IBM Software Group

IBM Rational Tool Qualification Kits

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AGENDA

- IBM Rational Tool Qualification Overview
- IBM Rational DOORS Kit for ISO 26262 and IEC 61508
- IBM Rational Rhapsody Kit for ISO 26262 and IEC 61508
- Tool Qualification Kit for Test RealTime
- ISO 26262 Process Templates

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IBM Rational Approach to Tool Qualification

Lessen the costs to produce certifiable or compliant products by providing:

- Artifacts that can be used for multiple industries (Auto, A&D, Medical, Nuclear, etc).
- Services to help customers customize or create additional tool qualification assets
- Templates and other artifacts to jumpstart project deployment and tool qualification efforts
- Lifecycle and Design Automation that matters

IBM Rational Approach to Tool Qualification

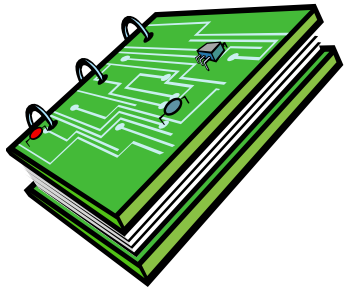
Providing pieces to simply the compliance/qualification puzzle

Support Processes

Validation Test Suites

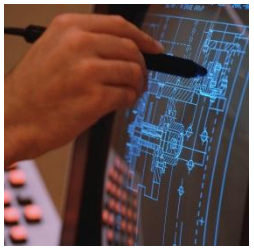
Independent Process Audits

Guidance on how to safely use the tool(s)



Tool Architecture Templates

Process templates with workflows, roles, required artifacts, process and tool guidance



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The IBM Rational DOORS Kit for ISO 26262 and IEC 61508

- Released as part of DOORS 9.5 on November 28, 2012
- Applicable to DOORS 9.4, 9.4.0.1, and DOORS 9.5 (Not DOORS NG at this time)
- Available for download as part of the DOORS 9.5 via Passport Advantage

Artifact	Description
TÜV SÜD certificate for DOORS for ISO 26262 and IEC 61508	PDF image of the issued certificate
TÜV SÜD report to the certificate	Report for the TÜV SÜD Certificate for Rational DOORS for ISO 26262 and IEC 61508
Rational DOORS Safety Manual	Describes best practices in using DOORS for safety related projects. These recommendations are an integral part of the certificate.
DOORS ISO 26262 Template	DOORS project archive that contains includes basic modules and attributes for capturing requirements and safety information
Intended Use Validation Suite	DOORS project with a set of requirements traced to features, test cases and tests that can be performed in customer environments to document and verify specific uses of DOORS .

Generic TUV Certificate

Users are responsible for verifying that their tool usage complies with the scope of the certificate and executing the tool qualification processes per the standard they are required to comply with

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

TÜV SÜD Product Service

CERTIFICATE

No. Z10 12 11 82971 001

Holder of Certificate: **IBM Corporation**
Buchan House
21 St Andrew Square
Edinburgh
EH2 1AY
UNITED KINGDOM

Factory(ies): 82971

Certification Mark:

Product: Software Tool for Safety Related Development

Model(s): IBM Rational DOORS

Parameters: IBM Rational DOORS is fit for purpose for developing safety related software according to IEC 61508 and/or ISO 26262.
The report no. IE77001aC is a mandatory part of this certificate.

Tested according to: ISO 26262:2011
IEC 61508-3:2010
IEC 61508-4:2010

The product was tested on a voluntary basis and complies with the essential requirements. The certification mark shown above can be affixed on the product. It is not permitted to alter the certification mark in any way. In addition the certification holder must not transfer the certificate to third parties. See also notes overleaf.

Test report no.: IE77001aC

Date, 2012-11-20

(Andreas Bärwald)

404648

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How customers can rely on these artifacts for tool qualification

Tool Qualification Method	Applicability of the TÜV SÜD Certificate and related assets
1a: Increased confidence from use in accordance with 11.4.7	TÜV SÜD has evaluated the customer information and bug tracking of IBM Rational which contributes to an increased confidence because it helps with systematically collecting data and acquiring errors over a large number of customers and projects. **The applicable requirements of the qualification method "Increased confidence from use" (ISO 26262, part 8, 11.4.7), were assessed successfully. Tool users can use this result as additional in-formation to substantiate their own argument "Increased confidence from use".**
1b: Evaluation of the tool development process in accordance with 11.4.8	The TÜV SÜD has evaluated the DOORS development process according to an appropriate standard based on the relevant portions of the ISO 26262:2011 standard. **The qualification method "Evaluation of the tool development process" (ISO 26262, part 8, 11.4.8), was performed successfully. It can be applied without any restrictions. In addition, IBM Rational holds an ISO 9001 certificate for the DOORS development process as well.**
1c: Validation of the software tool in accordance with 11.4.9	The TÜV SÜD has analyzed the validation suite that is used by IBM Rationale for DOORS relative to the usage of features described in the DOORS Safety Manual. It is the **responsibility of the customer to check if the described conditions of use and the used features match with the descriptions in the safety manual**. Any features not described in the safety manual are not covered by the certificate and need extra measures by the customer (e.g. executing their own validation for those features). In addition, IBM Rational is able to provide a **DOORS Intended Use Validation test suite as a basis for customers that desire to run DOORS Validation Tests using DOORS differently than described in the safety manual** and to ensure that all features work like intended in their environment. This test suite is not covered by the certificate itself but may be used to enforce the argument for 1c.
1d: Development in accordance with a safety standard	This argument is not applicable, since DOORS was not developed as a safety critical development item according to a safety standard.

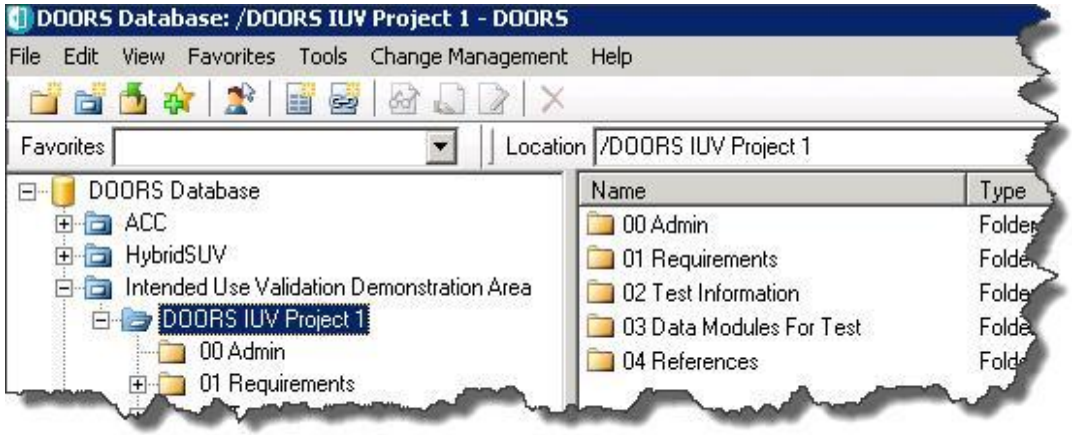
DOORS Safety Manual

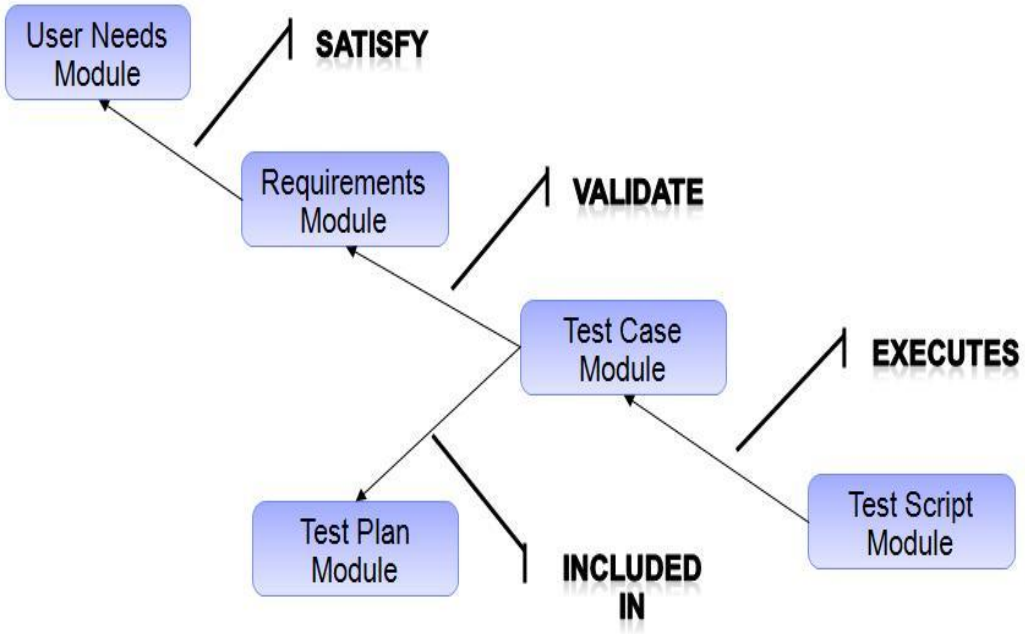
- Provides guidance on installation, administration and usage
- Defines usage at feature level to easily adapt it to numerous use cases
- Defines potential errors such as data corruption from disk error and provides recommended usage to detect or prevent the error
- Each feature analyzed to provide a generic confidence level for Tool error detection (TD) and subsequent tool confidence level (TCL)

Contents

DOORS Intended Use Validation Test Suite

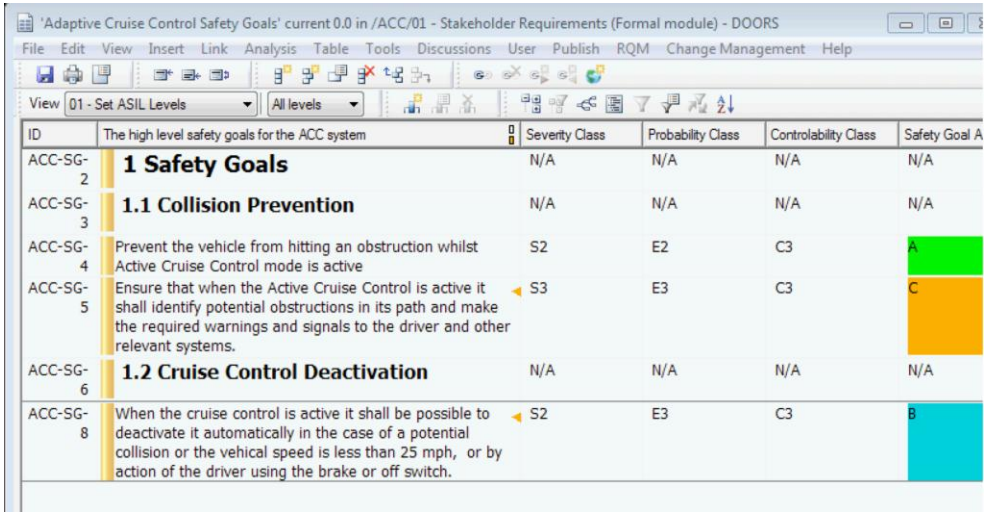
- DOORS project Archive
- Populated with common usage models
- Easy to modify and extend to fit customer specific user scenarios
- Framework for performing validation testing as needed to help qualify DOORS usage
- Supplements TUV SUD certificate and related artifacts
- Leverages manual tests to execute and capture test results
- IBM can provide services to customize and execute in our environment

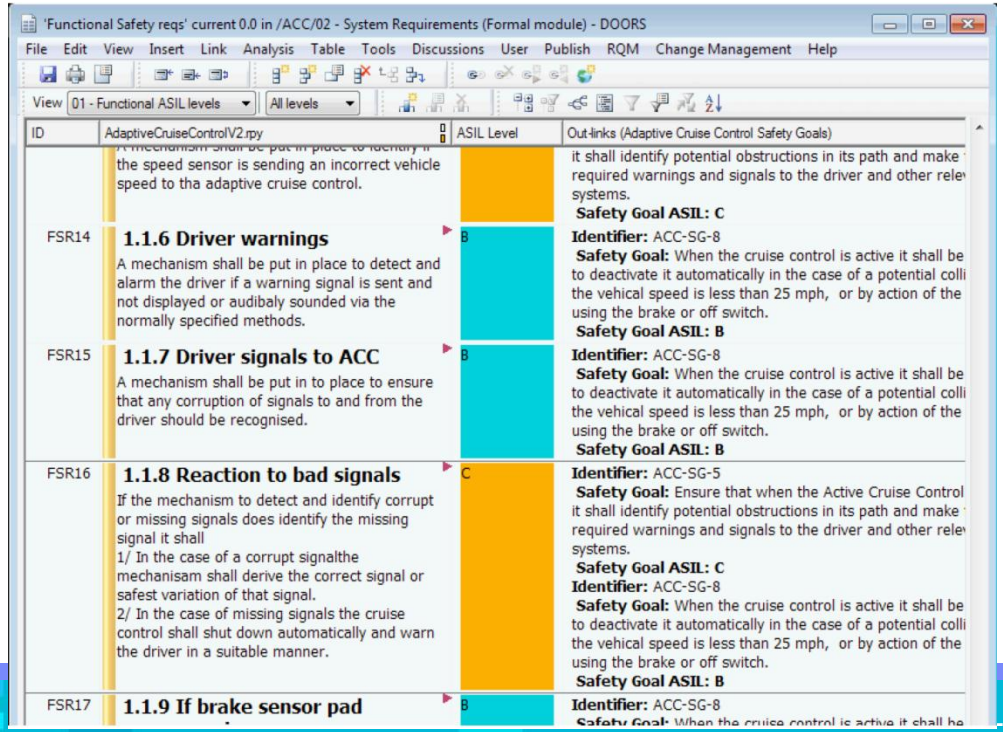




DOORS Template for ISO 26262

- Capture Severity, Probability and Controllability attributes
- Automatically determines ASIL
  - Working on matching these attributes to attributes in Rhapsody
- Developing requirements module structure to capture relationships between
  - Stakeholder (Item Definition) Requirements
  - Functional Safety Requirements
  - Technical Safety Requirements
  - System Safety Requirements
  - HW and SW safety requirements
- Automatic propagation through Safety Requirement Hierarchy of ASIL
- Delivered as a DOORS project archive





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Rhapsody Kit for ISO 26262 and IEC 61508

Similar Kit for DO-178B/C

- Overview Doc: describes the contents of the Rhapsody kit
- Rhapsody Reference workflow : provides an exemplary workflow for modelling, code generation and verification in safety critical
- Rhapsody TestConductor Add On Workflow: describes testing activities and objectives
- Rhapsody TestConductor Safety Manual: provides additional information for using TestConductor in safety related applications
- TÜV SÜD Certificate for Rhapsody TestConductor Add On
- TÜV SÜD Report on Certificate for ISO 26262 and IEC 61508
- Rhapsody TestConductor Add On Validation Suite: separately available test suite for Rhapsody TestConductor to help in qualification efforts
- Kits for the SXF (C++) and SMXF (C) frameworks

CERTIFICATE

No. Z10 12 07 81878 001

Holder of Certificate: International Business Machines Corp.
5 Technology Park Dr.
Westford MA 01886
USA

Factory(ies): 73219

Certification Mark:

Product: Software Tool for Safety Related Development

Model(s): IBM Rational Rhapsody Tes/Conductor Add On

Parameters:

The model-based verification tool is classified as T2 offline support tool according to IEC 61508-4. It is qualified to be applied in safety related software development for all SIL levels according to IEC 61508, and for all ASIL-Levels according to ISO 26262.

The report IW84460C is a mandatory part of this certificate.

Tested according to: IEC 61508-3:2010, ISO 26262-8:2011

The product was tested on a voluntary basis and complies with the essential requirements. The certification mark shown above can be affixed on the product. It is not permitted to alter the certification mark in any way. In addition the certification holder must not transfer the certificate to third parties. See also notes overleaf.

Test report no.: IW84460C

Date, 2012-09-13 (Matthias Rameil)

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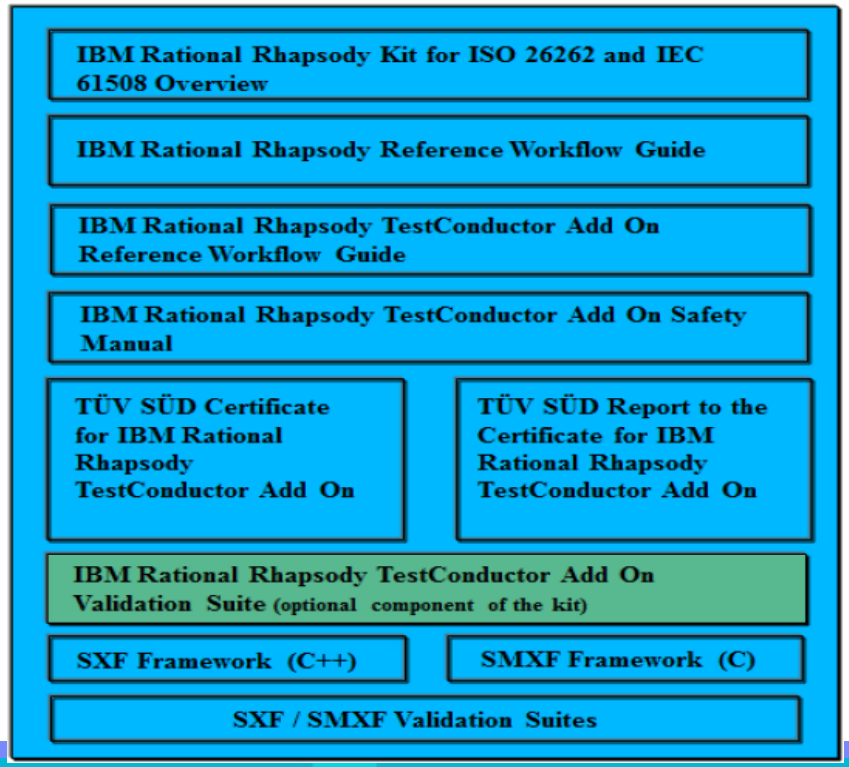

IBM Rational Rhapsody Kit for ISO 26262 and IEC 61508

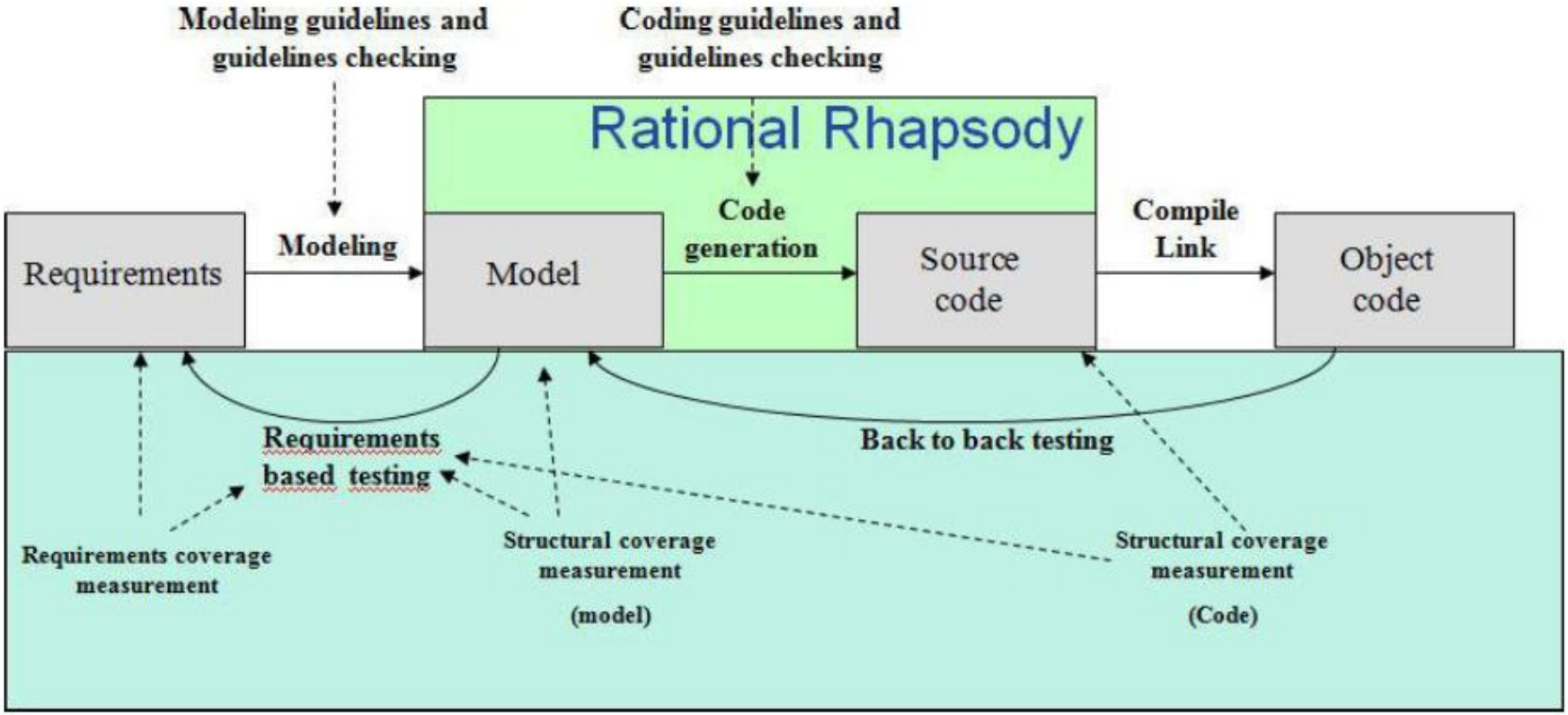

Figure 1: Activities of the IBM Rational Rhapsody Reference Workflow

Describe approach to workflow…using mechanisms such as Back to back testing, Reqs. Based Testing to achieve TD1 for code generation through process and qualified testing capability

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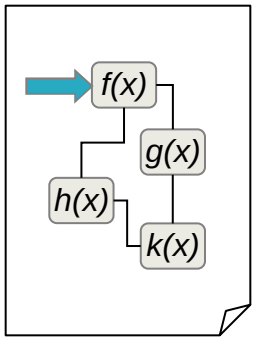
Rational Test RealTime

Cross-compilers

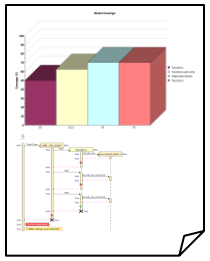


Source Code
C/C++
Ada[1], Java[2]

Rational Test RealTime

- Test Edition Environment
- Generate Test Harness (C, C++, Ada, Java)
- Generate Stubs
- Build Executable Test Harness
- Execute Test on Target Environments
- Generate Test Results

Test Results



Code Coverage
Memory
Performance
Trace Analysis

Microcontrollers (RTOS)
Emulators / Simulators

Qualification kit for the Component Testing and Code Coverage features for C and Ada languages only

(1) Ada 83 & 95
(2) Java 1.4 J2SE & J2ME

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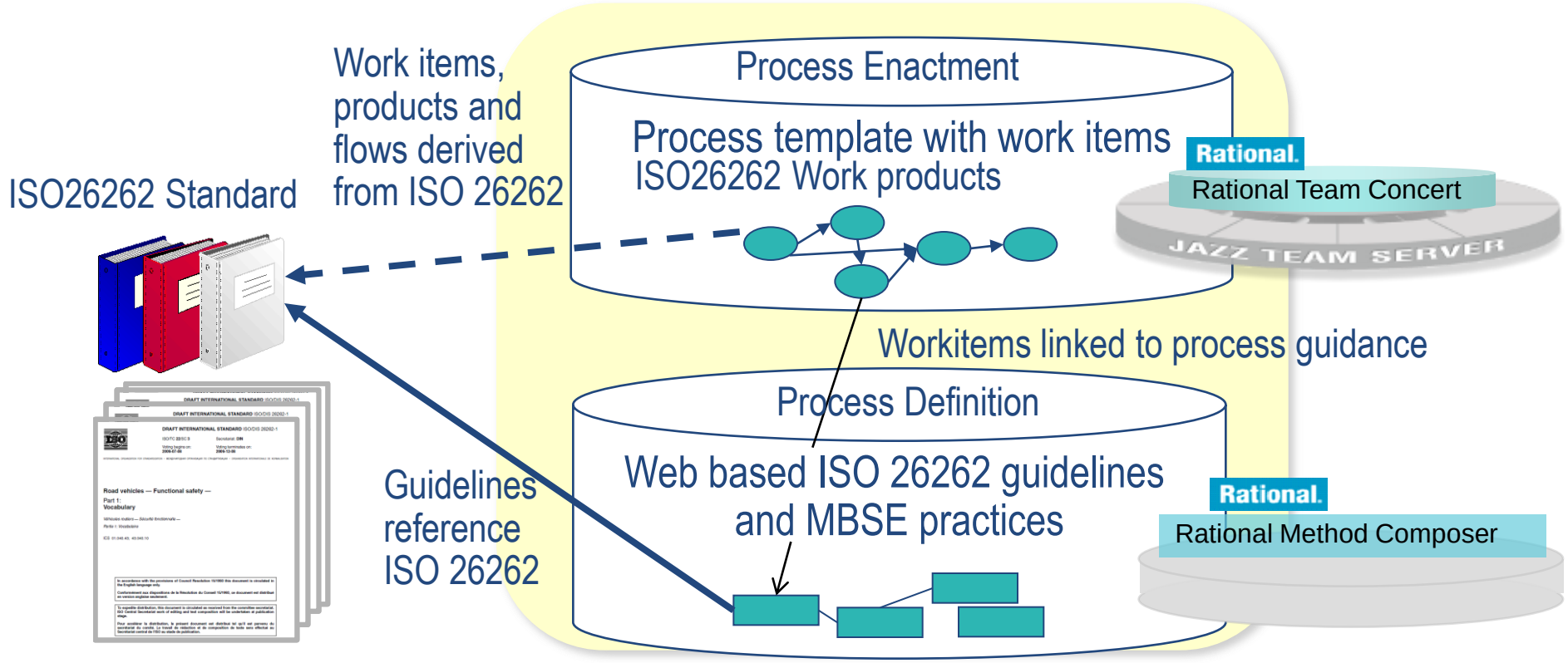
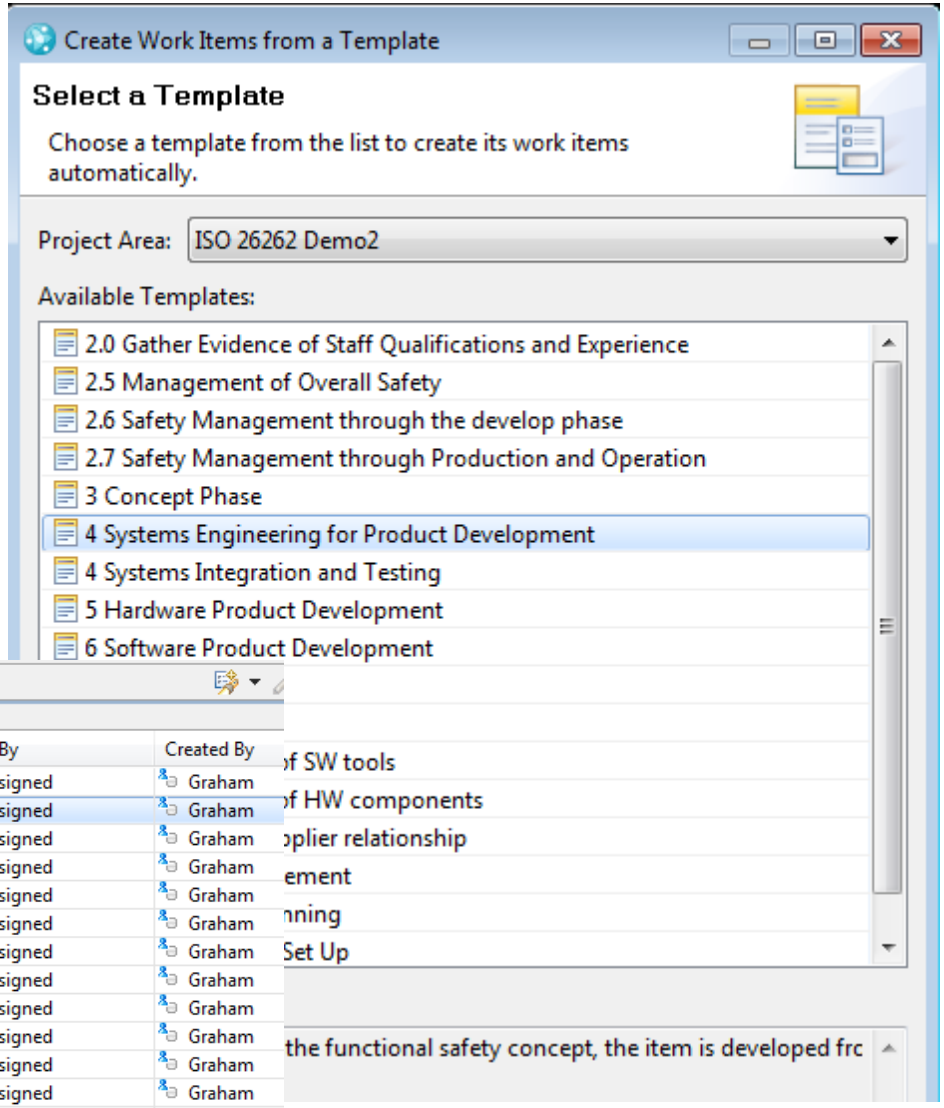
Out-of-the-box ISO 26262 Project Workflows

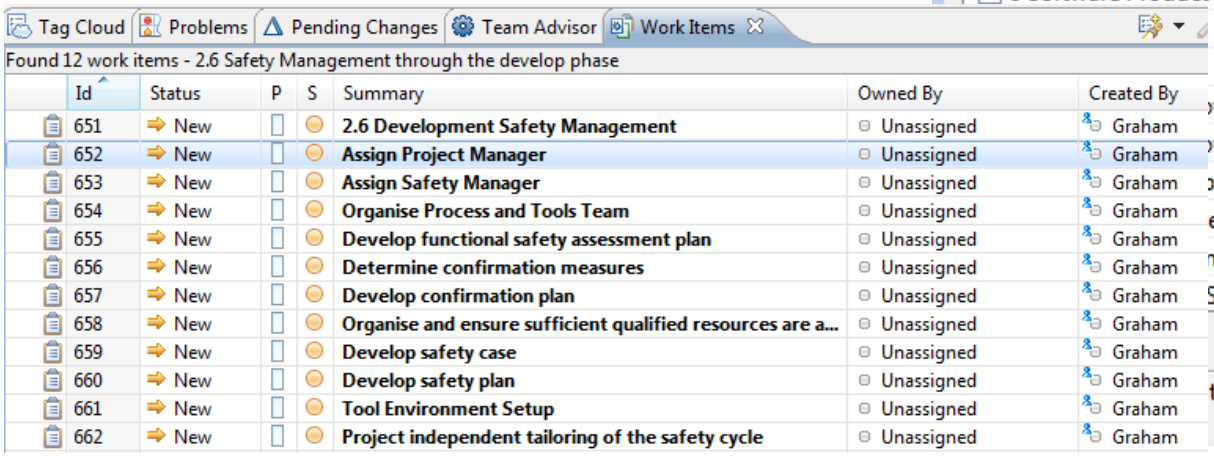
- Supports all core processes and work products defined in the standard
- Process template implemented in Rational Team Concert
- Guidance and practices implemented in Rational Method Composer



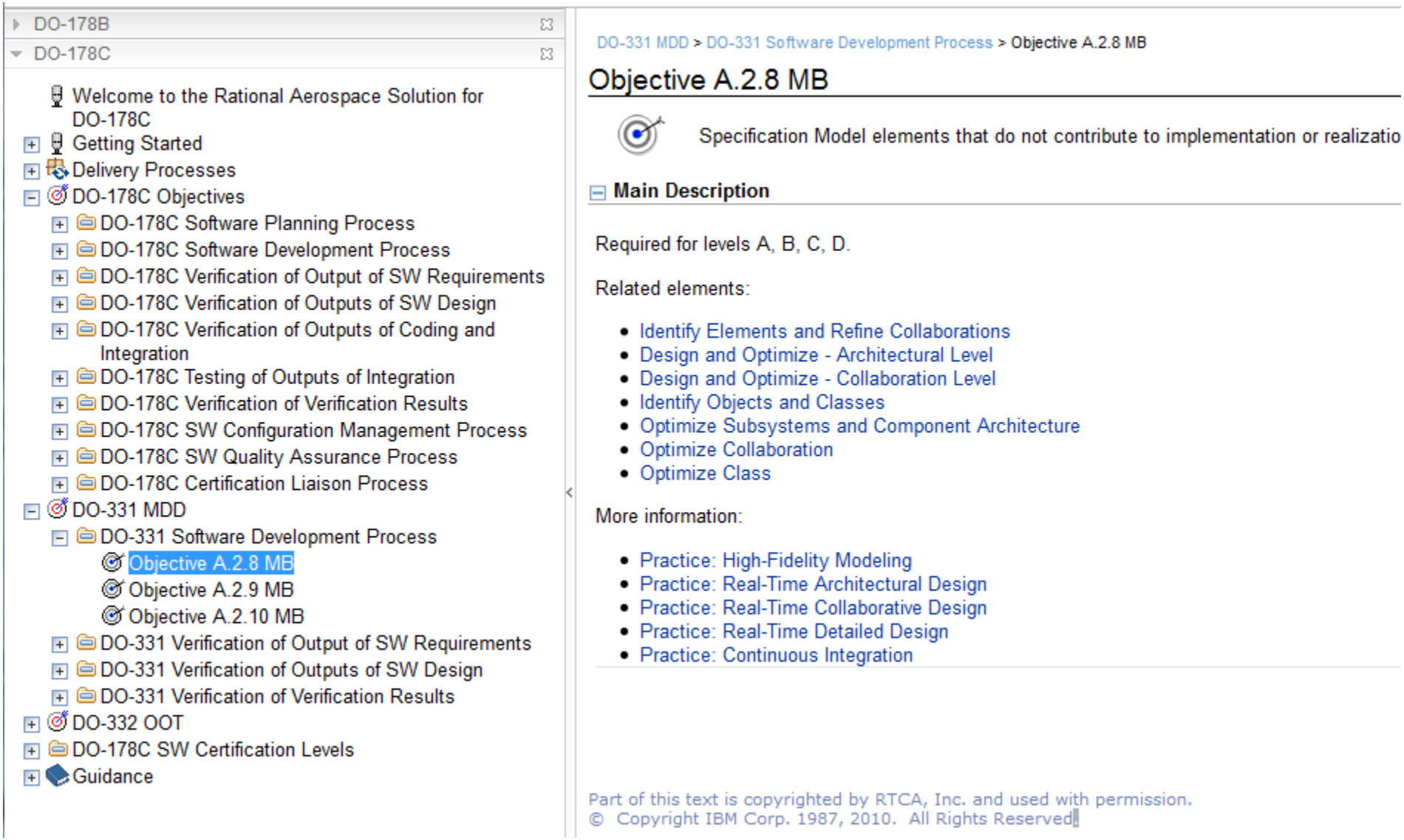
ISO 26262 work item templates

- Work item templates are modularised , it covers
  - Separate safety management section
  - Main concept phases
  - Seperation of production and operation activities
  - Aspects of supporting processes





Out-of-the-box Process Mappings to DO-178B/C Objectives



Out-of-the-box Process Mappings to DO-178C Objectives

DO-178B Objectives > DO-178B Software Planning Process > Objective A.1.5

Objective A.1.5

Software development standards are defined.

Main Description

The required outputs are:

- Software Requirements Standards
- Software Design Standards
- Software Code Standards

Required for levels A, B, C.

Related elements:

- Plan Requirements Management Strategy
- Requirements Management Process Description
- Checklists:
  - Platform Independent Model
  - PIM Review
  - Platform Specific Model
  - Scenario
- Guidelines:
  - Coding Standard
  - Design Constraints
  - Naming Conventions
  - Source Code
- SW Requirements Standard, SW Design Standard, SW Coding Standard

More information:

- Practice: Requirements Management
- Practice: High-Fidelity Modeling
- Practice: Real-Time Architectural Design
- Practice: Real-Time Collaborative Design
- Practice: Real-Time Detailed Design

DO-178B Objectives > DO-178B Verification of Outputs of Coding and Integration > Objective A.5.5

Objective A.5.5

Source code is traceable to low-level requirements.

Main Description

Traceability of a few source code statements per low-level requirements is required.

This is required for levels A, B, C.

Related elements:

- Translate and Validate - Architecture Level
- Translate and Validate - Collaboration Level
- Translate and Validate - Detailed Level
- Test Iteration [Template]
- Test Findings
- Test Evaluation Summary
- Traceability Record
- Requirements Traceability

More information:

- Practice: Model-Based Testing
- Practice: Independent Testing
- Practice: Requirements Management
- Practice: Elaborate Draft System Requirements Specification

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