Take Control

Using Enterprise Batch Records to Build Your MES

White Paper

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MAVERICK TECHNOLOGIES

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The Problem for Manufacturers....3
Defining Terms....3
Platform Suite Versus Point Applications....3
The Case for Enterprise Batch Records to Implement MES....4
There's an App for That!....5
Does it Ever Make Sense to Implement a Platform Suite?....6
Vision of the Total Solution is Still Required....6
A Proposed Framework or Model....6
The Well-documented Value of MES....7
Conclusion....8

The Problem for Manufacturers

Manufacturers need a cost-efficient MES solution that is not disruptive to their installed base of technology, is scalable and allows them to incrementally implement the functionality they identify as necessary and beneficial to improve operations management in their manufacturing environments.

Defining the Terms

MES or MOM?
Manufacturing execution systems (MES) are information technology systems that manage manufacturing operations in factories. Over the years, international standards and models have refined the scope of such systems in terms of activities and functions that they support.

The Manufacturing Enterprise Solutions Association (MESA) model provides structure for MES by defining 11 functions that set the MES scope. The ANSI / ISA-95 standard merged this model with the Purdue Reference Model (PRM), creating a functional hierarchy. Here, MES was established at level 3, between enterprise resource planning (ERP) at level 4 and process control at levels 0, 1 and 2. Activities in level 3 are distributed over four main operations: production, quality, logistics and maintenance. Additional parts of the ANSI / ISA-95 standard defined the architecture of MES in more detail, covering internal distribution functionality, as well as what information to exchange internally and externally.

The collection of systems performing functions on ISA-95 level 3 are sometimes also referred to as manufacturing operations management (MOM). This collection may incorporate additional systems such as laboratory information management systems (LIMS), warehouse management systems (WMS) and computerized maintenance management systems (CMMS).

While the ANSI / ISA-95 standard and MESA model provide additional details as they relate to specific differences in terminology, MES and MOM will be used as interchangeable acronyms in this paper.

Platform Suite Versus Point Applications

The large players in the MES software space reference their "MES platform," a suite of applications acting as extensions to a core software platform designed to work together. While the extensions may be implemented over time with some level of tailored configuration, there is a core platform that must be implemented initially. The implementer must understand the platform architecture and how the software was designed to perform specific functions and activities. Understanding the limitations of the architecture is crucial to ensure a good fit of the MES platform package to the specific requirements of a particular manufacturing process for a given client.

The drawback of most large-platform packages is that their design assumes and incorporates certain ways to perform manufacturing functions. This does not easily lend itself to changing how things are done as part of a continuous improvement program. Client experience has sometimes been that they must stay with or change to a manufacturing process that the platform software supports, as opposed to doing what is best for the business with software systems that evolve as the manufacturing processes develop and change on the plant floor.

Packaged MES software platforms have their place and benefits. However, this paper contrasts the platform approach with a tailored, data-driven design approach, utilizing point solution applications that work together over time to create an integrated plant-wide MES.

Point solutions solve specific production problems one at a time. They are smaller, easier and less expensive to implement, and provide tangible results that support continued investment in implementing other point solutions. The modular, incremental approach ultimately results in a comprehensive integrated manufacturing execution system that continues to deliver business results long after the initial investment has been recouped.

The Case for Enterprise Batch Records to Implement MES

It's time to rethink the typical approach to MES / MOM, shifting from an application-first focus to a data-driven plan.

Traditionally, MES has been designed and implemented based on the functions that are desired. The design of the platform suites is based on providing the functions included in the MESA model first, with secondary consideration to the plant floor data required to support those functions, as dictated by the design and architecture of the functions software.

We need to turn that approach around, first considering what data must be captured in the manufacturing process for use by any of the desired functions. A universal data platform with accurate, real-time plant floor data and information will feed functional applications as needed.

Batch processing is the dominant manufacturing model across multiple industries, so our concept is to create an enterprise batch record, capturing everything that happens in the manufacturing process.

Enterprise batch records (EBR) are used to store all information about the product manufacturing process, including:

- Batch header, status and results
- Supplier information
- Materials produced and consumed
- Distribution information
- Processes performed and process data
- Equipment used and equipment data
- Labor used and labor data
- HACCP results
- Safety results
- Quality results
- Deviations and incidents
- Maintenance activities
- Sanitation and CIP activities

Having the information captured and available in the form of an EBR supports the needs of the entire enterprise, particularly as they relate to:

- Information to support research and development for product enhancements based on manufacturing results and variances
- Supporting product liability and recall
- Supporting continuous improvement efforts through mining of operational data
- Supporting current and future regulatory reporting
- KPI reporting
- Analysis of the operations data and performance for any function determined to be of importance and value to the specific business

There's an App for That!

By moving away from the application-first approach and instead creating an EBR to capture the information that is relevant for manufacturing operations, we can support any functions that are of value through individual applications that leverage the information.

Implementing MES via an EBR opens up opportunities to achieve additional operational benefits. These include:

- Continued use of existing installed applications. By not requiring functioning applications to be replaced by a similar functionality in the MES platform, the total cost of a MES implementation can be lowered. The required investment is reduced, as well as the training required to support operations if a total "rip and replace" approach had been utilized.
- Support for incremental investment in MES functionality by only implementing the functions that are of most importance for the particular manufacturer making the investment. Priority of the applications implemented should be controlled by the business return expected, not by the supplier-required software platform implementation.
- Faster ROI based on quicker realization of the return for each building-block component of the system. Incremental deployment means smaller investments can go in faster and provide quicker financial return from the specific functional component. The benefits derived from the initial implementation can help fund succeeding application investments, providing the possibility to make the overall initiative self-funding, as incremental improvements and savings are achieved.
- Freedom to utilize a best-of-breed approach for the individual functional applications. Seldom, if ever, does one software supplier have the best solution for manufacturing in all areas of the MESA model. By taking the EBR approach, the business has the freedom to select individual applications that are deemed best for their specific needs.
- Opportunity for a modular component approach. The business is free to work with as many or as few suppliers as make sense for their specific business, and is not locked into a single supplier. In addition to selecting the best-of-breed application for a particular function, there is often a benefit in not being dependent upon a single supplier for future enhancements and changes to the application.

Does it Ever Make Sense to Implement a Platform Suite?

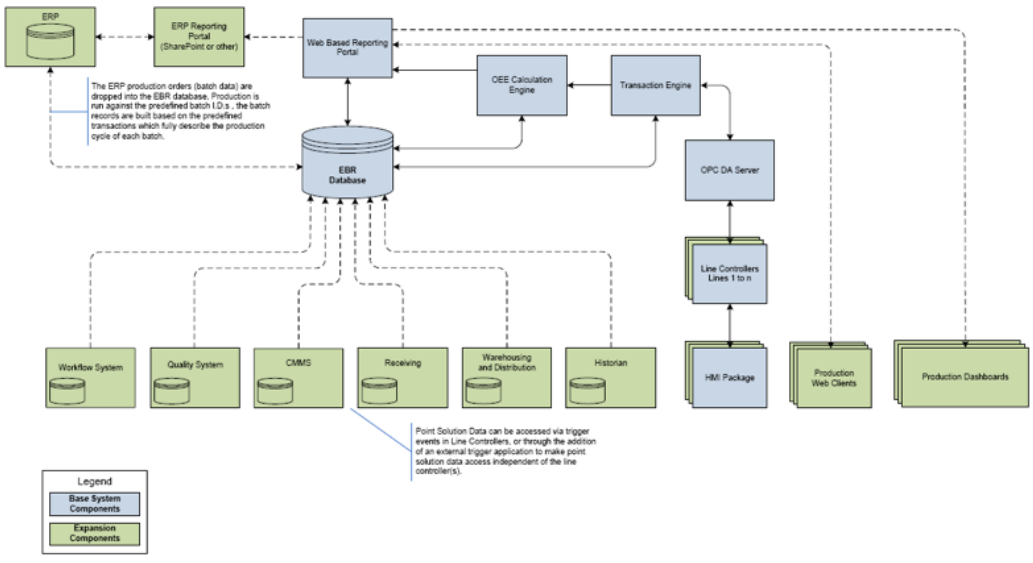
A platform suite may still be a viable way to enforce a technology refresh and application consistency if you have a small installed base and are comfortable with the commitment to a primary supplier for all ISA-95 level-3 functionality. In cases where the business has not yet invested in implementation of any MES functionality and is able to commit to a program — for both a significant up-front investment, as well as ongoing support costs — the platform approach may be the best solution. However, the cost of entry is often beyond the means of many mid-tier manufacturers who are not receiving the benefits available to them through the implementation of a comprehensive MES solution.

Vision of the Total Solution is Still Required

We've said that you can utilize the best-of-breed from an application standpoint, but we don't mean to imply that overall design of the level-3 functionality and integration of the applications can be left open-ended. When taking the approach of modular component solutions, leveraging EBR to provide the total MES over time, it is important that the total solution integration be architected conceptually at the outset. Then, as each application is implemented, the ongoing integration is structured and enforced.

The goal is to provide a modular, scalable solution that continues to grow and evolve with the business. The integration plan for the applications must be architected up front, although the individual applications can be implemented later. The concept behind the EBR with component implementation is to allow the applications that provide the greatest return to be implemented as individual pieces of a comprehensive solution. This stands in contrast to implementing point solutions with no thought to the future integration of those individual applications into a cohesive system.

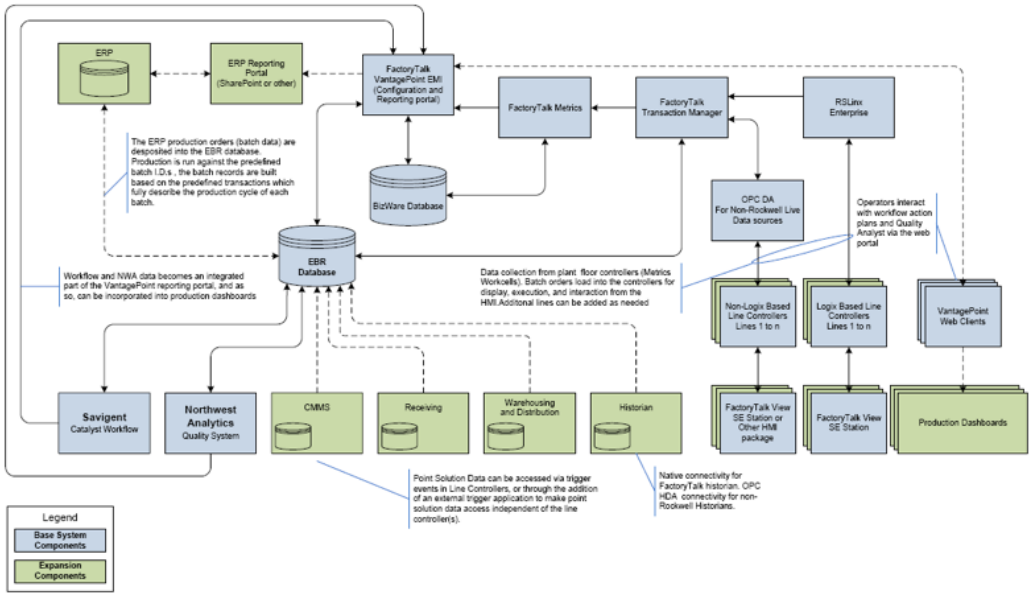
A Proposed Framework or Model



The framework identified here demonstrates how a business may architect a comprehensive EBR approach, but choose to first implement only overall equipment effectiveness (OEE)along with access to the EBR database via a web-based reporting tool. It is recognized that many more components can and will be provided over time as the benefits are realized from the original implementation. The initial investment covers the overall design architecture, along with the implementation of the first application.

What about an example of how this approach benefits the business by leaving the architecture open and not locked in to a single supplier? Consider the following diagram, which is the same conceptual framework as the diagram above. In this case, however, a business has chosen to employ the Rockwell Factory Talk® Vantage Point metrics and web-based reporting for the OEE engine, while utilizing the NWA Quality Information System™ and the Savigent Catalyst™ workflow software for the operator workflow components of the process.

This diagram is meant as an example and not as a recommendation for a particular component represented in the diagram. It shows how, with a little forethought and design effort, a business can implement portions of the EBR approach while using different supplier's software — provided that the overall architecture is established and integration is accomplished primarily through the database.



The Well-documented Value of MES

MESA and others have done a good job providing case studies and surveys that document the value that a business can and should receive from implementing MES. If you are looking for information on the value to be achieved, we refer you to MESA and industry analyst sources. The objective of this paper is to suggest that the same or even greater value can be achieved through taking the data- and information-driven EBR approach to implementing a MES solution.

Your greatest value may come from a particular component of MES that is based on your specific business needs. We suggest that you consider the option to implement MES functionality in a different and less expensive way than the comprehensive platform suite approach.

Conclusion

As an industry, we have made great strides to improve manufacturing efficiency and competition through the deployment of MES. But, by approaching MES development differently, we can accomplish more even faster, and with a lower initial investment and TCO.

The goal is a “solution approach” to MES development that offers value in its flexibility, cost-effectiveness, supportability, vendor flexible implementation and focus on the manufacturing process — not the software.

At MAVERICK, we have implemented and continue to implement MES solutions based on the platform suites of all the leading software suppliers in the MES space, when appropriate for our clients. However, there are increasingly often times when a client has an existing installed base and has moved down the path of implementing some functions of MES, where the packaged platform approach is not the best solution for the business. MAVERICK is committed to understanding the unique challenges and needs of our clients and providing system solutions that are the best fit for their circumstances. Often, that takes the form of moving forward with a modular component approach to creating an EBR-based MES.

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