AeroSpace and Defence
Industries Association of Europe

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Presentation of a test case for requirement management exchange based on ISO STEP AP 242 ed1 XML

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Overview of the use case for exchange of requirements sets between OEM and RSP

Use Case 1: Exchange process of requirements set between Original Equipment Manufacturers and Risk Sharing Partners

Minor comment : To be updated

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Requirement Management Interoperability

Description of scenario

Name – Exchange process of requirements set between OEM and RSP.

Problems and needs

The exchange and use of requirements between people within the same enterprise or in the frame of extended enterprises is quite complex because information to export could be numerous and various. Indeed, requirements are generally stored in several modules of the IBM Rational DOORS tool. Each module represents a table containing a set of requirements (lines) defined through different columns (e.g. Requirement Status, statement, rationale, etc.). Therefore, to export a specific set of requirements' attributes for a dedicated purpose to one or several stakeholders, one needs a mean supporting all the possible combinations. Moreover, if the possible values of some attributes are clearly defined, for some of them, the value remains as free text. This is the case of the requirement statement that states an expected behaviour or global performance of the product under consideration. This kind of value is not enough structured to be useful consumed by designers through their own business tools.

In fact, data representation and exchange of requirements are not well standardized even if some datamodels of requirements start to be properly defined. This situation drives difficulties to ensure smooth exchanges of information between different tools and requires developing adapters for retrieving and using the right data.

The lack of tool interoperability for the exchange and management of requirements still exists and justify we address this issue. Within this business case, specific attributes of requirements set are extracted from a requirement management tool to be exchanged from a main actor (this main actor might represent the OEM or organization tasked with specifying and delivering a system) to a second actor (this second actor might represent a risk sharing partner – RSP - or a subcontractor that must interpret the system requirements and manage their own supply chains). The second actor should reply with information regarding the interpretation and consumption of requirements. The first actor then will manage its requirements with regard to the answers given by the second actor.

Context of use case (global overview)

A company (customer – OEM[1]) wants to exchange (parts of) its Customer Requirements Specifications (CRS) with one or more other companies (supplier - RSP[2]).
After a series of exchanges of requirements data in specifications (SysRS[3]) from the customer to the suppliers and vice versa, the customer has his CRS (with comments from the suppliers), the various SysRSs from the various suppliers (with the comments from the customer) and the links between the requirements data in the CRS to the requirements data in the various SysRS in his RM-Tool-Database.

Note: this present use case partially covers the global overview of the context of exchange of information between OEM and RSP.

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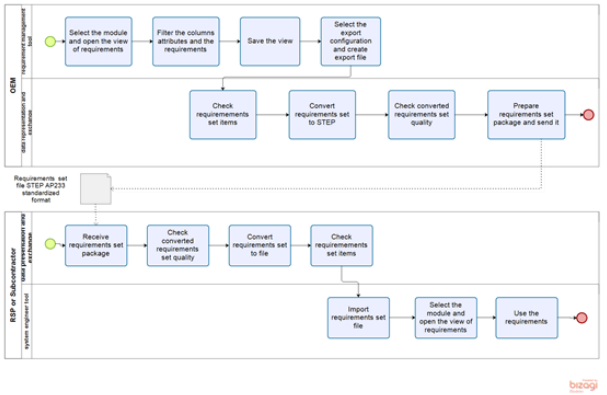
Requirement Management Interoperability

Use case summary

Scope	The exchange of the requirements data
Level	High Summary
Preconditions	The two parties have a contract in place. The two parties have a RM-Tool installed (or at least are able to emulate the functionality of state of-the-art RM-Tools) with STEP AP233 import/export extension.
Success End Condition	The CRS with comments and information of suppliers with Relations is defined
Failed End Condition	No CRS is in the supplier RM-Tool-Database.
Primary Actor	The Customer
Trigger	The Customer exports his CRS and sends it to the supplier

Process diagram



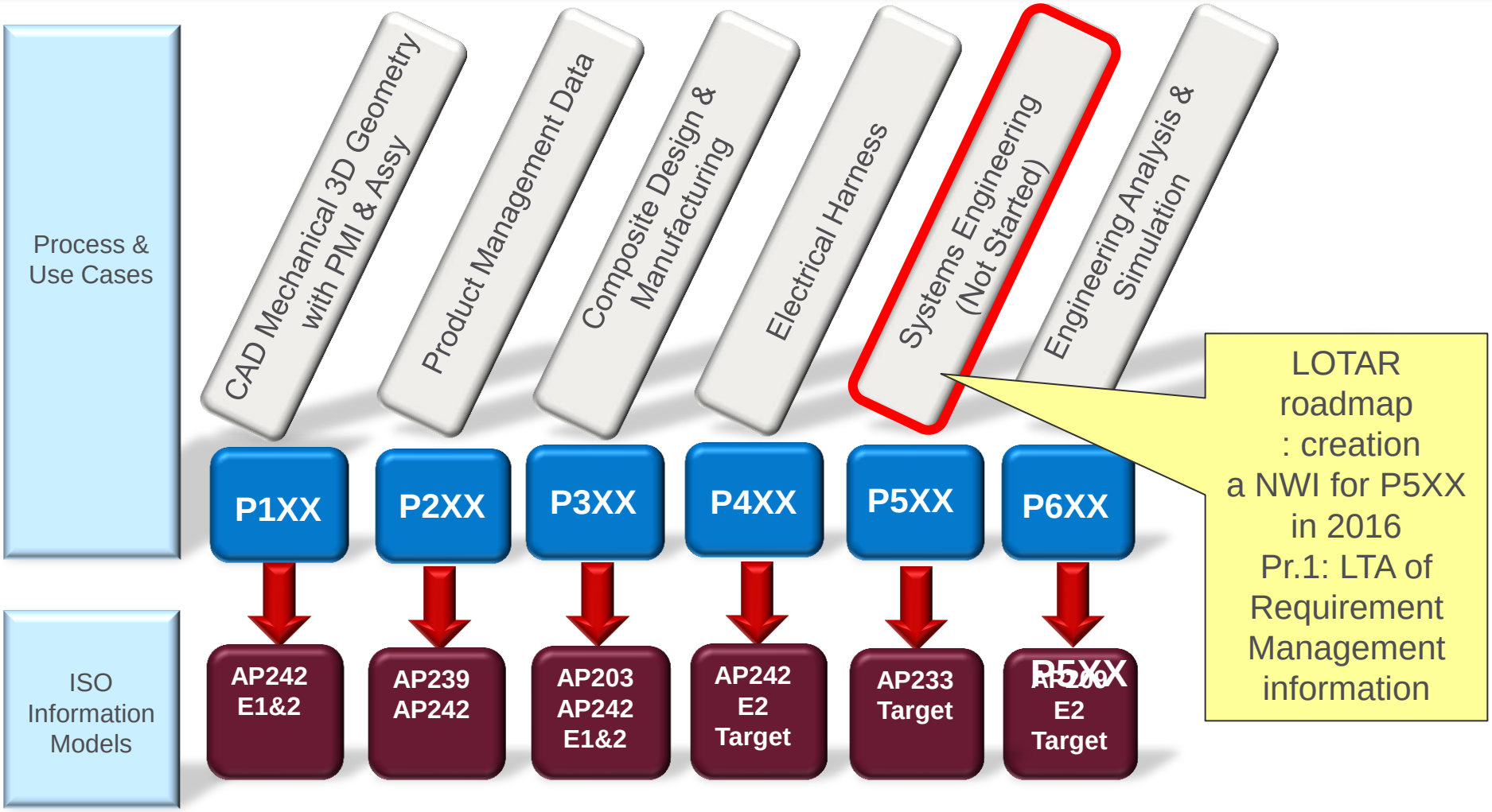
Scenario initiation

Request to exchange a set of requirements between two the OEM and RSP. Note: the actors use applications allowing exchange of information through nested STEP AP233 files.

Sequence of events within activity

Select the module and open the view of requirements: the System Engineer through its RM tool selects the requirements module and opens the view he wants to export.

NAS / EN 9300 Standards (5) year vision



Roadmap for development of LOTAR parts for Systems Engineering & main interdependancies

Draft Oct. 2015

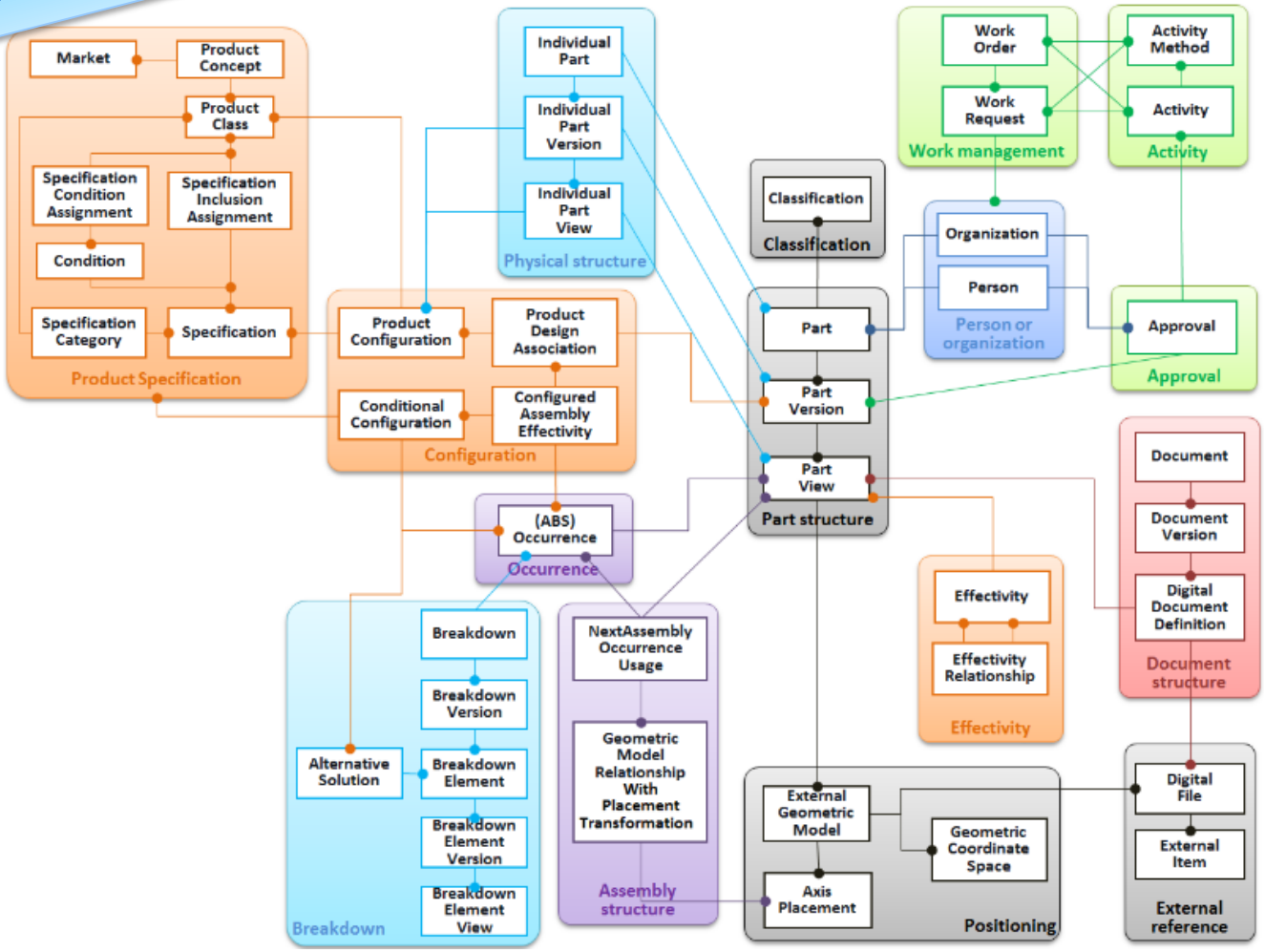
5 years roadmap for LTA&R of Systems Engineering				2016	2017	2018	2019	2020
LOTAR	Systems Eng.	P500	Fundamental concepts		→	→	→ Dev. E1	
LOTAR	Systems Eng.	P510 V1	Requirement managment.		→	→	→ Dev. E1	
LOTAR	Systems Eng.	P520	To be defined					
Data model	Systems Eng.		STEP AP242 ed1 and +		ed1 IS	ed2 IS	ed2 IS	ed2 IS
Data model	Systems Eng.		STEP AP239 ed3			ed3 DIS?	ed3 IS	ed3 IS
Data model	Systems Eng.		STEP AP233 ed2?					
Impl. Forum	PDM IF (Req. Mngt)?		Test Rounds AP242 ed1 and +		ed1 IS	ed1 IS	ed2 IS	ed2 IS
Impl. Forum	PDM IF (Req. Mngt)?		Test Rounds AP239 ed3			ed3 DIS	ed3 IS	ed3 IS

- Plan of support / contributions to the PDM IF, for requirement management in order that the PDM IF:
  - organizes test rounds based on LOTAR use cases
  - Develop recommended practices for Requirement management managed in configuration, related with product structure

- Plan of support of final Requirement Management harmonization between STEP AP 242 ed2 and STEP AP 239 ed3
- Plan of support of development of STEP AP 233 ed2?

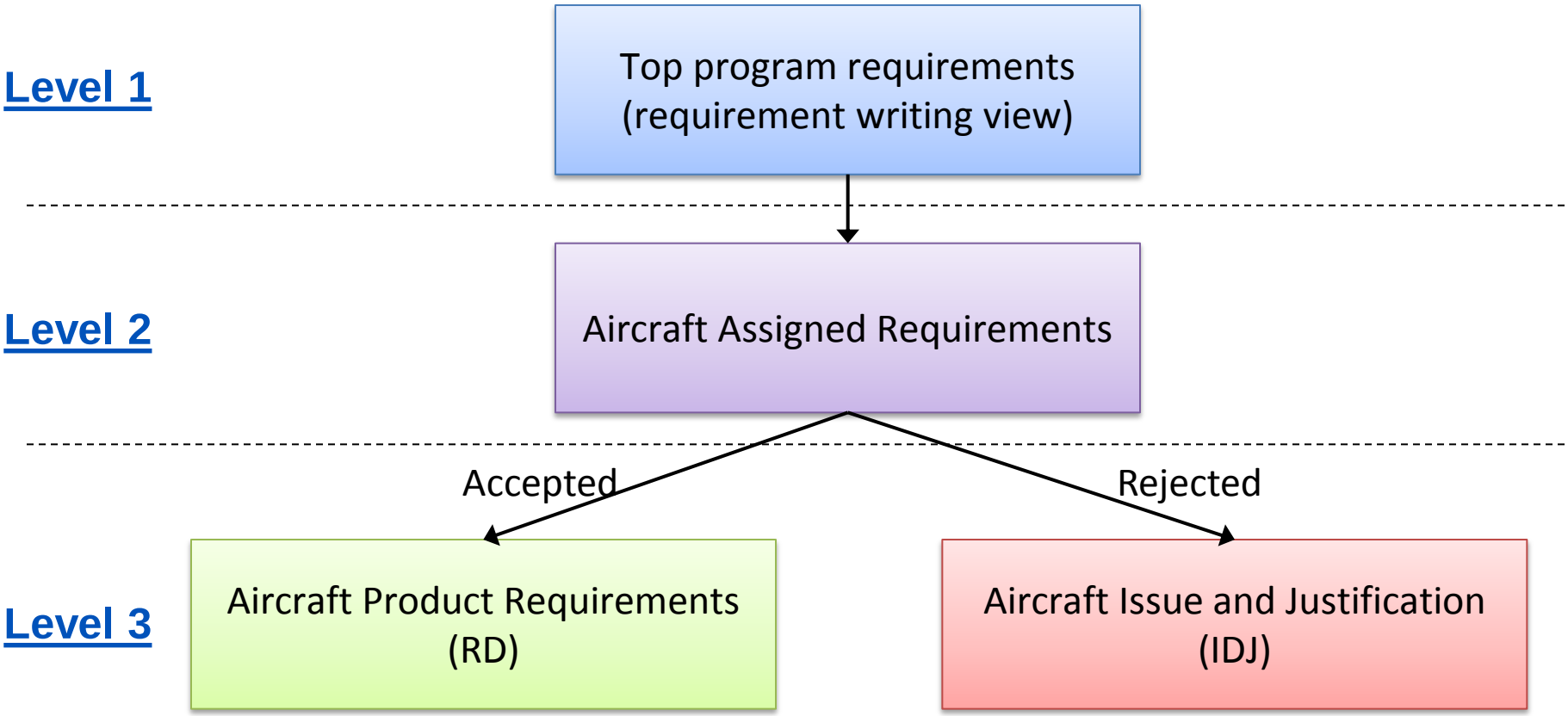
Overview of the STEP AP 242 ed1 information model (BO Model)

Simplified overview



Presentation of the public test case

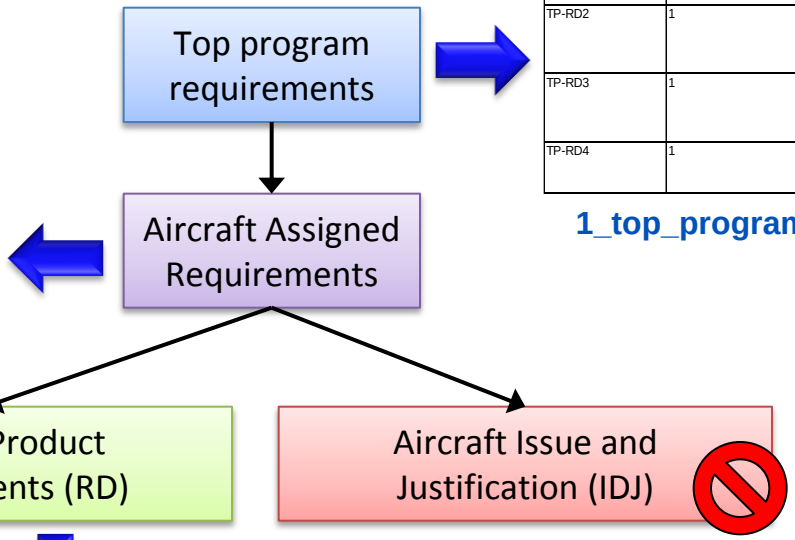
Proposed requirements are organized according to the following hierarchy tree.



Presentation of the public test case

2_Aircraft_Assigned_Requirements_AP242_BO_Model.xls

Identifier	Requirement Statement	AI Allocation Agreement	AI Applicability	AI Owner
AAR_1	The time spend on runway shall be minimized by each aircraft after landing.	Accepted	X1.1 X1.2 X1.3	John Doe
AAR_2	The duration of taxiing phases on ground shall be minimized to reduce fuel consumption, pollution and noise near airports.	Accepted	X1.1 X1.2 X1.3	Thomas Anderson
AAR_3	The optimisation of the deceleration on ground is requested to be fully automated without actions of flight crew.	Rejected	X1.1 X1.2 X1.3	Thomas Anderson
AAR_4	The ATC shall provide a clearance to the pilot to start push-back and taxi-out phases.	Rejected	X1.1 X1.2 X1.3	Ash Carter



Identifier	Requirement Version	Requirement Statement	Working Status
		Business case and constraints	
TP-RD1	1	The time spend on runway shall be minimized by each aircraft after landing.	X1-1: Analysed X1-2: Analysed X1-3: Analysed
TP-RD2	1	The duration of taxiing phases on ground shall be minimized to reduce fuel consumption, pollution and noise near airports.	X1-1: Analysed X1-2: Analysed X1-3: Analysed
TP-RD3	1	The optimisation of the deceleration on ground is requested to be fully automated without actions of flight crew.	X1-1: Analysed X1-2: Analysed X1-3: Analysed
TP-RD4	1	The ATC shall provide a clearance to the pilot to start push-back and taxi-out phases.	X1-1: Analysed X1-2: Analysed X1-3: Analysed

1_top_program_RD_AP242_BO_Model.xls

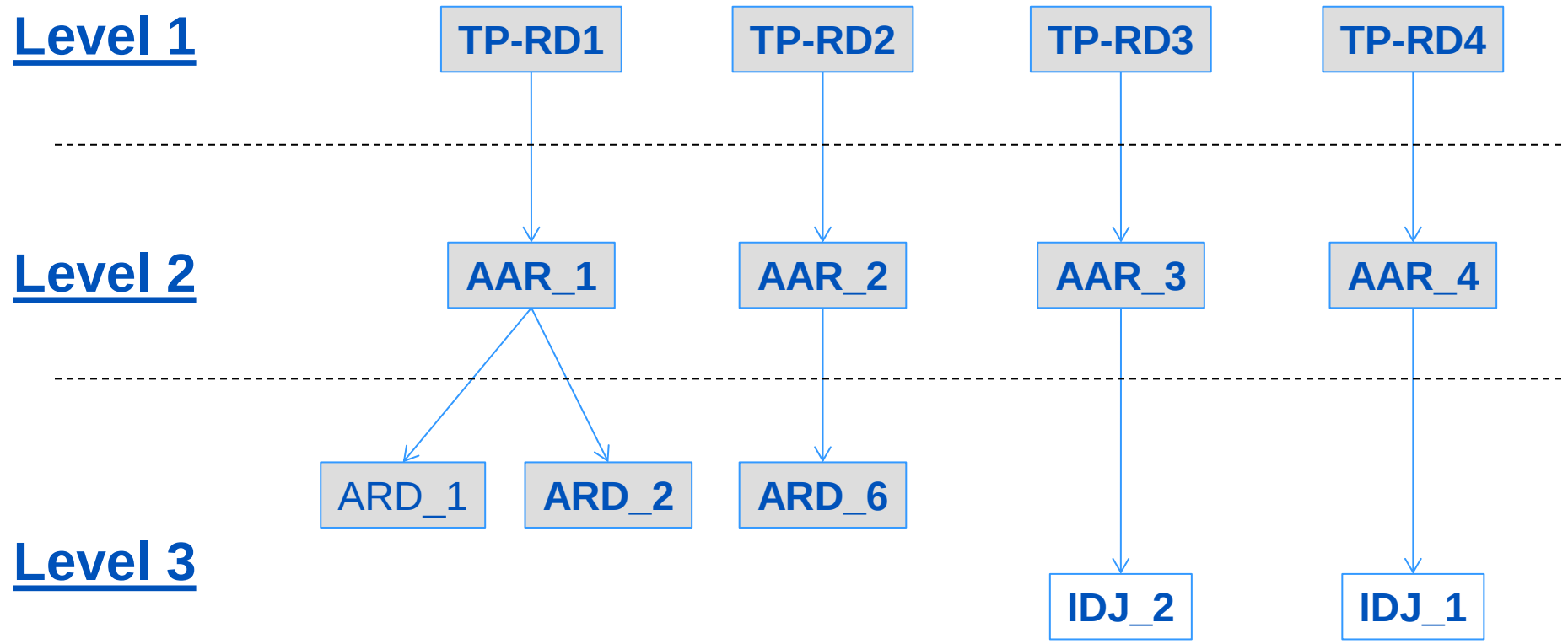
No addressed in the public test case

3_Aircraft_RD_AP242_BO_Model.xls

Identifier	Requirement Version	Requirement Statement	Working Status	Rationale
ARD_1	1	In case the pilot activates the braking system, the aircraft shall automatically brake to reach the selected exit at maximum taxiing speed (15 knots).	X1-1: Analysed X1-2: Analysed X1-3: Analysed	Reduce time spent on the runway.
ARD_2	1	During the whole ground braking phase, the aircraft shall keep a deceleration factor equivalent to 0.55 g until exit is reached.	X1-1: Analysed X1-2: Analysed X1-3: Analysed	Reduce time spent on the runway respecting passenger comfort.
ARD_3	1	On the request of the pilot, the Aircraft shall arm and disarm the braking capability.	X1-1: Analysed X1-2: Analysed X1-3: Analysed	Consistency with safety considerations and cockpit philosophy regarding auto-flight modes integration (always deactivable).
ARD_4	1	Once given the taxiing exit to the braking, the aircraft shall provide to the pilot the deceleration profile before and during landing.	X1-1: Analysed X1-2: Analysed X1-3: Analysed	Inform pilot regarding braking distance in flight and while landing
ARD_5	1	The Aircraft shall use either Navigation Display (ND) or Primary Flight Display (PFD) to display information about the braking.	X1-1: Analysed X1-2: Analysed X1-3: Analysed	Design constraint (respect of the X1.1 cockpit design philosophy).
ARD_6	1	Before landing phase, the aircraft shall use the taxiing exit selected by the pilot.	X1-1: Analysed X1-2: Analysed X1-3: Analysed	Pilot selects the optimal exit according to airport map and arrival gate used by the aircraft

Presentation overview of the public test case

Test cases requirements cascading:



No addressed in the public test case

Types of information to be exchanged in the Requirement Mangt. AP242 XML public test case

Examples of information coming from the level 1 requirements file:

- Identifier: Unique identifier for the object filled automatically by DOORS RMF

- Requirement Version: Version number of the requirement that enables to manage requirements into configuration.

- Requirement Statement: States an expected behaviour or global performance of the product under consideration.

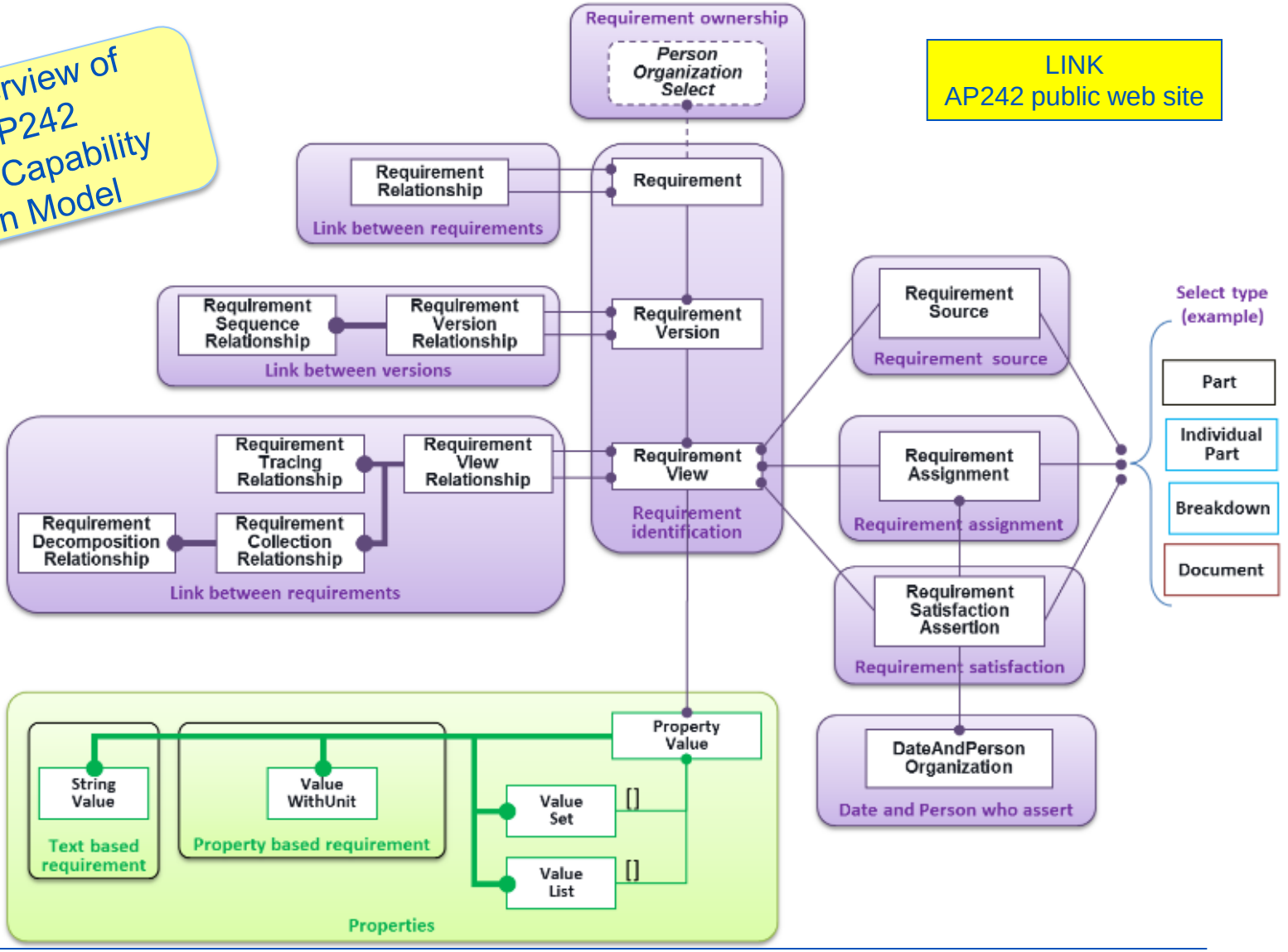
- Working Status: Current version of the requirement/activity.

- Rationale: Provides the justification and/or the reason for the activity/requirement. The rationale is particularly useful for orphan requirement (i.e. requirement that are not traced to an upper level requirement).

Identification of the subset of the STEP AP 242 ed1 data model to be used

Simplified overview of the ISO AP242 Requirement Capability Information Model

LINK
AP242 public web site



Mapping of the types of information to be exchanged with STEP AP 242 ed1 data model

Mapping of the information coming from the level 1 requirements file:

Level 1 requirement information	STEP AP242 ed1 BO Model
Identifier	Requirement.id
Requirement Version	RequirementVersion.id
Requirement Statement	Requirement.description
Working Status	RequirementView.InitalContext reference to ViewContext.LifeCycleStage
Rationale	RequirementSource
Applicability	RequirementAssigment reference to Project
Allocation	ViewContext.ApplicationDomain
Owner	PersonInOrganization
Implementation Level	PropertyDefinitionAssignment
Validation Status	ApprovalAssignment reference to Approval
Stakeholders	ApprovalAssignment reference to Approval
Source	RequirementSource reference to document
link up	RequirementDecompositionRelationship
link down	RequirementDecompositionRelationship

Overview of the STEP AP 242 XML file

Requirement

Version

View

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl" href="viewer.xsl"?>
<n1:Uos xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:n1="http://standards.iso.org/iso/ts/10303/-3001/-ed-1/tech/xml-schema/bo_model"
  <Header/>
  <DataContainer xsi:type="n1:AP242DataContainer">
    <Requirement uid="rd0001">
      <ClassifiedAs><Classification uidRef="cl0001"/></ClassifiedAs>
      <Description><CharacterString>The time spend on runway shall be minimized by each aircraft after landing.</CharacterString></Description>
      <Id><Identifier uid="ri0001" id="TP-RD1"/></Id>
      <Name><CharacterString>Top level requirement 1</CharacterString></Name>
      <Versions>
        <RequirementVersion uid="rv0001">
          <Id><Identifier uid="rvi0001" id="1"/></Id>
          <Views>
            <RequirementView uid="rvv0001">
              <DefinitionalRepresentations>
                <PropertyValue uid="pv0001" xsi:type="n1:StringValue">
                  <Definition><PropertyDefinitionString>second</PropertyDefinitionString></Definition>
                  <DeterminationMethod><ClassString>required</ClassString></DeterminationMethod>
                  <ValueComponent><CharacterString>40</CharacterString></ValueComponent>
                </PropertyValue>
              </DefinitionalRepresentations>
              <InitialContext uidRef="vc0001"/>
              <RequirementSource uid="rs0001">
                <Description><CharacterString>Reduce runway usage per aircraft to increase capacity.</CharacterString></Description>
                <Source uidRef="dv01001"/>
              </RequirementSource>
              <PropertyDefinitionAssignment uid="pda0001">
                <AssignedPropertyDefinition>
                  <PropertyDefinitionString>Refined at lower level</PropertyDefinitionString>
                </AssignedPropertyDefinition>
              </PropertyDefinitionAssignment>
              <RequirementViewRelationship xsi:type="n1:RequirementDecompositionRelationship" uid="rvr0001">
                <Related uidRef="aar-rvv0001"/>
                <RelationType>
                  <ClassString>link down</ClassString>
                </RelationType>
              </RequirementViewRelationship>
            </RequirementView>
          </Views>
```

Visualization of the content of the STEP AP242 XML file with an html page

Requirements viewer

Level 1

Identifier	Requirement Version	Requirement Statement	Working Status	Rationale	Applicability	Allocation	Owner	Implementation Level	Validation Status	Stakeholders	Source	Link Down
TP-RD1	1	The time spend on runway shall be minimized by each aircraft after landing.	X1.1 : Analysed X1.2 : Analysed X1.3 : Analysed	Reduce runway usage per aircraft to increase capacity.	X1.1 X1.2 X1.3	Aircraft	n.c	Refined at lower level	X1.1 : Validated X1.2 : Validated X1.3 : Validated	Airport ATC OperationAirline Flight Operations	MoM Marketing Ref Mark-007-v2	AAR-01
TP-RD2	1	The duration of taxiing phases on ground shall be minimized to reduce fuel consumption, pollution and noise near airports.	X1.1 : Analysed X1.2 : Analysed X1.3 : Analysed	Protect environment.	X1.1 X1.2 X1.3	Aircraft	n.c	Refined at lower level	X1.1 : Validated X1.2 : Validated X1.3 : Validated	Local airport AuthoritiesAirline Flight Operations	MoM Marketing Ref Mark-007-v2	AAR-02
TP-RD3	1	The optimisation of the deceleration on ground is requested to be fully automated without actions of flight crew.	X1.1 : Analysed X1.2 : Analysed X1.3 : Analysed	No manual action of the pilot during landing and deceleration on ground.	X1.1 X1.2 X1.3	Aircraft	n.c	Refined at lower level	X1.1 : Validated X1.2 : Validated X1.3 : Validated	Airline Flight Crew	MoM Marketing Ref Mark-007-v2	AAR-03
TP-RD4	1	The ATC shall provide a clearance to the pilot to start push-back and taxi-out phases.	X1.1 : Analysed X1.2 : Analysed X1.3 : Analysed	The ATC is responsible of the movements of Aircraft on ground.	X1.1 X1.2 X1.3	Aircraft	n.c	Refined at lower level	X1.1 : Validated X1.2 : Validated X1.3 : Validated	Airport ATC Operation	MoM Marketing Ref Mark-007-v2	AAR-04

Level 2

Identifier	Requirement Statement	AI Allocation Aggreement	AI Applicability	AI Owner	AI Priority	AI Rationale	AI Source	ARS mod origin	AI Stakeholders	AI Validation Status	AI Working Status	Link Up	Link Down
AAR-01	The time spend on runway shall be minimized by each aircraft after landing.	Accepted	X1.1 X1.2 X1.3	John DOE	1	Reduce runway usage per aircraft to increase capacity.	MoM Marketing Ref Mark-007-v2	Top program RD	Airport ATC OperationAirline Flight Operations	X1.1 : Validated X1.2 : Validated X1.3 : Validated	X1.1 : Analysed X1.2 : Analysed X1.3 : Analysed	TP-RD1	ARD-01 ARD-02
AAR-02	The duration of taxiing phases on ground shall be minimized to reduce fuel consumption, pollution and noise near airports.	Accepted	X1.1 X1.2 X1.3	Thomas ANDERSON	2	Protect environment.	MoM Marketing Ref Mark-007-v2	Top program RD	Local airport AuthoritiesAirline Flight Operations	X1.1 : Validated X1.2 : Validated X1.3 : Validated	X1.1 : Analysed X1.2 : Analysed X1.3 : Analysed	TP-RD2	ARD-06
AAR-03	The optimisation of the deceleration on ground is requested to be fully automated without actions of flight crew.	Rejected	X1.1 X1.2 X1.3	Thomas ANDERSON	1	No manual action of the pilot during landing and deceleration on ground.	MoM Marketing Ref Mark-007-v2	Top program RD	Airline Flight Crew	X1.1 : Validated X1.2 : Validated X1.3 : Validated	X1.1 : Analysed X1.2 : Analysed X1.3 : Analysed	TP-RD3	
AAR-04	The ATC shall provide a clearance to the pilot to start push-back and taxi-out phases.	Rejected	X1.1 X1.2 X1.3	Thomas ANDERSON	1	The ATC controller is responsible of the movements of Aircraft on ground.	MoM Marketing Ref Mark-007-v2	Top program RD	Airport ATC Operation	X1.1 : Validated X1.2 : Validated X1.3 : Validated	X1.1 : Analysed X1.2 : Analysed X1.3 : Analysed	TP-RD4	

Next actions

- Support of other ASD SSG members? (Airbus Group, etc),
- Update of the ASD SSG web page; information in the next ASD SSG news letter
- Preparation of a pilot for exchange of AP242 ed1 files between 2 RM systems
  - Proposal to describe validation properties for quality control of end to end exchange
- Preparation of other public test cases:
  - Priority 1: requirement management referencing a procut breakdown structure
  - Priority 2: Preparation of a test case for RM referening 3D GDT within a CAD model
- Coordination with PDES Inc “Requirement management traceability project” (AP233)
- Prep. of an ASD SSG confcal in S1 2016 with the main RM applications vendors
- Target: launch of the Requirement Management Impl. Forum, part of the PDM IF
- Identify and execute the changes required for:
    - the STEP modules and STEP core model dealing with requirement management
    - The associated XML implementation model for requirement management
  - Target date of the workshop: March 2016, USA, Gaitherburg