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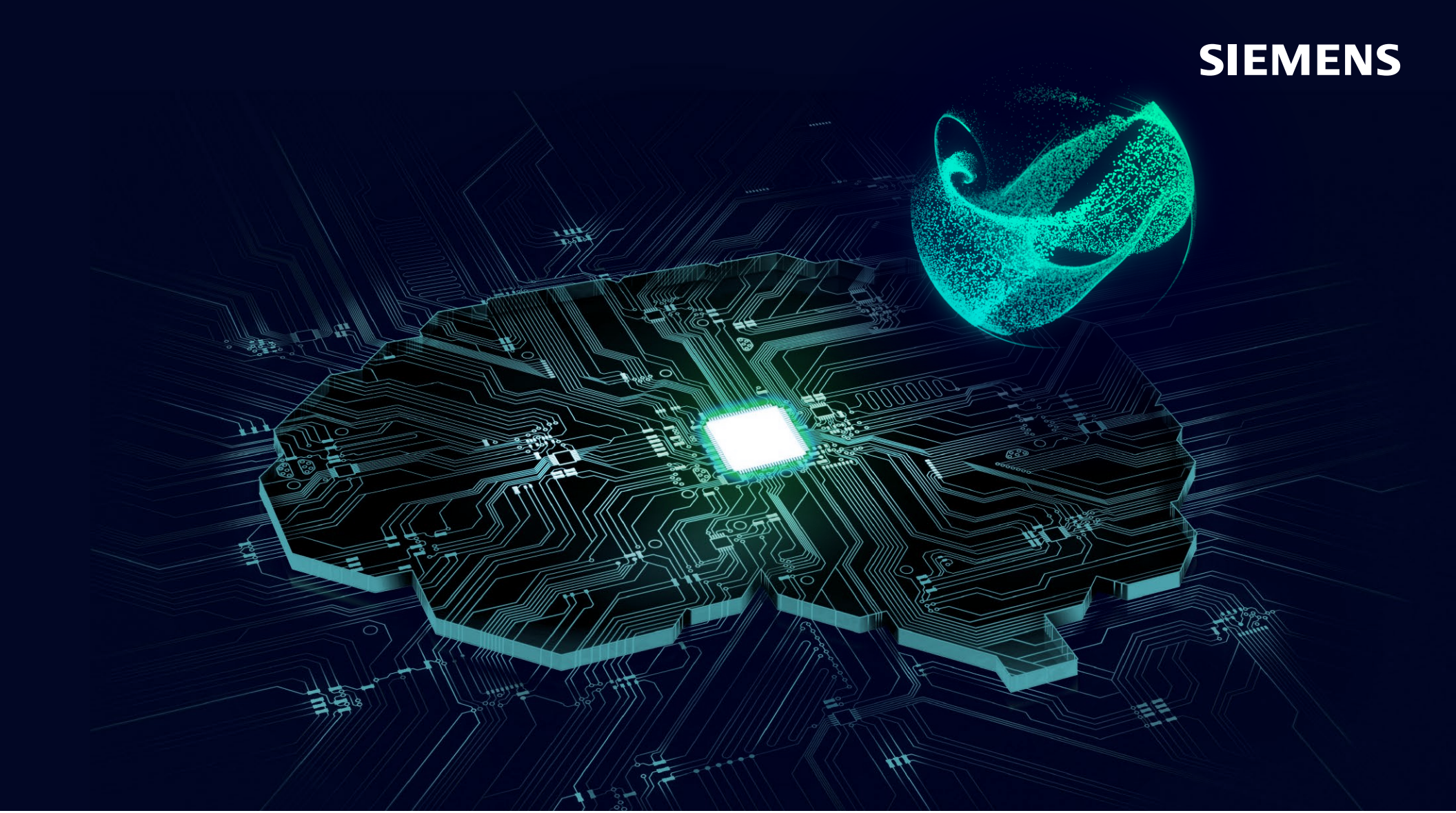


Keys to semiconductor traceability and quality

How chipmakers can achieve end-to-end traceability and maximize product quality

Why end-to-end connectivity is now essential

Historically, the semiconductor industry was built upon legacy and homegrown systems, yet today these systems cannot scale to meet the kind of expansion and complexity called for by the explosion in demand.

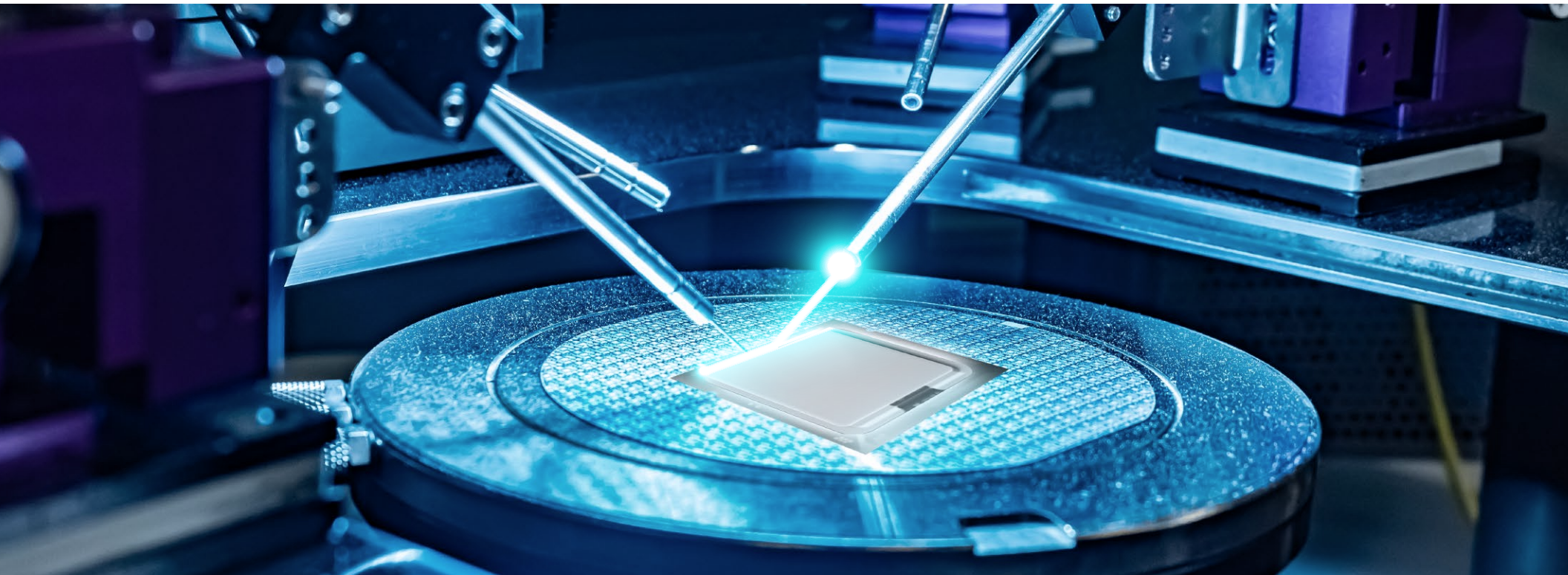
Too many semiconductor companies today are still operating with fragmented legacy systems, unconnected without a common data platform or common language across systems. Key design, engineering and manufacturing functions exist in silos where sharing information and collaboration is complex. Also, there is a lack of visibility between electronic design automation (EDA)/design management tools and product lifecycle management (PLM) tools. In addition, the lack of visibility from disparate systems inhibits intellectual property (IP) re-use, and makes end-to-end traceability nearly impossible, creating more technical debt for these companies.

It's time to move on from fragmented legacy systems

Unfortunately, many product teams do not have the benefit of integrated systems that allow seamless data flow from the design, planning, processing and reporting phases to empower collaboration. In fact, Tech Clarity research found that over 60 percent of semiconductor companies "use six or more systems" to store, access, and manage data.[1]

As a result, semiconductor engineers typically waste time finding the information they need from various systems. According to the same research by Tech-Clarity, when answering the question, "What percentage of time do you estimate your technical resources (designers, engineers, etc.) spend directly on product innovation, product development and engineering?" The answer was less than 50 percent of their time. It's possible for companies to become more efficient and do much more with the resources they have. It's essential to have one PLM platform that can be used to store, access, share and manage data throughout the product lifecycle and across the value chain. Without it, a company's ability to compete long term in a constantly evolving industry is at risk.

1. Tech-Clarity in "Retool Semiconductor Innovation for Profit - A Lifecycle Approach for Smart Products and Devices, " page 15, © Tech-Clarity, Inc., https://tech-clarity.com/semiconductor-innovation-for-profit/10280, 2021.

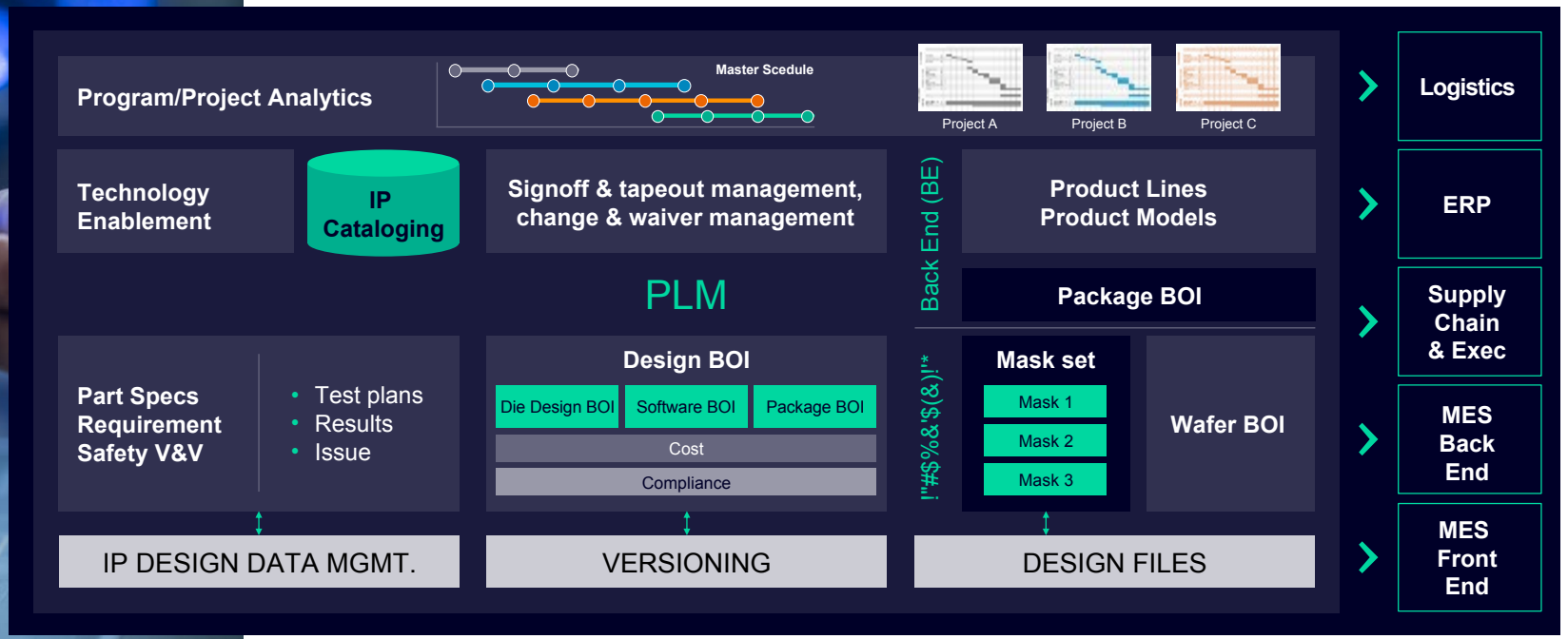


Fragmentation inhibits innovation

For semiconductor companies to keep up with the current pace of innovation, taking control of their product data and processes is critical. To achieve this business goal, they must include EDA design and verification, packaging design data, embedded software, documentation, bill-of-information (BOI) data and bill-of-process information (BOP). Without all the information it would be impossible to harmonize all design and manufacturing process information for the entire lifecycle of the product. The result is a holistic view of all the product design, manufacturing and process data from across the enterprise and value chain that ends fragmentation and enables cross-functional collaboration that delivers on time and on budget.

The PLM ecosystem diagram below shows some of the different modules for the semiconductor solution and its design integration touch points, including version control systems, design simulation and verification EDA tools, plus the IP design data management system, manufacturing execution system (MES), logistics and supply chain data.

True digital transformation begins with lifecycle management that connects all systems and objects to provide one continuous digital thread of data throughout the entire manufacturing process from concept to end-of-life while also providing the ability to store, access and manage all data. With such comprehensive, detailed information flowing within the enterprise, a semiconductor company can expect to beat the competition and exceed its business goals. And by improving reliability, achieving faster new product introductions (NPIs), reducing design re-spins and costs and providing secure supply chain collaboration, they increase innovation and boost product quality.



From disconnected systems to digital traceability

Having a preconfigured ready-to-use PLM solution reduces the time for deployment and helps to define fair process flow with thousands of operations inputs and output resources, materials and tools. By connecting the bill-of-materials (BOM) and BOP, changes are communicated downstream to participating sites. PLM is also used to manage fab probe assembly, test process technology and mapping information between the process nodes and manufacturing locations, while enabling complete lifecycle traceability, including lot traceability, genealogy and commonality for one digital thread from finished product to design artifacts.

Accurate lifecycle traceability reporting

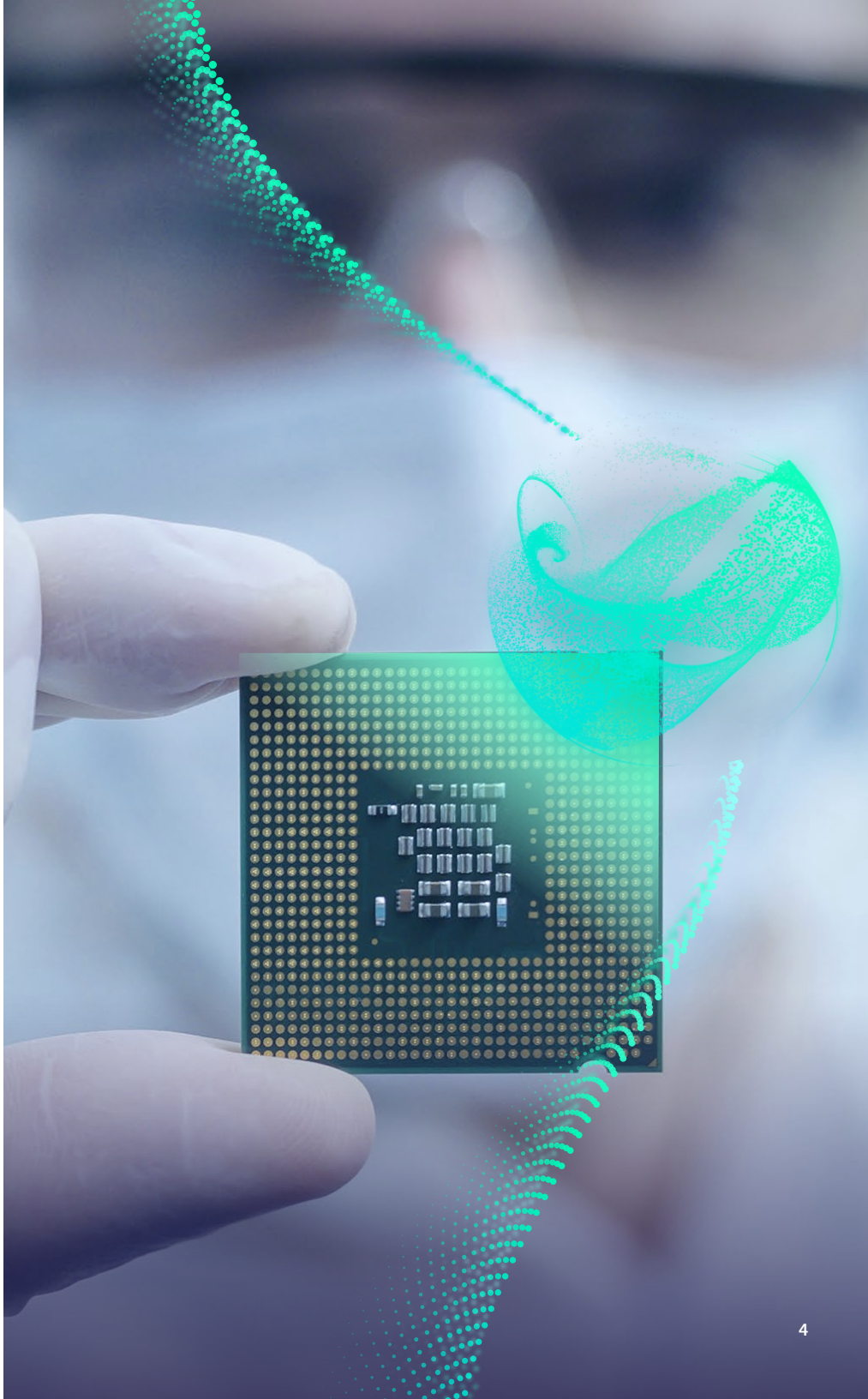
With PLM, a lifecycle traceability report for a product revision shows how the different objects – from a digital asset to the physical asset – are connected, creating a single digital thread from design to manufacturing. The report addresses real-time reporting and decision-making and real-time root-cause analysis, identifies IP revisions for a specific design and establishes provenance while enabling continuous improvement, yield improvement and more.

As operations and products grow in complexity, deeper insights are needed to reduce capital costs, improve quality and yield, and speed NPI time-to-market. PLM dashboards show this performance per fab or on an enterprise scale, with machine learning, real-time artificial-intelligence-based data analytics, data re-use, and more.

The smart semiconductor solution

True innovation is impossible for semiconductor companies that manage siloed and outdated tools, environments and processes. And true digitalization is necessary to innovate and provide complete end-to-end traceability. It also allows for knowledge sharing and collaboration across departments and the supply chain, resulting in rapid root cause analysis and change management.

There is only one solution that empowers semiconductor businesses, from fabs, fabless, integrated device manufacturers (IDMs), foundries, and outsourced semiconductor assembly and tests (OSATs) to subcons to manage the entire lifecycle of products with one integrated data model and a single source of truth for the entire chip development, design and manufacturing process. Siemens Digital Industries Software provides robust, out-of-the-box solutions that are used to seamlessly manage data from all domains so teams can design products right the first time, improve NPIs, reduce costs and drive innovation for a clear competitive advantage.



Harmonize all semiconductor design and manufacturing process data into a single source of truth for the entire product lifecycle from concept to delivery

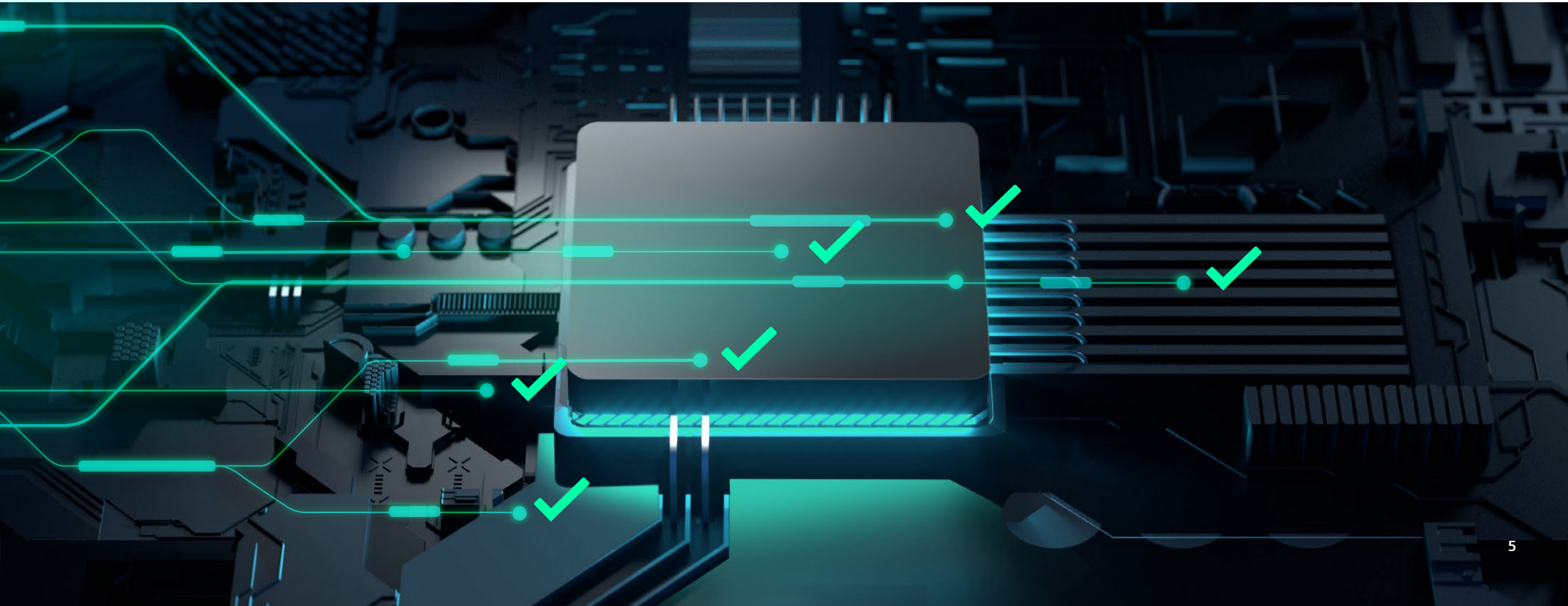
In today's rapidly changing semiconductor market, achieving end-to-end traceability and a high level of product quality are essential to competing successfully. In a recent industry survey[2] conducted by Tech-Clarity, product quality was found to be the single most important factor in profitability and success, according to 66% of semiconductor business leaders. How do business leaders meet this challenge?

Achieving today's increasingly higher standards for traceability and quality comes down to one factor: digital transformation. Without true digitalization throughout the product development process from front to back, companies will simply begin to fall behind the competition.

The Teamcenter® software for semiconductor lifecycle management, which is part of the Xcelerator portfolio of software and services from Siemens Digital Industries Software, offers a true competitive advantage to semiconductor businesses.

From startups to large enterprises, scale your semiconductor design, simulation, manufacturing and IoT capabilities to match your product and market requirements. Utilize new technologies quickly and cost-effectively, learn and keep pace with new solutions, collaborate securely across engineering domains, and leverage your ecosystem as a network of innovation partners. Siemens Xcelerator as a Service leverages cloud computing to provide powerful new capabilities that will help speed digital transformation for semiconductor companies.

2. Tech-Clarity survey of 277 semiconductor and high-tech professionals, reported by Julie Fraser, Vice President, Tech-Clarity in "Retool Semiconductor Innovation for Profit - A Lifecycle Approach for Smart Products and Devices, " page 4, © Tech-Clarity, Inc., https://tech-clarity.com/semiconductor-innovation-for-profit/10280, 2021.



Inefficiencies were baked into our processes and system. Now, we actually have a negative project slip rate. We're not just meeting our promised delivery dates – we're beating them, thanks in part to an improved engineering change management process.

Bill Duggan, Engineering Manager, Teradyne

Teradyne – adopted Siemens product lifecycle management (PLM) and reduced their engineering change order cycle by 84%, from 90 days to just 14 days, resulting in $2 million saved yearly.

We were very lucky that our management made a wise management when the company was at a low point to invest in PLM and restructure the entire product development process. This has given us the competitiveness we enjoy today.

J.K. Wei, System Engineering Director, Inventec Corp.

Using Teamcenter as one of the keys, Taiwanese ODM Inventec turned its fortunes around and rose to #17 on Business Week's "Info Tech 100" list.

We realized that PLM would cut our development time in half.

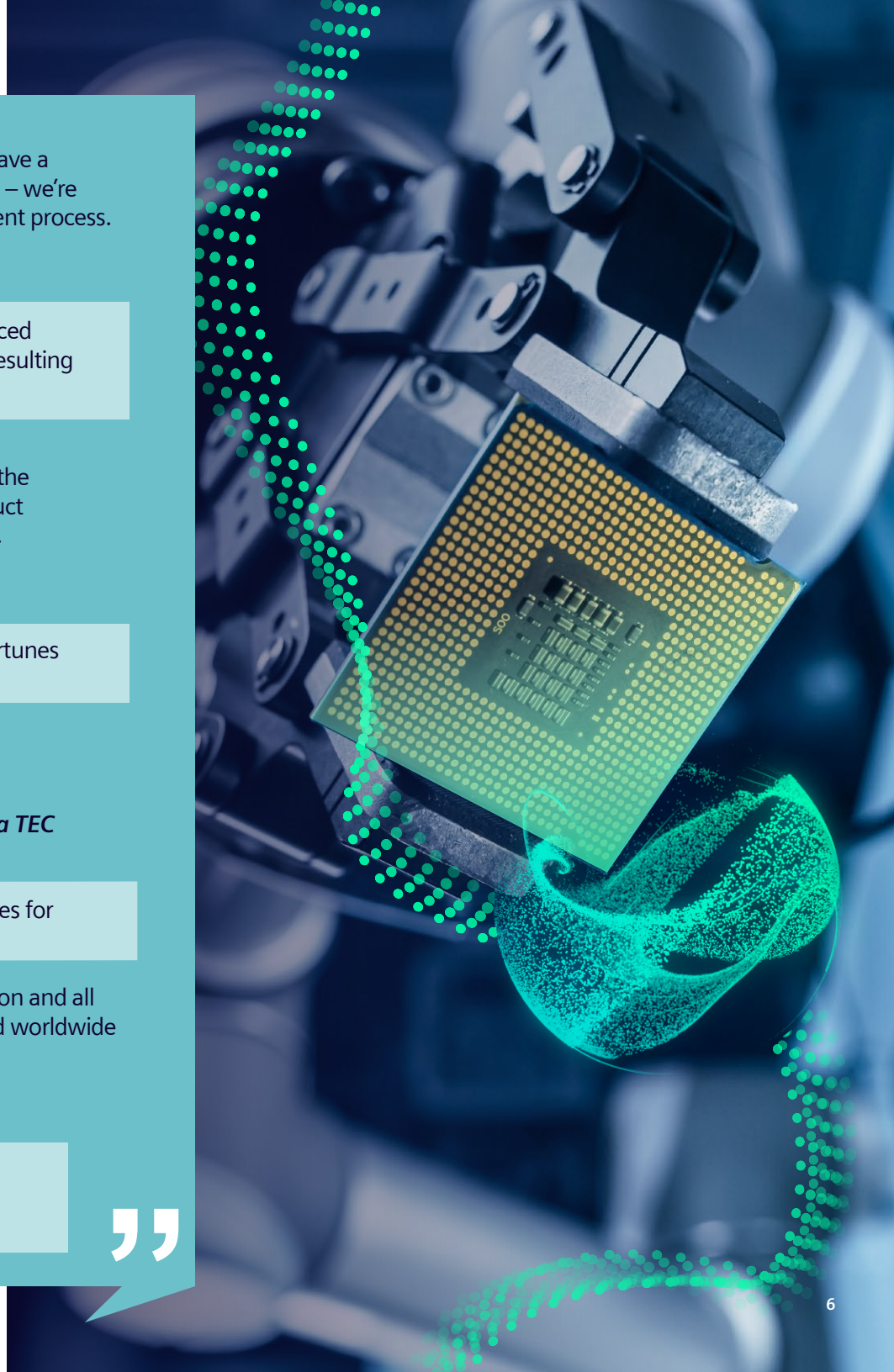
Takuro Ito, Group Manager, Re-engineering Group, System LSI, Toshiba TEC Corporation

Toshiba TEC used Teamcenter to completely re-engineer its business processes for maximum productivity.

We view the PLM implementation as a sound foundation to support innovation and all of our business strategies, including global brand building, diversification and worldwide market penetration.

YU ZI DA, Vice President, Haier Group

By managing information for eight Haier Group product departments and increasing the visibility of development projects, Teamcenter helps shrink time-to-market by 15 percent.



About Siemens Digital Industries Software

Siemens Digital Industries Software is driving transformation to enable a digital enterprise where engineering, manufacturing and electronics design meet tomorrow. Our solutions help companies of all sizes create and leverage digital twins that provide organizations with new insights, opportunities and levels of automation to drive innovation.

For more information on Siemens Digital Industries Software products and services, visit siemens.com/software or follow us on LinkedIn and Twitter.

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