



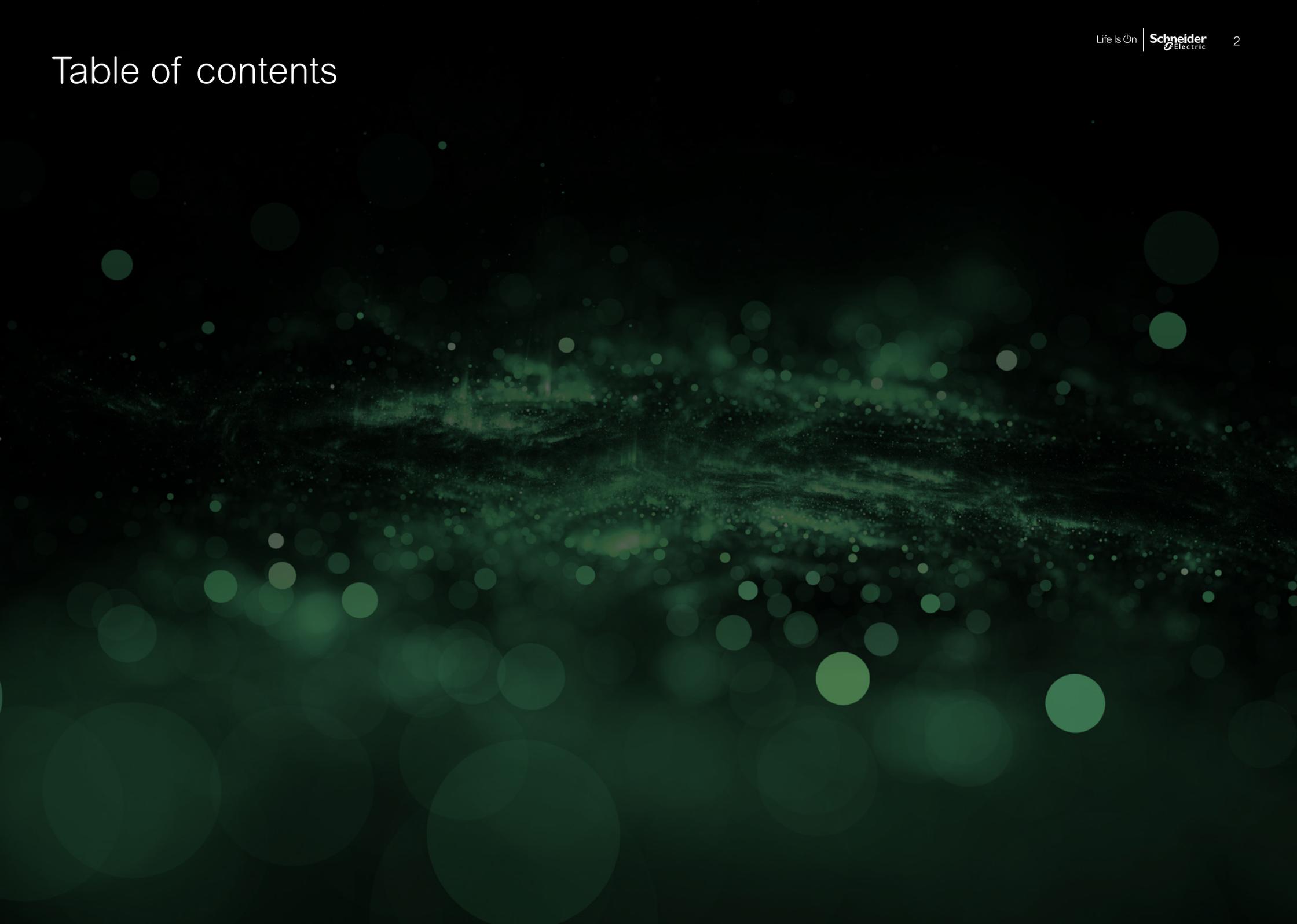
Digital twin: bring your data to life
for better performance

Life Is On

Schneider
Electric

se.com

Table of contents



CHAPTER 01

What is a digital twin?

“A digital twin is not an end result, product, outcome, or technology in and of itself. Instead, it’s a dynamic data-supported framework that functions as a business enabler leading to results, products, outcomes, or new technologies. It’s a means to an end, and the end is solving a real-world problem with real-world data.”

Hervé Coureil
Chief Digital Officer,
Schneider Electric



50%

of large industries
will use digital twins
by 2021¹ (Gartner*)

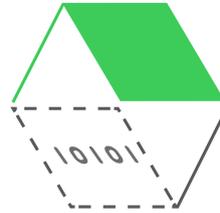
*Gartner does not endorse any vendor, product, or service depicted in its research publications, and does not advise technology users to select only those vendors with the highest ratings or other designation. Gartner research publications consist of the opinions of Gartner's research organization and should not be construed as statements of fact. Gartner disclaims all warranties, expressed or implied, with respect to this research, including any warranties of merchantability or fitness for a particular purpose.

One giant leap for IoT

Today, digital twins are proliferating rapidly across various industries. While there may be multiple ways to define a digital twin, at its core, a digital twin is a virtual representation of the key attributes of a physical object or process that can be tracked and updated along the lifecycle to achieve design and operational efficiencies. It's more important, therefore, to focus on the intended business outcomes and the ways a digital framework enables them.

One key aspect of the digital twin is an “evolving” digital profile of the end product or the overall composite system that brings together traditional simulation models with intelligent data and analytics. When based on reliable, high-quality data, digital twins enable a range of real-time insights that can enhance quality, performance, productivity, and energy efficiency — despite the ever-changing conditions and constraints.

A closer look at a digital twin framework



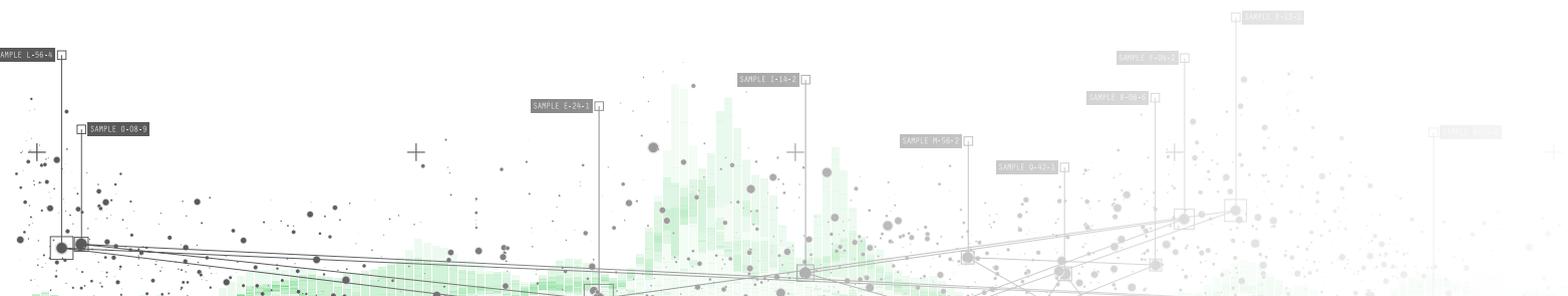
A virtual model / simulation connected to the real asset(s) to enable synchronization of real-time data



Data-driven business intelligence in context of the asset, process, or end-to-end system, supported by internal behavioral models



Stakeholder collaboration during design, build, operate, and maintain phases, as enabled by digital continuity through open interfaces within a digital ecosystem



The time for broad proliferation of twins is now

If the seeds for digital twins were planted many moons ago, why the buzz today? The convergence of several factors makes the digital twin concept a proven business enabler for accelerating digital transformation, in turn overhauling old-school static representation into dynamic, real-time simulation enhanced by intelligent, live data.

The right technology mix to advance IoT's value

IoT sensors

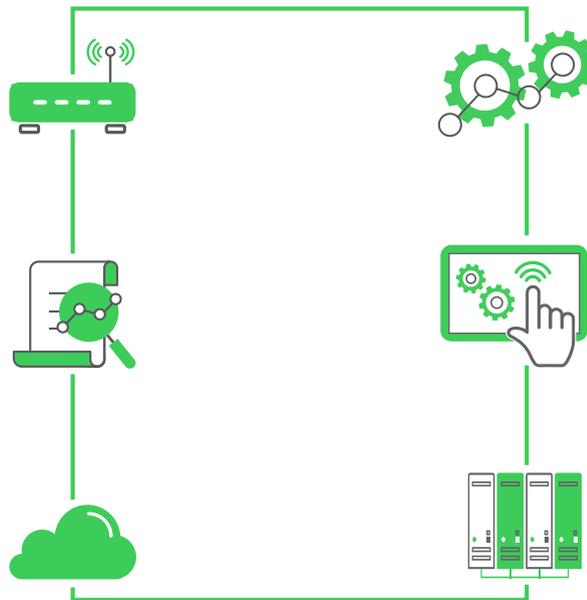
Widespread connectivity of equipment and assets

Big data

Voluminous amounts of data, both structured and unstructured

Cloud

Lower-cost, cybersecure capabilities for secure data storage and computing



AI and machine learning

Data-driven insights, business intelligence, and self-learning capabilities

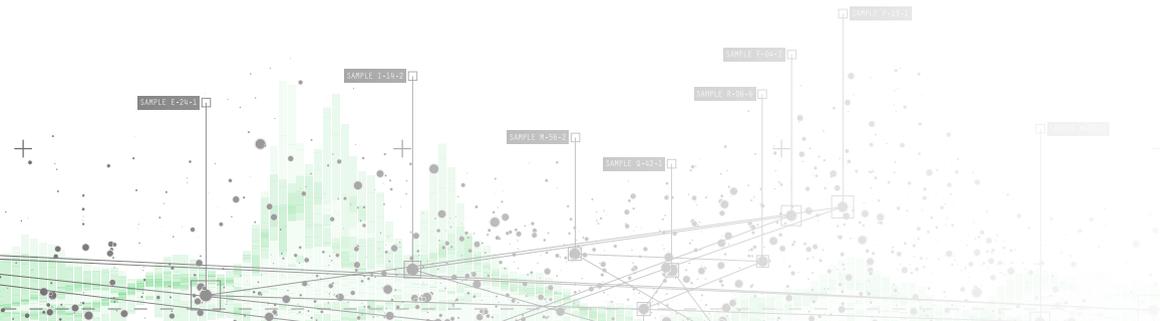
HMI innovation

Technological advances in 3D visualization, AR & VR

Edge architecture

Intelligence generated close to the source of data

For Schneider Electric, connectivity redefines everything, and we have believed in its transformative power for decades. Fifty years ago, Schneider integrated intelligence in machines and automated industrial processes, revolutionizing manufacturing. Twenty years ago, we introduced Open Protocol Ethernet on factory floors. Today, the concept of digital twin is another way to deliver on the promise of the Internet of Things: connectivity that turns data into operational and energy efficiency across all levels of an enterprise.



Digital thread: a data-fueled lifeline

The continuous synchronization between the physical product and its digital representation is crucial to the success of digital twins. Built on reliable, continuous, and intelligent IT and OT data, the “digital thread” establishes the continuity across the product lifecycle and provides a “single source of truth” — the lifeline for accelerating outcome-driven ways to capture IoT’s business value.



PRODUCT

for example, a circuit breaker, PLC, or an associated service



PROCESS

for example, a process for distillation in a refinery or electrical load balancing



COMPOSITE

for example, a hierarchical collection of twins for a plant or facility



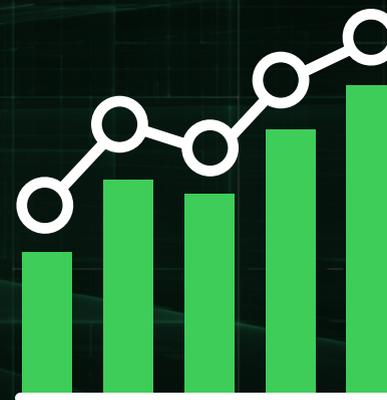
Let's take a closer look at the business value ...

CHAPTER 02

Where's the business value?

“In 10 years, digital replicas of industrial equipment in industries ranging from food and beverage to manufacturing and healthcare will be widespread. That’s going to be a competitive advantage: to understand how your assets are performing not only from a maintenance perspective but also profitability.”

Elizabeth Hackenson
Chief Information Officer,
Schneider Electric



10%

improvement in effectiveness of large industrial companies using digital twins by 2021 (Gartner*)²

*Gartner does not endorse any vendor, product, or service depicted in its research publications, and does not advise technology users to select only those vendors with the highest ratings or other designation. Gartner research publications consist of the opinions of Gartner's research organization and should not be construed as statements of fact. Gartner disclaims all warranties, expressed or implied, with respect to this research, including any warranties of merchantability or fitness for a particular purpose.

Driving business outcomes

Despite the buzz around the term, it's important to note that a digital twin is an enabler of value and not itself the desired outcome or a product. It's a means for a business to leverage technological advances to solve real-world problems with real-world data and to enable new digital business models. In fact, a prudent approach would be to assume an ecosystem view where a digital twin framework assimilates best-in-class technology along the product lifecycle to enable a range of benefits stated below.

With a digital twin framework, you can ...

Boost efficiency and safety through:

- Increased productivity
- Improved product design and quality through simulation of what-if scenarios and incorporating feedback
- Improved safety by anticipating and avoiding potential operator mistakes
- Immersive user experience for service operators, thereby reducing downtimes

Revolutionize the customer experience through:

- Streamlined product innovation
- Remote troubleshooting with context
- New digital business models (e.g., services)

Streamline processes and data reliability through:

- A digital thread that enables data continuity
- Data provenance and continuity to track and explain data
- A real-time continuum across otherwise disconnected CapEx and OpEx phases

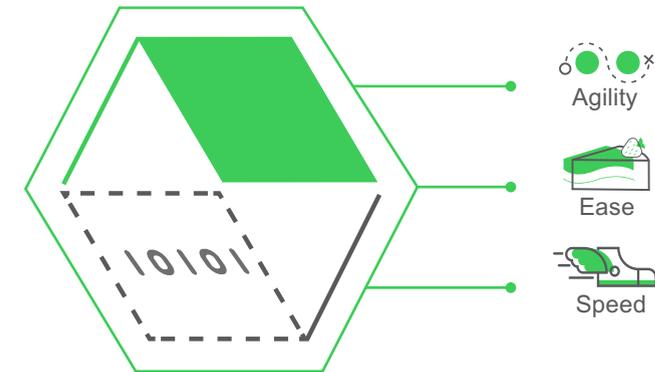
Enhance enterprise digital culture through:

- Collaboration across many stakeholders from historical silos
- A way to upskill workforce for digital and attract digital natives

30%

of Global 2000 companies will be using digital twin data to improve product innovation success rates, achieving gains of up to 25% (IDC)³

A digital twin framework offers ...



Meet the twins

What if you could validate design before you build, reduce the risk of equipment failure, improve factory operations and efficiency? A digital twin is the enabler. It makes design, commissioning, and implementation easier, while improving productivity and operations across the digital value chain, including the digital customer service experience.

The Gartner Hype Cycle 2018⁴ calls out digital twins to be at the peak of inflated expectations. As this concept matures, there will be a variety of twins in terms of complexity and fidelity. On the lower end of the spectrum will be twins that represent individual “things” and have very basic capability. Along the spectrum, the process twins may include higher fidelity models representing behaviour in terms of physics, mechanics, electrical, thermodynamics, etc. Any of these individual twins may also be combined in a hierarchical manner to represent composite systems. For example, a composite twin of an oil refinery might include individual twins representing process and electrical components.



The SOMIC Group

Industry of the future, *today*

SOMIC Group, specialists in end-of-line packing systems for small products — in this instance coffee capsules — faces continuous advances in packaging design and short production lifecycles that require fast machines and retooling. This manufacturing firm had to innovate to ensure its systems were smart, adaptable, and efficient — resulting in shorter time to market. [SOMIC used a digital twin](#) to build the prototype of a coffee capsule machine that enables simulation of the real, improved performance.

EcoStruxure™
Innovation At Every Level

Results ...

Half the footprint
but **double** the output

“Reliability is important to us because production security and the high availability of machines are important to our customers. They count on the high performance of SOMIC machines. Schneider Electric EcoStruxure solutions have enabled us to achieve maximum performance in our machines.”

Patrick Bonetsmüller
Chief Executive Officer,
The SOMIC Group



Let's explore how to adopt a digital twin framework ...

CHAPTER 03

How can you apply the framework?

“Digitization demands a fundamental rethinking of the way organizations operate. They need to be confident that their technology investment will deliver a high return on capital and can lower the total cost of asset ownership.”

Craig Hayman
Chief Executive Officer,
AVEVA



50%

of network-related product and asset digital twins into digital twin ecosystems by 2024 (IDC)⁵

Three essential ingredients

A digital twin framework is a viable way to seize data's value by giving current and future meaning to all of that data. In fact, a digital twin with reliable, accurate data is at the core of any digital twin or framework.

Three elements are essential to coordinate the stakeholders engaged in the digital asset or process lifecycle. Together, they provide the ingredients for closing the loop around mapping IoT data to value while ensuring strong data governance and security:

A clear data strategy and a secure data architecture



An IoT-enabled technical architecture



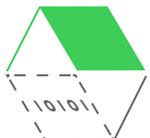
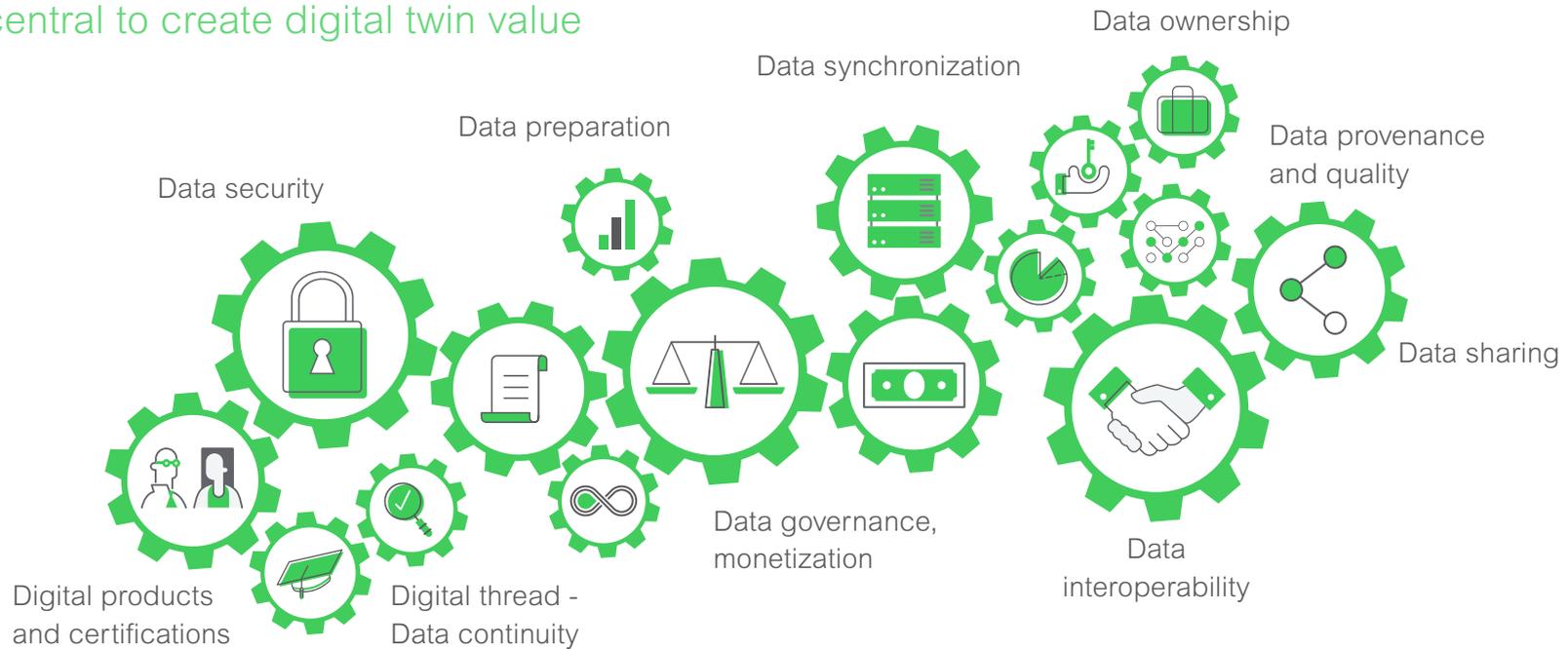
A strong digital culture across the organization



Creating a data strategy and architecture

Data is at the core of any digital twin framework and the basis of a digital thread. Establishing data continuity, quality, and provenance; validating data reliability; and adopting a secure data management approach are essential elements for tracking and explaining data. The goal is to know what, when, and why something happens in both current / real-time and future states at any given time. Reliable data is the basis of any digital twin's ability to support delivery of high-quality business outcomes, especially over the lifetime of an asset when data quality may degrade. Since data will come from disparate parts of the organization (e.g., lines of business, customer service, production assets), clear data governance is necessary to create vibrant, validated, and always-reliable digital twins.

Data services central to create digital twin value



Let's explore how to get started ...

Leveraging an IoT-enabled technical architecture

To support the services within a seamless and unified digital twin framework, you need to leverage an IoT-enabled technical architecture designed to capture data's business value across the full digital value chain. Schneider Electric's EcoStruxure™ architecture (shown here for the industry end market) offers the essential core components. It's an open, extensive architectural pattern that securely brings together disparate types of data across the asset lifecycle.

EcoStruxure™ for Industry Innovation At Every Level

[Learn more](#)

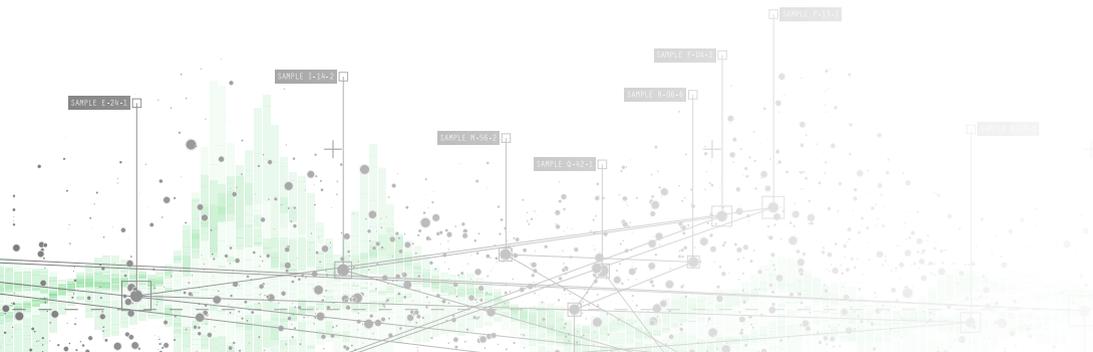


*The Schneider Electric industrial software business and AVEVA have merged to trade as **AVEVA Group plc**, a UK listed company. The Schneider Electric and Life Is On trademarks are owned by Schneider Electric and are being licensed to AVEVA by Schneider Electric.

Creating a strong digital culture throughout the organization

As a business enabler or tool, a successful digital twin strategy depends on an organizational culture and operating model that can align processes and workflows, digitally mature people (including lines of business and IT), and technology. Let's look at traditional organizational silos, for example. It's imperative to break down the barriers between the CIO / IT organization, lines of business, operations, the supply chain, and the entire digital ecosystem to ensure that the digital twin has concrete business relevance and can come to life within the context of cost and business outcomes.

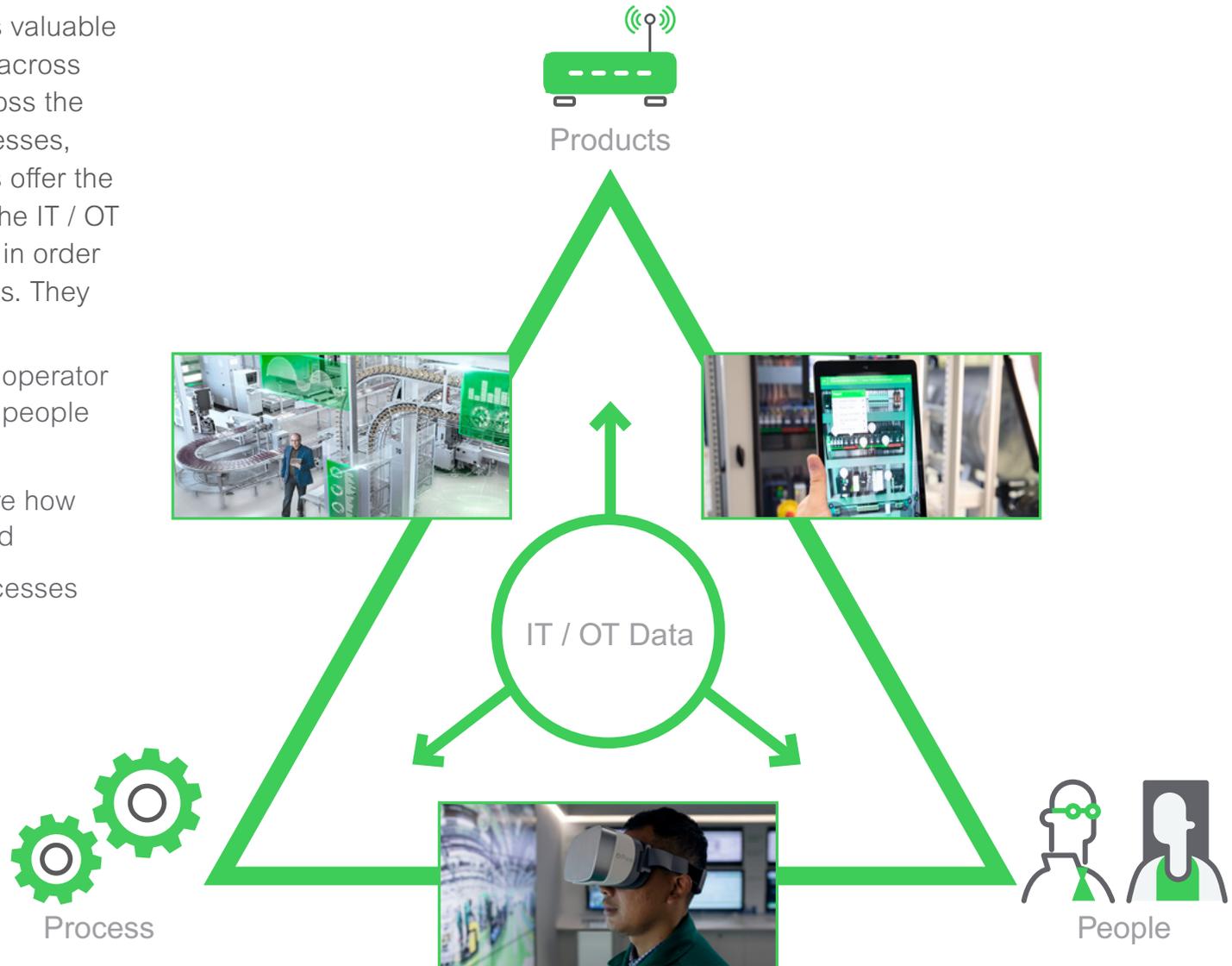
A digital twin helps create a single source of truth around data spanning the digital ecosystem. By removing silos in this manner and utilizing consistent, high quality data, the organization can make better, faster decisions. The payoff? Enhanced value from the use of digital twins.



People, products, and process

A digitally connected organization has valuable data, but that data is typically spread across departmental silos. When applied across the 3Ps of the organization (people, processes, and products), digital twin capabilities offer the opportunity to integrate and harness the IT / OT data across these organizational silos in order to achieve targeted business outcomes. They enable:

- Rich, immersive user experiences, operator training, etc., at the intersection of people and products;
- Visibility and control to help improve how people better utilize processes; and
- Automation and digitization of processes associated with products.



CHAPTER 04

How can you get started?

“Once the dynamic simulation of the plant is built, the testing results create a feedback loop based on what the engineers have learned from experimenting with the digital plant. That information then goes back into reshaping and optimizing the design. Therefore, the vision is that a plant can actually be optimized before it’s built.”

Peter Herweck,
EVP of Industrial Automation,
Schneider Electric



1/3

of high-tech companies report that a fragmented software vendor landscape hinders digital thread approach (Accenture).⁶

Where do you begin?

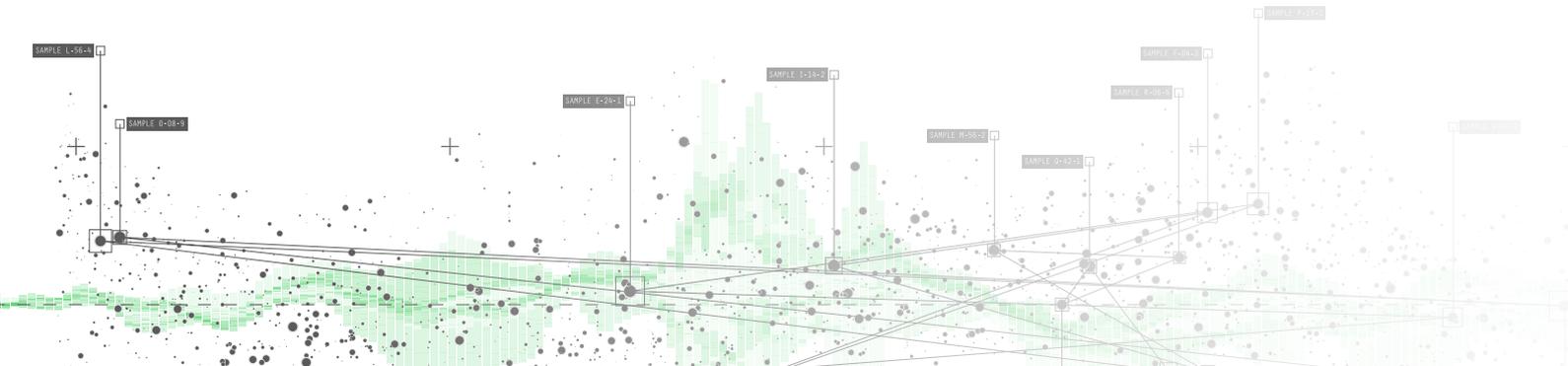
Incorporating digital twins as part of your environment may seem overwhelming. A common mistake to avoid is expecting that digital twins will allow you to tackle every problem at once. Instead, know that there is no one-size-fits-all approach. Start small and prioritize the business objectives to be achieved. Also be mindful that in the practical environment, there will be the need to integrate systems and possibly digital twins from multiple domains and vendors.

To begin with, review whether any of the following common business objectives matches the kind of problems your organization is looking to solve.

- Lower the CapEx demands of plant design or electrical distribution upgrades
- Simulate “what if” safety scenarios, when connected to the real asset(s)
- Create customized products quickly
- Shorten the product development lifecycle
- Improve productivity of assets
- Lower risk of failure by minimizing unplanned downtime
- Increase energy efficiency via safe load-shedding
- Develop new digital business models / services
- Revolutionize the customer experience
- Lower operator risk and increase workplace safety

“Unless you narrow down the digital twin concept phase by phase for the lifecycle, it can be very difficult to have a business-focused conversation. For any other technology solution, you must first identify the kind of problems you want to solve along the lifecycle.”

Fabrice Jadot
Next Generation
Automation Solution
Incubator, SVP,
Industrial Automation,
Schneider Electric



Common integration considerations

As a test case, begin with conceptualizing a project that needs an individual / discrete digital twin. The simplicity will help with lining up the right people, process, and technology (including setting up a digital twin framework). As the organization gains maturity, more discrete twins can be connected as part of the larger system in the form of composite twins. Regardless of the approach, keep in mind the following integration best practices:

Break down organizational silos

Within any digital twin project, stakeholders include designers and engineers, an IT architect, product developers, plant operation technicians, and a procurement manager. Your goal is to streamline historically siloed, cross-functional processes to keep the business goal and return on investment top of mind at all times.

Establish clear data governance

How will you aggregate and analyze disparate data across the digital twin's lifecycle? Within the context of your organization's data strategy, determine the architectural pattern of data to be used for your digital twin framework (see page 21). The convergence of IT and OT data includes people, process, and technology, and all data used to bring to life a digital twin should adhere to cybersecurity and data sovereignty standards (GDPR, etc.).

Look to your IT department as consultants

It's imperative to partner with your IT department as a business consultant who can advise on how much bandwidth and storage is needed to collect, store, process, analyze, and access data. Another consideration is the preparedness of IT and operations teams to manage the lifecycle of digital twins, ensuring a way to create a secure feedback loop to turn unstructured data into business insights from the shop floor to the front office.

Enable dynamic collaboration in real-time

Make dynamic collaboration possible via secure open interfaces, supporting real-time conversations about design improvement, instantiating the facsimile, engineering, functional testing, project execution, and coordination with the end-user and the Engineering, Procurement, and Construction (EPC) contractor.

Develop a clear IoT edge strategy

Data is everywhere. Consider that in a connected factory or across a grid, hundreds — and even thousands — of sensors are spewing voluminous amounts of data. One example puts this scale in perspective: some systems can now have 200+ parameters instead of just 4 or 5 in the pre-IIoT days. It's therefore essential to establish a clear edge strategy for analyzing and processing data close to its source instead of sending all data to the cloud for analysis. For a view of developing an edge strategy, see the [“Capturing the business value of the IoT edge”](#) e-guide.

Establish a digital thread

It's critical to document creation and modifications to the digital twin: data quality, reliability, and provenance. Instead of a single “owner,” different parts of the business will collaboratively contribute to the digital thread, guided by clear data governance to ensure reliability, data integrity, and provenance.

Manage cybersecurity and privacy

Every digital enterprise must scrutinize cyber risk across its ecosystem. Today, that means looking well beyond a sole connected object or database to the full digital ecosystem. Create and communicate your cybersecurity and data privacy strategy across your organization, especially as the connectivity of Information Technology systems migrates at an accelerated rate into the Operational Technology layer. Consider [Cybersecurity Services](#) to support your efforts.

Leverage outcome-based services

How will you act on what the digital twin reveals? Consider outcome-based services based on values such as uptime or productivity to take advantage of continuous data insights.

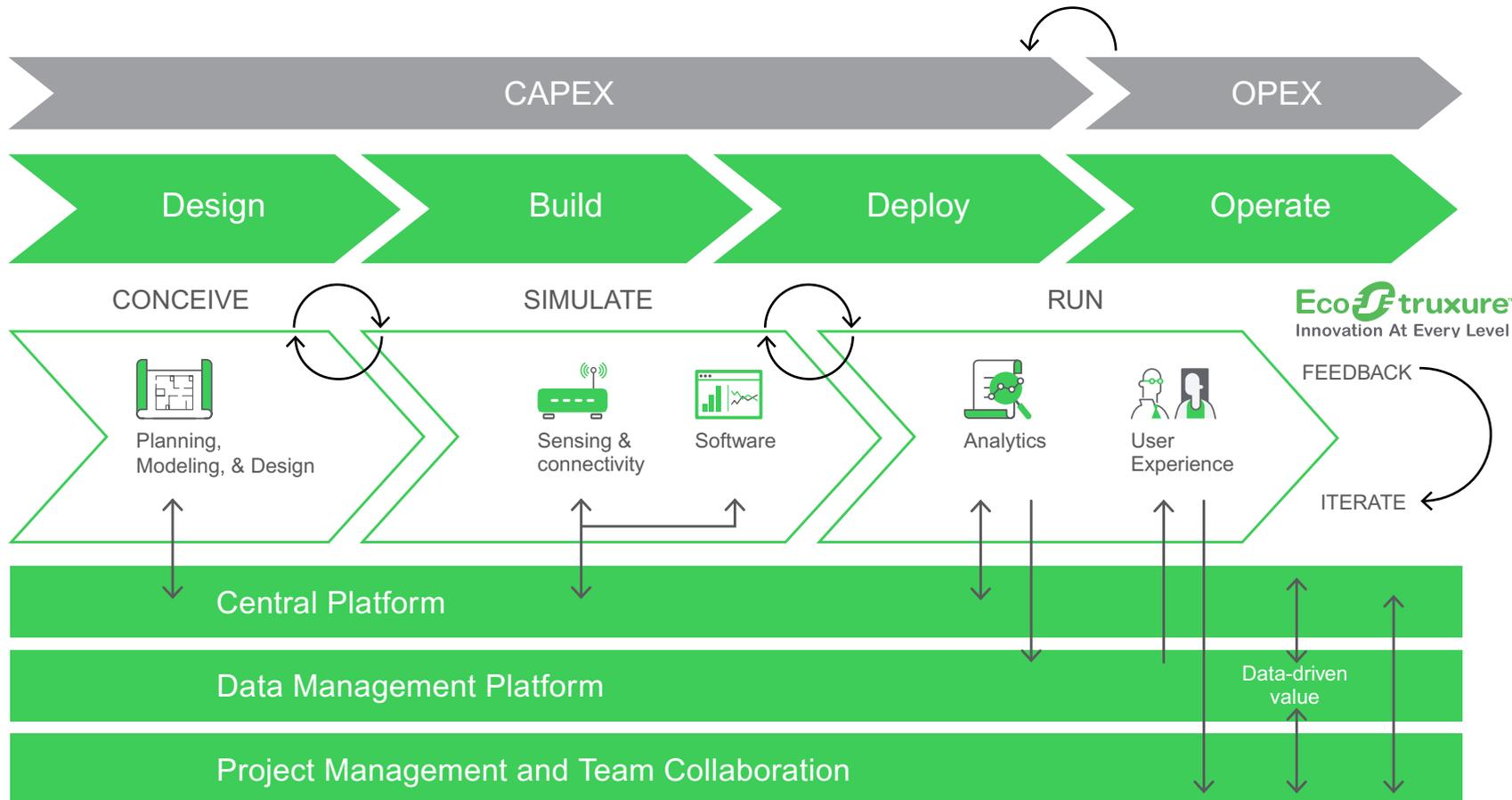
“Enabling a robust foundation for data quality is essential for creating a single source of data’s truth. In turn, partners within the dynamic ecosystem can make better, faster decisions based on reliable data”

Luc Hossenlopp
Chief Technology Officer,
Schneider Electric
Services

Leveraging a digital twin framework

How do you capture the full business value of digital twin capabilities? In addition to the integration considerations stated earlier, it is beneficial to adopt a framework approach to integrate various ecosystem components supporting the lifecycle of the asset from the CapEx through the OpEx stages. Schneider Electric views the various stages of this framework from conception through simulation to operate and run as being supported by underlying platform services. These include orchestration of the various digital twin capabilities, a robust and secure set of data management services, and a versatile collaboration environment supporting project and lifecycle management.

Schneider Electric's ecosystem framework for digital twins



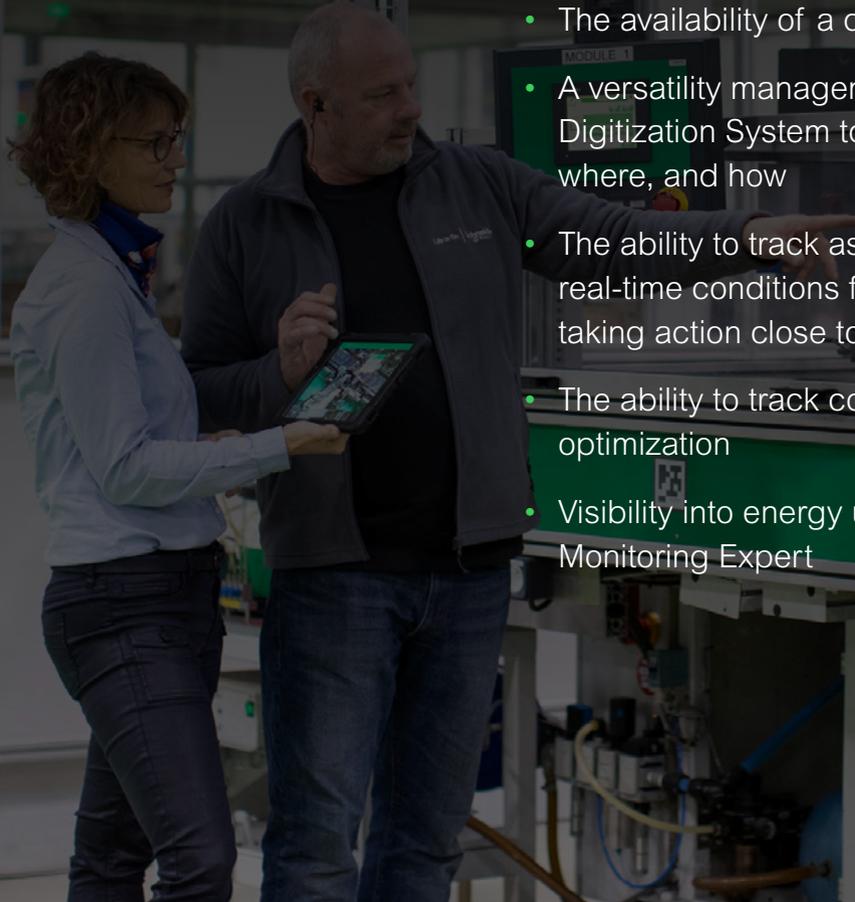
Bringing to life efficiency and sustainability gains

Schneider Electric is digitally transforming its supply chain by integrating innovative technologies, IT solutions, and data analytics into its own manufacturing operations — termed the Smart Factory program, which covers 80 sites, 10 of which are “showcase” factories. Recognized by Gartner and the World Economic Forum, [the Smart Factory program](#) showcases factories such as the one in Le Vaudreuil, France, where digital twin capabilities are integrated.

This smart factory introduced digital tools to support its mass production operations. The production line has been 100 percent automated and, using augmented reality, technicians can now analyze data and address issues, making interventions safer and reducing diagnostic time by 30 percent.

Increased visibility into operations, maintenance, and energy use to support informed decision-making through:

- The availability of a digital copy of the shop floor
- A versatility management system and Lean Digitization System to tell operators who did what, where, and how
- The ability to track assets across the lifecycle and real-time conditions for machine optimization, in turn taking action close to the source of the data
- The ability to track components for materials optimization
- Visibility into energy usage via EcoStruxure Power Monitoring Expert

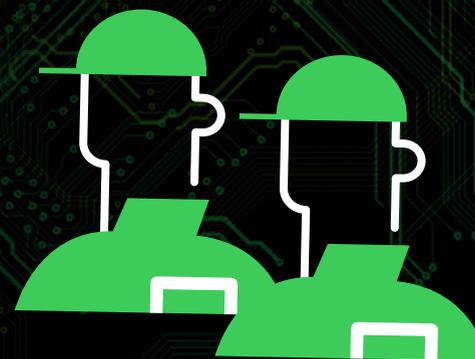


CHAPTER 05

How can partnerships help?

“In a world where co-innovation and customer-centricity are the new norm, it becomes critical for every company to leverage the brainpower, agility, and disruptive ability of a large ecosystem to create competitive, innovative differentiation that enhances efficiency, productivity, and sustainability.”

Jean-Pascal Tricoire
Chairman & Chief Executive Officer,
Schneider Electric



60%

of manufacturers will have empowered shop floor workers with AR / VR, intelligent apps, and cobots by 2021 (IDC).⁷

The value of partnerships

As mentioned before, the digital twin framework brings together best-in-class technologies to yield targeted business outcomes. Schneider Electric firmly believes that this digital twin ecosystem will include a combination of Schneider and partner offerings.

- What kind of problems do you need to solve along the digital value chain?
- Do you need to optimize the design of a high-Capex asset or process?
- Do you need to improve steps along the supply chain (e.g., invoicing, parts fulfillment)?
- Do you need to get a better handle on data management?
- Do you need to leverage an AI or machine learning expert to supplement your core domain expertise?

Regardless of your driving needs, you can connect with the following partners to get started with digital twin integration:

Cloud providers

Some cloud providers have emerged as digital twin experts. Microsoft's trusted, secure cloud, for example, provides the storage and computing backbone for digital twin frameworks. As Microsoft's Director of Azure IoT, Sam George, points out, "Most IoT projects today start from a device-centric

approach, and in our ongoing quest to make building IoT solutions easier, we found that customers find it more natural to first model the physical environment and then connect (existing or new) devices to that model."⁸

Digital service experts

Digital services such as [EcoStruxure Advisor Offers](#) allow you to act upon events / alerts triggered by the digital twin. Connecting the digital twin through IoT solutions leads to more and more insight-based services to augment the asset and operations. This link between the digital twin and operational data yields intelligence that improves efficiency, reduces downtime by predicting and preventing failures, mitigates complexity, and offers ongoing insights into the "state of the state" of the asset, process, or full plant operations.

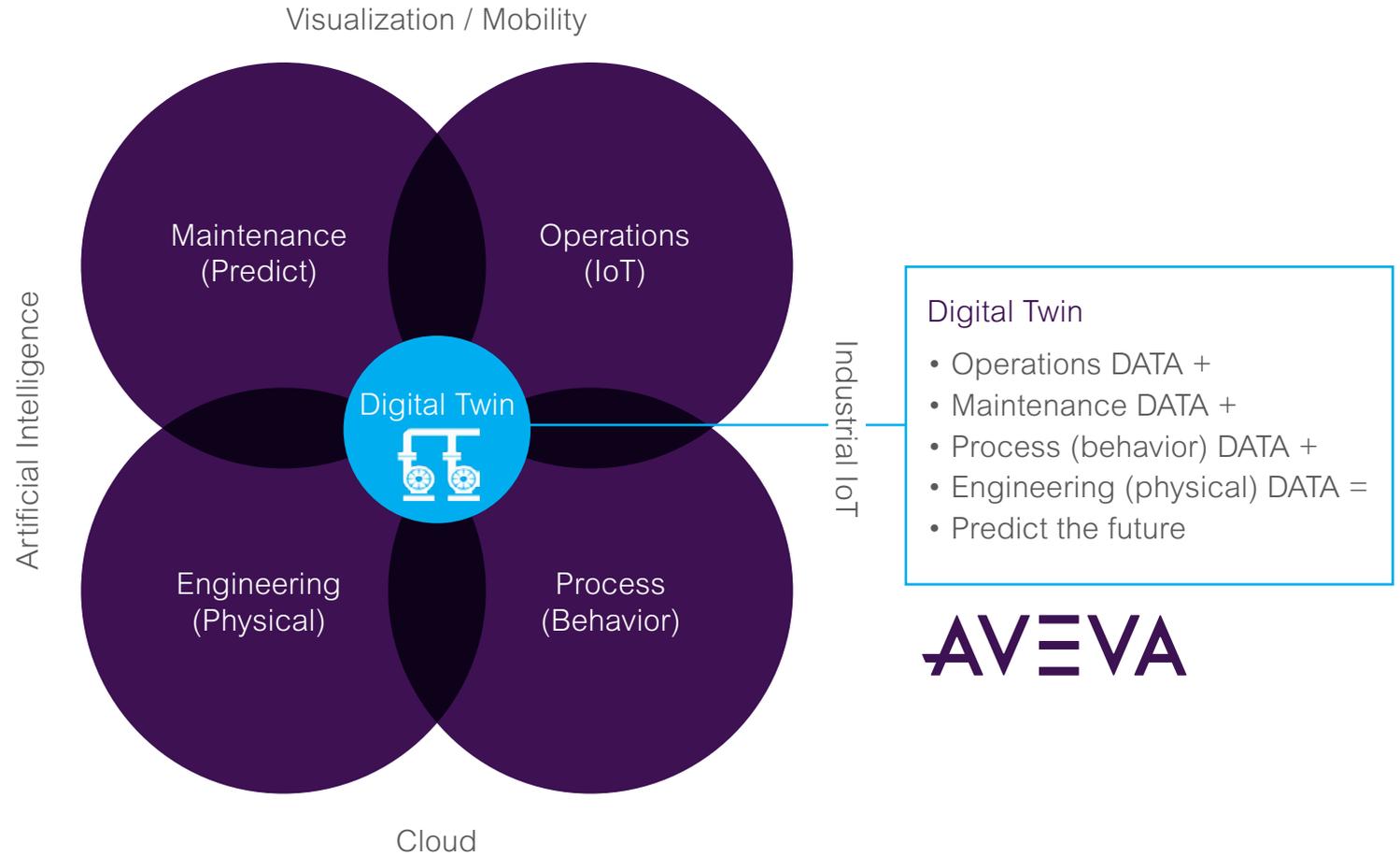
"The business value of a digital twin comes from the real-time communication between the design and operation layers. As a business enabler for creating digital services (whether connected services, software, or both), digital twins transform data to insights."

*Cyril Perducat
Executive Vice President
IoT & Digital Offers,
Schneider Electric*

Partners with specialized offerings

The end-to-end lifecycle workflow may need to include additional vendors offering niche products that support the various stages of the digital twin lifecycle such as modeling, physical simulation, model execution, and visualization hardware. A robust framework allows seamless partner integration in an open ecosystem through the use of standards and well-documented interfaces.

Software experts such as AVEVA can support the development of a 360° digital representation of a process design, providing continuity of simulated design and engineering along the full digital value chain, particularly in the Oil & Gas segment. And for more information on expertise to combine process and power twins, see the [“Digital Transformation through Integrated Process and Power”](#) white paper.

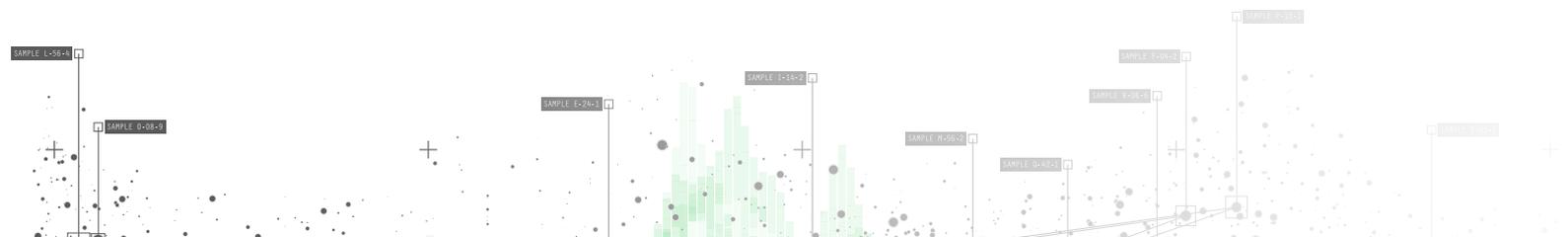


Digital Twin

- Operations DATA +
- Maintenance DATA +
- Process (behavior) DATA +
- Engineering (physical) DATA =
- Predict the future

AVEVA

Intelligent information management



The power of an open, collaborative business platform

Connect to a digital ecosystem of experts. Schneider Electric Exchange empowers Schneider, partners, and niche players to create, collaborate, and scale solutions that support modeling, simulation, analytics, and visualization. As a technical resource library, collaborative workspace, and digital marketplace, [Schneider Electric Exchange](#) brings together domain and segment expertise, data tools, AI models, and a marketplace to support and advance digital twin applications.



“For us at Senseye, Schneider Electric Exchange has been invaluable. Working specifically with Schneider’s innovative Le Vaudreuil Smart Factory has informed our decision making in our product roadmap, as we are able to engage closely with people working in factories and plants and collect and share data.”

Robert Russell
Chief Technology Officer
and Co-founder,
Senseye

Join us today

Bühler

Co-innovating digital twins to drive digital transformation

Bühler, a leading developer of equipment for processing foods and manufacturing materials, is harnessing more data thanks to greater connectivity while improving operations. As part of its digital transformation, [Bühler has also incorporated Schneider Electric's augmented reality application](#). It piloted these augmented reality systems to provide personalized digital information to the users of its machines, based on customer needs.

Dr. Holger Feldhege, COO manufacturing, logistics, and supply chain, says, “the speed of the resulting display on the terminal is greater than what we could previously achieve using routing slips, or other paper or electronic records.” As a result, Bühler and its customers are reducing downtime, speeding up operations and maintenance, and reducing human errors.



EcoStruxure Augmented Operator Advisor

From buzz to benefits

It goes without saying that the need for digital twins will vary by company. Whichever challenge launches your project, the time to start is now.

Since a one-size-fits-all approach simply will not work, identify the most pressing business need. Start with a single use case and grow from there.

- Simulate “what if” safety scenarios
- Create customized products more quickly
- Revolutionize the customer experience
- Develop new business models

Indeed, the concept of digital twins and their capabilities will continue to mature over the coming years. Nevertheless, the time is now to work with Schneider Electric EcoStruxure to seize the concrete business value of digital twins.

Living data for better performance

And remember, continuous synchronization of reliable data about the product, process, and / or composite system is important for achieving business outcomes. Adopting an ecosystem view that uses a framework to integrate best-in-class tools will provide structure and scale, resulting in high returns on your investment in digital twins.



References

- ¹ Pettey, Christy “Prepare for the Impact of Digital Twins.” September 18, 2017. <https://www.gartner.com/smarterwithgartner/prepare-for-the-impact-of-digital-twins/>.
- ² Ibid.
- ³ IDC FutureScape: Worldwide IoT 2018 Predictions. IDC FutureScape. Doc # US43161517. October 2017.
- ⁴ “5 Trends Emerge in the Gartner Hype Cycle for Emerging Technologies.” August 16, 2018. <https://www.gartner.com/smarterwithgartner/5-trends-emerge-in-gartner-hype-cycle-for-emerging-technologies-2018/>.
- ⁵ “IDC FutureScape: Worldwide IoT 2019 Predictions.” IDC FutureScape. Doc # US44390618. October 2018. <https://www.idc.com/research/viewtoc.jsp?containerId=US44390618>.
- ⁶ “The Digital Thread Imperative.” Accenture. September 2018. https://www.accenture.com/_acnmedia/pdf-84/accenture-digital-thread-for-high-tech-pov-september-2018.pdf.
- ⁷ “IDC FutureScape: Worldwide Manufacturing 2019 Predictions.” IDC FutureScape. Doc # EMEA43135818. October 2018. <https://www.idc.com/getdoc.jsp?containerId=EMEA43135818>.
- ⁸ “Microsoft Ignite 2018: Build and secure next-generation IoT and edge solutions at scale.” Blog. September 24, 2018. <https://azure.microsoft.com/en-us/blog/topics/internet-of-things/>.

Discover our IoT-enabled EcoStruxure architecture.

se.com

