

**Innovazione e Qualità del software:
la progettazione della prossima generazione di macchine flessibili per
la produzione**

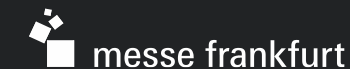
MathWorks

Aldo Caraceto
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Evolving requirements for OEMs

End Users have evolving requirements and expectations from OEMs. The key areas include: Overall Equipment Effectiveness (OEE:), Time-to-Market (TTM), novel features (AI, Predictive Maintenance, Data Analytics apps, etc.), Industry 4.0 (Flexible Manufacturing, Digitalization, Zero Defect Manufacturing, etc.), and Sustainability (energy efficiency, enabling sustainable manufacturing processes, etc.)



OEE



TTM



Novel Features

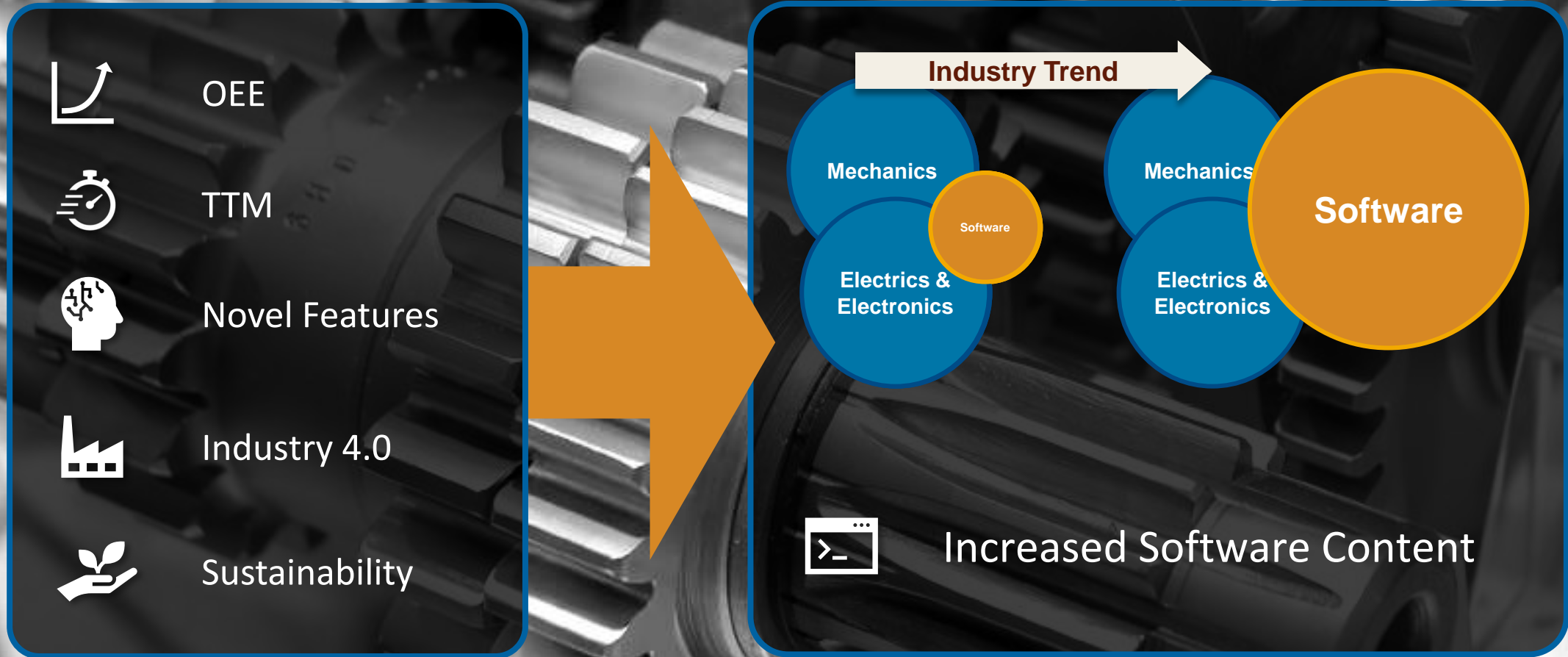


Industry 4.0



Sustainability

Evolving requirements for OEMs lead to increased software content



Increased software content creates challenges and opportunities



Increased Software Content



Challenges

Increased Complexity:

- Engineering and development effort
- Potential sources of errors
- Multidomain know-how



Opportunities

Increased machinery data:

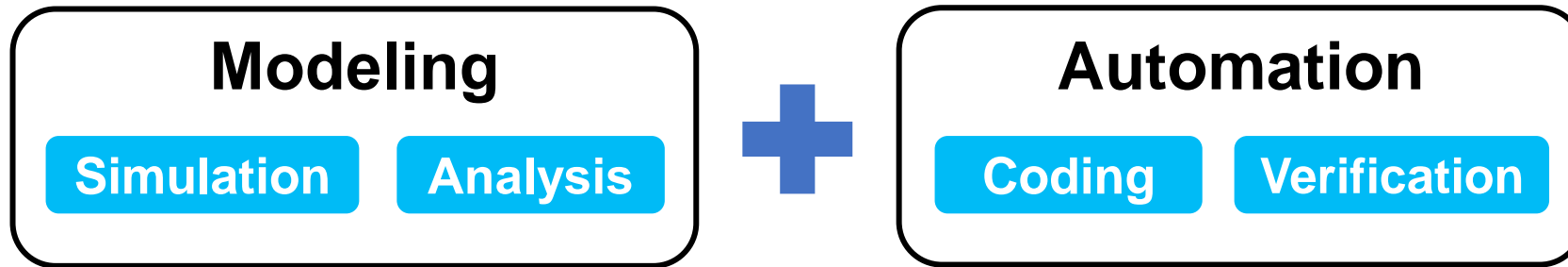
- Differentiation through features and performance
- New products and services
- New revenue streams

Agenda

- What is Model-Based Design
- How modeling and simulation is used to mitigate design complexity
- How design models are re-used to offer digital services to end users

Model-Based Design

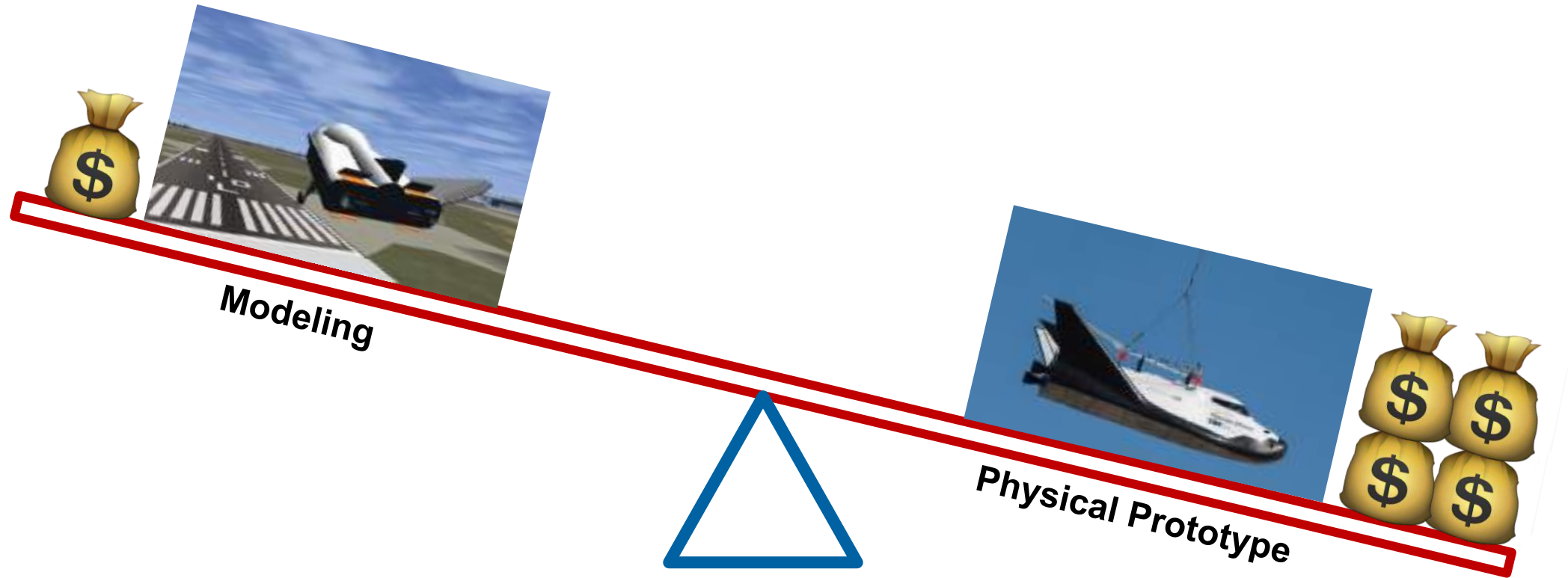
Systematic use of models throughout the development process



Try out **new** ideas
Fast repeatable tests

Eliminate **manual steps**
and **human error**

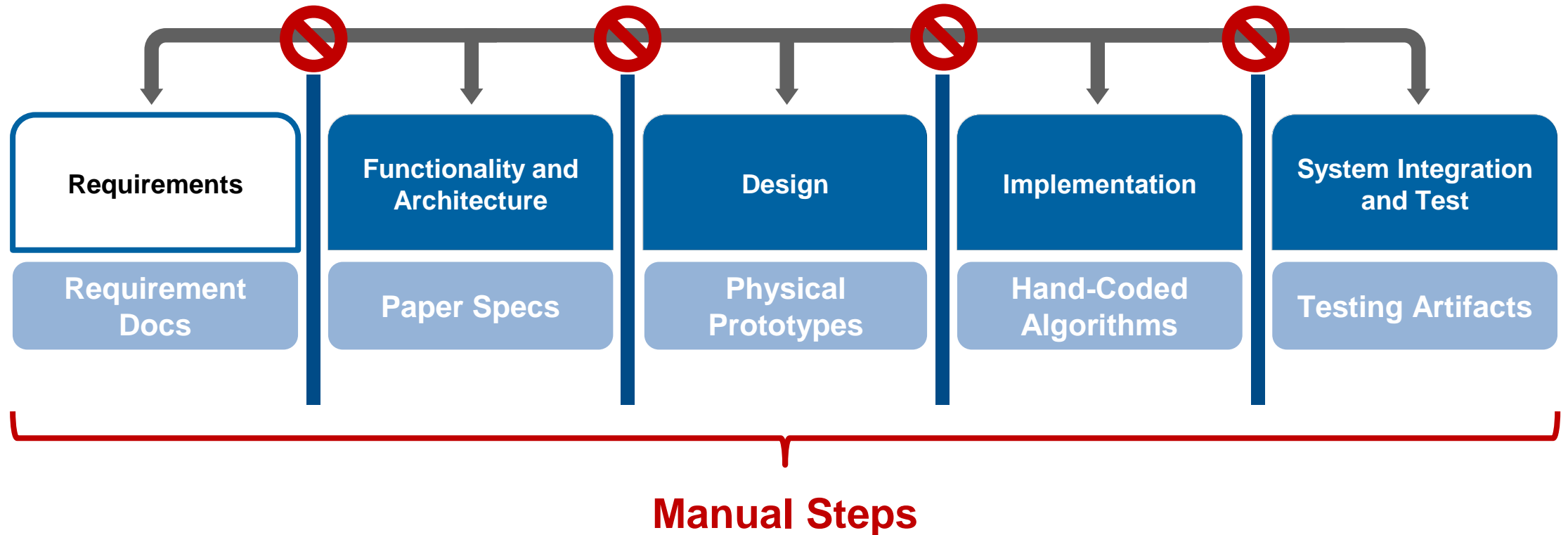
Physical prototypes are costly and iterate slowly



Design space **exploration**
Continuous design **improvement**

Costly and **time-consuming** to build
Hinders rapid iterations

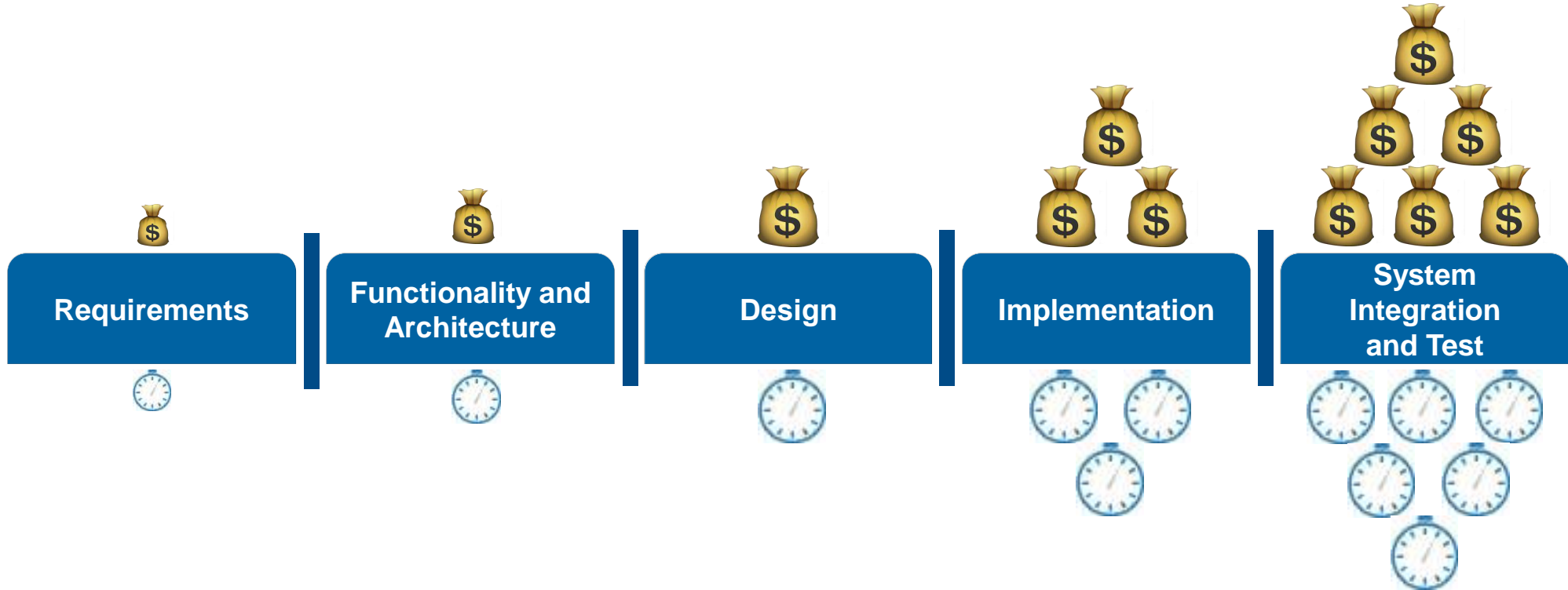
Requirements and artifacts are **hard to manage, change, and trace**



Manual steps introduce **errors** and **slow down** the development process

Issues found late in the process are more **costly** and **time-consuming** to fix

Cost to Fix Issues



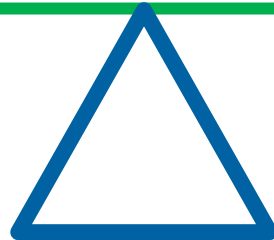
Time to Fix Issues

Modeling and simulation help cut costs and speed up design iterations



Modeling

Simulation Analysis

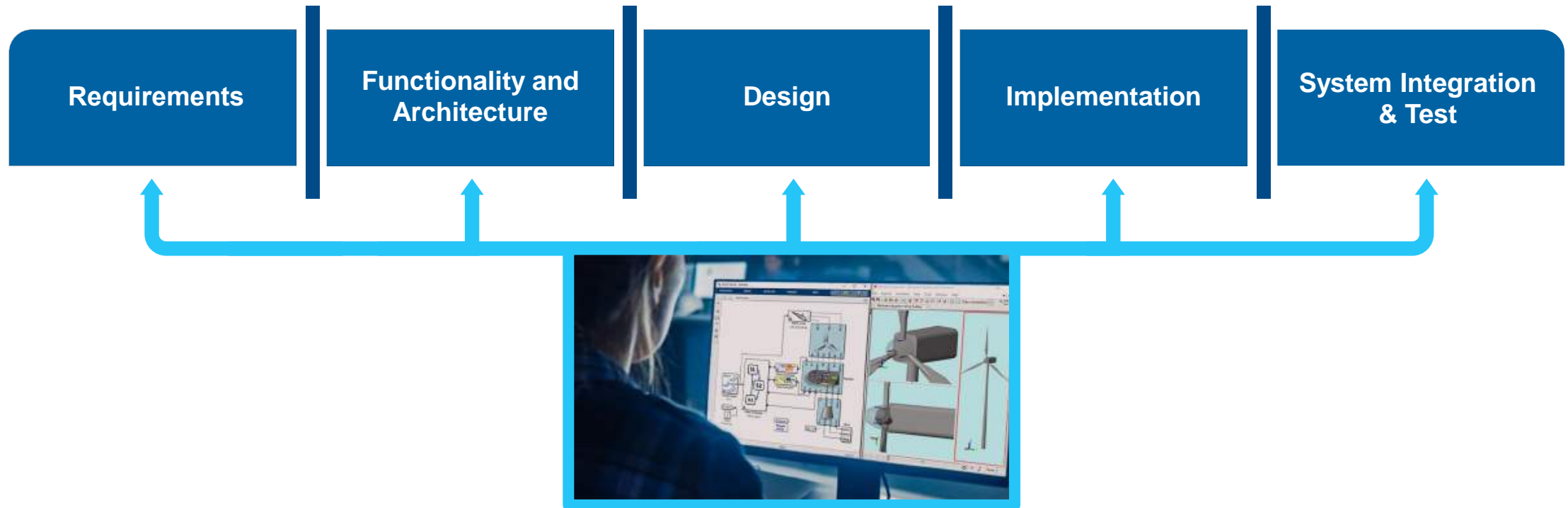


Physical Prototype

Rapid prototyping and testing

Requirements **capture** and artifact **traceability** throughout the process

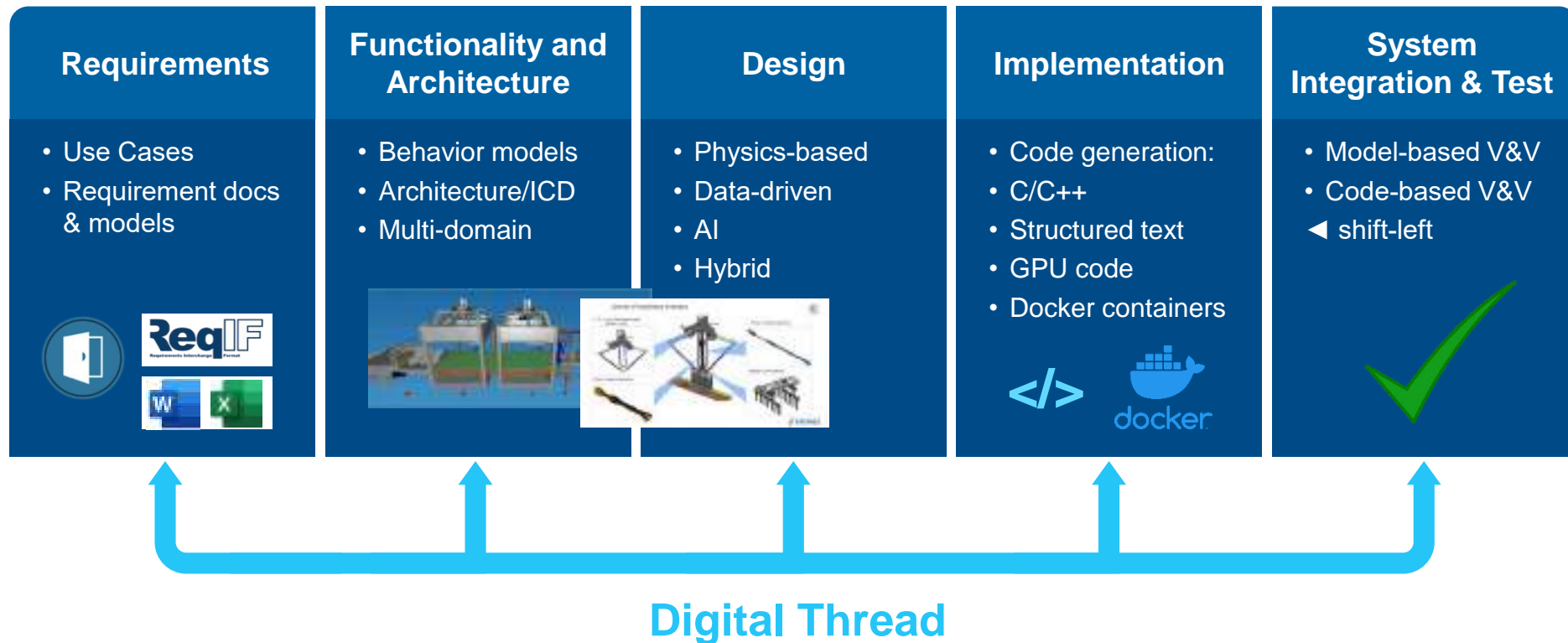
Model-Based Design



Models are at the **center** of your development process
Create a **digital thread**

Systematic Use of Models in product Engineering and Development

Authoritative Source of Truth ▪ Reuse/Refine ▪ Value at Multiple Stages



Metso Develops Controller for Energy-Saving Digital Hydraulic System for Papermaking Equipment Using Model-Based Design

Challenge

Precisely control the speed, position, and pressure of calender rolls in paper finishing equipment

Solution

Simulate, prototype, and implement advanced controls for a digital hydraulic system using Model-Based Design

Results

- Months of design time saved
- Weeks of customer startup time eliminated
- System reliability increased



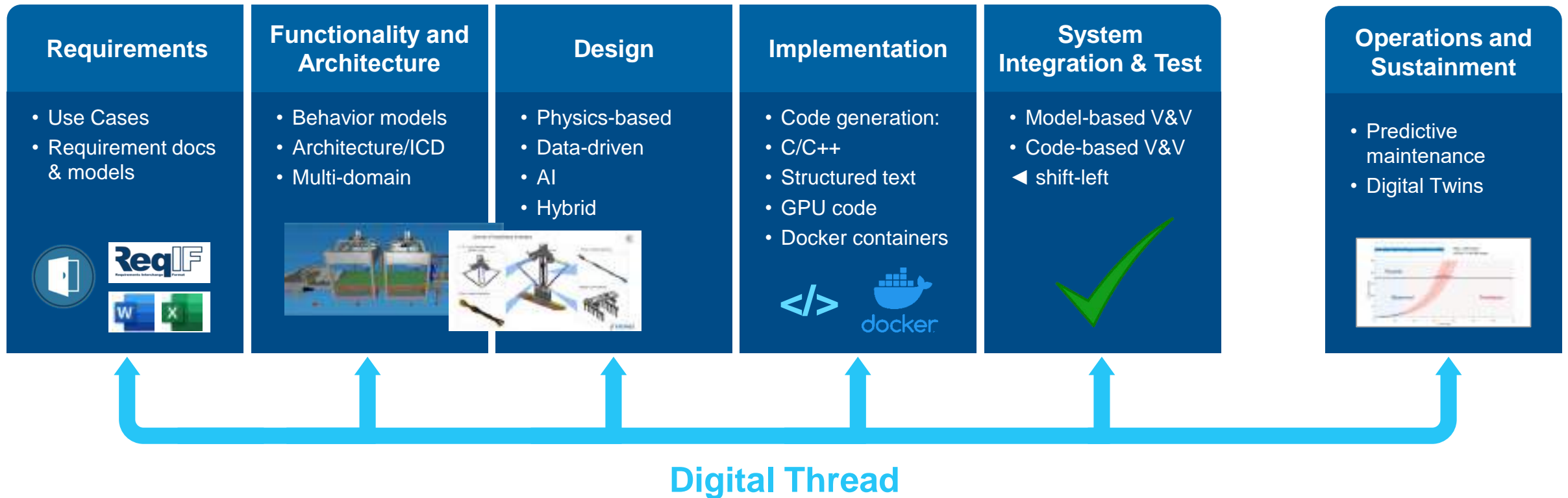
Metso's papermaking equipment. The machine's calender is controlled by a digital hydraulic system.

"Using Model-Based Design [...], we achieved multiple goals simultaneously. We developed a sophisticated controller for digital hydraulics that is more reliable, accurate, and efficient than previous systems, and we accelerated development, which gives us a competitive advantage."

- Kari Leminen, Metso

Systematic Use of Models in the Lifecycle

Authoritative Source of Truth ▪ Reuse/Refine ▪ Value at Multiple Stages



Atlas Copco Minimizes Cost of Ownership Using Simulation and Digital Twins

Challenge

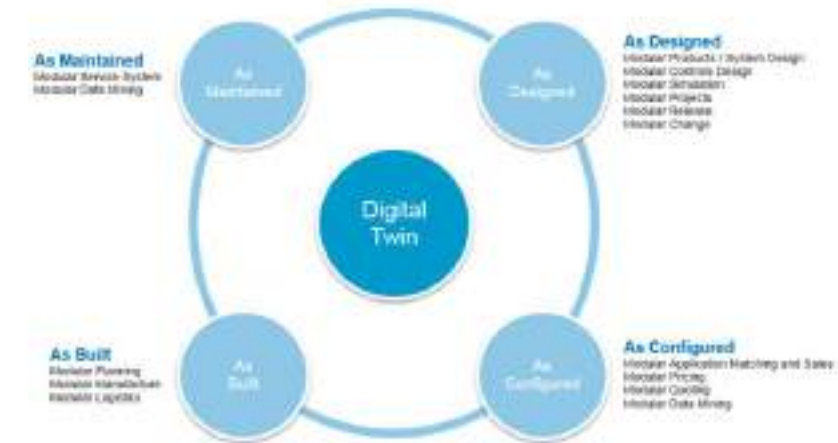
Build platform to enable predictive maintenance for air compressors

Solution

Integrate simulation and data analytics for digital twins that serve as a single source of truth

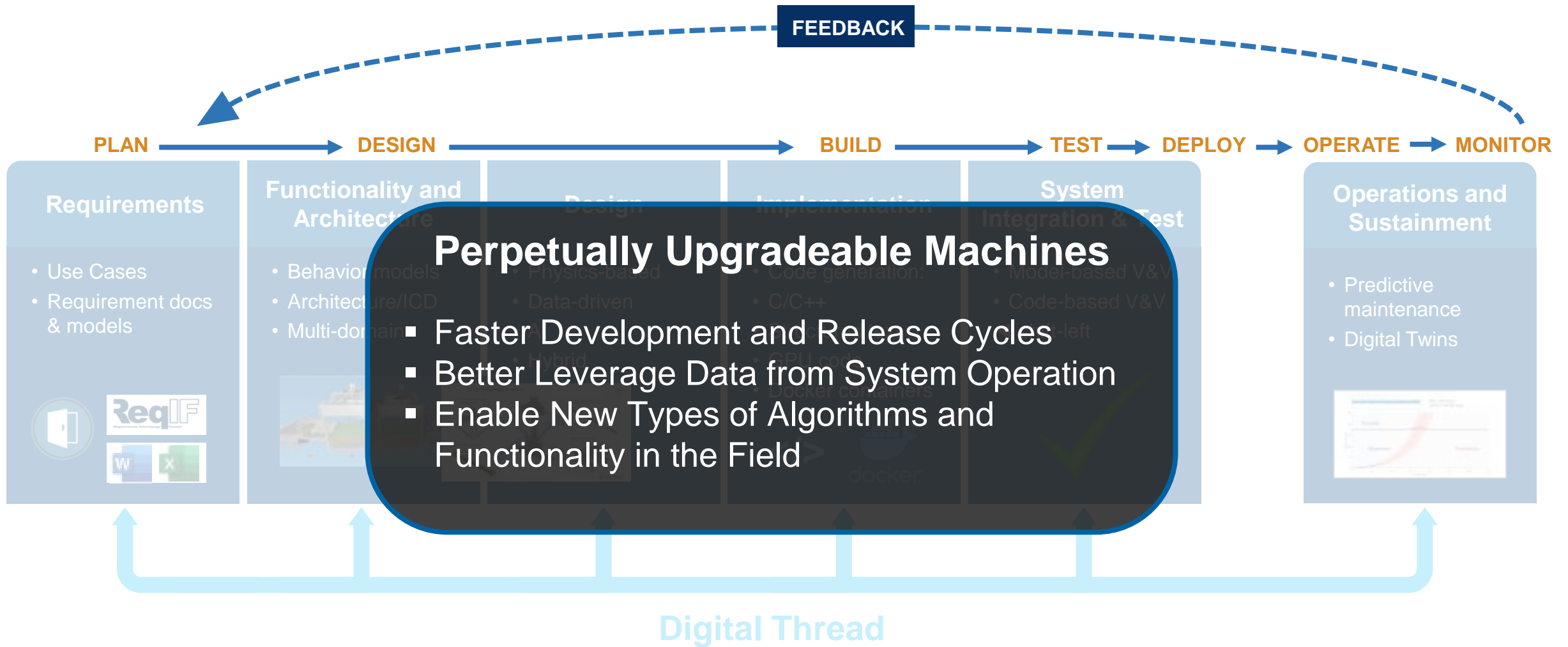
Results

- Easy interaction with application-specific data sources
- Vast range of data analytics and simulation capabilities
- Ability to combine databases with a physical model
- Open information sharing between teams from engineering, sales, and service



Digital twins serve as the single source of truth.

A Different View of the Lifecycle



OEMs benefit from systematic use of models throughout the development process



Increased Software Content



Model-Based Design



Innovation and Software Quality



Short **agile**
iteration cycles



Saved time and
cost



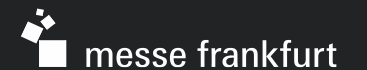
Minimal defects
and **high quality**

[GRAZIE PER L'ATTENZIONE]

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