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Secure Simulation in Collaborative Settings via a Functional Mockup Trust Centre

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Bildquellen: Daimler AG, Porsche AG, BMW AG, Bosch GmbH, VW AG, Audi AG, Siemens, ESA, Airbus, MTU

Confidential

Executive Summary

Technical-scientific Transfer
("Technisch-Wissenschaftlicher Transfer")

Company foundation in 1986

300 employees

Executive Board
Dr. Dimitris Vartziotis
Joachim Laicher
Frank Beutenmüller
Dr. Victor Fäßler

Need for secure model sharing

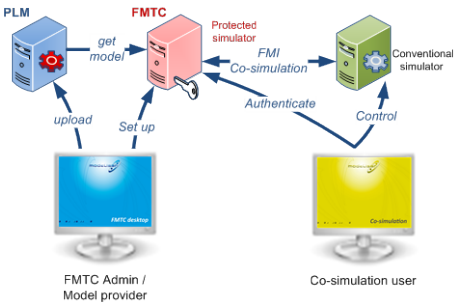
Collaborative simulation settings

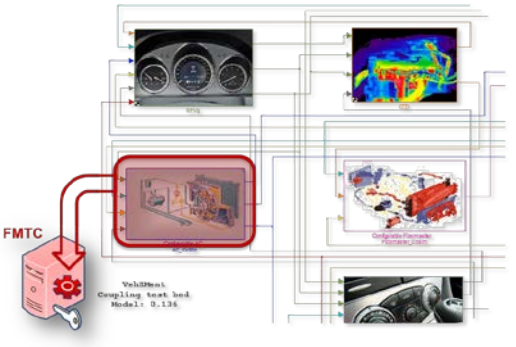
Digital spacecraft development facilitated by data base for various component models and simulators

Shared use of models provided by OEM and supplier

Protection of intellectual property is key issue

Further challenge: Product life cycle management (PLM)





Functional Mockup Trust Centre (FMTC)

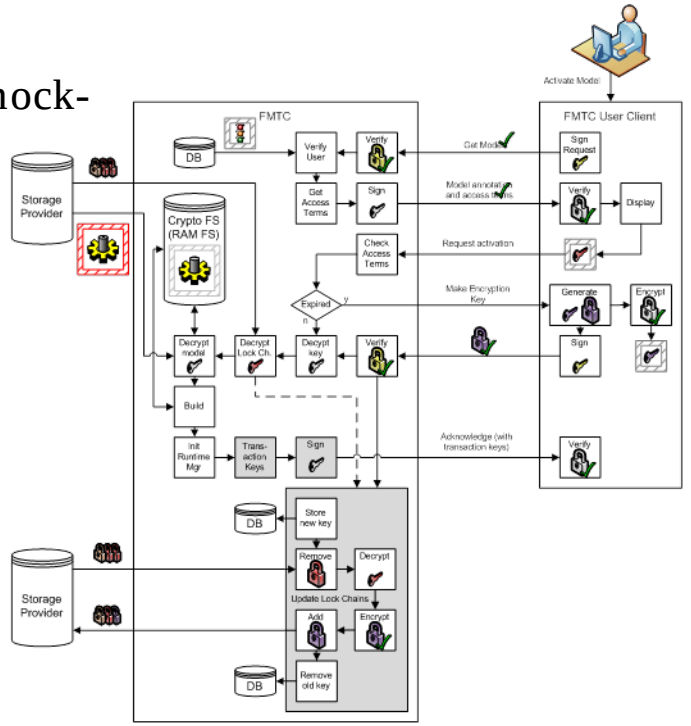
TWT FMTC
Breakthrough and industry value

Innovation

Protection of simulation models during functional mock-up

Cryptographic methods and processes for protection and signature

Safe PLM storage of confidential models



Industry value

Suppliers: safeguarding of intellectual property

Customers: (re-)liability and improved digital prototypes ➔ shorter development cycles

SOA application [Mezger et al., INDIN 2011, Lissabon]

Specification and implementation by TWT GmbH.

TWT FMTC
Concept and data management

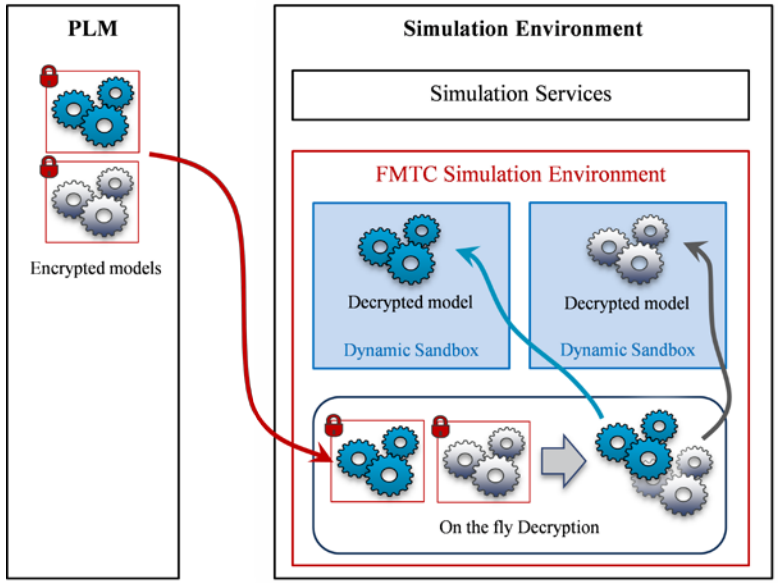
Safeguarded models only decryptable inside a trusted FMTC

PLM can be used to store and version the simulation model (even if potentially unsecure itself)

Dedicated access roles to the system

Change management with full traceability

Logging of all simulations and parameters for reproducability and traceability



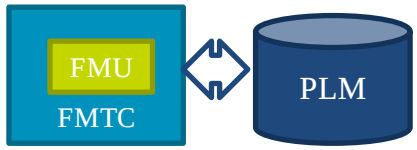
Use cases

System simulator

Optimization of a model at supplier site

System model inside FMTC for supplier

Connection to PLM



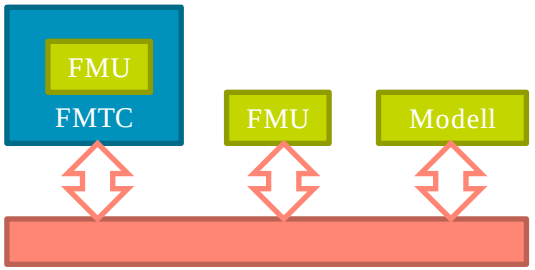
Co-Simulation

Integration of various models at OEM site

Model development from Tier-1

Co-Simulation at OEM integrates fully functional model of Tier-1

IP-security, decryption not possible outside FMTC



Co-Simulation use case

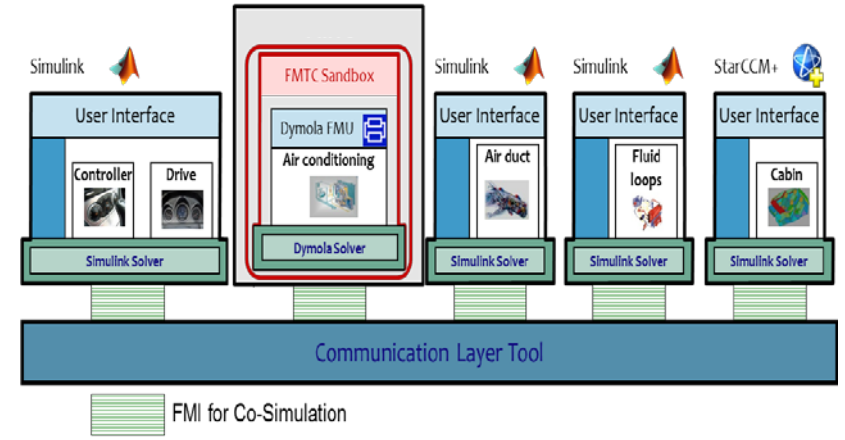
Usage with FMI standard

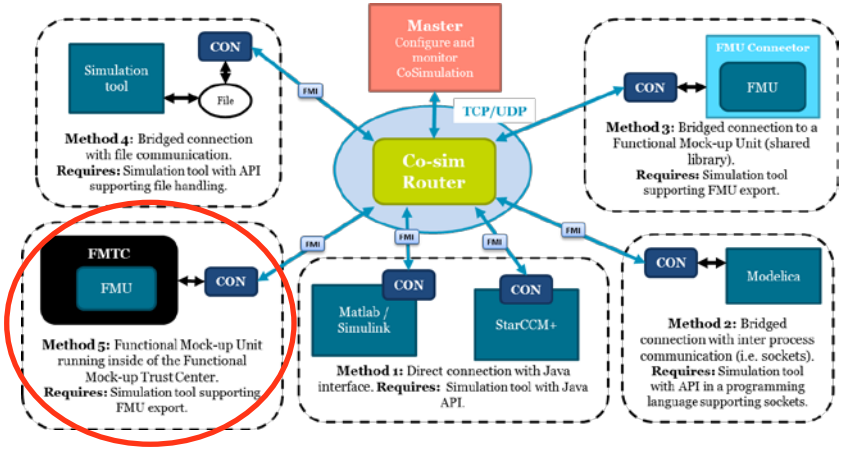
Often involves several machines with specific simulators in software or hardware

Integration of individual solutions into one common solution

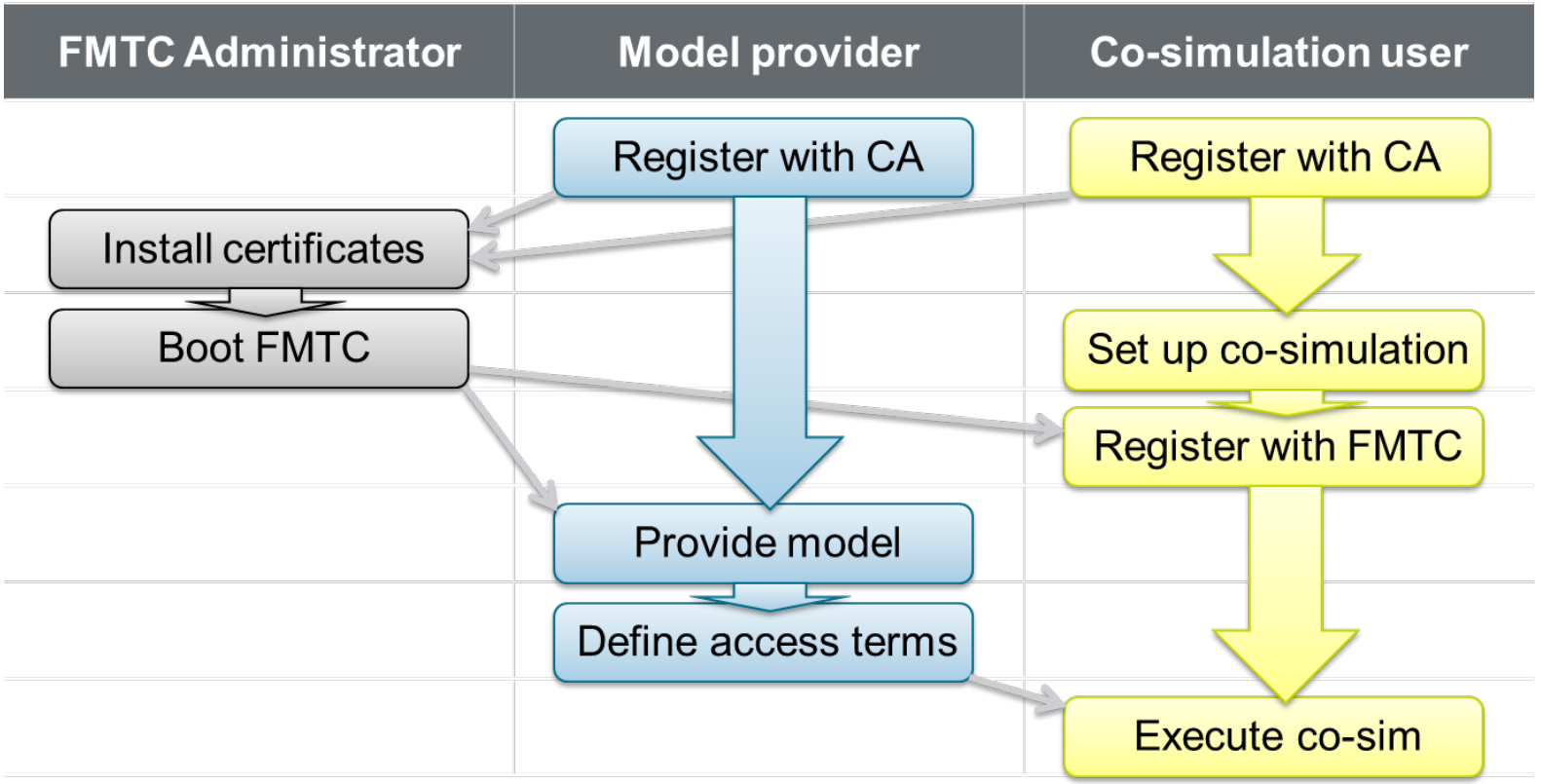
Parallel execution of separate simulators with synchronous or asynchronous communication

FMTC provides method to embed a model securely to a co-simulation environment





TWT FMTC – Typical Steps

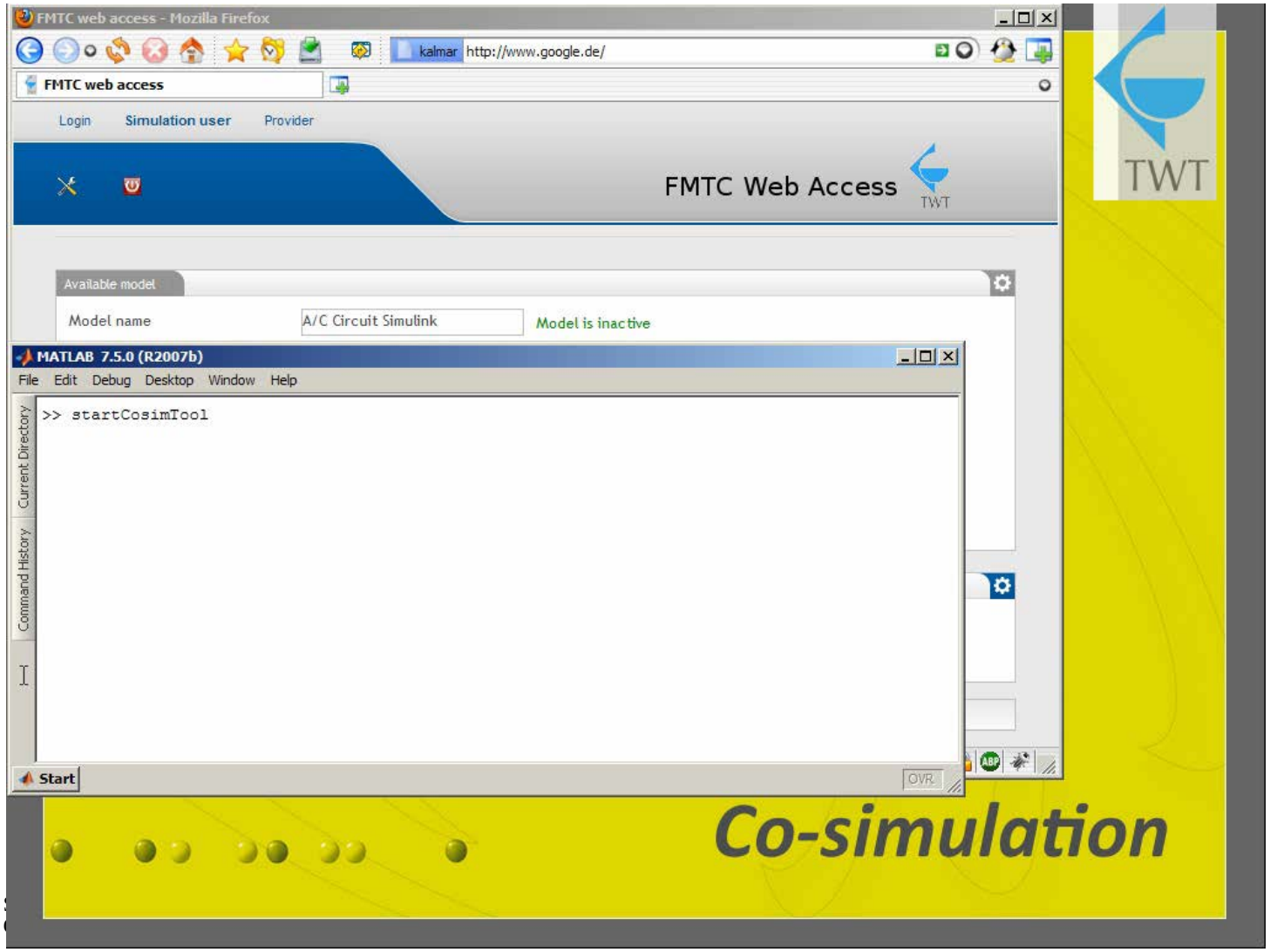


Comparison of Interfaces FMI – SMP2

Functional Mock-up Interface vs. Simulation Model Portability 2

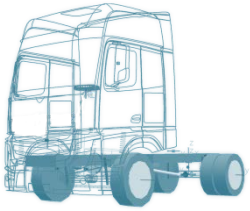
	FMI	SMP 2
Target	• Open standard for model exchange and Co-Simulation (incl. solvers) • Initially mostly in automotive domain • Maintained by Modelica Association	• Open standard for model exchange (**no Co-simulation**) • Initially intended for Space Applications (ESA) • Maintained by ECSS
Structure	• Model description as .xml • Models are executable .dll or C code	• Model definition written in SMTP, mapped to C++
Features	• Platform independent • IP protection by encapsulation in .dll • Nested models	• Platform independent • Modelling concept similar to UML • Object oriented design, Inheritance
Interfaces/ Tools	Modelica, Matlab/Simulink, Simpack...	C++ (implemented), Java (planned)...

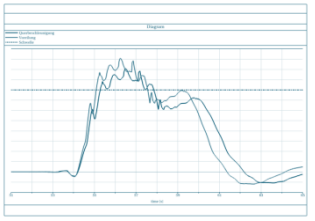
To execute Co-Simulation with FMTC



TWT.reference project

Simulative Certification of ESP





Modelling	Simulation	Analysis	Homologation
MBS vehicle models Integration of ESP signals through SiL Consideration of engine characteristics and brake pressure	Simulative passage of loading cases Circular drive and change of lanes Analysis of the tilt protection and the stabilization control	Target-performance comparison Analysis of the longitudinal and transverse acceleration Evaluation of brake and control interventions	Automatic compilation of documents Verification of the successful homologation Simulation process certified by the German Federal Motor Transport Authority

Horak et al., TWT & Daimler, 21st Aachen Colloquium 2012

Certified by the German Federal Motor Transport Authority (KBA)

Summary

FMTC allows for collaborative model development securing intellectual property rights

FMTC provides possibilities for comprehensive data management

FMTC supports FMI and can be adopted for SMP2 standard by implementing necessary interfaces to the Simulation Services

FMTC provides a method to embed a model securely to a co-simulation environment

TWT has expert knowledge in certification-level simulation and homologation

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