

Model based approach in configuration data management for LVCUGEN Flight Software

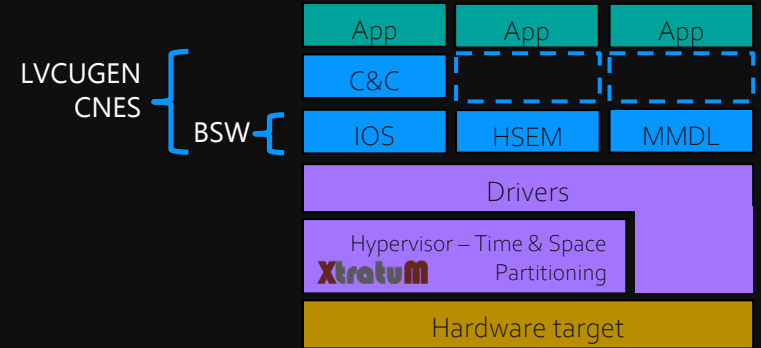
ESA MBSE2021 - Model Based Space Systems and
Software Engineering - 29-30 September 2021

S. Duprat (1), A. Haugommard (1), J. Galizzi (2), C. Navarro (3), M. Masmano (3)
(1) Atos, (2) CNES, (3) Fentiss



Introduction

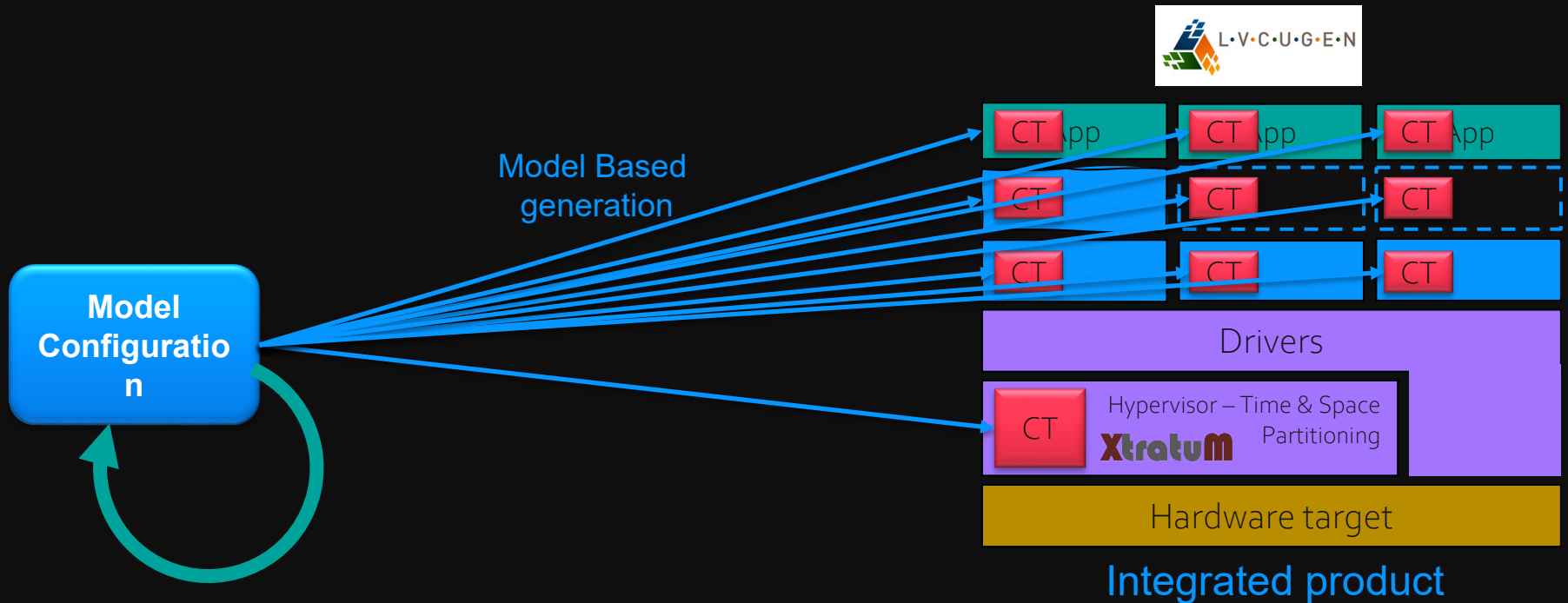
- History : from CNES Research & Technology Action, to Operational Deployment
- Actors
 - Atos : Techno provider, integrator, engineering
 - CNES : Flight Software Integration & validation
 - Fentiss : Component provider (hypervisor)
- Context
 - LVCUGEN : Modular Flight Software TSP Based Architecture
 - Complex configuration to manage
- Approach
 - Need a toolled solution to handle complexity and guarantee safe usage of components
 - Need to verify configuration on the build and not a posteriori
 - MBSE well adapted for **checking** and **generation** and prototyped during the R&T



LVCUGEN based architecture



Model Based Solution for LVCUGEN configuration

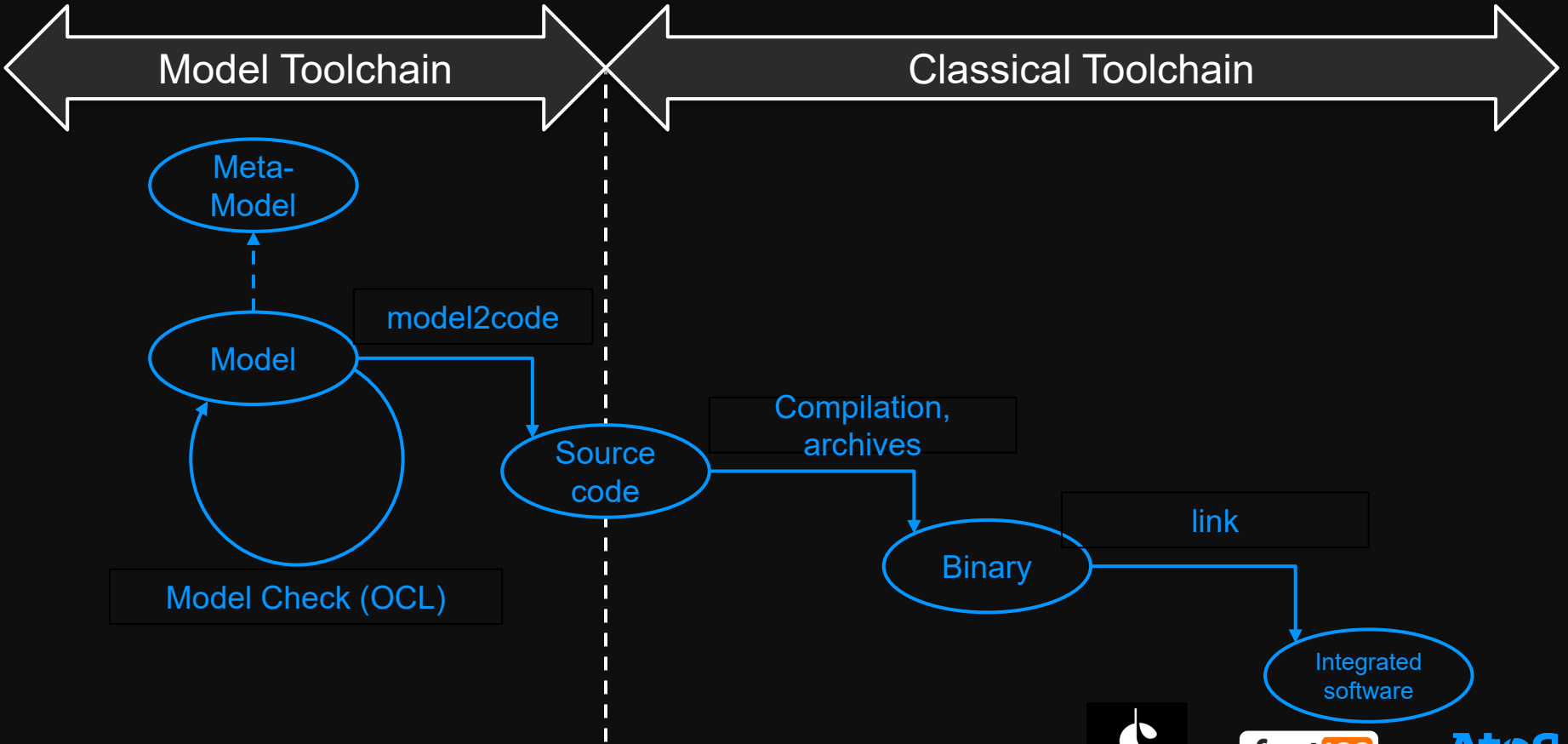


CT : Configuration Table

Model Verification

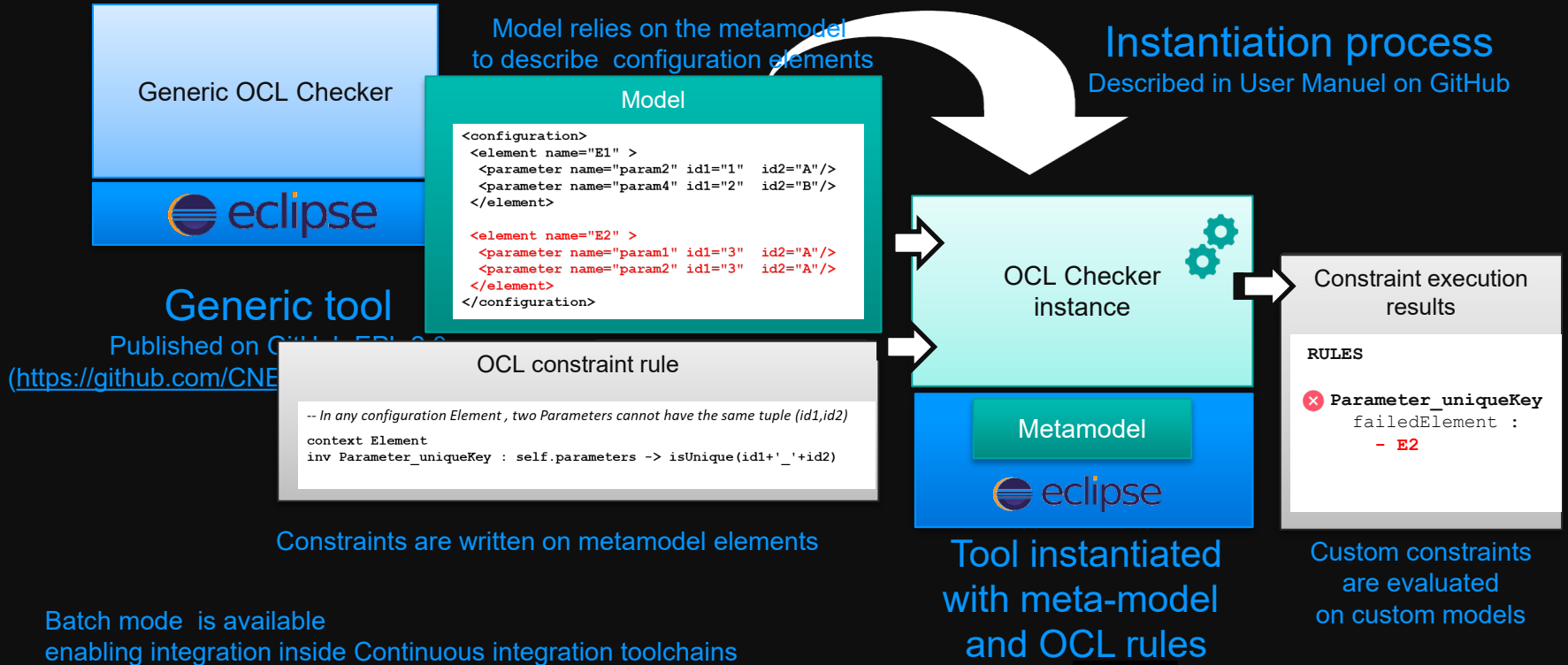
- Usage Domain of each component
- Consistencies
- Mission specific configurations (memory, CPU budgets, ...)

Software Engineering workflow

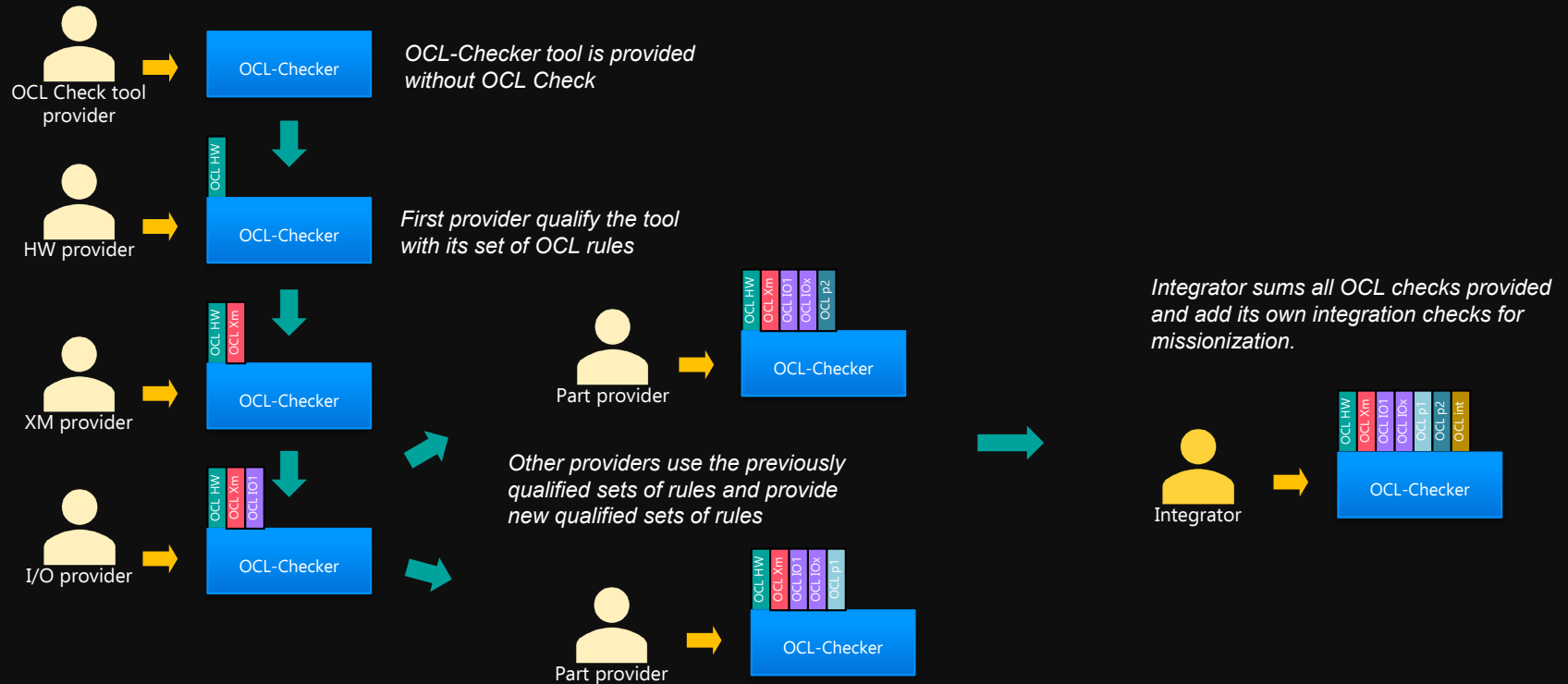


OCL Checker generic tool

Object Constraint Language for a custom model checking tool



Multi-supplier perimeters & missionization







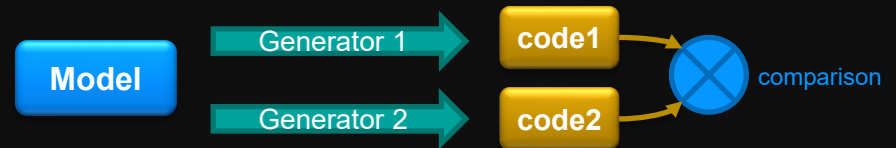
Qualification considerations

OCL Checker feature

- DO330/ED215 application (multi domains tool qualification standard)
- Qualification
 - Generic features of the generic tool
 - Qualification kit available with the tool
 - Specific checks on instantiated tool
 - User completes tests for each constraint to be verified
 - Qualification kits made for LVCUGEN components

Code Generator feature

- Generate embedded source code, more constrained qualification (case of ACG)
- Selected solution : double generation chain + comparison
 - Chain 1 : Eclipse/EMF/Accileo solution
 eclipse  emf 
 - Chain 2 : Python Model2Text generation
 python™



Achievements and lessons learned

- 😊 Whole functional perimeter handled
- 😊 Collaborative work
 - Adoption by Fentiss for Hypervisor constraint verification
- Industrial Integration
 - 😊 Deployment on each partition ongoing
 - 😊 Integration to continuous Integration thanks to batch mode
 - 😊 Check and generation processes on continuous integration
 - 😞 Plugin deployment still manual
- Learning curves
 - 😞 Needs large panel of engineering software skills (from meta-model to the binary software product)
- Community
 - OCL Checker tool on GitHub (EPL 2.0 Open Source license)
 - Adopted by Fentiss
 - Integrated in CNES LVCUGEN partition
 - Other interested parties ? Is TASTE interested ?

Questions

Thank you!