COMMENTARY

CIMdata®

Beyond MES

Optimizing Manufacturing with Industrial IoT

Key Takeaways

Modern manufacturing solutions must evolve beyond traditional MES capabilities, integrating systems like PLM, ERP, and EAM to improve operational efficiency across the entire manufacturing asset lifecycle.

CONTACT's MES solution is based on CONTACT Elements for IoT—a framework constructed on a composable architecture that is extendable to other process areas related to the Smart Factory, including Manufacturing Operations Management.

CONTACT Elements for IoT enables an incremental approach to implementing Smart Factory capabilities, allowing companies to balance risk and achieve quick wins by improving automation, connectivity, and process optimization.

CONTACT for IoT provides data-driven automation of business processes and monitoring of the lifecycle of manufacturing assets that streamline production processes, optimize resource allocation, and drive operational efficiency.

Introduction

As companies strive to enable smart manufacturing, they seek solutions that extend beyond traditional Manufacturing Execution Systems (MES) by leveraging real-time data, advanced analytics, and integrated systems to drive agility, efficiency, and innovation throughout their manufacturing operations. MES has long been central to improving manufacturing operations by connecting, monitoring, and controlling shopfloor processes. Acting as the crucial link between enterprise resource planning (ERP) systems and factory equipment, MES facilitates production execution through functionalities such as scheduling, resource allocation, and work-in-progress (WIP) tracking. However, MES is only a part of the broader Manufacturing Operations Management (MOM) framework, which seeks to optimize all aspects of manufacturing.[1]

Despite their potential, MES solutions have faced persistent challenges that limit their effectiveness. MES solutions often lack visibility to real-time data, which hampers production tracking, equipment

[1] Research for this paper was partially funded by CONTACT Software

monitoring, and inventory management. Furthermore, siloed legacy systems obstruct a holistic operational view. Different factories will often acquire different equipment and/or processes to perform the same production tasks resulting in an overall inefficiency of a company's operations. This leads to poor process control, resulting in high defect rates and inconsistent product quality. They also create production bottlenecks, increase machine downtime, and hinder process efficiency, ultimately reducing overall productivity. Attempting to run MES solutions with limited connectivity adds to the burden of maintaining up-to-date documentation, which is resource-intensive. These disconnects result in a lack of traceability of materials, parts, and processes, which is time-consuming, costly, and error prone.

These standalone manufacturing solutions often require extensive customization, making deployments resource-intensive and costly. Additionally, user adoption often suffers due to the lack of organizational change management and adequate training. As manufacturing transitions to smart manufacturing, the limitations of traditional MES highlight the need for a more integrated, flexible, and scalable approach—one that extends beyond MES to address the full spectrum of factory operational challenges.

The Smart Factory: Advancing Beyond Traditional MES

To overcome the persistent challenges in modern manufacturing, smart factory solutions (i.e., factory solutions that integrate automation, AI, IoT, and data analytics to optimize production processes) must evolve beyond the limitations of traditional MES software. Rather than functioning solely as a production execution tool, these solutions should align more closely with MOM solutions, integrating IT and operational technology (OT) systems to enable seamless connectivity across the manufacturing ecosystem. By leveraging advanced analytics and real-time data, smart factory solutions drive operational efficiency, enhance decision-making, and support digital transformation throughout the entire lifecycle of manufacturing assets.

A modern manufacturing approach requires a holistic integration of MES with other critical operational systems, including Product Lifecycle Management (PLM), Enterprise Resource Planning (ERP), and Enterprise Asset Management (EAM). This interconnected framework ensures comprehensive visibility and control over manufacturing operations, from product design and planning to execution and maintenance. The ability to unify these systems fosters a data-driven environment where information flows seamlessly across an enterprise's critical systems, eliminating silos and enabling more informed decision-making.

To handle the complexity and variability of manufacturing environments, smart factory solutions should be designed with a modular architecture, enabling scalability, flexibility, and seamless integration across systems. This approach provides the flexibility to tailor implementations to specific operational needs while maintaining scalability and interoperability across different facilities and production processes. By adopting modular, cloud-enabled, and service-oriented architectures, manufacturers can future-proof their operations, ensuring their solutions remain adaptable to evolving business, product, and technological demands.

A successful transition to a smart factory environment requires an incremental implementation strategy. Rather than attempting a disruptive, large-scale transformation, companies should adopt a phased approach, deploying capabilities gradually to achieve sustainable, scalable growth. This allows organizations to validate improvements at each stage, manage change effectively, and minimize operational disruptions.

One of the key enablers of this transformation is quickly becoming the application of AI-driven advanced analytics. Harnessing real-time insights enables manufacturers to optimize resource allocation, streamline production processes, and proactively address inefficiencies. Predictive maintenance, demand

forecasting, and automated quality control further contribute to productivity by reducing downtime and increasing overall equipment effectiveness (OEE). These capabilities position manufacturers to achieve greater agility, resilience, and competitiveness in an increasingly digital and data-driven industrial landscape.

As the industry shifts toward smart manufacturing, the convergence of MES, MOM, and emerging technologies will define the next generation of operational excellence. Companies that embrace this integrated, data-centric approach will be well-positioned to navigate the complexities of modern manufacturing and drive sustained business value.

CONTACT Software Elements for IoT: Going Beyond MES

CONTACT Software has developed a solution that extends beyond traditional MES, enabling smart factory operations that drive productivity improvements across manufacturing. The core philosophy behind CONTACT Software's approach is to ensure manufacturers can adapt to future business challenges, emphasizing minimizing the long-term total cost of ownership beyond immediate budget cycles, and maximizing long-term ROI.

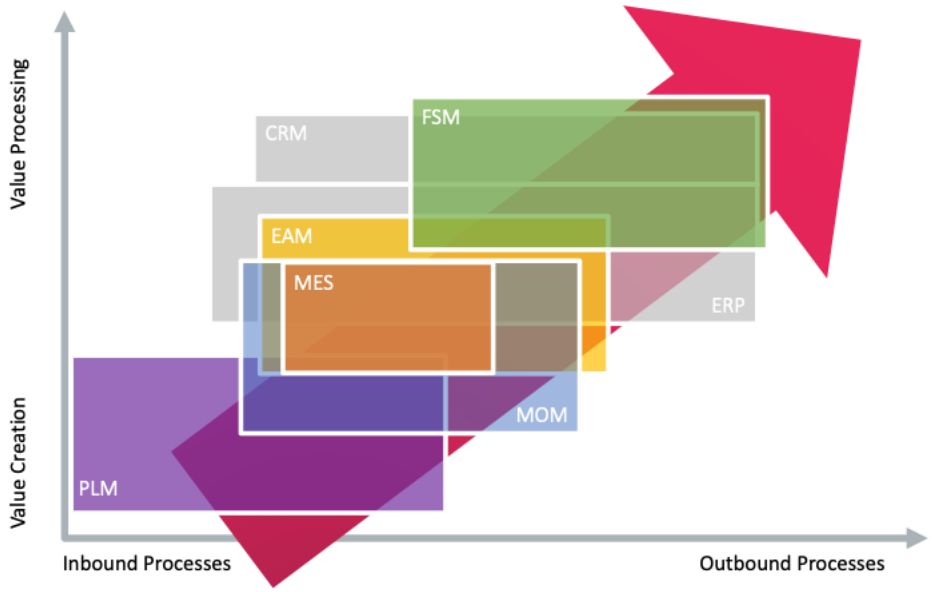
CONTACT Elements for IoT

At the heart of CONTACT Software's offerings is CONTACT Elements, a modular and composable architecture. A specific subset, Elements for IoT serves as the foundation for Industrial Internet of Things (IIoT) applications, integrating MES and MOM functionalities. CIMdata has previously highlighted the advantages of the CONTACT Elements Platform, recognizing its open, flexible, and resilient framework.[2] This architecture supports digitalizing value streams from design through validation, production, and after-sales operations in a closed loop. In today's interconnected business environment, isolated, hyper-optimized systems can often have an adverse impact on the overall enterprise value. Smart Factories demand a holistic approach, ensuring seamless integration between production equipment and required digital applications.

CONTACT Elements for IoT Key Features

CONTACT Elements for IoT enables the comprehensive digitalization of industrial assets across their lifecycle. Key capabilities include connectivity services that integrate IT, OT, and ET systems. This includes accelerator technologies such as AI/ML, simulation, 3D visualization, and time series analysis to enhance decision-making. Its process automation functionalities facilitate the deployment of digital twins and archive management, while microservices provide modular features such as ticket management. Layered on top, domain applications leverage microservices and industry-specific solutions to optimize process performance. This composable architecture allows organizations to achieve sustainable value while enabling end users to adapt and modify solutions using low-code/no-code capabilities.

[2] https://www.cimdata.com/en/resources/complimentary-reports-research/commentaries/item/20364-contact-cloud-bringing-contact-elements-to-the-cloud-commentary



Rethinking System Architectures in the Lifecycle of Industrial Assets

Incremental Implementation for Smart Factories

To facilitate the development of smart factory operations, CONTACT Software's solutions can be implemented in a modular and incremental manner. This ensures a balance between meeting long-term digital transformation goals and short-term measurable gains. As a first step, companies can pursue digital production initiatives within their factories that encompass asset management, maintenance management, document management, and operational data collection. A logical next step is to add connectivity and automation capabilities that reduce manual intervention and improve response times by incorporating IoT-driven machine data collection, monitoring and analytics, data-driven process automation, and predictive maintenance. Companies looking for advanced smart factory capabilities can enhance production networks through cross-site standardization, closed-loop engineering, multi-site deployment, and production control to drive further operational effectiveness. CIMdata advocates for an incremental approach that aligns with strategic objectives while mitigating implementation risks.

Business Benefits of CONTACT For IOT Smart Operations

The business benefits of CONTACT Elements for IoT Smart Operations enable companies to react quicker to real-time conditions, disruptions, and changing production demands with resilience, improved productivity and quality, and increased overall equipment effectiveness. By integrating real-time data, manufacturers can synchronize their supply chains, ensuring precise, up-to-date information flow and driving more efficient operations. Real-time analytics foster continuous improvement, while AI-driven energy management is used to enhance consumption based on production orders, enabling work shift priorities to be optimized. One customer reported energy savings of up to 23% by doing so.

Case Studies

thyssenkrupp Dynamic Components, a leading global manufacturer of powertrain components for hybrid and electric engines, has implemented CONTACT for IoT across its ten global production sites. Their implementation automates shop floor management, standardizes work schedules, and optimizes numerous operational processes. This integrated approach enables smooth cross-system workflows, real-time production control with KPI dashboards, and efficient shift handovers with comprehensive documentation.

Kübler, a high-tech specialist in measurement, transmission, and evaluation solutions, utilizes CONTACT Elements for IoT to streamline shop floor management and condition monitoring. By integrating IoT with PLM and MES, Kübler's solution delivers seamless data consistency and bi-directional communication between engineering and production. The company benefits from automated variant management, real-time process monitoring, and efficient coordination of customer orders and workforce shifts. The closed-loop methodology enhances optimizing production performance. This integration lays the foundation for Kübler's digital factory, driving efficiency and continuous improvement across the value chain.

Conclusion

Modern manufacturing demands solutions that extend beyond traditional MES, integrating PLM, ERP, and EAM to optimize operational efficiency across manufacturing asset lifecycles. CONTACT's MES solution, built on the CONTACT Elements for IoT framework, leverages a composable architecture that extends across MOM and other Smart Factory processes. CONTACT Elements for IoT's modular approach enables manufacturers to adopt Smart Factory capabilities incrementally, balancing risk while achieving rapid automation, enhanced connectivity, and streamlined process optimization. By providing data-driven automation and real-time manufacturing asset lifecycle monitoring, CONTACT's solution improves production efficiency, resource utilization, and operational agility. CIMdata recommends that organizations pursuing Smart Factory transformation include CONTACT Software in their evaluation.

About CIMdata

CIMdata, a global strategic management consulting firm, provides services designed to maximize an enterprise's ability to design, deliver, and support innovative products and services. For more than forty years, CIMdata has provided industrial organizations, providers of digital technologies and services, and investment firms with world-class insight, expertise, and best-practice methods on a broad set of product lifecycle management (PLM) topics and the digital transformation they enable. CIMdata also offers research, subscription services, publications, and education through certificate programs and international conferences. To learn more, visit www.CIMdata.com or email info@CIMdata.com.