

Real-Time Simulation Solutions for Intelligent Heavy Machinery Development

Intelligent heavy machinery development is driven today by major challenges like alternative power sources (“decarbonization”), energy efficiency and operator assistance & autonomous systems. In practice these challenges lead to issues like:

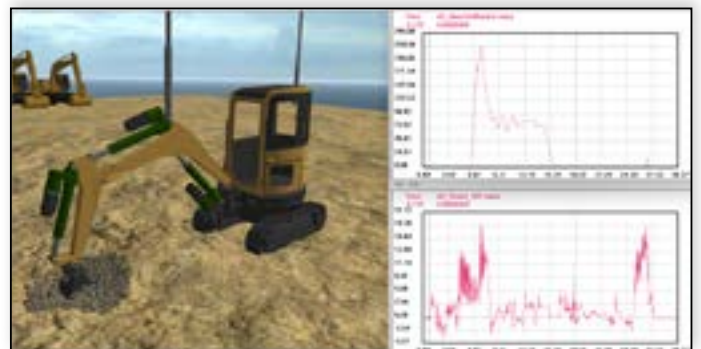
- Development takes more time than expected
- Software and automation testing becomes more challenging and time consuming
- Cost of physical prototypes, their testing and zero series are rising
- Final testing with the physical product may transfer to customer
- Poor customer experience in case of product/software/quality/warranty issues

To overcome the above issues, the world-class companies have successfully started the use of real-time simulation including not only the machine, but also machine work process (e.g. soil handling), dynamic environment interaction (e.g. additional traffic in the work area), sensors (e.g. LiDARs and cameras) and integration with other development environment hardware/software assets (e.g. using FMI/FMU or ROS 2).

Mevea is providing scientifically and field proven real-time simulation software for the intelligent heavy machinery development in the three main application areas:

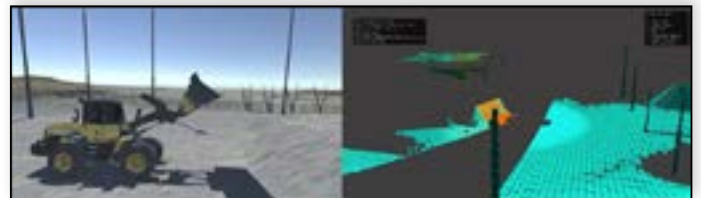
1. Full Equipment and Intelligent Component Design and Validation

Physics-based digital twin is used to simulate in real-time the full system and intelligent components including virtual equipment, environment, sensors and work processes like dynamic soil interaction. Other simulation software can be included via co-simulation API or FMI/FMU.



2. Assistive and Autonomous System Development and Testing

Physics-based digital twin is used to test virtually assistive and autonomous systems. System development environment, including ROS/ROS2 and control system hardware & software can be integrated into real-time simulation loop.

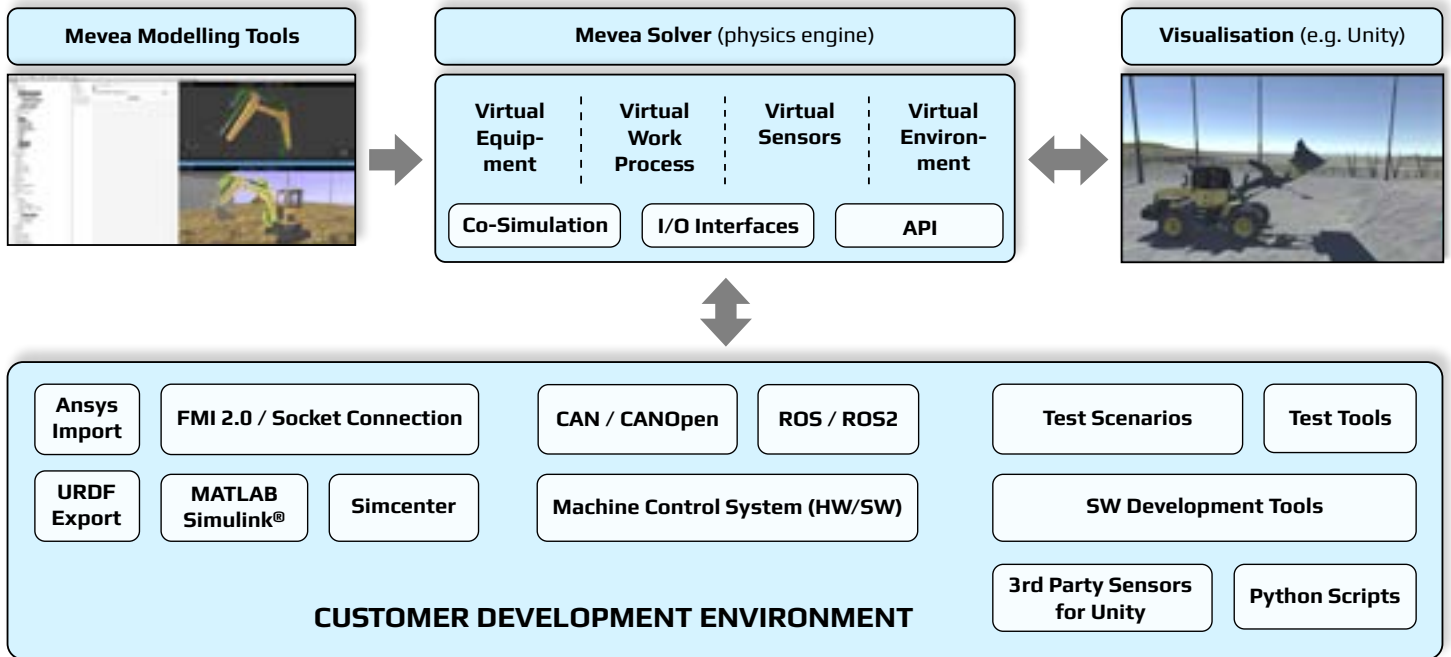


3. Custom Simulator Development

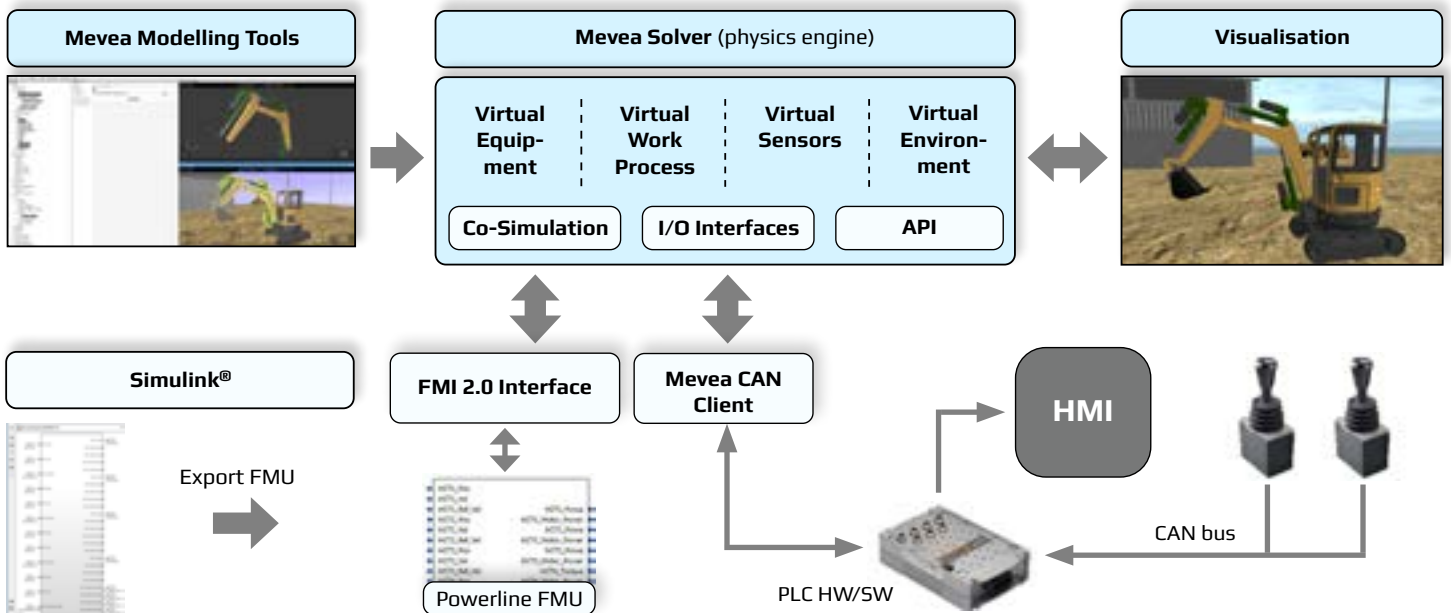
Product Development or operator training simulator development based on customer specifications.



Mevea real-time simulation software architecture enables integration with customers' product development environment and utilization of existing assets and knowledge.



An example of Mevea simulation software architecture applied for development and testing of a small excavator equipped with innovative electromechanical actuators replacing the conventional hydraulic cylinders to achieve improved energy efficiency. Advanced control software and hardware with existing simulation model assets are included into real-time simulation.



Customers who are using Mevea simulation solutions and knowledge for the development and testing of intelligent heavy machinery have achieved tangible business benefits:

- Faster development and testing with lower cost and less physical prototyping
- Fully integrated development environment utilizing existing assets and knowledge
- Better and optimized products by being able to involve equipment operators into development process already from the concept phase