OPTIMIZATION OF MACHINE INTEGRATION

A SHARED VISION FOR MACHINERY INTEGRATION IN THE MANUFACTURING SECTOR

- COMPREHENSIVE
- SCALABLE
- SECURE
- INCLUSIVE
- OPEN

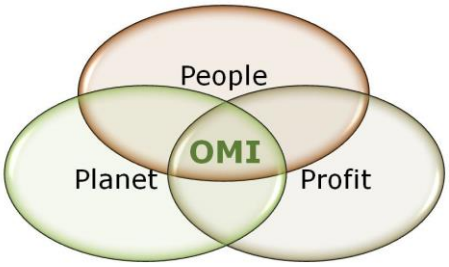
ODVA, IN PARTNERSHIP WITH OPC FOUNDATION AND SERCOS INTERNATIONAL

Executive Summary

Machinery is central to the production process and manufacturers strive to optimize how it integrates with other machines and supervisory systems in their business enterprise. Manufacturers traditionally benchmark this high-value equipment by asset turnover, which measures how efficiently a company's assets generate revenue. In today's economy, however, production professionals and business executives need to have a more holistic focus. So in addition to asset (i.e., machinery) turnover, manufacturers must measure the ability of assets to help the enterprise meet overall business goals and adapt to rapidly changing market demands. Ease of integration is an important element of this equation.

ODVA supports optimizing machinery integration using an open and interoperable framework for communication which is comprehensive, scalable, secure, open and inclusive for both manufacturers and machine builders. To that end, ODVA has embraced an approach to this framework that engages OPC Foundation and Sercos International to foster cross-collaboration and innovation.

For machine builders, optimization of machinery integration (OMI™) provides opportunities for creating additional value through simplified communication between machines and from machines to supervisory systems. By transforming data into information, OMI will provide tools for dynamic decision-making, thus maximizing machine productivity, improving machine performance and enhancing the preventive maintenance of machinery assets. As a result, OMI will create more value from machines, extend machinery life cycles, and will emerge as a natural sweet spot to help manufacturers meet their overall business objectives, including workforce, profitability and sustainability goals.



This white paper describes the opportunity to optimize machinery integration for the manufacturing sector and provides an overview of an open, unified integration model for machinery communication including:

- Machinery in the industrial ecosystem;
- A shared vision of machinery in the Production domain;
- Industrial use cases for OMI; and
- OMI in practice.

The audience for this paper includes business and technical leadership at manufacturing and machine builder companies who are seeking to roadmap their long-term information integration and communication technology in support of overall business objectives.

Machinery in the Industrial Ecosystem

ODVA's approach envisions an interoperability framework for machinery that encompasses three domains of the industrial ecosystem – production, enterprise and power grid – as depicted in Figure 1. This vision recognizes the value of communication in machinery control for production processes, while highlighting the possibility of viewing and using machinery information, such as energy metrics and safety factors, as a shared resource and common currency across the domains critical to manufacturers.

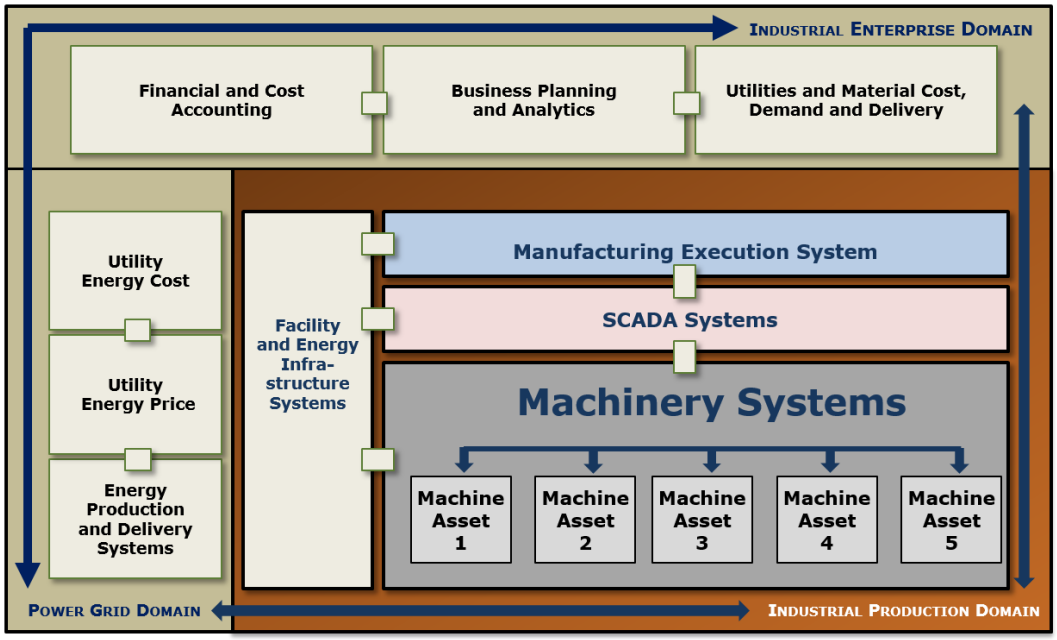


Figure 1
OMI in the Industrial Ecosystem

Vision of OMI in the Production Domain

Although machinery is essential to manufacturing, production professionals have not been provided with standard tools and guidance to simplify the integration of machinery in a holistic way. OMI will change this paradigm by outlining best practices. By implementing OMI, manufacturers can gain visibility into machinery information throughout the layers of the production domain in a standard way while also benefiting from simplified connectivity needed for machine-to-machine communication. This, in turn, will help machine builders drive innovation, while helping manufacturers drive significant productivity improvements.

The integration of machinery within the production domain is the key focal point of OMI. The large community of device suppliers, who are members of ODVA, OPC Foundation and Sercos International, supply information and communication solutions for use in this domain and can collectively provide a holistic approach and technology that is:

- Comprehensive in its long-term view of the need for integrating machinery within the production domain and with other domains in the industrial ecosystem;
- Scalable from small to large manufacturing operations;
- Secure for remote access to machine and supervisory-level information;
- Inclusive of heterogeneous networks and standards; and
- Open by virtue of its use of multivendor, interoperable standards managed by independent, vendor-neutral organizations.

Use Cases for OMI

Realization of OMI requires a three-pronged approach for use by the industrial consumer: (1) communication connectivity; (2) machine-to-supervisory communication; and (3) machine-to-machine communication.

ODVA's approach for OMI originates from the key challenges faced by machine builders and manufacturers when looking to integrate machines. These challenges include:

1. There is a proliferation of automation networks in machine automation.
2. The useful life of machine assets is long, which results in many installations with legacy networks.
3. Machine builders are motivated to provide a high-value machine which is differentiated from their competition on price and performance relative to asset turnover, not overall equipment effectiveness.
4. To maintain machines, manufacturers need to give OEMs secure, remote access to the information that is being shared from machine-to-machine as well as from the machines to supervisory systems including line control, MES and enterprise applications.

Through collaboration, ODVA and its Machinery Initiative alliance partners – OPC Foundation and Sercos International - along with their respective members will facilitate resolution of these challenges. The OPC Foundation is dedicated to creating and maintaining open specifications that standardize the secure communication and analysis of process data, alarm and event records, historical data, and batch data to multi-vendor enterprise systems and between production devices. Sercos International, meanwhile, is dedicated to interconnecting motion controls, drives, I/O, sensors and actuators for motion controlled machines and systems.

For interoperability of production systems and the integration of the production systems with other systems, ODVA embraces the adoption of commercial-off-the-shelf and standard, unmodified Internet and Ethernet technologies as a guiding principle wherever possible. These organizations plan to work together, with their respective members, on an open, unified integration model that will provide standards and guidelines to machine builders on designing, installing and servicing equipment and help users access data from their machinery and correlate it with data derived from their line controllers and MES systems.

Use Case Type 1: Machine-to-Machine Communication
Machine-to-machine communication is the foundation of OMI. Establishing standards will help minimize the time and cost of machine integration and reduce the custom software and special hardware needed to integrate different vendor's equipment together. By sharing a unified integration model for key functions needed for machines to interoperate with one another - including command, configure and control - along with a common data model to communicate key machine attributes, machine builders and manufacturers will find machines from multiple vendors and design cycles to be easier, faster and cheaper to integrate.

Use Case Type 2: Machine-to-Supervisory Communication
Communication between machines and supervisory systems is the accelerant for OMI. By leveraging line controllers and manufacturing execution systems (MES), manufacturers can consolidate and exchange machine information across systems to collect production data, assist in asset management, and report diagnostics and alarms. This machine monitoring and management helps reduce downtime by promoting efficient utilization and multiplies the benefits of machine integration by automating actions that improve overall equipment effectiveness. OMI allows existing automation to incorporate the functionality needed to realize new efficiencies in machinery utilization, thus protecting the user's investment in technology.

Use Case Type 3: Communication Connectivity
Connectivity is the enabler for OMI. Machinery in the industrial ecosystem is characterized by multiple heterogeneous networks connected to multiple physical domains both inside and outside the manufacturer's enterprise. By leveraging common standards for physical media, network infrastructure and secure remote access, both users and machine builders will be able to reduce the cost and complexity of machine integration while improving maintainability and safety of machines. As reliability is also essential, the OMI approach will define how communication gets handled when machinery is unavailable.

Technical Approach

Users will benefit from an open, interoperable framework for communication and connectivity that provides a platform for integration of machinery assets and systems into the production domain and with the other domains in the industrial ecosystem. Based on the evolution of existing standards, it will preserve and enhance the user's return on investment. To achieve this result, OMI's technical approach will be:

- Performance-enhancing to preserve operational and maintenance tasks while providing potential improvements in overall equipment effectiveness;
- Accretive to augment existing investments in machinery know-how and networking technologies;
- Prioritized to align efforts to first enable machine-to-machine communication and connectivity; then support machine-to-supervisory communications; and finally, outline a comprehensive platform for machine integration with the industrial domain via manufacturing execution systems.

At the heart of this approach is the unified integration model for the OMI-enabled machinery asset. The OMI-enabled asset is a network-connected machine that has the ability to produce or consume data for use in machine-to-machine tasks within a process or in external information exchange with equipment in supervisory systems. The enabling technologies for this foundation are:

- the Common Industrial Protocol (CIP™) and the family of CIP Networks such as EtherNet/IP™;
- the Sercos protocol and the family of Sercos networks such as Sercos III; and
- the OPC Unified Architecture (OPC UA).

As shown in Figure 2, this integration model allows for adaptability and transportability of information from machine to machine and from the machine to other critical manufacturing systems. The machine may support services needed to command, control and configure between machines; provide production data to line controllers and manufacturing execution systems; and/or enable secure remote access. Remote access supports a scalable approach to machine maintenance, service and support by allowing off-site plant personnel or external experts to connect and communicate in real-time with machine assets. Secure remote access to these assets is a key benefit of a strong security design, and is enabled by data transfer and network infrastructure models and best practices made available by members of ODVA, OPC Foundation and Sercos International. A protocol

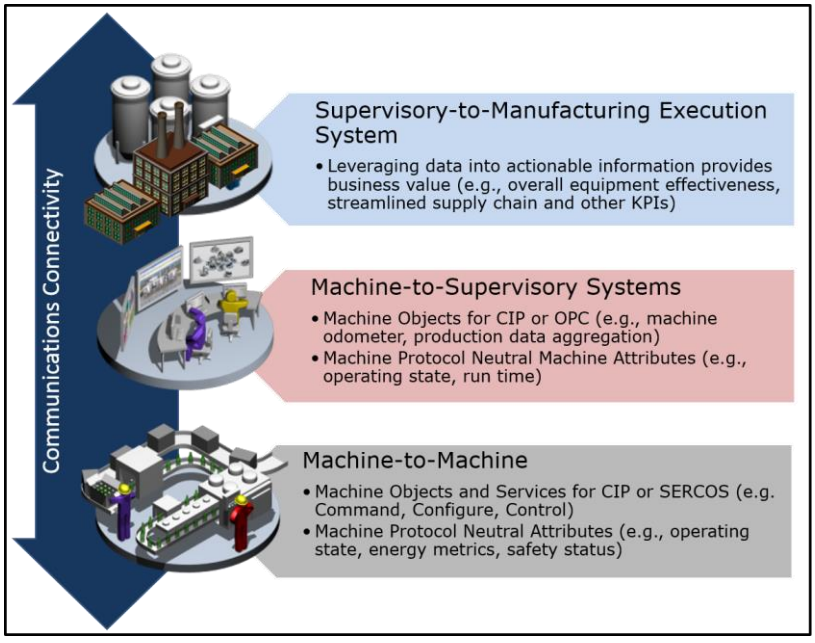


Figure 2
The Unified Integration Model across all three Levels of the Production Domain

neutral data model allows for flexibility in the propagation of machine information via multiple protocols to facilitate an e-business model such as capturing machine uptime and other key performance indicators or “KPIs.”

OMI in Practice

The comprehensive approach of OMI allows industrial consumers to treat the machine as a shared resource within and between each domain of the industrial ecosystem. Within the Production domain, where the machine’s return on investment is typically measured, machine information needs to be available at all three layers – machine asset, supervisory systems, and MES – where it is presented, controlled and managed using a hierarchical organization. OMI is first realized when one machine is integrated easier, faster and less costly with another. Ultimately, OMI will enable an optimized machine deployment and integration approach that makes it possible to dynamically share information across the enterprise to maximize overall equipment effectiveness.

In practice, an OMI-enabled machinery asset communicates its machine information either to another machine or to supervisory systems. The OMI approach allows machine information to be communicated and then aggregated and assimilated. The result is that machine information can be consumed and manipulated more easily by programmable automation controllers (PACs) and line controllers where visualization and control decisions are made through the application of process-based decision rules.

The same communication actions of machine information and its aggregation, visualization, or control can be applied throughout the Production domain – the unified integration model is the key! This model reduces integration costs as machine information is moved through the production levels and is integrated with other industrial domains. The dynamic approach of OMI, further enabled by an IP-enabled communication model, allows processes to be optimized for overall equipment effectiveness while still balancing the key production goals related to energy utilization, machine safety and operational efficiency.

Application Example: OMI-enabled Case Packer

A case packing machine is an important element of many packaging lines in the consumer packaged goods industry. It is imperative for the user to monitor critical operating variables, such as units of production entering the machine (e.g., bottles, cartons, bags), consolidated units of production exiting the machine (e.g., cases), packaging materials used (e.g., corrugated containers, glue, labels, etc.), scrap materials created in the process, operating time, downtime, and scheduled operating time. Many of these parameters can be sensed at the machine and the data collected over a communication network or by a discrete or process signal to an input or output module in a PAC. Others can be calculated based on known data, such as time. The data is often collected by disparate technologies and must be transformed into usable data at the machine control or information system. The collection of the data from the sensing devices will be enabled by the OMI communication connectivity; the interlocking of the case packers with its upstream and downstream machine partners (typically a labeler and a palletizer respectively) will be enabled by machine-to-machine connectivity; and the collection, harmonization, presentation, and use of the production and asset data will be enabled by machine-to-supervisory capability of OMI.

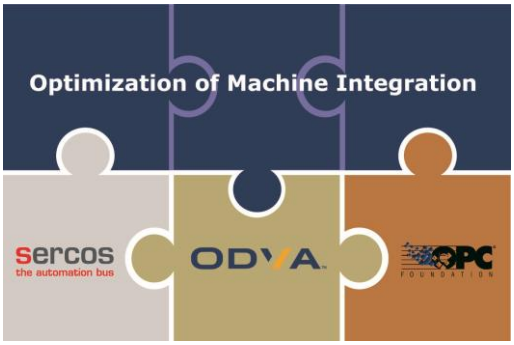
Commitment to OMI

OMI is central to ODVA's long-term commitment to help industry realize its goals for sustainability and increased productivity. The definition and roadmap for OMI is the result of a lengthy investigation by ODVA and its leadership into the machinery needs of industry, and a collaboration with OPC Foundation and Sercos International to support the shared vision of a unified integration model.

By taking a unified approach to the integration of machines, it is expected that OMI will address key challenges faced by machine builders and manufacturers, including:

- Easier installation and interoperability through common data models and connectivity standards;
- Opportunities to innovate by leveraging leading open standards for exchange of data;
- Better overall equipment effectiveness through standard objects and services to consolidate and exchange information across systems; and
- Faster and cheaper maintenance through secure remote access.

OPC Foundation and Sercos International share ODVA's core values of vendor-neutrality, open participation and open technologies. The collaboration between these three organizations provides the ideal forum for building consensus among market leaders in industrial automation around the next generation of productivity enhancements pertaining to the Optimization of Machine Integration.



About ODVA

Founded in 1995, ODVA is a global association whose members comprise the world's leading automation companies. ODVA's mission is to advance open, interoperable information and communication technologies in industrial automation. ODVA recognizes its media independent network protocol, the Common Industrial Protocol or "CIP" – and the network adaptations of CIP – EtherNet/IP, DeviceNet, CompoNet and ControlNet – as its core technology and the primary common interest of its membership. ODVA's vision is to contribute to the sustainability and prosperity of the global community by transforming the model for information and communication technology in the industrial ecosystem. For future interoperability of production systems and the integration of the production systems with other systems, ODVA embraces the adoption of commercial-off-the-shelf (COTS) and standard, unmodified Internet and Ethernet technologies as a guiding principle wherever possible. This principle is exemplified by EtherNet/IP – the world's number one industrial Ethernet network. For more information about ODVA, visit odva.org.