



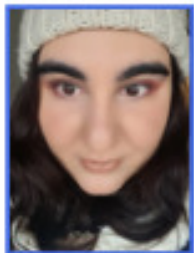
# Enhancing the MBSE-Hub for AIV Reporting Needs



MBSE 2022



# About the presenter



Incoming call

**Nieves Salor Moral**



IGNORE



ANSWER

## What's your job?

I am a Senior Software Engineer and Project Manager;  
Ground Segment expert for AIT and OPS projects at RHEA Group

## What do you do?

- Apply and Formalize ECSS Standards
- Architecture Design and Software Implementation
- Conceptual Modelling experience with NORMA, BPMN, UML, etc.
- Automatic code generation and interfacing from MBSE.

CANCEL

OK

# The Project



## PROJECT DESCRIPTION

### Actors & Data Sources

The project is foreseen to be used by:

- AIV Test Engineers (Prime/Suppliers)
- AIV Responsible (Prime/Suppliers)
- Mission Managers
- ESA Technical Officers

Requirements and knowledge used for the system sources from:

- Test Report Standard (previous activity involving LSI)
- OHB AIV Experts
- SSO Discussions
- ECSS Standards

### Which are the key points?

The project brings MBSE to the AIV Domain focused on the exchange of information reviewed and generated during the integration, testing and validation phases of a mission.

Project is divided in two phases:

- Analysis and Specification
  - Formal Specification of the AIV engineering data starting from the Test Report Standard
  - Relation with the SSO model
  - Definition of interfaces and user and system specifications
- Development and Deploy
  - Development of the Web User Interfaces for visualization of AIV reports and exchange of data
  - Development of the exchange interfaces, DTOs, database..
  - Integration with the Hub System services
  - Validation by OHB of the resulting system



#### PART OF OSMOSE

Models are coordinated with OSMOSE WG and modelled in



#### Hub Extension

This is not a separate tool!!! AIV Features capitalize on the capabilities of the MBSEHub adding support for more semantics, interfaces and including the user interface



#### Web Displays

System features will be available through REST services but also through a dedicated Web User Interface



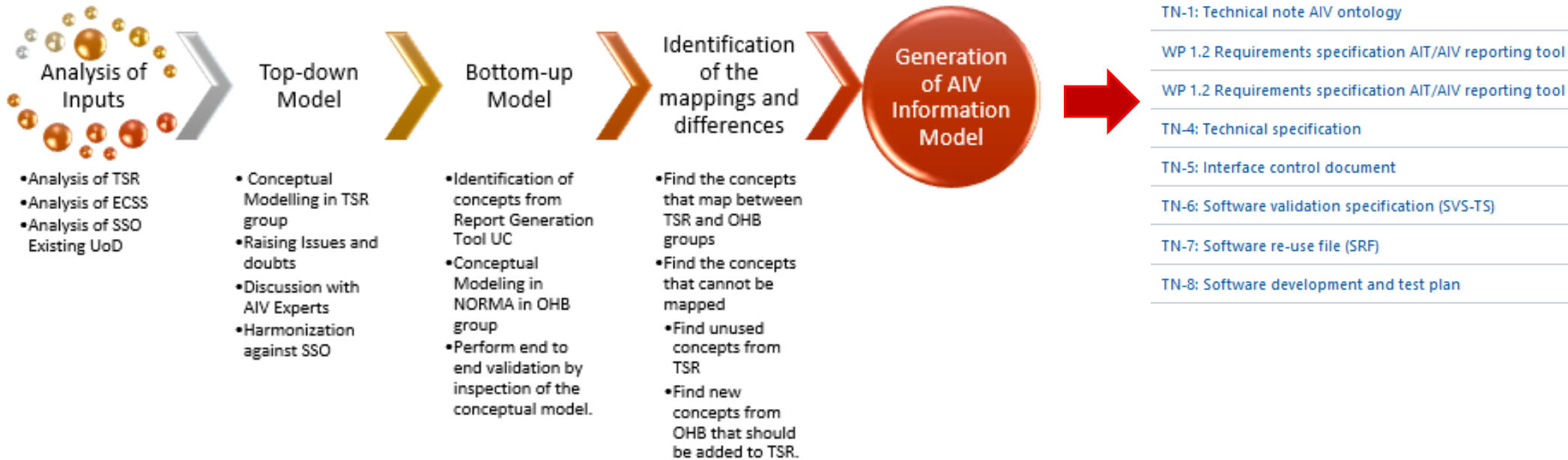
#### Auto generation

MBSE uses Kalliope for automatic generation of code for the data storage, data exchange and service definition

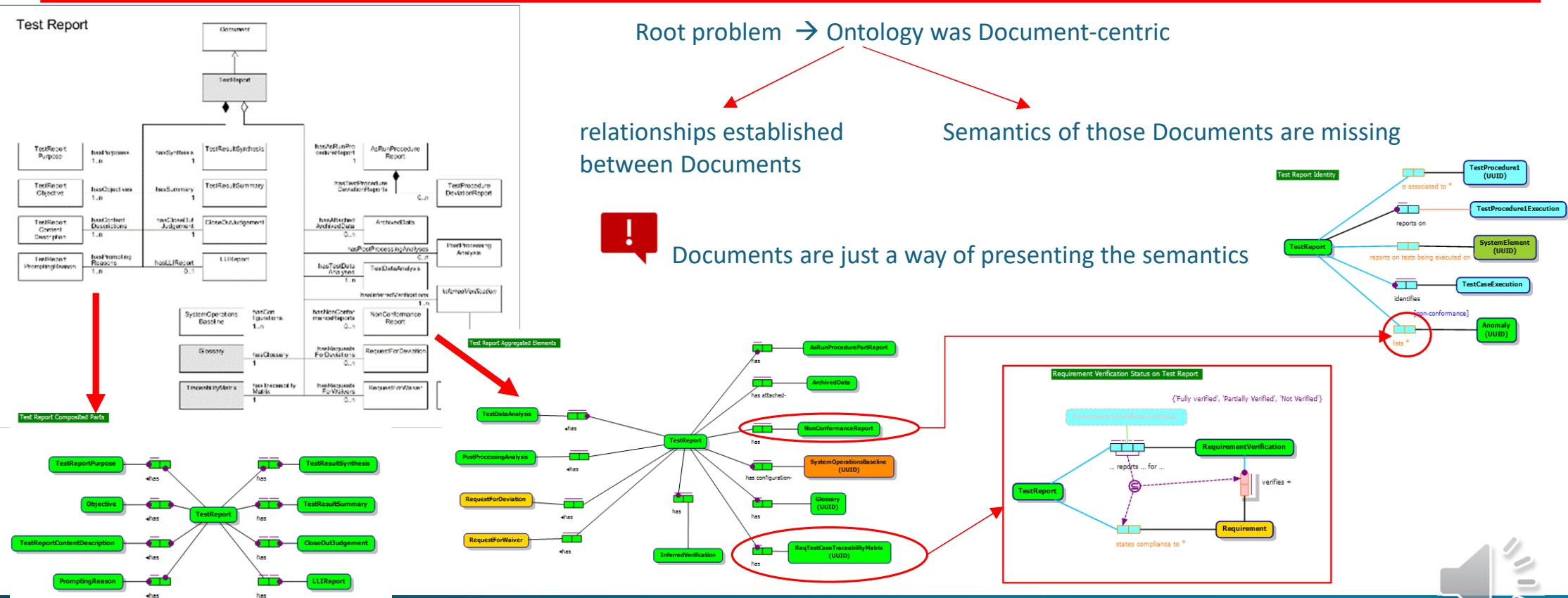
# Project Scoping and Process



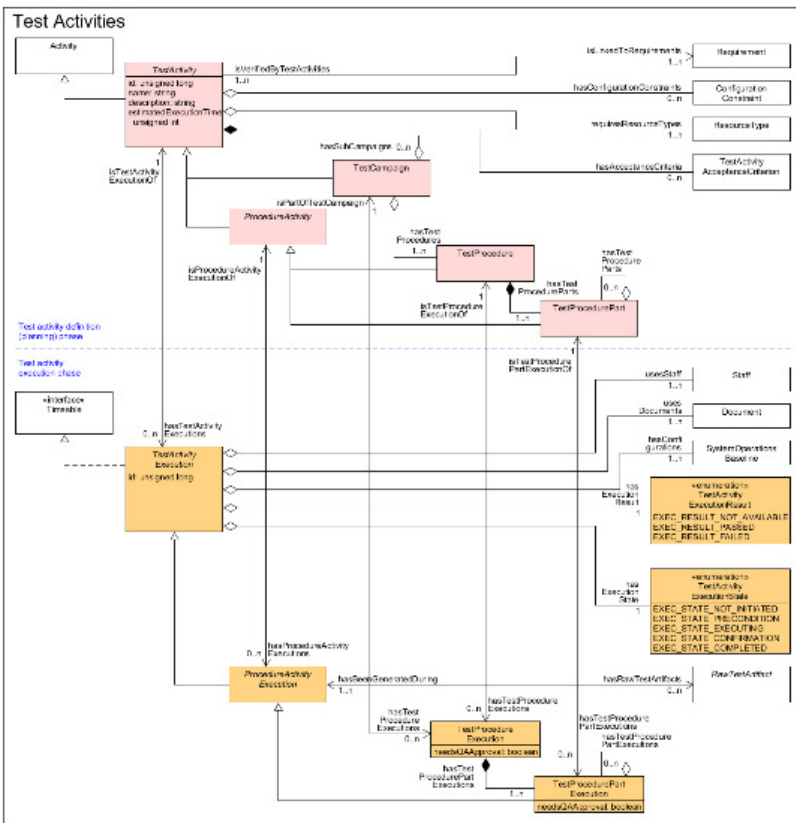
# Project Scoping and Process: Modelling UoD > Process



# Project Scoping and Process: Modelling UoD > Top-down problems

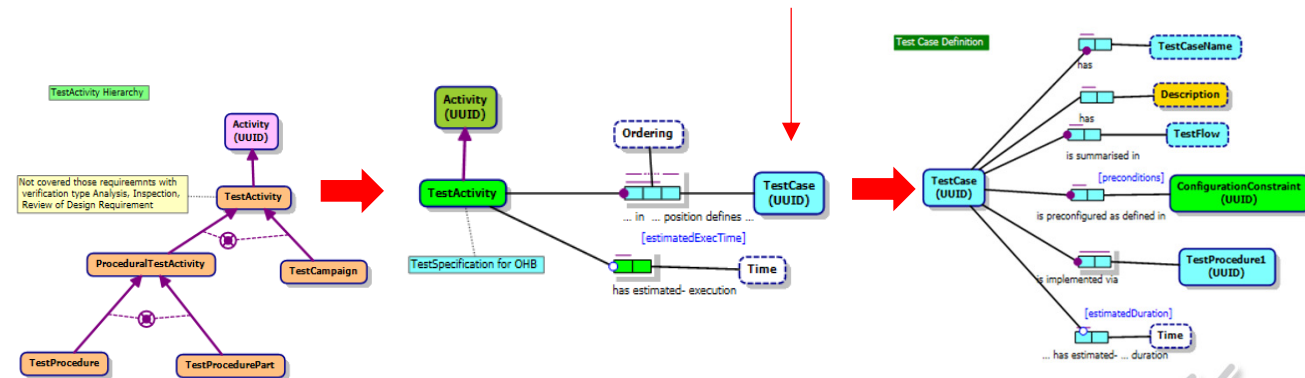


# Project Scoping and Process: Modelling UoD > Top-down problems

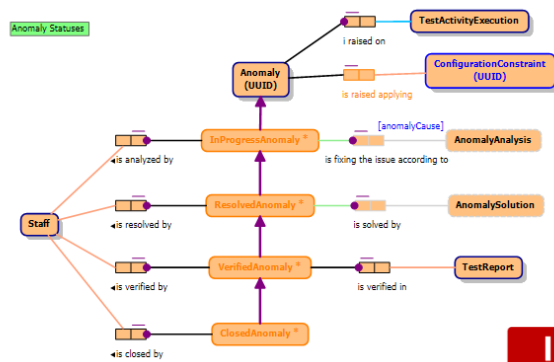


## Problems found:

- Procedure Activity Concept only considers AIV PoV and will collision with other Domains
- Hierarchy of Procedure Activity is inconsistent...a part cannot be an instance in itself
  - ECSS 70-40 convention on Test Activities, Test Cases, Test Procedures and Test Steps not followed
    - Conflict with 70-32 definition of Procedure Activity and Test Procedure



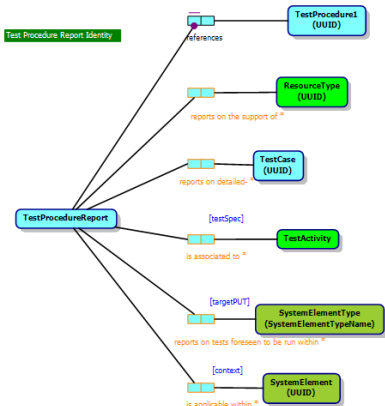
# Project Scoping and Process: Modelling UoD > Enhancements



Added suggestions after assessing with AIV Experts

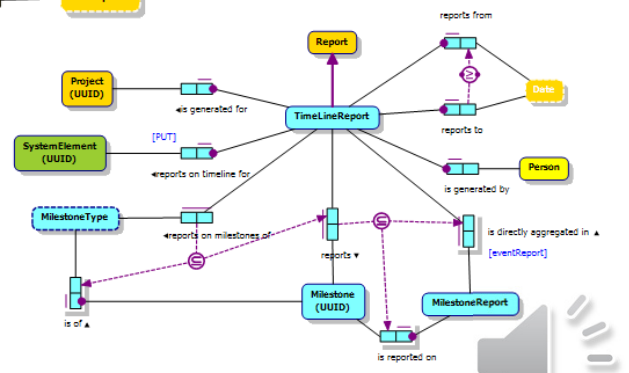
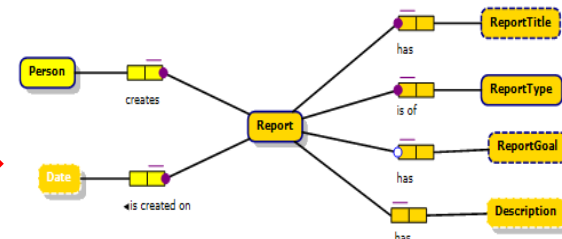
- Lack of relation between Anomaly and Test Activity Execution in which the Anomaly is discovered.
- States of the Anomalies are important for AIV campaigns, in TSR were not covered

Added concept of Report to the model (but not as a Document)

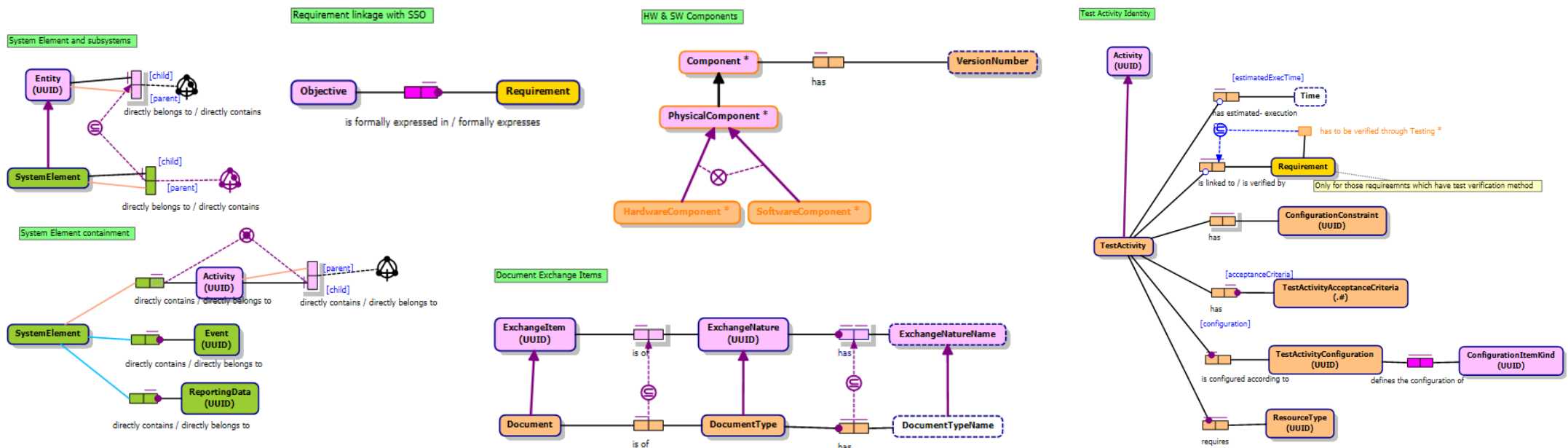


Added semantics to each type of AIV Report:

- Status Report
- Milestone Report
- TimeLine Report
- Test Specification Report
- Test Procedure Report
- Test Report



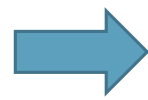
# Project Scoping and Process: Integration with SSO



# Project Scoping and Process: ICD Definition



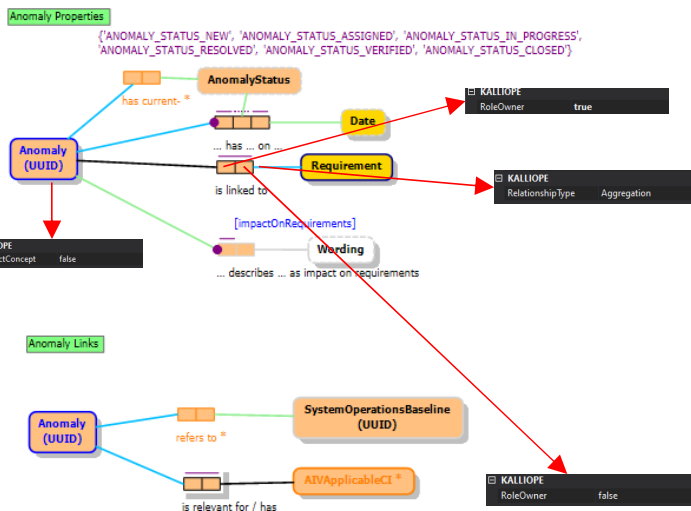
**nORMa**



**Kalliope**  
Object Role Modelling



**JSON**



```

Anomaly:
  required:
    - ImpactOnRequirements
    - Uuid
  properties:
    AnomalyIsLinkedToRequirements:
      type: array
      items:
        $ref: '#/components/schemas/Requirement'
    AnomalyIsRelevantForAivApplicableCIs:
      type: array
      items:
        $ref: '#/components/schemas/AivApplicableCI'
    AnomalyStatus:
      type: string
      enum:
        - ANOMALY_STATUS_NEW
        - ANOMALY_STATUS_ASSIGNED
        - ANOMALY_STATUS_IN_PROGRESS
        - ANOMALY_STATUS_RESOLVED
        - ANOMALY_STATUS_VERIFIED
        - ANOMALY_STATUS_CLOSED
    ImpactOnRequirements:
      type: string
      Uuid:
        type: string
      FacilityAnomaly:
        allOf:
          - $ref: '#/components/schemas/Anomaly'
      properties: {}
    ProductUnderTestAnomaly:
        allOf:
          - $ref: '#/components/schemas/Anomaly'
      properties: {}
    Facility:
      type: string
  Requirement:
    allOf:
      - $ref: '#/components/schemas/PrescriptiveParagraph'
    properties:
      HasToBeVerifiedThroughTesting:
        type: boolean
      RequirementIsVerifiedByTestActivities:
        type: array
        items:
          $ref: '#/components/schemas/TestActivity'
  
```

```

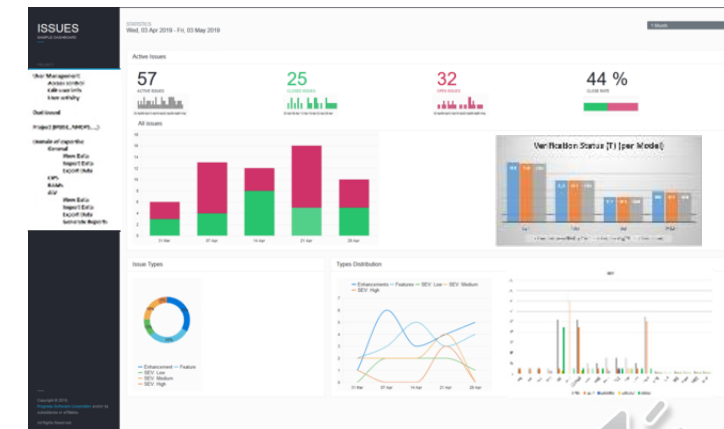
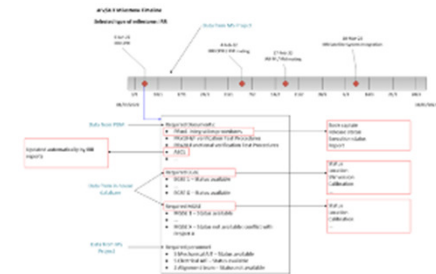
Anomaly {
  AnomalyIsLinkedToRequirements
  [Requirement {
    Uuid
    PrescriptiveParagraphIsOfRequirementType
    RequirementType {
      RequirementTypeName string required: true
    }
    HasToBeVerifiedThroughTesting boolean
    RequirementIsVerifiedByTestActivities [TestActivity { ...}]
  }
  AnomalyIsRelevantForAivApplicableCIs [AivApplicableCI {
    AivApplicableCIsCompliantWithConfigurationConstraints > [...]
    AivApplicableCIRefersToComponent Component > [...]
  }
  AnomalyStatus string Enum:
    [ ANOMALY_STATUS_NEW, ANOMALY_STATUS_ASSIGNED, ANOMALY_STATUS_IN_PROGRESS, ANOMALY_STATUS_RESOLVED, ANOMALY_STATUS_VERIFIED, ANOMALY_STATUS_CLOSED ]
  ImpactOnRequirements* Uuid* string
}
  
```

- Native Format: JSON
- Import/Export AIV Data from JSON
- Future from Excel (CSV)/XML

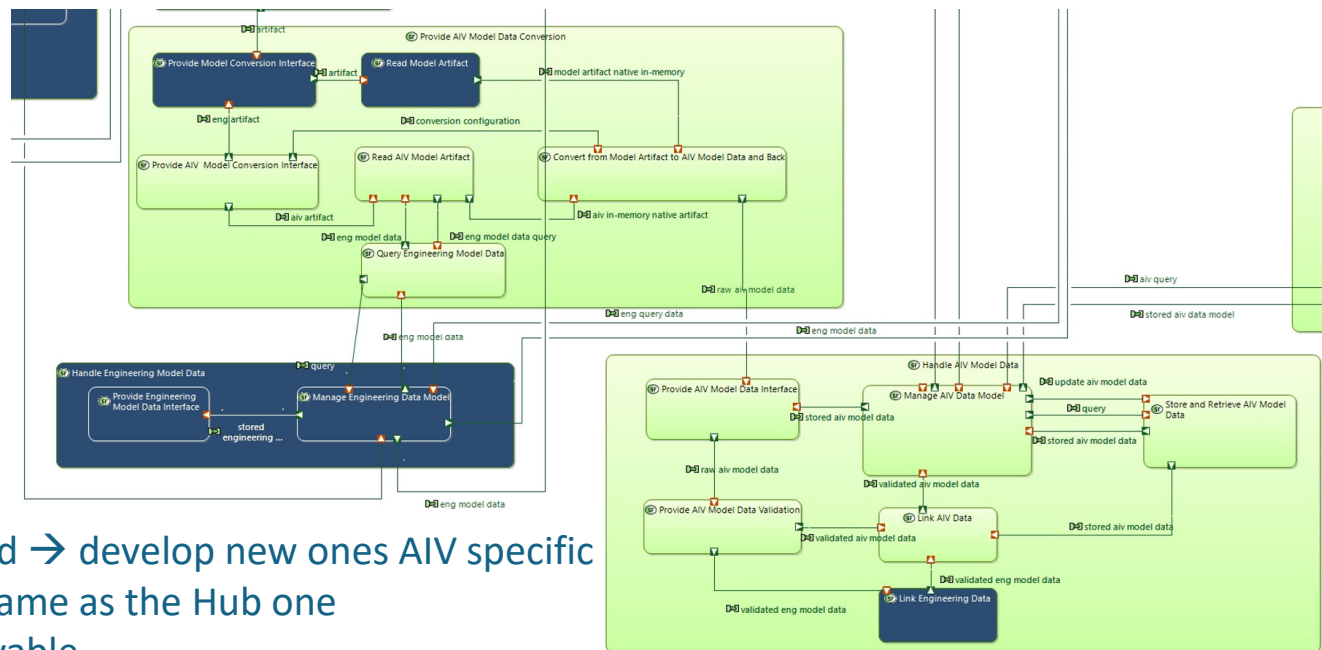
# Project Scoping and Process: Report & Displays Implementation



- Status Report → an overview of the number and status of certain concept types per system element (traditionally displayed in XY plots).
- Verification Status Report → overview on the verification status of a Project or a specific Requirement Specification Document.
- TimeLine Report → a timeline view based on parameters from an input project schedule showing different selectable milestones.
- Milestone Report → customizable parameters which characterize a specific Verification Milestone.
- Procedure Summary Report → a summary and status of a procedure.
- Test Specification Summary Report → summary and status of the test specification depending on parameters related to the Procedure concept.
- As-Run Report Summary → a summary and status of the test report



# Project Scoping and Process: MBSE Hub Integration

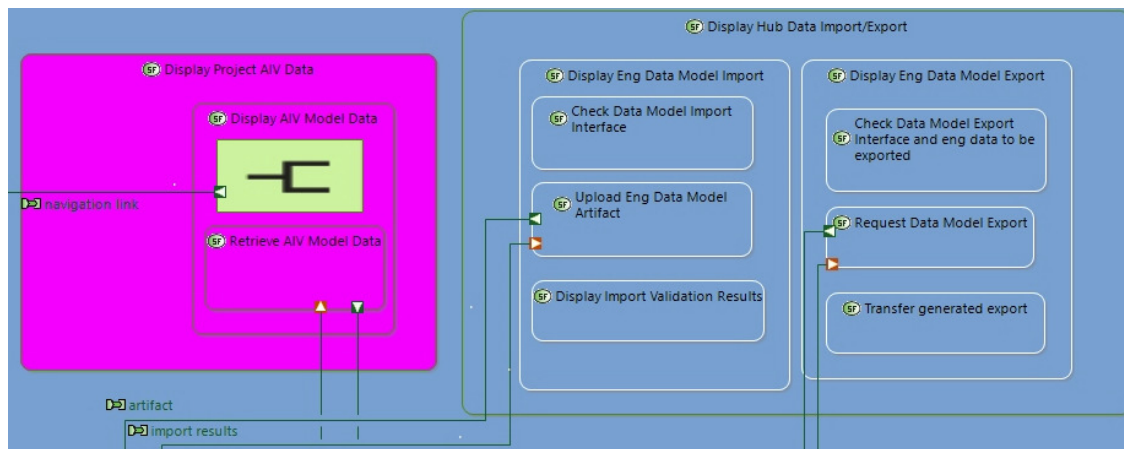


- Microservice Based → develop new ones AIV specific
- Database → The same as the Hub one
- Kubernetes deployable

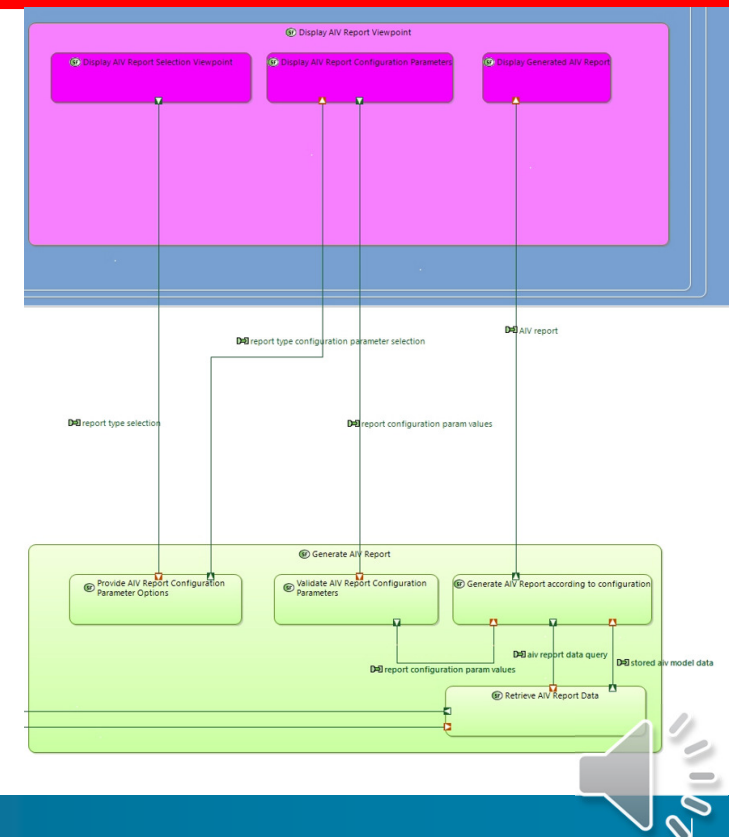
**Functional: 116**  
**Performance: 1**  
**Interface: 4**  
**Security: 2**  
**Quality: 8**  
**Maintainability: 1**  
**Configuration: 3**  
**Data: 2**  
**Validation: 10**  
**Human-factor: 10**  
**Hardware: 10**

**Total: 167 requirements**

# Project Scoping and Process: MBSE Hub Integration



- Razor-based UIs calling the Hub REST microservices
- Automatically Tested with Selenium





# Reach The Team

We love questions and feedback – and we're always happy to help!  
Here are some ways to contact us.

## ESA Contact

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## MBSE 4 Team Contact

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**THANK YOU**

