MARVL CIP

TEC-SW FINAL PRESENTATION

CIP
Common Information Platform

Speaker:

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OVERVIEW

Introduction

ESA Need

Project Objectives

MARVL Context

CIP Architecture

CIP Demonstration

Conclusion

Q&A

INTRODUCTION

- ESA TRP Activity
- **MARVL** - **M**odel b**A**sed **R**equirements **V**erification **L**ifecycle
- Exchange of “structured” Engineering data/information Between stakeholders (customer & supplier)
- **Common Information Platform** (CIP) developed in support of MARVL requirements

MARVL CONSORTIUM

: Prime

- Meta model design of the FDM (Functional Data Model)
- Public REST API (including data store persistence)
- Web UI client

AIRBUS DEFENCE & SPACE

- Meta model design of the CDM (Common Data Model)
- Use case definition
- Demonstration data preparation

MARVL CONSORTIUM

ScopeSET
The Tools Experts

- MARVL RCP, desktop client

3DSE
Management Consultants

- Process gap analysis
- Recommendations

INTRODUCTION

- Many (MBSE) tools used by industry to create digital models.
- Exchange with agency is often document centric.
- Conversions of model data to documents and vice versa has the following down sides:
- Same information is repeated in different documents,
- Inconsistencies due to lack of configuration control ,
- Difficult to navigate between documents,
- Tracking of evolution, changes, and overall status is difficult

EUROPEAN SPACE AGENCY NEED

EUROPEAN SPACE AGENCY NEED

- A platform that facilitates model-based information exchange through the project life-cycles between:
  - interdisciplinary / multifunctional information exchange
  - multiple stakeholders (e.g. ESA, Airbus)
- A platform that supports traceability through the project lifecycle
- Support technical oversight and formal review process

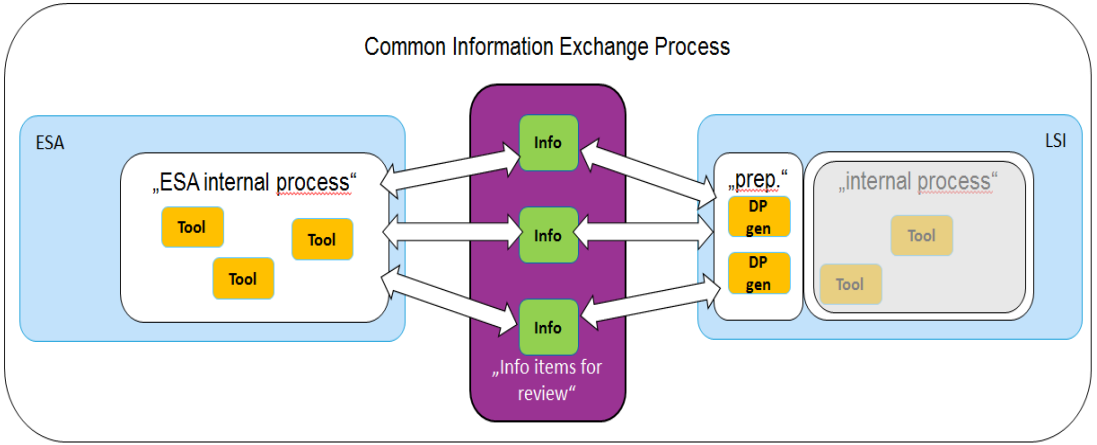
MARVL - CONTEXT

MARVL aims to develop a methodology to improve the processes and the related information exchange between the Customer (the Agency) and the Supplier (i.e. Large System Integrators (LSI)) across the full lifecycle

MARVL - CONTEXT

Process analysis

- From document based to model and information based;
- Support the structured sharing and exchange of data;
- Define a process to exchange this data;
- Define a properly supported process to perform reviews and early verification of requirements.



MARVL - CONTEXT

Approach

- Analyse the requirements of ESA and the LSI to support the effective exchange of requirements, verification information and engineering data across the full-lifecycle of the mission.
- Develop a model of the process and information exchange.
- Define a **Common Information Platform** (CIP) to support the exchange of data and information between the different actors.
- Develop a demonstrator of the CIP using an example mission and three engineering domains.
- Elaborate a roadmap for the introduction and deployment of the methodology and CIP within the European space industry.

MARVL - CONTEXT

Approach

- Model Driven Architecture using consortium tooling:
  - ScopeSET DME - Data Model Editor for model design
  - RHEA CDP4 used for collaborative requirements definition
    available as oss: https://github.com/RHEAGROUP/CDP4-WebServices-Community-Edition
  - C# Ecore parser: ecorenetto
    available as oss: https://ecorenetto.org/
  - C# ReqIF parser: ReqIF#
    available as oss: https://reqifsharp.org/

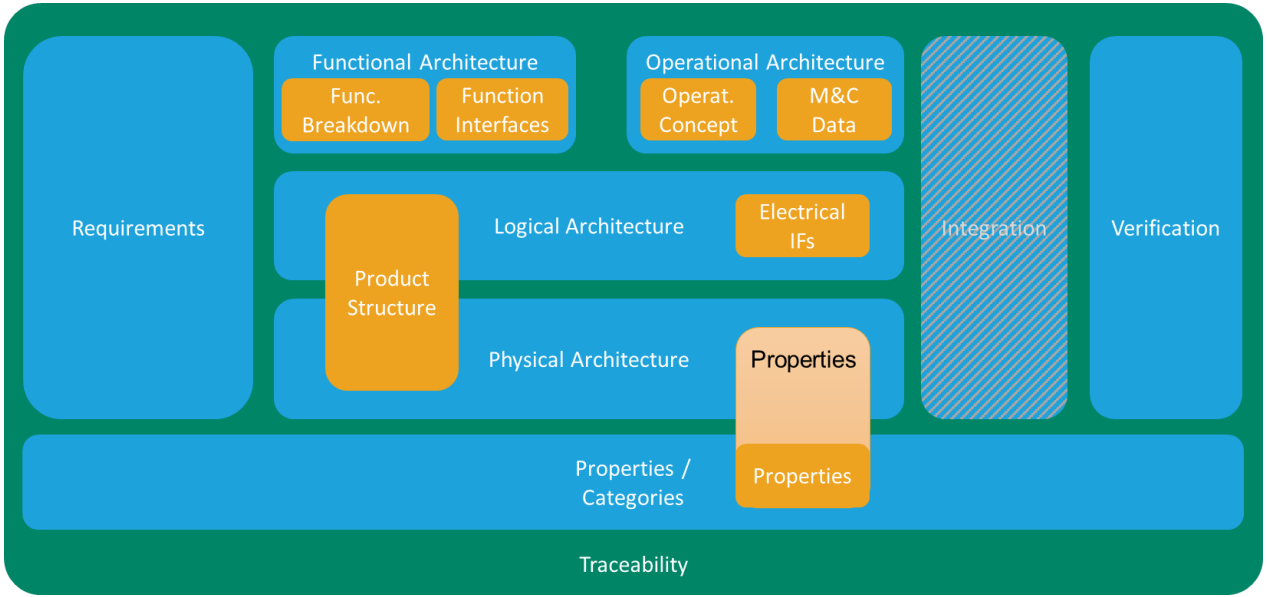
MARVL - CONTEXT

Approach

- Model Driven Architecture used to auto generate:
  - C# .NET Core libraries
  - Typescript libraries
  - Java libraries
  - REST API endpoints
  - SQL (PostgreSQL)
  - Cypher (Neo4J)

KEY ENGINEERING CONCEPTS

- Navigation, Inspection and Annotation (review) of Engineering Data coming from deliverables in a model-based fashion



MARVL - CONTEXT

CDM Design

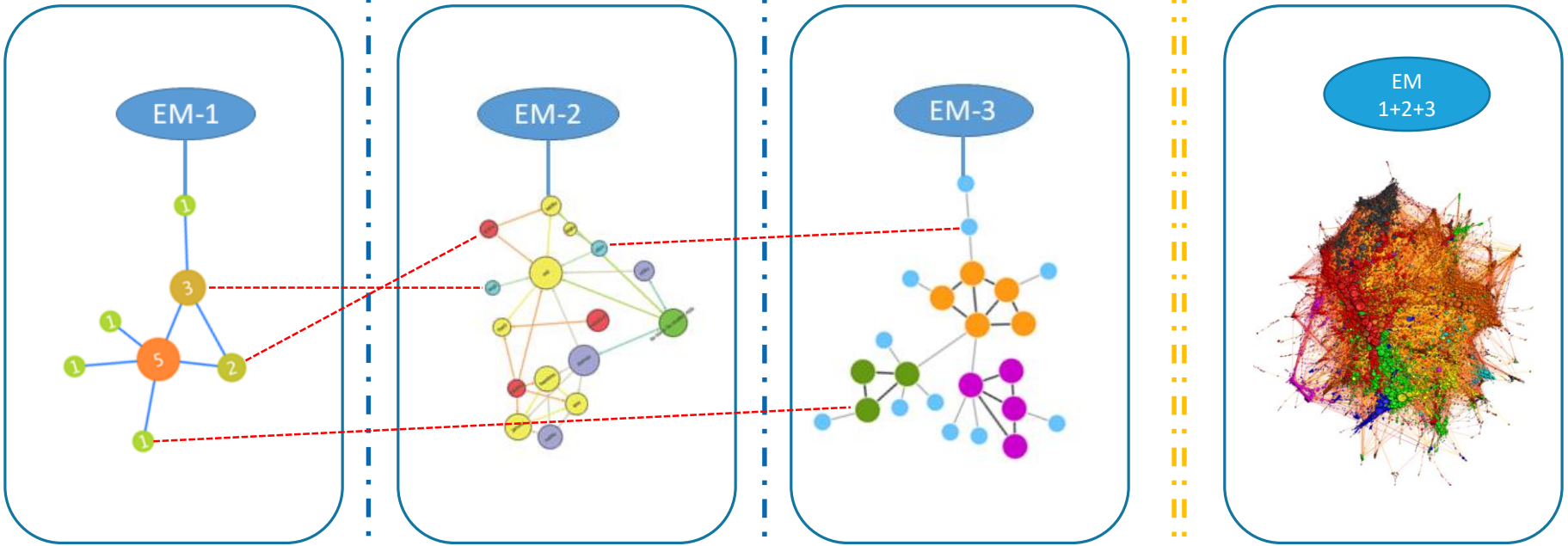
The MARVL Common Data Model is based on multiple available models to provide coverage of identified engineering concepts:

- EGS-CC (European Ground Systems Common Core)
- VSEE (Virtual Spacecraft Engineering Environment)
- ECSS E-TM-10-25A

MARVL - CONTEXT

- Model Based compared to Document Based
  - Document delivery is still supported
- Combine the data authored in multiple tools into one logical “model”:
- supported by conversion plugin architecture:
  - ReqIF
  - Capella
  - CIP Native format
- Use the “logical” model to navigate the relationships between Engineering Data to support verification activities during Reviews as well as Technical Oversight

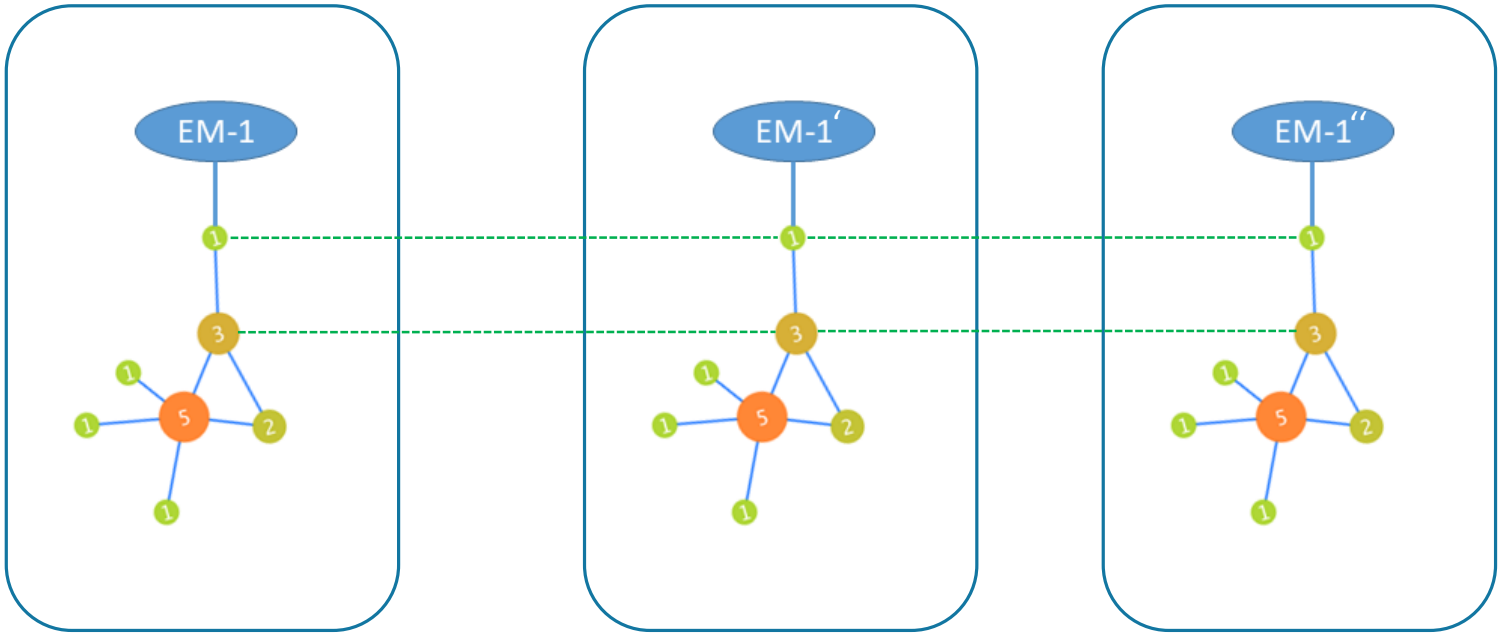
MARVL – MERGED MODEL INSPECTION



Requirements
(ReqIF)

Functional Avionics
(Capella)

Physical Architecture
(Native CIP)



Requirements
(ReqIF)

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CIP ARCHITECTURE

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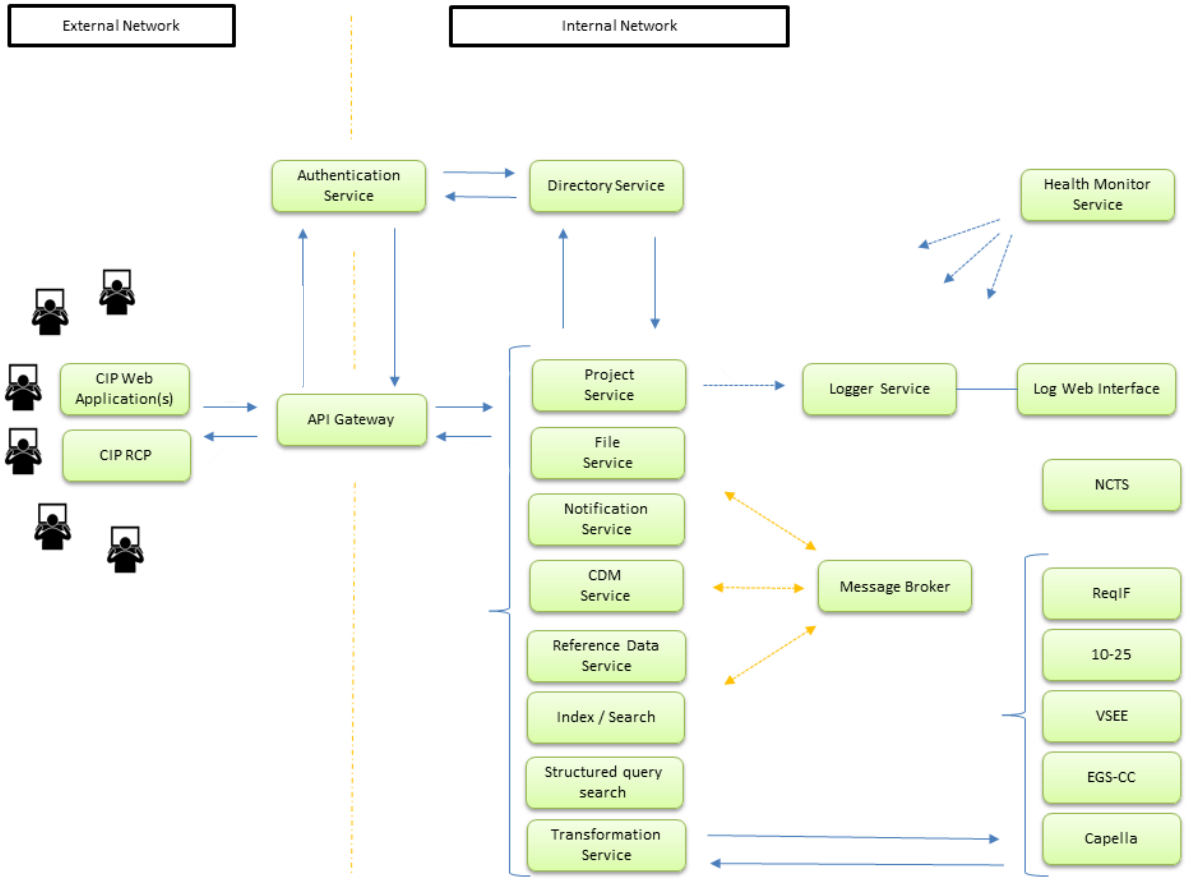


CIP ARCHITECTURE

- The majority of the microservices are based on Microsoft .NET Core using OWIN Middleware pipelines such as NancyFx.
- Inter microservice communication based on Message Queues.
- Authentication based on IdentityServer4 based on OpenID Connect and OAuth 2.0.
- Authorization based on RBAC (configurable roles and permissions).
- The CIP is Deployed using Docker and Kubernetes.

CIP CLIENT TIER

CIP web client technolgy

- Angular 4
- HTML 5
- Bootstrap
- Webpack
- NPM

CIP FRONT TIER

The front tier provides TLS termination and reverse proxy

- Nginx

https://

CIP MID TIER

The mid tier is deployed as a microservice architecture

- Microsoft .NET Core 2.0
- Java 8
- NancyFx REST
- Identity server 4
- RabbitMQ
- Nunit

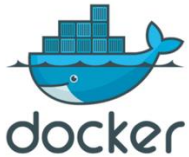
CIP BACK TIER

Multiple data stores used according to particular need

- PostgreSQL
- SQLite
- ElasticSearch
- Neo4J CE

TOOLING

- Visual Studio 2017
- Phabricator project management
- GIT
- Jenkins
- SonarQube
- Nexus
- NuGet
- Docker / Kubernetes



CIP DEMONSTRATION

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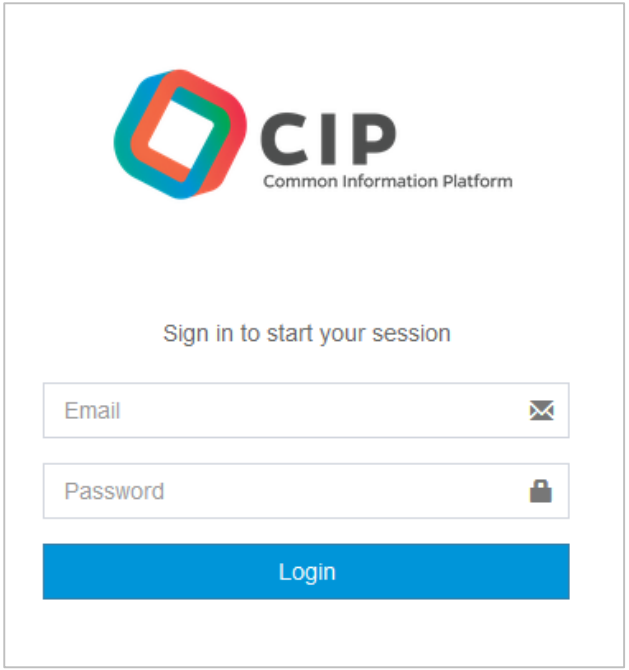


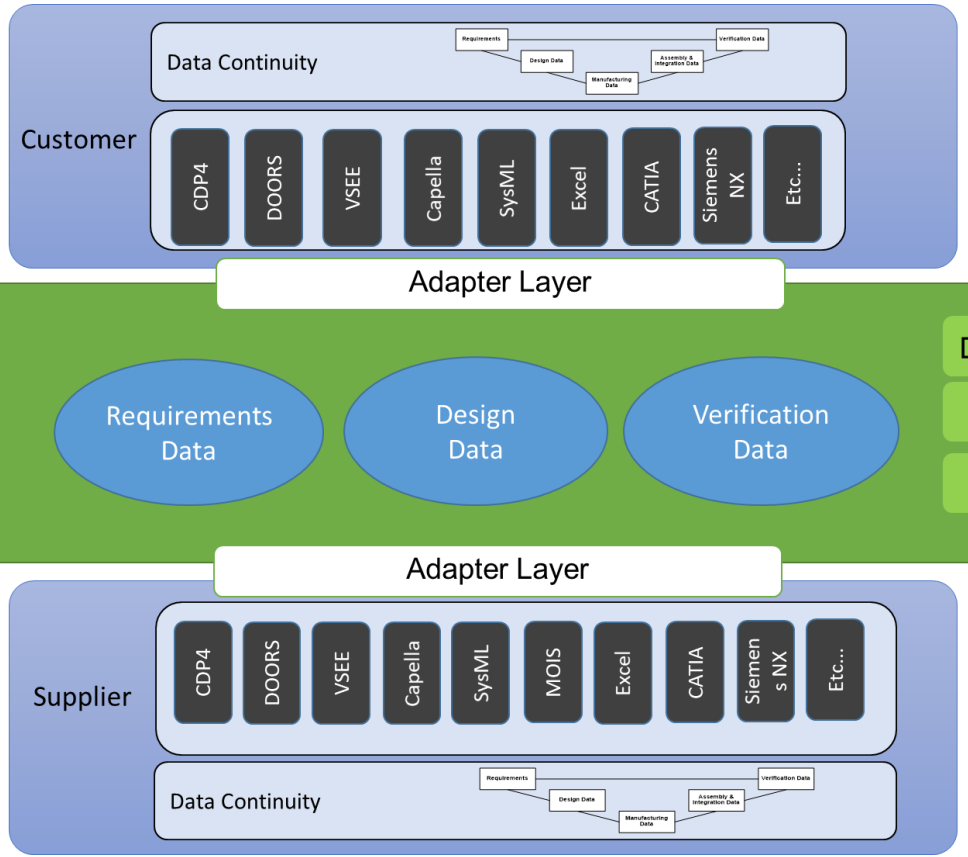
CONCLUSION

CONCLUSIONS

The MARVL project has resulted in the delivery of the **Common Information Platform** which:

- facilitates an interdisciplinary / multifunctional information exchange between the multiple stakeholders
- facilitates model traceability through the model lifecycle
- facilitates ESA's model review process

MARVL CIP FUTURE



Q&A

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