2. Project One-Page Description

Context. A general trend in product development is the increasing complexity of technical systems and the distributed networks in which they are designed and manufactured. Complexity of technical systems involves an increased degree of automation, a number of involved technologies and the fact that SW and HW development is strongly coupled. Component suppliers are increasingly involved into the design process of the overall system. OEM's request the component supplier to validate the functionality of a supplied component in the system context already in the design phase long before the system is actually built.

Goals. The integrated holistic environment approach of model-driven development in the OPENPROD project generalizes model-driven approaches to include most aspects of product development, thus significantly increasing the effectiveness of the process. Key aspects of the project:

- A holistic whole-product model-driven rapid development and design environment for both software and hardware, also including support for product business processes.
- Open source tools and components for open reusable solutions.
- Standardized model representation of products primarily based on Modelica and UML.

25 partners from 5 countries: 11 large industries, 4 SMEs, 5 research institutes, and 5 universities.

Market relevance. Strong market trends towards more complex products including both software and hardware components, requiring more integrated whole-product development approaches. However, closed proprietary solutions are often a hindrance to wide-spread dissemination and uptake. On the contrary, open solutions provided by OPENPROD will enable high impact based on easy uptake and wide dissemination.

Development Activities and Major Expected Outcomes

A whole-product model-driven open modeling/simulation/development and design environment:

- Integrated model-driven Modelica-UML-Eclipse-based environment with unified model representation to address SW/HW modeling (e.g. mechatronic applications and embedded software), distributed business processes. Product optimization and sensitivity analysis.
- Precise requirements capture and traceability based on behavior trees integrated with Modelica/UML in Eclipse; ontology-based generic 2D/3D graphic modeling and database coupling.
- Ontology mapping framework for linking design system models and Modelica based simulation models. Semantic, ontology based representation of the Modelica language.

Enhanced OpenModelica model compiler with innovations and vendor specific tool additions:

- Model compiler for extended full Modelica, including Eclipse Ecore based UML subset and language enhancements for modularity, aspect orientation, and transformation from PIM to PSM representations.
- Model portability and system safety based on precise model semantics and stronger type checking. Real-time tool interoperability through OPC interconnect and TLM-based co-simulation.
- Efficient execution based on parallel multi-core code generation and simulation, also targeting real-time multi-core platforms; enhanced numerical solvers and compiler run-time.

Advanced industrial application demonstrators and vendor tools:

- Vendor M&S and in-house tools: NX/TeamCenter and Comos (Siemens), Imagine.Lab (LMS), MathModelica (MathCore), IDA Simulation (Equa), BEAST (SKF), D&C Engine (BR), sensitivity analyzer (Appedge).
- Demonstrators: Energy and power systems (Siemens, EDF), Mechanical/Mechatronics (SKF, Siemens, MaCo, BR), Building and tunnel applications (Equa), Combustion engine and vehicle (IFP), Automotive (PSA).
- Simulations of business processes, with improvement and training of product development processes (Nokia), managing networked investment projects (Pöyry), and effective service processes models (Metso).