ESI Extends the Virtual Engineering Environment

CIMdata Commentary

Key takeaways:

- *A major transformation is underway in engineering processes for today's complex systems and cyber-physical products (mechanical, electronics, embedded software, and controls), triggered by several significant global trends, including:*
  - *"Smart Systems" driven by the "Internet of Things" and Industry 4.0*
  - *"Mass Customization" with software features as key differentiators*
  - *"Design for purpose" materials and manufacturing methods (e.g., additive)*
  - *"Design for energy efficiency" and scarce materials conservation and re-use*
  - *"Products delivered as services" (an on-going utility business model)*
- *Global market leaders in multiple industries are rapidly expanding their strategic use of virtual prototyping and simulation into this complex systems realm to gain a competitive advantage in innovation, quality, and time to profit extending into design for manufacturing and the in-service aspects of the product lifecycle*
- *ESI continues to execute on a corporate strategy to provide multi-domain and multi-fidelity solutions for realistic virtual prototyping of both components and systems by unifying the detailed 3D/4D capabilities of FEA, SEA, and CFD with the 0D/1D systems simulation space*
- *ESI is undertaking the next major step in providing physics-based performance simulation within a cloud-based platform to link the virtual and physical worlds via model-based, predictive data analytics*

Virtual prototyping has moved well beyond just being a design check tool or an alternative to minimize physical testing and validation cycles via the effective use of both conceptual 0D/1D and high fidelity 3D simulations in both the time and frequency domains. It has been well documented over the past several decades that virtual modeling and simulation offers companies the ability to improve design decisions in the early stages of ideation and conceptual design before significant costs have been committed or incurred; thereby avoiding late design changes where re-work leads to lengthy product delays and major cost overruns. Simulation and robust design technologies let engineers quickly and cost-effectively investigate "what-if" scenarios and design alternatives, explore innovative new ideas, and gain deeper insights into how a product will deliver its intended customer value throughout its lifecycle including in-service maintenance, design upgrades, and/or design re-purposing.

What is new is that these global business trends now place physics-based systems modeling and simulation squarely on the critical path for the development of today's complex systems and their associated manufacturing processes. Virtual prototyping has become an indispensable element in developing a true Model Based Systems Engineering (MBSE) process and will play a key role in the transformation to the interconnected world of the Internet of Everything. Companies that adapt product development platforms and related processes to take advantage of model-based approaches that leverage virtual prototyping and simulation as a strategic element of the product development process will not only survive but will thrive. Those companies that lag in the adoption of such new concepts will fall behind and ultimately may well face extinction.

The ESI Immersive and Holistic Virtual Engineering Environment

ESI is now focused on creating a next generation of cloud-based integrated modeling and simulation solutions that will enable companies to address the industry's future business and engineering challenges. Based on a single common core data exchange paradigm across all application domains, the ESI platform is designed to provide a unified environment for multi-physics and multi-domain behavior modeling and simulation of complex systems that is collaborative, visually robust, data-managed, and analytics centric.

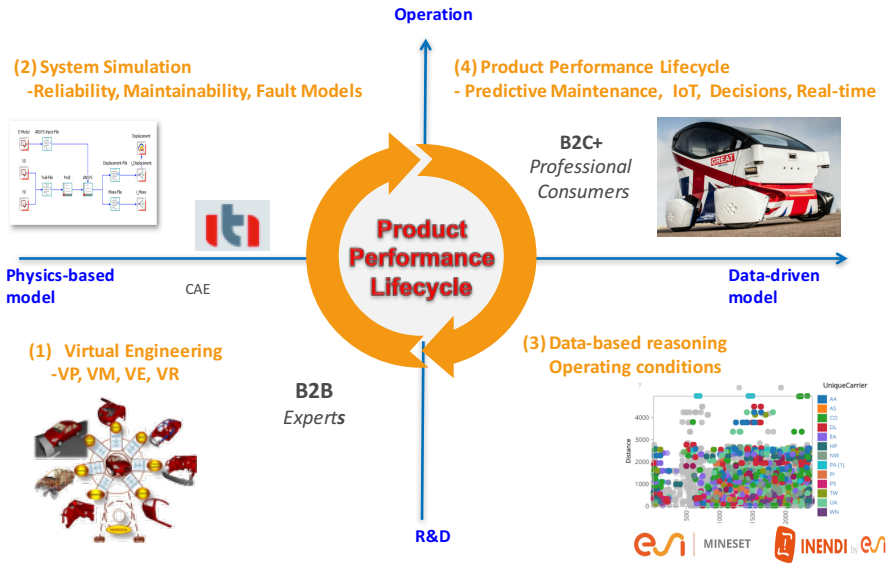
ESI's value proposition is based on a 3-phase transformative strategy of developing, validating, and continuously enhancing industrial systems and their manufacturing processes:

- *Understand the Physics*—Build, exercise, and evaluate virtual prototypes across multiple performance domains that represent the real-world usage of the product. This includes virtual prototyping for not only the conceptual design and development of the product but also for simulation of key manufacturing systems and processes required to build the product (e.g., stamping, forging, subtractive techniques, etc.).
- *Experience the Virtual Design*—Design teams interact collaboratively with the functional 3D virtual prototype in an immersive 3D virtual reality environment.
- *Enable Real World Decisions*—Link the virtual prototype and the physical product (*as designed, as built, and in service*) to discover correlations and variances in system performance characteristics and to drive better next generation product design decisions via model-based predictive analytics.

The ESI multi-physics portfolio consists of systems modeling, materials and manufacturing simulation, immersive 3D visualization, simulation data management, and data analytics. The ESI virtual prototyping suite has been expanded significantly by a series of strategic acquisitions of simulation and related IT technologies that include:

1. ITI GmbH—0D/1D systems modeling and simulation software that enables realistic simulation of mechatronic and multi-domain systems (Q1, 2016)
2. Mineset Inc.—a big data visual analytics and machine-learning specialist (Q1, 2016)
3. Picviz Labs—a specialist in big-data-based predictive analysis through advanced visualization (Q2, 2015)
4. PRESTO software from AMOEBA Technologies—capabilities for electronics cooling simulation and design optimization (Q2, 2015)
5. Ciespace Inc.—an open cloud platform for engineering and scientific applications, 3D visualization, and collaboration (Q2, 2015)
6. IC.IDO GmbH—immersive virtual reality solutions (2013)
7. OpenCFD Ltd.—the leader in open source software for Computational Fluid Dynamics (CFD) (Q4. 2012)
8. Efield—solutions for electromagnetic interference (EMI) virtual simulation to predict electromagnetic emissions of electric/electronic devices (Q1, 2012)

While ESI has grown via an aggressive technology acquisition strategy over the past decade, ESI now faces the significant business and technology challenges of continuing to provide those best of breed modeling and simulation solutions to current users while also integrating them within the context of an integrated next generation platform that enables an immersive virtual engineering environment to answer challenges related to the Product Performance Lifecycle.



ESI's Product Performance Lifecycle Supports Its Data Analytics Approach
(Courtesy of ESI)

Based on discussions with ESI, CIMdata anticipates that over the coming releases, the ESI portfolio will continue to evolve to encompass additional cloud-based capabilities for:

- Co-simulation between 0D/1D system dynamics models and 3D FEA sub-system models leveraging industry standards such as Modelica and FMI/FMU
- Predictive analytics for complex sets of physics-based systems simulation results
- System level fault modeling for improved reliability and predictive maintenance
- Autonomous systems development leveraging integrated machine learning and immersive visualization

As such, with effective technology integration and business execution, CIMdata expects that the ESI Virtual Engineering product platform based on immersive visualization and predictive analytics will be able to offer industrial manufacturers a virtual engineering environment that spans the product lifecycle by integrating the worlds of virtual performance engineering and virtual product manufacturing with on-going, in-service predictive maintenance based on real world customer usage. Essentially, the key capabilities that will be required to meet many of the product development challenges in the age of "Smart Systems" as deployed in the Internet of Things (IoT) and Industry 4.0 cyber-physical environments.

About CIMdata

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