CPS Simulation models categories in Extended Enterprises (Short paper)

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FRENCH INSTITUTES OF TECHNOLOGY

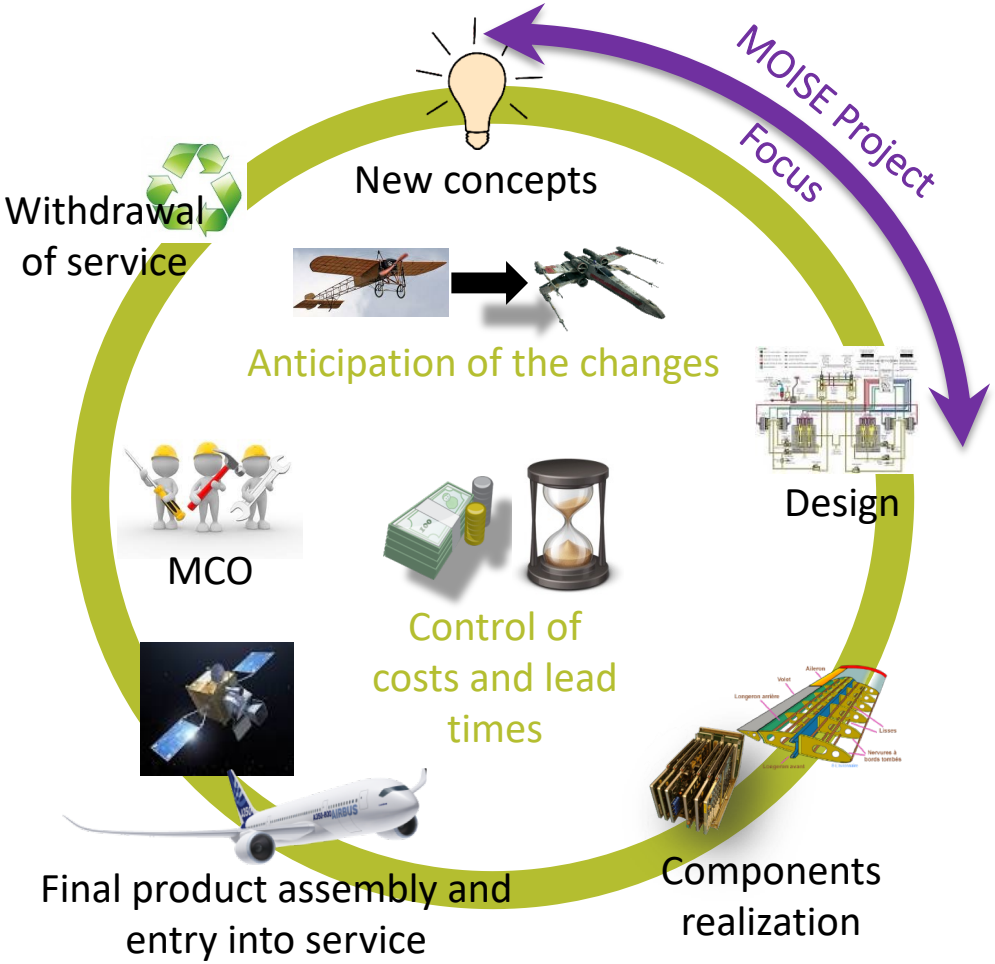
IRIT

IRT Presentation

- ✓ **8 IRTs** were launched since 2012 in the frame of the **French 'Investissement d'Avenir' (PIA),** to supplement to other instruments (Competitivity Clusters, SATT for IP valorization, IDEX for higher education and fundamental research, etc.)
- ✓ The aim of those **thematic multi-disciplinary institutes** is to **reinforce competitiveness of French industry on the global market** through world class technology research projects, teams and platforms.
- ✓ Based on a **50-50 private-public partnership** between French government and Public Research and Higher Educations establishments on the one hand, and key industrial partners on the other hand.

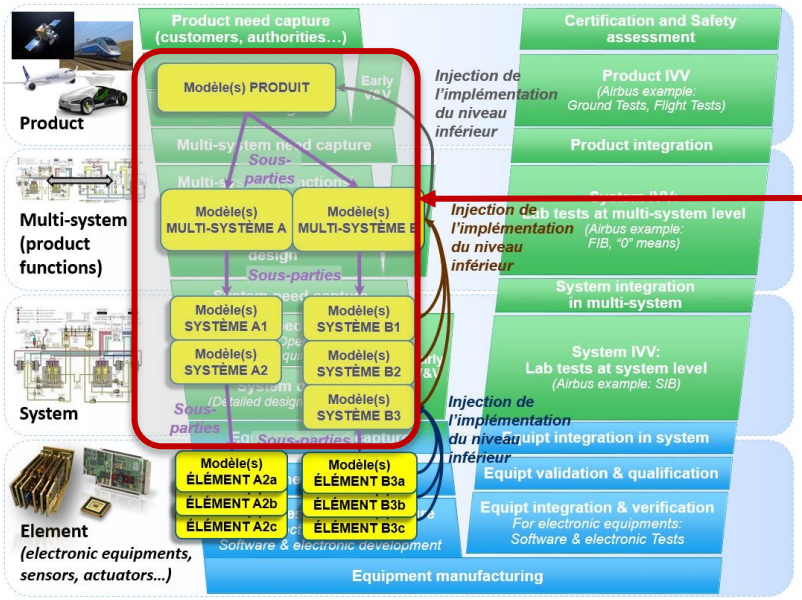
In 2015, the 8 IRTs came together to create the Association of Technological Research Institutes (FIT)

MOISE Project : Economics Challenge

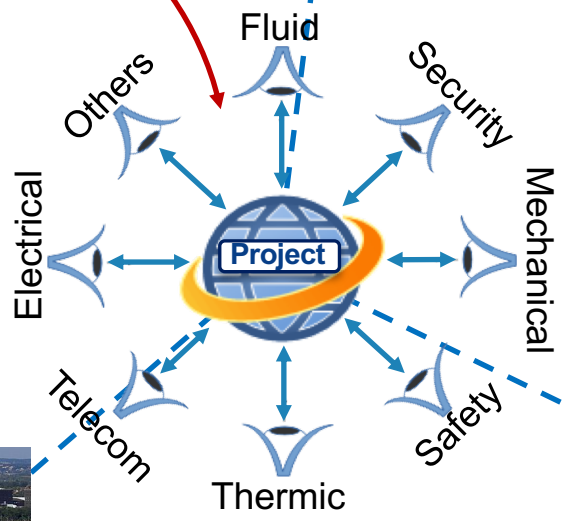


- **Productivity**
  - Cost containment
  - Control of process deadline in Extended Enterprise (Customers, Suppliers, Subcontractors…)
  - Change anticipation
- **Competitiveness**
  - Innovative products, quality of products and services,
  - Reduction of time to market,
  - Reduction of the customer training cost

MOISE Project focus



MOISE Project focus

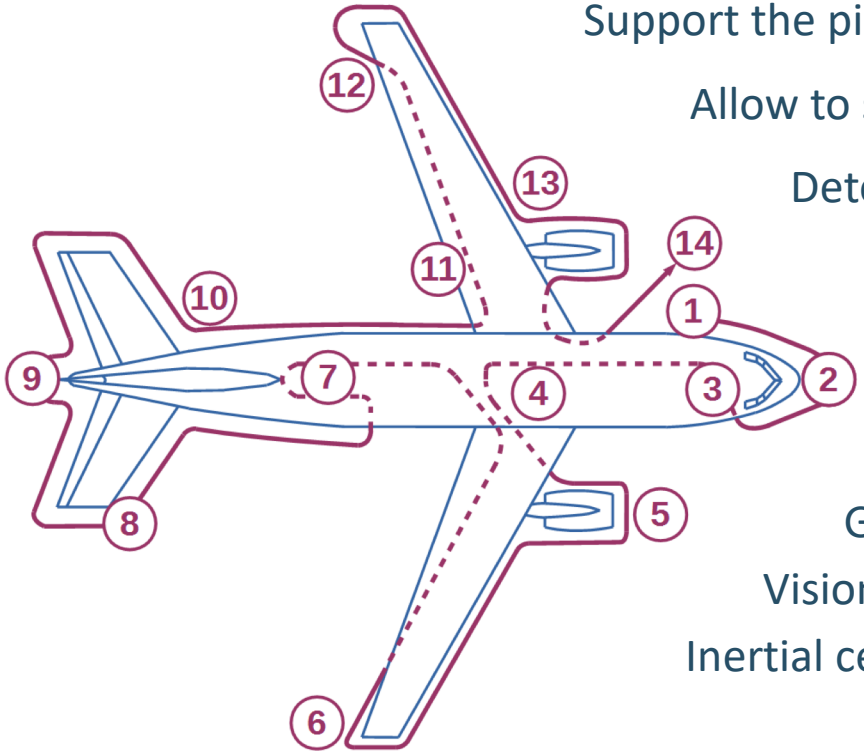


In the MBSE and Extended Enterprise (collaborative work, IP protection) context:
How to handle the variety of engineering domains and heterogeneous data?

Modeling and Early Validation and Verification are key assets

MOISE AIDA Use Case

AIDA : Airplane Inspection Drone Assistant



Support the pilot in the mandatory pre-flight aircraft inspection

Allow to scrutinize all areas (top of the wings, …)

Detect irregularities (forgotten caps on sensors, …)

Can follow automaticaly flight plan

Can be manually controlled

Radar

GPS Locator

Vision system

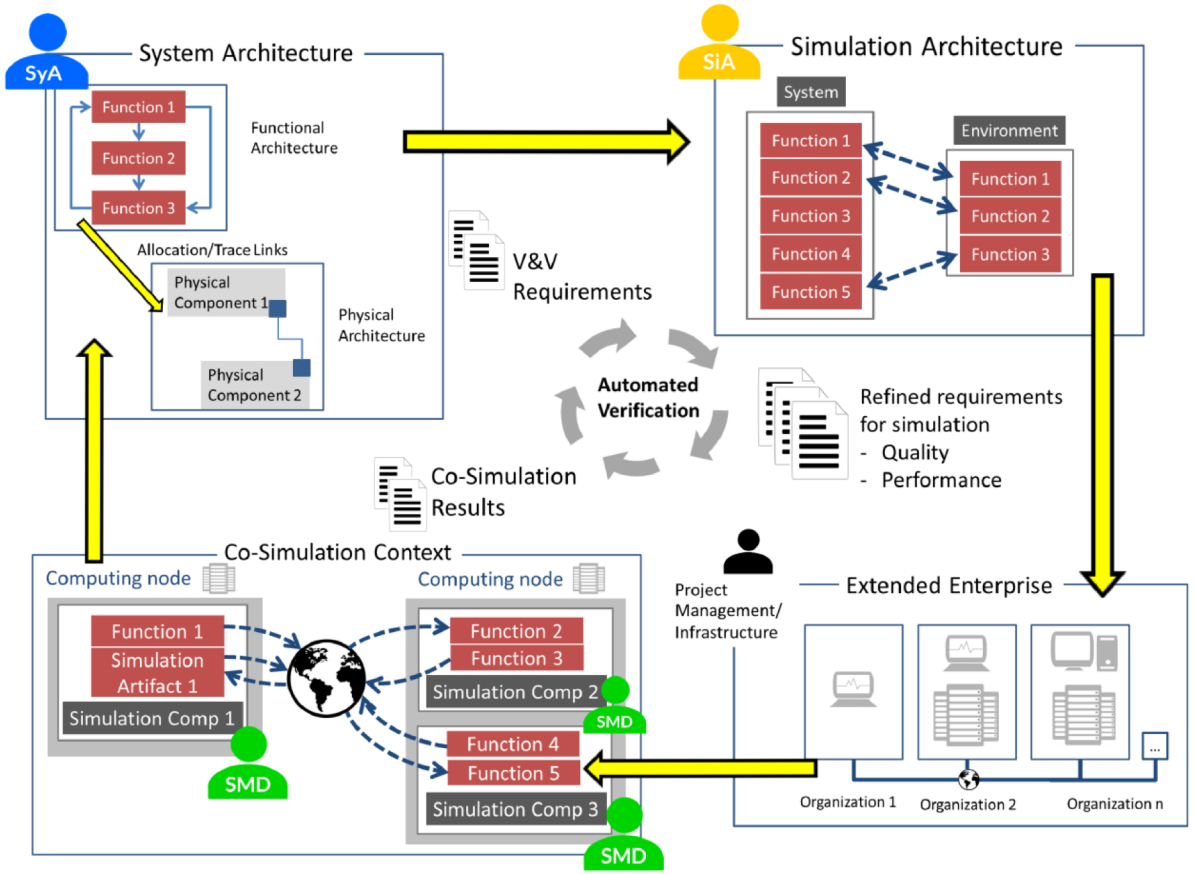
Inertial central

Data is saved locally, and transfered in real-time to the ground

MOISE methodology and MBSE for CPS co-simulation activities

- MOISE Methodology
- Co-simulation activities
- Flight Plan
- Example and mission sketch
- Functional Archi & Simulation
- Conclusion
- Expectation

MOISE Simulation Methodology



SyA *System Architect*

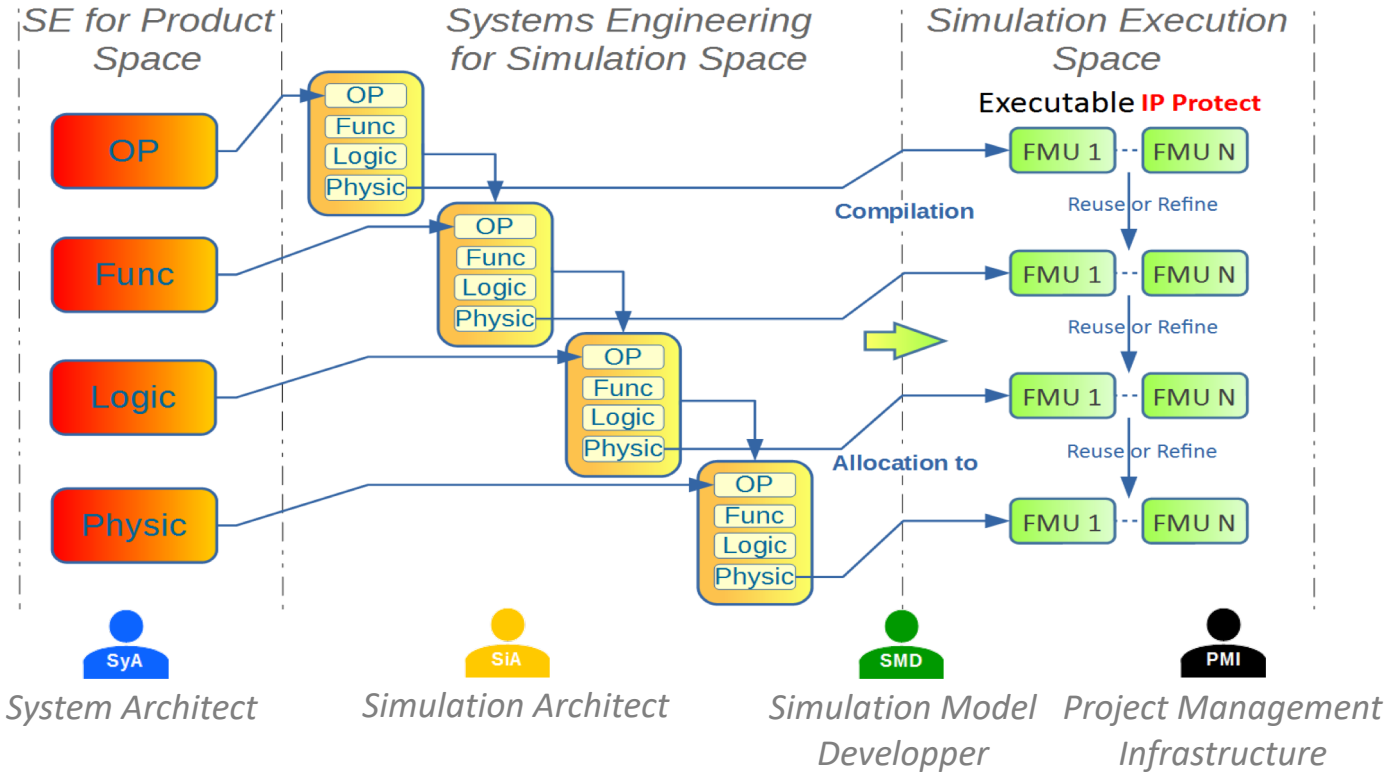
SiA *Simulation Architect*

SMD *Simulation Model Developer*

PMI *Project Management Infrastructure*

How do we handle the development of simulation models ?

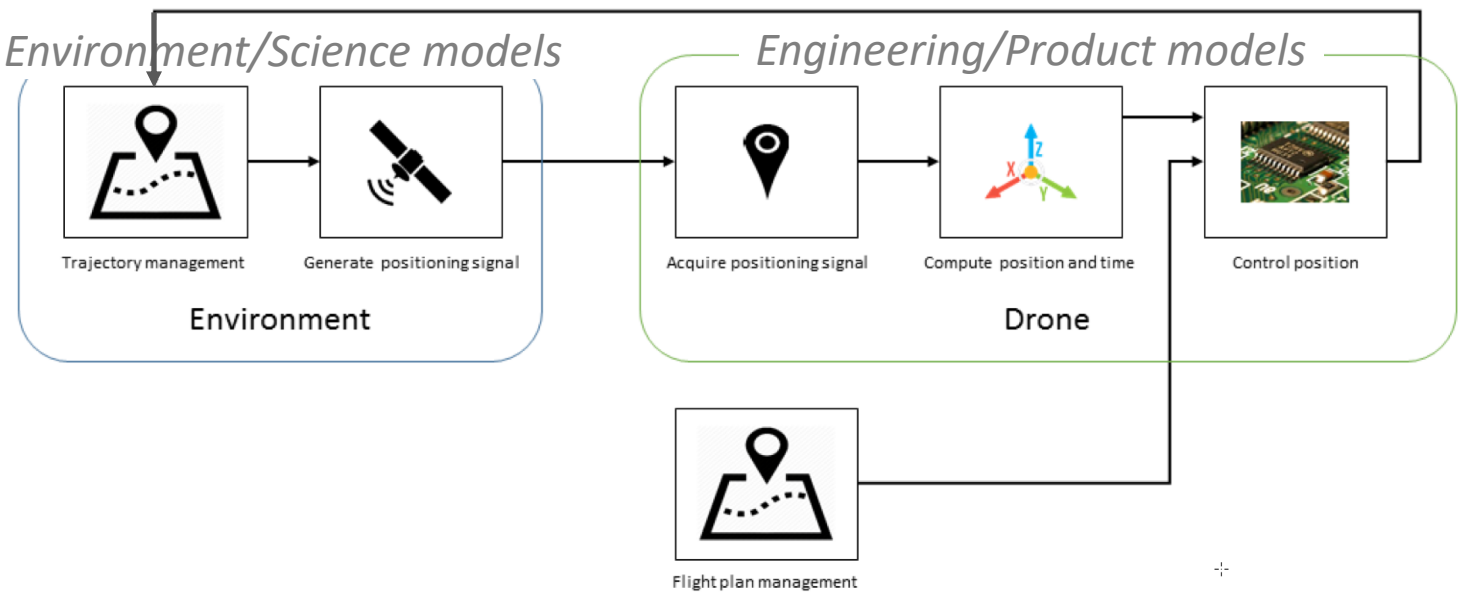
Co-Simulation activities



FMI standard allows to preserve the know-how of the stakeholders in an Extended Enterprise

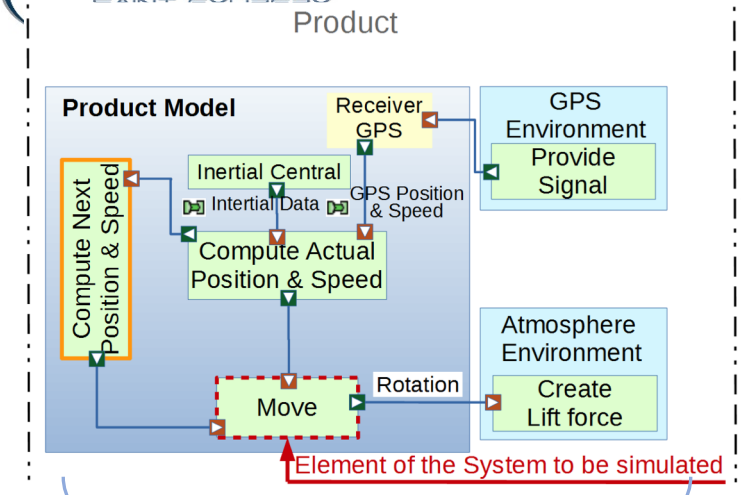
How do we ensure the consistency of simulation models ?

Environment & Product Models



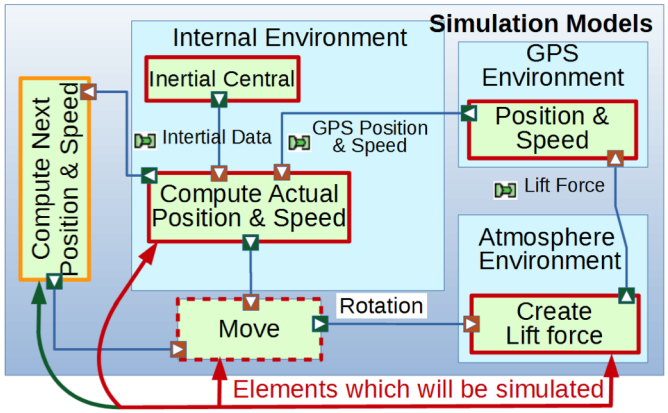
- *Environment Models are descriptive Science (Lee) models used to assess the product models*
- *Key point: should be deterministic and the level of details should be consistent in order to ensure an efficient and meaningful simulation*
- *Product Models are prescriptive Engineering (Lee) models and must be deterministic*

Model categories



Becomes

Traceability



SyA

System Architect

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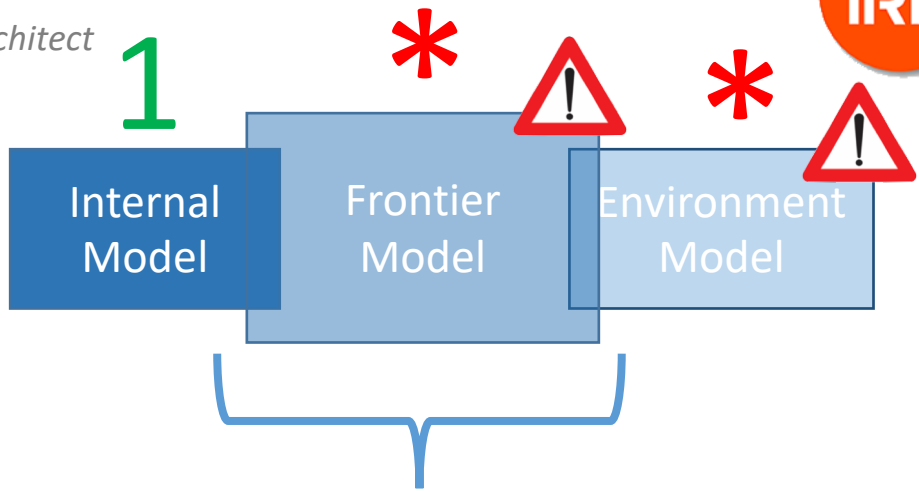

Designed by Stakeholder	Designed by Stakeholder	Designed by external
System Architects	Simulation Architects	Simulation Architects
Prescriptive	Partly Prescriptive	Descriptive
Engineering	Partly Descriptive	Science
Exact by Design	Engineering	Required fidelity
	Must be assessed w.r.t. other Stakeholders models	& representativeness

SiA

Simulation Architect

SMD

Simulation Model Developer

Conclusions - Expectations

Conclusions - Expectations

- Need for intermediate simulation models when developing a system using agile Concurrent Engineering in an Extended Enterprise
- These models are used only to conduct early model based V&V activities
- Models are neither fully prescriptive nor fully descriptive with respect to the product => additional verification activities
- Can explore more easily a large spectrum of situations & environment behaviour

Expectations

- This work will be extended to the full AIDA model and other use cases
- Create an ontology of models categories for developing Cyber-Physical Systems and associated V&V activities

Acknowledgements

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Any question?