

Federal Register Notice: 89 FR 51554, [Federal Register :: Networking and Information Technology Research and Development Request for Information on Digital Twins Research and Development](#), June 18, 2024.

Request for Information on the National Digital Twins R&D Strategic Plan

Ansys

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Ansys Vision for Empowering the National Digital Twins R&D Strategic Plan

RFI Response: Digital Twins R&D Plan

Walter Schwarz, PhD
Senior Principal Application Engineer
Ansys, Inc.

July 26, 2024

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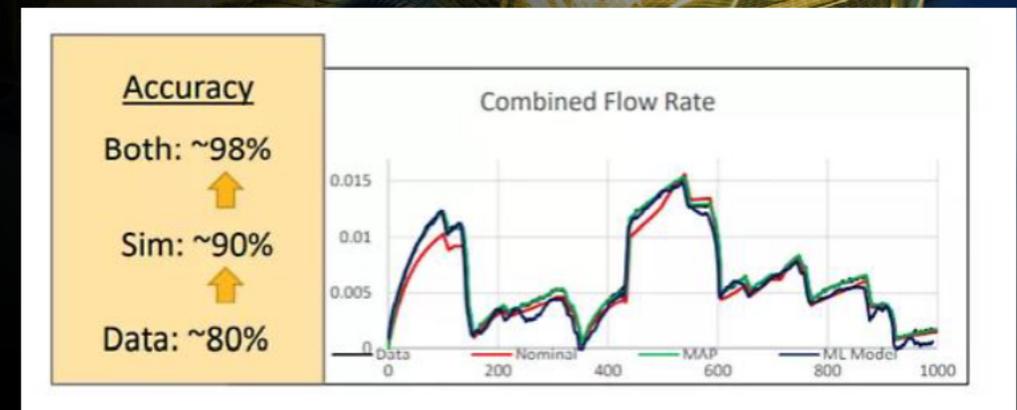
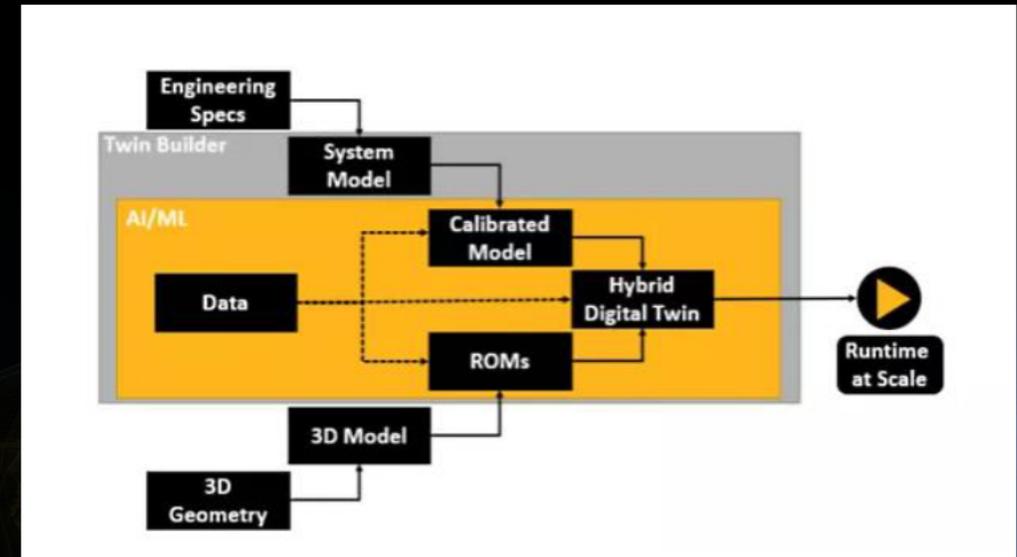
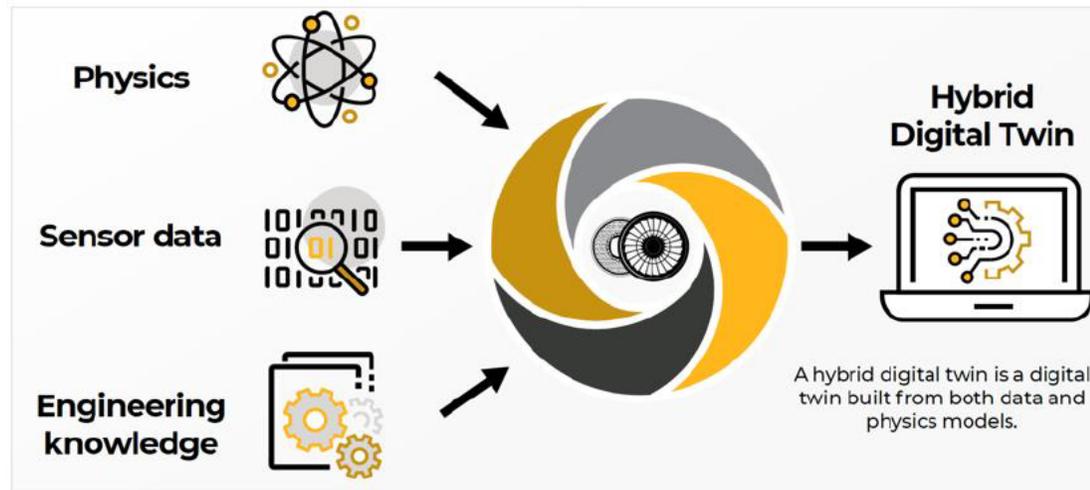


Artificial Intelligence (AI): AI and Digital Twins:

Ansys believes that the AI/ML area is just getting started, there are novel algorithms coming out all the time. Innovators in digital engineering are always watching the latest, newer methods and tracking what is happening in the AI/ML community and applying it to simulation.

Data-driven models alone can provide roughly **80% accuracy**, while simulation-based models increase that number to **90%**. But combining the two methods can produce nearly **98% accuracy results**.

Hybrid Digital Twins: Leverage Models + Data

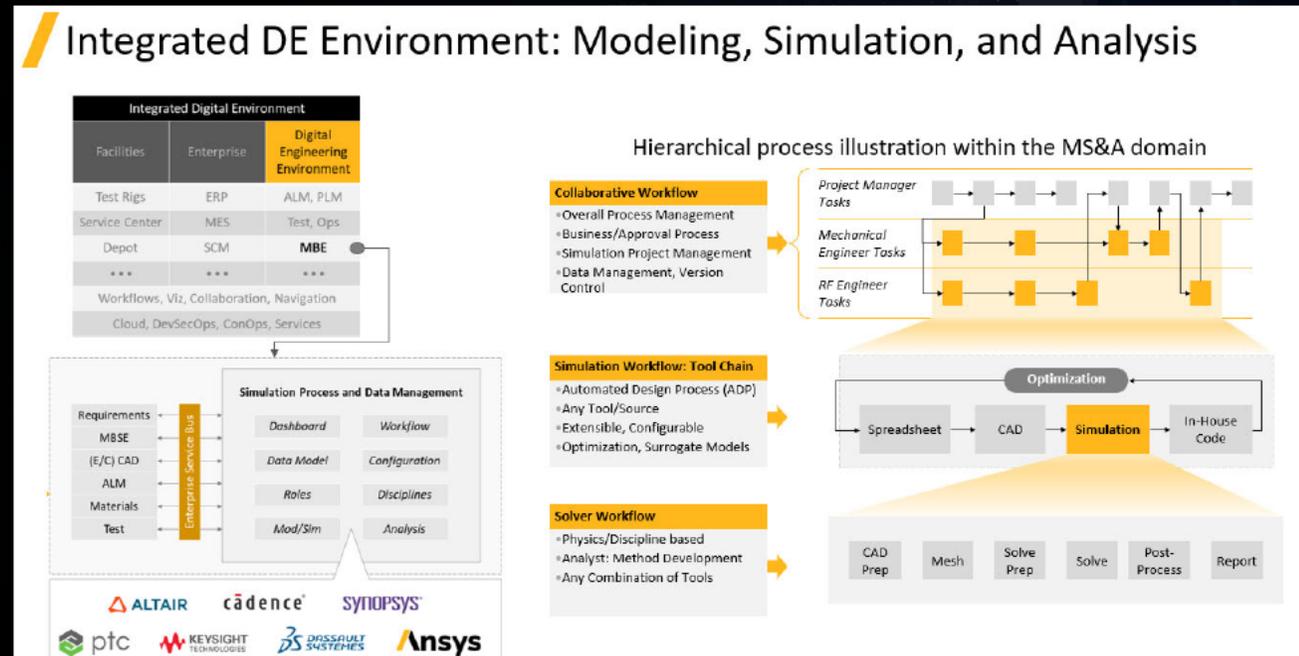


Data: Encourage Adoption of Data Management Best Practices:

Ansys believes that it is important to establish a **Digital Engineering Environment (DEE)** that should include a dedicated engineering simulation **authoritative source of truth (ASoT)** in the form of a **Simulation Process and Data Management (SPDM)** system to effectively manage engineering groups and enable simulation data, asset data, and models to be preserved and managed in a structured, traceable, and reusable manner. The SPDM system also allows teams to work effectively as a team using the available **collaboration tools even when the team is not geographically located together**. This environment can also be linked to a more extensive product development ecosystem with other **ASoTs**, such as **Product Lifecycle Management (PLM)** systems.

A DEE would enable users to harness the benefits of **digital twins** and take advantage of the synergies that come with a virtual connected system. **Such a system, coupled with the proper methodologies and processes, allows engineering programs to have fine-grained traceability, easy accessibility of tools, managed data and models, and effective information management.**

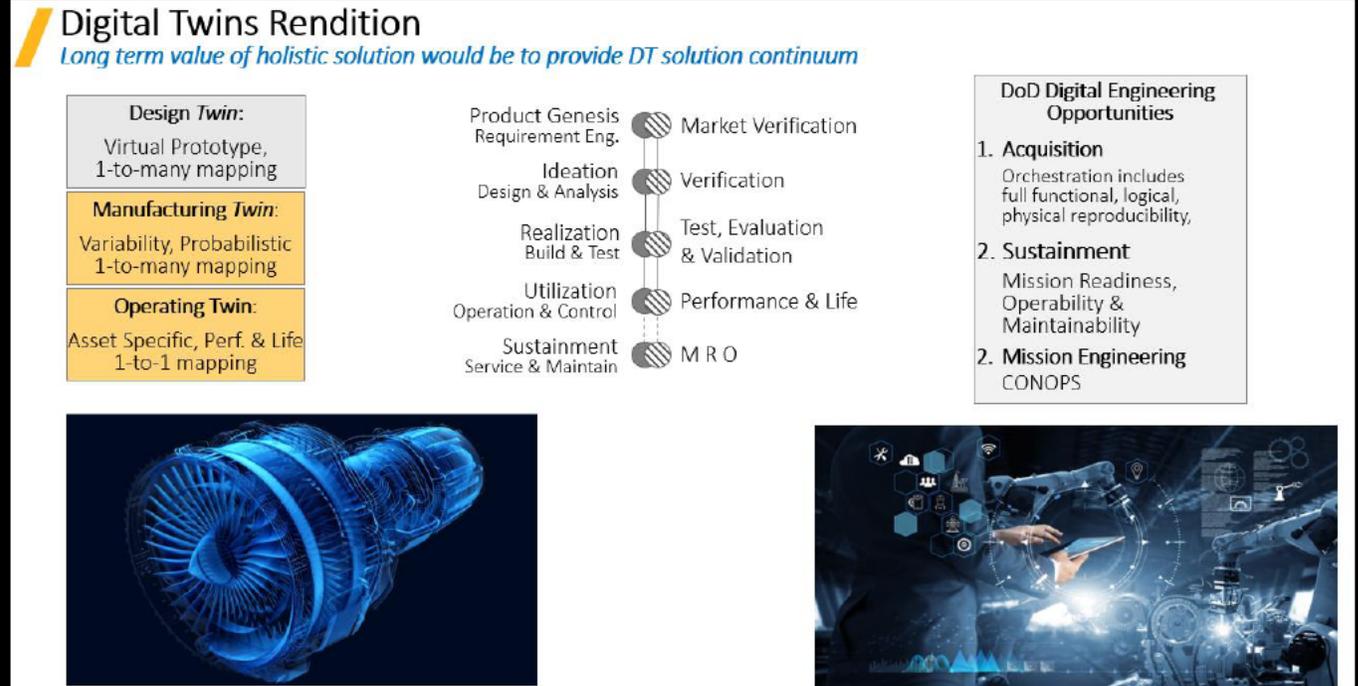
Commercial Off-the-Shelf (COTS) solutions are available and should be taken advantage of immediately rather than funding and re-inventing the wheel when the **goal is to encourage data collection, curation, expand sharing and usage, and to provide access to shared public datasets and repositories.**



Ecosystem: Establish a National Digital Twin R&D Ecosystem:

In 2020, **Ansys** along Microsoft, Dell, Leandlease, and Object Management Group founded the **Digital Twin Consortium** to drive **awareness, adoption, interoperability**, and the **development of digital twin technology**. Members have a **collaborative partnership among industry, academia, and government expertise**. The total number of members is over 100.

Ansys supports the goal to increase collaboration among all who would **plan, perform, and/or benefit from Digital Twin R&D**

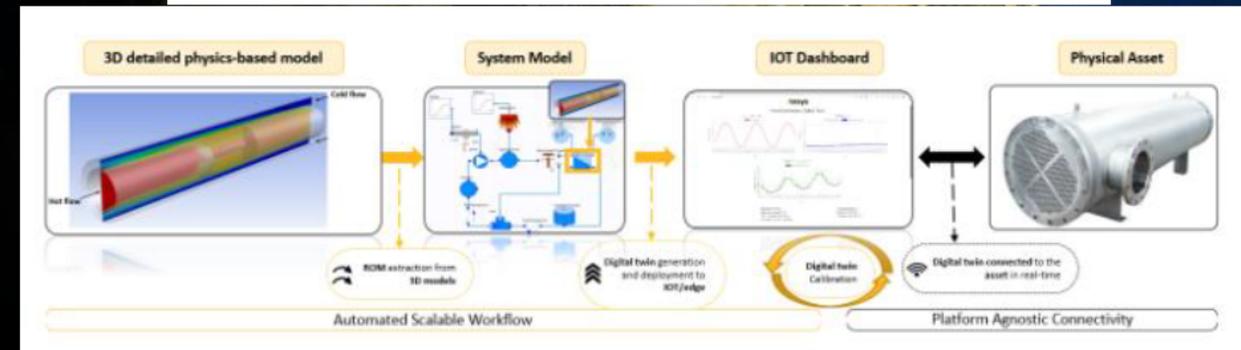
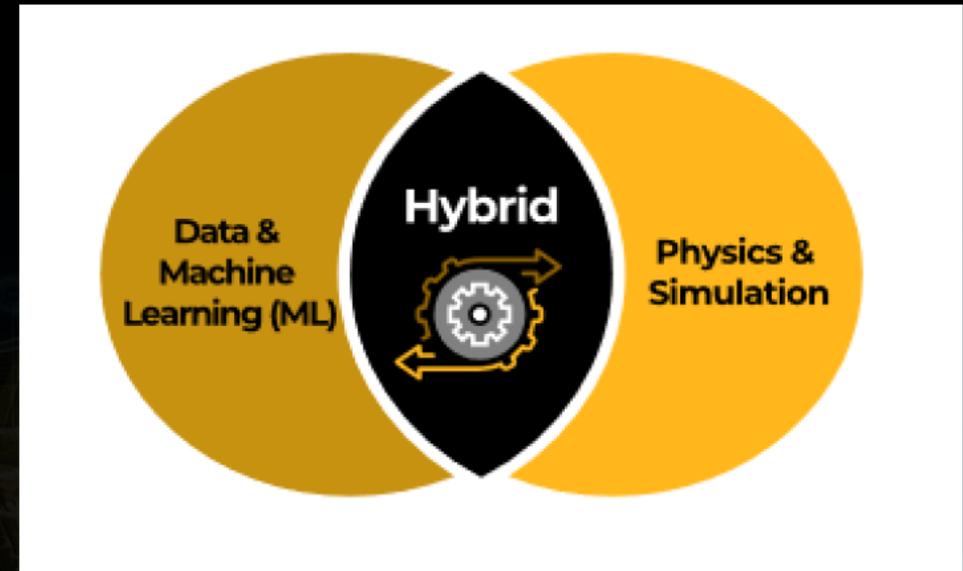


Standards: Promote Development of Evaluation Tools, Methodologies and Consensus Standards for Digital Twin Development and Testing and Interoperability:

Ansys is interested in collaborating to develop Evaluation Tools, Methodologies and Consensus Standards for Digital Twin Development and Testing and Interoperability

In particular, the following areas are important:

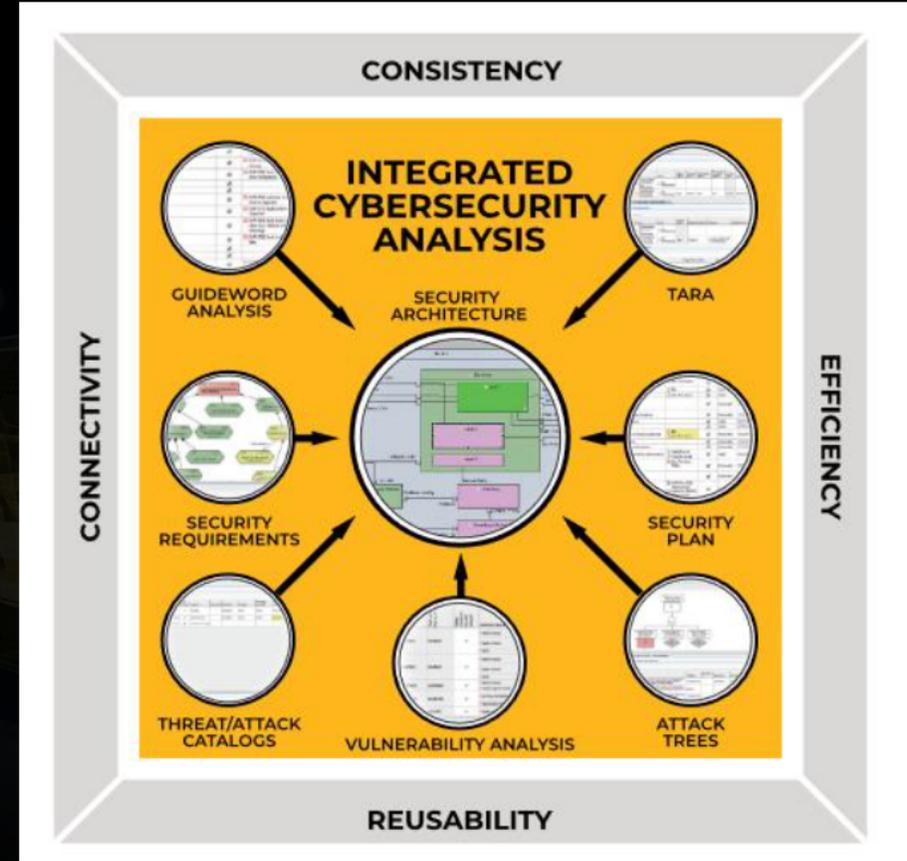
- Ontology and data exchange protocols
- Encryption standards
- Taxonomy
- Evaluation of data-driven Digital Twin components
- Hybrid Analytics
- Continuous and multi-modal data sources
- Personalized applications derived from Digital Twins
- Transferability
- IIOT connectivity
- Digital Twin deployment and scalability
- Generalizability and robustness of Digital Twins



Trustworthy: Realize Secure and Trustworthy Digital Twins:

Ansys considers **Cyber Security Analysis** to be a critical task to help realize **Secure and Trustworthy Digital Twins** because it will help to

- Identify the assets in the system and what their **important security attributes** are
- Systematically identify **system vulnerabilities that can be exploited** to execute attacks
- Understand the **consequences of a potentially successful attack** with respect to the assets
- Estimate the **potential of an attack** (i.e. effort to execute it)
- **Associate a risk with each threat**
- Plan and execute **appropriate security measures** based on the **identified risk**



VVUQ: Develop Rigorous Methods for Verification, Validation, and Uncertainty Quantification for Digital Twins:

Ansys sees that Verification, Validation, UQ for Digital Twins is increasingly becoming more important as DTs are being used for a variety applications where **safety is critical & consequences of failure are severe**: Medical, Energy, Industrial, Automotive, Aerospace & Defense

Ansys supports the effort to develop rigorous VVUQ methods

Towards a digital twin for nuclear fusion

Challenge

Design, monitoring, and maintenance of fusion reactors and equipment cannot rely on extensive testing or in-operation diagnostics due to the prohibitive costs and harsh environments

Solution

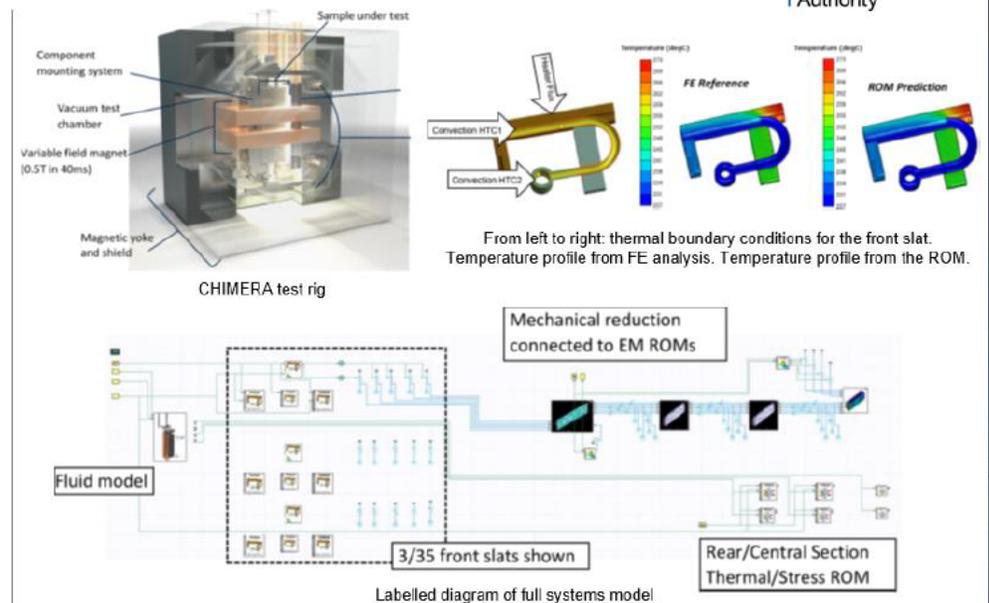
A demonstrator is developed to model fusion components subject to combined loads

Ansys Maxwell enabled calculating the forces experienced by the equipment due to the magnetic field
Thermomechanical loads were evaluated with **Ansys Mechanical**

Ansys Twin Builder allowed generating reduced order models and coupling them

Benefits

Digital twin is shown to be a key technology to support the design and operation of future nuclear fusion power plants



M. Tindall et al., Towards a fusion component digital twin – virtual test and monitoring of components in CHIMERA by systems simulation, Fusion Engineering and Design, Volume 191, 2023