FUSION FOR ENERGY

Requirements Management & Verification in F4E with DOORS & IRDRMFAO

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IBM Rational event “Desarrollo de software en época de crisis”, 21-Feb-2013, Madrid (Spain)

Reference: F4E_D_24M8SR v3.0

Plan

(Courtesy: ITER)

1. Introduction (1/2)

1.1. F4E

The European Joint Undertaking for ITER and the Development of Fusion Energy ('Fusion for Energy' or F4E)

Established in 2007 in Barcelona, Spain

Staff: approx. 350

3 tasks:

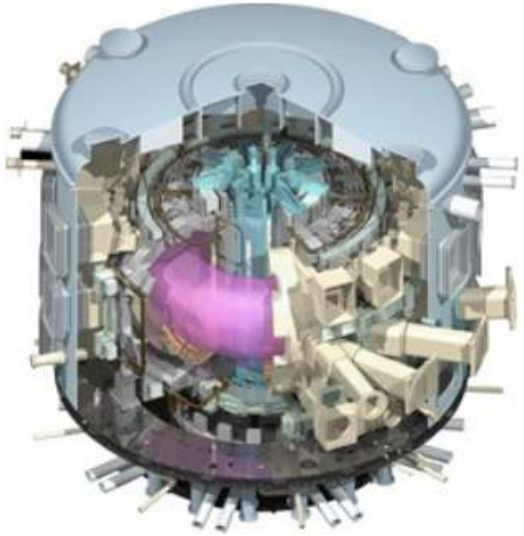
- **provide Europe's contribution to ITER**
- **implement the Broader Approach agreement between Euratom and Japan**
- **prepare for the construction of DEMO**

1. Introduction (2/2)

1.2. The ITER project

History

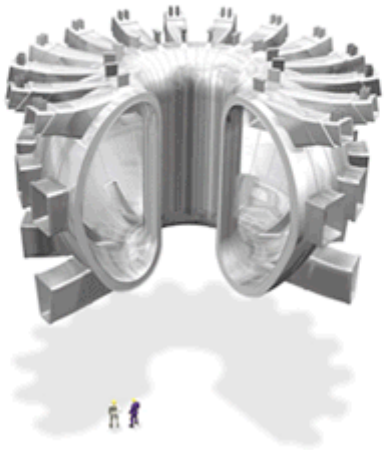
- 1985, proposed by Gorbachev to Reagan
- 2005, Cadarache (France) chosen to host the ITER machine
- 2006, ITER agreement signed by the 7 parties (China, EU, India, Japan, Korea, Russia, USA)
- the world's largest scientific partnership



Scientific objective

- demonstrate steady state fusion power production
- validate technologies required for fusion power plants
- study and optimise plasma behaviour
- generate 500 MW of fusion power with a power amplification $Q \geq 10$
  (Q = Total fusion power / Input power to the plasma)

Plan



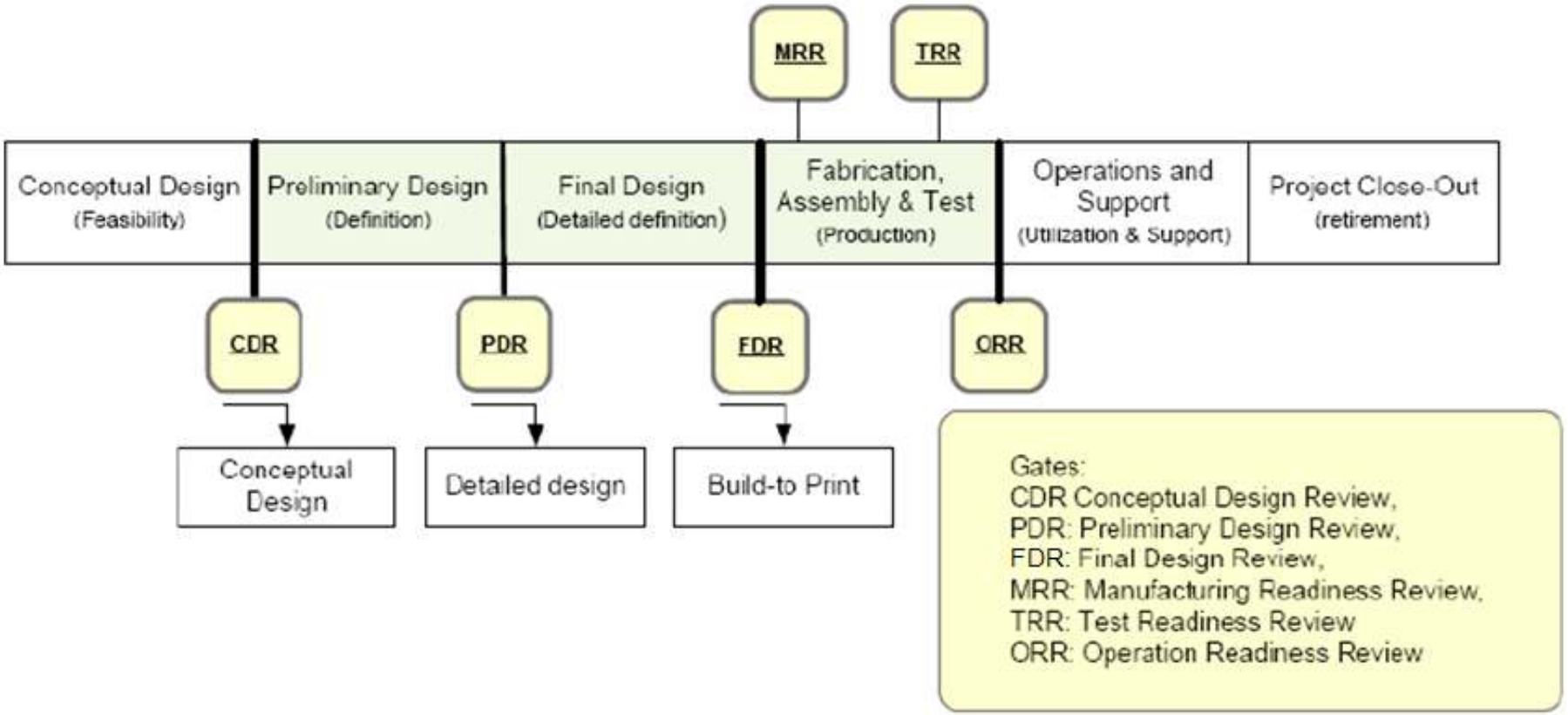
(Courtesy: ITER)

2. The RMV process (1/7)

RMV = Requirements Management & Verification

2.1. RMV, a key domain of Systems Engineering

Product Lifecycle

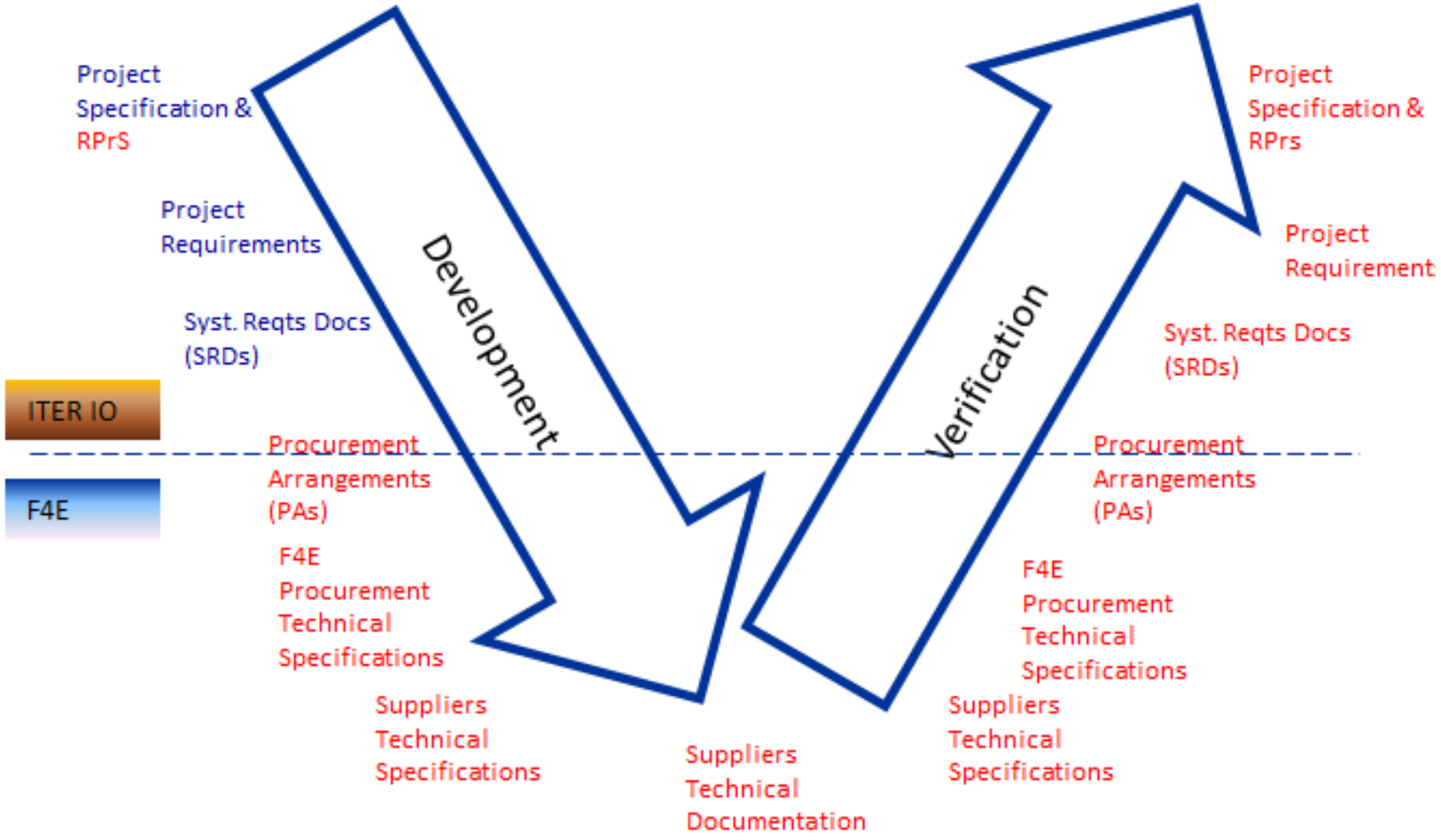


2. The RMV process (2/7)

RMV = Requirements Management & Verification

2.1. RMV, a key domain of Systems Engineering

Waterfall model



2. The RMV process (3/7)

RMV = Requirements Management & Verification

2.2. RMV, what for?

How do you demonstrate that you flowed-down 100% of customer requirements?

How do you manage your margins, your flexibility behind requirements?

How do you assess impacts when a Deviation occurs, when a Non Conformity occurs?

How do you document that verification is planned? closed?

Are we ready for the next review?

How do you accept deliverables?

RMV is the basis for accepting a deliverable.
RMV captures how much a deliverable matches customer needs.

2. The RMV process (4/7)

2.3. Deliverables of the RMV process

Statement of Compliance (SoC)

Annex B - Tech Spec for LN2 Plant, F4E_D_23WR9Z v4.3				
Requirement identifier	Requirement text	Compliance status	Verification Method	Comment
5		C:4 NC:1		
	Applicable Documents			
AD01	Electrical Design Handbook. Part 4 - Electromagnetic Compatibility (EMC). https://user.iter.org/?uid=4B523E&version=v2.1&action=get_document	C	E	
AD02	Specification of piping fluid identification with conventional colour, https://user.iter.org/?uid=44ED6H&version=v1.2&action=get_document	C	E	See detailed SoC in Annex 2 to the Technical Proposal.
	1. Introduction			
	2. Scope of the tender			
	3. General design requirements			
REQ-0001	The system of units to be used in the Contract deliverables shall be SI-units.	C	E	
	4. Specific technical requirements			
REQ-0002	The fully inflated total gasbags volume shall be 800 m3 minimum.	C	E, T	
REQ-0003	Noise level generated by equipment inside building 51 and measured at a distance of 1 m for all operational modes shall not exceed 100 dB(A).	NC	A, T	The equipment X generates 102 dB(A) at a competitive price. It is proposed in baseline. In an option, equipment X can be replaced by equipment Y that complies with 100 dB(A) limit. See details in Technical Proposal §2.4 and in Commercial Proposal §3.2.

2. The RMV process (5/7)

2.3. Deliverables of the RMV process

Compliance Matrix (CMx)

PA Annex B - Functional Spec LN2 Plant.... ITER_IDM_34VL6W v3.2		F4E				
Requirement identifier	Requirement text	Category	Compliance status	Deviation Request number	satisfied by....	Comment
	Applicable Documents					
AD01	Quality Plan. 3.0. https://user.iter.org/?uid=22MFMW	Quality	C		Annex A - Mngmt Spec for LN2 Plant, F4E_D_24F5TP v1.1 [AD01] Supplier Quality Requirements, F4E-QA-115 v2.0	F4E equivalent document applies.
AD02	Electrical Design Handbook. Part 4 - Electromagnetic Compatibility (EMC). ITER_D_4B523E v2.1, https://user.iter.org/?uid=4B523E.	Electrical	C		Annex B - Tech Spec for LN2 Plant, F4E_D_23WR9Z v4.3 [AD03] Electrical Design Handbook. Part 4 - Electromagnetic Compatibility (EMC). ITER_D_4B523E v2.1, https://user.iter.org/?uid=4B523E.	
AD03	Loads specification for the ITER Cryoplant. [Online] 1.0. https://user.iter.org/?uid=3TFKW7.	Mechanical Thermal	C			Described or summarized in Annex B.
	3. General Design Requirements					
REQ-001	The system of units to be used in the DA deliverables shall be SI-units.	Quality	C		Annex B - Tech Spec for LN2 Plant, F4E_D_23WR9Z v4.3 [REQ-0018] The system of units to be used in the Contract deliverables shall be SI-units.	
	4. Performance Requirements					
REQ-002	The volume of necessary Gas Bag shall be defined by the Contractor in accordance with the different ITER modes.	Mechanical	C		Annex B - Tech Spec for LN2 Plant, F4E_D_23WR9Z v4.3 [REQ-0070] The fully inflated total gasbags volume shall be 800 m3 minimum.	Sizing of the gasbags is defined by Justification of Helium Storage, Purification and Recovery System Sizing (https://idm.f4e.europa.eu/?uid=23C6W6&version=v3.0&action=get_document)
REQ-003	Equipment shall comply with the noise level criteria as specified by the PA Specifications to achieve the specified level for Cryoplant buildings, ITER site and ONF house (refer to section 3.4.1).	Mechanical	NC	DR776	Annex B - Tech Spec for LN2 Plant, F4E_D_23WR9Z v4.3 [REQ-0314] Noise level generated by equipment inside building 51 and measured at a distance of 1 m for all operational modes shall not exceed 100 dB(A). Annex B - Tech Spec for LN2 Plant, F4E_D_23WR9Z v4.3 [REQ-0315] Noise level generated by equipment outside building 51 and measured at a distance of 1 m for all operational modes shall not exceed 75 dB(A).	
REQ-004	The LN2 plant shall be compatible with the meteorological conditions defined in AD03 Load Spec.	Mechanical Thermal	C		Annex B - Tech Spec for LN2 Plant, F4E_D_23WR9Z v4.3 [REQ-0308] Equipment located outdoors shall be designed for a temperature in the range -20°C to +40°C. Annex B - Tech Spec for LN2 Plant, F4E_D_23WR9Z v4.3 [REQ-0309] Equipment located in building 51 shall be designed for a temperature in the range +5°C to +40°C with possible peaks to +45°C for short periods of time.	

2. The RMV process (6/7)

2.3. Deliverables of the RMV process

Verification Control Document (VCD)

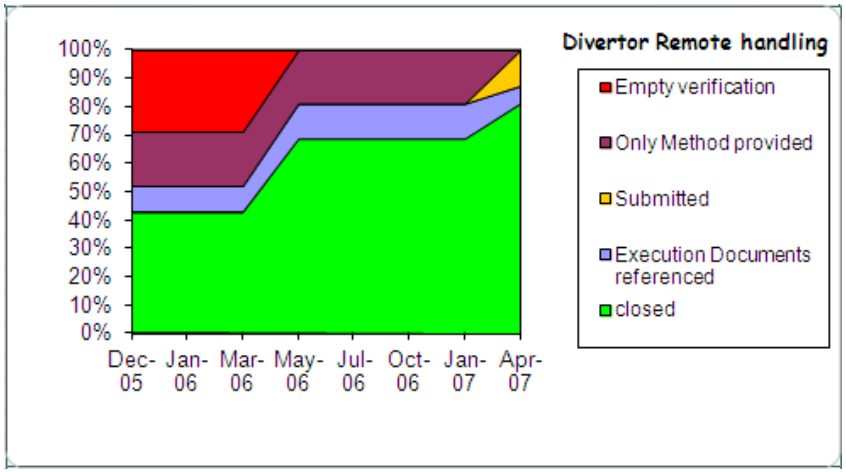
Customer Specification Title, reference, version					Supplier					
Requirement				Deviation	Verification Item				Requirement	
Identifier	Text	Category	Compliance status	Request & NCR	Method	Level	Execution document	Reporting document	VCD status	Reason for close-out status
	1. Introduction									
REQ-001	The satellite shall have a heigth of maximum 2 m.	Mechanical	C		E			CAD drawing "Overall dimensions of the satellite", 25TRV3 v2.0	C	VCB#05
REQ-002	The Satellite Thermal Control Subsystem shall ensure that all satellite equipment temperatures remain within the thermal design limits defined for each satellite	Thermal	NC	SDR 588	A			Thermal Analysis Report, 25WB8W v1.0	S	
					T		Spec for Thermal Balance Test on Satellite Qualification Model, 25NL22 v1.0	Report for Thermal Balance Test on Satellite Qualification Model, 25U58Z v1.0		
	2. Second heading one									
REQ-003	The satellite shall be able to enter in satellite survival mode by ground command.	Avionics System, Nuclear Safety	C		T		Spec for Integrated Satellite Test 1 on Avionics Model, 252585 v1.0	Report for Integrated Satellite Test 1 on Avionics Model, 25QMXY v3.0		
					T		Spec for Integrated Satellite Test 1 on Satellite Qualification Model, 259RKZ v1.0			

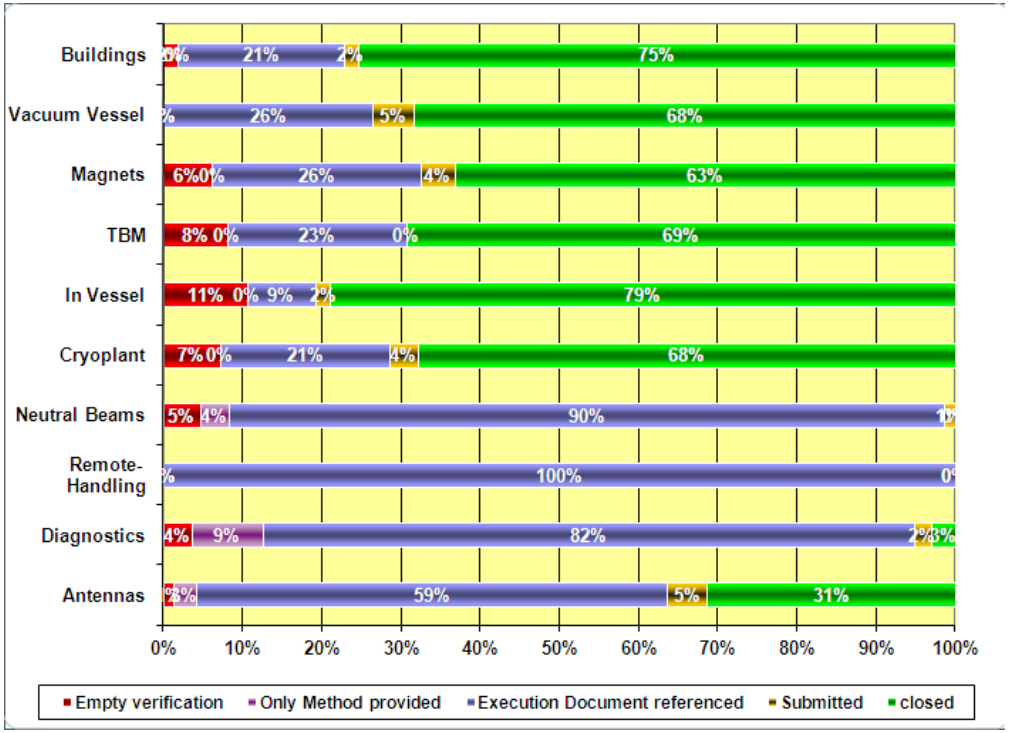
2. The RMV process (7/7)

2.3. Deliverables of the RMV process

Dashboards

(fictitious data)





Plan

(Courtesy: ITER)

3. Implementation strategy

3.1. Selection of Pilot Projects

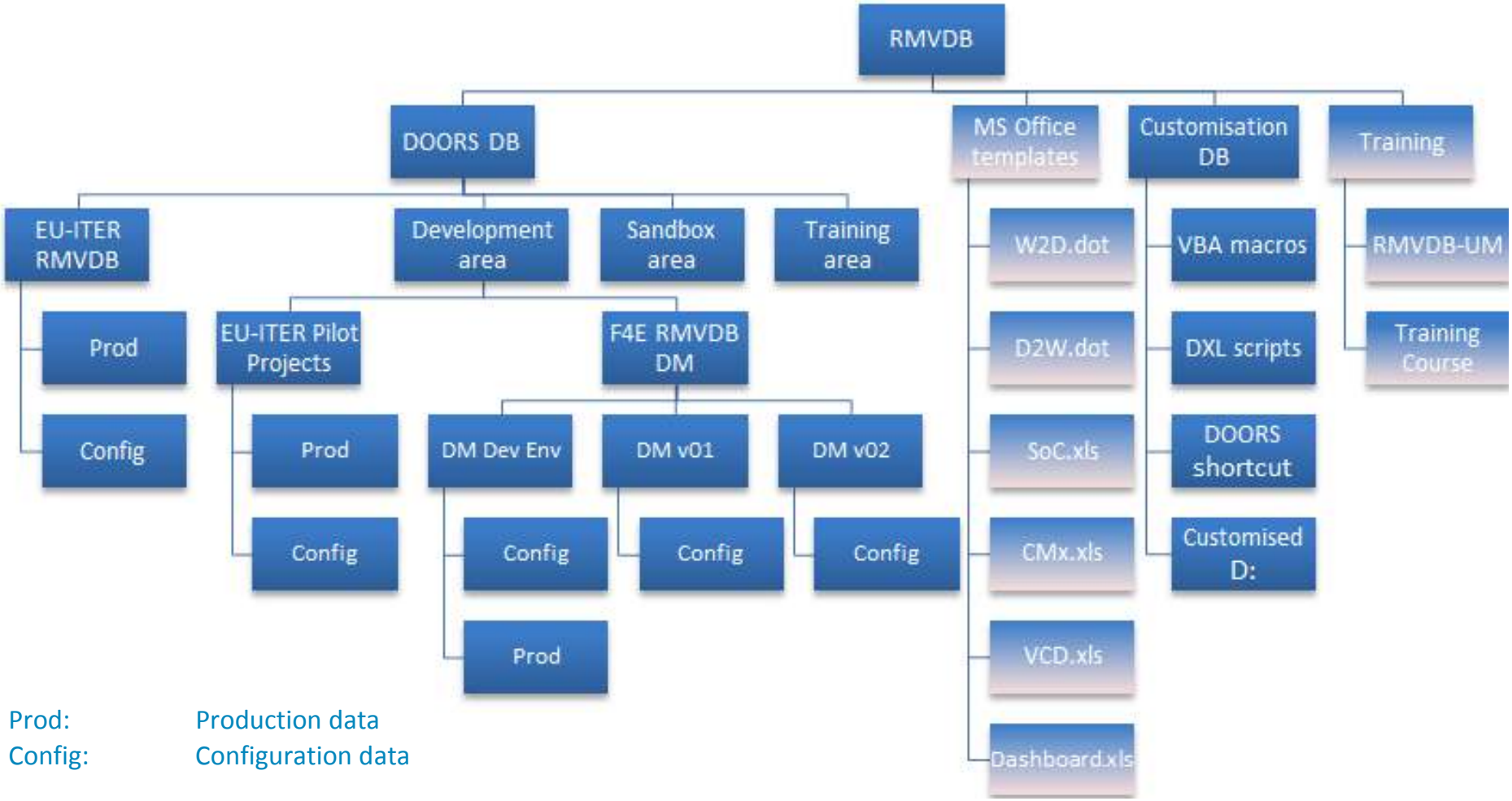
- Motivated teams…
- … already with Systems Engineering culture

3.2. Change Management (internal marketing)

- Support of Management
- Interfaces with legal, procurement, project teams
- 3 information sessions in 2012, audience > 50 persons each time

4. DOORS & IRDRMFAO (1/10)

4.1. RMVDB Product Breakdown Structure



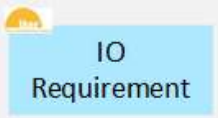
Prod: Production data
Config: Configuration data

IRDRMFAO = IBM Rational DOORS Requirements Management Framework Add-On

4. DOORS & IRDRMFAO (2/10)

4.2. Data Model

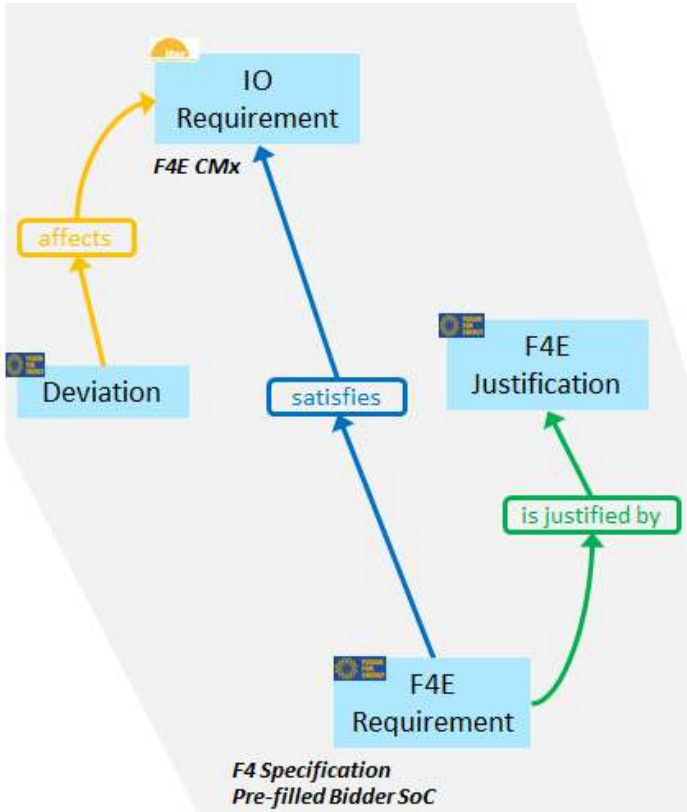
Define Customer requirements



4. DOORS & IRDRMFAO (3/10)

4.2. Data Model

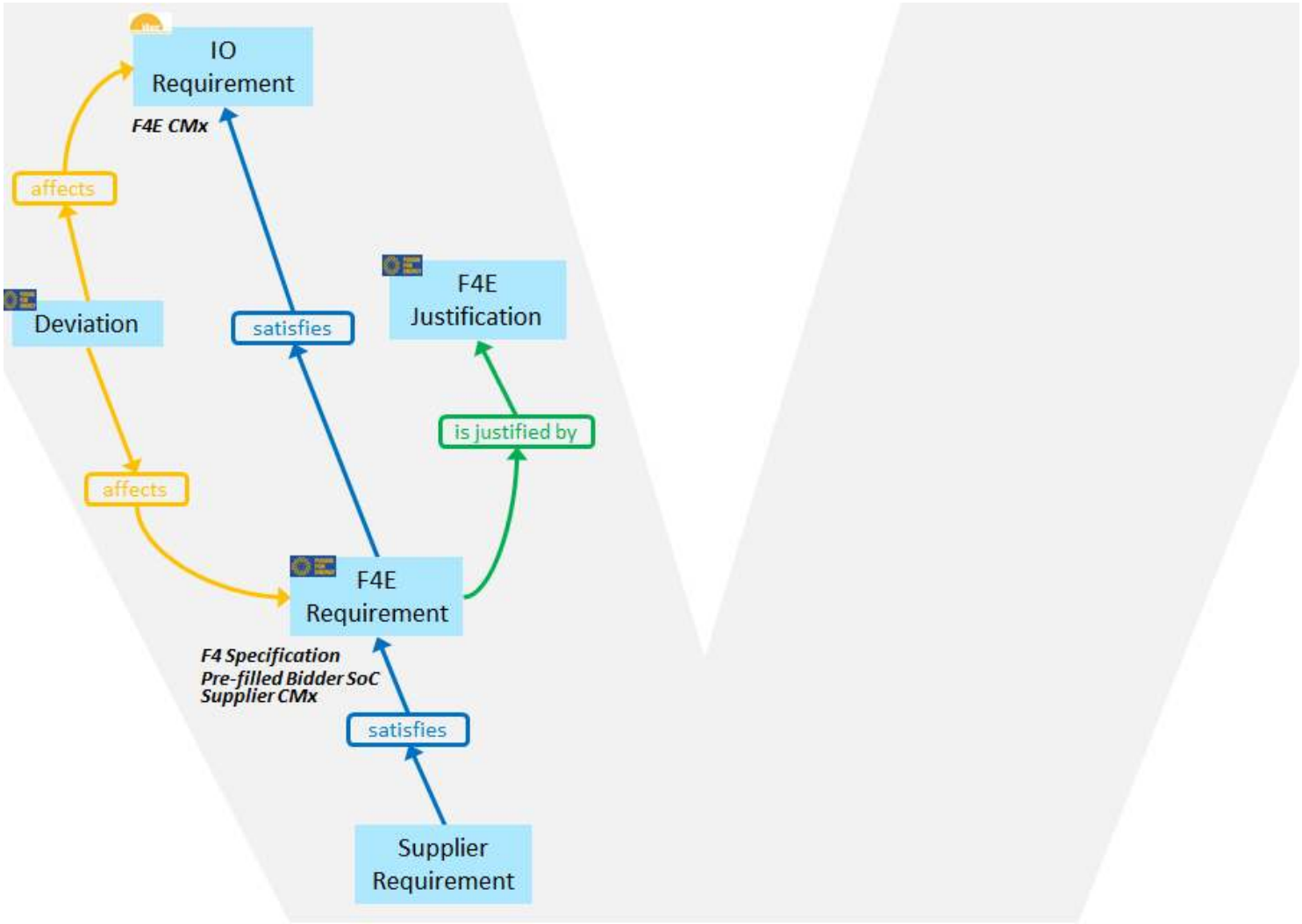
Develop your own requirements



4. DOORS & IRDRMFAO (4/10)

4.2. Data Model

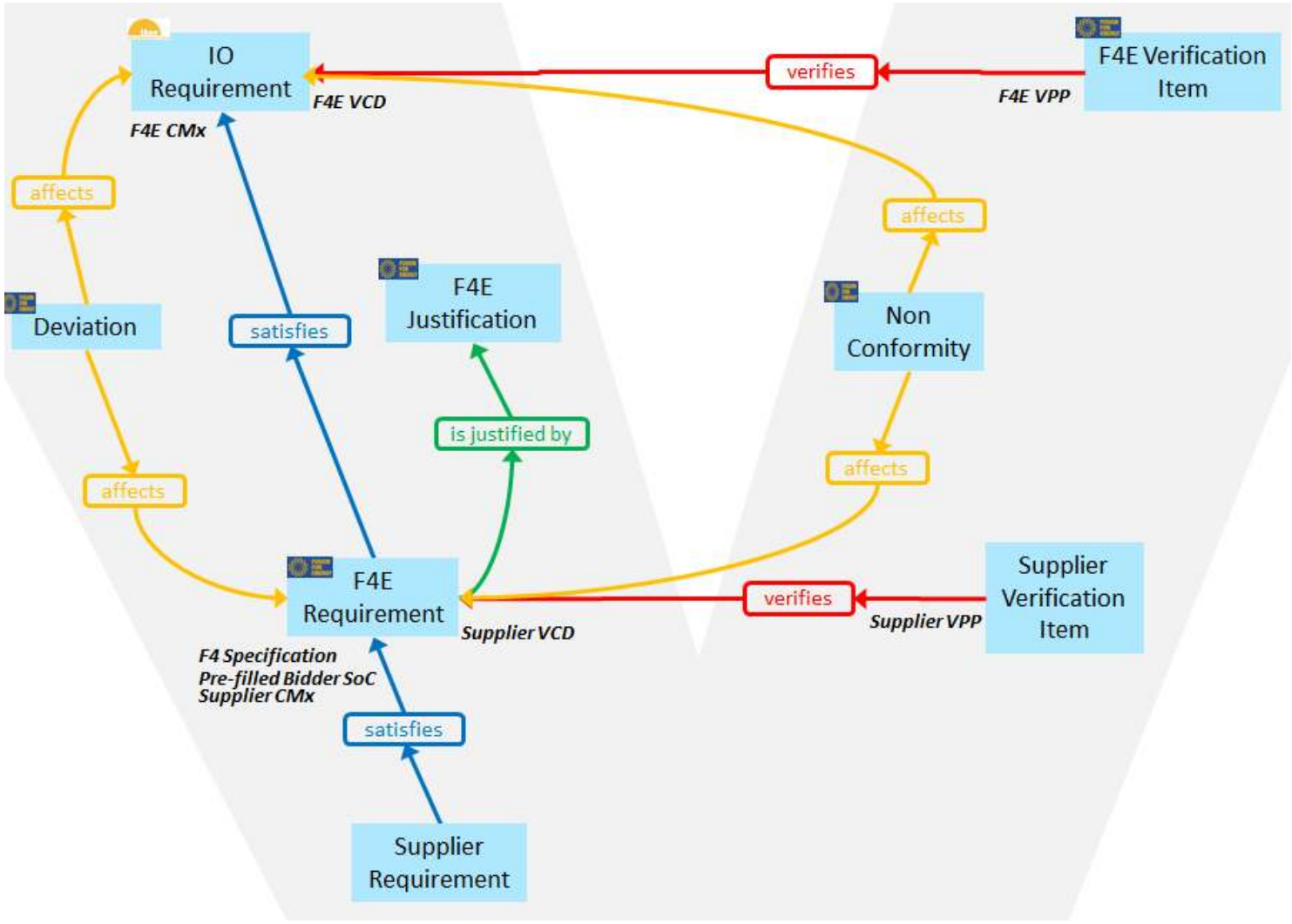
Maintain your compliance



4. DOORS & IRDRMFAO (5/10)

4.2. Data Model

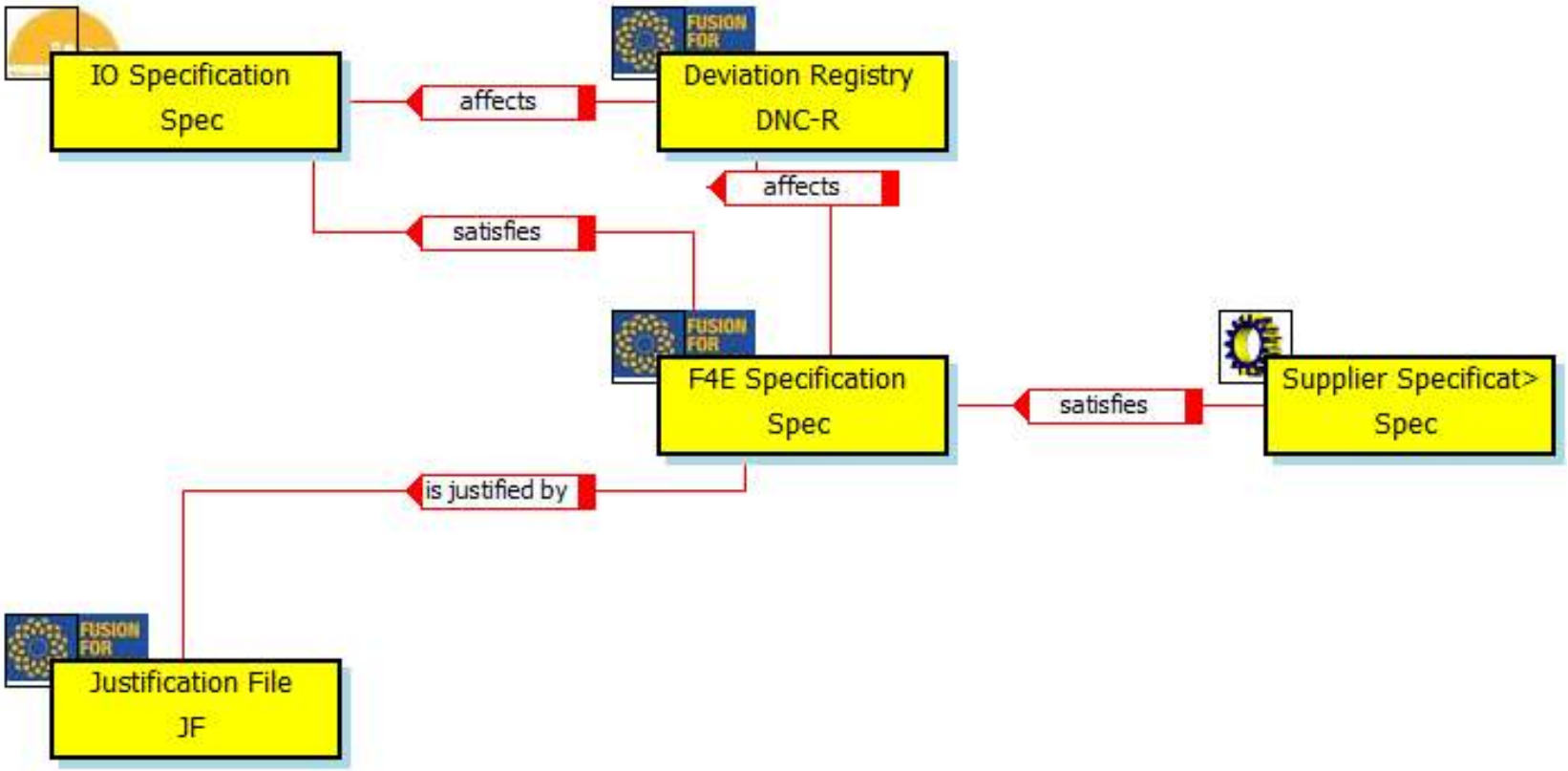
Verify requirements



4. DOORS & IRDRMFAO (6/10)

4.2. Data Model Maintain your compliance

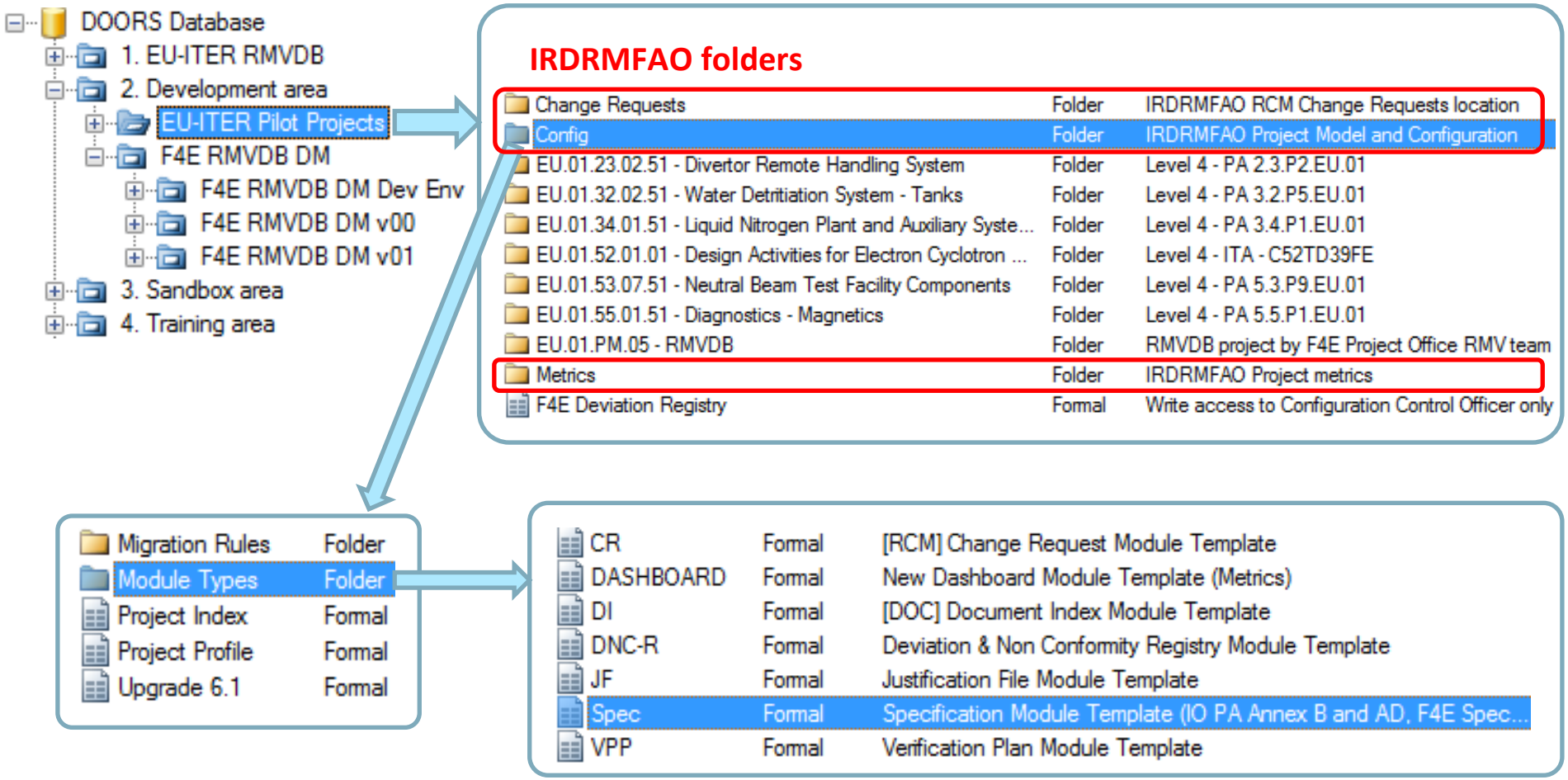
As implemented with IRDRMFAO Explorer



IRDRMFAO = IBM Rational DOORS Requirements Management Framework Add-On

4. DOORS & IRDRMFAO (7/10)

4.3. DOORS projects and folders



IRDRMFAO = IBM Rational DOORS Requirements Management Framework Add-On

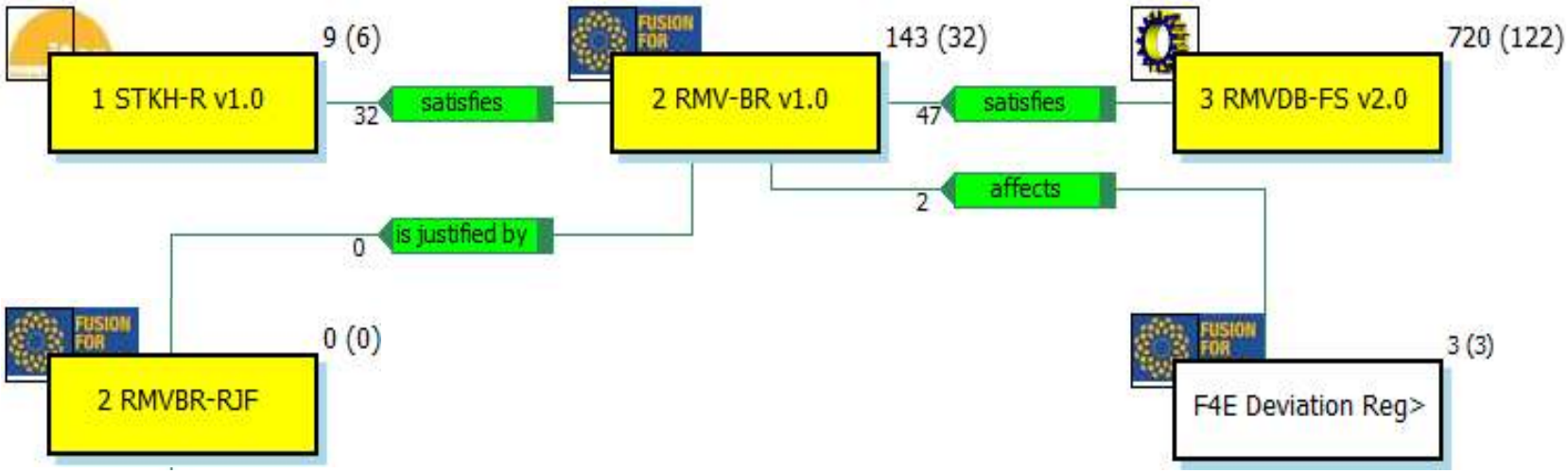
4. DOORS & IRDRMFAO (8/10)

4.3. DOORS projects and folders

Production data

1 STKH-R v1.0	Formal	Stakeholders Requirements
2 RMV-BR v1.0	Formal	RMV Business Requirements
2 RMVBR-RJF	Formal	RMVDB Requirements Justification File
3 RMVDB-FS v2.0	Formal	RMVDB Functional Specification

Data Model, as instanciated and recognized by IRDRMFAO



4. DOORS & IRDRMFAO (9/10)

4.4. View of the DOORS Compliance Matrix

'rich hover': hover the mouse over the view name to display view description

clickable url

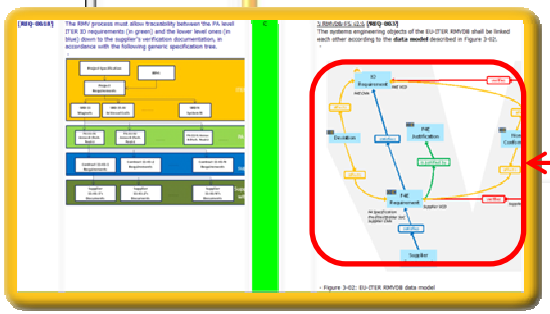
'2 RMV-BR v1.0' current 1.0 (v1.0 IDM) in /ib tests 05 EU-ITER Pilot Projects 1/EU.01.PM.05 - RMVDB (Formal module) - DOORS

File Edit View Insert Link Analysis Table Tools Discussions User Publish F4E_addins Change Management RMF Help

View F4E 30. CMx All levels

F4E 30. CMx: Compliance Matrix

PUID	RMV	Compliance	Deviation	satisfied by...	Comment
[REQ-0023]	Ac... be possible by Non F4E staff integrated in the F4E PT Teams	C		3 RMVDB-FS v2.0 **[REQ-029]** F4E in-situ external suppliers shall access to F4E RMVDB from a dedicated F4E computer set up by F4E in F4E premises.	
[REQ-0024]	The RMVDB must allow remote access by F4E staff and by the suppliers in order to introduce Supplier's RMV data.	NC	**[DR-003]** Remote access not available (22N9EF v1.0)		
[REQ-0025]	The RMV team shall define interfaces files for requirement import/export to/from suppliers.	C			RMVDB interfaces with Suppliers are defined in https://idm.f4e.europa.eu/?uid=24WVZQ.
[REQ-0026]	The RMV team shall define interfaces files for requirement import/export to/from ITER IO.	C		3 RMVDB-FS v2.0 **[REQ-031]** The RMVDB shall allow the capture of IO specifications in a **format agreed with IO**.	
[REQ-0027]	The RMVDB must Export to word/pdf standard requirement document from system.	C		3 RMVDB-FS v2.0 **[REQ-054]** The F4E RMVDB end user shall be able to **generate a Word document** from RMVDB in less than 3 clicks. - Starting point: end user is logged in RMVDB on the data he wants to export. - Ending point: generated document is open on the screen in a word processing application like Word. --- 3 RMVDB-FS v2.0 **[REQ-055]** The F4E RMVDB end user shall be able to **generate a pdf** document from RMVDB in less than 9 clicks. - Starting point: end user is logged in RMVDB on the data he wants to export. - Ending point: generated document is open on the screen in a pdf reader like Adobe Acrobat Reader.	



OLE objects in traceability column

several child requirements

4. DOORS & IRDRMFAO (10/10)

4.5. IRDRMFAO Dashboard

Configure (scope, metrics, alarms)

Update

Export to Excel

alarm
(fired as long as coverage rate < 80%)

# of requirements

per compliance status

per coverage rate

5. Conclusion

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How do you demonstrate that you flowed-down 100% of customer requirements?

> with the Compliance Matrix (DOORS view)

How do you manage your margins, your flexibility behind requirements?

> with the Requirements Justification File (IRDRMFAO Data Model)

How do you assess impacts when a Deviation occurs, when a Non Conformity occurs?

> thanks to the traceability (between your IRDRMFAO objects in the database)

How do you document that verification is planned? closed?

> with the Verification Control Document (IRDRMFAO Data Model)

Are we ready for the next review?

> monitor progress with Dashboard, set alarms (IRDRMFAO feature)

DOORS and IRDRMFAO help you maintaining CMx, RJF, impact analysis, VCD and Dashboards.

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