

The Digital Thread: The PLM Economy Perspective

2023 Market & Industry Forum—4 April 2023



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

4 April 2023—Frankfurt, GERMANY

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Maximizing clients' ability to design, deliver, and support innovative products and services.


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Key Takeaways



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- 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

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Topics to be Discussed



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


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From EDM to TDM to PDM to cPDM to...

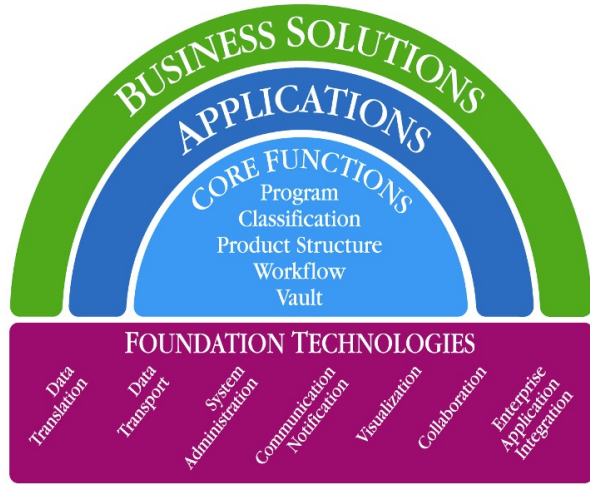
 Product data management evolved well beyond simple CAD data management


- 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

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CIMdata’s World Class cPDM Model

The merging of technology, data models, and business solutions



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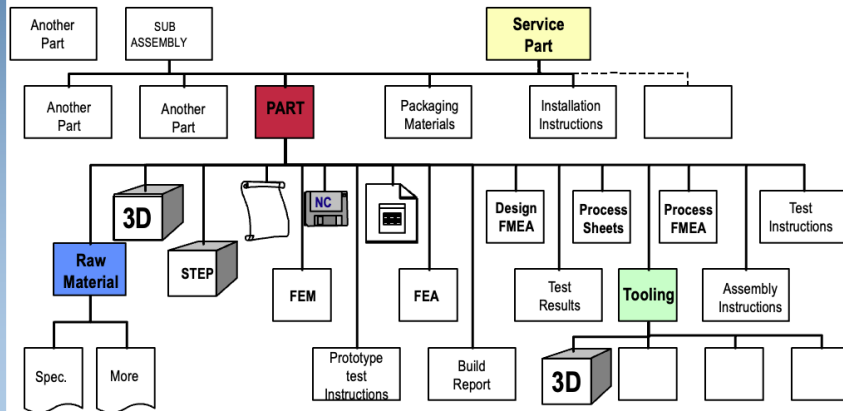
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Data Vault & Document Management

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



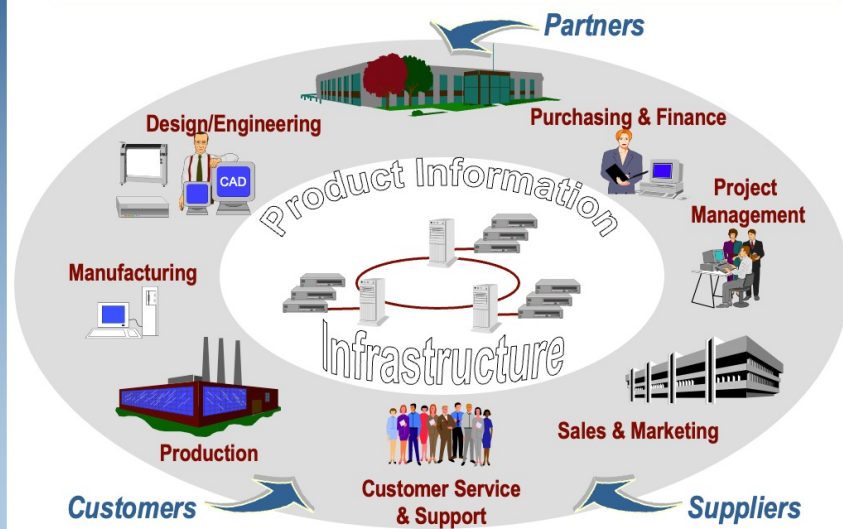
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Product Information Infrastructure

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



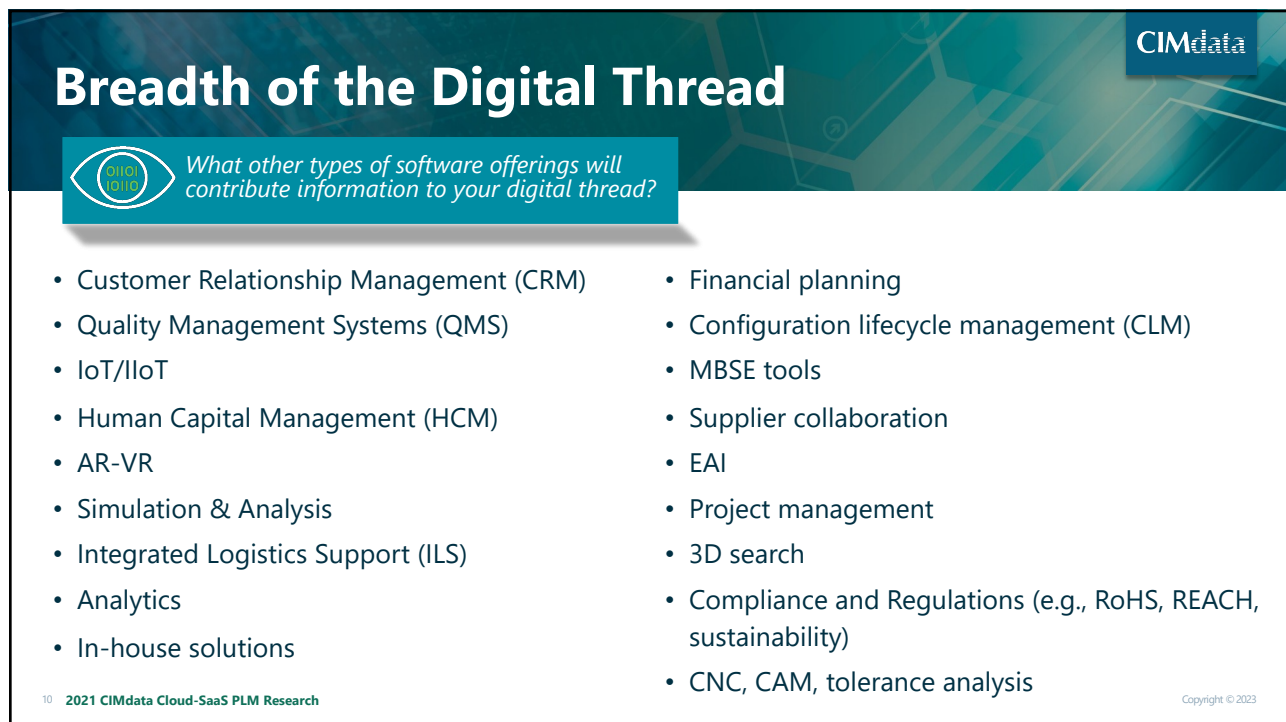
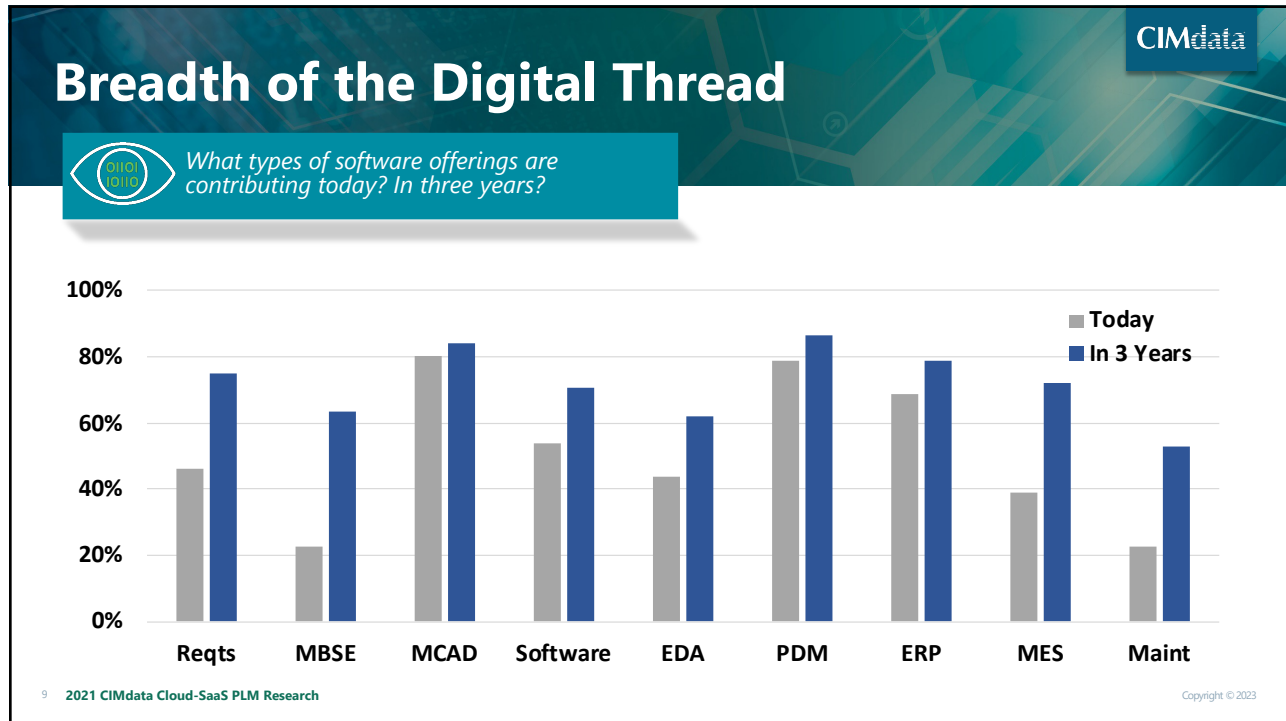
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Collaborative Research Program


Study Digital Thread current state and future trends

Sponsors












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

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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

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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

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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?

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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

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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

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ShareAspace from Eurostep

Proactively and retroactively supporting digital thread creation and management

The diagram illustrates the ShareAspace digital thread architecture. At the top, three pillars—Collaboration, Configuration Management, and Analytics—support a central digital thread. This thread connects various data points: Functional Element, CAD, Part, Product as Realized, and Location. Below the thread, five stages of the PLM process are shown: Concept & Specification (Requirements Management, Systems Engineering), Product Design (CAD, PDM, Engineering BOM), Support Design (LSA, Technical Publications), Construction (Manufacturing Systems), and Operation (Asset Management, Condition Monitoring). The ShareAspace logo is positioned to the right of the thread.

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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

The diagram shows the Jama Connect system as a central hub for requirements management. It is divided into six main stages: Needs Analysis, Requirement Definition, System Design, Implementation (Software and Hardware Development), Validation, and Verification. The system is integrated with a wide range of external tools and services, including Slack, Jira Software, Azure DevOps, SolidWorks, Simulink, Matlab, Xilinx, LDRA, Jenkins, GitHub, Enoviv, Catia, Teamcenter, and Windchill 11.

18 *Image courtesy of Jama Software* Copyright © 2023

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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...

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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”.



The screenshot shows the Cassini PLM software interface. It features a dark theme with a sidebar on the left containing navigation options like Home, Dashboard, My Tasks, Conversations, Search, Settings, My Profile, My Recent, My Alerts, My Notifications, My Messages, My Documents, My Files, My Folders, My Recent, My Alerts, My Notifications, My Messages, My Documents, My Files, My Folders. The main area displays a 'Good Morning Administrator!' greeting and a grid of widgets. The widgets include: My Tasks (7), Conversations (29), My Profile (1), My Recent (88), Search (7), Settings (6), My Recent (3), My Alerts (6), My Notifications (1), My Messages (1), My Documents (1), My Files (1), My Folders (1), My Alerts (1), My Notifications (1), My Messages (1), My Documents (1), My Files (1), My Folders (1).

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Image courtesy of Altair

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Autodesk Platform Services née Forge

 Services underlying cloud platforms for Autodesk's three businesses





AUTODESK FLOW AUTODESK FUSION AUTODESK FORMA

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Nexus for Digital Engineering & Mfg.

 Open collaboration platform connecting people, technologies, and data



Nexus Solutions Design for Additive Manufacturing
NECIOUS SOLUTION

Nexus Apps
 • Metrology Reporting
 • Materials Connect
 • Materials Enrich

ne:::us 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

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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.”




Share design data with your mechanical team and effortlessly create today's advanced electronic products.

[Learn More](#)

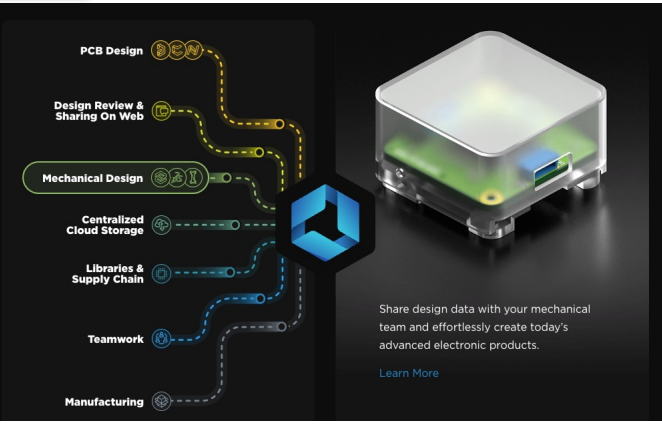
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Altium 365

 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



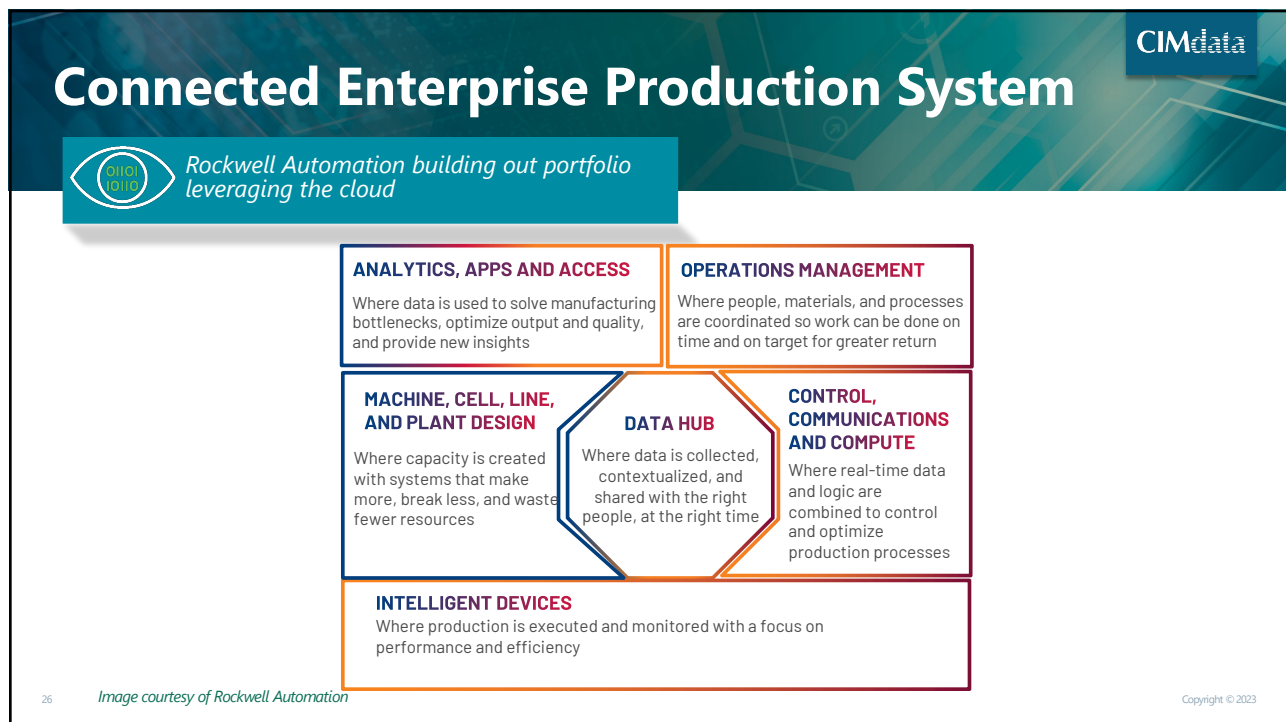
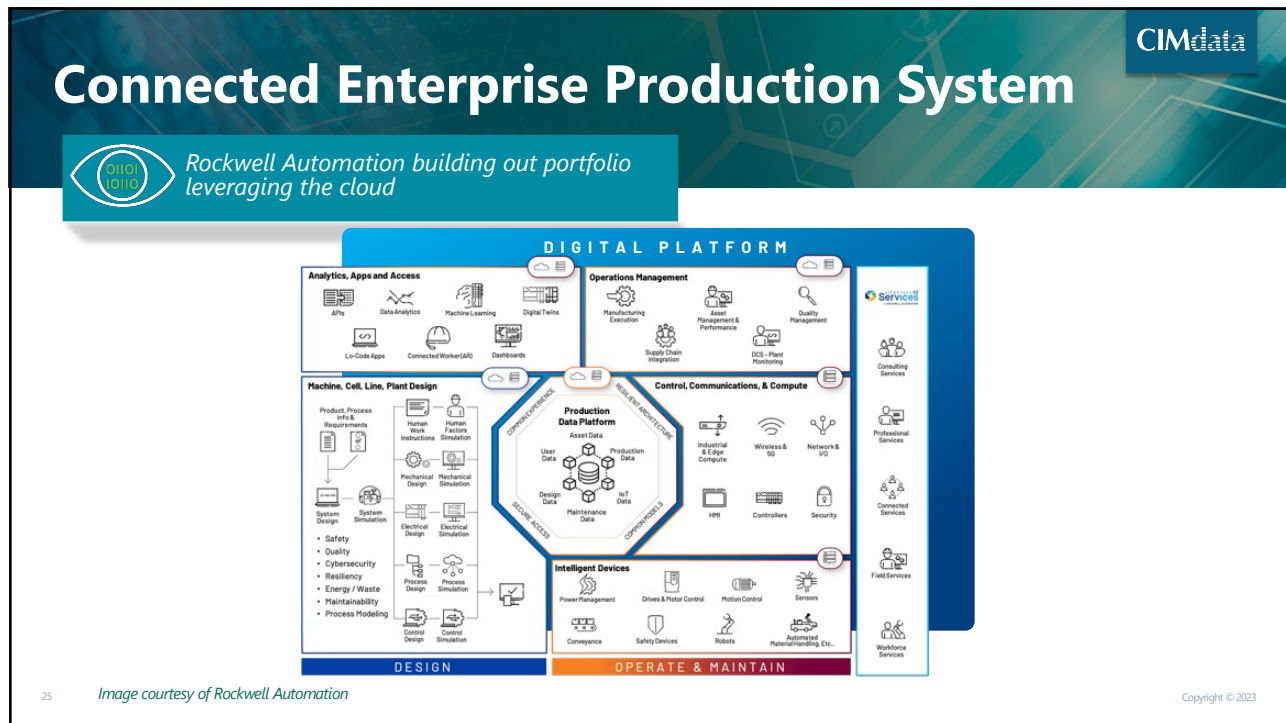
Share design data with your mechanical team and effortlessly create today's advanced electronic products.

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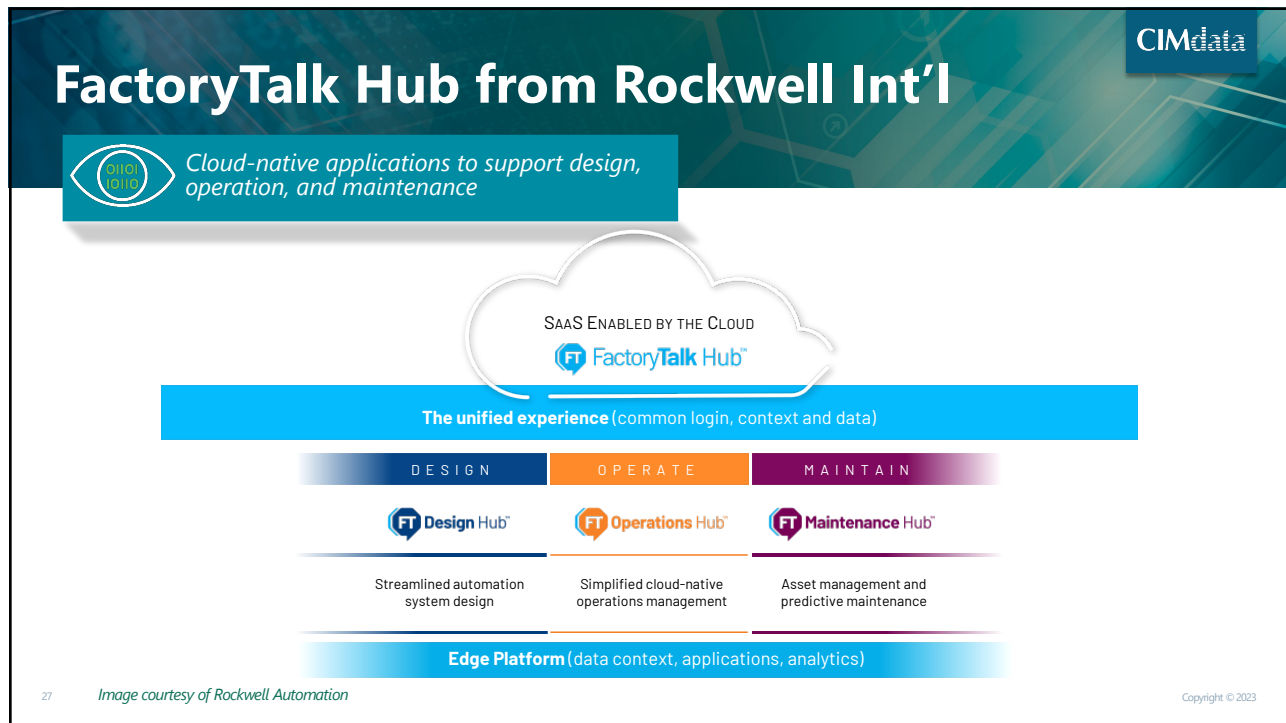
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FactoryTalk Hub from Rockwell Int'l

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

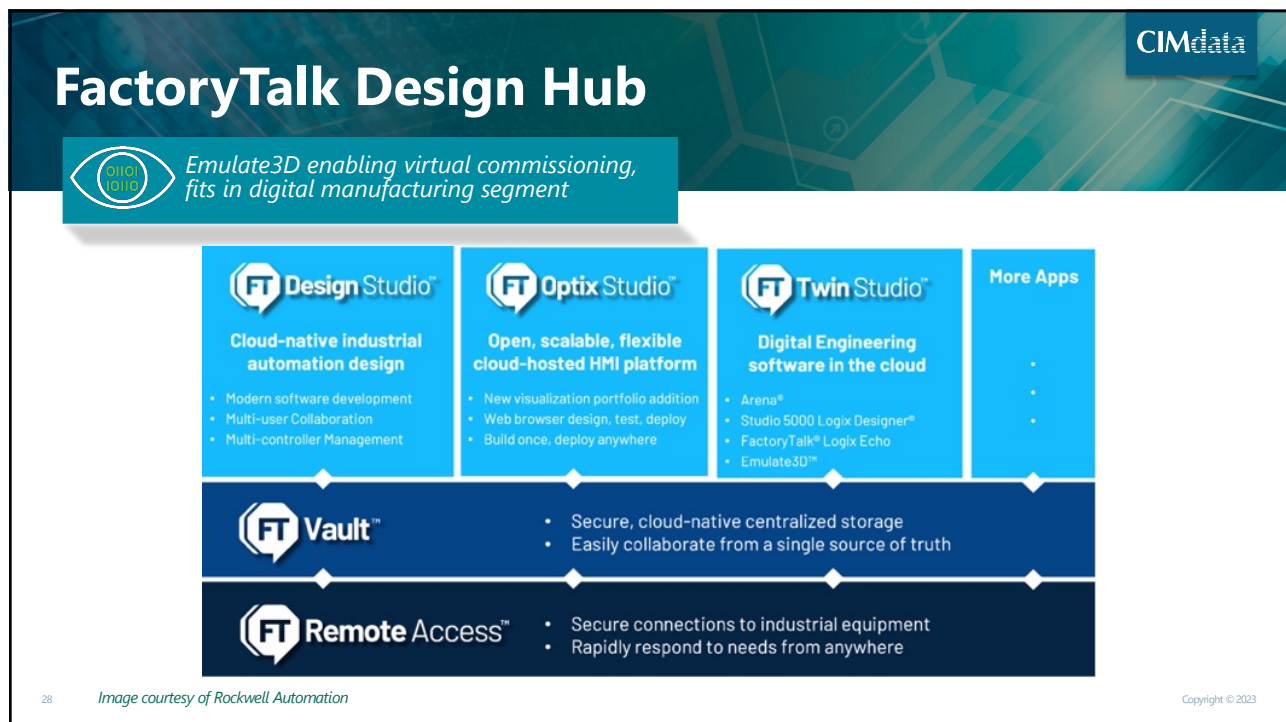
SAAS ENABLED BY THE CLOUD
FT FactoryTalk Hub™

The unified experience (common login, context and data)

DESIGN	OPERATE	MAINTAIN
FT Design Hub™	FT Operations Hub™	FT Maintenance Hub™
Streamlined automation system design	Simplified cloud-native operations management	Asset management and predictive maintenance

Edge Platform (data context, applications, analytics)

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FactoryTalk Design Hub

Emulate3D enabling virtual commissioning, fits in digital manufacturing segment

FT Design Studio™	FT Optix Studio™	FT Twin Studio™	More Apps
Cloud-native industrial automation design	Open, scalable, flexible cloud-hosted HMI platform	Digital Engineering software in the cloud	
<ul style="list-style-type: none"> • Modern software development • Multi-user Collaboration • Multi-controller Management 	<ul style="list-style-type: none"> • New visualization portfolio addition • Web browser design, test, deploy • Build once, deploy anywhere 	<ul style="list-style-type: none"> • Arena® • Studio 5000 Logix Designer® • FactoryTalk® Logix Echo • Emulate3D™ 	<ul style="list-style-type: none"> • • •

FT Vault™	<ul style="list-style-type: none"> • Secure, cloud-native centralized storage • Easily collaborate from a single source of truth
FT Remote Access™	<ul style="list-style-type: none"> • Secure connections to industrial equipment • Rapidly respond to needs from anywhere

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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?

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Machine Learning & the Digital Thread



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

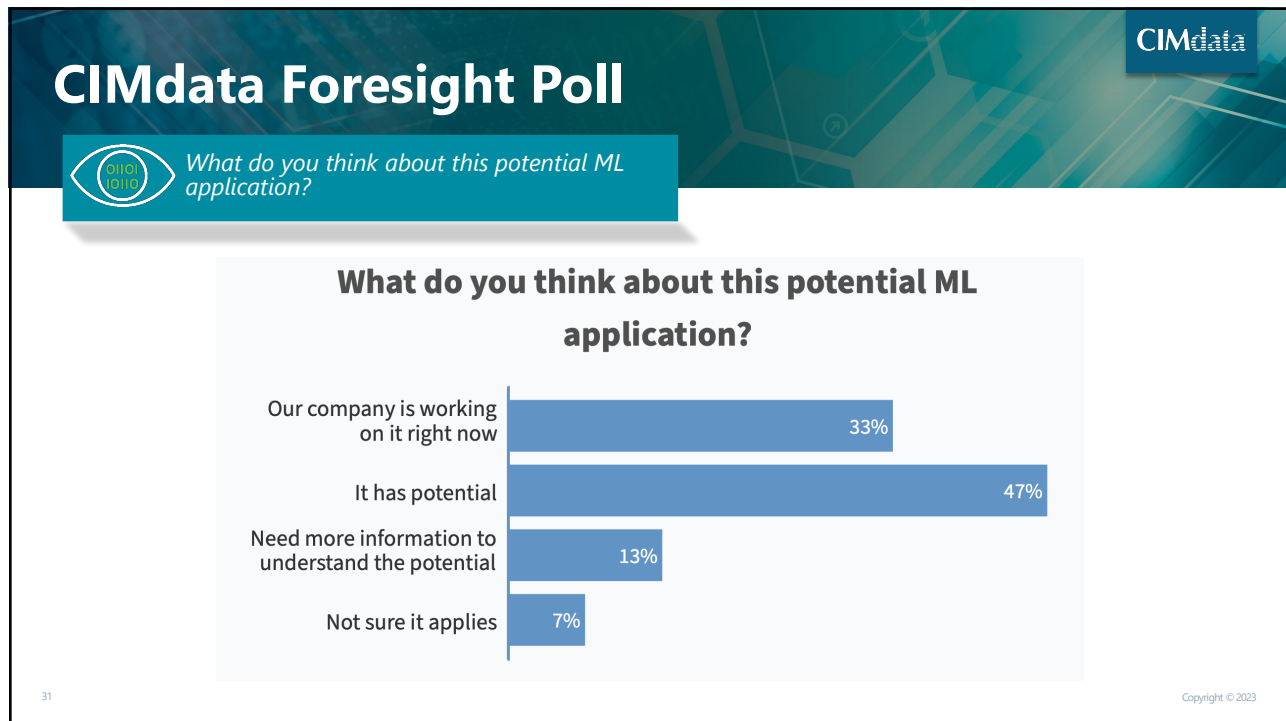
- IBM Watson learned context by consuming corpi in different domains
- Any sports fans in the house? Game previews, stories autogenerated
- ChatGPT generating excitement by its ability to “create” new content from existing information
- Is this a good play for ML in PLM? A lot of unstructured information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

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- ### 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
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To Learn More...


 We welcome your comments and questions after the session


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Questions & Answers

 What's on your mind?



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