



LIGHT MANUFACTURING EXECUTION SYSTEM (MES) FOR HI-TECH MANUFACTURING

Abstract

In manufacturing, not all solutions are one size fits all. Some job shop manufacturers and discrete manufacturers, for instance, find that the off-the-shelf Oracle Manufacturing Cloud solution does not meet their engineering, production, and quality requirements. At the same time, a more sophisticated manufacturing execution system (MES) would be overkill for their needs, considering the complexity, level of investment, and change management associated with it. What they need is a solution that can digitize the shop floor and turn it into a paperless workspace. Thus, Infosys developed the Light MES solution using open-source technology. The solution not only addresses the basic shop floor needs, but also provides a platform to develop and model more complex production use cases. In this white paper, we walk you through its capabilities and solution drivers that help in increasing uptime, cost accuracies, optimizing inventory, and simplifying change management.



Overview

The manufacturing industry is changing rapidly with the introduction of new technologies that are replacing legacy systems. While manufacturing processes are becoming leaner with advanced technologies, standardized manufacturing and quality processes may not suit all manufacturing models.

With hi-tech manufacturing enterprises migrating to the cloud, the business imperative is a digitalized manufacturing execution system that is tightly coupled

with standard ERP frameworks. It should be able to meet engineering and quality requirements on the shop floor and be highly specialized with rich and varied features. Such solutions are available, but their opportunity cost makes them financially unviable for hi-tech manufacturers.

Infosys has developed an in-house digitalized manufacturing execution system - Light MES. It not only meets the needs of hi-tech manufacturers but is also affordable. The platform solution has an in-built system with a modular business

modelling capability for engineering, production execution, and quality. It has a fail-safe mechanism, with minimum data entry requirements, and is integrated with Oracle Cloud in real time.

In this white paper, we walk you through the Light MES solution, detailing how it can help hi-tech manufacturers meet their manufacturing needs with a limited budget.

The Light MES Solution has been built by Infosys Oracle Cloud Services in collaboration with Hi-Tech Manufacturing offering Infosys Stratos, part of Infosys Cobalt.

Overview

Manufacturing enterprises seek a solution that has a simplified user interface with a touch screen, intuitive web consoles, and minimum data entry requirements. Oracle Manufacturing Cloud delivers mixed-mode manufacturing execution in the same plant with integrated quality and embedded analytics, but these features may not be sufficient for job shop manufacturing. It explains why manufacturers want to retain their legacy MES systems.

For an MES solution to be successful, some limitations need to be addressed to achieve seamless manufacturing operations:

- The operator needs detailed instructions or work methods, with images and documentation at various points of the manufacturing execution process
- Operator qualifications need to be defined, so that supervisors can place them at appropriate machines across the shop floor
- Operations need to be divided into sub-operations and assigned to different sets of users
- Multiple operations of a work order needs to be planned and executed simultaneously with proper time recording, improving plant performance
- Various manufacturing scenarios and customer requirements require a single set of quality benchmarks for various steps of manufacturing operations

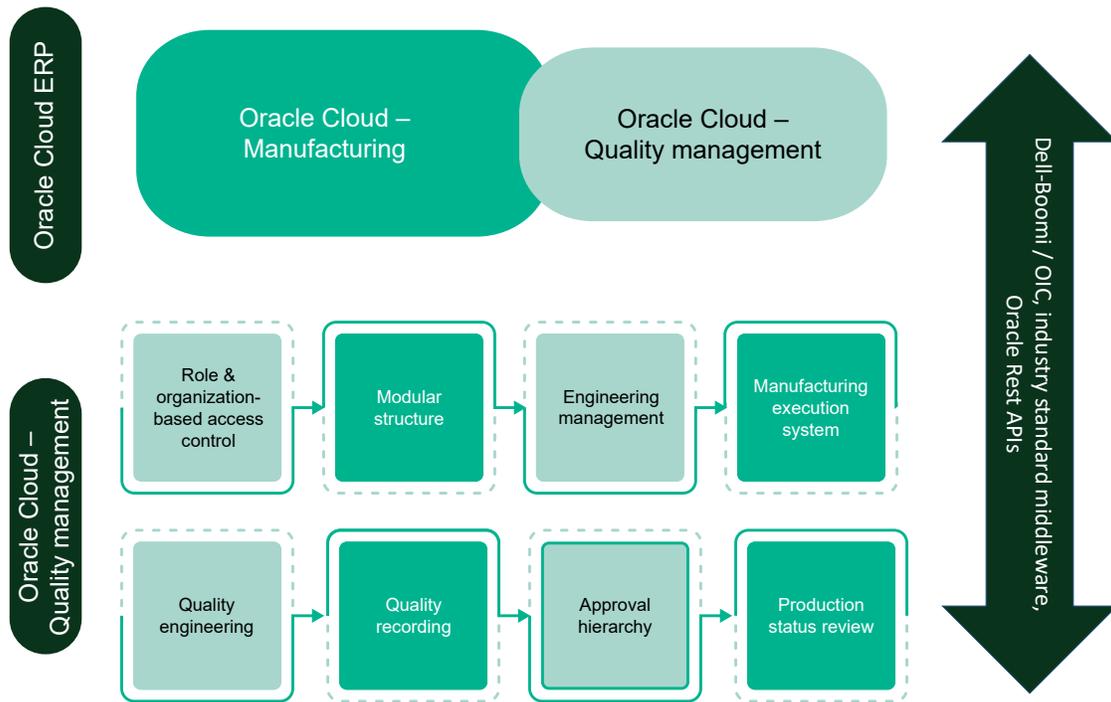
In addition, the MES solution should be able to integrate with a global ERP application such as Oracle Cloud.

Solution Features

Infosys developed the Light MES solution taking into consideration the needs of hi-tech manufacturers. It can manage all discrete manufacturing and quality transactions with the same efficiency of a best of breed MES product. Light MES enables manufacturing engineers, production operators, and production supervisors, quality control managers to execute their jobs perfectly. It also enables them to report production and quality metrics and efficiency. Moreover, Light MES is not a standalone product - it integrates with Oracle Cloud, and when required, can work with multiple middleware tools such as Oracle Integration Cloud (OIC) or Dell Boomi. It is a fully configurable PaaS solution using open-source technology, reducing for software licensing, which means lower costs.

Light MES offers:

- a. Modular structure: The MES is classified into multiple categories – Admin, Engineering, Execution, Quality and Reporting
- b. Role- and organization-based access control: Specific role definitions are created for each module with execution and management capabilities
- c. Master data management: Maintenance of data needed for engineering and production execution
- d. Engineering management: Enrichment of the work definition with additional features and sub-steps
- e. Quality engineering: Ability to enrich the work definition with category-based quality characteristics
- f. Approval hierarchy for engineering readiness: Approvals for engineering and quality for production execution readiness
- g. Work order execution: Ability of the production managers and production operators to manage their daily operations
- h. Quality execution: Ability to record quality characteristic values and record non-conformance
- i. Production status review: Ability of the management and execution personnel to review the current shop floor status



A. Modular Structure:

Light MES is categorized into multiple sub-sections

- Role & Access Control
- Master Data Management
- Engineering Management
- Quality Engineering
- Approval Hierarchy
- Work Execution
- Reporting & Dashboards
- Label Printing

B. Role-based Access Control:

Role-based access control is a set of rules that govern and restrict user access to specific systems / processes or user operations in the assigned organization. This also restricts users from accessing information for which access is not provided. The role configuration is designed based on a modular structure with both view and execution access. An individual could be assigned multiple roles with organization access as an additional control on the site of operations.

C. Master Data Management:

Manufacturing engineering and execution needs certain master data to execute operations. Oracle Manufacturing Cloud has such master data, which needs to be interfaced with Light MES to enhance the sequence of steps. Master data includes instances such as controls on access by work centers, operator qualifications, all of which must be maintained. Execution of manufacturing processes can be controlled based on master data.

D. Engineering Management:

For a manufacturing part, Oracle Cloud has the item with its attributes, its bill of materials (BOM) and its work definitions. There can be multiple work definitions, depending on the type or its alternatives. But this is not sufficient for most shop floor execution teams for operations.

Infosys built in a capability for Light MES to further enrich the work definition. It caters to the need for sub-steps in operations, as well as for parallel execution. Also built into the tool is the functionality to provide assembly images, instructions, and documents needed for optimal execution.

The solution also includes the ability to create separate enrichments per work definition type, version, and item version. This version control function and the ability to map the start of the execution process make the solution easy to manage.

E. QualityEngineering:

Light MES needs only a single quality plan per item and can map characteristics to operation steps and sub-steps, and map them to different quality category levels such as standard, critical. It also allows users to define sample size for each quality category level.

F. Approval Hierarchy:

Sequencing with sub-steps and additional notes, attachments and imaging for engineering, and mapping of quality characteristics to operation steps require validation and approval for execution. Light MES provides separate role-based approvals for engineering and quality, with additional controls.

G. Work Order Execution:

The Light MES production execution console is a user interface management system that executes all work order operation steps, down to the most basic level task. It is tightly integrated with engineering and quality processes, to ensure fast-track paperless manufacturing. It empowers shop floor teams and enables process and quality control.

All work orders are created in Oracle Manufacturing Cloud and interface with the MES. Work orders are executed in MES and completed operations are booked back to Oracle Manufacturing Cloud. The process involves time recording, parallel processing, label printing, operation completion, operation image loading, and referencing with controls on operator qualification and work center access control.

H. Quality Execution:

The production execution console in Light MES enables digital quality operations management. It provides everything the operator needs to follow the process, procedures to maintain and continuously improve production quality. The required quality inspection characteristics are associated with the manufacturing operation sequences, enabling operators to enter in line quality results. Additional rework hours reporting, non-conformance reporting, reject and scrap material with approvals, recording sample based inline quality results are a few of the options available.

I. Production Status Review:

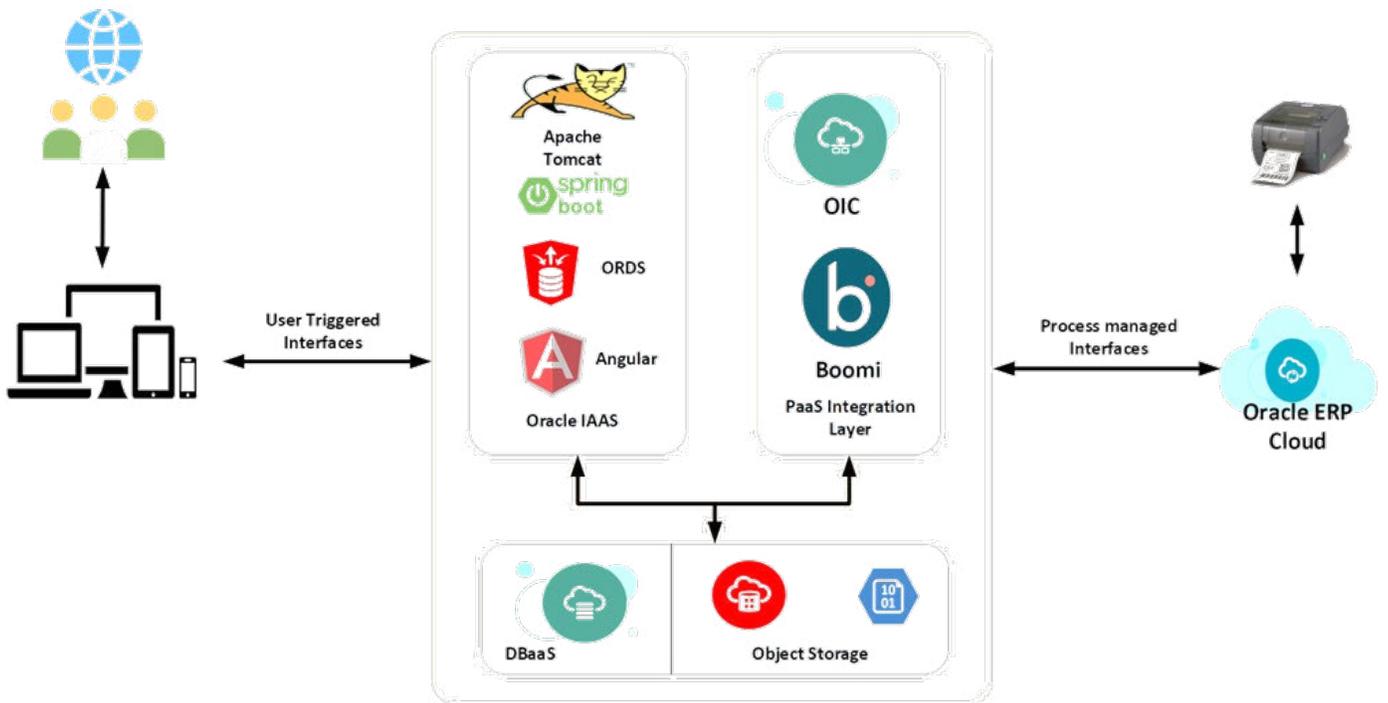
Light MES also provides a dashboard which provides a comprehensive view detailing all work orders in progress with their status in terms of operation completion and progress, and material shortages. It also provides a clear picture of the backlog of work orders.

Integration Scope and Architecture

The Light MES solution was developed using open-source technologies with Oracle Cloud Integration using Oracle Cloud Infrastructure or Dell Boomi. The integration involved both user-triggered for an online transaction mode, or process-managed using a schedule for a concurrent transaction mode. A high-level view of the technical architecture:

Solution approach consists of four pillars – engineering, execution, quality, reporting





Benefits of Light MES

Business impact	<ol style="list-style-type: none"> 1. Global standard manufacturing execution system 2. Increased customer satisfaction: Compliance with customer's quality standards requirements 3. Harmonized business process across engineering, manufacturing execution, quality check and assurance 4. Ease of adoption of improved business process, increased agility in responding to changes 5. No licensing hassles, and available over mobile devices to business users
Cost benefit	<ol style="list-style-type: none"> 1. Fail-safe system leading to fewer instances of non-conformance, reduced rework, and customer returns 2. Guided manufacturing reduces reliance on skilled / experienced assemblers on the shop floor; direct labor cost reduction
Productivity	<ol style="list-style-type: none"> 1. Increased efficiency by reducing number of systems, touch points, modern user-friendly UI 2. Integration with allied systems (Oracle SaaS) eliminates redundancy in data entry 3. Integration with 3D drawings, quality, ERP ensures that all information is available in one place for operator and eliminates the need to navigate multiple systems and screens 4. Production status dashboard offers production visibility to supervisors and management
Scalability	<ol style="list-style-type: none"> 1. Solution addresses the major and most often highlighted white space in Oracle SaaS manufacturing – the need for a modern digital manufacturing execution system 2. Solution is scalable across industries, types of manufacturing and technology platforms 3. UI compatible with desktops, tablets, and mobile devices – ensuring complete scalability across workstations and functions

Conclusion

The Light MES solution provides the tools to manage and monitor work order execution, ensure products are built to specifications, and document all manufacturing execution details and material flow in real time on the shop floor.

It streamlines work order flow with real-time integration of work definition and production execution, tracks operational

execution, evaluates quality, plant resource utilization through clock in and clock out. It improves operational efficiencies by reducing production costs and providing clear visibility into manufacturing execution. Real-time integration with Oracle Manufacturing Cloud facilitates work-in-progress (WIP) execution and valuation. Persona-based manufacturing engineer and production operator consoles provide clear visibility into manufacturing.

With reliable, real-time information, managers and operators are better equipped to streamline order flow and production execution, track the transformation of products from raw materials into finished goods promptly and evaluate yield, quality, and resource utilization for continuous improvement. The production status dashboard provides the right information at the right time to shop floor managers to optimize current conditions and improve production output.



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Arijit has over 18 years of consulting, project management, and pre-sales experience. His expertise includes Oracle Cloud as well as applications for supply chain management and procurement. He has vast implementation experience with global clients in North America, Europe, and Asia. He is the product owner and anchor for the Infosys Oracle Cloud's Stratos Hi-Tech industry platform solution.



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Infosys Cobalt is a set of services, solutions and platforms for enterprises to accelerate their cloud journey. It offers over 14,000 cloud assets, over 200 industry cloud solution blueprints and a thriving community of cloud business and technology practitioners to drive increased business value. With Infosys Cobalt, regulatory and security compliance, along with technical and financial governance comes baked into every solution delivered.

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