

## The New MES: Distributed Architectures Are Helping to Bridge the IT/OT Divide

**A combination of today's edge and cloud technologies offers an unprecedented opportunity to effectively manage execution locally, while optimizing performance across the enterprise and extended supply chains**

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**T**he manufacturing execution system, or MES, has long lived in that no man's land between the real-time, deterministic world of plant-floor automation and the transactional realm of enterprise resource planning (ERP) systems. Indeed, the essential role of the MES has always been to manage production activities in accordance with overall business objectives, and to report back to the enterprise level on the results of those activities.

While the vision is straightforward, implementation has often been complex: MES tasks such as quality control, production tracking and maintenance management require one foot in the multi-protocol, purpose-built world of operational technology (OT) and another in the more uniform, structured realm of information technology (IT).

These domains, in turn, have traditionally been managed by different organizations whose very success was judged by different key performance indicators (KPIs). It's no wonder, then, that so many MES implementations over the years struggled to successfully align manufacturing performance with enterprise ambitions.

Today, however, a new set of business drivers and enabling technologies are finally bringing these worlds together. Manufacturing organizations are looking to implement new, digitally-driven strategies such as mass customization even as operational technologists move to adopt the networking and computing paradigms of their IT counterparts. And they're moving quickly, according to market intelligence firm IDC.

### **IT/OT convergence accelerating**

IDC's [2019 FutureScape report](#) "Worldwide Smart Manufacturing 2019 Top 10 Predictions" forecasts that before the year is up some 50% of manufacturers will have begun to incorporate governance models to integrate IT and OT, thus expanding the IT skills of OT users as these two domains continue to converge.

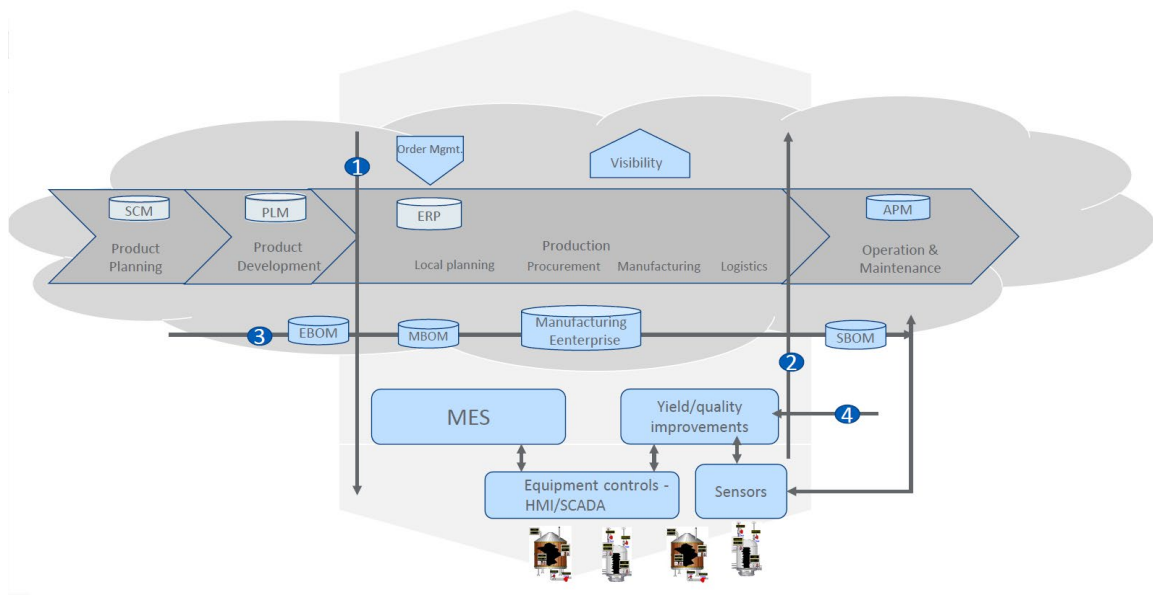
Further, 2019 will be the year that demand fluctuations and mass customization needs drive 35% of manufacturers to consider augmenting factory capabilities using data from customers, connected products and social media, IDC predicts.

Another prediction from that same report is that by 2022, 40% of manufacturers will have employed a cloud platform that crosses traditional IT boundaries and integrates operational technology in order to turn more data in value.

## Hybrid cloud/edge solutions emerge

In particular, unified platforms based on a hybrid cloud/edge architecture enable manufacturers to flexibly run control, computing, analysis and visualization tasks where most appropriate. In the context of MES, that means that production execution can be effectively run at the edge while longer term storage and data analytics heavy-lifting is done in the cloud. This not only reduces local infrastructure footprint but enhances system performance while reducing system maintenance needs.

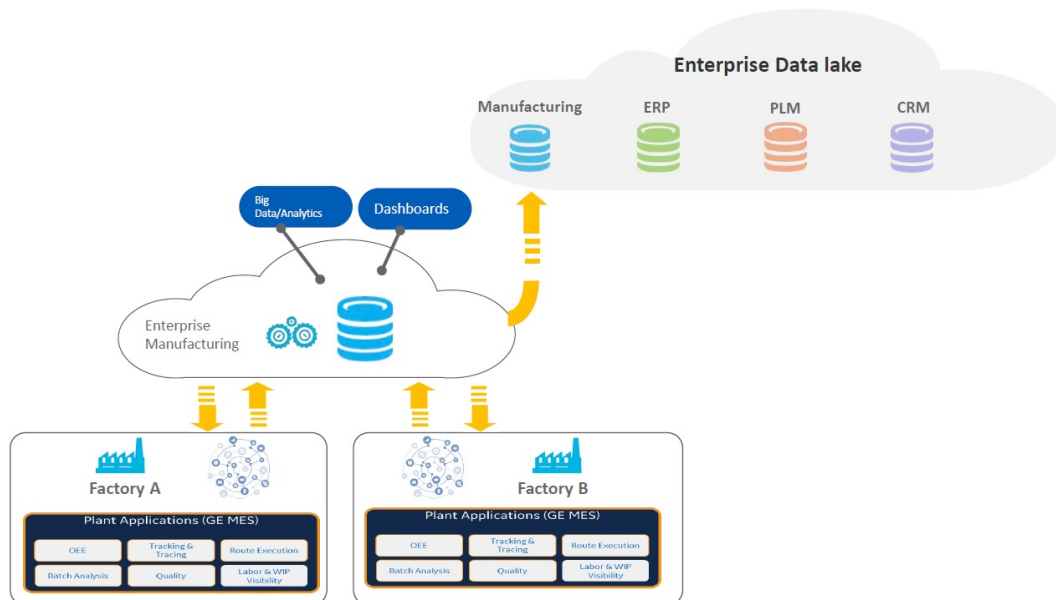
The Industry 4.0 model also calls for the horizontal integration of factory equipment and production operations across the value chain, starting from the raw-material supplier/product developer through to demand-planning components, supply-network-planning components, manufacturing elements, logistics/warehousing and ultimately end customers (Figure 1). An array of next-generation technologies represented by the Industrial Internet of Things (IIoT) and embodied in the new MES hybrid cloud/edge architecture make this possible.



*Figure 1. The horizontal and vertical integration of the manufacturing value chain enables 1) individualized production/process order data executed on the plant floor, 2) real-time flow of manufacturing data to the enterprise, 3) horizontal flow of information along the value chain (from engineering bill of materials, EBOM, to service bill of materials, SBOM), and 4) feedback loop of maintenance, defect and failure data to improve quality.*

As the traditional automation and information management pyramid as defined in the ISA 95 standard continues to evolve to a hybrid edge-cloud model that converges OT and IT functions, manufacturing data can finally be analyzed together with enterprise data to yield new levels of insight and understanding. And MES can live up to its promise.

GE Digital, for one, has created a hybrid cloud architecture that brings together IT and OT data for visualization and data analysis tasks, as well as providing linkages to longer term stores of enterprise data in the cloud (Figure 2). With this approach, time-sensitive execution on the edge works in conjunction with operational analytics in the cloud. Each persona in the organization—whether OT, IT, plant manager or maintenance engineer—receives a customized view with just the perspective and insights they need to advance the organization’s goals.

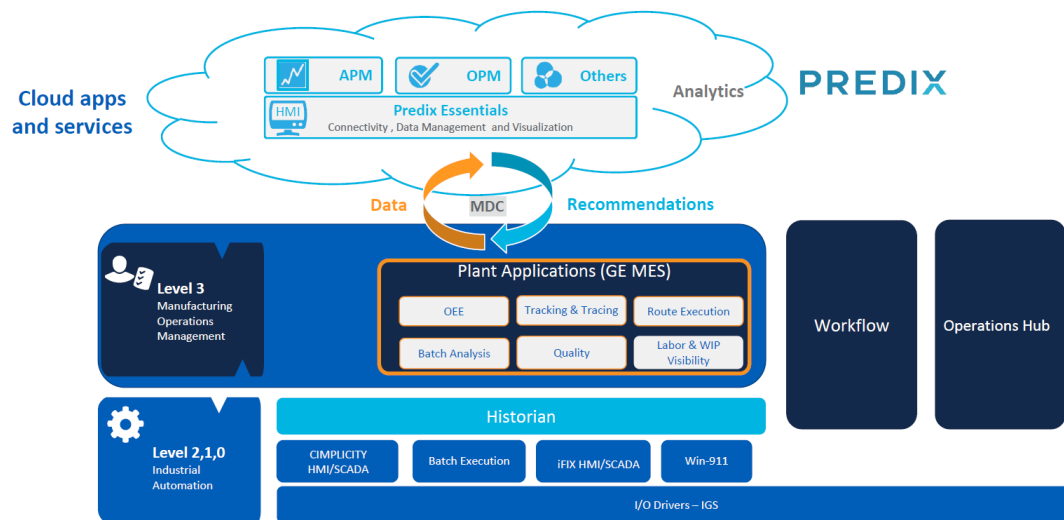


*Figure 2. GE Digital’s hybrid cloud model offers a single MES platform for both discrete and process applications. The hybrid approach enables the convergence of OT and IT functions by facilitating execution on the edge teamed with complementary visualization and analysis at the cloud level.*

The GE Digital approach to MES in particular (Figure 3) encompasses the company’s Plant Applications, which are designed to maximize overall equipment effectiveness (OEE), improve production scheduling and ensure product quality by leveraging real-time production data.

Meanwhile, the Predix Manufacturing Data Cloud, or MDC, consolidates, stores and transforms manufacturing data across plants, providing the foundation for high-level

analytics such as for asset performance management (APM) and operations performance management (OPM). Two other Plant Applications are Production Manager, which helps manufacturers reduce work-in-process (WIP) as well as gain tight control on quality and a streamlined supply chain, and Tracker, which helps to accelerate time-to-market and improve production performance at global scale. Importantly, GE Digital's MES solutions work both with GE Digital's leading industrial automation, simulation, APM and OPM solutions as well as those of third-party providers.



*Figure 3. GE Digital's hybrid cloud/edge MES solution provides an integrated approach to local, real-time execution at the edge together with cloud-based applications for analytics and visualization across fleets of assets and multiple plants and factories.*

Clearly, as manufacturing organizations seek to further optimize enterprise performance in the face of increasingly finicky customers, hybrid cloud/edge architectures and flexible, scalable MES applications will be key to making the long-time vision of flawless manufacturing execution a reality.

This white paper was made possible by GE Digital, which connects streams of machine data to powerful analytics and people, providing industrial companies with valuable insights to manage assets and operations more efficiently. For more information on GE Digital's hybrid edge-cloud manufacturing execution solutions, visit <https://www.ge.com/digital/MES>

