Developing Simulation as an "Enterprise Asset"

Powered by comprehensive and collaborative engineering platforms

October 18, 2023

Sandeepak Natu s.natu@cimdata.com
Don Tolle d.tolle@cimdata.com

Simulation-Driven Systems Development Practice
CIMdata Inc.

www.CIMdata.com

CIMdata

Defining What Comes Next in Digital Transformation

Strategic management consulting for competitive advantage in global markets

The leading independent authority on PLM and its digital transformation. We provide research, education, and strategic consulting to clients around the world.

OUR MISSION:
Maximizing clients' ability to design, acquire, deliver, and support innovative products and services.

www.CIMdata.com

Our Services

Strategic advice & counsel through a comprehensive & integrated set of services

- Research & analysis
- Technology evaluations
- Market-specific insights
- Industry news & trends

- Industry conferences
- Seminars & webinars
- Certificate programs
- Best practices

- Strategic guidance
- Aligning solutions with needs
- Program management advisement
- Market positioning

Agenda

Presentation Outline

- Simulation and Analysis: Market trends
- Simulation and Analysis: Technology trends
- Evolution of simulation as “Enterprise Asset”
- Need of “Engineering Platform”
- Conclusions

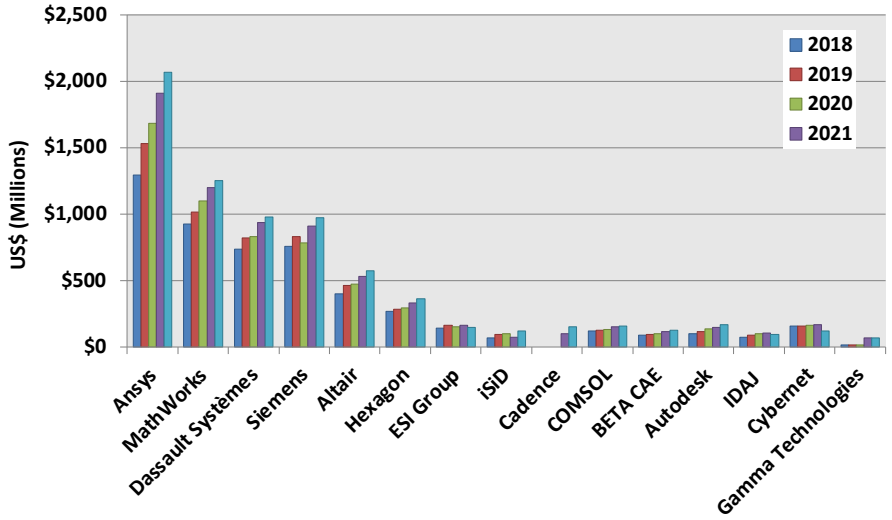
Simulation and Analysis (S&A)

Revenues in $US millions

Revenues presented are CIMdata estimates

Year	Revenue	YoY	5 Year CAGR
2022	$9,228.8	10.9%	-
2023F	$10,077.9	9.2%	10.0%

Segment Leaders



Comments on the Segment

- Significant M&A activity in market leaders
- Trends driving growth will remain strong (smart connected product/Industry 4.0, need for more simulation on the left side of the Vee)
- Platforms growing in importance (Minerva, Cassini)
- MBSE and systems of systems interest and investment growing
- S&A and EDA intersection growing

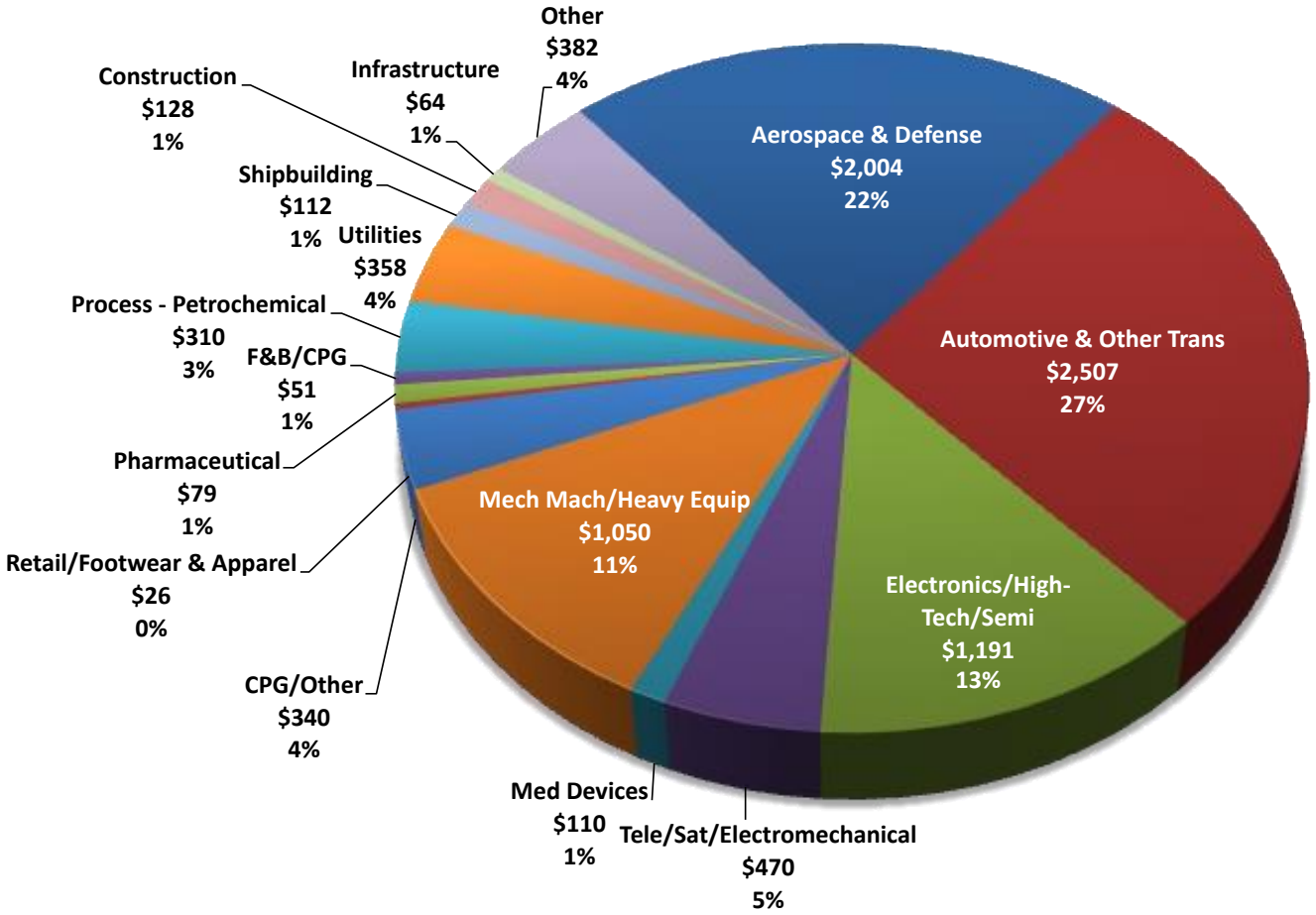
Notable M&A in 2022

- Altair added Cassini, Powersim, Gen3D, Concept Engineering, and RapidMiner
- Ansys acquired OnScale, Motor Design Limited, C&R Technologies, and a German DYNA partner
- *Keysight acquires ESI (2023)*

2022 S&A Revenues by Industry

Data from the 2023 CIMdata S&A MAR

Revenues presented are CIMdata estimates



Technology Trends in S&A

Emerging technology opportunities (1 of 2)

- Model-based systems engineering
  - After a sluggish adoption over the years, MBSE and MBX adoption seeming to show momentum due to increase in product complexity. Driver for digital transformation
  - Role of model-based development from requirements to operations and after sales
- Multiphysics, Co-simulation and systems simulation gaining wider acceptance
  - Increased product complexity. Mechanical, Electrical, Electronics and Software co-development
- Digital Transformation, Digital Twin/Thread
  - Digital transformation in progress across OEMs and Tier I and II companies. Simulation is finding transformational role in the same.
- Simulation process and data management
  - Need of common data and process models come to the fore. SPDM gaining traction as part of digital transformation of PLM and more for driving forward the business benefits of simulation
  - Possible integration of test data as well

Technology Trends in S&A

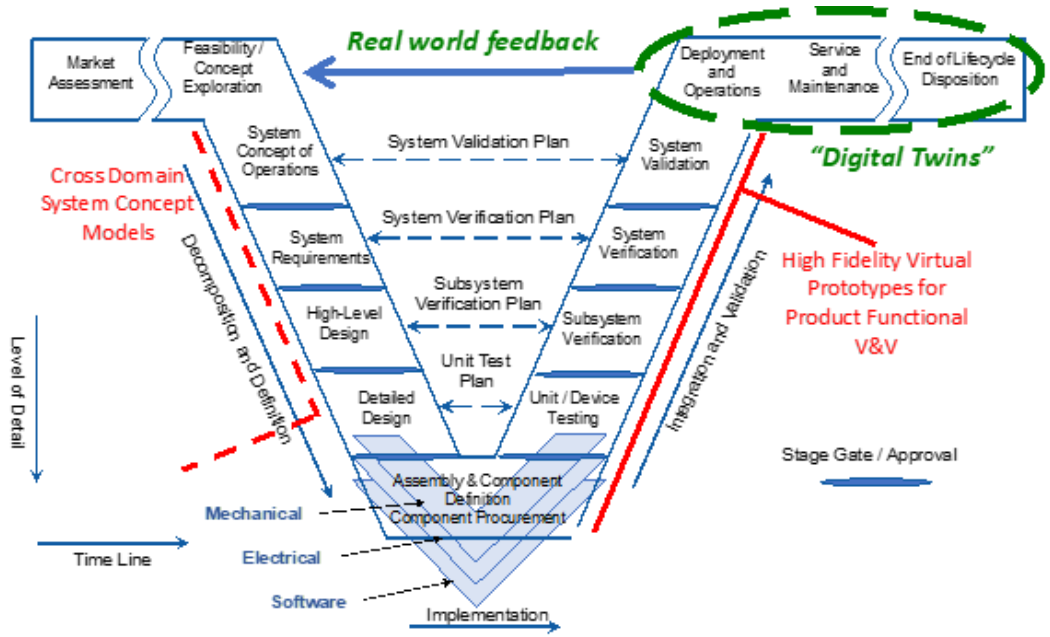
Emerging technology opportunities (2 of 2)

- Generative design, optimization, implicit modelling and additive manufacturing
  - Generative design functionality, lattice structure based material and additive manufacturing makes an interesting mix. May start significant industry trends: small quantity speciality products, performance-driven materials/products, and at scale customization
- Confluence of physics-based simulation and AI/ML
  - Support and services functions. Best practice development. User error correction. Parameter tuning of complex physical models. Productivity boost for users.
  - Pathbreaking technologies such as PINN as well as geometry-based learning can have transformative impact
- Cloud computing and SaaS
  - Entry barrier for consumption of complex, large scale and on-demand simulations falling continuously
- Convergence of Mechanical, Electrical/electronic and software Simulation Tools
  - Simulation of complex systems as they are. High fidelity, multi-fidelity, mixed fidelity simulations

Simulation as an "Enterprise Asset"

The Business Drivers

- Product complexity is increasing multi-fold
  - Mechanical, Electrical/electronic systems, Software and connectivity
- Competitive pressures
  - Need to win or maintain market position
- Need for shorter design cycles
  - Customer choice is evolving rapidly
- Address new market opportunities
  - Need itself is evolving. Shorter lifecycle of products
- Demand for lower cost products
  - Cost can have many dimensions e.g., environmental impact



Adapted from: US Federal Highway Administration: "Systems Engineering for Intelligent Transportation Systems"
http://ops.fhwa.dot.gov/publications/seitsguide

Simulation as an "Enterprise Asset"

Integration of simulation with enterprise digital thread

Portfolio Planning

Conceptual Design

Product Engineering

Manufacturing

Requirements

Info

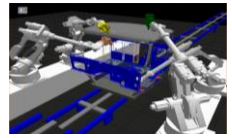
Re-use
Re-purpose
Re-mfg.
Re-cover
Re-cycle
Re-tire

Disposal & Recycling

Digital Thread refers to the **communication framework** that connects data flows, which can be used to produce an integrated and holistic view of an asset's data from physical and virtual systems (i.e., its digital twin) throughout its lifecycle across traditionally siloed functional perspectives

Simulation & Validation

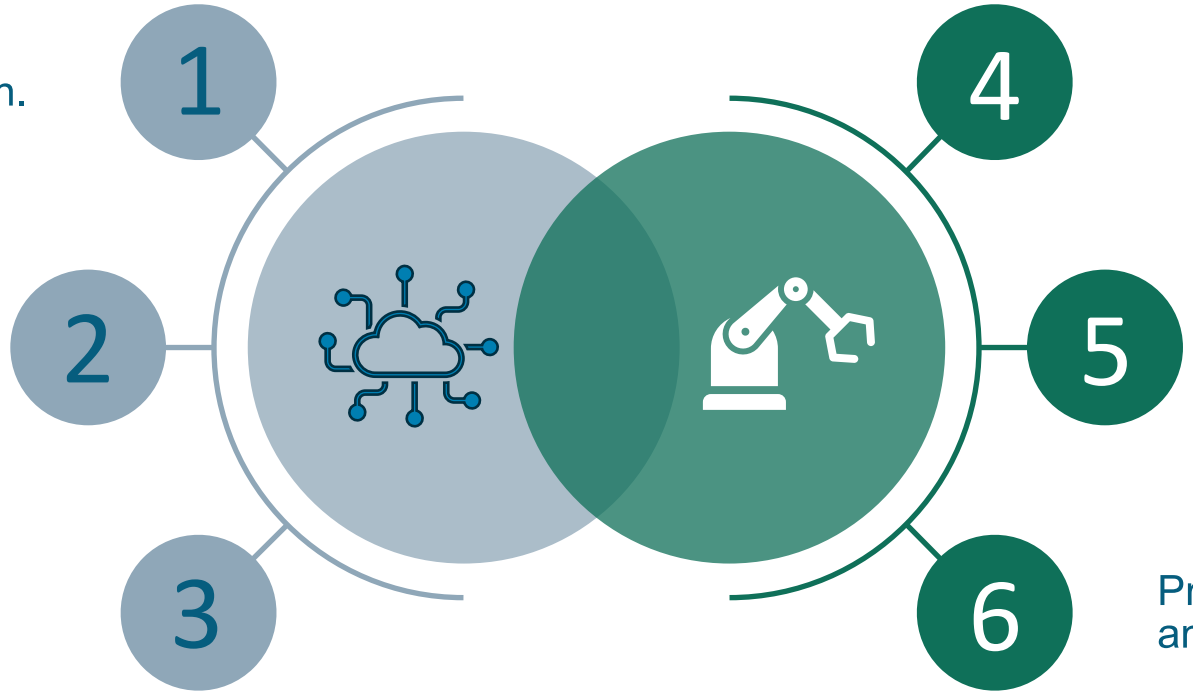
Build & Produce



Comprehensive and Collaborative Digital Engineering Platforms

Technology backbone for use of simulation across enterprise

1. Single and multi-physics and fidelity models and simulation.
2. Design space exploration, optimization and creation of reduced-order models
3. Creation and dissemination of workflows across organization
4. Work across mixed environments, licensing models and HPC resources
5. Connect with data science, digital engineering and digital transformation, IIoT initiatives. Realization of “Digital Twin” of products and processes
6. Process and data management and connect with PLM systems



Comprehensive and Collaborative Digital Engineering Platforms

Realization of business benefits from modelling and simulation

1. Single source of truth for models, workflows and data. Authorization and usage framework
2. Monitoring and supervision framework including budgets and RoI calculations
3. Possibility of exploring “As a service” business models using higher level of visibility in the asset performance

4. Organizational knowledge repository enabling higher levels of innovation
5. Integration with PLM, ERP, SCM functions enabling larger context for engineering modelling and simulation
6. Improved quality, cost savings and scalability

Concluding Remarks

Summary

- With increasing product and process complexity, simulation and analysis is playing a greater role across the entire product lifecycle
  - Employed as a “Strategic Asset” by innovative market leaders
- Collaborative Engineering platforms based on open APIs and industry standards have a huge role to play in the digital transformation
  - Integration frameworks for data/IP, people and best practice processes
  - Low code vertical app capabilities can enable technology “democratization”
- Need a robust technology and IT backbone to realize the business value
  - Creation, archival and re-use of knowledge enables the enterprise“ Digital thread”
  - Leverage all levels of advanced computing- Desktop, GPUs, Cloud, IoT/Edge

Questions & Discussion

Open discussion

Thank You

From the whole CIMdata team