SW Requirements Analysis

**Change History**

| **Version** | **Date** | **Change Description / Reason** | **Author** |
| --- | --- | --- | --- |
| 1.0 | 2017-12-08 | Initial version based on Hella Process (State Avenue)  Process Flow chart is updated.  Input and Output updated in each Tasks.  Attributes table and Traceability figure are added. Decision 1 merged in Task 4 and delete. | Hae-Min, Woo |
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# Purpose Description

## Purpose

The **SW Requirements Analysis** describes the process for the determination and documentation of the requirements of product-related SW.

## Main description

The inputs of the SW Requirements Analysis are the System Requirements Specification and the System Architecture Design. The main activities in this procedure are to filter the SW related requirements out of the system requirements specification and create new requirements based on design decisions from previous system architecture design phases.

## Result of Process

As a result of the successful implementation of this process:

* Analyzed System Requirements which were allocated to SW
* Bidirectional traceability from SW Requirements to System Requirements and System Architecture
* Reviewed SW Requirements Specification which is mature enough to start SW Design
* A check for possible ASIL decompositions was performed
* Review on safety relevant parts of the SW Requirements specification was performed.

The **SW Requirements Analysis** describes the process for the determination and documentation of the requirements of product-related SW. The task is to filter the SW related requirements out of the system requirements specification and create new requirements based on design decisions from previous system architecture design phases.

# Major Roles Acting in this Process

|  |  |
| --- | --- |
| **Role** | **Contribution and Responsibilities** |
| SW Project Manager | * Decide if SW Requirements Specification is mature enough to start SW Design |
| SW Analyst | * Analyze System Requirements and setup SW Requirements Specification * Identify SW Requirements and establish traceability * Review (and update) and ensure completeness of safety relevant parts of SW Requirements Specification * Review (and update) and ensure completeness of SW Requirements * Create and communicate new baseline |
| Safety Manager | * Supports review of work products |

# Process

## Process Input – Output Definition

The following process input is required:

|  |  |
| --- | --- |
| **Process input** | **From supplier** |
| System Requirements Specification | System Analyst |
| System Architecture Specification | System Architect |
| Technical Safety Concept | Safety Manager |

|  |  |
| --- | --- |
| **Process output** | **To customer** |
| SW Requirements Specification | SW Architect  SW Developer  SW Integration Tester  SW Tester |
| Communication Record | SW Quality Planner  Project Manager  Safety Manager |

## Introducing Aspects

This process covers the normative requirements of safety norm ISO 26262. In case of “non-ASIL” – Projects all work products with “safety” in their title and Task 3 shall be ignored.

## Process Flow Chart



In case of “non-ASIL” –Projects all work products with “safety” in their title and Task 3 shall be ignored.

### Task 1: Setup SW Requirements Specification

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Input | | SW Requirements Specification | | | | | |
| Output | | SW Requirements Specification (Prepared with attribute structure) | | | | | |
| D: |  | E: | SW Analyst | S: |  | I: |  |
| D = Decision | | E = Execution | | S = Support | | I = Information | |

**Objective**

The objective is to prepare the document “SW Requirements Specification”.

**Description**

The SW Analyst shall

* + Prepare SW requirements specification using a structure reflecting the needs of the project.  
    (This structure has to include necessary attributes like “status”, “verification criteria”, “release planned for implementation”. Structure and attributes have to reflect priorities, e.g. “priority of implementation”, “technical priority” and categories, e.g. “type [functional / non-functional]” or “criticality [A, B, C]”.)

Below table is mandatory attribute for SW Requirements Specification.

|  |  |
| --- | --- |
| **Attribute Name** | **Description** |
| Object Identifier | Created and managed by DOORS. It contains the absolute number and the defined prefix. |
| Object Text | The Object Text contains the text of the object. This may be a requirement, a description, etc. |
| H\_ChangeRequestReference | If the object has been changed due to a change request, this attribute is used to refer to this change request to ensure the traceability.  ***Note***: Additionally in the PCM-Tool (PTC-IM) a reference to the DOORS object ID is inserted. |
| H\_Implement | This attribute is set to “Yes” when the requirement is implemented. It could be used by the test team to identify requirements that can be tested. |
| H\_ObjectContent | Describes whether an object is to be considered to be a requirement or not. Useful for checking whether tests are defined for requirements. Some attributes only have a meaningful content for requirements. |
| H\_ObjectStatus | This attribute describes the status of the object concerning its workflow. If an object is not a requirement this attribute is set to the value NA.  Project progress can be deduced from this attribute in combination with other information. |
| H\_ReleasePlan | This attribute defines, to which releases a requirement is connected. This is also important for the test designer to set up a useful testing order and to elicit testing metrics. Variants of system should have their own release identifier. |
| H\_Responsible | Documents who is responsible for content of object.  It can be used to identify the contract person in case of questions or disagreements.  This is not automatically the person who made the change (which can be easily seen from DOORS history as long as the module is not baselined). |
| H\_SafetyClassification | This attribute is used by the project manager and the safety manager to document, which safety level (ASIL: Automotive Safety Integrity Level) the requirement has in terms of the functional safety (as defined by ISO26262). It documents the results of the functional safety analysis. The attribute has to be set only for Objects with H\_ObjectContent = Requirement. |
| H\_TestCriterion | This attribute is used to check if it is possible to setup. If a test is thinkable write it down in max. two sentences. If this is not possible the requirement is likely to be a source of trouble. Reject or rework it with customer until such a test is thinkable. |
| H\_TestLevel | This attribute defines on what level this requirement shall be tested. This is defined by test manager. It is used for reporting and metrics. |
| H\_TestStatus | This attribute contains the last valid test result for the requirement and is used for management reporting. |
| H\_ModuleClass | This attribute describe what module class is related to a requirement. |

Figure 1 Attribute for SW Requirements Specification (DOORS)

### Task 2: Document SW Requirements and establish traceability

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Input | | System Requirements Specification  System Architecture Specification  HW/SW Interface Specification  SW Requirements Specification (Prepared empty with structure)  Technical Safety Concept (in case of ASIL Projects) | | | | | |
| Output | | SW Requirements Specification | | | | | |
| D: |  | E: | SW Analyst | S: | System Analyst  Safety Manager  Test Manager | I: |  |
| D = Decision | | E = Execution | | S = Support | | I = Information | |

**Objective**

Objective of this task is to get all SW requirements completely, structured, free of contradictions and created along the quality requirements in the prepared document. The result describes the functional behavior and shall not restrict the technical realization of the functional behavior. The SW should be analyzed for side effects to other parts of the system and all open points are known and reported to the stakeholders.

**Description**

The SW Analyst

* + Identifies SW requirements needed to realize the system
  + Identifies additional SW requirements by analyzing known interfaces from other parts or from outside of the system (SW, Hardware, Mechanics, Electronics, e.g.)
  + Identifies additional sources of SW requirements (Laws, etc.)
  + Identifies SW requirements out of these additional sources
  + Creates the SW requirements in the SW Requirements Specification including linkage to their sources (bilateral traceability to all sources demanded) regarding defined quality criteria for requirements
  + Searches for possibilities of ASIL decomposition (together with Safety Manager) and report them to the Project Manager(\*)
  + Closes all gaps in SW requirement specifications

For any requirement he

* Ensures testability by creation of verification criteria
* Ensures bilateral traceability to System Requirements Specification and System Architecture Design
* Searches for contradictions between requirements and solves them
* Reports possible impact to cost, schedule and functionality if SW related customer requirements have to be altered to realize the system and supports project manager in analysis of the impact.
* Analyzes and communicate side effects via known interfaces to other parts of system or outside of the system (hardware, mechanics, electronics, other controllers e.g.)
* Analyzes and communicate impact of SW-requirements to operating environment
* Analyzes effects to application parameters (trigger update in case of necessary changes)

In addition he reports all remaining gaps or un-clarified SW requirements including depending risks to project management (e.g. via mail or phone). For handling risks the risk management procedure is to be followed.

If DOORS not use, Traceability Matrix should be created.

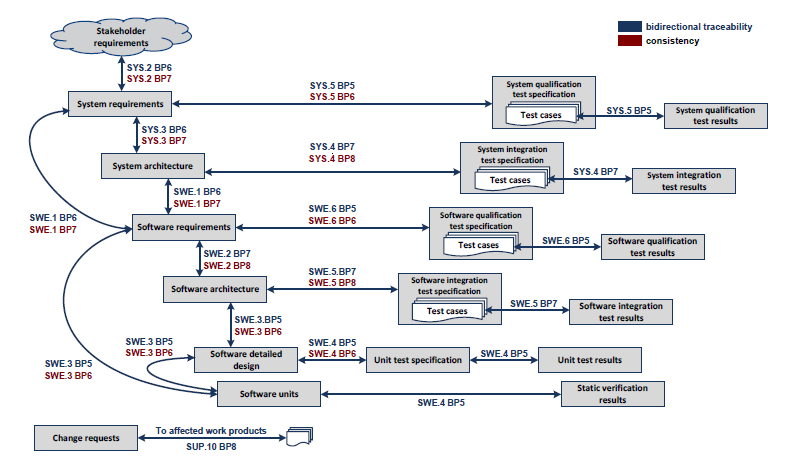


Figure 2 Bidirectional Traceability and Consistency [Ref. Automotive SPICE PAM 3.0]

### Task 3: Review (and update) and ensure completeness of safety relevant parts of SW Requirements Specification

This task is only for projects with ASIL classification.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Input | | Technical Safety Concept  SW Requirements Specification | | | | | |
| Output | | SW Requirements Specification (updated) | | | | | |
| D: |  | E: | SW Analyst | S: | Safety Manager | I: |  |
| D = Decision | | E = Execution | | S = Support | | I = Information | |

**Objective**

The consideration of Technical Safety Concept related requirements has to be ensured by review. Missing safety requirements will be implemented and marked as safety relevant during this task.

(***Remark***: The functional safety requirements from customer are created during task 2 and reviewed in task 4. This task is dedicated to ensure the completeness of safety requirements not derived from functional level in accordance with ISO 26262.)

**Description**

The SW Analyst shall trigger the review with Safety Manager to

* Ensure the completeness of safety relevant SW requirements to implement the Safety Concept
* Ensure the complete analysis of safety relevant requirements derived from Safety Concept considering
  + System and Hardware configurations
  + Application parameter values
  + Hardware/SW interface specification
  + Timing constraints
  + External interfaces
  + Operation modes with impact to SW
  + Ensure the bilateral traceability to Technical Safety Concept
  + Ensure that all safety relevant requirements are marked as such
  + Close all gaps in Technical Safety Concept dependent parts of SW Requirement Specification
  + Report all remaining gaps, unfixed safety related SW requirements and uncovered parts of Technical Safety Concept inclusive dependent risks to project management

### Task 4: Review (and update) and ensure completeness of SW Requirements

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Input | | SW Requirements Specification | | | | | |
| Output | | Review Checklist SW Requirements Specification  Review Record | | | | | |
| D: | SW Project Manager | E: | SW Analyst | S: | SW Architect  SW Tester  Systems Analyst  Safety Manager  SW Quality Planner | I: |  |
| D = Decision | | E = Execution | | S = Support | | I = Information | |

**Objective**

The objective of this review is the quality improvement of the requirements and the SW Requirements Specification.

The objective is to get a decision by the SW Project Manager whether the SW requirements specification is mature enough to start the SW Design.

**Description**

The SW Analyst shall trigger the review with stakeholders to

* Ensure the completeness of SW requirements to meet the system requirements and customer needs (this may include functional safety requirements)
* Ensure the completed analysis of SW requirements including creation of verification criteria
* Close all gaps in SW requirement specifications
* Report all remaining gaps or unfixed SW requirements inclusive dependent risks to project management
* Supply SW Project Manager with reports and review protocols
* Trigger decision whether the SW Requirements Specification is mature enough to start the SW Design or will be reworked

### Task 5: Create and communicate new baseline

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Input | | SW Requirements Specification | | | | | |
| Output | | SW Requirements Specification (baselined)  Communication Record (e.g. mail or meeting minutes) | | | | | |
| D: |  | E: | SW Analyst | S: | Configuration Manager | I: | All Stakeholders |
| D = Decision | | E = Execution | | S = Support | | I = Information | |

**Objective**

The objective is to create a baseline of all documents updated or created during this process.

**Description**

The SW Analyst shall

* Supply Configuration Manager with reviewed SW Requirements Specification and review protocols
* Performed baseline creation with CM Officer.
* Communicate the new baseline to all stakeholders and document communication

# Changes, References, Appendix, Terms

## References

|  |  |  |
| --- | --- | --- |
| **Category** | **Document Name** | **Document Number** |
| Process | Requirements Analysis of Product-related SW | AD-PE1-1-04 |

## Template

|  |  |  |
| --- | --- | --- |
| **Category** | **Document Name** | **Document Number** |
| Template | SW Requirements Specification | 8365 |
| Template | Review Checklist SW Requirements Specification | 8347 |

## Abbreviation

|  |  |
| --- | --- |
| **Abbreviation** | **Description** |
| **SW PM** | SW Project Manager |
| **PM** | Project Manger |
| **SW** | SW |
| **QPS** | SW Quality Planner |
| **SYS RS** | System Requirements Specification |
| **SYS AS** | System Architecture Specification |
| **SW RS** | SW Requirements Specification |
| **TSC** | Technical Safety Concept |
| **HSI** | Hardware SW Interface Specification |