



# **The Digital Thread: The PLM Economy Perspective PLM Market & Industry Forum A CIMdata Leadership Event**

**April 2023**

*Stan Przybylinski, Vice President, [s.przybylinski@CIMdata.com](mailto:s.przybylinski@CIMdata.com)  
+1.734.668.9922*

**#plm4um**

**[www.CIMdata.com](http://www.CIMdata.com)**

Copyright © 2023





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, deliver, and support innovative products and services.**

[www.CIMdata.com](http://www.CIMdata.com)

Copyright © 2023

# Key Takeaways



*The Digital Thread: The PLM Economy Perspective*

- Notions of digital thread more than 20 years old, always heterogeneous in the extreme
- Many solutions types can support digital thread use cases
- Historically spoke about integration or data linking but other digital “shred” offerings emerging, other ways to connect needed
- Machine learning one option to leverage collaboration and decision-making scenarios across disparate systems

# Topics to be Discussed



*The Digital Thread: The PLM Economy Perspective*

- Getting to the Digital Thread
- Optimizing the Digital Thread
- Platforms Supporting the Digital Thread
- Enhancing Learning from the Digital Thread
- Concluding Remarks

# From EDM to TDM to PDM to cPDm to...

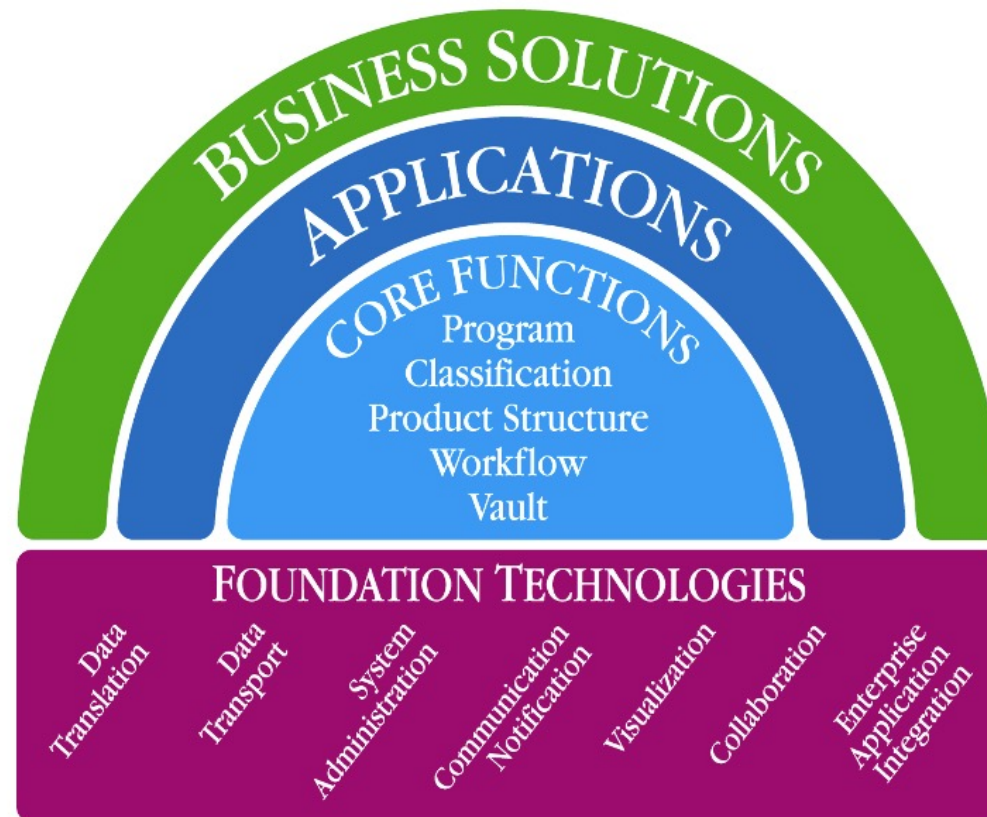


*Product data management evolved well beyond simple CAD data management*

- The emergence of digital tools in Industry 3.0 created need for managing large complex data
- In the late 1990s CIMdata promoted a new phrase: collaboration Product Definition management (cPDm)
  - MRP went from MRP to MRP II to ERP as functionality evolved
  - Avoided "PDM II," added collaboration, visualization, and notion of product definition across the lifecycle
- cPDm a "strategic business approach" not wedded to a solution type

# CIMdata's World Class cPDm Model

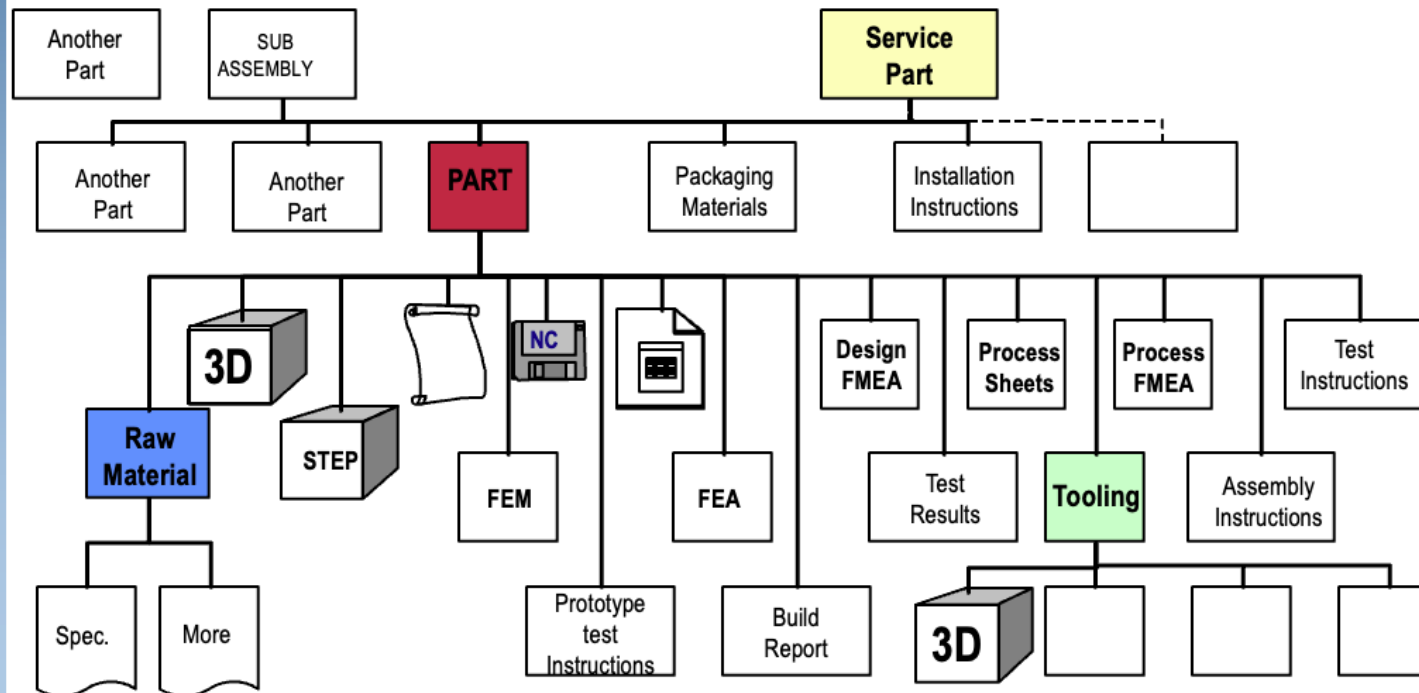
*The merging of technology, data models, and business solutions*



# Data Vault & Document Management

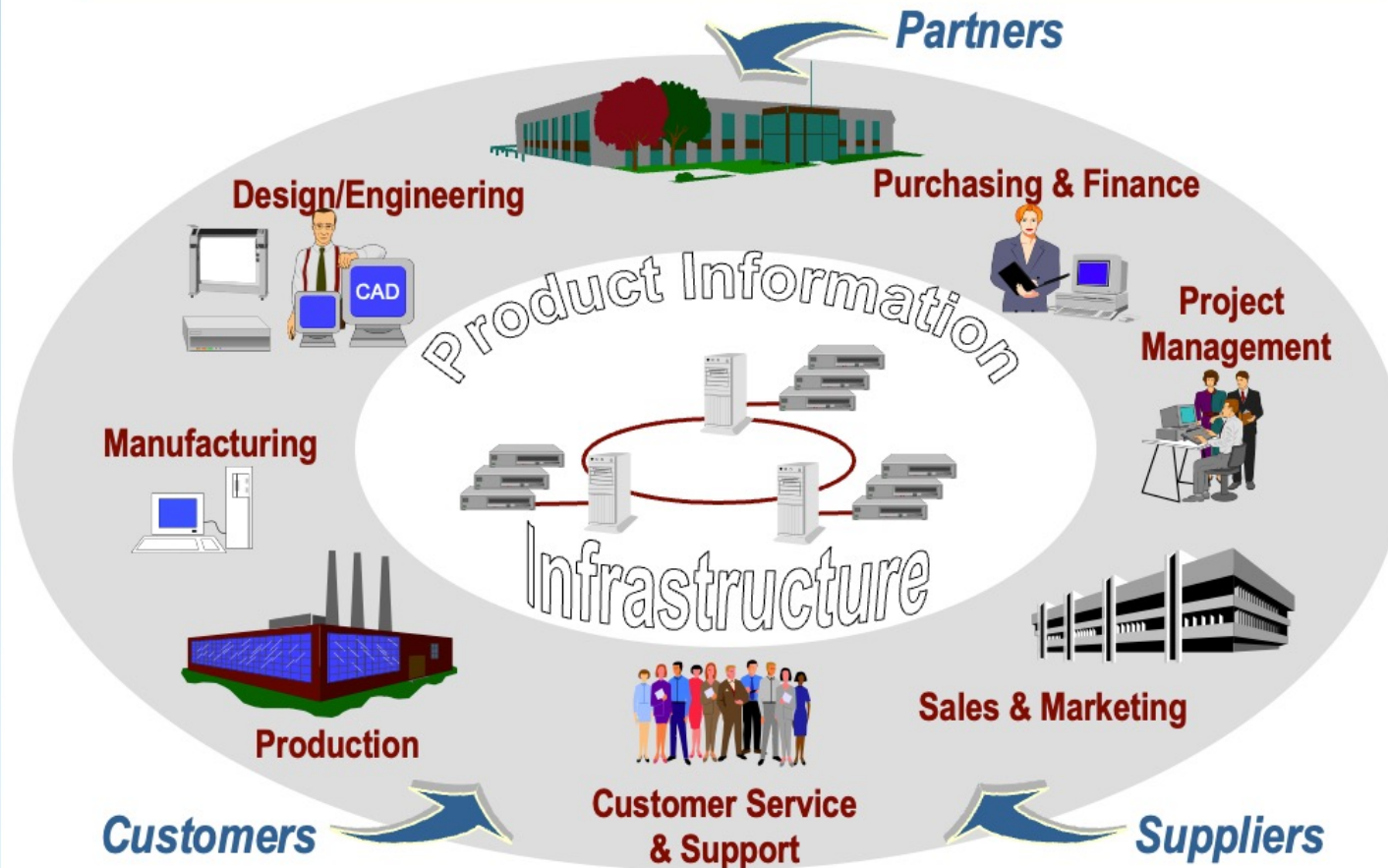
*Products have many associated parts, documents, and files*

- ◆ Identification must be consistent and recognizable
- ◆ Many files may represent one logical object, e.g., 3D model



# Product Information Infrastructure

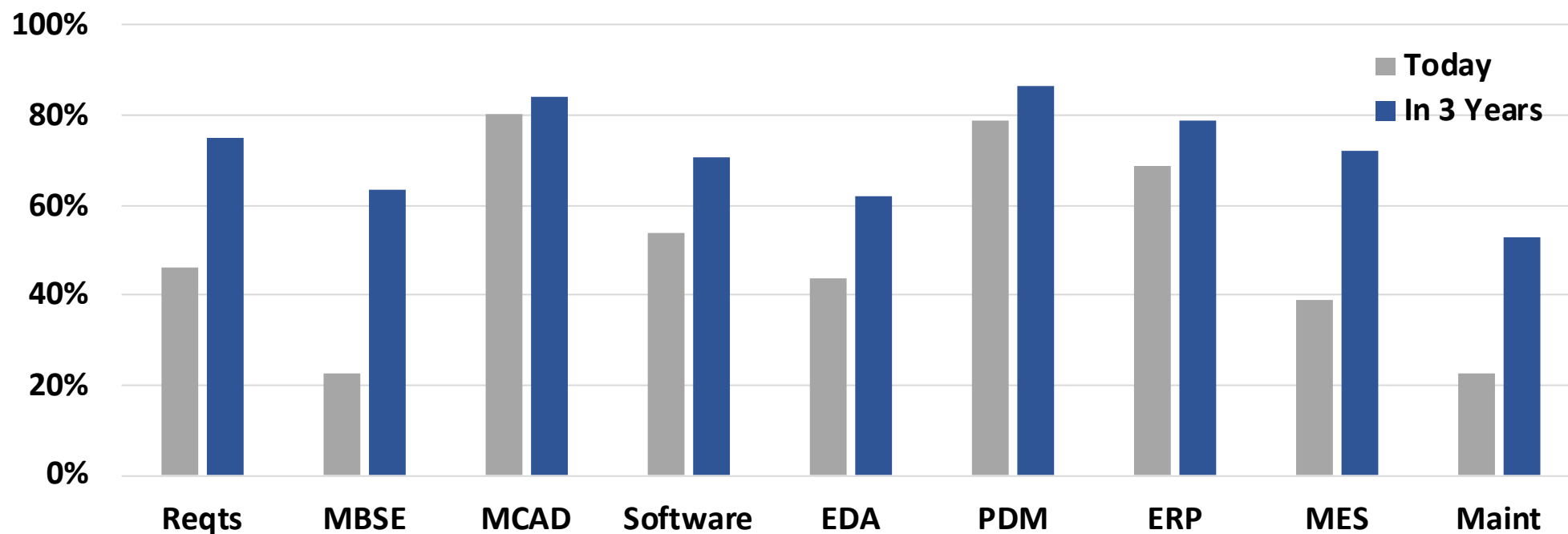
*Integration of distributed systems, processes, and data into one environment*



# Breadth of the Digital Thread



*What types of software offerings are contributing today? In three years?*



# Breadth of the Digital Thread



*What other types of software offerings will contribute information to your digital thread?*

- Customer Relationship Management (CRM)
- Quality Management Systems (QMS)
- IoT/IIoT
- Human Capital Management (HCM)
- AR-VR
- Simulation & Analysis
- Integrated Logistics Support (ILS)
- Analytics
- In-house solutions
- Financial planning
- Configuration lifecycle management (CLM)
- MBSE tools
- Supplier collaboration
- EAI
- Project management
- 3D search
- Compliance and Regulations (e.g., RoHS, REACH, sustainability)
- CNC, CAM, tolerance analysis

# Collaborative Research Program



*Study Digital Thread current state and future trends*

**CIMdata** **AEROSPACE & DEFENSE PLM ACTION GROUP**

CIMdata / AD PAG Digital Thread Survey  
Answers marked with a \* are required.

1/6 16%

**CIMdata / AD PAG Digital Thread Survey**  
September 2022

The Digital Thread, in various incarnations, has been a core element of the product lifecycle management (PLM) vision for decades. The concept of automated linkage of multiple representations of a product, each tuned to the needs of various creators and consumers along the lifecycle, is very powerful. Until recently, tracing these linkages has been primarily a manual process, extracting product information from myriad heterogeneous systems and relating them in ad hoc reports. But now, with recent advances in commercial PLM solutions, the Digital Thread, with automated linkages and traceability, has become a practical possibility, even for industries with complex products, such as aerospace & defense.

In response, leaders in the A&D industry are starting to implement targeted digital thread solutions and envision expanding these solutions upstream and downstream throughout the product lifecycle. With the newness of this approach there is not much available in the way of lessons learned or actual value achieved. This lack of real data is a barrier to broader investment within industry. On the other hand, solution providers lack insight into current state and future investment drivers within industry that is crucial to their solution strategies and roadmaps.

The Aerospace & Defense PLM Action Group (AD PAG) is an association of aerospace & defense companies which functions as an advocacy group for this industrial community with the PLM software and service providers. Digital thread is a huge topic in the global aerospace and defense industry and the Group recently completed a study on the topic.

<https://www.cimdata.com/en/aerospace-and-defense/publications/digitalthread>

In this new research effort, CIMdata and the AD PAG are partnering with Aras, Eurostep, Jama Software, PTC, and Siemens Digital Industries Software, all solution providers committed to addressing the digital thread challenges of industrial companies. This research is intended to provide meaningful insight to both communities on industrial needs, status, and plans for their digital thread implementations. And this survey to gather your perspective is a key component of our research.

Completing the survey should take 30-40 minutes of your time. Only summary statistics and charts of your responses will be provided to our sponsors and published by the CIMdata team. Respondents can request a copy of the survey results at the conclusion of the survey.

In return for your participation, those fully completing and submitting the survey with a business email address will be entered into a drawing for one of the following incentives:

- \$100 Amazon gift card (10 offered)
- \$50 Amazon gift card (10 offered)

The drawing for the incentives will be randomized and made after the survey is closed.

Thanks for your participation and let's get started!

**Please read and answer all of the questions.**

CIMdata, Inc.  
Ann Arbor, MI USA  
<http://www.CIMdata.com/>

## Sponsors



aras

•eurostep



jama  
software®



ptc

SIEMENS

## Objective

*The A&D PLM Action Group members and the PLM solution provider sponsors share a common objective for this research –  
To gain understanding of needs and opportunities within industry that will inform Digital Thread solution strategy and roadmap*

# Varied Capabilities from Different Providers



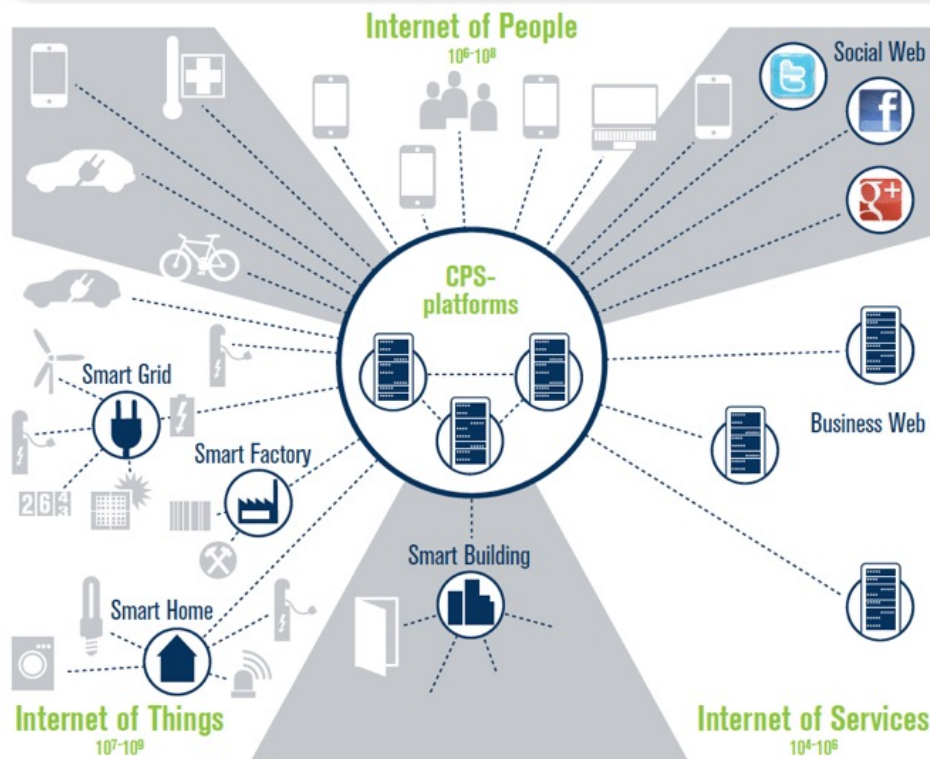
*Comprehensive cPDm the legacy home, but many other approaches exist*

- PTC and Siemens solidly in the comprehensive cPDm segment
  - The legacy home of the thread concept
  - Offer a range of tools
  - Dassault Systèmes not a sponsor but is firmly in this group, as are others
- Aras in cPDm but few tool offerings; wider reach through OEM deals
- Eurostep's platform helps clients build digital threads proactively and retroactively
- Jama Software focusing on requirements traceability across the digital thread, linking to other platforms & tools

# The Industrie 4.0 Vision



Everybody and (virtually) everything on someone else's (heterogeneous) digital thread



*"In a 'smart, networked world', the Internet of Things and Services will make its presence felt in...five key areas identified for action in 2009: climate/energy, mobility, health, security and communication.*

*In the manufacturing environment, vertical networking, end-to-end engineering and horizontal integration across the entire value network of increasingly smart products and systems is set to usher in the fourth stage of industrialisation – 'Industrie 4.0'."*

Recommendations for implementing the strategic initiative INDUSTRIE 4.0,  
Final report of the Industrie 4.0 Working Group

Copyright © 2023

# Optimizing Digital Thread Participation



*Virtual thread will require more complete access to heterogeneous data sources*

- You may not need to have a full solution, but you need to know how to “play nicely with others”
- What that has meant historically is solution integrations
  - Coopetition rears its ugly head
- Low code/no code exposing / mashing up many data sources; easing data and application access
- Many APIs ≠ Open – are you exposing what you want or what end-user organizations actually need?

# Democratizing the Digital Thread



*Market dynamics, "coopetition" that can impact digital thread effectiveness*

- ISVs looking to deliver their portfolio in new ways
  - Cloud-based SaaS
- To expand addressable market working to "democratize" access to their IP portfolio
- Building them into workflows, experiences
- But digital thread support optimized for native offerings
- cPDm often the nexus of collaboration for the thread
  - Necessary but not sufficient – virtual almost by definition

# High-Level Requirements



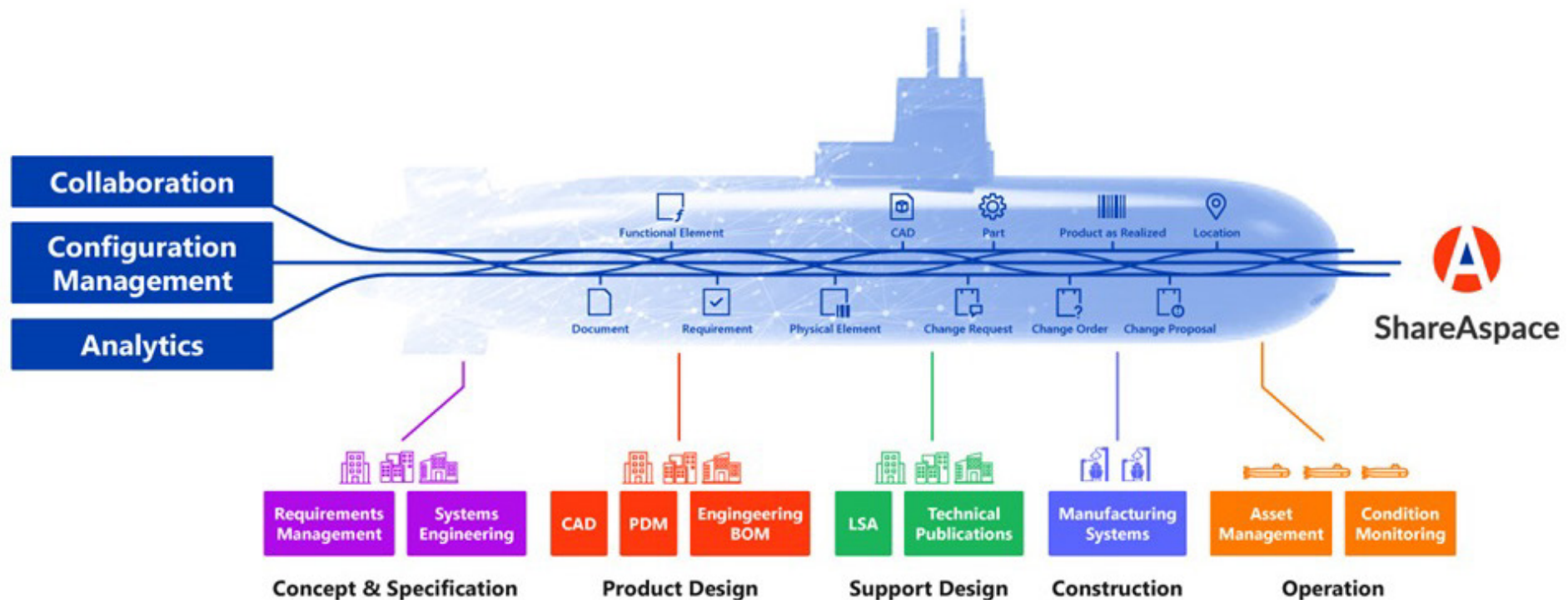
*Optimizing the heterogeneous digital thread*

- Support for industry and de facto standards
- Support for engineering work in process required?
- Degree of configuration management support
  - Of the product and the digital thread, itself
- Data governance a big issue
  - Data persistence across a complex virtual digital thread often lacking
- Support capturing and leveraging learning across that heterogeneous digital thread
  - Artifacts are necessary but not sufficient

# ShareAspace from Eurostep



*Proactively and retroactively supporting digital thread creation and management*



# Jama Connect from Jama Software



*A requirements system of record linking heterogeneous data sources*

- "...requirements system of record..."
- Many "PLM" integrations
  - Aras, Teamcenter, Windchill
  - Big Lever, Pure Systems
  - Ansys, MathWorks, CATIA No Magic, Enterprise Architect (Sparx)
  - Jira, Azure DevOps, Bugzilla, GitHub
- Formed Requirements Traceability Alliance to increase reach



# cPDM Feeding Frenzy



*Significant cPDM investments in H1 2021,  
Cassini in February 2022*

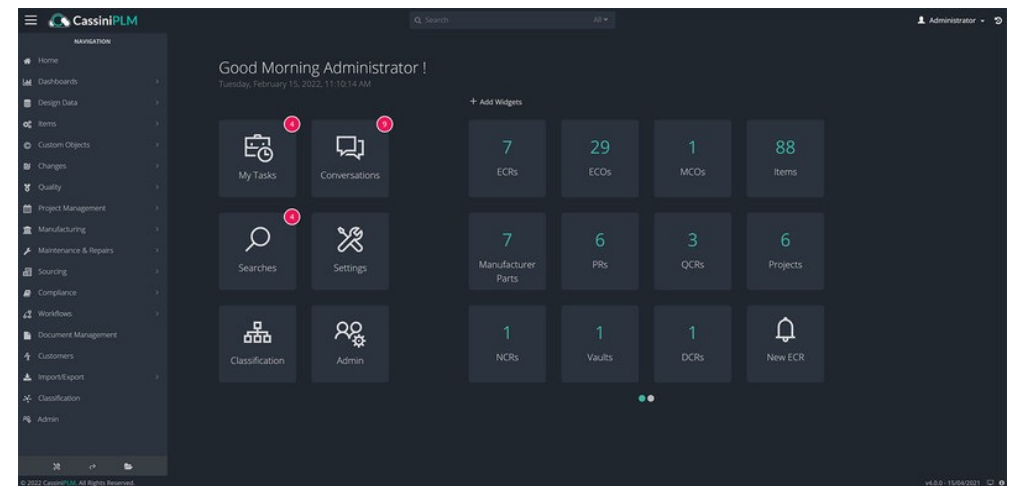
- A lot of players interested in one or more of these deals
- PTC and Arena – completed January 2021
  - Provides cloud-based collaborative business process support, nicely complements MCAD/PDM capabilities of Onshape
- GI Partners and Aras – announced April 2021
  - "...creating a single, end-to-end digital thread foundation..."
- Autodesk and Upchain – completed May 2021
  - More about cloud PDM as part of Autodesk's manufacturing offerings
- Altair acquires Cassini...

# Altair Acquires Cassini



*"...to Accelerate Development of Digital Thread Technology"*

- "A digital thread provides a 360-degree view of conceptualized product data, streamlines and accelerates new product development, and improves processes, creating a seamless experience between the digital and physical worlds".
- "The ability to manage high fidelity system data of all types across engineering, quality, service, and more is critical to fully unlock the potential of AI-based simulations".



# Autodesk Platform Services née Forge

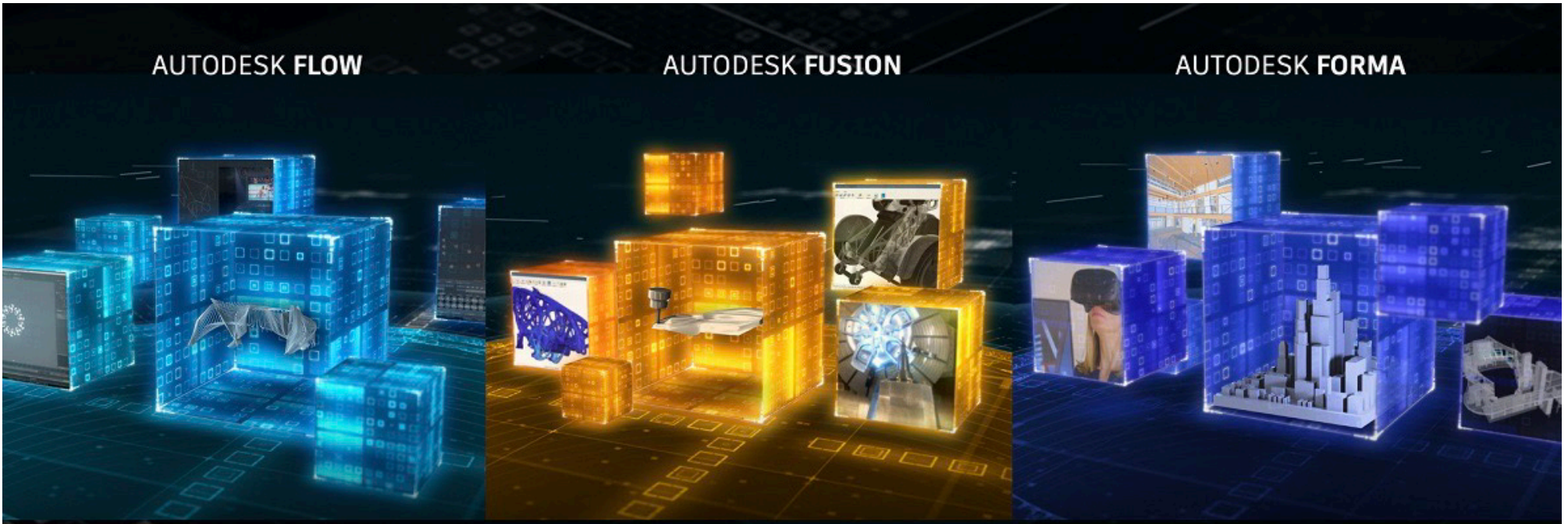


*Services underlying cloud platforms for Autodesk's three businesses*

**AUTODESK FLOW**

**AUTODESK FUSION**

**AUTODESK FORMA**



# Nexus for Digital Engineering & Mfg.



*Open collaboration platform connecting people, technologies, and data*



**Nexus  
Solutions**

Design for Additive Manufacturing

**nexus SOLUTION**



**Nexus  
Apps**



Metrology Reporting

**nexus APP**



Materials Connect

**nexus APP**



Materials Enrich

**nexus APP**



**nexus**

Digital Reality Platform

## Nexus Home

- Manage your products
- E-commerce
- Training and Documentation
- Support

## Platform Capabilities

- Project Collaboration
- Visualization
- Artificial Intelligence
- Nexus for Developers

## Platform Services

- Compute

# Altium 365



*Focused platform to support collaboration  
between MCAD and ECAD*

"Altium 365 is the electronics product design platform that unites PCB design, MCAD, data management, and teamwork."



# Altium 365



*Focused platform to support collaboration between MCAD and ECAD*

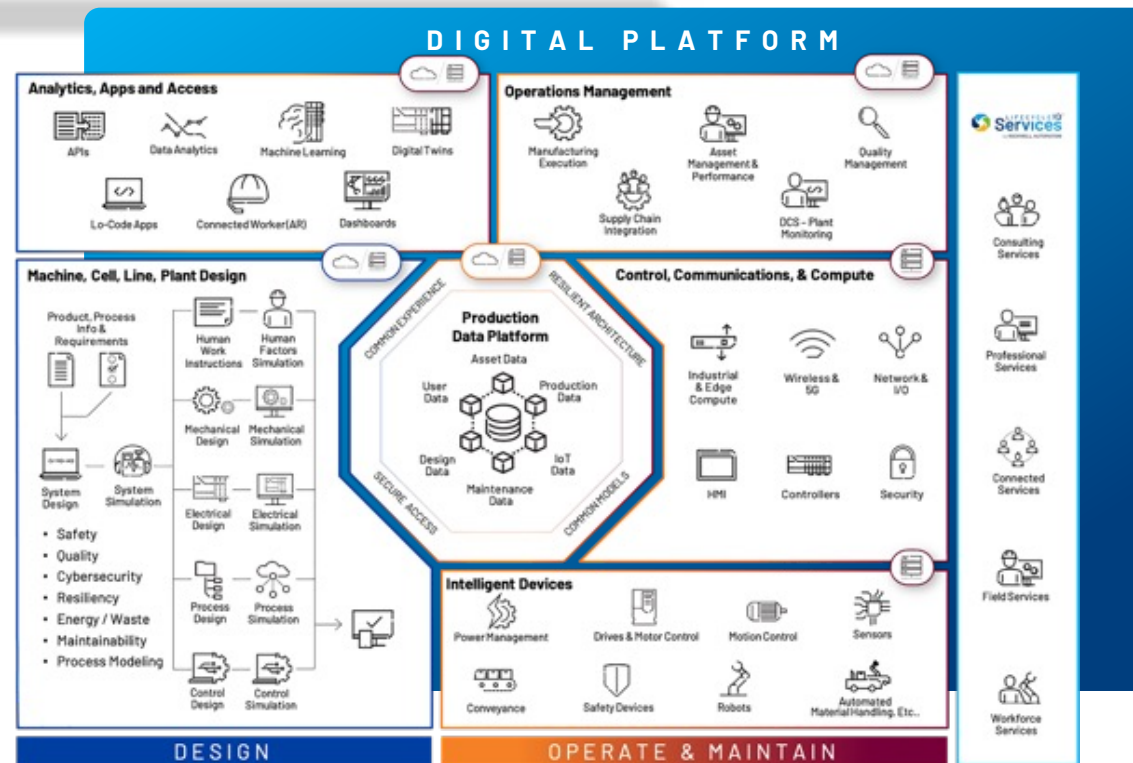
- Tight bi-directional connection between ECAD and MCAD
  - Define mods to boards in MCAD
  - Altium ECAD does the right thing to instantiate the change physically and electrically
- Capabilities exist in integrations between MCAD and ECAD systems
- Going beyond to support for collaboration, change management



# Connected Enterprise Production System



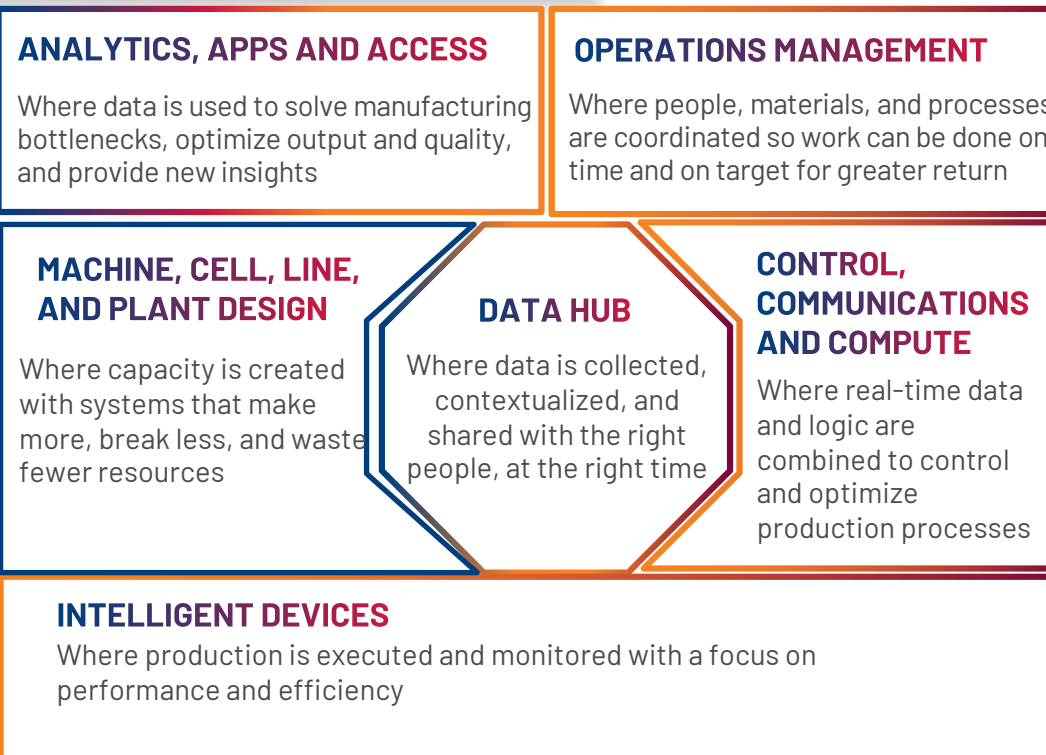
Rockwell Automation building out portfolio leveraging the cloud



# Connected Enterprise Production System



*Rockwell Automation building out portfolio  
leveraging the cloud*



# FactoryTalk Hub from Rockwell Int'l



*Cloud-native applications to support design, operation, and maintenance*

SAAS ENABLED BY THE CLOUD



**The unified experience** (common login, context and data)

DESIGN

OPERATE

MAINTAIN



Streamlined automation system design

Simplified cloud-native operations management

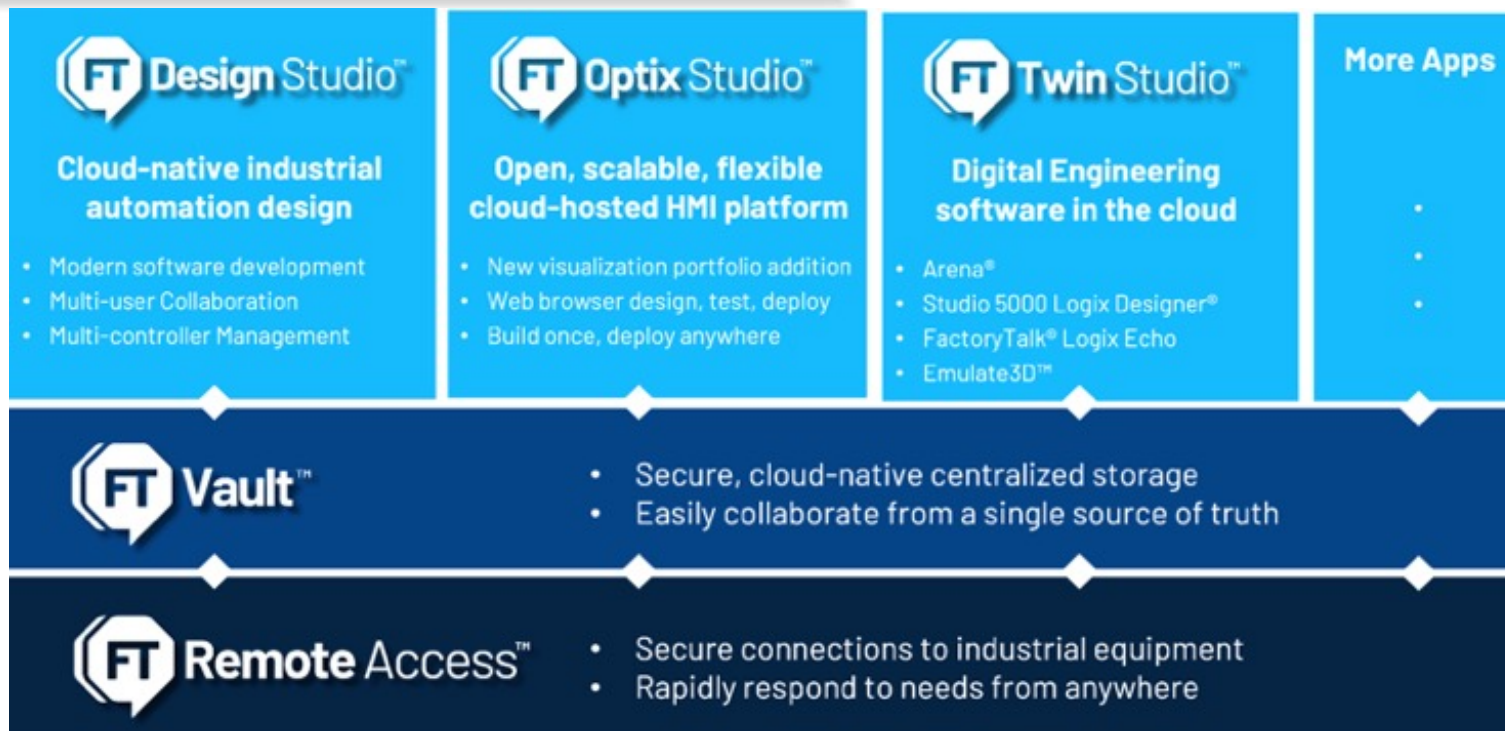
Asset management and predictive maintenance

**Edge Platform** (data context, applications, analytics)

# FactoryTalk Design Hub



*Emulate3D enabling virtual commissioning,  
fits in digital manufacturing segment*



# Learning PLUS Artifacts Essential



*Learning only through artifacts often not efficient or effective*

- The digital thread often focuses on providing access to and linking artifacts from idea through life
- Users talk about “replaying the digital thread” or “walking the digital thread backwards” to review the learnings to address quality issues or to innovate
- But the artifacts are not enough, need context...across the heterogeneous digital thread
- Do we really want to review artifacts only to understand history and context?

# Machine Learning & the Digital Thread



*Use ML for summarizing context, decisions, and other learnings with the digital thread*

- IBM Watson learned context by consuming corpora in different domains
- Any sports fans in the house? Game previews, stories autogenerated
- ChatGPT generating excitement by its ability to “create” new content from existing information
- Is this a good play for ML in PLM? A lot of unstructured information in IP in heterogeneous digital threads
- Explanatory capabilities a good fit to summarize actions across the lifecycle

# Concluding Remarks



*A robust virtual digital thread will tie disparate data and applications*

- Research emphasized support for standards critical, most ISVs do
- Need to better support data governance across the virtual digital thread
  - Configuration management of the digital thread beyond the BOM
  - Data persistence across heterogeneous thread
- “Digital shred” offerings shifting nexus of collaboration, linkage to application files may not be enough
- Potential applications of machine learning to summarize learnings for communication to functions spanning the thread and value chain

# To Learn More...



*We welcome your comments and questions  
after the session*

- Stan Przybylinski, Vice President
- [s.przybylinski@CIMdata.com](mailto:s.przybylinski@CIMdata.com)
- CIMdata Main: +1.734.668.9922
- Mobile: +1.734.276.3088

# Questions & Answers

CIMdata



*What's on your mind?*



**CIMdata** Defining What Comes Next in Digital Transformation



*Strategic management consulting for  
competitive advantage in global markets*

**Serving clients from offices in North America, Europe, and Asia-Pacific**

**World Headquarters**

Ann Arbor, Michigan USA

Tel: +1.734.668.9922

**EMEA Headquarters**

Weert, NL

Tel: +31 (0) 495.533.666

**Asia-Pacific Headquarters**

Tokyo, Japan

Tel: +81.47.361.5850

**[www.CIMdata.com](http://www.CIMdata.com)**