

WHITE PAPER

MES standardization made easy: Connecting multiple plants to a central, enterprise manufacturing execution system (MES)

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Executive summary:

Rather than hosting a manufacturing execution system (MES) at each individual plant, some companies have been looking into running a single, central, “enterprise MES” that’s connected to multiple geographically distributed plants. This paper outlines how such an enterprise MES works, what it requires and what its advantages are so you can determine whether it’s a good fit for your business.

Introduction

Because a manufacturing execution system (MES) is so critical for plant operations, businesses have traditionally deployed a separate MES at each individual plant. But new technology makes it possible to centrally host a single MES for multiple plants at a data center. Such an “enterprise MES” has some advantages that make it attractive to companies with a distributed plant network. But it does require some specialized infrastructure to implement successfully.

This paper will help you evaluate whether an enterprise MES is a good fit for you by covering:

1. How an enterprise MES capitalizes on a “model-driven” approach
2. How it works
3. What its advantages are
4. What infrastructure a company needs to implement an enterprise MES effectively
5. What you should look for in an MES provider

1. Capitalizing on a model-driven MES

An enterprise MES takes the benefits of the model-driven MES approach and uses them to better enforce standards across multiple plants. The model-driven MES approach pioneered by AVEVA allows multiple plants with different physical production processes and automation procedures to all follow the same procedures.

This is how the model-driven approach works. First, a company describes manufacturing work tasks and data-collection procedures in the form of templates that abstract away from the differences in production processes and automation systems at each individual plant. The MES at each plant also creates a model of the unique physical setup and capabilities of that particular plant. Each plant can then use the model in its MES to execute the same template in a way that takes into account the plant’s unique attributes.

That way, all the plants can follow the same operational, data-collection and continuous-improvement procedures – even though the precise way each plant executes these procedures may differ to comport with the attributes unique to its setup and current status.

For example, one plant might generally need to maintain a higher recipe limit flexibility than other plants in the enterprise because of its local climate or variability in the quality of its raw materials. The MES model for that plant will take those features into account so that the plant can still use the same templates as the other plants in the enterprise. **The model-driven approach uses the same templates at each plant** – but modifies them to support each plant’s unique characteristics, as modeled by its individual MES.

With a model-driven MES, an enterprise with multiple plants can create libraries of templates that describe the best practices for operational activities, reporting procedures and continuous improvement practices – and then implement those best practices at all of its plants. Each plant in an enterprise can adopt those same standard templates and use its individual MES model to configure them to comport with the plant’s unique features.

However, when an individual plant has control over its own MES, it requires discipline and strong governance to avoid deviation from the enterprise-wide standards specified by the templates. When plants deviate from the standard, the enterprise can find itself with inconsistencies in how different plants are collecting and reporting KPI and other data. In this case, the enterprise loses the benefits of standardization, and comparisons of operational data won’t capture meaningful differences between performance at different plants. It will be difficult to determine whether plant A is really producing more efficiently than plant B – or whether it’s just reporting data in a way that makes it seem more efficient.

2. Architecture of an enterprise MES

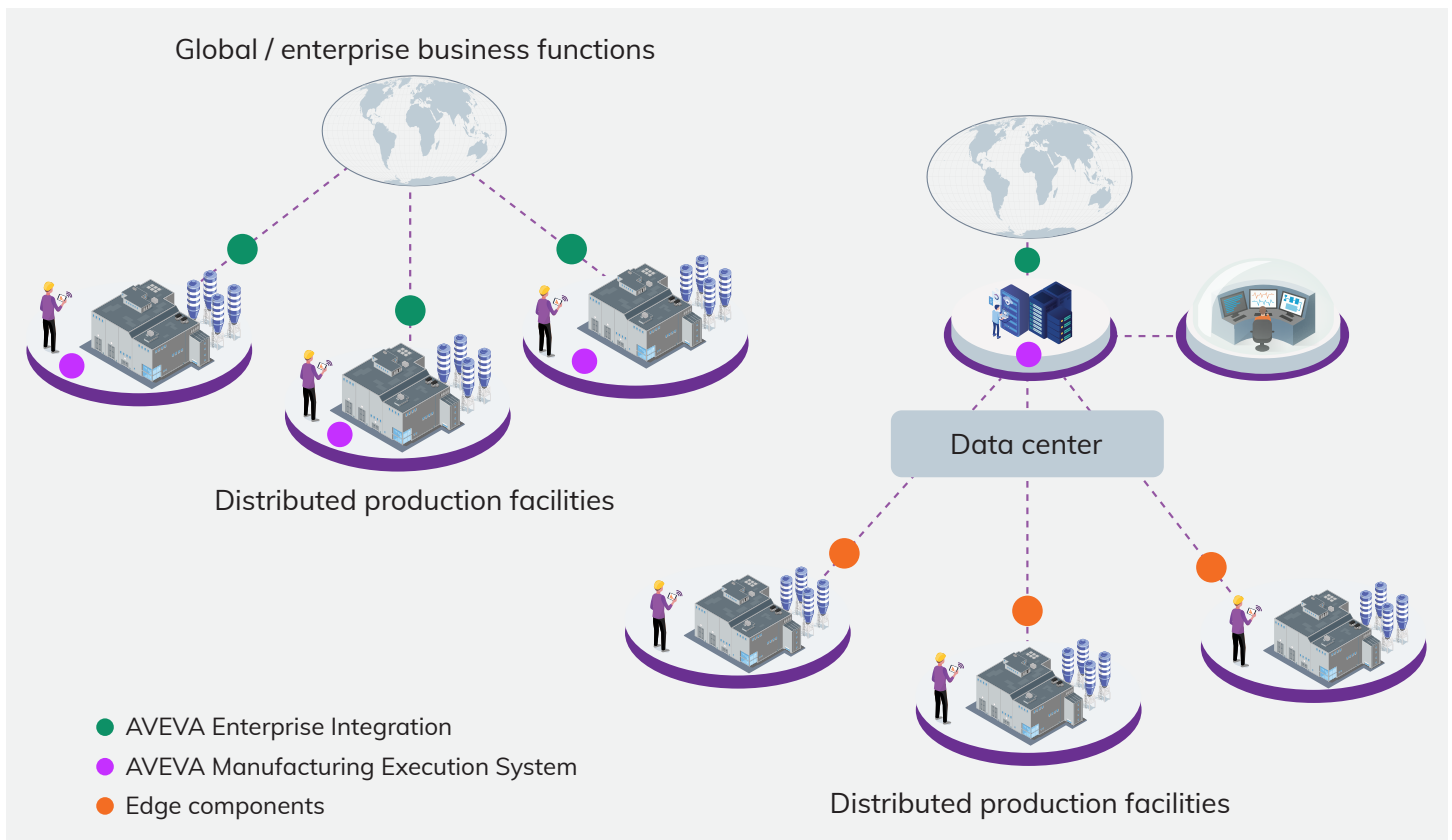
An enterprise MES helps solve this problem by enforcing consistent adherence to standards. Instead of having a separate MES at each plant, a central corporate data center hosts a single MES for multiple plants.

That central enterprise MES makes models of the unique physical setup and capabilities of each of the plants connected to it. It also holds the standard templates that govern all of those plants. Because all the templates are at one central location, the company can enforce standards across multiple plants from one central location.

Such centralized control allows an enterprise MES to facilitate multi-site standardization – and decrease IT infrastructure and MES solution lifecycle costs, compared to traditional MES deployments at multiple local plants. So, some manufacturers are interested in adopting this approach.

Until recently, there were too many obstacles to implementing an enterprise MES that could both collect data from automated manufacturing processes in real time and also manage human work activities. But new technological advances have finally made it possible.

The next section surveys some of the benefits of implementing an enterprise MES before section IV goes on to outline the infrastructure a company needs to successfully implement an enterprise MES.



With a traditional multi-site MES architecture (left), each plant has its own MES, which uses a local set of enterprise-standard templates. With a centralized architecture (right), one enterprise MES connects to multiple plants. It allows the enterprise to store and manage data centrally so it can ensure that all operational activity and reporting gets executed based on the same enterprise-wide standards.

3. Benefits of an enterprise MES

Connecting multiple plants to a model-driven enterprise MES has at least four main advantages.

Best-practice sharing and continuous improvement

Because an enterprise MES helps multiple plants collect and report data in a consistent way, it helps ensure that comparisons of KPIs across plants are accurate. So, you can use that comparison data to determine when one plant has hit upon a best practice when compared to others. That knowledge lets you pilot and test data-driven lean and continuous-improvement practices.

You can also improve established best practices more quickly and more frequently. Once a better way of doing things gets worked out at one plant, an update to the template for that procedure at the enterprise MES can roll out the change to all the other plants. That way, once one plant improves or pilots a production process, collaboration workflow, dashboard or user experience, the whole plant network can start using it and benefit more quickly.

Cost savings

Using a single enterprise MES for multiple plants requires less software and hardware than having a separate MES at each site. An enterprise MES also requires fewer IT resources and subject-matter experts to maintain it. So, it can save on costs for IT infrastructure and ownership.

An enterprise MES also reduces the cost and time-to-value for adding smart technologies, such as machine learning, artificial intelligence or augmented reality. It is much more effective to expand and manage your operational technology investments from a central enterprise MES rather than adding them to multiple, separate, on-site MES deployments and operational data sources.

Fast product launches

When new data comes in from R&D, enterprise resource planning (ERP), product lifecycle management (PLM), or other external systems, you just need to update one enterprise MES to synchronize the data across all the plants connected to it. That centralization of data lets you introduce new products more quickly across multiple plants. Once you successfully pilot a product at one plant, updates to the recipe used by the MES will allow the other plants to start making the product more quickly.

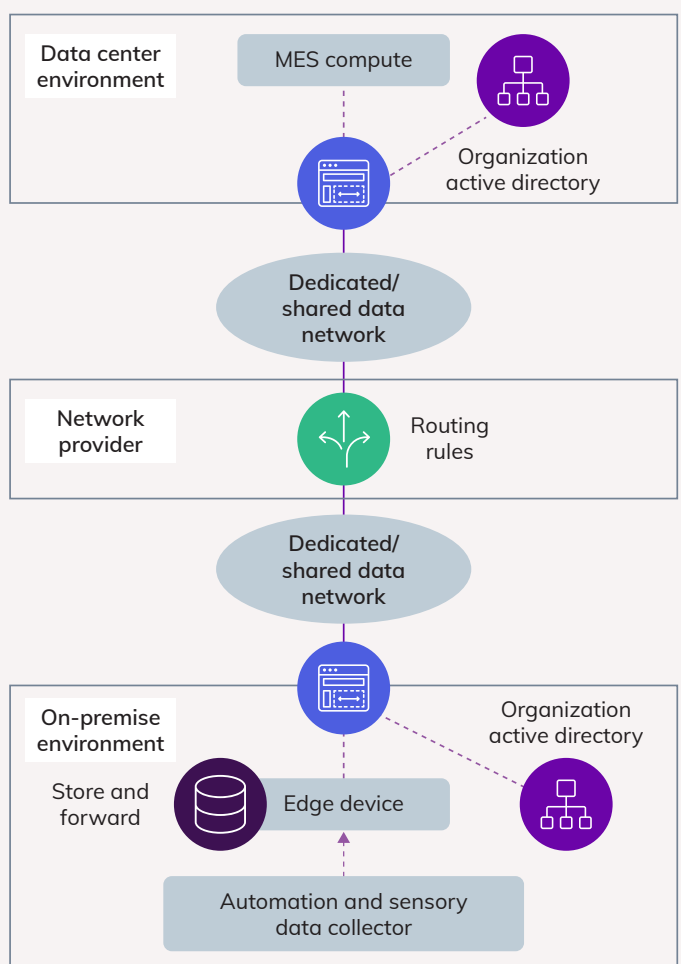
Improved supply chain visibility

An enterprise MES also makes it easier for companies to visualize multi-site operations and coordinate overall supply chain operations across the plant network. Business planning and supply chain management can decide on plans that are feasible for their plants to execute on time and in full. They can also readily assess current plant inventory and capacity to respond more intelligently to supply chain disruption, unplanned events in the plants and changes in demand.

For example, a company could see which plants have the material in stock to deliver on a profitable short-term demand opportunity. If the company is competing on price, it can then optimize the production plan to use those plants that can produce the product most cost-effectively.

4. Requirements for an enterprise MES

While an enterprise MES has the potential to cut IT infrastructure costs, companies still have to establish some specialized infrastructure to make sure it runs effectively.



On premises

MES requires a small footprint of computing assets deployed locally in the plant. That footprint will connect with the local control systems and devices to support automated data collection and perform data validation logic. It then sends consistent data sets to the enterprise MES.

You want to ensure that the data you collect in each plant reliably reaches the enterprise MES. So, you should have a data collection engine at each plant that stores data locally before sending it on to the enterprise MES in a guaranteed fashion that can withstand network disconnection with no data loss.

That way, if network disruptions prevent the MES from receiving data, the plant has a stored backup to fill in any gaps.

At the data center

The MES application service at the data center contextualizes and processes the data that comes in from the multiple plants. It enters the data into a data store and updates production progress, inventory and other statuses in real time. Once updated, these statuses are visible to the entire enterprise, so anybody who needs them can access them and use them to make decisions.

The MES application service validates the incoming data for rules- and limit violations. If it finds a violation, it will trigger operator notifications or workflows specifying the regular or corrective actions prescribed for that event.

The MES application service at the data center also uses the incoming data to calculate KPIs and other metrics, either on a scheduled basis or in response to specified events. It can run results calculations for near-real-time monitoring and persist them in a contextualized information model for short- and long-term analyses. For example, it can analyze production performance versus plan, or equipment utilization, with drill-down information into downtime and production-loss root-cause information. It also facilitates interactive reporting of up- and downstream material flows for traceability and product genealogy investigations.

The network

An enterprise MES architecture requires a reliable and performant data network that extends organizational directory services, such as Active Directory, from the edge to the data center. To make sure your network has the required network bandwidth, resiliency and availability to reliably transfer data between plants and the enterprise MES, you should use a smart virtual private network (VPN).

Make sure your VPN is a smart VPN. Smart VPNs have smart routing logic and redundant routes that allow for high availability of the network. They come with service-level agreements that guarantee KPIs such as uptime, bandwidth and latency.

5. What to look for in an MES provider

There are several factors to consider when choosing an MES provider.

Trusted expertise

First, you need a trusted solution. Find a provider that offers industry-leading technology. Your provider should also have domain expertise. It can use that knowledge to help you transform and improve operations consistently across multiple sites in a way that's adaptable to the physical setup and capabilities specific to each.

This is a journey, so you want a company that will provide services to support your progress. It should also support a corporate "center-of-excellence" approach to identify and standardize best practices to be quickly rolled out across multiple sites.

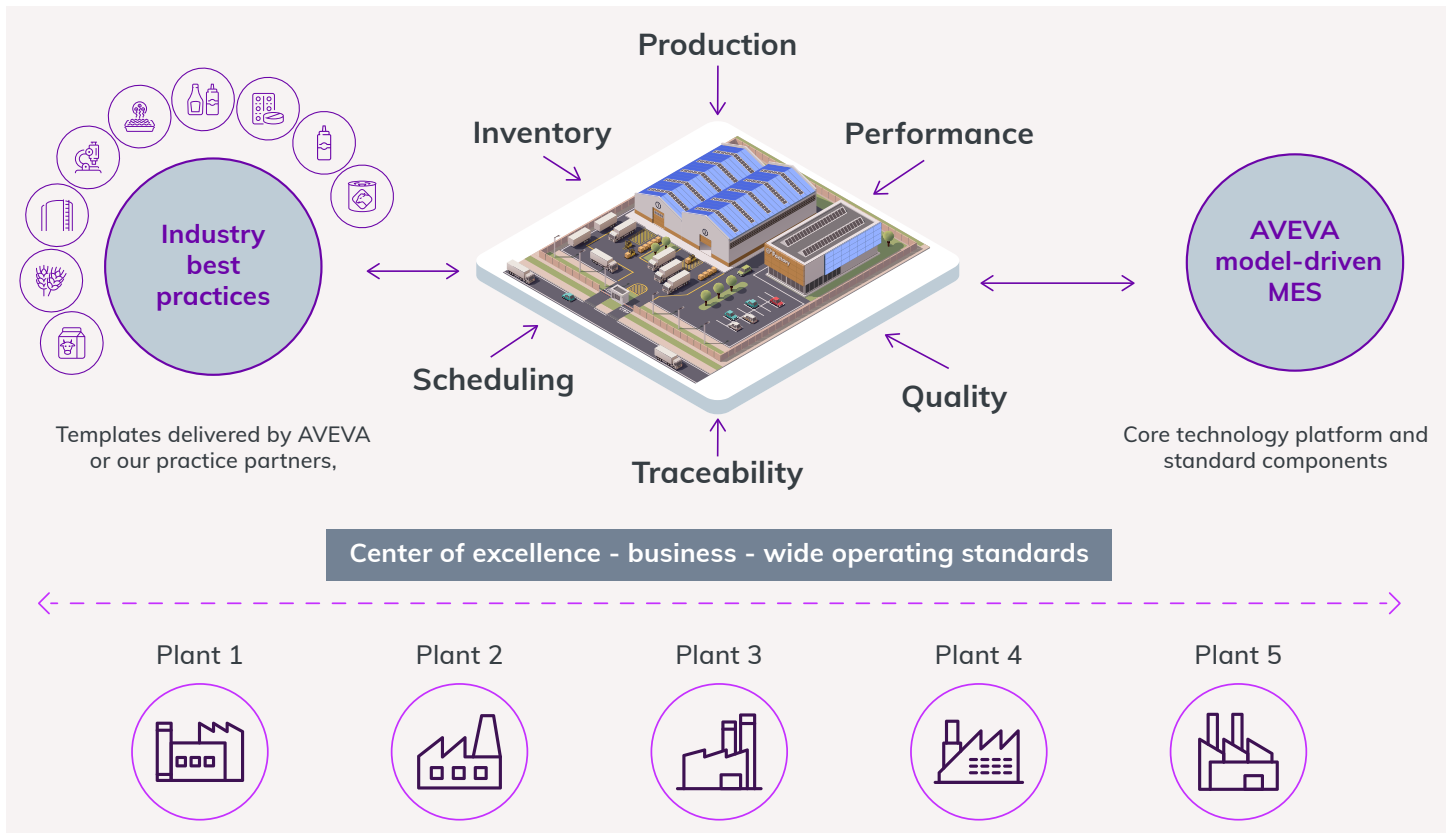
Global support

You'll also want your MES supplier to have global support and a wide system integrator network.

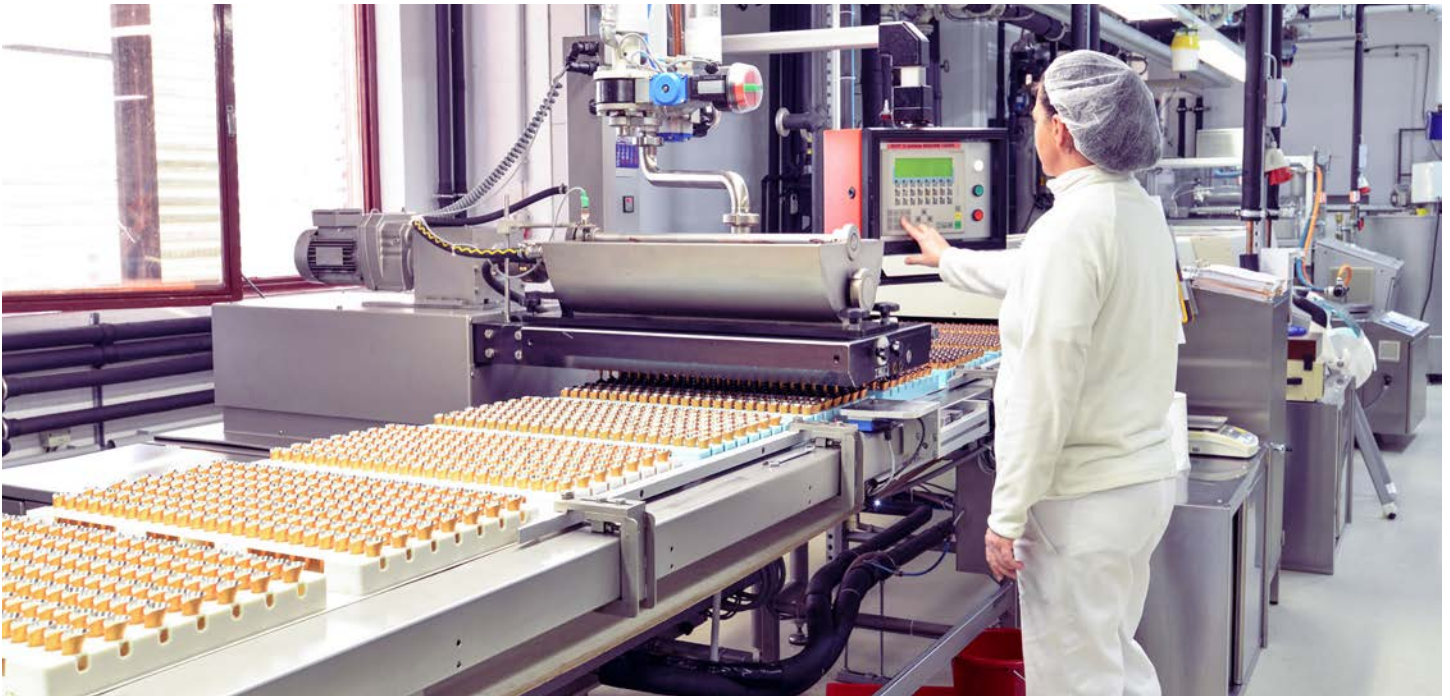
Agnostic connectivity

The whole point of an enterprise MES is to connect multiple plants – so your MES should have built-in agnostic connectivity to existing plant floor systems, devices and equipment automation.

AVEVA™ Manufacturing Execution System provides all the features you'd want for an enterprise MES deployment. Even if you decide that an enterprise MES isn't the right solution for your network of plants, you may still benefit from multiple on-site deployments of AVEVA Manufacturing Execution System and its model-driven approach to the standardization of operational practices and reporting.



Support for an center of excellence to design and govern best practices for your network of plants



To learn more about how to deploy AVEVA Manufacturing Execution System, either as an enterprise MES at a data center or on site at individual plants, please visit:

aveva.com/mes

About the authors

Tom Troy joined the AVEVA organization in August of 2007. His current primary responsibility is to drive the strategic direction and investment decisions within the Operations and Execution portfolio in AVEVA, which includes: MES, Batch and Recipe Management, Quality, Workflow and Enterprise Integration applications. Tom has extensive experience in MES product marketing, product development, and solution consultancy. Tom has a BS degree in Electrical Engineering from Temple University in Philadelphia, PA.

Michael Schwarz is the Product Marketing Senior Manager for manufacturing execution software at AVEVA. With over 25 years of industry software sales and marketing experience he is passionate about how technology helps to solve problems and can improve quality of life. Michael holds a graduate degree in electrical engineering from the Bergische Universität Wuppertal, Germany.