DIGITAL THREAD:

Helping Businesses Go Beyond Cost Savings and Precision to Realize Game-Changing Products

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Preface

Imagine every product you use, from the consumer goods, appliances, and accessories that simplify your day-to-day life, your apparel and footwear, the bike you ride, the car you drive, to the smartphone and apps at your fingertips...

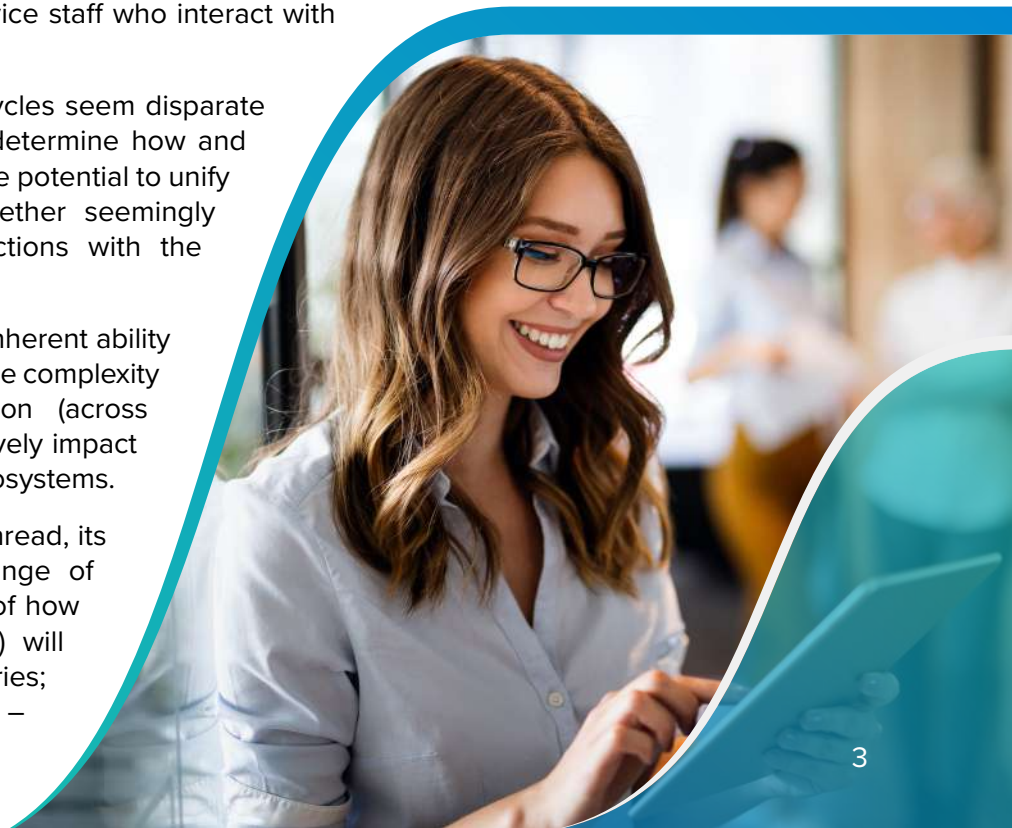
What if; these products were conceived, designed, built, and serviced with utmost precision and quality, centered around you, the consumer? Now think of this achieved seamlessly in the digital realm, using data and insights, connecting each step in the product's lifecycle ***'concept through disposal'*** with closed feedback loops that improve your experience of the product.

For manufacturers, the physical world is sprawling. There are physical products, their components, parts, equipment, and assets that companies create. There are places where these products are created and live: factories, worksites, labs, offices, cities, and homes. There are sensors and infrastructure that surround, support, and connect these products, and there are the people, communities, and service staff who interact with these products through their lifecycles.

In most cases, these products and the facets of their lifecycles seem disparate and unique to the purposes they serve – it's difficult to determine how and where they intersect with one another. Digital Thread has the potential to unify our view and action across these facets, weaving together seemingly disparate and independent product purposes and functions with the ecosystems they operate in.

In the digital realm, this is accomplished by leveraging the inherent ability of technology, data, and insights to abstract, filter, and distil the complexity of the physical world into pertinent digital information (across touchpoints) to make the right product decisions that positively impact consumer experiences, satisfaction, and the enablement ecosystems.

In this article, we'll dive deeper into the concept of digital thread, its key benefits, and its potential applications across a range of industries. By the end, you'll have a better understanding of how digital thread (the concept, design, and implementation) will shape the future of products and services across industries; from thought to concept, design, build, service, and disposal – and why it's a must-have for businesses to thrive.



What is Digital Thread?

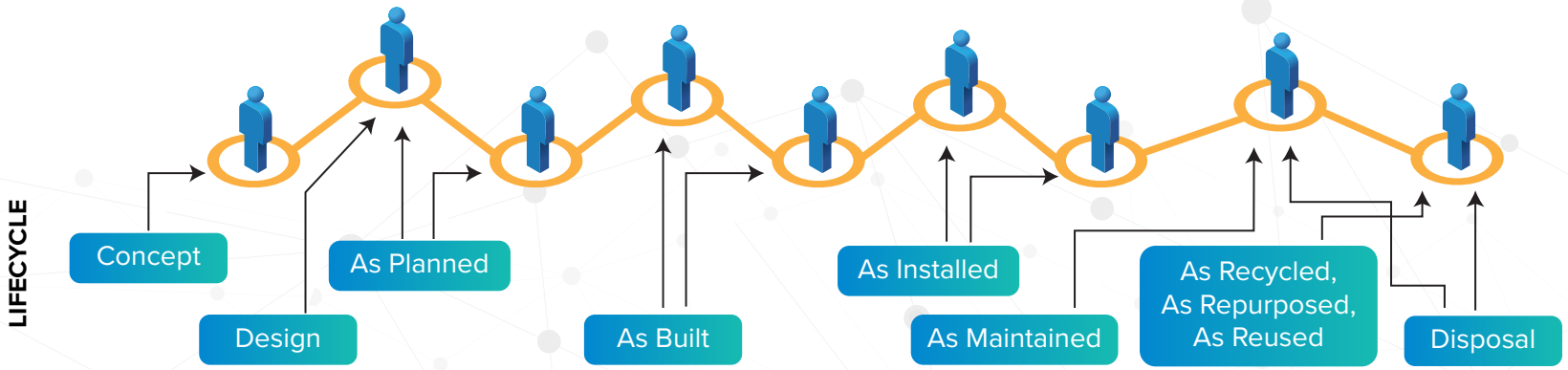
Digital Thread is defined as ***'a data-driven architecture that links together information generated across the product and service lifecycle and is envisioned to be the primary or authoritative data and communication platform for a company's products and services at any instance of time.'***

It provides seamless views for action of information throughout a product's lifecycle. At its core, it is a ***'digital backbone'*** that closes the loop between the digital and physical worlds to form the foundation of the Digital Twin, a synonym yet relatively more famous buzzword today.

It serves as a single source of truth for all product data across every facet, from concept to design specifications, engineering and build processes, usage history, and service routines through disposal. The information captured and stored digitally enables manufacturers to optimize products, improve ergonomics, usability experience, and quality to seamlessly integrate with operating ecosystems, and better serve consumers (people) throughout a product's lifecycle.

The term digital thread is also used to describe the traceability of the digital twin back to the concept, requirements, parts, components, and control systems that constitute the physical product or asset.

The infographic below illustrates a high-level digital thread across a product's lifecycle.



Digital Thread Across Product Lifecycle

The Evolution

Legacy Products, New-Age Tools, and Digital Thread

Early innovations, file servers, file shares, and enterprise integrations formed the foundation for subsequent waves of technology-enabled digital product innovations. They helped SMEs (Subject Matter Experts) and digital evangelists realize CAD (Computer Aided Design) and PLM (Product Lifecycle Management) as digital products and tools that enabled transparency, information sharing, and collaboration to accelerate business productivity by leveraging the digital realm. These products and tools enabled the introduction of digital processes to model, analyze, manage, store, and communicate information across departments and manufacturing functions. This was the first step to eliminating operational siloes.

The integration of these products and tools created cohesion to enable informed and accurate decision-making to grow business efficiencies. At the same time, ERP (Enterprise Resource Planning) systems enabled businesses with planning and tracking business resources, and CRM (Customer Relationship Management) systems commenced catering to the first demands of customer satisfaction.

These digital products, when connected, enabled the utilization of processes through the ‘product creation’ lifecycles, optimized enterprise resource usage for improved productivity, and connected businesses with their customers and prospects. The availability and access to knowledge gleaned could now be shared upstream and downstream to inform others in the value creation chain.

Closely following these innovations were federated systems architecture, knowledge graph, and IoT that enabled interconnectivity leveraging technology between physical products and objects via sensors to gain real-time data, insights, and information about these products through their build, run, and operate lifecycles.

More recently, with virtual reality (VR) and augmented reality (AR), the ability to place physical objects, products, parts, components, and people together in the digital realm further evolves our ability to simulate, emulate, and perceive these products within the context of entire production and consumption ecosystems.

All these independent yet related innovations enable the fusion of entire product lifecycles, from concept to design, manufacturing, usage, service, and finally disposal with hyper-personalization of the consumer context. These innovations aid businesses to rapidly connect the dots that enable precision across products to better serve people and communities – the true consumers of their products.

And now, the current wave of disruption fuses these innovations, among many other supporting and surrounding ones, to realize what thought leaders of the last decade had coined the ‘Digital Thread.’

Digital thread and the preceding innovations are related but have different objectives. Their focus is driven by problem statements at various stages in a timeline fused and the associated technology capabilities, maturity, and limitations at those times.

For e.g., PLM refers to the software, systems, and processes that manage product lifecycle from ideation and design to manufacturing, distribution, and end-of-life, initially restricted to the context of the manufacturing industry. It's a comprehensive approach to managing product data and processes, including product design, engineering, and manufacturing.

On the other hand, digital thread is a more wholistic concept enabled with real-time data and insights (across every business facet) with presentation, representation, and interaction. It involves connecting all data and processes throughout the lifecycle of a product or service.

It is a digital representation, a comprehensive digital twin of the physical product and all data related to it, from design and engineering to manufacturing and service, and culminates in disposal. The digital thread allows stakeholders to engage, interact, simulate, perceive, access, and utilize the data across the product's lifecycle, enabling greater visibility, collaboration, control, and governance for rapid decision-making.

Benefits of Digital Thread

Connecting data and processes through the lifecycle of a product or service, digital thread enables creation of a digital equivalent (a digital twin) for a physical product or asset. It offers a wide range of benefits that enable businesses with improved governance and actionable insights for remediation.

- **Increased Visibility/Product and Service Optimization:** Unparalleled visibility into manufacturing operations and product usage enables manufacturers to analyze data from every stage of the product's lifecycle and identify inefficiencies, optimize processes, products, and services, resulting in reduced cost, improved quality, and delightful customer experiences.
- **Enhanced Customer Service/Product and Service Innovation:** Companies that collect and analyze data about their customers' usage of their products and services can gain valuable insights into customer preferences and emerging needs enabling them with a first-mover advantage. This helps them conceive new products and services driven by consumer demand and enables the ability to personalize existing products and services, resulting in increased customer satisfaction and opportunities to cross-sell and up-sell related and new products and services.

  According to a Forrester survey, companies that use data-driven insights to optimize operations and enhance customer experiences achieve revenue growth rates 5-10% higher than their competitors. (Source: Forrester)
- **Enhanced Collaboration/Engineering Excellence:** It enhances collaboration and communication between departments and teams by connecting all product data and making it accessible in real time. This facilitates more effective teamwork and informed decision-making based on transparency and a comprehensive understanding of the entire process.

- **Enhanced Traceability:** Digital thread, a wholistic concept, enables tracking a product's design through production history and usage. This makes it simpler to identify impediments and trace them back to their source, improving the overall quality of the product.
- **Real-Time Connectivity:** Real-time data analysis and connectivity through the digital thread enables quick and confident decision-making by providing decision-makers with up-to-date real-time information.
- **Improved Product Quality & Manufacturing Efficiencies:** By monitoring every stage of a product's development leveraging digital thread, quality issues can be identified and addressed earlier in the product lifecycles. This results in fewer product impediments, reduced wastage, and improved customer satisfaction.
- **Sales & Marketing Experience:** The plethora of actionable insights made available can inform and guide decisions for rapid customer acquisition enabled through precise targeting strategies and outreach.

In summary, the benefits of digital thread are significant and far-reaching. By connecting data and processes throughout the lifecycle of a product, or a service, companies can improve governance and operations, reduce costs and risks, enhance collaboration and communication, make informed decisions, and ultimately deliver improved experiences and outcomes to their customers.

Digital thread is emerging as a crucial business acceleration pathway for companies to embrace. Gartner reports that digital thread will become mainstream in the coming years. We will soon observe this innovation manifest itself in our daily lives.

The Challenges with Implementing Digital Thread

As with any innovation, implementing digital thread doesn't come without its fair share of challenges:

- **Legacy System and Interoperability:** One of the biggest obstacles is integrating disparate systems and data sources across an organization. This requires a significant investment in the modernization of technology and expertise, as well as a commitment to standardizing data and processes across the organization.
- **Cybersecurity:** Another challenge is ensuring data security and privacy. With a plethora of sensitive information stored in a centralized digital thread, it's essential to implement robust cybersecurity measures and data governance policies to protect the organization against cyber threats and unauthorized access.
- **Workforce Readiness/Skills Incubation and Development:** Implementing digital thread requires establishing a mindset and culture of collaboration across different disciplines in addition to onboarding new skills and capabilities (e.g., data analytics and digital process modelers). Organizations must invest in new skill acquisition, training, and development programs to ensure their workforce is ready to enable and use the digital thread technology effectively.
- **Vendor lock-in:** An organization becomes overly reliant on a single vendor for their offerings, making it difficult or expensive to switch to other options. This can create a problem for the digital thread, as it limits the organization's flexibility to choose different vendors and technologies, creating a roadblock to the seamless flow and integration of data throughout a product's lifecycle.

Business Opportunities

Digital thread presents a vast range of business opportunities across industries. According to McKinsey, "Manufacturers that successfully implement a digital thread can improve productivity by up to 25 percent, reduce the time to market by 20 to 30 percent, and reduce new product introduction costs by 10 to 30 percent." (Source: McKinsey)

Manufacturing: Digital thread will transform the manufacturing industry by rapidly assimilating, synthesizing, and analyzing data captured from every step in a product's lifecycle. This enables manufacturers to identify inefficiencies, optimize processes, reduce costs, enhance product quality, and grow customer satisfaction.

Healthcare: Digital thread will unlock business opportunities in healthcare by rapidly synthesizing patient and medical trial data to enable rapid decision-making. This will lead to better patient outcomes, improved drug development, and personalized medicine.

Retail & Consumer Goods: Across the retail and consumer goods industries, digital thread will enable better customer experiences by providing real-time data on products, customer preferences, and behavior. The insights gained can then be used to personalize marketing campaigns and improve product recommendations, ultimately leading to higher sales and customer satisfaction.

Construction: In the construction industry, digital thread will connect data from architectural plans, building information models (BIM), project management software, and other sources to streamline construction processes. This will lead to better collaboration, improved efficiency, and reduced cost and time-to-market.

Energy and Utilities: Digital thread will connect data from sensors and other monitoring devices to optimize energy transmission and usage. It will enable predictive maintenance, optimize maintenance schedules, and reduce downtime and outages.

In summary, the examples cited above illustrate far-reaching opportunities for digital thread and the immense potential for businesses to optimize their operations, improve customer experiences, and unlock new revenue streams. Further clubbing digital thread with its predecessor innovations, ecosystem innovations, and trained AI models presents myriad opportunities to grow business effectiveness and top-line revenue whilst maintaining a flat and gradually diminishing bottom line.

Digital Thread Use Cases

There are numerous use cases for digital thread across a variety of sub-industries. These use cases leverage the inherent ability of the digital realm to abstract, filter, and distil the complexity of the physical world into pertinent digital information across design, engineering, vendor, supplier, integration teams, consumers, and support staff to make the right product decisions that positively impact product purpose. Below are examples of key candidates for adoption of digital thread:

1. **Aerospace and Defense:** Aerospace and defense are specialized precision manufacturing sub-industries. They rely on complex products, components, parts, cutting-edge design, innovative and disruptive technology, integration, and training, which, if not achieved, can lead to loss of life and damage to property. This makes them prime candidates for digital thread adoption. Implementing a digital thread enables this industry to gain a wholistic actionable view of their processes and close feedback loops with engineering teams, partners, vendors, product stakeholders, staff, and crew to reduce risks, improve quality, reduce costs, and ensure compliance with strict regulatory and compliance statutes.

   For example, **Lockheed Martin's** implementation of digital thread in its production process tracked impressive results. By gathering and analyzing data throughout the product lifecycle, the company identified inefficiencies, and optimized engineering processes, resulting in a 25% reduction in costs and a 30% improvement in quality. (Source: Lockheed Martin)

2. **Automotive:** The automotive industry is another prime manufacturing sub-industry candidate for digital thread adoption. It requires close collaboration across different departments, teams, partners, vendors, suppliers, and staff. The implementation of digital thread will optimize processes, production, reduce waste, and improve collaboration between departments and teams. **Ford** implemented a digital thread strategy in its manufacturing process and reduced production time by 25%, improved quality by 20%, and saved $2 million in annual costs. The company achieved these results by collecting and analyzing data from every stage in the product lifecycle to identify and remediate inefficiencies. (Source: McKinsey)
3. **Medical Devices:** The medical device industry is highly regulated and requires strict quality controls. By implementing a digital thread, manufacturers can improve quality, reduce costs, and ensure compliance with regulatory requirements. **Medtronic**, a medical device company, implemented a digital thread in its production process to realize significant benefits. The company reported a 50% reduction in time to market, a 20% increase in product yield, and a 50% reduction in product impediments. (Source: McKinsey)
4. **Consumer Packaged Goods:** The consumer-packaged goods industry is highly competitive and requires quick time-to-market. With the implementation of digital thread, manufacturers can improve speed-to-market, reduce costs, and improve collaboration across teams. A study by Deloitte states, companies that have implemented a digital thread strategy have seen up to a 50% reduction in development time and a 30% increase in overall efficiency (Source: Deloitte).

   Procter & Gamble implemented a digital thread in its production process to enable a 20% cost takeout and improve inter-team collaboration (Source: Procter & Gamble).

Digital Thread: The Future

The potential of digital thread to unify product concepts, three-dimensional (3D) modeling, parts libraries, simulation, verification and testing, and then computer-controlled manufacturing, inspection through usage, retirement, and disposal presents tremendous opportunities for business process refinement and optimization.

Like its predecessors, from steam, electricity, semiconductors, technology, and the internet, it will change the nomenclature of industries as we know them today. The incredibly promising future of digital thread will enable business effectiveness across cost, time-to-market, product quality, and customer satisfaction.

As supporting technology ecosystems and open standards evolve and mature, digital thread will enable frictionless integration and connectivity across entire product realms to realize true and complete Digital Twins.

Industry leaders and consulting firms are bullish on the long-term benefits of digital thread for industries and businesses. In the long term, the projected digital thread benefits will enable waste reduction, reuse, re-purpose, and upcycling, contributing to sustainable living and a thriving planet.

By 2027, 60% of investment in product data management (PDM) across PLM will be augmented with digital thread, up from 35% today. While there are challenges to implementing the digital thread, the potential rewards will outweigh them. With time, complimenting tech maturity will enable stronger cohesion across larger connected experience ecosystems.

- **AI and Generative AI** will enhance and accelerate design phases by generating thousands of design options to enable the selection of the most optimal choice.
- **Blockchain Technology** will add the required layer of security to the digital thread, ensuring that data is secure, tamper-proof, and immutable.
- **Augmented Reality and Virtual Reality** will provide real-time information across unique consumer journeys to quickly identify and remediate impediments.
- **Metaverse-enabled** trials and experience centers will enable real-time interaction and simulations of products across usage scenarios to grow consumer awareness, trust, and satisfaction.
- **Trained Chatbots and Voice bots** will enrich consumer experiences with contextual and personalized responses to customer queries and self-service.

In our digital-first world, the potential applications of digital thread will only be limited by the human imagination. Mundane, time-consuming housekeeping tasks will move to the digital realm, provoking humans to move up the value chain. New skills will replace redundant ones, legacy systems and processes will be replaced with new-age tech, and the digital thread will be the center of gravity around which new-age businesses will thrive.

Digital thread will reach mainstream adoption in the next five to ten years.

About Hexaware Interactive:

At **Hexaware Interactive**, we enable businesses to thrive through disruption. Our primary focus is an empathetic partnership to enable the next wave of digital business transformations across every lifetime touchpoint. All this enabled with new-age experiences centered around business-people effectiveness.

Our team of passionate experts, partner with leading businesses and startups across industries. We help businesses through these journeys with strategy, consulting, concepts, design (experiences), build, and continuous optimization (process, experience, and tech) to bring new frictionless experiences to life. We leverage joint synergies to uplift existing business strategies and digital-first engagement experiences.

Partnering through deep research, first-principles innovation, and design thinking, we enable consumer-grade experiences for every target persona, be it employees, customers, vendors, partners, and affiliates, amongst others. We understand that leaving one stakeholder behind can fail an entire system.

If you are an established business or a startup looking to create a ‘never done before’ first principles strategy, design, and enablement of a new digital product or channel; OR to re-imagine, optimize, and streamline your business processes to enable efficacy; OR to develop a digital thread strategy to leapfrog business effectiveness (Purpose, Productivity, Profitability, Efficiency, and Sustainability) to respond to the next wave of consumer disruption:

We’ll prove our credentials and partner with you to define this journey and eliminate transformational friction to onboard these new-age experiences at speed and scale, focusing on every business success imperative.

The Evolution – Hexaware Interactive

'It is not the strongest of the species that survives, nor the most intelligent; it is the one most adaptable to change.' — Charles Darwin.

We are living witness to businesses rampantly adopting digital-first paradigms as a product, tool, or accelerator to eliminate friction, business process, and operating inefficiencies to craft flawless and lovable products and experiences, grow consumer traction, and retain competitive advantage.

We're aware of and are studying the tangible and intangible benefits of forefront industries adopting digital thread, be it manufacturing, retail, and consumer, with others closely following suit.

As with the industry, at **Hexaware Interactive**, we're evolving rapidly, too; we've identified opportunities and use cases (together: necessities) ripe for picking. Across the manufacturing and retail industries, we are partnering with leading businesses to

- Perform detailed business ecosystem studies.
- Identifying and solving for friction and resistance across business value chains that result in product impediments, delays, and cost-surge.
- Model digital process flow assets.
- Identify process and tech impediments for re-imagination.
- Develop training, enablement, and rollout strategies.
- Strategize and action digital-first modernization across process and legacy tech, enabled with new-age tech.
- Develop business modernization roadmaps.
- Define new-age KPIs (Key Performance Indicators).
- Prioritize pathways and waves for digital thread adoption.
- Continuously measure and optimize business benefits.

That said, we have identified effort-intensive tasks ripe for digital thread adoption across specialized sub-industries; we've developed demonstratable proofs-of-concept, training, enablement models, and new-age KPIs to accelerate business effectiveness, productivity, engagement, and speed to market.

Some key strategic roles we are onboarding to our team are:

Digital Thread Developers: A fusion of software engineers with experience in SysML, Business modeling, CFD, FEA, and PLM, able to conceive and realize digital twins.

Experience Makers: A fusion of UX designers and experience technologists with no-code engineering skills to build interfaces using no-code tools.

No-code UI Designer: Art director working on process designs directly inside no-code apps like Webflow.

Business Modelers: Full-stack digital product engineers who model and implement physical data and process flows in the digital-first realm.

Query Builder: Hybrid full-stack engineers working on connecting apps to backend sources and platforms.

API Tools Sourcer: A fusion of product and purchaser, working on identifying and assessing to select external API and SaaS tools and integrating with a no-code application.

Write to us at marketing@hexaware.com to learn more.

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