or images, style and formatting, but keeping modifiable within Smarteam. Picture mode allows capturing the clipboard content as picture keeping all the content. But the picture can not be modified anymore.

Select the format and then the primary requirement profile card is displayed with the requirement field filled with previous choice, fill all the needed attributes of the requirement and click Add to validate.



Information

Whatever the capturing process used, a filtering mechanism informs the user if a no supported character has been selected. Nevertheless the object creation is not forbidden.

4.4.2.3. Capturing requirements

Switch to the requirements view to have the ability to manage requirements by clicking on the requirements button .

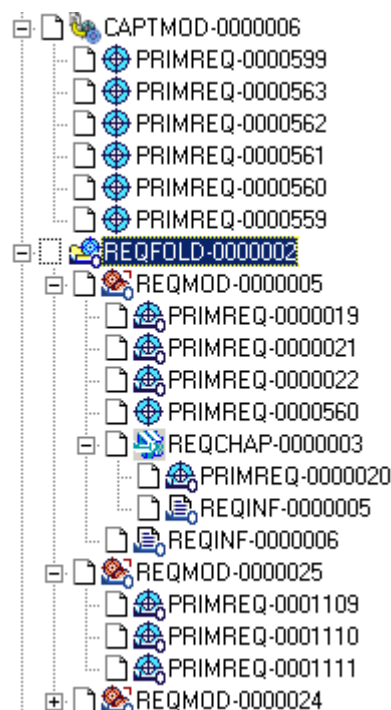


Creating a primary requirement

This function creates a new primary requirement as part of the active requirements module. Notice that you cannot create a primary requirement in a capture module other than capturing the requirements from a document (word).

The requirement can be freely defined by the user.

To create a primary requirement, do one of the following:



Click on 'Create Primary Requirement' button  in the 'CSE Tools' Toolbar. When the primary requirement InfoPath form is displayed, fill all the needed attributes of the requirement and click OK to validate.

- Right-click on the requirements module in the tree view then choose **Add → Primary Requirement**. When the primary requirement profile card is displayed, fill all the needed attributes of the requirement and click OK to validate.
- Select the requirements module in the tree view then **Menu → Action → Add → Primary Requirement**.

When the primary requirement profile card is displayed, fill all the needed attributes of the requirement and click OK to validate. CSE provides the capability to directly capture new requirements and to control the quality of this requirement definition.

The quality of the requirement statement is supported by attributes control.

Note

It's possible to create a primary requirement under a requirements module or a requirement folder.







Derive requirement

This function creates a new derived requirement thru a derivation operation, as a relative to the selected requirement.


A derived requirement created without applying a decomposition action is usually a requirement specifying a constraint. Instead of being a direct decomposition of the customer requirement, this requirement specifies **How** the customer requirement has to be met. Different requirement of this kind can be created and different alternatives evaluated as part of the requirements management process.

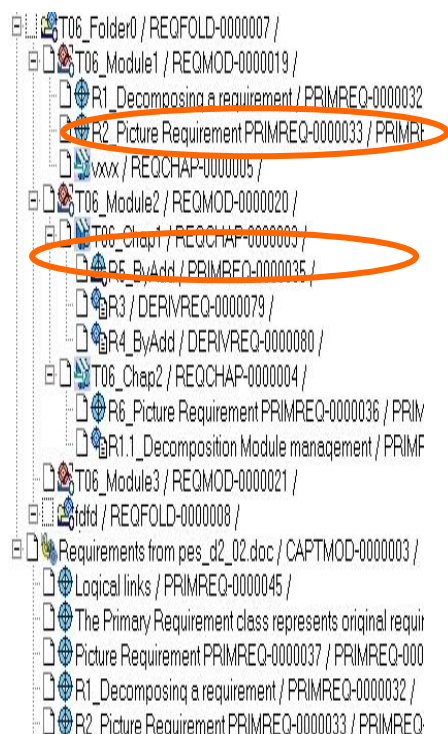
Example:

-  Comfortable
-  Surface quality
-  Material
-  **Maximum thickness**

CSE provides the capability to directly to derive requirements from already existing requirements. The requirement can be freely defined by the user.

To derive a requirement, do as below:

- Select a requirement (primary or derived), then click on '**Derive Requirement**' button  in the '**CSE Tools**' Toolbar. When the derived requirement InfoPath form is displayed, fill all the needed attributes of the requirement and save the form to validate the requirement creation. Afterwards, you will have to put the created derived requirement in the requirements module or requirements chapter in which it will be used.



Notes

Switch to the requirements view to have the ability to manage requirements.
It's possible to create primary a requirement as part of a module.

When deriving, the created requirement is put into the derivation module defined by the administrator. This derivation module is linked to the project of the source requirement. Nevertheless, if no derivation module is defined or if the source requirement does not belong to a project's desktop (directly or through its parent), no derivation module is used.

4.5. Requirements Decomposition

4.5.1. Function overview

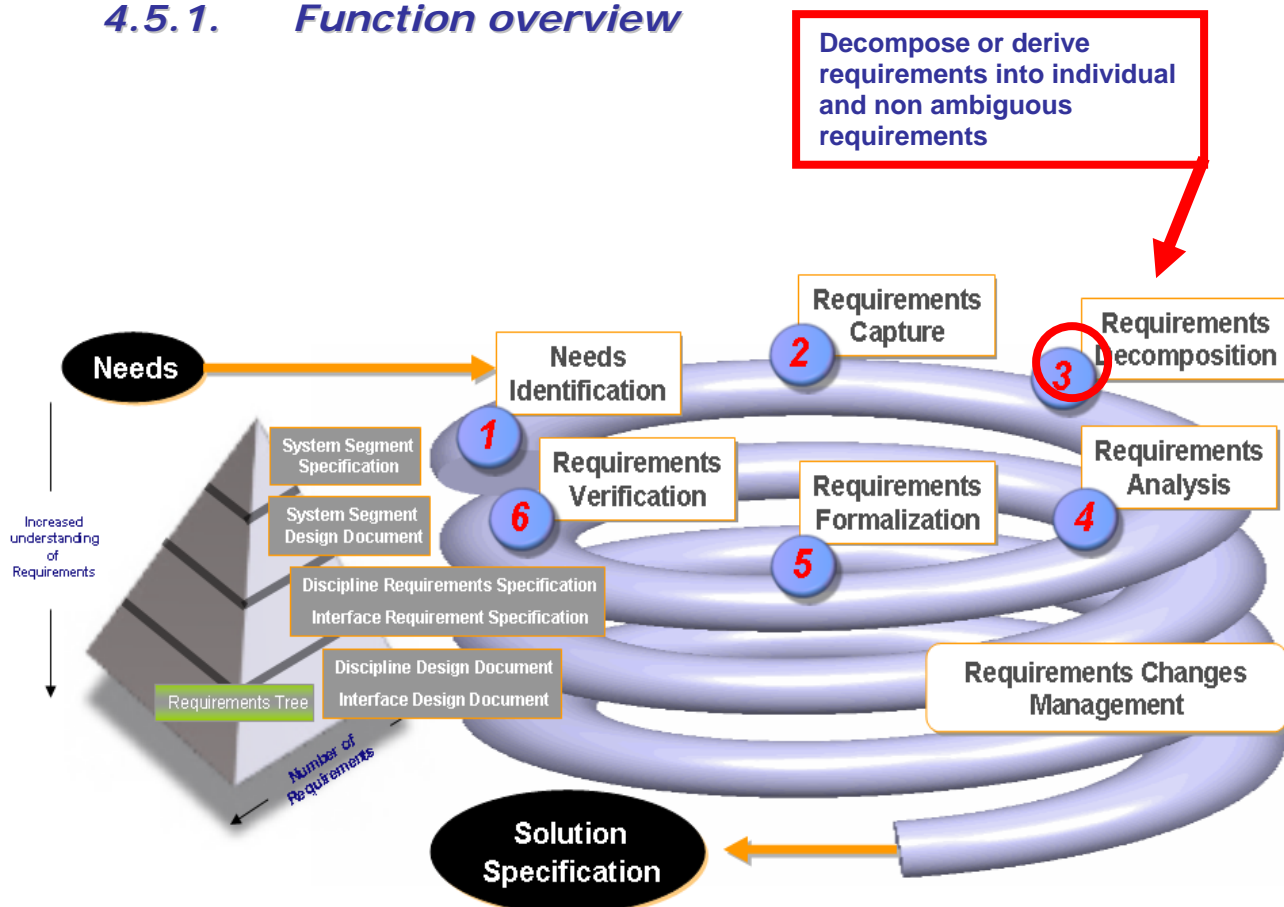


Figure 5 – Requirements Decomposition activity overview.

The objective of the requirements decomposition stage is to translate high level requirements (Primary Requirements) into individual detailed low-level and partitioned requirements in such way that integrating the partitioned requirements shall satisfy the higher-level requirements, and until defining unambiguous measurable requirements which is described by a single simple statement.

The systems engineer must ensure that the primary, decomposed and derived requirements are understandable, unambiguous, comprehensive, complete, and concise.

4.5.2. Function description



Decompose requirements

CSE is providing the capability to manage the requirement decomposition process.

Decomposing requirements means breaking down a requirement into component parts. For example, ABCD decomposes to AB and CD. AB then decomposes to A and B, and CD decomposes to C and D.

The Breakdown of Requirements is directly connected to the question of Atomicity or Granularity of Requirements. Every Requirement has to be atomic, that means it may not obviously be composed of two or more distinguishable Requirements. Atomic Requirements are (linguistically) not further divisible without loss of meaning.

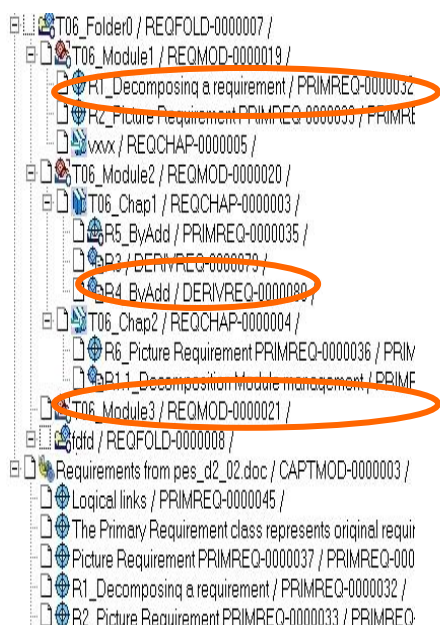
As a result of this decomposition, source and resulting requirements have a logical relationship managed within the requirements management application.


Notes

Derived requirements and decomposed requirements are represented by the same ENOVIA SmarTeam class "Derived requirements".

In some system engineering literature sometimes they don't make the difference

This function is available on both Primary & Derived Requirements.



- To decompose a requirement (primary or derived), choose the requirement that you want to decompose by clicking on it, then click on the 'Decompose Requirement' icon  to decompose it.
- When the derived requirement InfoPath form is displayed, fill or modify all the needed attributes of the requirement and click OK to validate the requirement creation. By default, the derived requirements are put inside a requirements module named "derivation module" and decomposed requirements inside a "decomposition module" one. Those names can be customized thru some admin settings (cf implementation guide). Afterwards, you will have to put the created decomposed requirement in the requirements module or requirements chapter in which it will be used.

Note

The new objects primary ID is composed by Source ID + Derivation number. Example : REQ -0155.1.1.3

The created requirement is put into the decomposition module defined by the administrator. This decomposition module is linked to the project of the source requirement. Nevertheless, if no decomposition module is defined or if the source requirement does not belong to a project's desktop (directly or through its parent), no decomposition module is used.

For this decomposition mechanism, a mapping mechanism between attributes (Values copied from source to resulting requirements) can be defined by the Administrator thru admin settings.

4.6. Requirements Analysis

4.6.1. Function overview

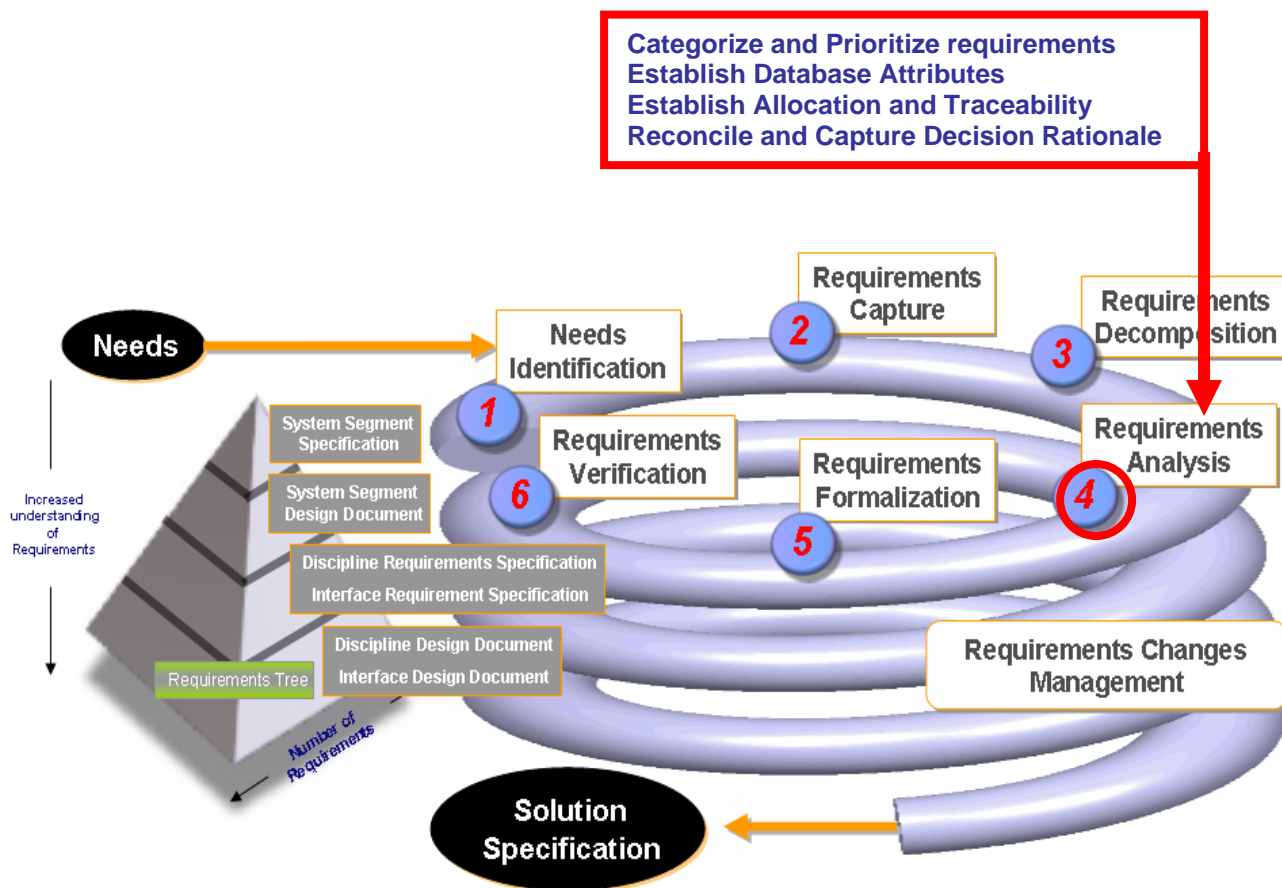


Figure 6 – Requirements Analysis activity overview.

This is an important step of the Systems Engineering Process. It consists in analyzing the process inputs.

Requirements analysis is used to develop functional and performance requirements; that is, customer requirements are translated into a set of requirements that define what the system must do and how well it must perform.

The systems engineer must ensure that the requirements are understandable, unambiguous, comprehensive, complete, and concise.

Requirements analysis must clarify and define functional requirements and design constraints. Performance requirements define quantity (how many), quality (how good), coverage (how far), time lines (when and how long), and availability (how often). Design requirements define those factors that limit design flexibility, such as: environmental conditions or limits; defense against internal or external threats; and contract, customer or regulatory standards.

During the Classification process, the requirement is assigned to the proper organization responsibility for authority and accountability and to the proper function(s) or system(s) component(s) within the product architecture.

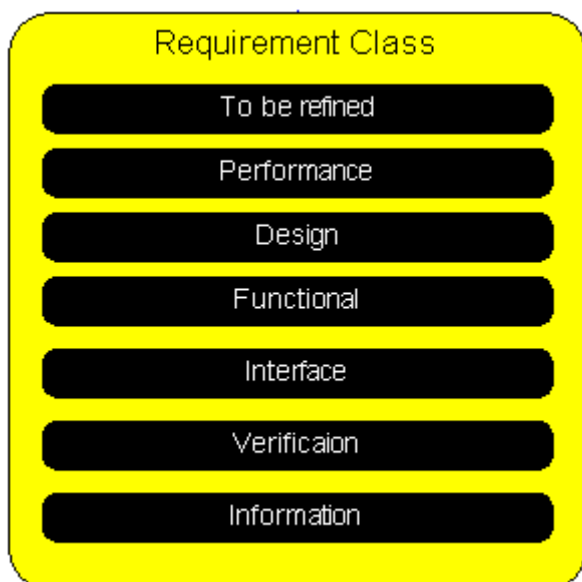
4.6.2. *Function description*

4.6.2.1. Categorize Requirements

In the categorization process we can associate to each requirement a type, a quality, a value, an origin, a validation and a responsibility

Categorization by Class

The “Class” attribute defines the main categories that are used to classify requirements. These categories are generally defined as follow:



These default values are defined in the lookup table “Requirement Class”.

They can be freely changed or adapted depending on company specificities or vocabulary.

Notes

All those values can be customized using the standard Smarteam capabilities. Refer to “Smarteam Administrative Guide” for further detail about customizing your application.

Categorization by Type

The “Type” attribute defines the reason of the requirements. A default category is defined and the following categories:



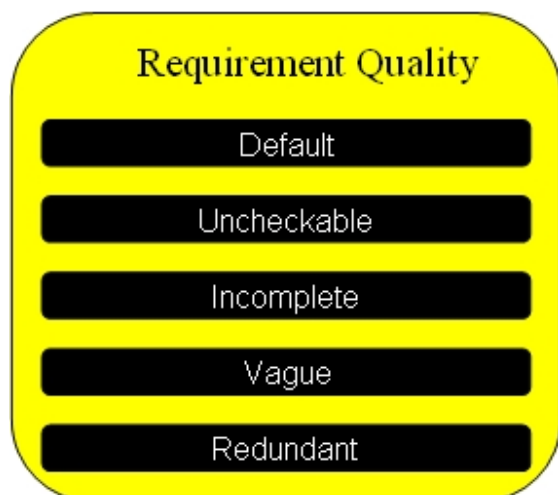
These default values are defined in the lookup table “Requirement Type”. They can be freely changed or adapted depending on company specificities or vocabulary.

Categorization by Quality

The Requirement Quality level gives a quality opinion and, consequently, suggests a subsequent recovering action.

The aim is to describe the requirements in the most detailed way not only for the clearness, for the completeness but also to allow a feasible verification procedure.

The default qualities are:



• **UNCHECKABLE:** A lack of quantification in the required performances is found.

• **INCOMPLETE:** The included references are badly defined.

• **VAGUE:** The requirement is ambiguous; the customer need is badly defined, different interpretations are possible.

• **REDUNDANT:** The content is included inside other requirements, it can be erased.

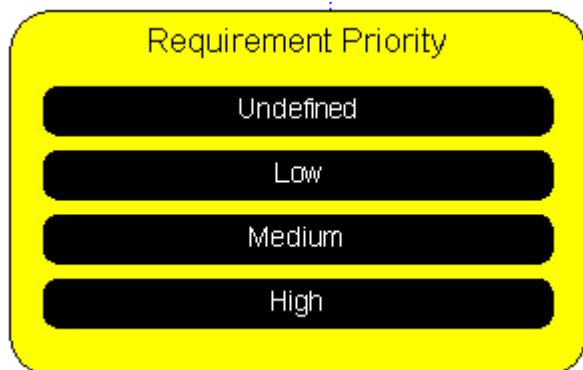
These default values are defined in the lookup table “Requirement Quality”.

They can be freely changed or adapted depending on company specificities or vocabulary.

Categorization by Priority

This characteristic identifies the relative importance of a requirement in terms of implementation, particularly in establishing criteria for trade studies. In a cost reimbursable environment, a customer may use priorities to mandate that certain elements must be completed before a specified ceiling is reached. The priority characteristic may also be used for establishing the sequence in which specified design or test activities should occur. Unlike the other characteristics, the values of priority will be dependent on program and company needs.

The default priorities are:



These default values are defined in the lookup table "Requirement Priority".

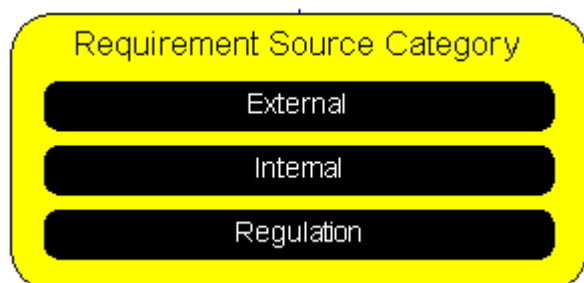
They can be freely changed or adapted depending on company specificities or vocabulary.

Categorization by Source Category

The requirement Source Category gives you the ability to check the source of the requirements.

For example it's possible to filter the requirements and to publish only IP free requirements.

The default Source Categories are:



These default values are defined in the lookup table "Requirement Source Category".

They can be freely changed or adapted depending on company specificities or vocabulary.

Categorization by Scope

The “Scope” attribute is defining the main scope of the requirements. The following categories are defined:



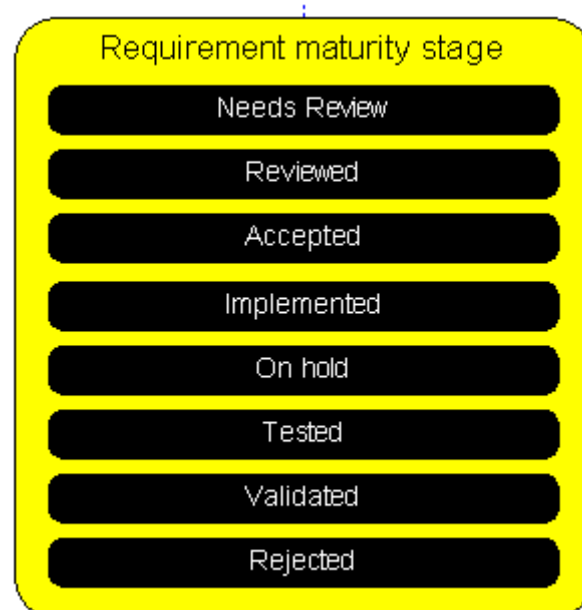
These default values are defined in the lookup table “Requirement Scope”.

They can be freely changed or adapted depending on company specificities or vocabulary.

Categorization by Maturity Stage

This “Maturity Stage” attribute supports the requirement Lifecycle stage. Its purpose is to define the progression/maturity of the requirement throughout its existence. A Lifecycle consists of states and transitions (gates). The state defines the status of the requirement (See STATE Attribute). The state can then be associated with multiple transitions. Transitions between the states are used as a trigger point to check necessary conditions prior to passing the gates, or for executing certain operations after passing the gate. The requirement Lifecycle transitions are supported by the Maturity Stage attribute.

Requirement maturities are commonly defined as follow:



NEEDS REVIEW	Requirement is ready to be reviewed.
ANALYSIS	Requirement is being worked on.
REVIEWED	Requirement is fully reviewed and pending final authorization.
ACCEPTED	Requirement is base-lined and ready for implementation.
HOLDING	Authorization for implementation is delayed; see comments.
REJECTED	Requirement has been disapproved for implementation.
IMPLEMENTED	Product associated with the requirement is ready for developer testing.
COMPLETE	Product associated with the requirement has passed all developer testing.
ACCEPTED	Product associated with the requirement has passed acceptance testing.

These default values are defined in the lookup table “Requirement Maturity Stage”.

They can be freely changed or adapted depending on company specificities or vocabulary.

Please note that some companies are both using internal and external reviews and used to manage two different process maturity attributes in order to track this different process stages.

Categorization by Compliance Level

The requirement compliance level identifies the depth of compliance mandated for a requirement.

There are generally only three compliance levels:



These default values are defined in the lookup table “Requirement Compliance Level”.

They can be freely changed or adapted depending on company specificities or vocabulary.

Mandatory	Whether a primary or derived requirement, it <i>must be implemented</i> . Such requirements usually include a "shall" statement in their structure. <i>If it is a primary requirement</i> and is not achievable, then a contract change or deviation/waiver is necessary. If it is a <i>derived requirement</i> and is not achievable, then a briefing must be presented to management (or in rare instances, the customer) for lessening of the requirement. An example might be a directive to use an in-house component, which is not deemed to conform to a primary requirement. If there are no alternatives to the derived requirement in such an instance, it is very likely that a higher ordered (parent) primary requirement may not be achievable and will also need to be changed.
Guidance	Whether a primary or derived requirement, it is <i>desirable that it be implemented</i> . In general, failure to implement does not constitute noncompliance so long as it can be demonstrated that a reasonable degree of implementation was attempted. This is equivalent to specifying a goal or desire on the part of the customer or management. An example would be "Use Mil-Std-499B as a guide in implementing the systems engineering process."
Information	This unique characteristic is essential when Requirements Management systems (requirements databases) are used in lieu of hard copy source documents. By strict interpretation, these "requirements" are not actually requirements, but <i>are non-binding statements, which significantly influence the context, meaning, and understanding of other requirements</i> . An example might be a reference to the customer's reasoning for specifying a particular approach or requirement.

Categorization by Design Constraint

This attribute is generally used to qualify a requirement representing an internal design constraint. Such kind of requirement is usually not communicated outside of the project team. The requirements qualified as design constraints are generally related to an issue. As opposed to external requirements the internal requirement that is related to design constraints can change depending on the technical solution chosen for the physical implementation.

Requirement Design Constraint

To be defined

General

Environment

Computer resource

Information

Interface

Security

Packaging

Standards

Policies

These default values are defined in the lookup table "Requirement Design Constraint".

They can be freely changed or adapted depending on company specificities or vocabulary.

Categorization by Risk Level

The requirement Risk Level identifies at an early stage the risk factor for a requirement.

The following categories are defined:

Requirement Risk Level

Unqualified

Low

Medium

High

Critical

These default values are defined in the lookup table "Requirement Risk Level".

They can be freely changed or adapted depending on company specificities or vocabulary.

Categorization by Verification Method

The requirement Verification Method identifies at an early stage the test and verification for a requirement.

These verification methods will help to define the acceptance test object linked to this requirement.

The following categories are defined:



These default values are defined in the lookup table "Requirement Verification Method". They can be freely changed or adapted depending on company specificities or vocabulary.

4.7. Requirements Formalization

4.7.1. Function overview

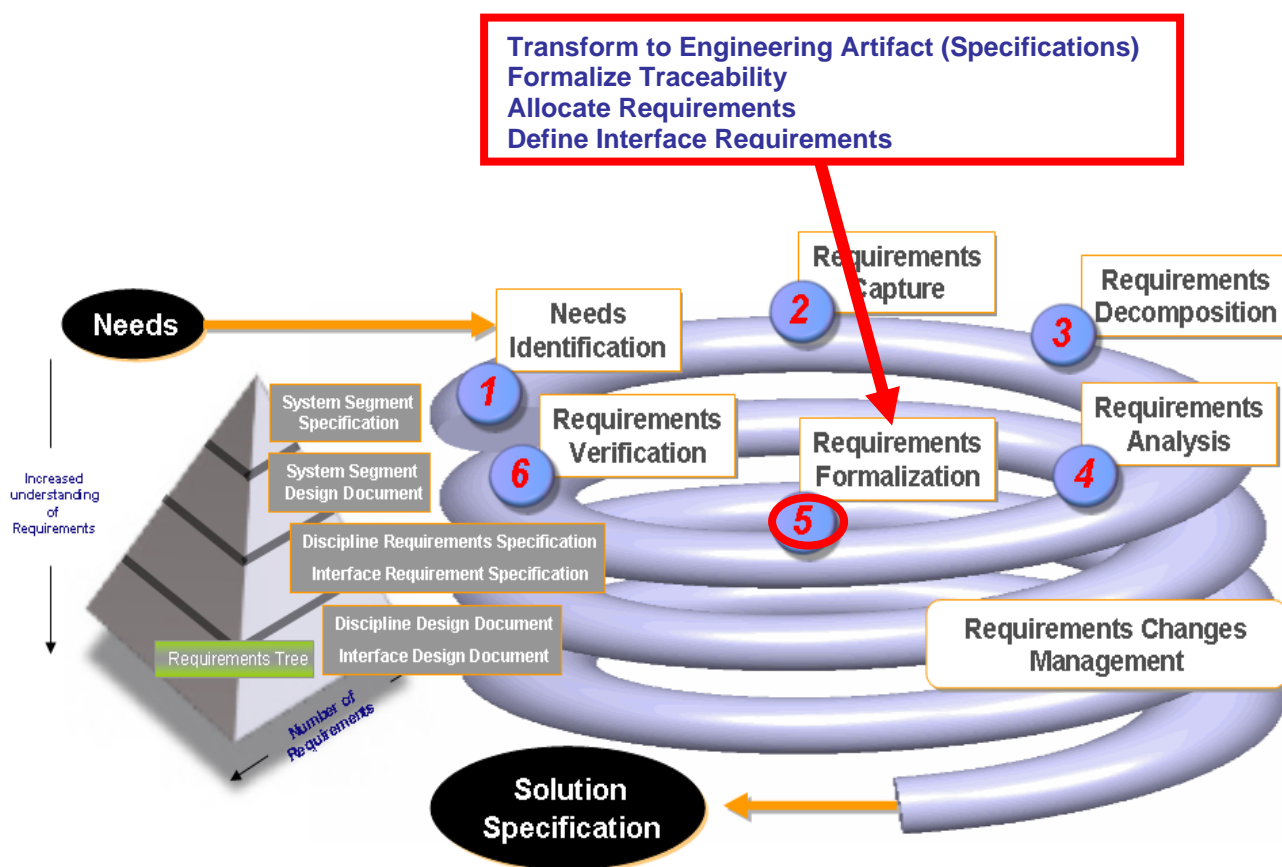


Figure 7 – Requirements Formalization activity overview.

The Requirement Allocation activity allocates or assigns requirements to system, or function activity components. This process verifies that the performance and verification requirements are correct and complete at each level before further allocation and decomposition.

The allocated requirements consist of all requirements, including the breakdown/decomposition of physical characteristics, functions, cost, schedule, reliability/maintainability parameters, and performance parameters.

During the allocation process, the requirement is assigned to the proper organization responsibility for authority and accountability and to the proper function(s) or system(s) component(s) within the product architecture.

During system development, a series of specifications are generated to describe the system at different levels of detail

- Forms the core of the configuration baselines.
- Baselines are defined at different phases of the design process.

4.7.2. Function description

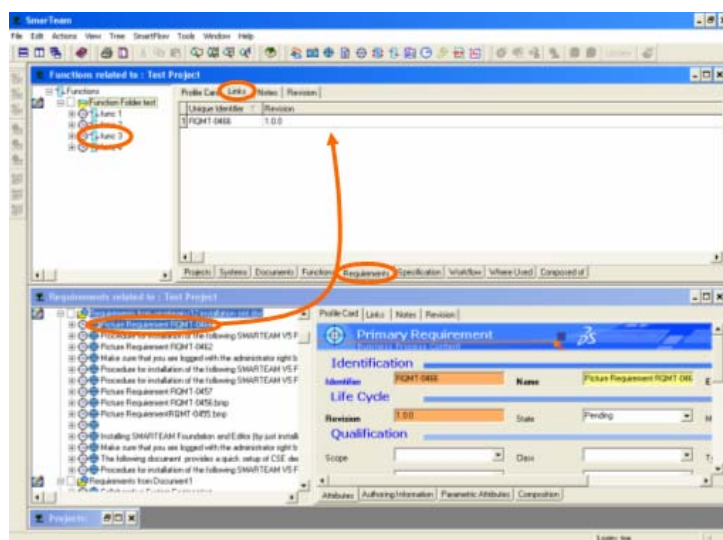
4.7.2.1. Create links

ENOVIA SmarTeam is providing the capability to create links between many CSE objects.

There are two main ways to create links, one if you want to create links between object belonging to the same window and the other to create all other links.

Creating links between object from different windows:

In the following example we can see how to create a link between a document and a requirements folder.



It's possible to create such links just by using drag and drop capability:

- Open the windows of the objects to link.
- Tile them horizontally.
- Drag the first object from the tree and drop it in the link tab of the second object.

Creating links between object from the same window:

In the following examples, we can see how to create a link between primary requirement and requirements module.

Note

Refer to ENOVIA SmarTeam documentation for further detail about links.

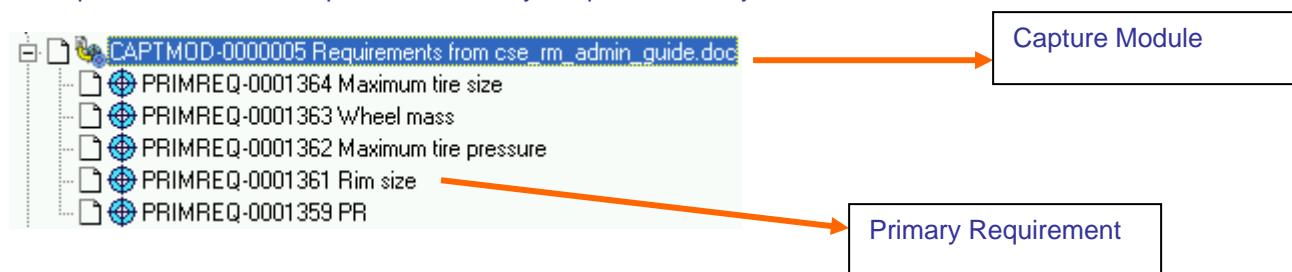
4.7.2.2. Allocate Requirements to Capture Module

When capturing requirements from a Microsoft Word document, a new capture module is created and all the primary requirement captured from this document are linked to the capture module, thus you can see in the same tree under the same node all the primary requirements coming from the source document.

A “Capture Module” is used to group and retrieve Primary Requirements according to a source document, a set of requirements coming from a stakeholder, norms and standards regulation.

A “Capture Module” has its own life cycle. At a given time, a Primary Requirement is attached to a Capture Module.

A “Capture Module” is composed of “Primary Requirement” objects



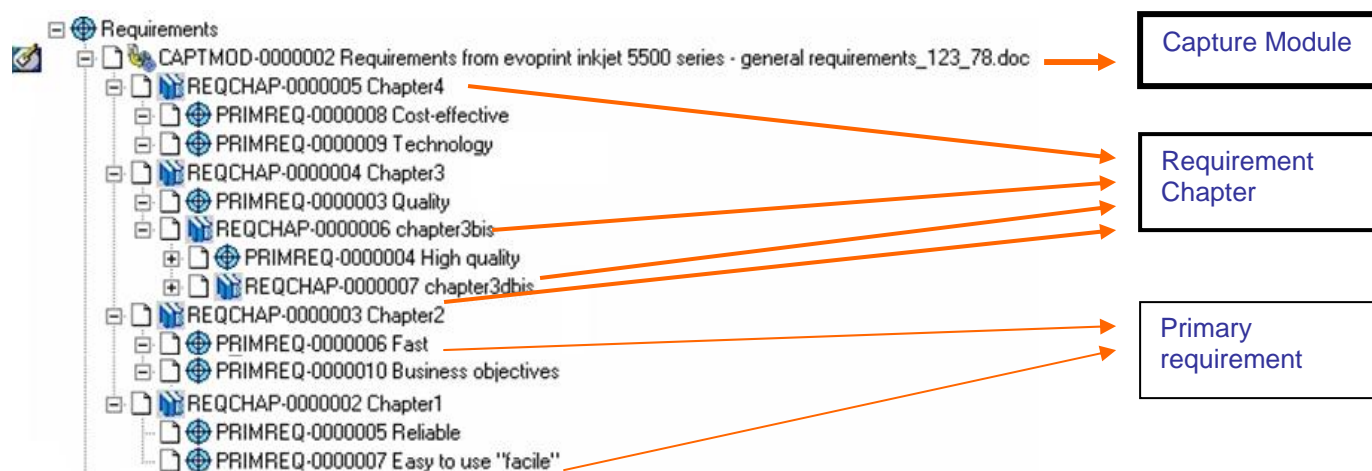
First possibility: According to this behavior, it's possible to structure the capture module in the same way as the source document using the requirement Chapter as possible node in the tree. The capture module will become the reference (create a release version for this module) and module will not be modified afterwards. The source document will exist as complementary information.

The second possibility is to keep the word document as the reference and use the capture possibilities only for traceability. To do so, capture all requirements from source document in a capture module. Then create a new requirements module with chapters. To fill this module users have 3 possibilities:

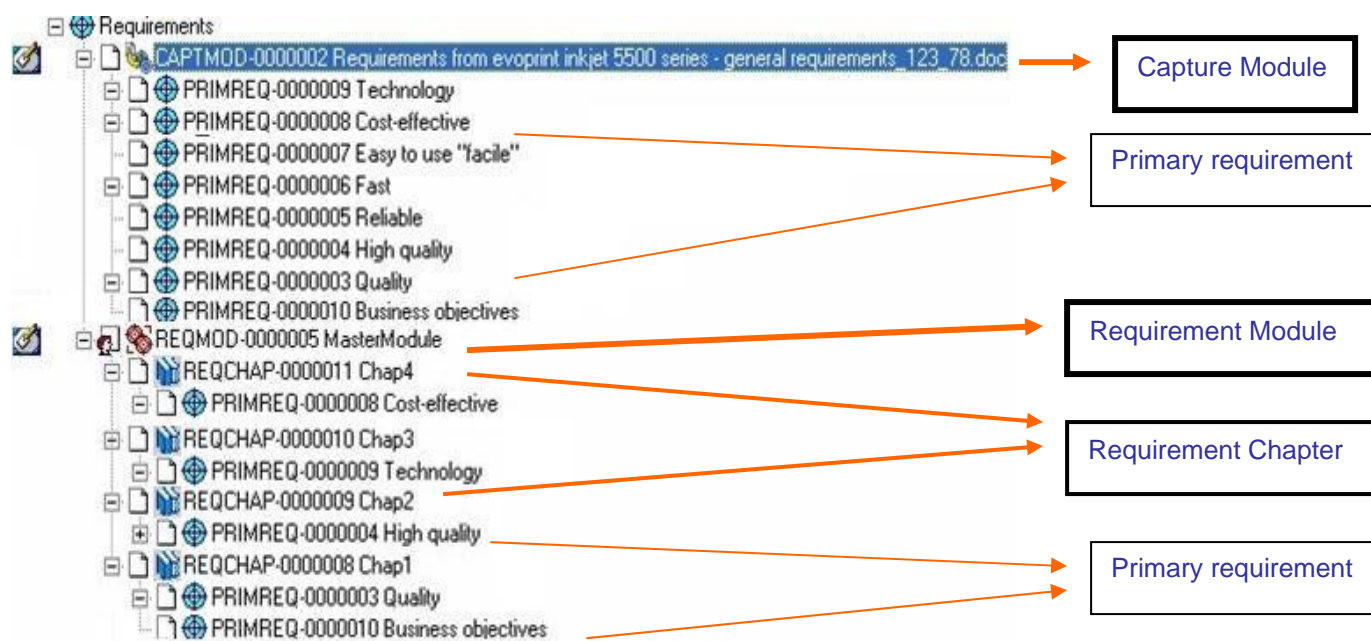
1. Copy requirements from the capture module to requirements module or chapter.
2. Derive requirements from the capture module and put the derived requirements into the new module
3. Create new primary requirement and create general links with the captured requirements

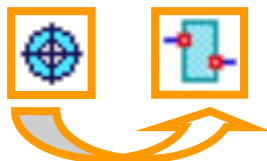
The capture module is not a reference and can even be considered as obsolete

First possibility:



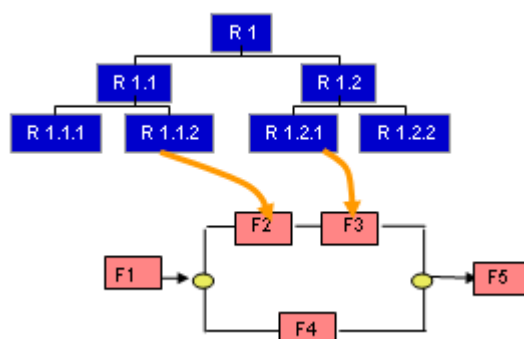
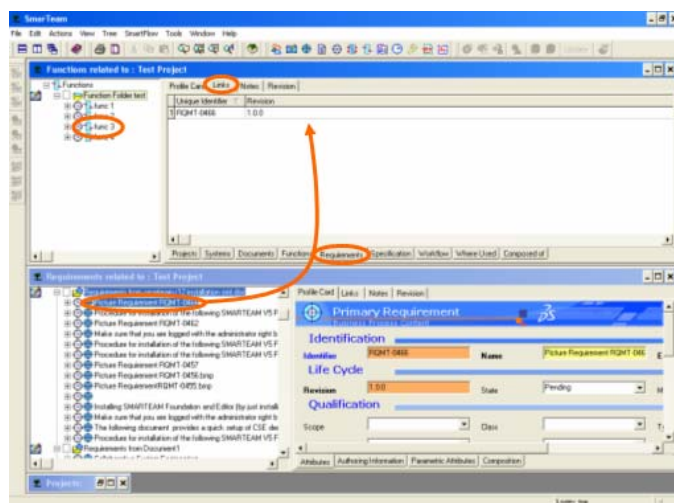
Second possibility:





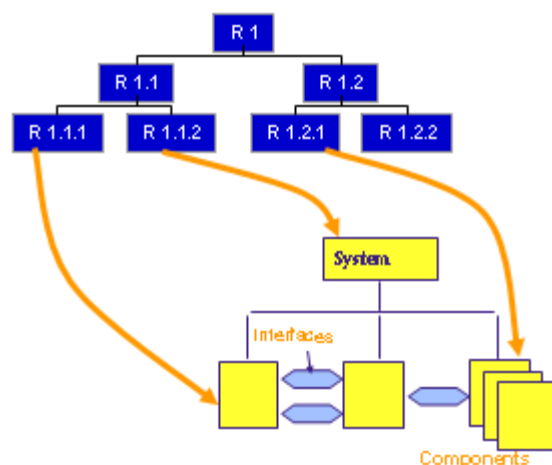
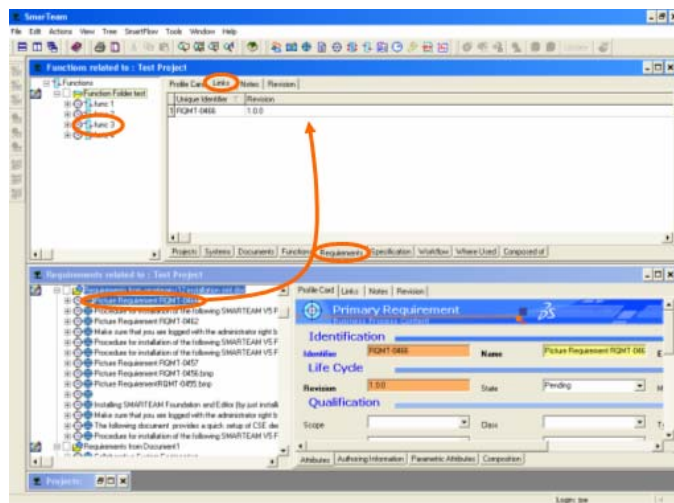
4.7.2.3. Allocate Requirements to Functions

Allocating requirements to functions consists in creating general links between a requirement and a function.



4.7.2.4. Allocate Requirements to Systems

Allocating requirements to systems consists simply in creating a general links between a requirement and a system.



Notes

You can create such links in ENOVIA SmarTeam very easily by just using Drag and Drop feature.



4.7.2.5. Retrieving Unallocated Objects

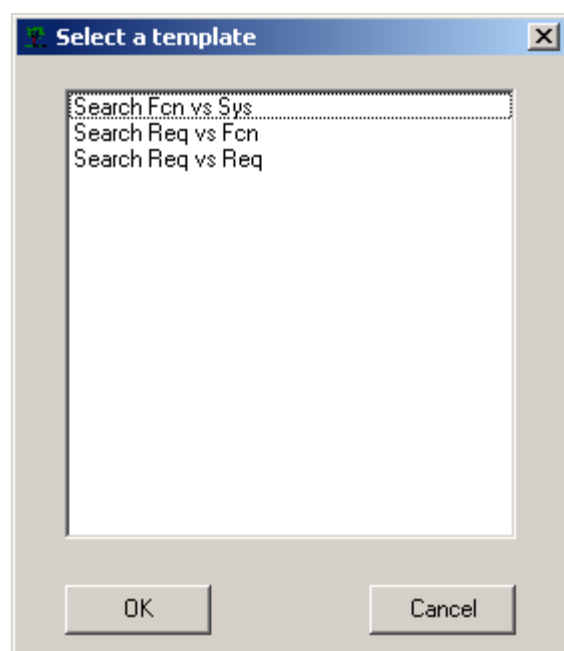
The unallocated objects search allows searching for all the objects from a class that are not linked (unallocated) with at least one object from another class.

By default CSE provides three queries:

- Functions objects not allocated to Systems objects
- Requirements objects not allocated to Functions objects
- Requirements objects not allocated to Requirements objects

To define new queries, report to the “Requirements Management Implementation Guide”

To launch the functionality, select a project and click on the ‘**Get Unallocated Objects**’ icon 



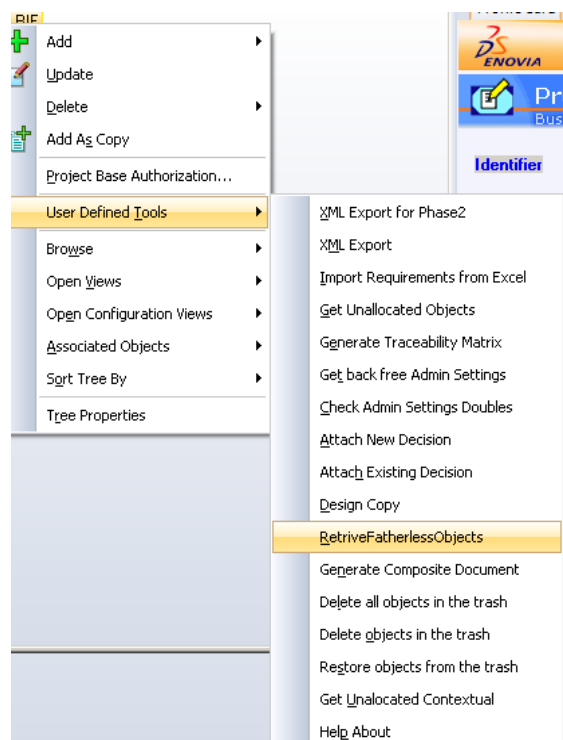
Unallocated requirements from			
Data		Chart	
	Class	Unique Identifier	Revision
1		RQMT-0191	
2		RQMT-0192	
3		RQMT-0193	
4		RQMT-0134	
5		RQMT-0156	
6		RQMT-0215	
7		RQMT-0396	1.0.0
8		RQMT-0397	1.0.0
9		RQMT-0477	1.0.0
10		RQMT-0399	1.0.0
11		RQMT-0378	1.0.0
12			1.0.0
13		RQMT-0206	
14		RQMT-0393	1.0.0
15		RQMT-0394	1.0.0
16		RQMT-0395	1.0.0
17		RQMT-0217	
18		RQMT-0220	
19		RQMT-0223	

The Result is displayed on a pop up window with the Chart capability.

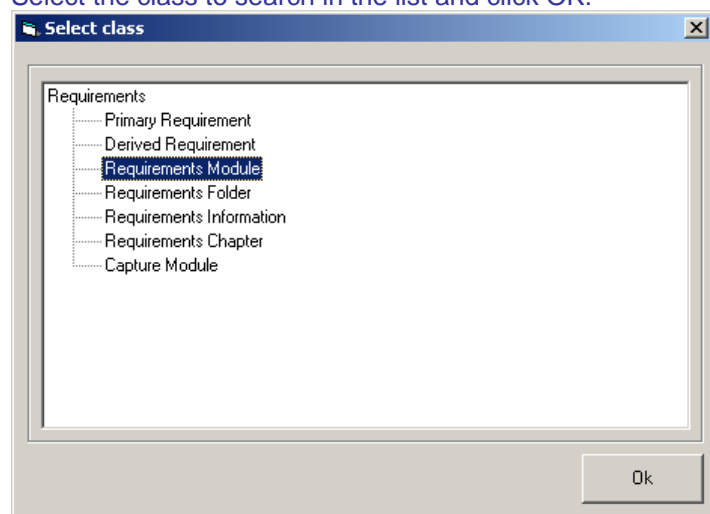
4.7.2.6. Retrieving Fatherless Objects

The Retrieve Fatherless Objects search allows searching objects related to a selected object which don't have hierarchical link to this parent object and are not linked to the desktop. Hidden objects (moved to the CSE trash) are not retrieved and only objects the user is allowed to see are retrieved.

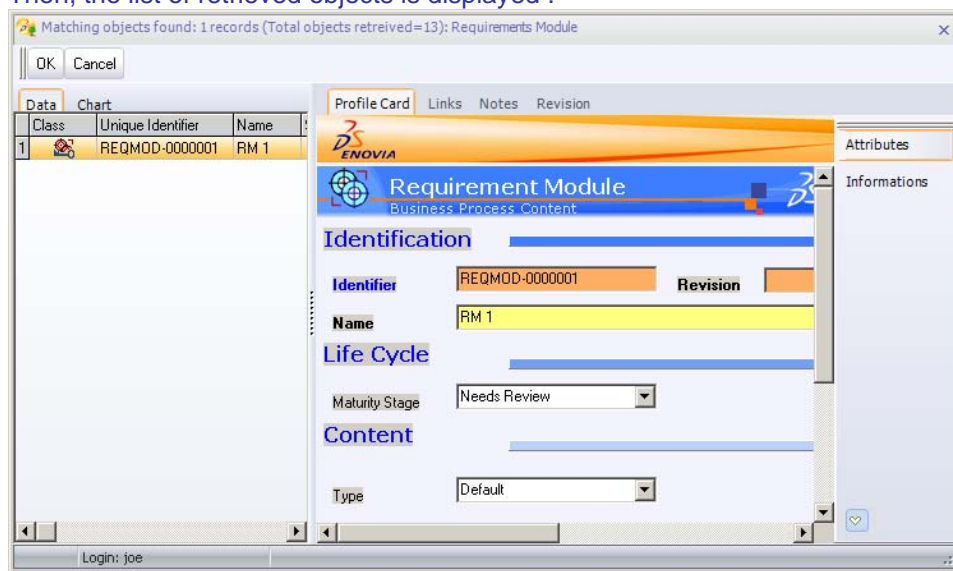
Select the object and click on the UDT “RetrieveFatherlessObjects”



Select the class to search in the list and click OK:



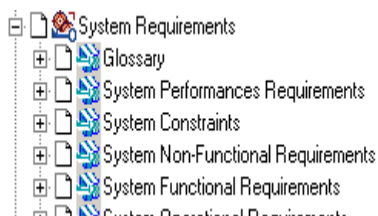
Then, the list of retrieved objects is displayed :



Click OK to close the window.



4.7.2.7. Using Requirements Module



In CSE, requirements can be organized by Modules.

The Modules entities provide the capability to define a specific view of the requirements which is used to structure the document hierarchy.

A requirements module has to be seen as a requirements document.



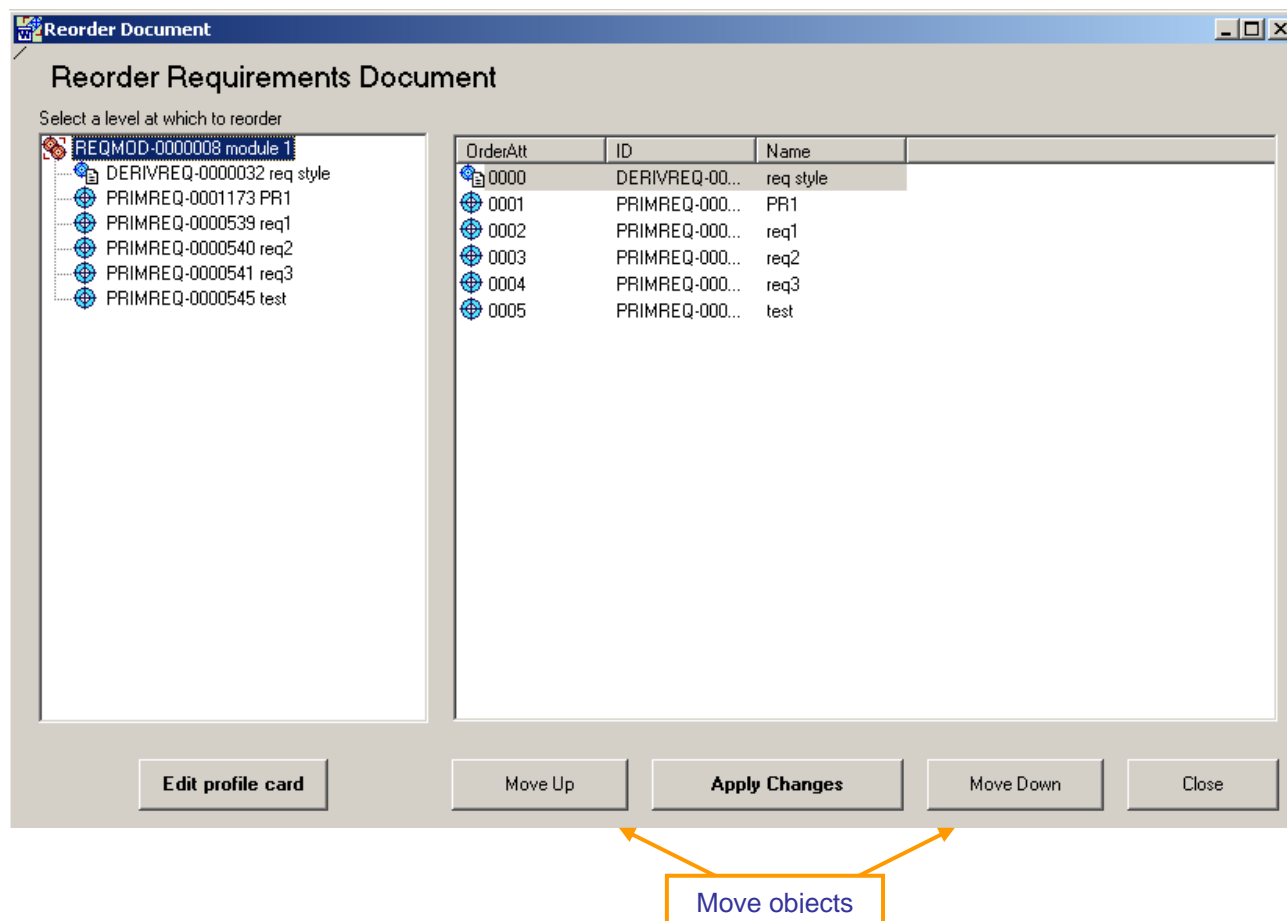
4.7.2.8. Organizing requirements view with folders

A "Requirement Folder" is used to group requirements module.



4.7.2.9. Re-Ordering Requirements in CSE

The order of Requirements in SmarTeam is by default the one in which they were created. This order can be modified by using the re-order button. You then get a specific GUI to reorder the elements of a list (see below).



The reordering of attributes using this capability is only guaranteed to properly affect the ordering in *InfoPath Edition* (if installed) and in *Document Report*. The order in the SmarTeam Tree may be different depending on selected tree properties (Expand level and tree ordering options).

The reordering functionality is not available for a “Checked in” or “released” module. Nevertheless this behavior can be modified thru a dedicated admin Setting (cf Requirements Management Implementation Guide).

From this GUI, you can also edit the profile card of the selected object and perform most of the SmarTeam standard operations as displayed below.

Modify Object: Primary Requirement

Data Chart

Class	Unique Identifier
1	PRIMREQ-0000541

Profile Card Links Notes Revision

Primary Requirement
Business Process Content

Identification

Identifier: PRIMREQ-0000541 Name: req3 External ID:

Life Cycle

Revision: State: Released Maturity Stage: Needs Review

Qualification

Scope: Industry Standard Class: Design Type: Default

Priority: Low Risk Level: High Source Category:

Compliance Level: Mandatory Design Constraint: Policies Weight Factor:

Content

Requirement Edit/View Infopath

Below is defined the time response of the system according to the flight scenario :

In flight	landing	take off
12	5	3

Comments:

Validity condition:

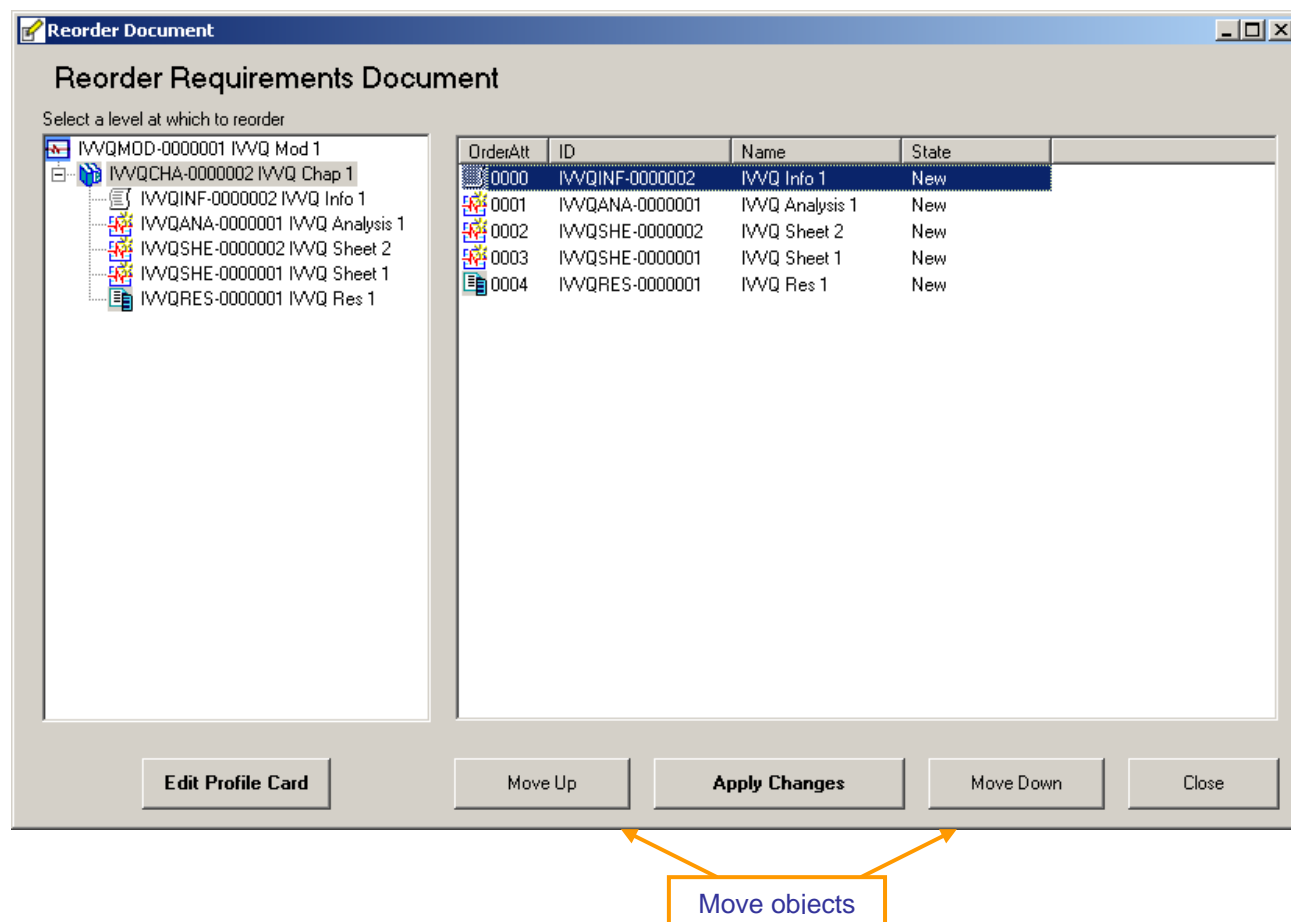
Attributes Authoring Information

Login: joe

4.7.2.10. Re-Ordering IVVQ objects in CSE



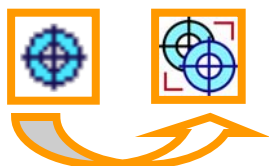
The order of IVVQ objects in SmarTeam is by default the one in which they were created. This order can be modified by using the re-order button. You then get a specific GUI to reorder the elements of a list (see below).



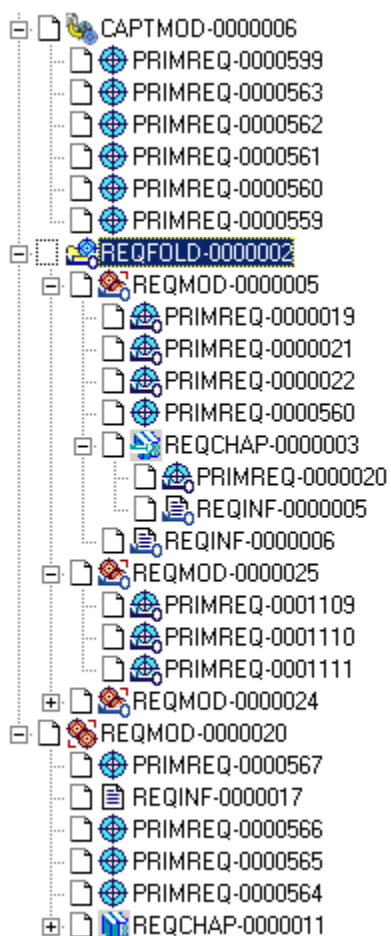
The reordering of attributes using this capability is only guaranteed to properly affect the ordering in *InfoPath Edition* and in *Document Report*. The order in the SmarTeam Tree may be different depending on selected tree properties (Expand level and tree ordering options class and/or Description).

The reordering functionality is not available for a "Checked in" or "released" module. Nevertheless this behavior can be modified thru a dedicated admin Setting (cf Requirements Management Implementation Guide).

4.7.2.11. Allocate Requirements to Module



Allocating a requirements to a module consist simply in creating a general links between a requirement and a module.



Creating such link in ENOVIA SmarTeam is very easy just by using Drag and Drop.

4.7.2.12. Derivation Traceability Matrix

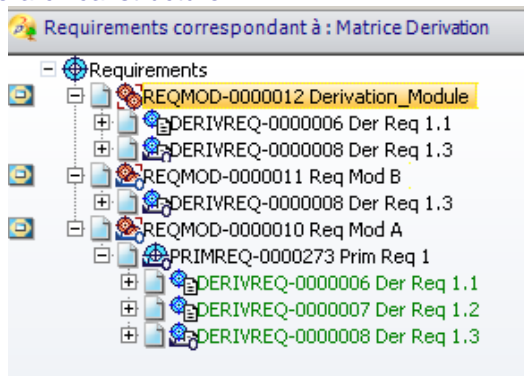
Derivation Traceability Matrix offers a synthesis of the traceability links between a set of selected "root" requirements and all the requirements derived from each one, recursively.

For each retrieved derived item, the modules directly linked as parents are exported.

The search is limited to five levels.

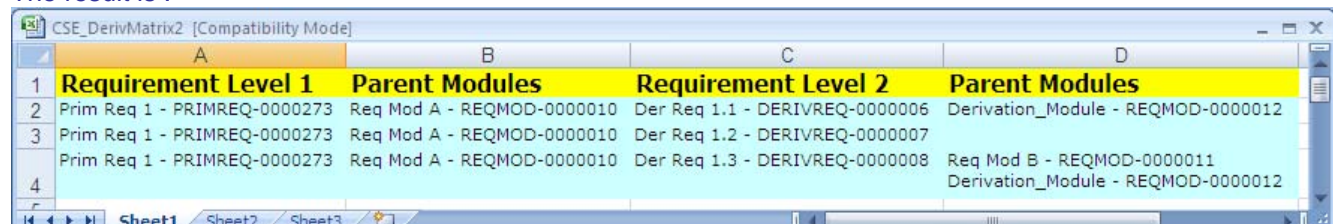
The expected result is provided in an Excel sheet that exports derivation from selected objects.

User selects at least one leaf class Requirement. Derivation links are retrieved from this selected leaf object. If the user selects a container object (Module, Folder...), the entire children requirements are retrieved. There is no limit on the depth of the hierarchical structure.



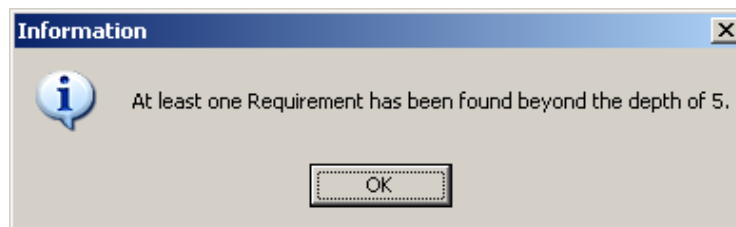
Once "root" objects are selected, the user calls new User Defined Tool (UDT) to generate the derivation matrix.

The result is :



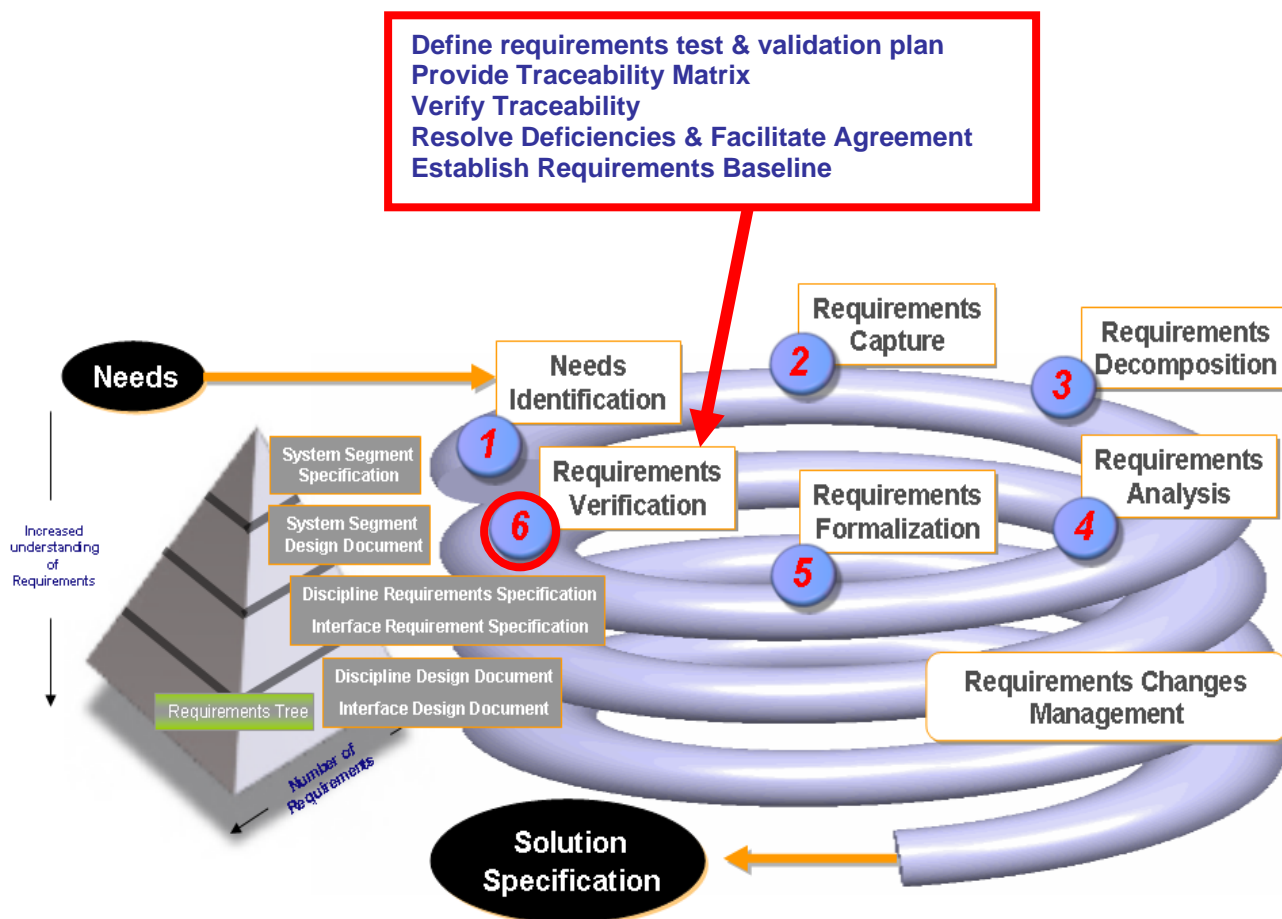
	A	B	C	D
1	Requirement Level 1	Parent Modules	Requirement Level 2	Parent Modules
2	Prim Req 1 - PRIMREQ-0000273	Req Mod A - REQMOD-0000010	Der Req 1.1 - DERIVREQ-0000006	Derivation_Module - REQMOD-0000012
3	Prim Req 1 - PRIMREQ-0000273	Req Mod A - REQMOD-0000010	Der Req 1.2 - DERIVREQ-0000007	
4	Prim Req 1 - PRIMREQ-0000273	Req Mod A - REQMOD-0000010	Der Req 1.3 - DERIVREQ-0000008	Req Mod B - REQMOD-0000011 Derivation_Module - REQMOD-0000012

Derivation links are retrieved recursively up to five levels. If more than five derivation levels exist, a warning must be raised.



4.8. Requirements Verification

4.8.1. Function overview



The Requirement Verification activity defines requirements test and validation plan, verifies requirement traceability (using the provided matrix), resolves deficiencies, facilitates agreement, and finally establishes requirements baseline.

Many reports are necessary to manage the system engineering process.

CSE-RM is providing multiple requirements evolution traceability and report capabilities:

- Tracking changes on a requirement.
- Viewing evolution of modification applied to a given version of a requirement.
- Reporting evolution on a list of identified requirements.
- Viewing requirements version evolution

What goes into each report depends on the process and information needs of those receiving the report(s). Determine their information needs and document the information that will be associated with the

requirements when you set up your CSE requirements database and configuring the application. Here is the list of recommended report that you can easily customize depending on your company rules.

4.8.2. Function description

Refer to the Appendix A – BPA provided data to use matrix reports template.

4.9. Requirements Baseline

4.9.1. Function description

Base-lining capabilities in CSE allow you to take a “snapshot” of the project current state in terms of requirements. The baseline can be of the entire project or a subset (useful for example) when releasing requirements to external contractors.

Creating a baseline allows you to freeze the current state of the project (or a subset of the project) for later review.

You have to use the Lifecycle mechanism to create a baseline in CSE:

Requirements Lifecycle, as implemented in CSE, ensures that validated requirements modules cannot be altered after their validation (a change is possible but only on a different version of the module). In order to validate (release) a module, all child modules and requirements must first be validated first, effectively meaning that a released module may serve as a baseline.

4.9.1.1. Requirement Lifecycle behavior

Requirements Lifecycle Behavior is defined by different states that can be assigned to requirement objects, in addition to rules that control the possible changes that can be made to a requirement object in a given state.

These states correspond to the standard ENOVIA SmarTeam states, as defined for revision controlled objects. In *Requirements Lifecycle*, these states take a slightly different meaning than the classical document sense. Additional rules and behaviors are applied by CSE in order to make sure these states and behaviors adhere to the needs of the requirements management domain.

The possible states for requirement objects are:

New – Initial state of a requirements object – indicates 1) work in progress 2) The object has not yet been validated.

Checked In – This state means that the object is frozen (to change it, a new minor revision has to be made) but not validated. An object in this state can be either checked out, creating a new minor revision on which to make changes, or released – validating the object and freezing it as a major revision.

Checked Out – This state indicates Work-In-Progress by a specific user. The object is protected from change by other users (except the one which checked it out). An object in this state can be checked in, or released.

Released – This state indicates that the object is frozen **and** validated. The content and hierarchical structure of an object in the released state cannot be modified. To make changes on a released object, a new release has to be created.

Notes

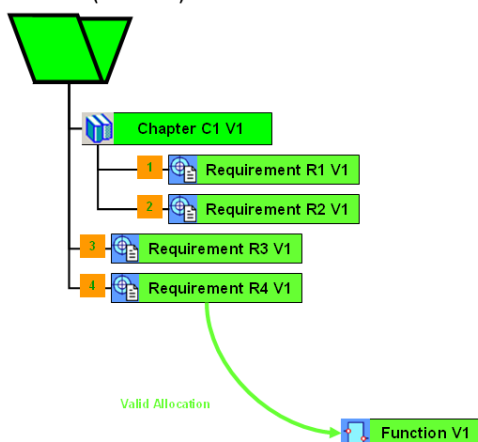
Smarteam is providing by default all the lifecycle operations thru “lifecycle” contextual menu. As that contextual menu can not be removed of the Smarteam interface, you can access it. However all the lifecycle operations shall be launched thru “User Defined Tools” contextual menu for the requirements tree as well as for the others CSE trees.

That specific lifecycle doesn’t provide anymore “Obsolete” and “Undo Checkout” operations.

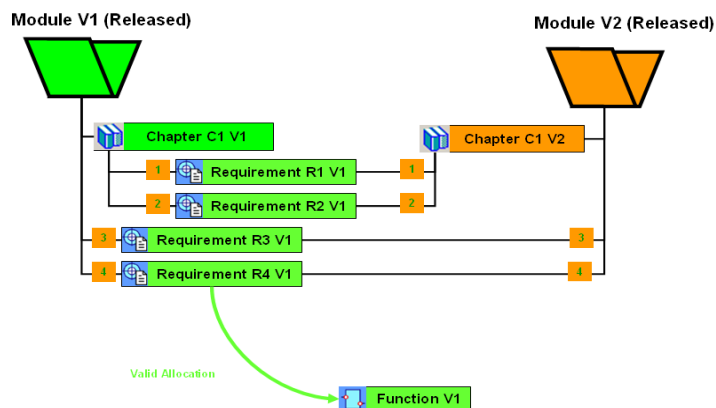
The following behaviors are only guaranteed for objects which are not located on the Smarteam desktop. Keep in mind to create requirements module only into a requirements folder.

The following diagram gives an example of a requirements change Lifecycle in 4 stages, starting from a released requirements module:

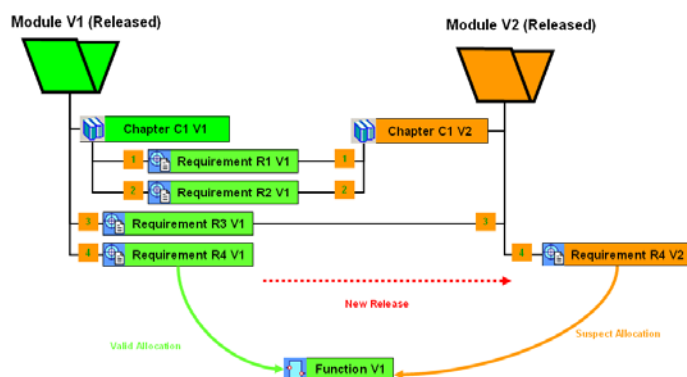
Module V1 (Released)



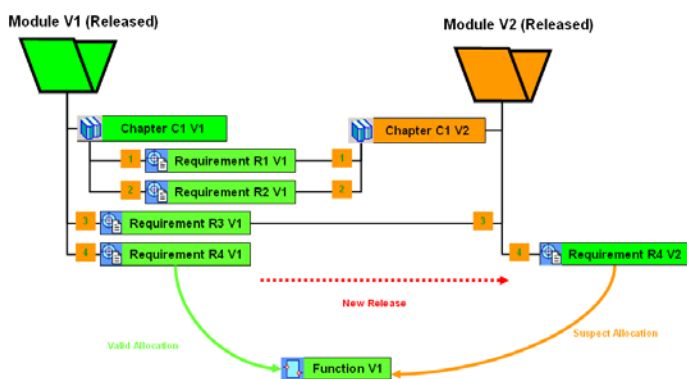
Stage 1 – A released (validated) version of the requirement exists.



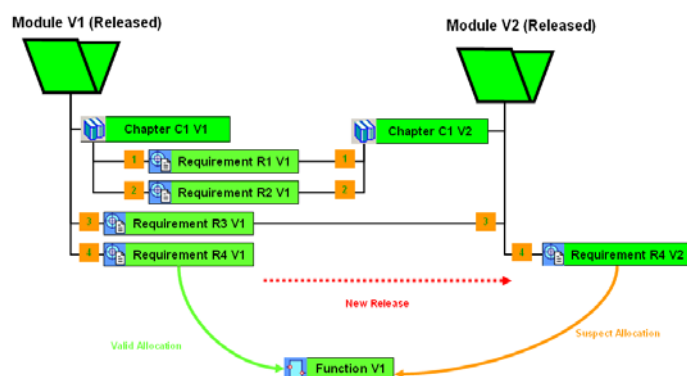
Stage 2 – Performing a new release operation on module 2, the module and its chapter are checked out. The requirements are linked to those new versions.



Stage 3 – Changing one of the requirements – To do so the user must create a new release of the requirement (Work-In-Progress). CSE Automatically copies any general link that the original requirement has to the new WIP requirement. User is now free to make changes on the WIP requirement. The operation breaks automatically the link of the parent module to the previous released version.



Stage 4 – Validation – after working on the requirement, user can validate it. It is now possible to release (validate) the parent requirements module.

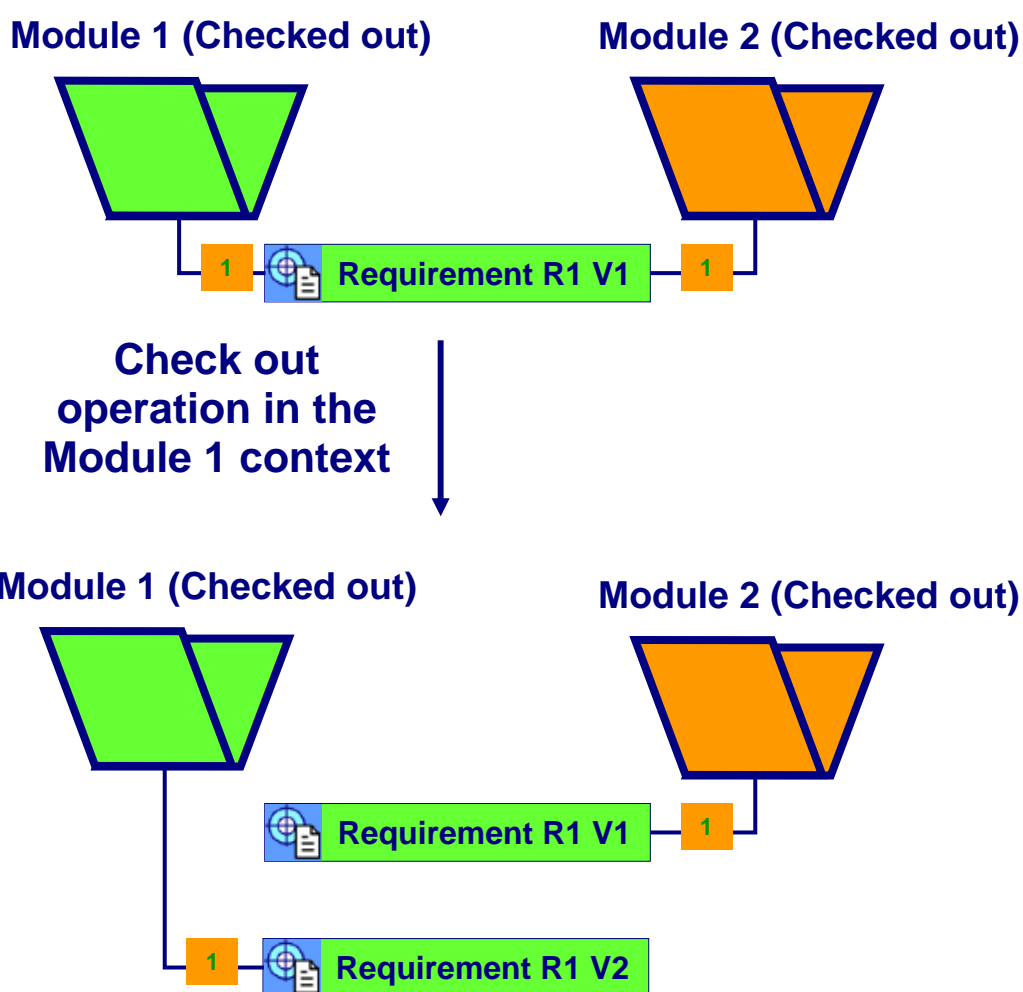


Stage 5 – Validation – after working on the module, user can validate it.

Note: On a lifecycle standpoint a module and all the chapters composing this module are only one element. So either a user performs a lifecycle operation on a module, this operation is also performed on each chapter composing the module. More over a chapter can only be the son of one and only one father (whatever the father is).

Validation – after working on the requirement, user can validate it. Validating the requirement breaks the link of the parent module with the previous released version, making sure that the parent always has only one released version of a specific requirement linked to it. It is now possible to release (validate) the parent requirements module.

All the lifecycle operations are contextual. In case of a requirement is linked to different modules or chapters, the lifecycle operations performed on the requirement are only applied in the current context. The following schema illustrates it.



Notes

In order to perform a check in or release operation on a requirements structure (module or chapter), all the sub-elements shall be at least in check in state.

4.10. Requirements Changes Management

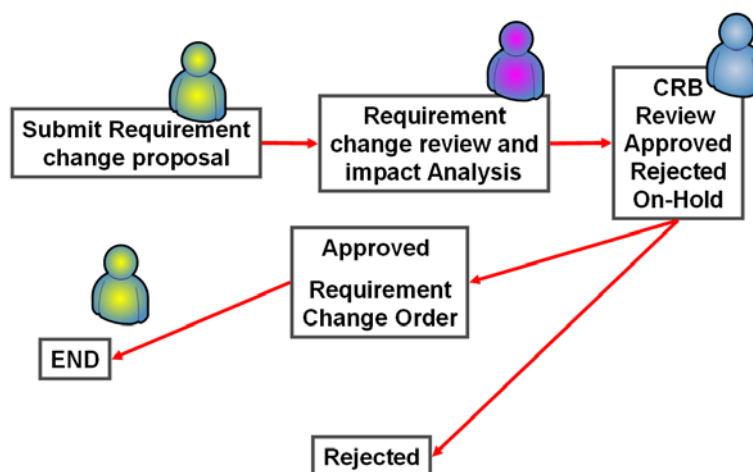
4.10.1. Function description

This activity manages and controls requirements throughout the product's Lifecycle.

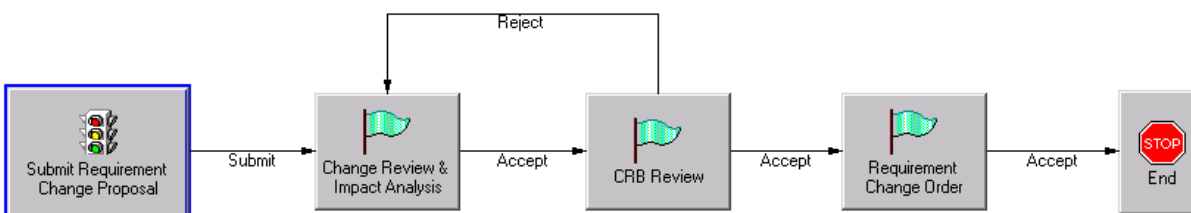
The activity identifies and controls all the issues and decisions, action items, formal and informal stakeholder/program management desires/directives, and any other real or potential changes to the requirements.

The activity is invoked when a new requirement is identified or a change occurs during any other activity within the Requirements Management process.

The change control is the process for incorporating changes to the product and project. The change control process ensures that changes are authorized, documented, and coordinated.



4.10.1.1. Requirements change proposal – Workflow



Using CSE enables the utilization ENOVIA SmarTeam Workflow capabilities. ENOVIA SmarTeam Workflow components enable the organization to implement a traceable, organized and manageable process involving the change and validation of Requirements (and other objects).

The Requirement Change Proposal is implemented in CSE as a generic flow process intended to manage the changing of a requirement, including review, impact analysis and the issuing of a requirements change order. Using this workflow as a basis, The CSE Administrator can configure and modify this process according to company regulation and methodology.

To customize the flow process to the customer organization the administrator needs to:

1. Assign Users/Groups for each node in the process.
2. Assign tasks for each user to perform before continuing to the next stage – such tasks may include releasing a requirement, validating suspect links, etc.

For the full documentation on how to configure and customize ENOVIA SmarTeam Workflow Processes please refer to ENOVIA SmarTeam documentation.

To propose requirement change, you must propose a new revision of requirement, to change requirement to submit for impact analysis and approval.

4.11. Requirements Export

4.11.1. Function description

This activity manages requirements export in a RIF (Requirements Interface Format) XML format.

RIF export allows providing requirements from original equipment manufacturer (OEM) to suppliers. This format is independent from a special Requirements Management tool and supported by most vendors of Requirements Management tools.

The following classes can be selected and exported:

- Requirement Folder
- Requirement Module
- Requirement Chapter
- Capture Module
- Primary Requirements

The following classes cannot be exported:

- Derive Requirements
- Decompose Requirements

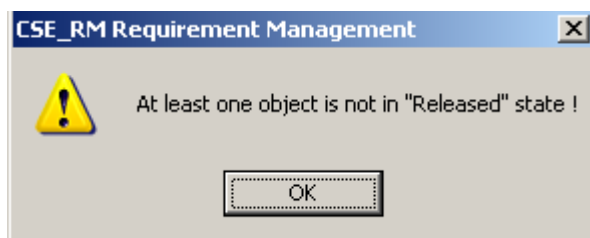
Two kinds of relation ships are retrieved:

- Hierarchical links to children. From the selected object, the objects linked as children are retrieved recursively. The retrieved children are included to the data set to be exported.
- From this dataset, logical links between objects are exported. Logical links between an object of the dataset and an object not included in the dataset is not exported to RIF file.

By default, the entire object collection is expected to be “Released”. If at least one of the objects is not released, RIF export is aborted and an error message is displayed. This rule is applied to the entire data set (i.e.: retrieved by logical and hierarchical relationships).

An Admin setting “RIF_LC_PREREQUISITE_DISABLED” set to FALSE allow exporting objects even they are not in “Release” state.

If the entire object collection is not “Released” and Admin setting “RIF_LC_PREREQUISITE_DISABLED” set to TRUE, the following window appears:

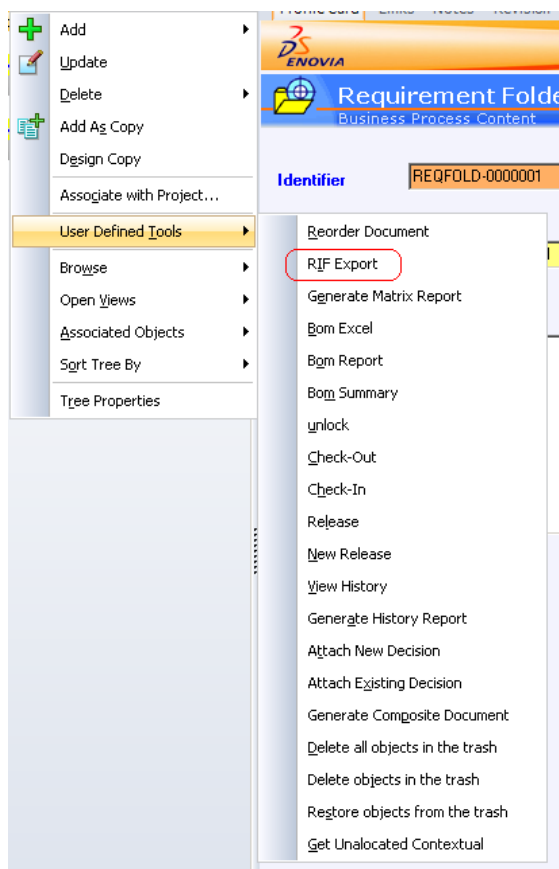


Click OK to change the objects state.

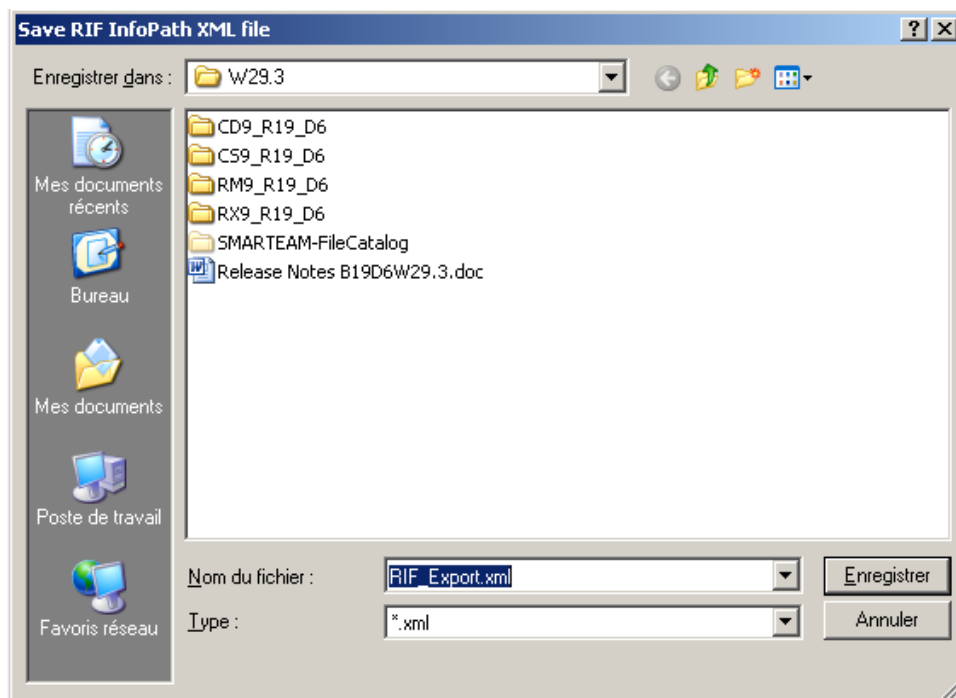
4.11.1.1. Export Requirement Folder

Select the requirement Folder you want to export.

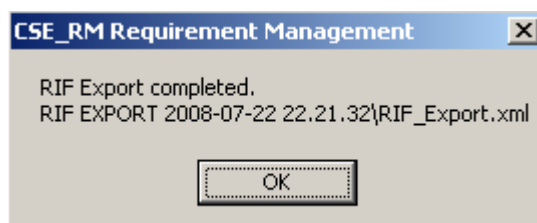
You can click on icon , or select the User Defined Tools menu (part of contextual menu) and choose function "RIF Export"



Then the following window appears. Choose the folder where you want to export the RIF file.



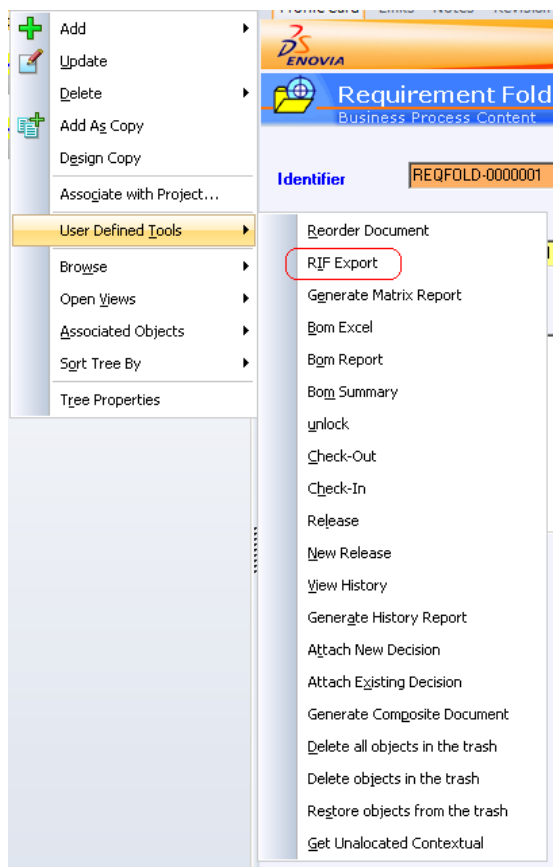
When the export is completed, the following window appears:



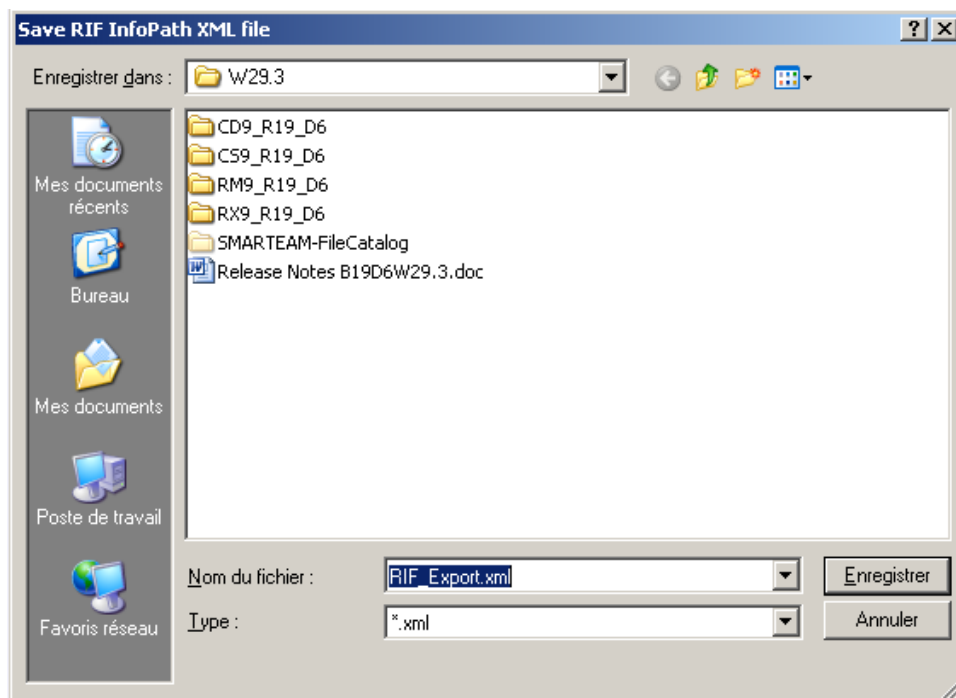
4.11.1.2. Export Requirement Module

Select the requirement Module you want to export.

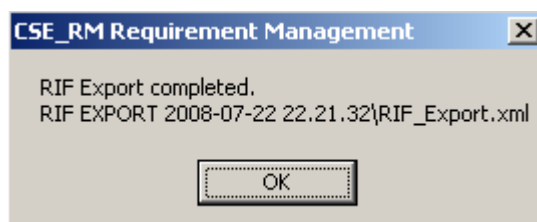
You can click on icon , or select the User Defined Tools menu (part of contextual menu) and choose function "RIF Export"



Then the following window appears. Choose the folder where you want to export the RIF file.



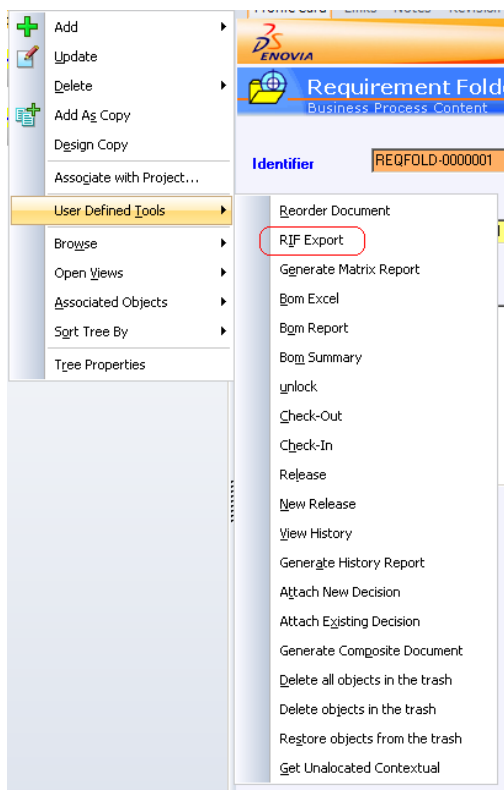
When the export is completed, the following window appears:



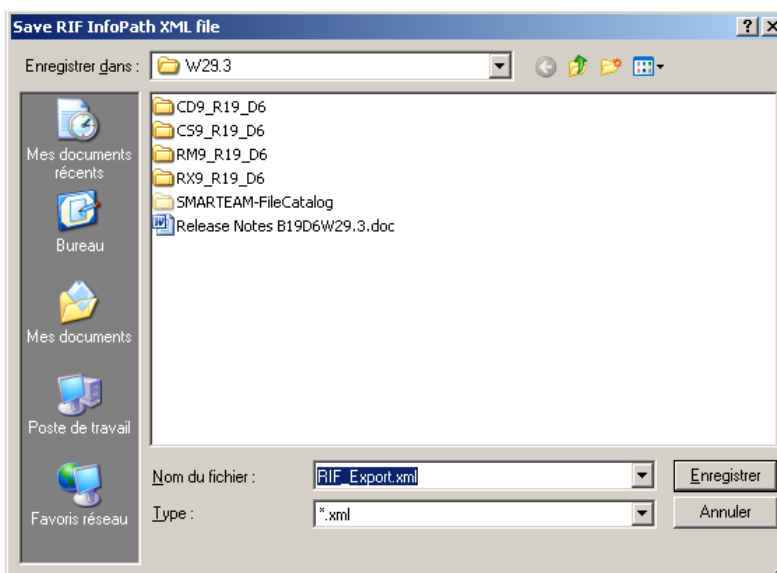
4.11.1.3. Export Requirement Chapter

Select the Requirement Chapter you want to export.

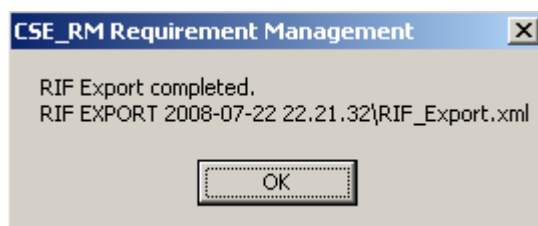
You can click on icon , or select the User Defined Tools menu (part of contextual menu) and choose function "RIF Export"



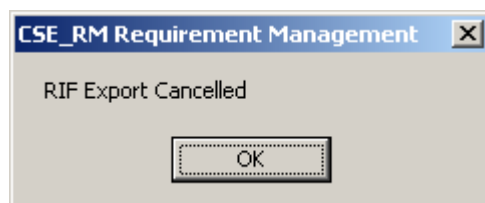
Then the following window appears. Choose the folder where you want to export the RIF file.



When the export is completed, the following window appears:



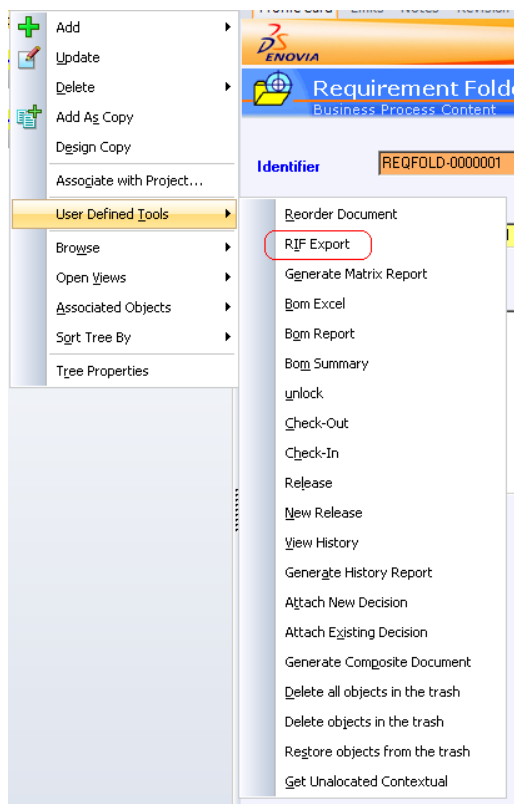
If you abort the export, the following window will appears :



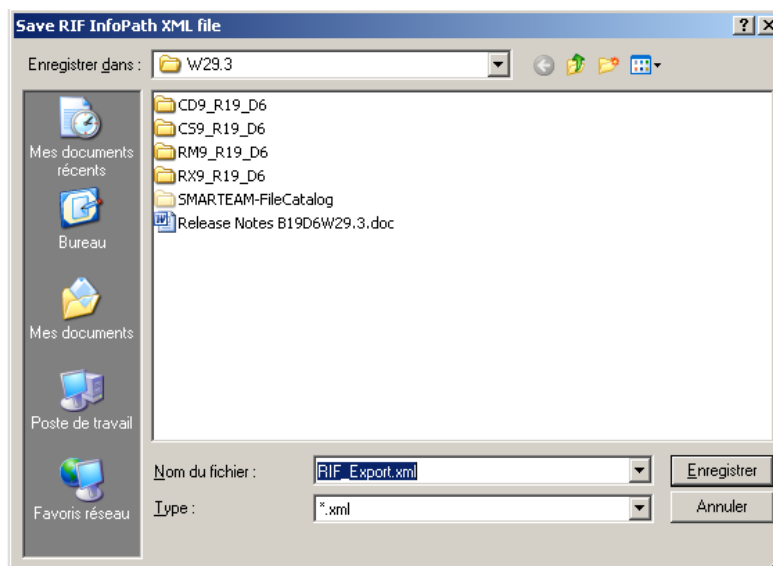
4.11.1.4. Export Capture Module

Select the Capture Module you want to export.

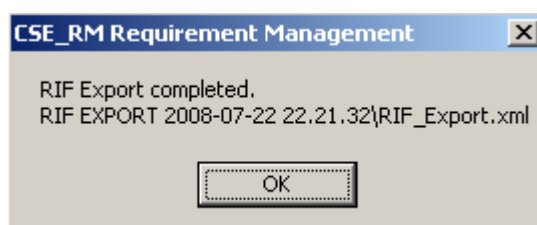
You can click on icon , or select the User Defined Tools menu (part of contextual menu) and choose function “RIF Export”



Then the following window appears. Choose the folder where you want to export the RIF file.



When the export is completed, the following window appears:



4.12. Requirements Import

4.12.1. Function description

This activity manages requirements import from RIF (Requirements Interface Format) XML format to CSE Database.

RIF import allows providing requirements from suppliers to original equipment manufacturer (OEM). This format is independent from a special Requirements Management tool and supported by most vendors of Requirements Management tools.

The goal of the RIF import is to insert/update/delete requirements from an external dataset. Permissions are manually managed by the end user, according to its own permissions on requirements stored in CSE

As prerequisite, in the RIF data set, requirements contents are supposed to be handled as side RTF files. According to RIF specifications, side files are referenced in the RIF XML file.

No life cycle operation is performed by the RIF feature. The end user is supposed to Check Out objects to be updated before.

By default, the content of CSE DB is the reference.

RIF's objects are compared to CSE DB. For each object, the following cases are managed:

- RIF object is not retrieved in CSE DB. Two options are suggested :

- By default, keep CSE object unchanged and discard RIF changes.
- Create this object in CSE DB.
- RIF object is retrieved. Two options are suggested :
 - By default, keep CSE object unchanged and discard RIF changes.
 - Overwrite CSE object with RIF object.
 - Merge both object and overwrite CSE object with the merge result. This option is available only for RTF file, Basic ASCII file and WinWord document.

The following classes can be imported:

- Requirement Folder
- Requirement Module
- Requirement Chapter
- Capture Module
- Primary Requirements

The following classes cannot be exported:

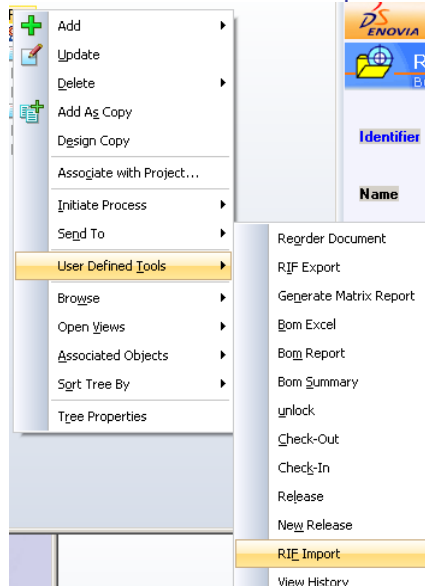
- Derive Requirements
- Decompose Requirements

Two kinds of relation ships are retrieved:

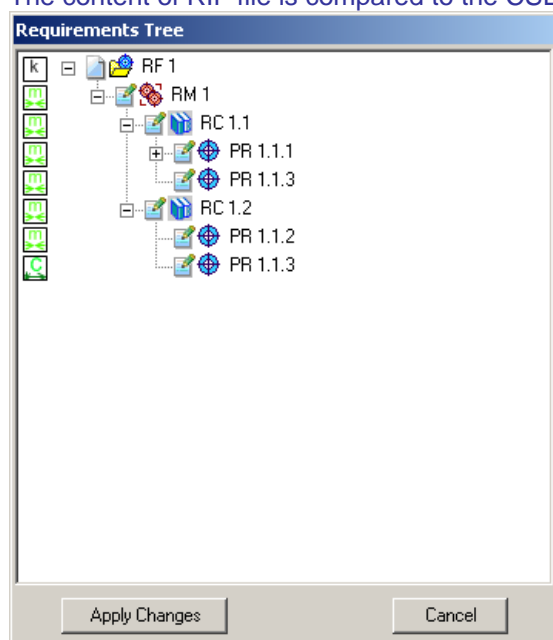
- Hierarchical links to children. From the selected object, the objects linked as children are retrieved recursively. The retrieved children are included to the data set to be imported.
- From this dataset, logical links between objects are imported. Logical links between an object of the dataset and an object not included in the dataset is not imported to CSE.

4.12.1.1. Import Requirements

Select the requirement you want to import and select the User Defined Tools menu (part of contextual menu) and choose function “RIF Import”.



The content of RIF file is compared to the CSE DB content and the result is displayed :

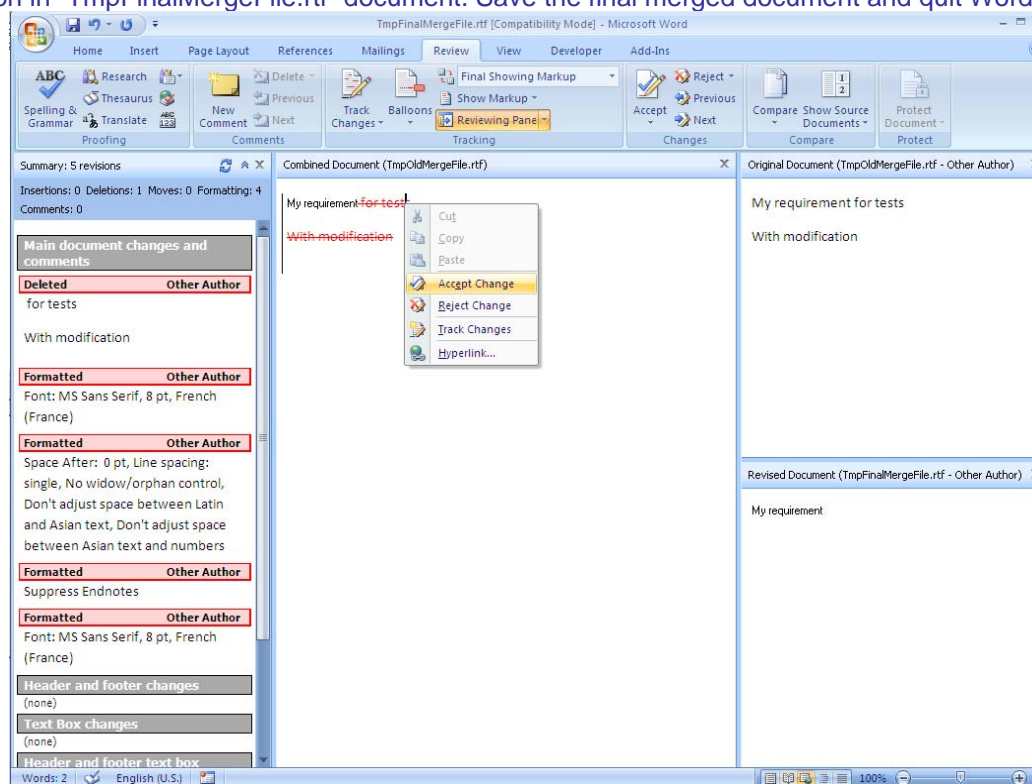


If objects are in Release mode, there is only Keep option (k) available.

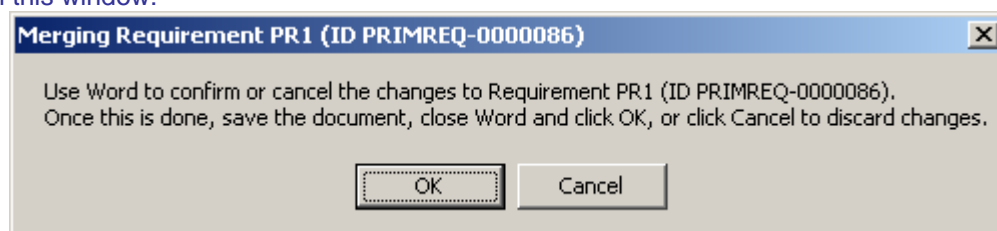
If objects are in New Release, option available depends on modification on these objects in CSE DB or RIF file.

Select the option for each object and click on “Apply Changes”.

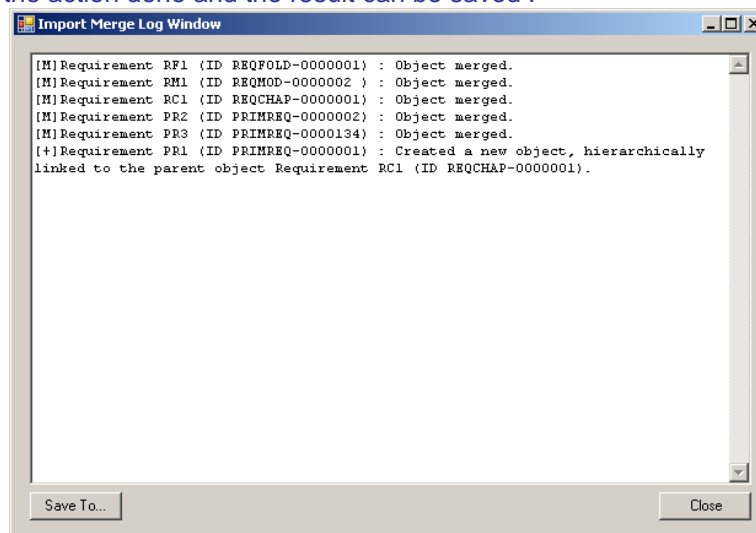
When merging requirement contents is necessary, a Word Merging window appears. Accept or reject the modification in “TmpFinalMergeFile.rtf” document. Save the final merged document and quit Word.



Click OK on this window:



A window summarize the action done and the result can be saved :



4.13. Requirements Export To Excel

4.13.1. Function description

This activity consists to export requirement from CSE requirements structure to an Excel worksheet. Export can be performed from "container" classes:

- Requirement Module,
- Requirement Chapter

Export can also be performed from "leaf" classes:

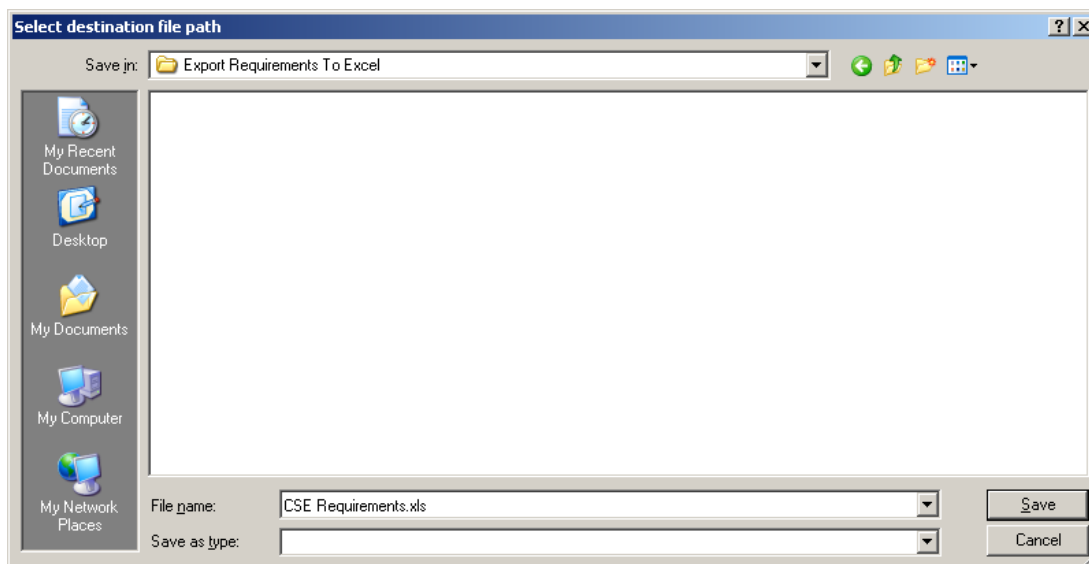
- Primary Requirement
- Derived Requirement

If the export is performed from a container object, structure is recursively parsed and leaf classes are exported. Anyway, only leaf classes are exported; not container.

4.13.1.1. Export Requirements

Select the container or leaf requirement you want to export and select the User Defined Tools menu (part of contextual menu) and choose function "Export Requirements To Excel".

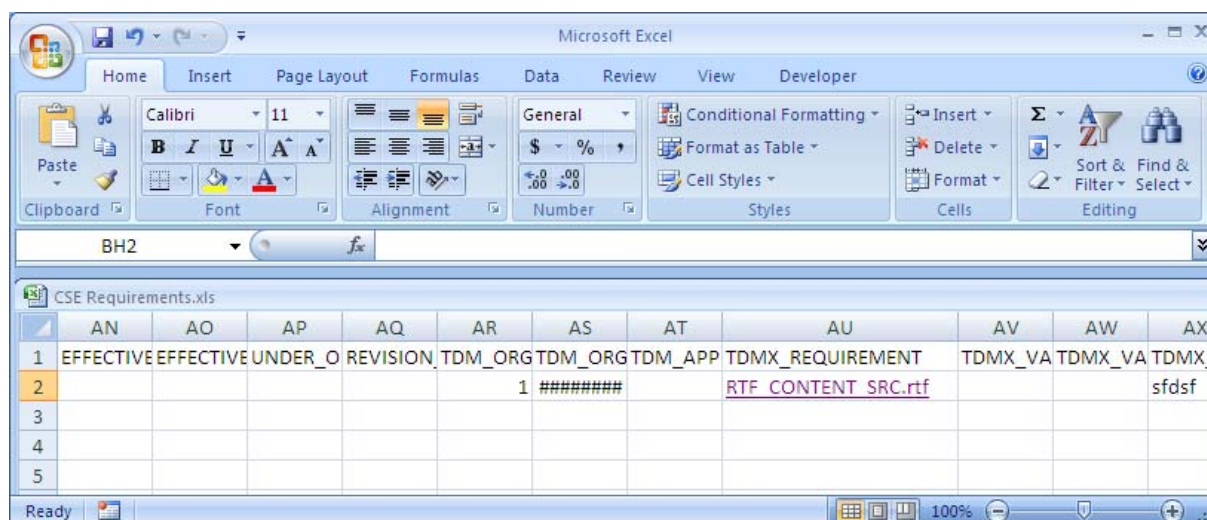
Then the following window appears. Choose the folder where you want to export the Excel file.

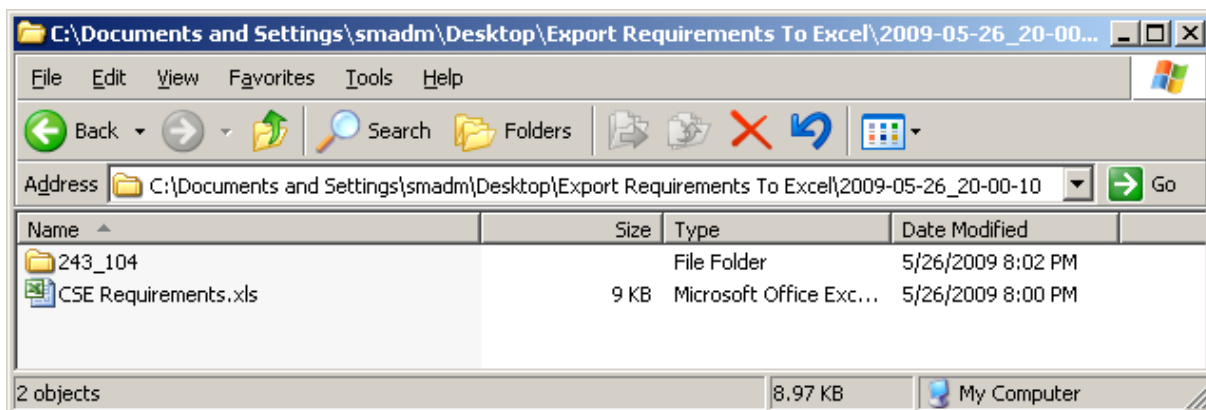


When the export is completed, the following window appears:

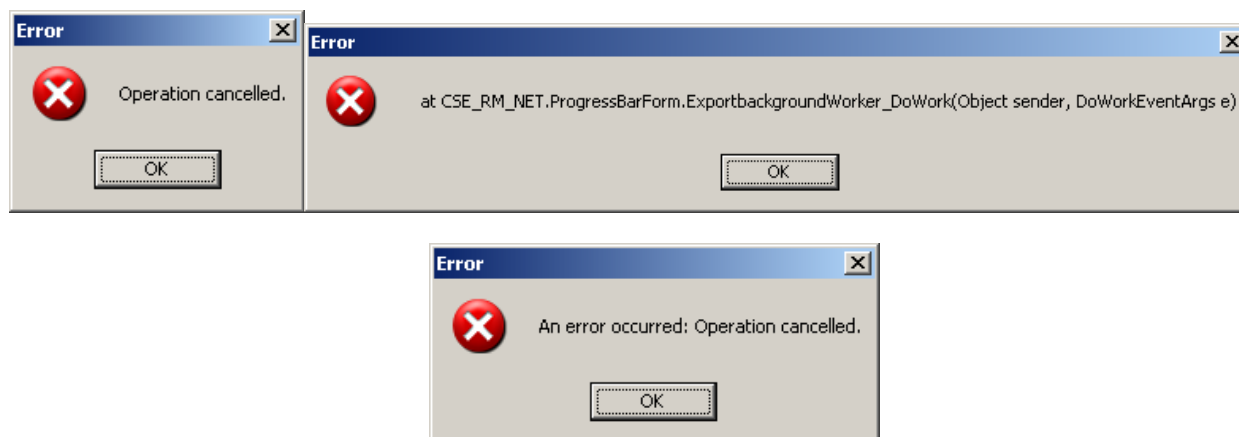


The Excel file contains the attributes of each Requirement. Rich Text content of the requirement is accessible with a link to a RTF file located under a Directory named <CLASS_ID>_<OBJECT_ID> of the Requirement:





If you abort the export, the following windows will appear:



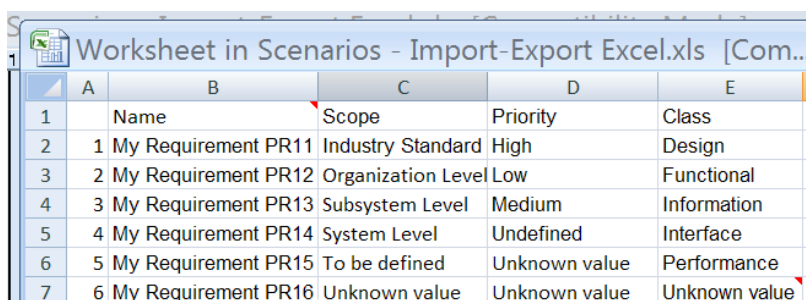
4.14. Requirements Import from Excel

4.14.1. Function description

This activity consists of creating new requirements from a MS Excel workbook. The expected input workbook must contain at least one worksheet. The worksheet is a matrix with the following specifications:

- First row is a heading row. It contains internal/display name option and column names.
- The first column contains the number of the row (1, 2, 3... n). The first empty cell of the first column is considered as the end of the matrix. Following rows/columns are ignored.
- Each column is an attribute of the “Primary Requirement” CSE class. If a heading is not an attribute of the class, it is ignored. If a heading is primary attribute, it is ignored (example “REVISION”, TDM_ID”, etc...).
- No heading is mandatory. Objects are created following this sequence:
 - Object is created,
 - Default values are applied,
 - Defined values are applied.
- No persistency/legacy is assumed. Each time a file is loaded, the entire rows are parsed and new requirement are created.

The cell “\$B\$1” contains the option of name to be used: SmarTeam “External Name” of the attributes. The values below the \$B\$1 cell are supposed to be the content of the name of the target class. If this attribute appears in another column, value is set by the last one.



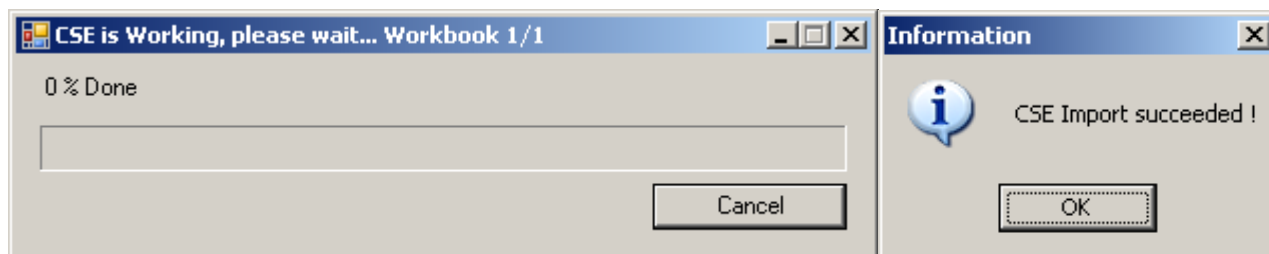
	A	B	C	D	E	F
1		Name	Scope	Priority	Class	M
2	1	My Requirement PR11	Industry Standard	High	Design	P
3	2	My Requirement PR12	Organization Level	Low	Functional	M
4	3	My Requirement PR13	Subsystem Level	Medium	Information	C
5	4	My Requirement PR14	System Level	Undefined	Interface	C
6	5	My Requirement PR15	To be defined	Unknown value	Performance	R
7	6	My Requirement PR16	Unknown value	Unknown value	Unknown value	F

4.14.1.1. Import Requirements

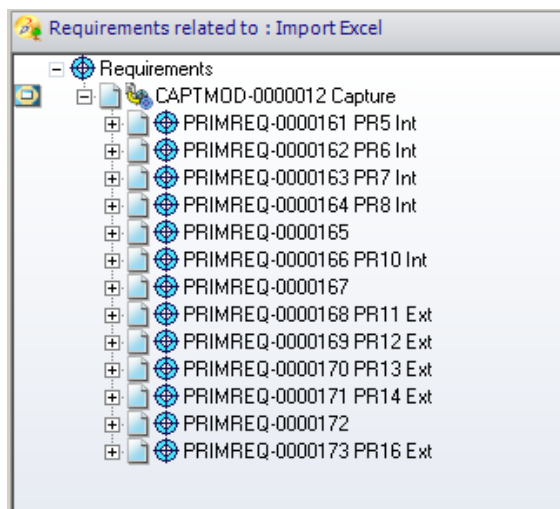
Select the project you want to import and select the User Defined Tools menu (part of contextual menu) and choose function “Import Requirements from Excel”.

A capture Module is created, if not exists, and the Primary Requirements are created with information provided by the Excel worksheet.

When the import is finished, the following window appears:



The Requirements are created under the Capture Module:



5. Appendix A – BPA provided data

5.1.1. Sample data

5.1.2. Templates

Notes

CSE is providing by default some report and matrix but you can freely customize your application. Refer to CSE Requirement Management Implementation guide documentation for further detail about customizing your application.



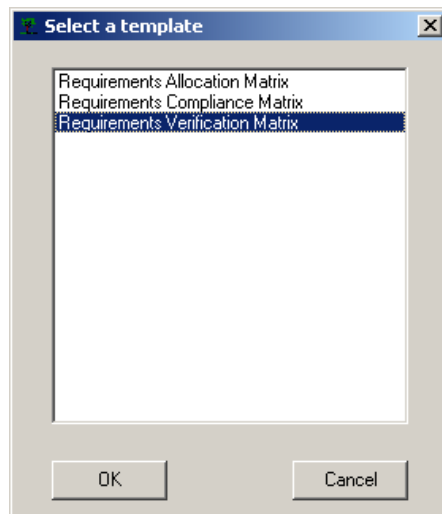
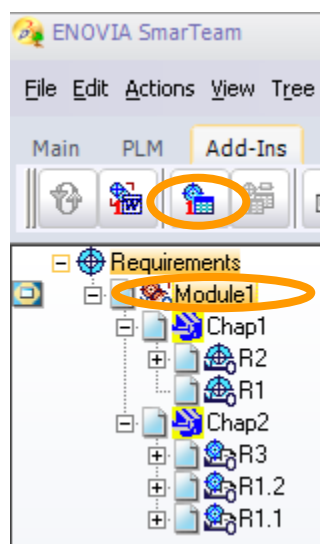
5.1.2.1. Requirements Verification Matrix (RVM)

The requirement verification matrix is providing in a compact form all the information related to the requirements list and decomposition. This matrix is required during the validation loop.

By default CSE provide the matrix with the following attributes, but you can completely customize this matrix:

The requirement verification matrix default attributes (Admin settings) :

-  ID
-  Requirement
-  Class
-  Value
-  Quality
-  Priority
-  Origin
-  Maturity stage
-  Owner
-  Linked requirements



From a selection in the requirements tree (i.e a Module1), you click on the “Requirement Matrix” icon, you select the template “Requirement Verification Matrix”, then, after click OK, you will get the resulting matrix

ID	Requirement	Class	Value	Quality	Priority	Origin	Maturity Stage	Owner	Linked requirements
PRIMREQ-0000019	Requirement R1	Functional		Default	High	External	Needs Review	joe	DERIVREQ-0000009 DERIVREQ-0000008
PRIMREQ-0000020	Requirement R2	Functional		Default	Medium	Regulation	Needs Review	joe	DERIVREQ-0000007
DERIVREQ-0000007	Requirement R3	Performance		Default	Low	Internal	Needs Review	joe	PRIMREQ-0000020
DERIVREQ-0000008	Requirement decomposition from R1	Information		Default	Low		Needs Review	joe	PRIMREQ-0000019
DERIVREQ-0000009	Requirement decomposition from R1	Functional		Default	High		Needs Review	joe	PRIMREQ-0000019

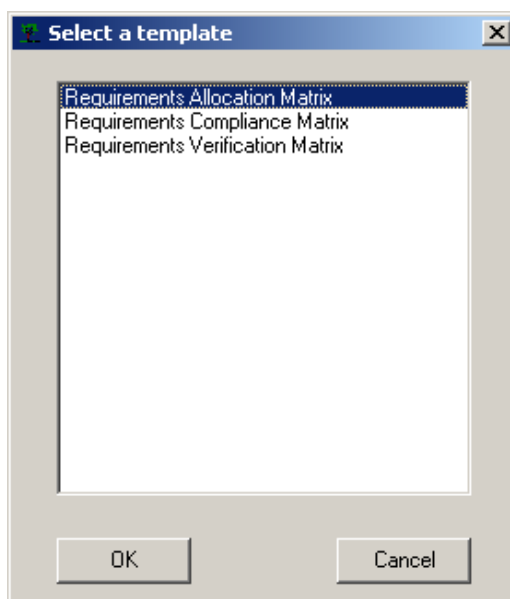
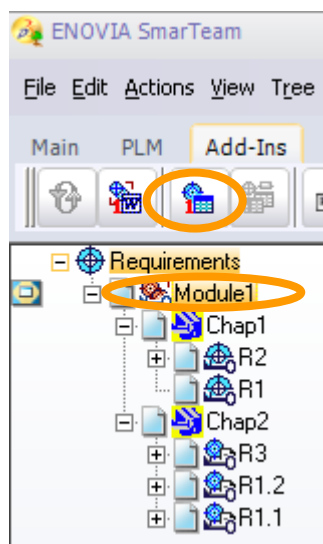


5.1.2.2. Requirements Allocation Matrix (RAM)

The requirement allocation matrix is providing with an overview of the requirement to function, requirement to system and function to system allocations. These allocations are represented here by a matrix. This publishing operation is using a company template for document formatting purpose.

The requirement allocation matrix default attributes (Admin settings) :

-  ID
-  Requirement
-  Quality
-  Priority
-  Scope
-  Linked Functions
-  Linked Systems



From a selection in the requirements tree (i.e a Module1), you click on the “Requirement Matrix” Icon, you select the template “Requirement Allocation Matrix”, then, after click OK, you will get the resulting matrix







ID	Requirement	Quality	Priority	Scope	Linked Functions	Linked Systems
PRIMREQ-0000019	Requirement R1	Default	High	Industry Standard	FUNC-0000007 FUNC-0000006	SYS-0000002
PRIMREQ-0000020	Requirement R2	Default	Medium	Subsystem Level	FUNC-0000008 FUNC-0000006	SYS-0000004 SYS-0000003
DERIVREQ-0000007	Requirement R3	Default	Low	Organization Level	FUNC-0000007	SYS-0000002
DERIVREQ-0000008	Requirement decomposition from R1	Default	Low	Industry Standard	FUNC-0000006	SYS-0000003
DERIVREQ-0000009	Requirement decomposition from R1	Default	High	Organization Level	FUNC-0000006	SYS-0000004 SYS-0000002

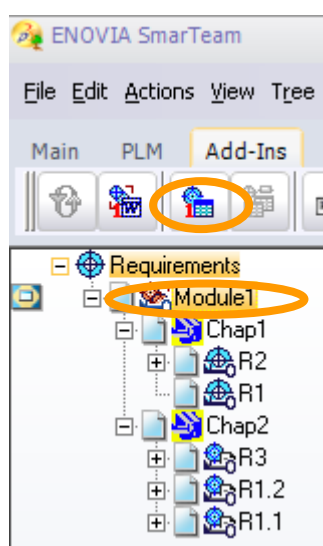


5.1.2.3. Requirements Compliance Matrix (RCM)

The requirement compliance matrix is providing with an overview of the requirement to test allocations. These allocations are represented here by a matrix. This publishing operation is using a company template for document formatting purpose.

The requirement compliance matrix default attributes (Admin settings) :

-  ID
-  Requirement
-  Quality
-  Priority
-  Scope
-  Linked Tests



From a selection in the requirements tree (i.e a Module1), you click on the "Requirement Matrix" Icon, you select the template "Requirement Compliance Matrix", then, after click OK, you will get the resulting

ID	Requirement	Quality	Priority	Scope	Linked Tests
PRIMREQ-0000019	Requirement R1	Default	High	Industry Standard	IVVQ-0000002
PRIMREQ-0000020	Requirement R2	Default	Medium	Subsystem Level	IVVQ-0000004 IVVQ-0000003
DERIVREQ-0000007	Requirement R3	Default	Low	Organization Level	IVVQ-0000004 IVVQ-0000002
DERIVREQ-0000008	Requirement decomposition from R1	Default	Low	Industry Standard	IVVQ-0000002
DERIVREQ-0000009	Requirement decomposition from R1	Default	High	Organization Level	IVVQ-0000004