WHITE PAPER

CLOUD MES: AUTOMATE, TRACK, AND SCALE

AT A GLANCE

This white paper examines the evolution of manufacturing execution systems (MES) and explains why the cloud is the best platform for synchronization of MES with enterprise resource planning (ERP). Learn what to look for in best-of-class cloud MES solutions, including:

- The best MES effectively choreographs plant floor activities.
- The plant floor is often a "black box" to top floor executives. Cloud MES opens the black box to deliver visibility for better production decision-making.
- MES compliments and connects to ERP solutions designed to consolidate corporate-level data and information.
- A well connected MES makes your entire company more effective.

Typically, ERP systems do not provide comprehensive MES capabilities and connecting to them be cumbersome. See how manufacturers are being more competitive with a strategic technology investment on the plant floor.

Cloud-based MES can connect your plants to your enterprise together to provide a level of visibility that ensures production efficiency, continuous improvement, and resiliency to your operations.

MESs were originally introduced to add visibility to supervisor control and data acquisition (SCADA) systems, record production and scrap, and to choreograph the execution of the production schedule. An entire ecosystem grew up around this idea, with devices, sensors and applications communicating with each other, largely disconnected from the ERP business systems. In the best of situations, ERP-generated production schedules and pick lists would be downloaded into the MES and activity reports uploaded back into ERP. This was less-than-an-ideal situation as business leaders could only react to issues after the fact, which could be delayed by a day or a week.

An MES comprises detailed plant floor data and activities and, as such, can be self-contained for day-to-day operations. However, information to and from ERP, such as schedules, priorities, inventory, and master data must be shared with the MES. Integration is crucial. With disconnected systems, batch data transfer may be the primary mechanism but greatly limits the timeliness of communication between the office and the plant – in both directions.

Over the years, both MES and ERP expanded their scope and coverage to the point where the dividing lines between what functions and capabilities properly reside in MES and which belonged in ERP became less clear, and in some cases began to overlap. Is quality management a part of MES or is it an integral function of ERP? How about scheduling, tooling and maintenance? Both ERP and MES have a role to play in these functions, and there are logical integration points for tying ERP and MES together. However, there are many variations in how a company defines those integration points based on how they run their business.

In fact, the various options and needs for MES have grown over the years and have resulted in another term to describe the category: manufacturing operations management (MOM). While the definitions vary, the two have become synonymous with addressing the needs of control and visibility for manufacturing operations. For the purposes of this paper, MES will represent both MES and MOM.

The Value of MES

The best MES systems deliver a real-time production ecosystem that guides, initiates and reports plant floor activities as they occur for optimized and responsive plant operations and processes. Although many MES vendors integrate different components together, a solution that was designed as a unified production environment will result in a single version of plant data and intelligence and will result in higher accuracy, accessibility, and control. Real-time visibility, including inventory movement and location during work-in-progress (WIP), worker and equipment activities and status, production counts and quality measurements provide operators and managers the infrastructure they need for quicker access to actionable information to make more timely decisions. Better decisions made with confidence in the data results in improved quality, efficient operations, and reliable schedule adherence.

For every action or transaction in production, data is captured in the MES system. Every unit of inventory is tracked for precise genealogy and traceability from the time it enters the MES domain until it is transferred to the parent distribution system. Visibility with high-resolution genealogy results in granular and accurate inventory tracking that can align inventory levels, eliminating both shortages and overages. And because inventory and production reporting are part of the unified MES ecosystem, traceability firmly ties inventory batches, lots or serial numbers to equipment, day/time, operator, measurements, and more for effective traceability to reduce the risk and exposure of a recall. With this data, manufacturers can quickly and definitively identify relationships, content and source information to trace the effect of any potential quality issue or improvement opportunity.

The key to limiting the impact of a recall is quickly and positively identifying all affected inventory and where it came from as well as finished products and where they were shipped to contain your culpability to a minimum versus a whole shift or production run. This bi-directional traceability can bring the needed visibility for manufacturers to trace issues upstream through the supply chain or downstream to customers.

Compliance with regulatory and quality standards should be delivered through an integral quality control and checkpoint system, to minimize waste and ensure standards compliance as well as providing full documentation. Integral process control with embedded control plans increase process repeatability, predictability, and quality. Error-proofing enforces required process activities, measurements and inspections through mandatory reporting before the work is allowed to proceed to the next step. Quality compliance documentation can be embedded into the process routings to achieve and retain quality certifications. And finally, automatic and integral statistical process controls provide real-time visualization of trends for operators and historical analysis for continuous improvement.

Plant-floor sensors and devices feed data directly into the MES ecosystem for accurate and timely information availability. Work instructions and documentation are made available directly to the point-of-activity at work centers and line stations where they are needed.

The detailed asset performance data can be used for predictive and preventive maintenance planning and early detection of potential need for equipment adjustments or repairs. Similarly, MES data can feed tooling management applications for dispatching and maintenance of tooling and fixtures. Because all activities are digitized, accurate costing results can be gleaned from the detailed data and can be communicated up to the ERP system. An effective MES infrastructure supports open communication and data exchange in both directions with the corporate ERP system.

MES in the Cloud Offers Scale and Reliability

Whether MES is an integral part of the corporate backbone or a separate, best-in-class addition, cloud deployment makes sense for several reasons. Uptime for plant operations is critical and if the enterprise system is down for planned or un-planned maintenance, the plant cannot function. With a cloud deployment – especially true with software as a service (SaaS) – all maintenance and support is handled by an organization whose core competence is keeping the system 'up' and available. Moreover, some cloud solutions continuously deploy enhancements and fixes so there is no need to take the system down for upgrades. If there is a service interruption, there are always live back-up (hot site) facilities available. In addition, as economies and markets rise and fall, IT resources to support plant expansion and contraction are scalable instantly without significant IT investment or involvement.

With effective integration between the relevant data streams, plants can configure and re-configure their MES system to suit their needs without impact on the parent ERP system. Configuration and testing is done "offline" and when the system is ready to be deployed, it happens with a flick of a switch. Moreover, in support of the goal of MES standardization, subsequent plants can be brought on-line using the same configurations in a fraction of the time and create a standard configuration across the enterprise to make management more effective.

Since the industrial automation network is connected to physical hardware and must support lots of data at potentially high speeds, it has traditionally been supported by an on-premise server. Data is communicated to the MES as required and with cloud MES, synchronizes using that edge server. MES offers very tight control of the various aspects of production including recording of uptime, production, and scrap. With a cloud deployment, any and all data about production, inventory and quality can be accessed by remote supervisors via mobile devices and the Internet. This enables managers to quickly engage in urgent issues whether they are on the other side of the plant or on the other side of the planet.

Quality managers can monitor, react and make immediate decisions to isolate and contain potential quality risks before they "escape" and result in charge-backs or worse – a recall. Should a quality issue result – regardless of fault – traceability to potential failure points can quickly uncover the culprit – even if caused by an upstream supplier – and enable quick resolution and reporting. Most importantly, this information is available in real time from anywhere through a simple Internet connection. A growing number of manufacturers are relying on cloud-based MES solutions to help manage their business because of this flexibility and the ability to be much more responsive to plant floor activities.

Cloud deployment and SaaS have been proven to be effective strategies for ERP with a rapidly growing number of enterprises opting for the cloud as the preferred platform for their enterprise system. These same benefits are available for cloud-based MES. Cloud/SaaS allows the manufacturer to focus on high-value activities like designing, manufacturing and distributing product by off-loading the IT burden while eliminating any worries about support, security and keeping the systems up-to-date and productive. As companies grow and expand, they can do so more easily without the traditional expansion of IT footprint, budget, and staff and can focus their resources on their core competency – production. Moreover, valuable technical professionals - difficult to find in today's tight labor market - can be re-directed to focus on more strategic pursuits such as spending more time with data and process analysis.

Cloud-based MES can tie together a distributed organization like no other technology. Plants and operating locations around the globe are brought together in the cloud to more closely coordinate activity and bring the entire enterprise under a single system of record while retaining the separation of each location's unique processes, functions and system needs. Plant-specific production, inventory and quality information is readily accessible by allied plants (if authorized) as well as supervisory and executive personnel from anywhere at any time, combined across facilities or separately as needed. And cloud-based MES is the perfect compliment to the growth of industrial IoT (IIoT), helping gather, connect and analyze virtually any data from production operations to drive greater operational efficiency.

What to look for in Cloud ERP/MES

The primary characteristic for an MES is functional breadth followed by functional depth. You want to be sure that your system will provide the full range of applications and features that you need to effectively manage your business. Key characteristics to consider are:

- An error-proofed production ecosystem that supports rigid operational control.
- High-resolution visibility and traceability tying production activities and quality performance with inventory flow.
- Easy access to APIs that can connect to your ERP.

Your plants must look for MES functionality that includes industrial-strength quality execution, production control, inventory, and maintenance management. A properly integrated solution can provide error-proofing capabilities that are not possible with more loosely connected tools. For example:

- Barcode scanning at every point that material is received, split, or moved. Integrated production control will protect against using the wrong material for the required bill-of-material (BOM).
- Disciplined inventory management gives the business clear visibility to work-in-progress material resulting in higher confidence to reduce excess inventory and the associated carrying costs. In addition, the real-time status can reduce or eliminate physical inventory counts.
- In-process inspection that provides real-time feedback to the operator in the case of a quality problem and with integrated statistical process control (SPC), to warn the operator when inspection measurements are trending toward specification limits.
- Central data management that serves as the single version of truth for all elements of the system. When properly integrated with quality, changes to BOMs, specifications, or routings get automatically communicated through a paperless system directly to workcenters eliminating delays that could result in waste.
- Integral maintenance management that ensures machines have proper maintenance and restrict jobs from being scheduled before machines are ready. Tooling and inspection controls ensure devices are within calibration before they are allowed to be used in production.
- Digital work instructions and set-up instructions when integrated with production processes can eliminate errors and support safety initiatives by preventing machines from being started until they are properly set up.

Cloud-based MES supports local operations for individual plants while at the same time participating in the corporate information infrastructure. Your MES should be effectively integrated with your ERP system in order to exchange and synchronize data. Best-in-class MES in the cloud is designed to integrate with corporate ERP, whether on the cloud or on-premise, without disruption or extensive ERP customization.

In today's highly competitive environment, manufacturers continually seek ways to improve throughput, control costs, manage quality and maintain the high levels of traceability and control that customers and regulators demand.
MESs provide an error-proofed production and quality ecosystem that controls and monitors the manufacturing process, synchronizes information with production scheduling, and provides broad visibility for more timely, confident decision-making.

MES in the cloud provides a more modern, future-proof IT infrastructure with increased uptime and deployment flexibility while off-loading security and access controls, system support and maintenance, and hardware costs to a SaaS provider. The control and visibility that it enables makes production decision-making more effective.

Stay ahead of your competition through your next strategic technology investment on the plant floor - MES on the cloud.

ABOUT PLEX

Plex Systems, Inc.® delivers the first smart manufacturing platform that empowers the world's leading innovators to make awesome products. Plex gives process and discrete manufacturers the ability to connect, automate, track and analyze every aspect of their business – from the shop floor to the top floor – to drive business transformation. Built in the cloud, the Plex Smart Manufacturing Platform includes ERP, MES, Industrial IoT, supply chain management and analytics to connect people, systems, machines, and supply chains, enabling them to lead with precision, efficiency and agility in an ever-changing market.