Model based validation

An overview of on-going activities

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➔ Why ?

Thales Alenia Space motivations

➔ How ?

General principles, overview of the future process

➔ Current status & conclusion

Component based MDE approach for development side

- Based on OMG lightweight CCM
- Huge effort on tooling, code generation, …
- Applied operationally on projects (Globalstar 2, Sentinel 3, …) with significant ROI

Objective :

Obtain at least the same ROI on the software validation process

(validation represent 40% of the overall software cost)

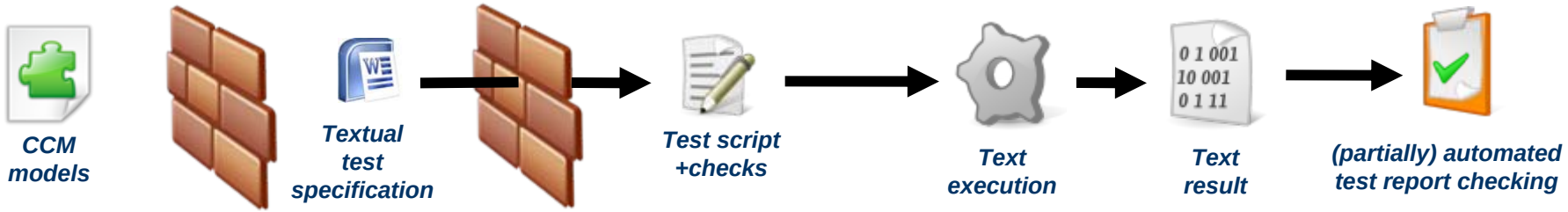
A join Thales group effort

- 4 divisions : Civil and Military aeronautic, Thales Communications, TAS
- Supported by research center (TRT) and group level tooling teams (EPM)
- Objective : one single vision tailored for each user and a strong tooling base

Supported by European projects : VERDE and MBAT

Current status on validation

Current process shows several discontinuities :



Drawbacks :

- **Test specifications formalised and checked too lately**

  Interface consistency, observability requirements, …

- **Test script language is at physical level**

  Deal with raw data buses exchanges, to dependant of the actual configuration of the system

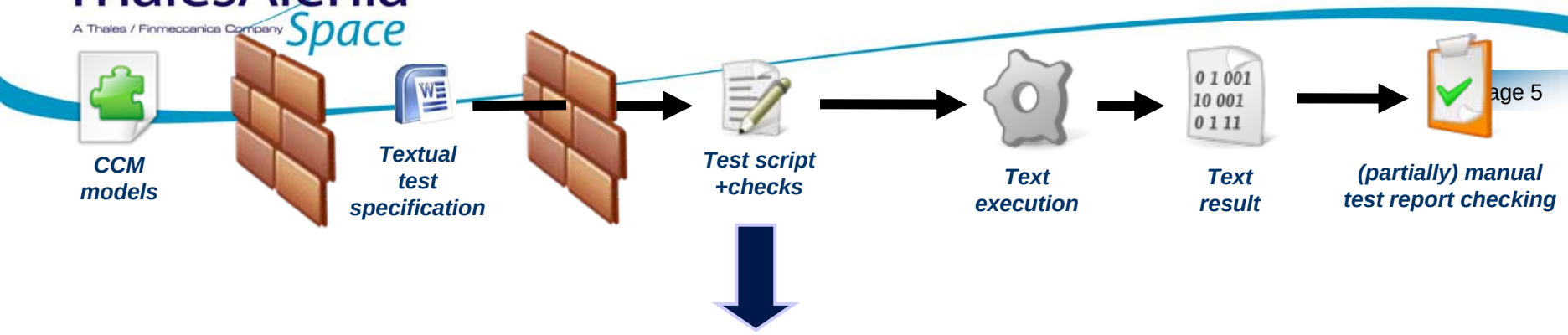
- **Manual check to ensure consistency between test specification and test script**

  Two separate activities with no formal link, only tracability links

- **Test script development is error prone**

  Too many test executions for test script « debugging »

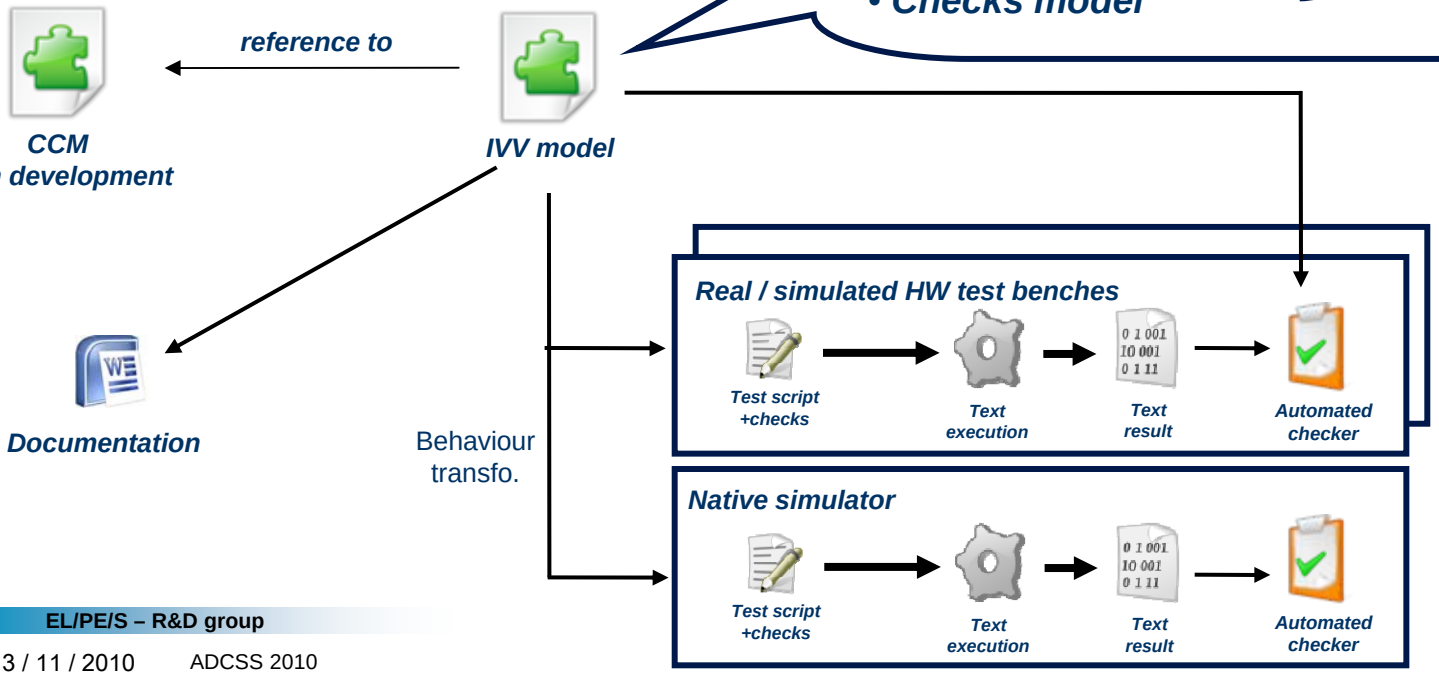
Process transformation



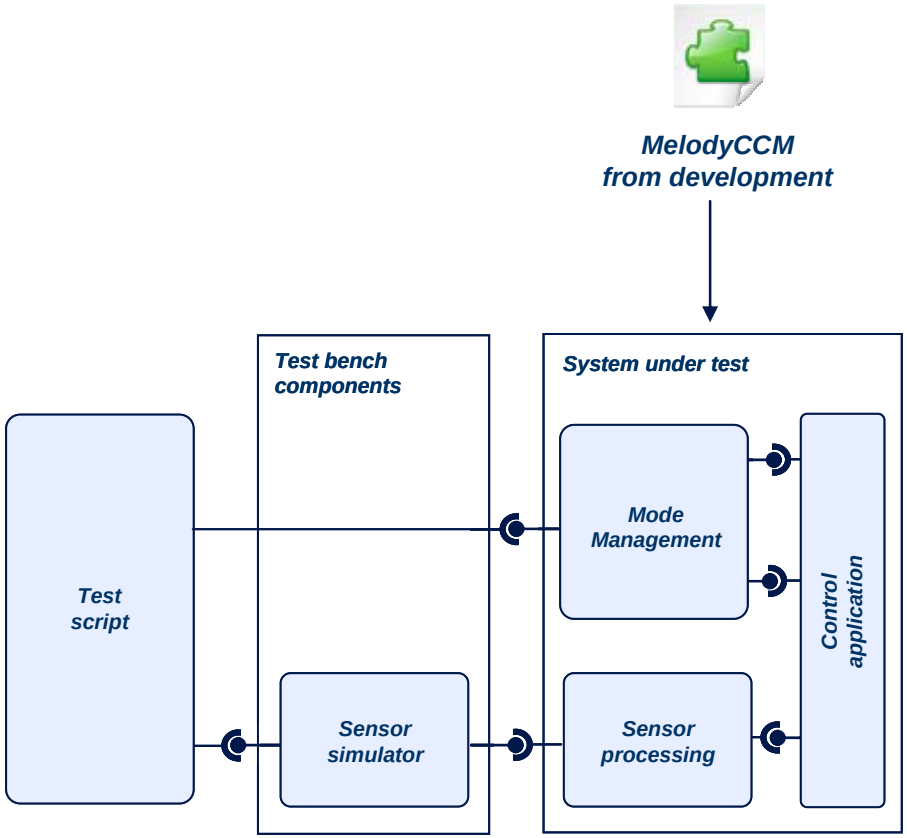
Content :

- **Static test model**
- **Test behaviour model**
- **Checks model**

} **At the CCM abstraction level !**



Test script behavioural modelling



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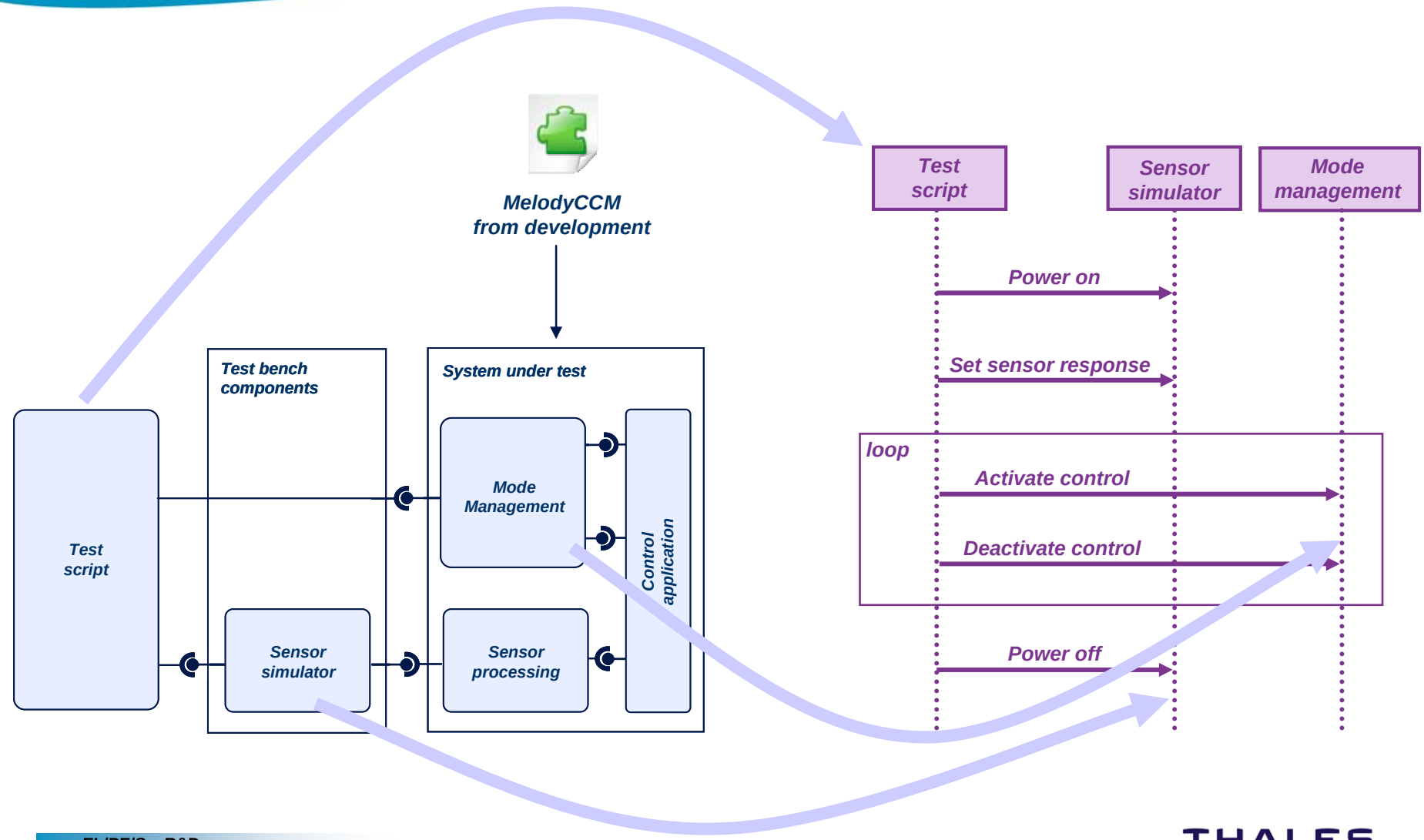


Log and checks

Observability needs are expressed in the model :

- List of parameters with sampling frequency and list of exchanges
- Transformed to commands configuring the observability of the platform

Test invariants are expressed at model level :

- Example : *“when the set_mode request is performed, the mode attribute of the control loop component change”*
- These invariants are used for automated checks

The execution traces are abstracted up to the model level

- Raw logs are dependant of the test bench (raw buses exchanges for example)
- Abstracted traces are only dependant on the model

Expected improvements

Test specification and actual tests are in line

Capability to formalise tests early

- As soon as a component model is available (design phases)
- Not dependant on the test bench or the hardware

Capability to verify test specification early

- For example : interfaces or attibutes needed for the test are available

Same test specification can be executed on several means

- For example : in native simulator at sub-co premises and on real HW at TAS ones
- Test invariants (checks) are the same at all levels

Test bench / protocol / software complexity hidden

- Less human errors lead to productivity improvement
- Validation teams are concentrated on real added value activities

Unified IVV meta-model across all the divisions :

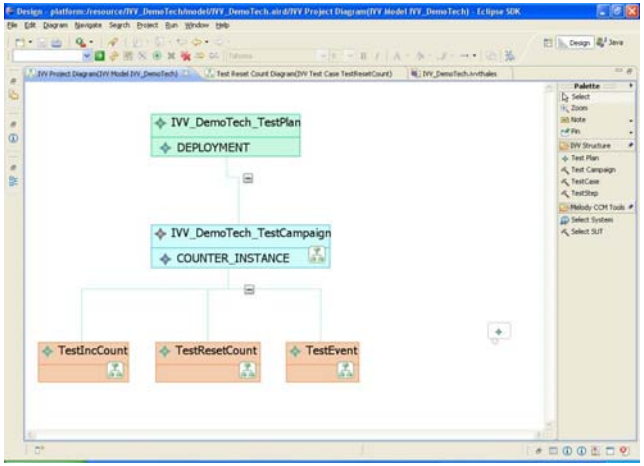
- then tailored for each specificities (for space : PUS, 1553, …)
- unified tooling (modeler, document generators, …)

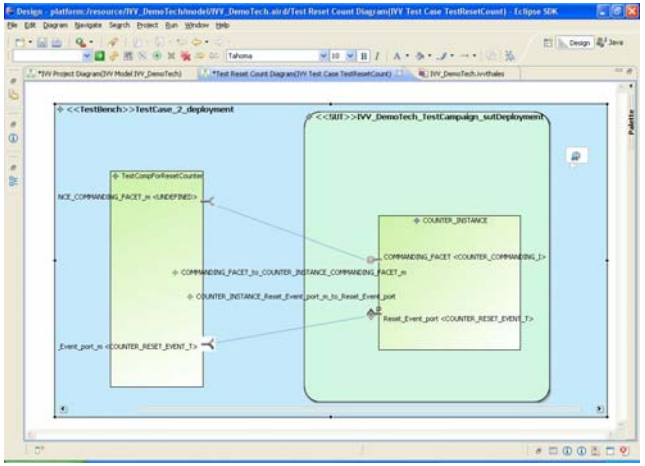
First stabilised tooling version delivered end of this year

Work will continue (3 years work plan)

- Link with operational scenarios design during system analysis phase
- IVV campain plannification tools
- Synthesis/configuration of simulators (native, HW representative,…)

Deployement target : new projects (Iridium, …)





Conclusion

As for the development phase, the validation phase take many advantages of the model based approach

- Methods and tools are basically the same than for development
- ROI is in the same order of magnitude

Efficient model based approach for validation has for pre requisite the availability of a model from the development phase

- Needs for a component model and a reference architecture

Model based validation R&D is a priority for Thales Alenia Space