The Digital Thread: The Industrial Perspective

2023 Market & Industry Forum—30 March 2023

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The Digital Thread: The Industrial Perspective

2023 Market & Industry Forum—30 March 2023

Presenter's Profile

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James Roche
Aerospace & Defense
Practice Director

- 35+ years of experience in transformation and IT enablement of product development and manufacturing processes.
- Strategic advisor and program manager for PLM programs across the Americas, Europe, and Asia.
- PLM Practice Manager at CSC Consulting and at A.T. Kearney.
- Previously with EDS, served as chief architect for General Motors' worldwide engineering systems.
- Areas of Focus
  - Facilitating cooperation within the aerospace and defense industry
  - Strategically expanding PLM within aerospace and defense companies
  - Extending PLM from airframe and propulsion OEMs to their external value chains

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Key Takeaways

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What you should understand at the end of this session

- Perspectives of industry leaders regarding the nature of the digital thread and drivers for investment
- Where and how industry leaders have successfully implemented portions of their digital thread vision
- Where and how industry leaders are planning to invest in future expansion of their digital thread vision
- The most significant barriers that have been faced and mitigation methods employed by industry leaders in pursuit of their digital thread vision
- How industry leaders view the current state of digital thread enabling technologies and the degree of alignment with their solution providers

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Agenda

- Introduction
- Digital Thread Status & Trends in Industry – Research Findings
  - The What & Why of the Digital Thread
  - The Current Reality of Digital Thread in Industry
  - Planning Investment for Digital Thread Expansion in Industry
  - Solution Capability and Provider Alignment
- Concluding Remarks

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Aerospace & Defense PLM Action Group

Mission

An association of aerospace & defense companies within CIMdata's globally recognized PLM Community Program, which functions as a ***PLM advocacy group*** to:

- Set the direction for the aerospace & defense industry on PLM-related topics that matter to members
- Promote common industry PLM processes and practices
- Define requirements for common interest PLM-related capabilities
- Communicate with a unified voice to PLM solution providers
- Sponsor collaborative PLM research on member-prioritized industry and technology topics

Founded in February 2014 – Website: www.ad-pag.com

Members

AIRBUS, BOEING, GE Aerospace, Gulfstream, Pratt & Whitney, Rolls-Royce, SAFRAN

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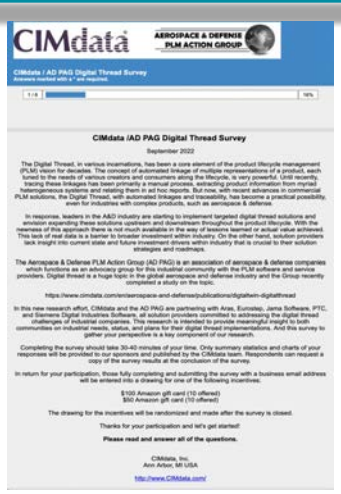
Collaborative Research Program

Study Digital Thread current state and future trends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AEROSPACE & DEFENSE PLM ACTION GROUP

CIMdata / AD PAG Digital Thread Survey

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 this topic.

https://www.cimdata.com/en/aerospace-and-defense/publications/digitaltwin-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.

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Ann Arbor, MI USA

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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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Information Gathering

Subject matter (domain) expert interviews & an online survey of committed professionals

Interviews

- Interviews were conducted by CIMdata with three communities:
  - 5 participating PLM solution providers,
  - 5 key A&D customers nominated by the participating solution providers, and
  - 5 AD PAG member companies
- The 10 A&D companies interviewed included
  - 9 of the Top 40 (23%),
  - 7 of the Top 20 (35%), and
  - 5 of the Top 10 (50%)
- The learnings from the interviews were applied to develop the line of inquiry in the web-based survey

Survey

- A total of 90 complete and validated online survey responses were received and analyzed
- The survey was intentionally designed to be a challenge for the respondent
  - Answering the questions required a deep understanding of the current status and future plans for digital thread realization within the respondent's company
  - The average time to complete the survey was approximately 30 minutes
- Achieved desired effect
  - Only domain experts on the topic of digital thread invested the time and effort needed to complete the survey

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Survey Respondent Demographics

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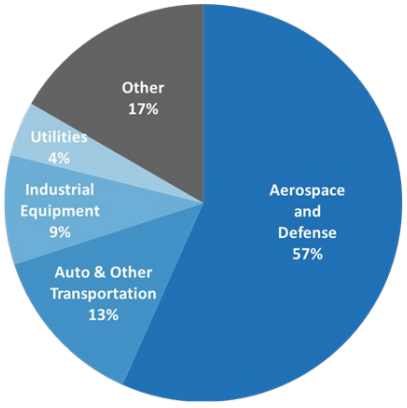
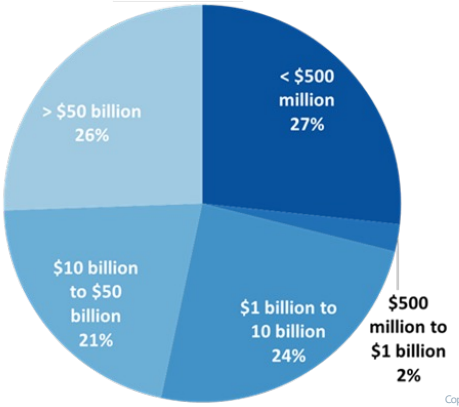
Heavily aerospace & defense with a broad representation across the supply chain

Distribution by Industry



Distribution by Company Revenue



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Agenda

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  - The What & Why of the Digital Thread
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  - Solution Capability and Provider Alignment
- Concluding Remarks

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The What & Why of Digital Thread

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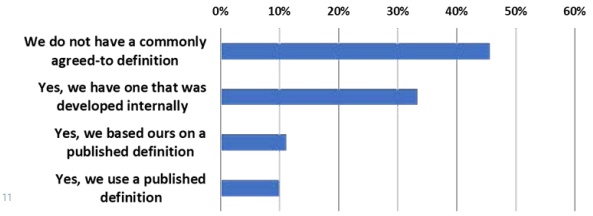
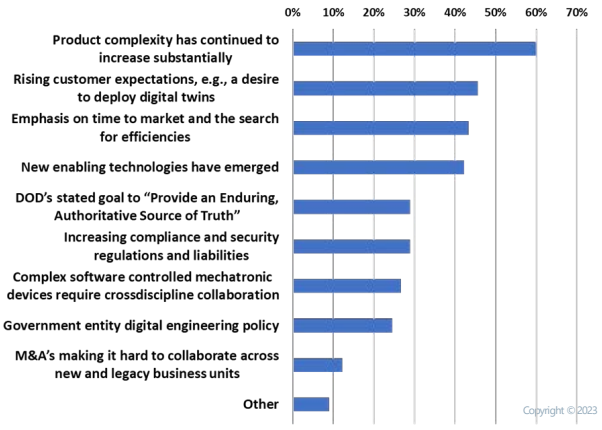
Conceptual understanding of digital thread within industrial companies is very immature

No Common Definition

- Interviews began with the question "What is your definition of the digital thread?" which yielded 15 different definitions
- Nearly half of survey respondents do not have an agreed to definition within their company; less than a quarter reference a published definition



Reasons for Rise to Prominence



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The What & Why of Digital Thread

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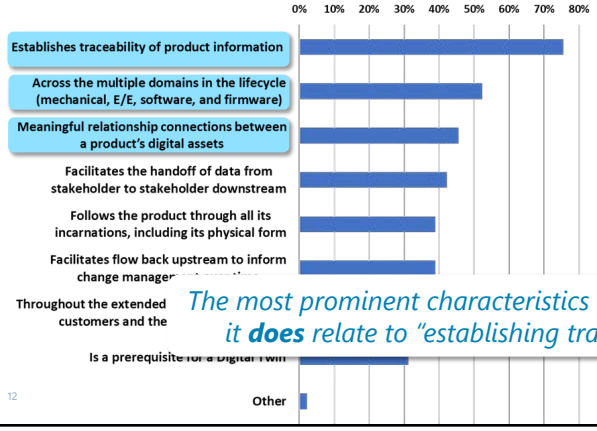
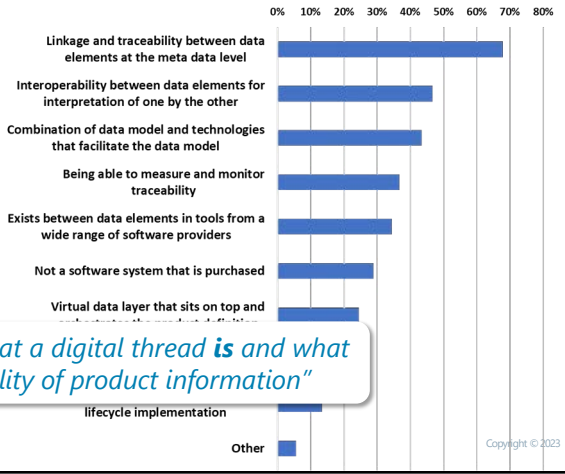
Among specialists there is a shared perception of what a digital thread does & is

The Digital Thread Does



The Digital Thread Is



*The most prominent characteristics of what a digital thread **is** and what it **does** relate to "establishing traceability of product information"*

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Digital Thread Value Footprint

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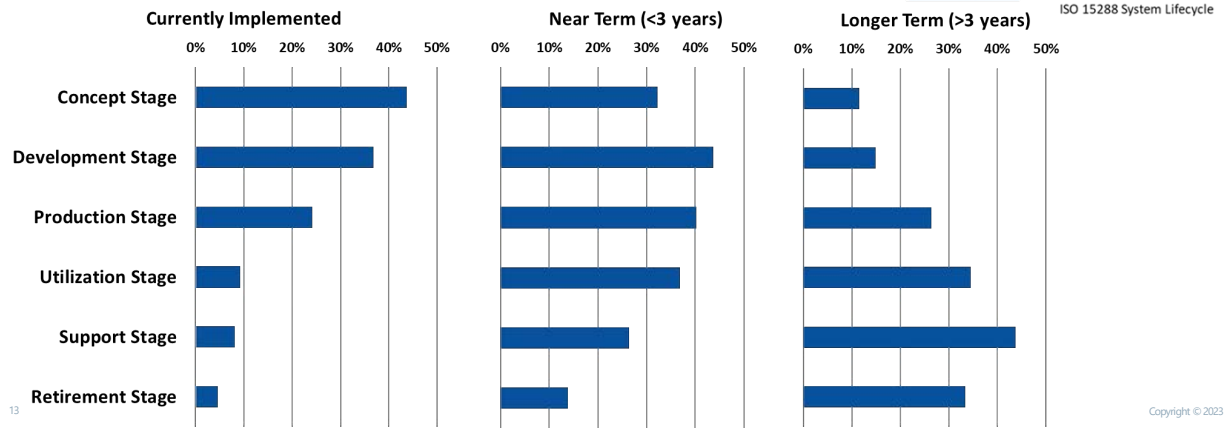
Program Stage – Plans to expand current implementations within & across lifecycle

Concept Stage | Development Stage | Production Stage | Utilization Stage / Support Stage | Retirement Stage

ISO 15288 System Lifecycle



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Digital Thread Value Footprint

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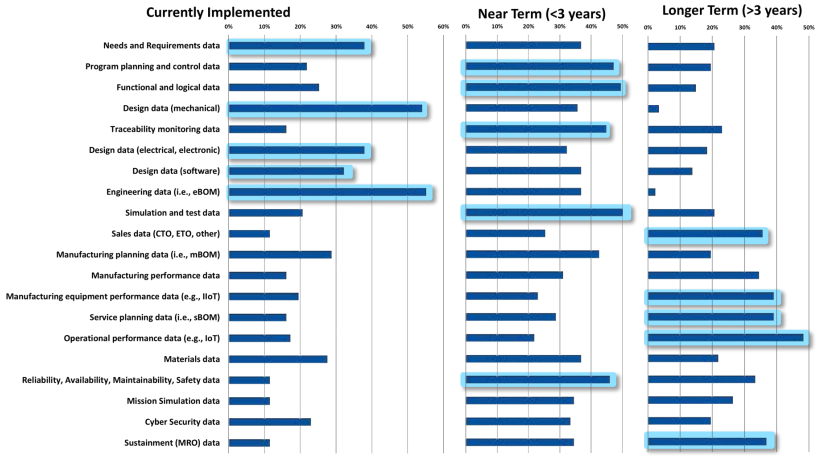
Data – Plans to enable traceability & SE and then expand across the product lifecycle



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Digital Thread Value Footprint

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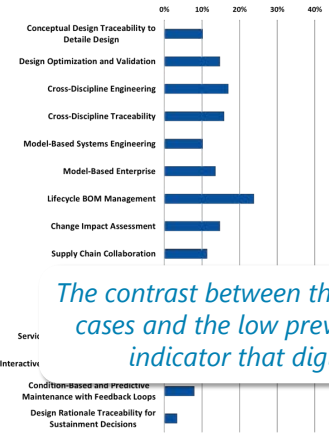
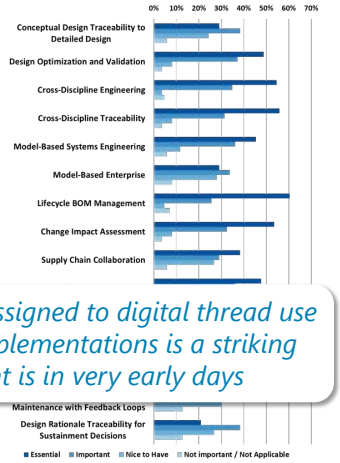
Use cases – Prevalence of implementations is low; assigned importance is broad & high

Currently Implemented



Assigned Importance



The contrast between the high importance assigned to digital thread use cases and the low prevalence of current implementations is a striking indicator that digital thread investment is in very early days

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Self-Assessment

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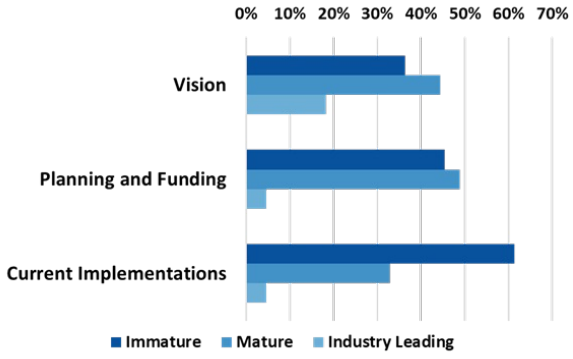
Maturity of digital thread strategy realization



- Most respondents assigned a rating of "mature" or "industry-leading" to their company's vision and level of planning and funding
- This suggests that they are ready to invest in implementations which the majority rate as "immature"
- This gap indicates a major business opportunity for solution providers

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Looking to the Future

Industry leaders are taking a broader view as they enter a more complex phase

- There will be more investment in production and service
- There will be increased emphasis on extending the digital thread community to include customers, partners, and suppliers more fully
- MBSE will be a fundamental driver of future investment
- The next stage will be more complex and transformative
  - There are examples of established programs that enjoy strong support from a well-informed and motivated senior management
  - But many are struggling to build awareness within their leadership and achieve early successes as proof points to motivate executive engagement and funding for execution

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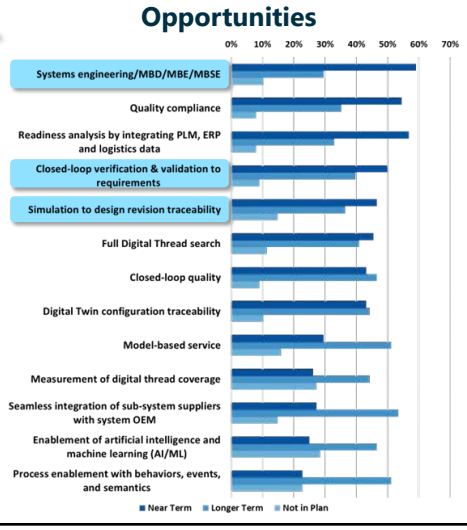
Future Investment Priorities

Top pain points relate to accessibility and traceability; top opportunities relate to SE



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Strategies for Success

An area of divergence between industry leaders is the focus of their implementations

- For some, it is providing ***interfaces to source applications*** to extract and associate product data artifacts and attributes, something like a search engine
- For others, the key is the ***association and traceability of dependencies*** between artifacts in support of a use case, such as the linkage and traceability of requirements through functional/physical design to simulation and test
- For a few, their current focus is on ***data governance***, which they believe is foundational for a richer and more extensive set of product lifecycle use cases

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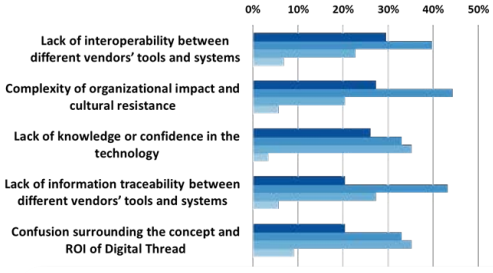
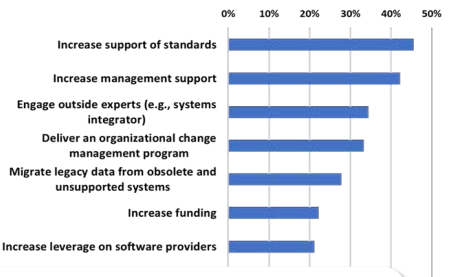
Strategies for Success

Inhibitors to formulating & executing a digital thread strategy & proposed mitigations

Principal Inhibitors



Means for Mitigation



The number 1 inhibitor to formulating and executing a digital thread strategy is "lack of interoperability between different vendors' tools and systems"

The number 1 proposed means for mitigation is to "increase support of standards"

Most Significant Inhibitor | Major Inhibitor | Minor Inhibitor | Don't' know

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Solution Technologies

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Key technical considerations

- ***Core to the value of digital thread is traceability*** across source and derivative product-related artifacts along the lifecycle & throughout the extended enterprise
- The ***digital thread value landscape is distributed across a heterogeneous value chain*** from customer to OEM to partners and multiple tiers of suppliers. This reality drives the need for data interoperability and elevates the importance of standards and openness of enabling solution architectures
- ***Proven technical solutions exist for enabling the digital thread***, and leading solution providers are investing heavily in research-guided strategies and roadmaps to further strengthen their offerings
- ***Data is the foundation of the digital thread***. This reality elevates the importance of sound data governance and a cleansed repository, especially as use case implementations proliferate and must be interlinked into an extended thread

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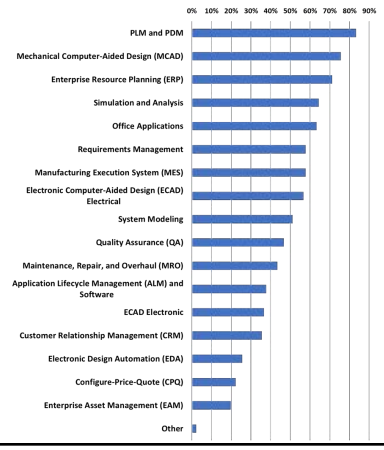
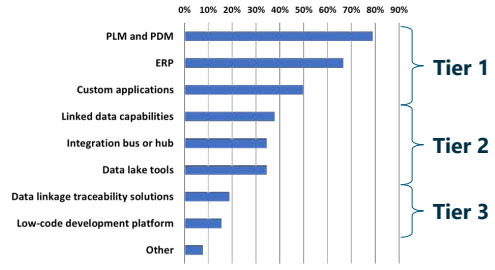
Enabling technologies in use today to create, consume and link product lifecycle data

Technologies Used to Create & Consume



Technologies Used to Link



Three tiers of linkage technologies

- Tier 1: Traditional solutions with the longest history
- Tier 2: Application and data integration tools
- Tier 3: Newer specialty technologies for combining data from multiple sources and establishing linkages and traceability
  - Expect the ranking of these to rise significantly over the next few years

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Solution capability and provider alignment

- Attitudes on solution capability and provider alignment are mixed
- Some industry leaders are quite critical, especially regarding data model accessibility and flexibility to comply with a corporate data governance strategy
- Others are somewhat neutral or slightly positive. They feel that some providers are moving in the right direction; some are not
- Several feel that solutions have improved significantly in the last 5 to 10 years and, despite some remaining gaps, are now fully capable
- Some express satisfaction that "good partnering" is happening

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Concluding Remarks

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Learnings from the research – the current reality (1 of 2)

- Industry investment planning is widely based on use cases and the associated ROI
- Digital thread investment within the ecosystem of industrial users, their customers, suppliers, and solution providers is poised for rapid growth
- New realities, such as rising customer expectations (e.g., DoD's authoritative source of truth) and new enabling technologies, are major drivers of the digital thread's rise to prominence

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Learnings from the research – the current reality (2 of 2)

- The conceptual understanding of digital thread within industrial companies is immature, but specialists within those companies have a surprisingly consistent view of what the digital thread is and does
- Lack of interoperability between different vendors' tools and systems is rated the number 1 inhibitor to formulating and executing a digital thread strategy
- Promotion of standards is rated the number 1 means for mitigation
- Current digital thread implementations are relatively modest in comparison to industrial companies' visions and plans

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Concluding Remarks

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Learnings from the research – planning future investment

- The top six pain points all relate to accessibility and traceability across data elements, especially of requirements throughout the lifecycle
- Systems engineering is ranked as the top new value opportunity
- The next stage of digital thread realization will be more complex and transformative
- Most industrial companies seem to be unaware of the complexities and prerequisite foundational elements as they pursue their visions
- A few have sophisticated programmatic approaches with strong support from a well-informed and motivated senior management

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Learnings from the research – solution capability and provider alignment

- There is a broad sense that solution capabilities have improved significantly in the last 5 to 10 years and that, despite some remaining gaps, these solutions are now fully capable
- The majority feel that their PLM solution providers are moderately or well aligned with their strategies for digital thread investment
- Lack of openness and dependence on 3rd parties for connectivity and data interchange with the PLM solutions is a universal concern
- Specialty technologies for combining data from multiple sources and establishing linkages and traceability are emerging to challenge the traditional platforms

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- Access A&D PLM Action Group resources at www.ad-pag.com
  - Digital Twin/Digital Thread Solution Definition for Aerospace and Defense: Phase 3, position paper, Feb 2023
  - Digital Twin/Digital Thread Solution Definition for Aerospace and Defense: Phase 2, position paper, Jul 2022
  - Multiple View Bill of Materials (BOM) Solution Evaluation Benchmarks, report, Jul 2020
  - Multiple View Bill of Materials, position paper, Feb 2019
- Access CIMdata resources at www.CIMdata.com
  - Multi-view BOM Value Potential, webinar, Apr 2022
  - The Digital Thread is Really a Web, with the Engineering Bill of Materials at Its Center, webinar, Sep 2021
  - Making Multi-view BOM a Reality, webinar, Mar 2020
- Contact for further discussion

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Questions & Answers

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What's on your mind?

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