An Industrial Validation of SMP

EADS astrium

ThalesAlenia Space
A Thales / Finmeccanica Company

Ellidiss Technologies
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cnes

SPACEBEL

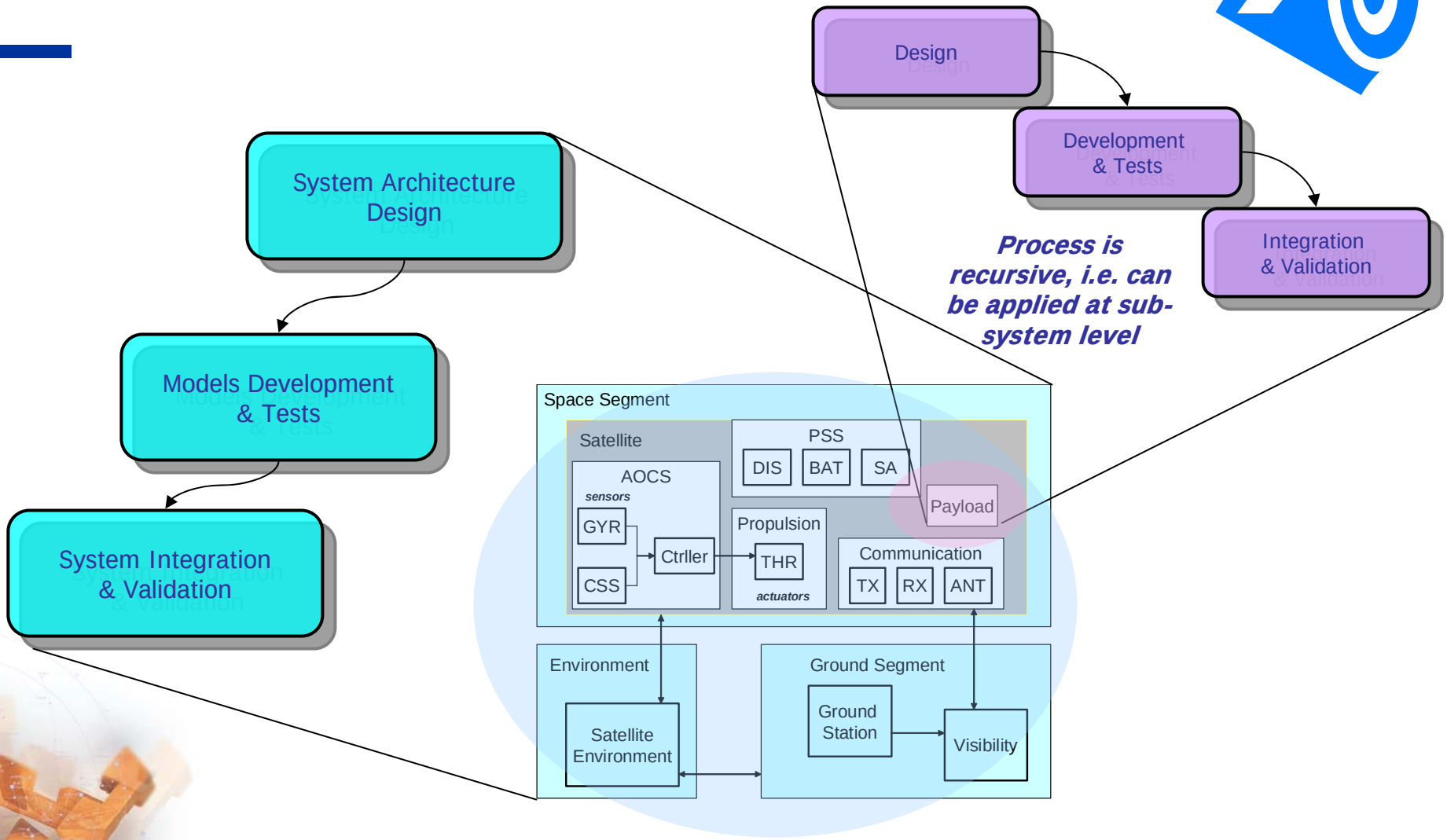
The Actors

- CNES (Prime)
  - Bernard Delatte
- Spacebel
  - Rachid Atori, Hien Thong Pham
- Thales Alenia Space
  - Franck Maingam, Gilles Mesiano
- EADS Astrium
  - Claude Cazenave, Pierre Guillet
- Ellidiss
  - Pierre Dissaux, Arnaud Schach

What were the objectives?

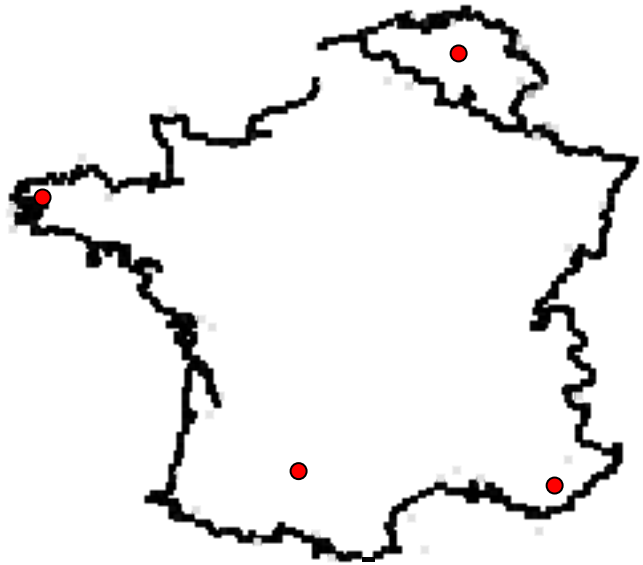
- Validation of SMP2 in an industrial process
  - Simulation of a representative satellite
  - Distributed development locations (multi-sites) taking into account
    - Different roles in the process
    - Information sharing via the SMP2 artefacts (catalogues & assemblies)
    - Source & binary code sharing
  - Provide inputs to the ECSS E40-07 SMP2 WG
- Validation on multiple simulator infrastructures
  - SIMSAT4 (ESOC)
  - BASILES Kernel (CNES/Spacebel)
  - SIMTG (Astrium)
- Validation of tooling user needs through the use of SMP2 tools
  - SIMSAT4 MIE (ESOC)
  - STOOD (Ellidiss)

Process – Principles



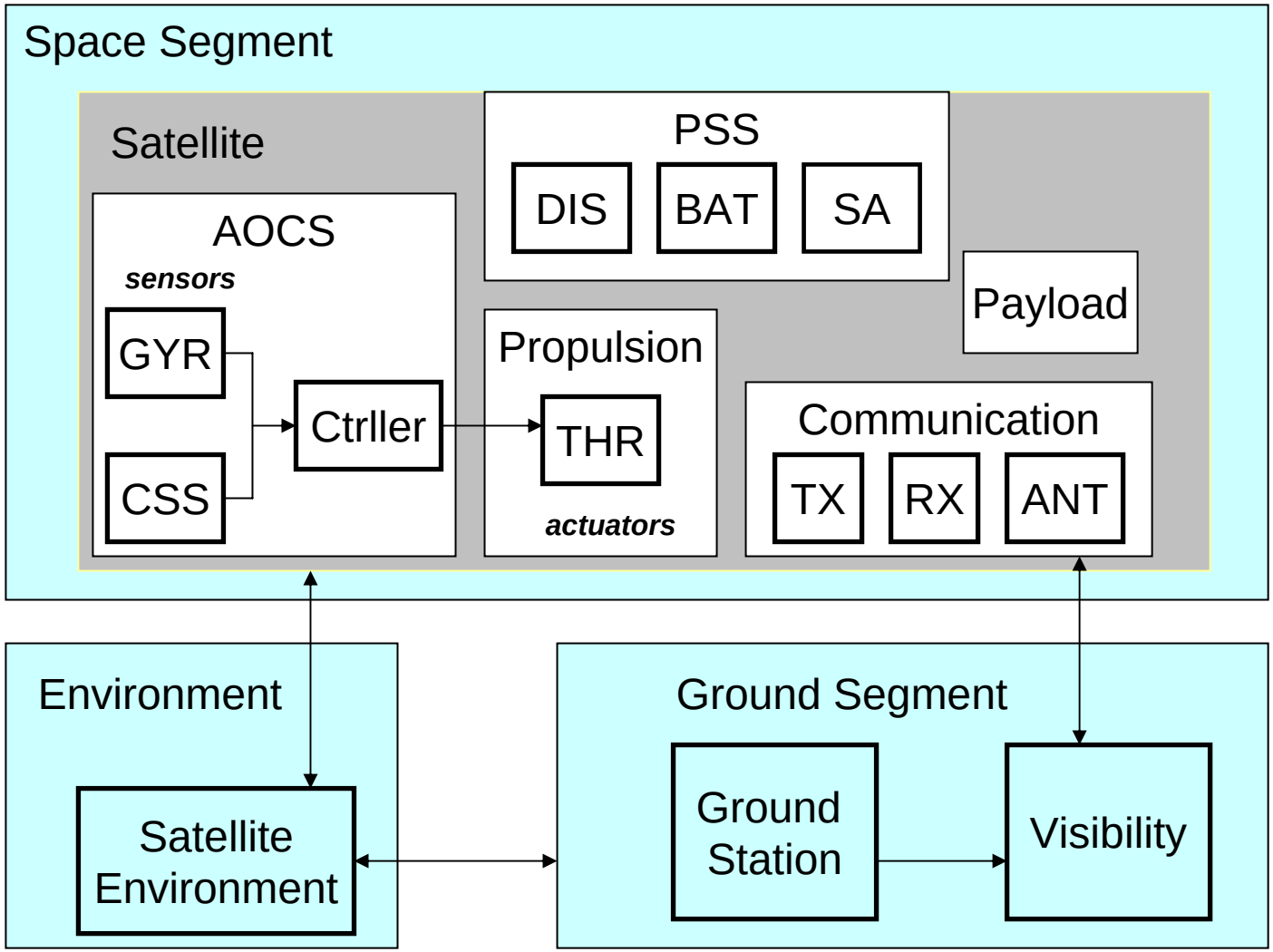
Process – Work Breakdown & Roles

Phase	Role	Responsible Actor
System Architecture Design	Main	Spacebel
	Contributors	Thales, Astrium & CNES
Models Development & Test	Main	Spacebel, Thales & Astrium
System Integration & Validation (BASILES Kernel & SIMSAT)	Main	Spacebel
	Contributors	Thales & Astrium
System Integration & Validation (SIMTG)	Main	Astrium
STOOD Support	Main	Ellidiss



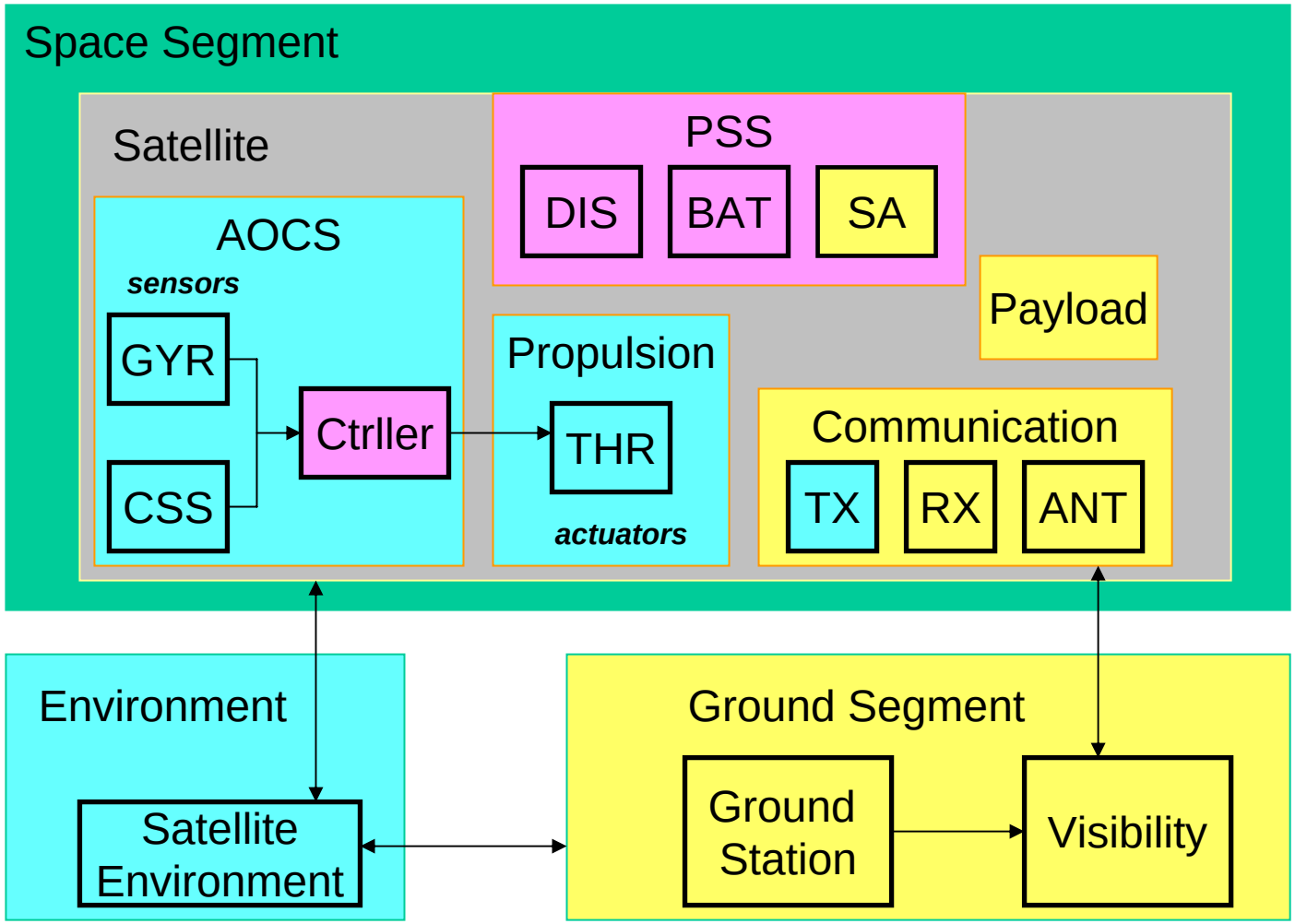
Simulator Overview

FES type simulator



What about Work Distribution?

FES type simulator



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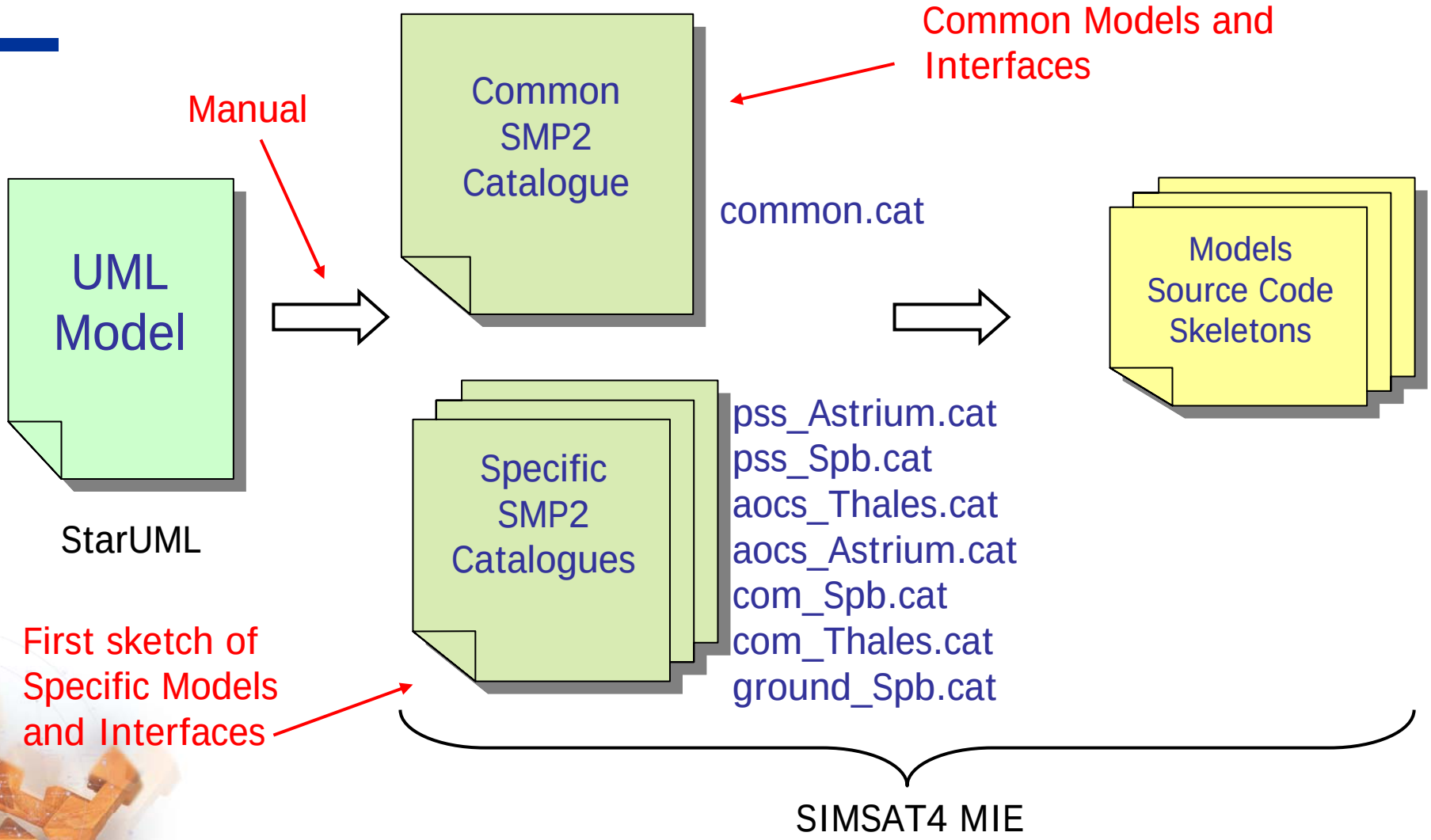
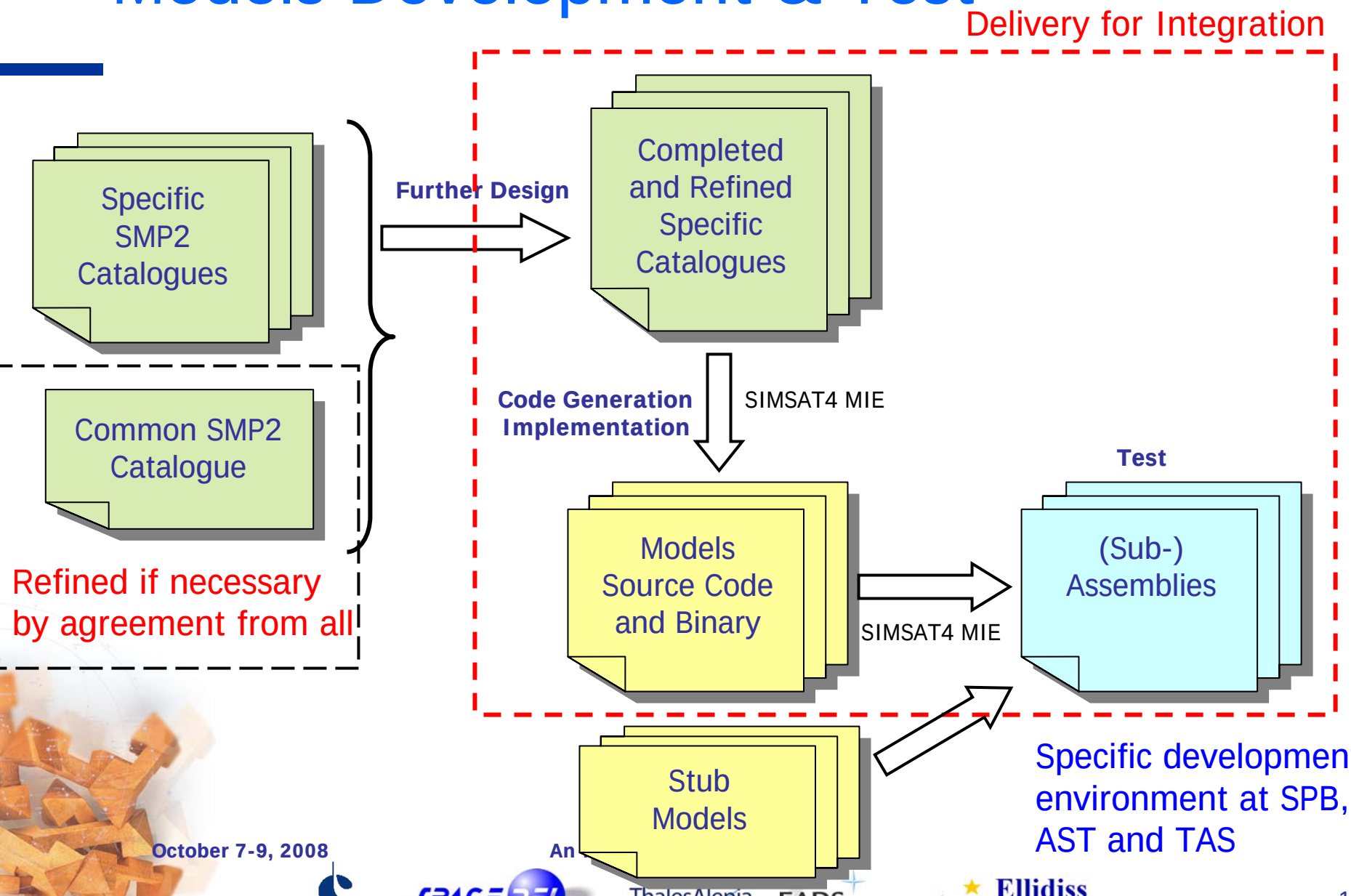
Detailed Work Distribution

- Work distribution takes into account multi-site development
- Promotes a maximum of information exchange between the participants:
  - each participant is in charge of
    - a sub-system (development & integration)
    - and one model belonging to another sub-system (development)
- Sub-system SMP2 artefacts are delivered to the integrator

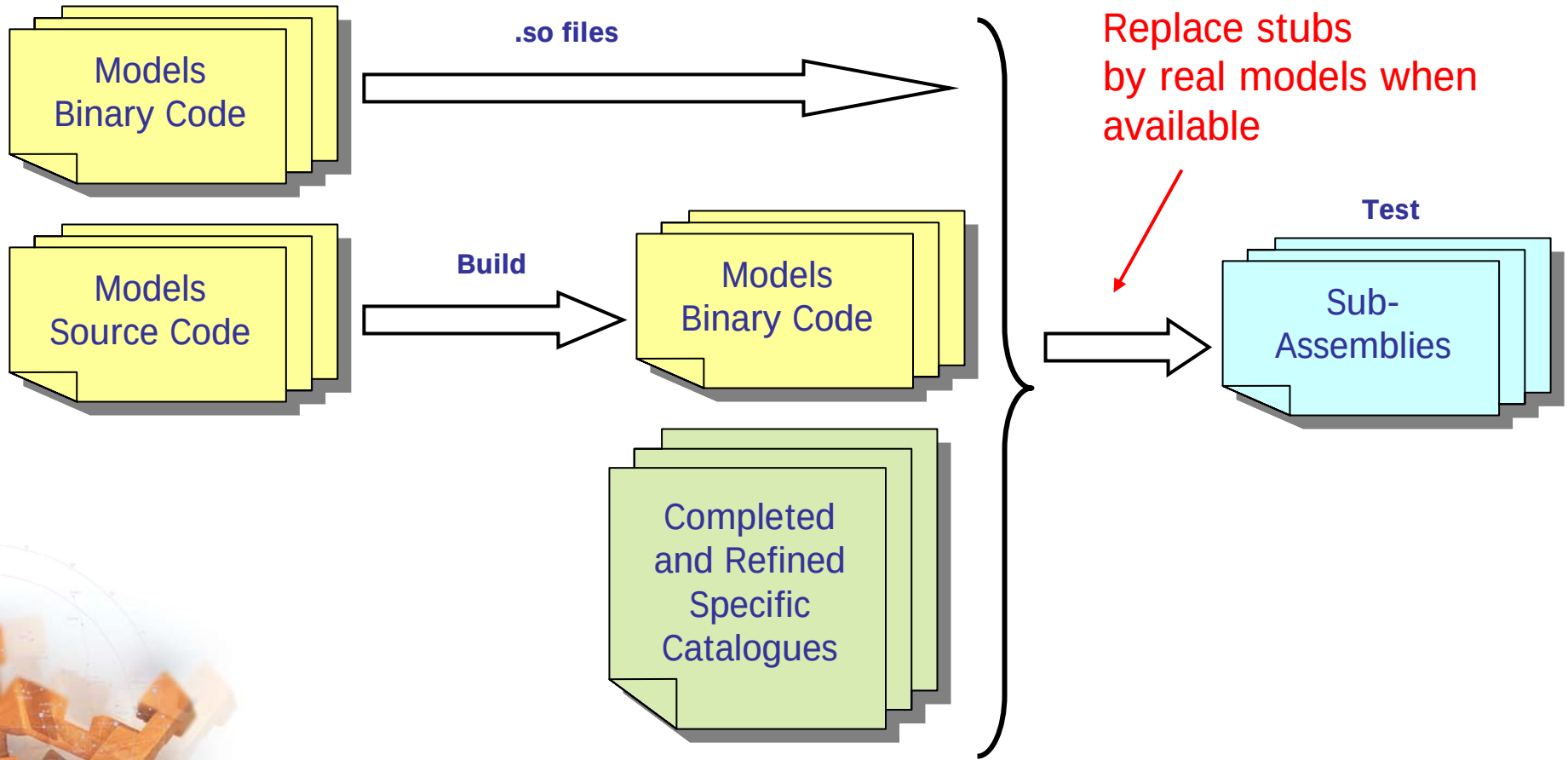
System Architecture Design



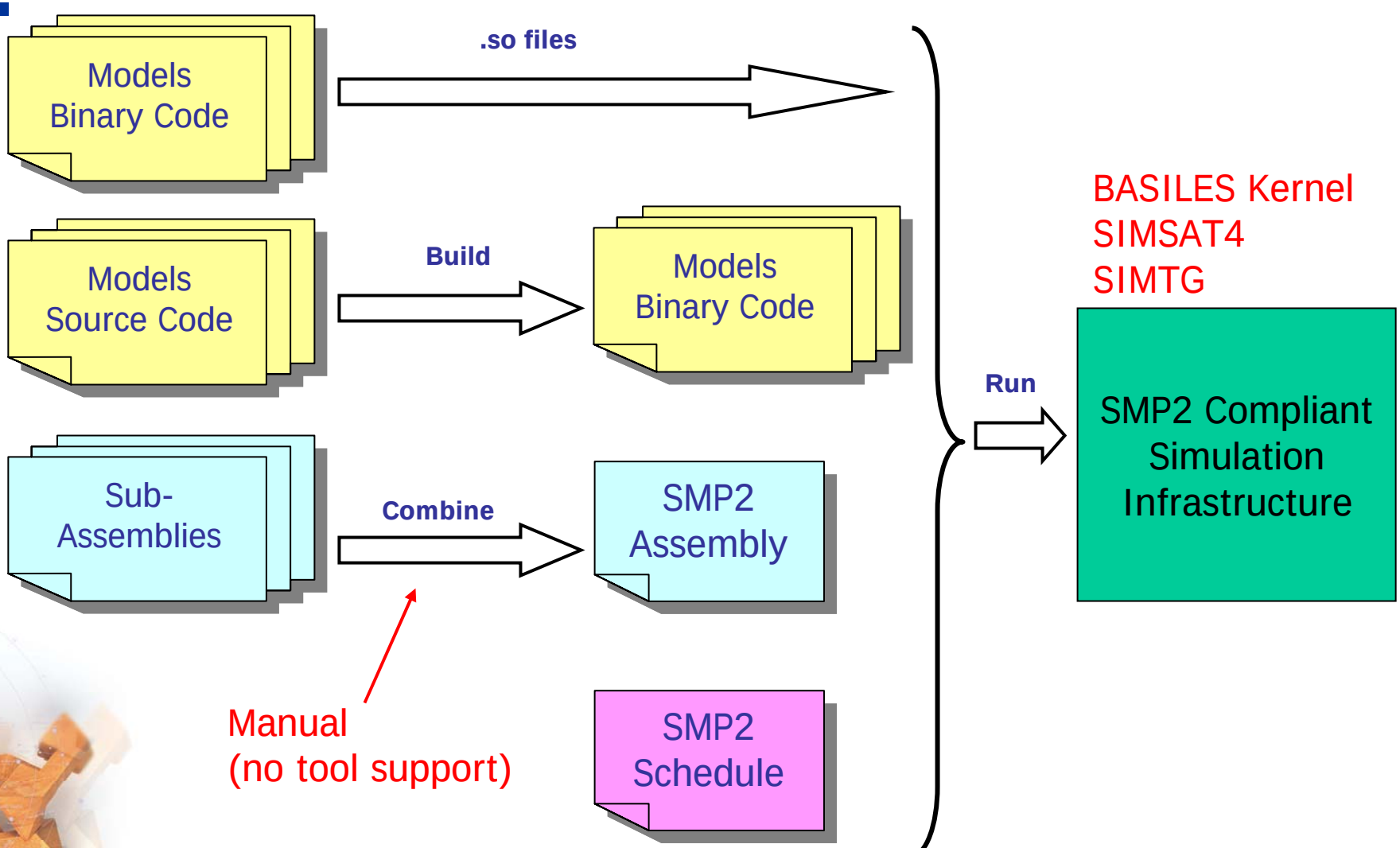
Models Development & Test



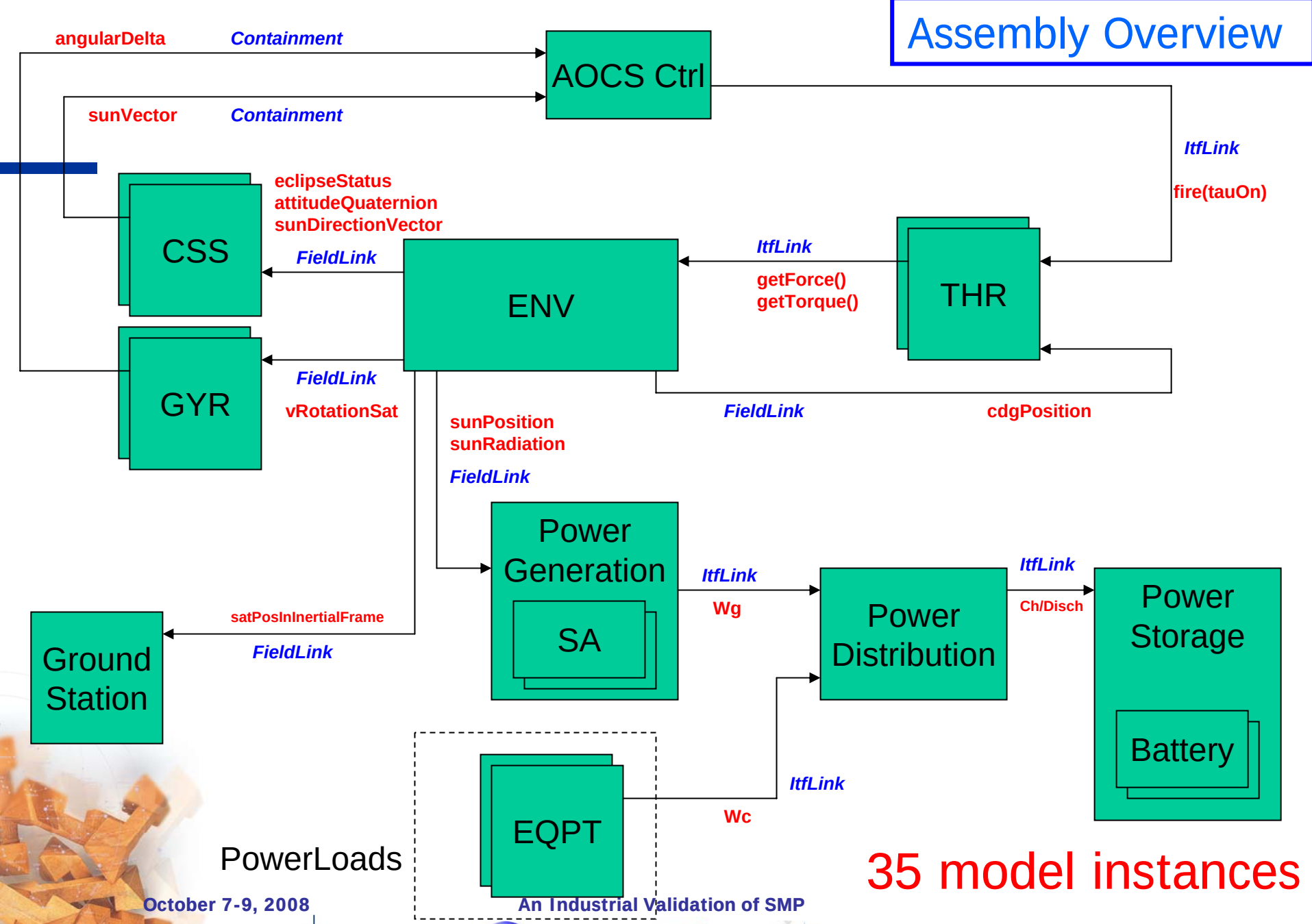
Sub-System Integration & Validation



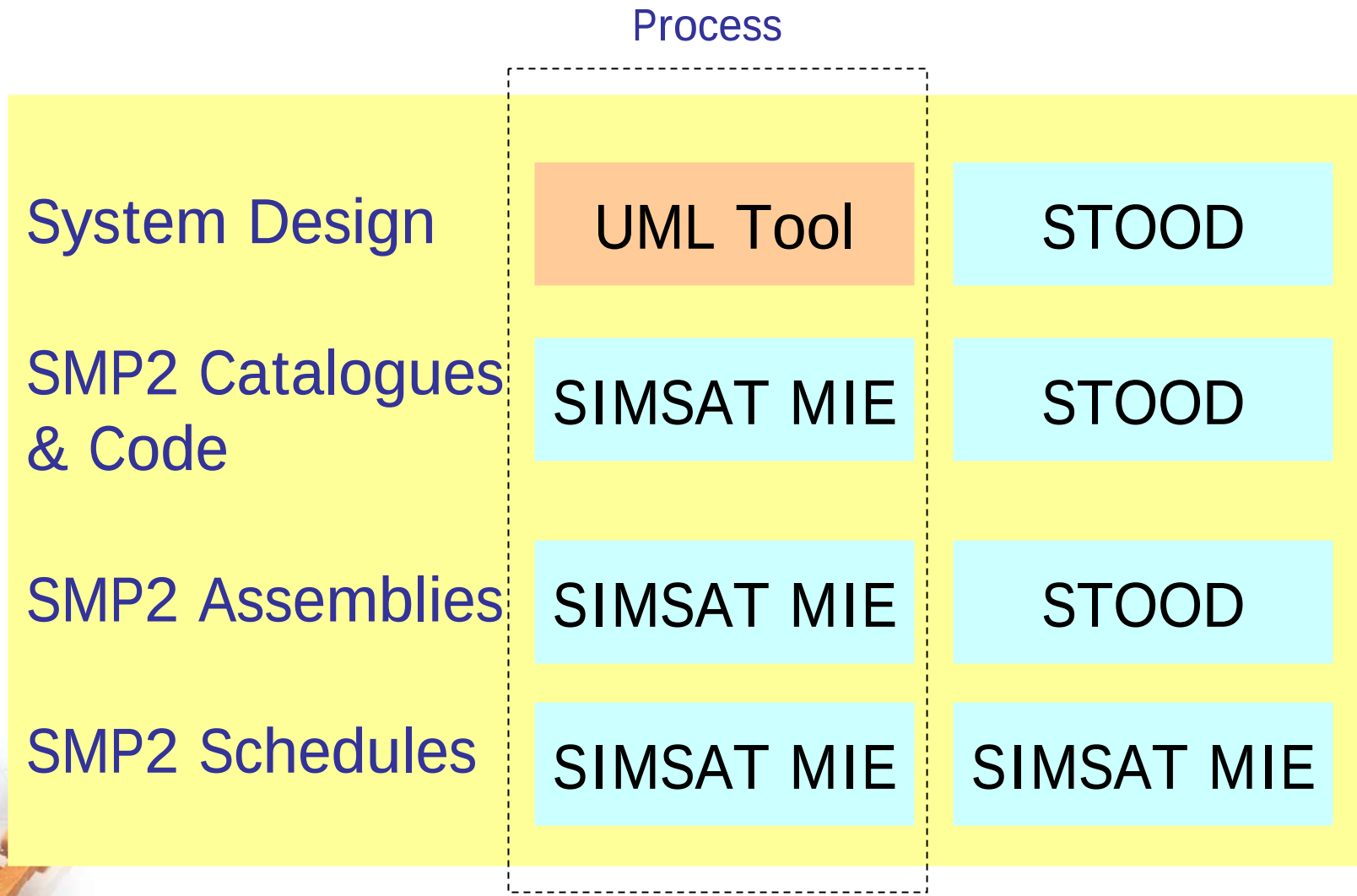
System Integration & Validation



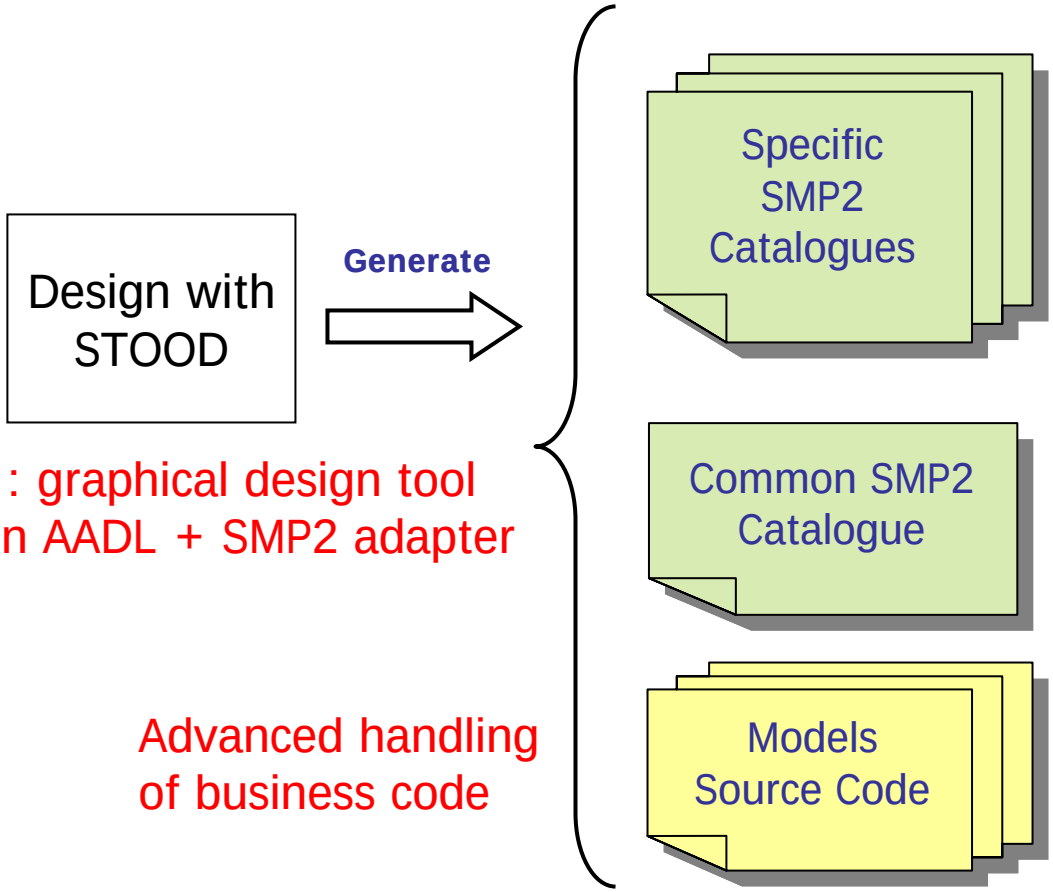
Assembly Overview



Tools Support



Designing with STOOD



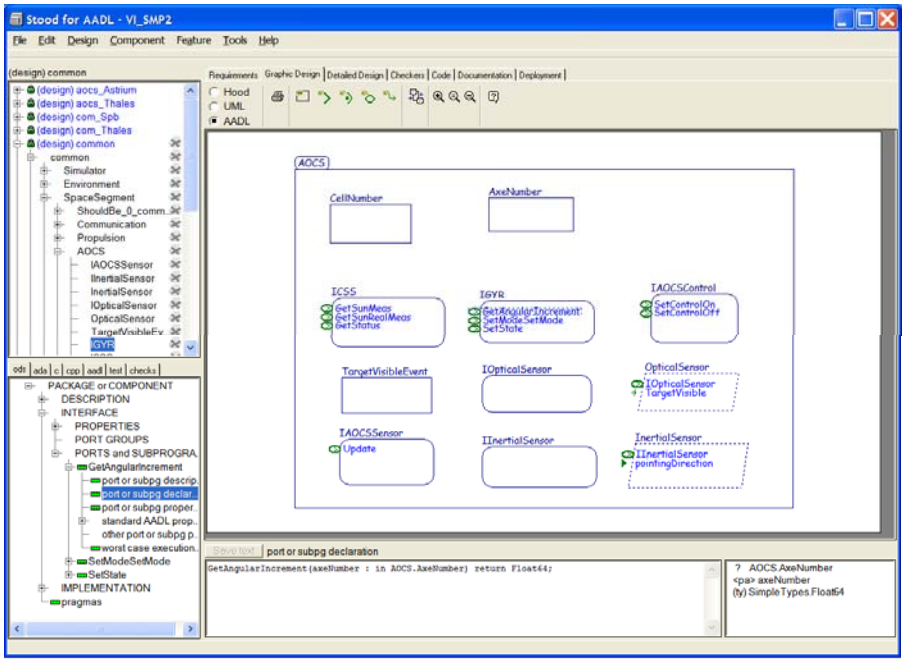
STOOD : graphical design tool based on AADL + SMP2 adapter

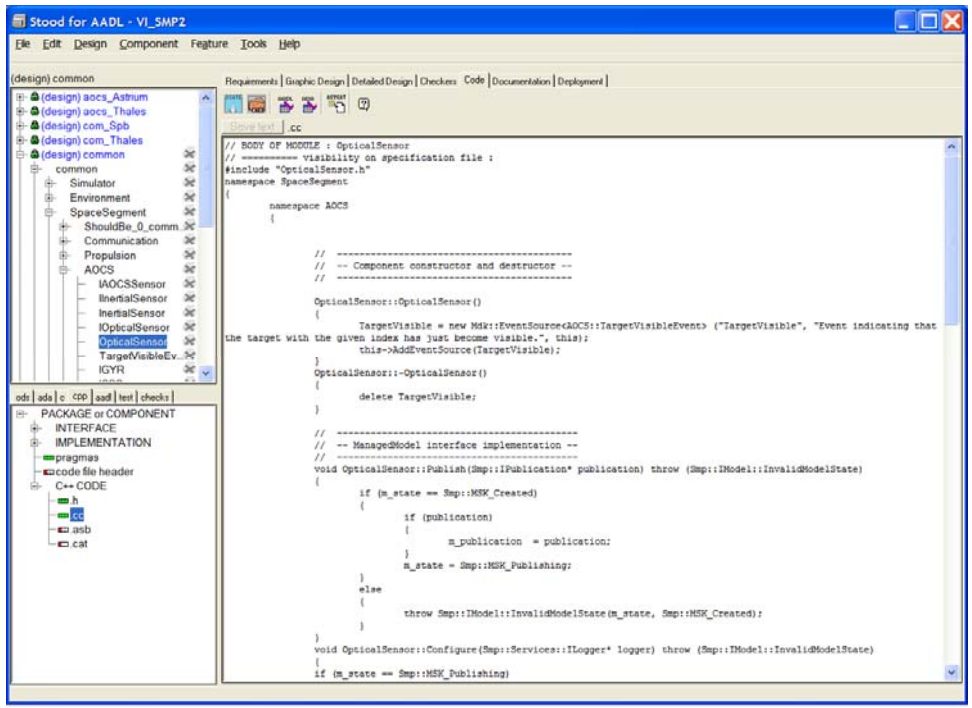
Advanced handling of business code

For comparison with the artefacts generated with the SIMSAT4 MIE

STOOD – Towards SMP2 modelling

Graphical Design Tool & SMP2 Code Generation





Results

- Simulation implemented and run successfully on SIMSAT4, BASILES Kernel, SIMTG
  - Test using source code OK
  - Test using binary code **NOK**
    - →reason – code linking with the MDK
    - →reason – infrastructure dependent

      how dynamic/static libraries are handled and how they are linked together is crucial

      →needs to be further investigated
  - AOCS control convergence obtained
- STOOD SMP2 generated artefacts files are syntactically the same as those from SIMSAT4.

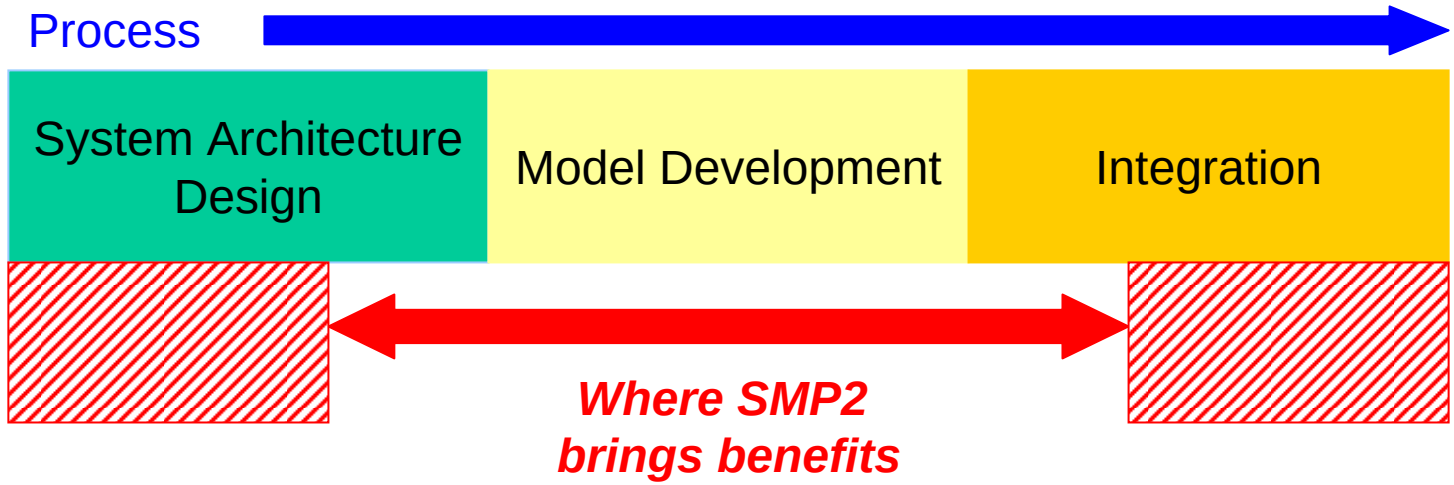
Conclusions

- This VISMP2 activity has allowed demonstrating a **cooperative** and **efficient** development of a simulator thanks to the **SMP2 standard**

Conclusions (cont'd)

- SMP2 is a valid approach for development
- SMP2 allows focusing on engineering rather than on infrastructure
- Process using SMP2 at system & sub-system level → recursive process

Conclusions – SMP2 vs Industrial Process



- System Architecture Design:
  - needs support from non SMP2 tools (e.g. UML/STOOD based)
- Models Development & Test:
  - real benefit (SMP2 serves as a common language among all development parties)
- System Integration & Validation:
  - needs more support from SMP2 (sub-assemblies, units, binary exchange, etc)

Conclusions – Need to be done ...

- Share of binary code: additional investigations need to be performed to better address the binary portability
- Investigate in order to address:
  - Design of complex models or interfaces (e.g. on board computers)
  - Hardware in the Loop simulators

Conclusions – About the Tools ...

- Tools need further improvements for industry adoption
  - Problems with SIMSAT4 (using a pre-release version) → it is now a lot more stable. However they are still some issues to be addressed.
  - STOOD needs further improvements for completing the SMP2 support
- Lack of a graphical visualization of models and assemblies
  - Exists in STOOD but to be further developed and improved

Recommended Evolutions

- Graphical notation for SMP2
- Improve support of sub-assemblies
  - Possibility to create links between assemblies → now taken into account in the upcoming ECSS E40-07 standard
- Add recommendation for infrastructure development (i.e. verify unit compatibility between model fields)

Demonstration

- Demonstration including a 3D animation of the VISMP2 simulation at the Astrium booth

Thank you for your attention.

Questions?