Integrating Your ERP and MES to Improve Operations

Advanced enterprise integration applications enable companies to leverage real-time information exchange between the business layer and the production layer to increase operational efficiency.

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Introduction

In the journey toward operational excellence, companies have invested a lot of money in Enterprise Resource Planning (ERP) systems, but the promise of easy integration between the top floor and the shop floor has been more difficult than imagined. Companies have had to spend a significant amount to enable communication between their ERP and MES layers because these systems speak different languages, and seamless communication requires extensive translations, resulting in added time and costs.

The good news is that the communication gap is narrowing with the introduction of ISA-95, the international standard for the integration of enterprise and control systems, and B2MML, a set of XML schemas that implement the data models in the ISA-95 standard. Companies that implement solutions that take advantage of these accepted standards can more easily integrate their disparate systems and gain better visibility and coordination between the enterprise and execution layers.

This paper discusses the challenges today's manufacturers need to overcome and the benefits of enabling real-time bi-directional integration between the ERP and MES systems to optimize plant operations. Tight connectivity is even more critical in today's fast-paced, global market environment, where reduced cycle time between supply and demand is key to success. Companies that have successfully integrated the top floor with the shop floor are realizing faster cycle times, higher throughput, better quality and improved decision making for a significant competitive advantage.

The negative effect of information silos

There are a number of challenges that today's manufacturers face, which hinders them from understanding what is happening on the plant floor as well as with customers and suppliers. The disparate nature of multiple systems across the enterprise makes it difficult to respond to changing customer demands and to achieve faster time to market and tighter inventory management—all of which contribute to efficiency and cost control across the supply chain.

Lack of visibility to the plant floor - Manufacturers need to understand problem-causing events and view them holistically instead of in isolation, as the lack of integration and visibility into the plant floor causes decision-making delays—resulting in longer cycle times for customers, lower customer satisfaction, and the inability to efficiently meet the demands of a fast-changing global marketplace.

Management needs to know what is happening on the plant floor while manufacturing needs up-to-date information on demand changes to help develop and optimize their schedules. Information at the enterprise layer gives manufacturers the ability to see the "big picture" and to make the appropriate changes based on what is happening on the plant floor to improve the overall efficiency of the operation.

Lack of integration of disparate systems - ERP systems know what customers want, and MES systems know how to build it. However, oftentimes these systems have been created by different software vendors and as such, speak different languages. Many manufacturers have resorted to entering data in multiple systems or inventing their own ways of communicating between these systems—both very costly and inefficient models.

Manufacturers need the ability to communicate seamlessly between these systems so they can gain visibility into orders, control inventory costs, and act on up-to-date order changes—critical factors to improving their operations.

Slow time to market - As the global marketplace has evolved, some companies have not been able to react quickly to the changing demands of consumers who are working at Internet speed and who have a wide variety of vendor choices. By communicating between the enterprise layer and execution layer, companies can better match supply with actual demand—reducing inventory and responding quickly to customer needs.

High inventory costs – Excess inventory—whether as raw materials, work in progress, and finished goods—ties up cash in the business that can be put to better use elsewhere. Businesses face the challenge of not being able to detect when inventory falls below a predetermined level so they can reorder from suppliers as needed.

Keeping inventory to a minimum frees up capital and also reduces the risk of having unwanted inventory on hand. If there is a quality or maintenance issue on the floor, real-time notification to the business layer can be made, enabling immediate action to address the issue.
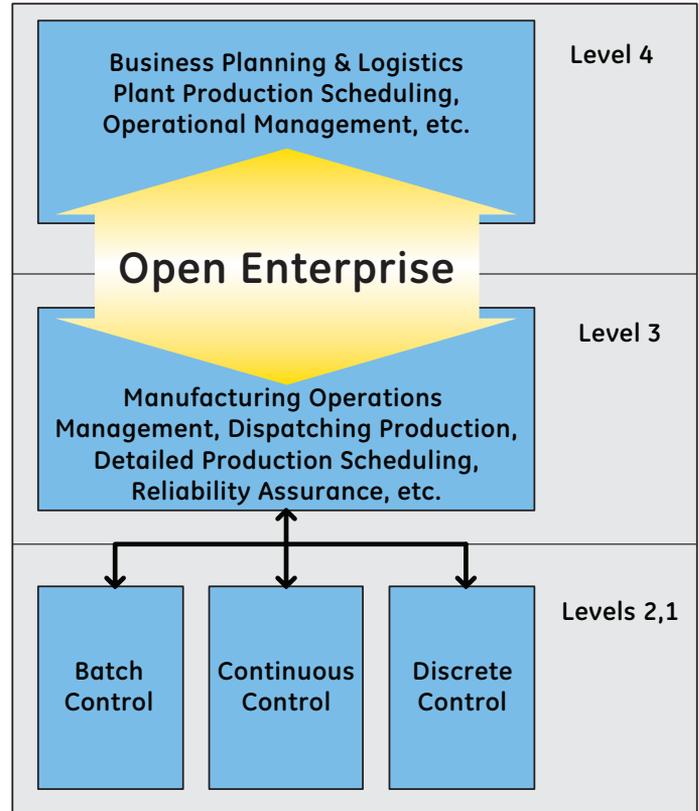
Enabling flexible integration between MES and ERP

To achieve operational excellence, manufacturers need increased visibility from the top floor to the shop floor with the ability to view the status of orders, inventory changes, and overall process performance. Seamlessly connecting manufacturing processes with the enterprise layer requires a tightly integrated yet flexible solution that leverages the latest technologies and standards.

Software applications such as GE Intelligent Platforms' Proficy* Open Enterprise connects a company's ERP system such as SAP to the Proficy set of MES solutions, using ISA-95 and B2MML standards to communicate valuable information between the two systems. As a single integration point, it allows decision makers at the enterprise level to leverage real-time information about production processes—providing increased visibility and insight for better business decisions—and for plant operators to leverage business information to improve fulfillment.

Such solutions can drive operational excellence and lean manufacturing by greatly improving visibility and efficiency while reducing costs due to factors such as excess inventory or waste. For example, any issue on the plant floor that may affect customer fulfillment can be communicated to the ERP system so steps are taken to mitigate the issue. Real-time notification can help correlate supply with demand—averting the need for a higher level of inventory than necessary and ensuring timely responsiveness.

This next section explains how Proficy Open Enterprise supports industry standards, enabling ease of use and closing the communication gap for improved visibility from the top floor to the shop floor.

Business Planning & Logistics Plant Production Scheduling, Operational Management, etc. — Level 4

Open Enterprise

Manufacturing Operations Management, Dispatching Production, Detailed Production Scheduling, Reliability Assurance, etc. — Level 3

Batch Control | **Continuous Control** | **Discrete Control** — Levels 2,1

Features of ISA-95:

- International standard that does not change with each new release from a vendor
- Defines the information that must be exchanged between the ERP and MES layers
- Has a broad support base of many companies
- Technology and vendor independent

By enabling real-time orders to be downloaded into MES from your ERP system and for performance information to be uploaded to your ERP—Proficy Open Enterprise serves as a bi-directional transport of data between the two layers for improved fulfillment and operational efficiency.

The benefits of utilizing ISA-95 and B2MML integration standards

In order for companies to survive and even thrive in the fast changing global economy, they need operational flexibility and quick implementations. Due to the challenge of high inventory costs discussed earlier, they can no longer afford to maintain a large safety stock of finished goods inventory on hand, which is essentially tied up cash that can't be used to grow and run a business until it is sold. Excess inventory should be avoided at all costs and at all levels—raw material, work in progress and finished goods.

Solutions that support ISA-95 standards such as Proficy Open Enterprise provide ease of integration and allow systems at different levels to communicate with each other without the need for costly custom setup or maintenance. The use of standards enables the exchange of information to flow freely from the enterprise level to the manufacturing execution level, which is critical as it allows companies to avoid costly issues such as excess inventory.

Furthermore, standards-based and "out-of-the-box" activities and templates enable companies to leverage quick time to value, which is critical for a competitive edge. The flexibility and speed with which they can execute activities such as aligning manufacturing processes with actual demand helps optimize operational efficiency while maximizing customer satisfaction.

Proficy Open Enterprise supports the following ISA-95 models:

Production Schedule

The ERP system sends the Production Schedule to the MES system, and based on this schedule, the MES system creates a detailed production schedule that accounts for limitations and other activities that the ERP system has no knowledge about such as cleaning of vessels, changeovers, equipment downtime, order sequencing and plant capability. The Production Schedule contains information that Level 4 (ERP) sends to Level 3 (MES).

The Production Schedule sent by ERP can be for a certain period (e.g., a week). Within this schedule is multiple production requests, for example, "create 90,000 cases of beer." Within these production requests are details on how the products should be created, specifying the personnel, equipment, material, material produced and material consumed requirements.

As shown in the Production Schedule example below, the ERP system downloads the production parameters, which help define what is to be created and the impact it will have on capability and resources within the plant.

Production Schedule – e.g., Daily Packaging

Contains:

- Production Requests – 90,000 cases of beer to be completed by midnight

- Production Parameters – Can size, fill size, lid size, case size, machine speeds

- Personnel – Operators, testers

- Equipment – Fillers, pasteurizer, packers, wrappers, palletizer, barcode printers and inline inspection

- Material Produced – 6 pack cases of beer (SKU) 16 oz

- Material Consumed – Cans, lids, cases, packaging material and volume of beer (Real-time countdown of inventory to have minimum overruns)

To support the large SAP install base worldwide, Proficy Open Enterprise can easily integrate into SAP using off-the-shelf available middleware.

Production Performance

The Production Performance contains information that Level 3 (MES) sends back to level 4 (ERP) as a result of the production request sent down from ERP. The Production Schedule contains the product requests, while Production Performance is a response to those requests. For example, maybe production only had enough inventory to produce a percentage of the requested products, or maybe more material was used than expected due to bad material.

In this case, the enterprise layer needs to know this information to control inventory and to order more material when necessary. This consumption information helps the business understand what is actually being used and can help identify waste as well as when inventory needs to be reordered in the optimal time-frame so there is not too much to trap cash or too little to risk halting of production.

The Production Performance contains such information as the actual production completed, material consumed to complete production, personnel, and the equipment used. Other informa-tion can also be contained within the product response such as comments from the operators. A production response may also include the status of the request such as the percent complete, finished or aborted—providing the enterprise layer with visibility into what actually happened on the plant floor compared to the initial request.

During production, the MES can respond to the ERP system with incremental updates on the progress of an order. This allows the business layer to understand the status and to verify whether the order will meet customer delivery requirements. Once a production schedule is downloaded from ERP to MES, the MES system can respond with an order confirmation to the ERP sys-tem to communicate that the order has been received and is queued up for production.

As shown in the following Production Performance example, a production response could send the following information to the enterprise layer. It communicates that the manufacturing system has produced 16,000 of the 90,000 requested cases and has consumed more material than it should have due to reasons on the floor (e.g., material quality issues).

Personnel Actual:
  Palletizer Operator

Equipment Actual:
  Palletizer

Material Produced Actual:
  16,000 Cases (P.O # 1234543216)

Material Consumed Actual:
  105,000 cans (P.O # 1234543216), 13,000 gallons of beer (Batch Id: AEC12343), 110,000 lids, 21,000 units packaging material

Status:
  In Progress

Supporting B2MML

While not all solutions support B2MML (Business to Manufacturing Markup Language) standards, which are an XML implementation of the ISA-95 standard, those that do offer additional flexibility and easier communications, particularly for customers who want to leverage their existing ERP invest-ments. The standards make it easier for businesses to integrate with their MES solutions regardless of what type of ERP system they have (e.g., SAP, Oracle)—ensuring that the data can be pro-cessed and enabling communication across the business.

Proficy Open Enterprise supports B2MML, translating messages to and from an ERP application. The ERP application generates a master production schedule and sends this in some type of format (e.g., IDOCs) to a middleware layer (e.g., SAP MII). The middleware layer translates the IDOC into B2MML, which can be passed and processed within Proficy Open Enterprise. Proficy Open Enterprise can then save the data within Proficy's ISA-95 model and/or route the message to other applications such as Proficy Plant Applications. Alternatively, Proficy Open Enterprise can create response messages in a B2MML format and send these messages to the ERP system.

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Single point of connectivity

In addition to standard translations, it is extremely important to have a single point from which information can be shared between the ERP and MES systems, as well as routed to other applications across the business. Having a central point enables information to be routed wherever it needs to be shared, driving true integration and visibility from the top floor to the shop floor, which in turn, allows for better and more timely decision making that impacts operational performance.

Proficy Open Enterprise provides a single point of connectivity for GE Intelligent Platforms' set of MES solutions through Proficy SOA. Once data is routed to Proficy SOA, it can be used within Proficy Workflow or any application (native or third party) tied to Proficy SOA. One of the big advantages of using Proficy Workflow is the ability to create business rules that allows businesses to set up the logic for making their products. For example, as a Production Schedule is downloaded into Proficy Open Enterprise, a screen can be made available to an operator to check the structure of the message and make any changes necessary or approve/reject the request.

At the enterprise level, users have insight into what is happening on the floor – raw materials, work in progress, finished goods inventory, status of orders. By knowing this information in real time or ahead of time, companies can limit their safety stock and as a result free up cash from their operation. They can better optimize their schedules without needing more equipment or personnel.

The visibility into the manufacturing process gives business managers the opportunity to improve processes that will give them an advantage in the marketplace.

ERP

Proficy Open Enterprise

Proficy SOA/Workflow	
Proficy Solutions	Third Party Applications
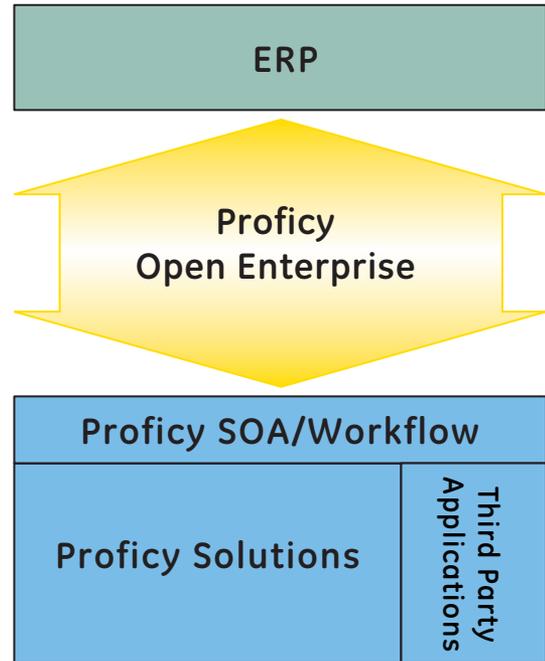
Automatic data flow can improve the efficiency of the operation significantly, making it imperative that systems have the ability to communicate with each other. It removes the necessity to enter data in two separate systems, which can be prone to error and time consuming. This integration also allows users of different systems to have access to the right information at the right time, for example, with more insight into actual production costs.

Summary

As companies strive to achieve operational excellence in today's fast-paced, global market environment, enabling interoperability between business and manufacturing systems is critical for success. Connecting the ERP and MES layers can help companies optimize plant operations and improve profitability by increasing visibility into their real-time operations management data for material consumption, performance reporting, real-time schedule execution and other supply chain and enterprise-level functions.

Advanced technology solutions such as GE Intelligent Platforms' Proficy Open Enterprise enable companies to leverage real-time operations management data and synchronize information and activities between their plant and business systems. Supporting ISA-95 and B2MML standards, it provides bi-directional integration for a deeper understanding as to what is happening on the plant floor—improving decision making at the enterprise level and enhancing execution capability at the plant level.

Integrating the top floor with the shop floor in real time can help companies drive increased operational efficiency, faster responsiveness to changing customer demands, and tighter inventory control—value-added results that enable a sustainable competitive advantage.

For more information about how GE Intelligent Platforms can help you integrate your critical business systems, visit www.ge-ip.com/openenterprise
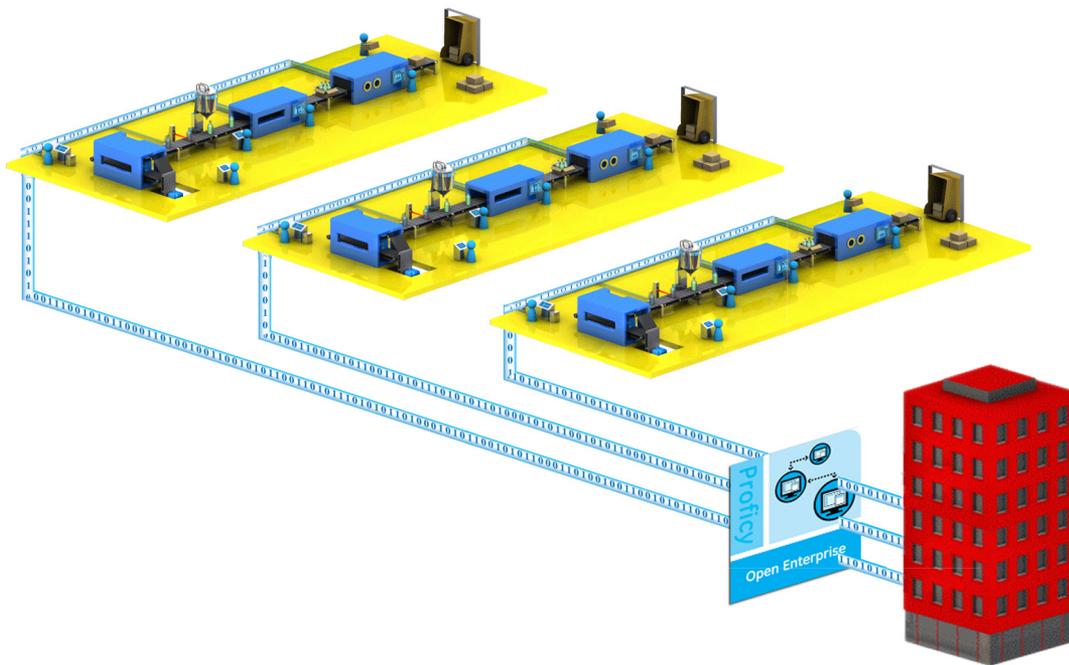
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