Open OpenO&M Framework is the key. It is an open integration solution facilitating the sharing of information among all plant information systems, including maintenance, reliability, and asset management functions.

Manufacturing companies are continually striving to achieve and maintain a high level of operational excellence. Operational excellence requires continual improvement of a company's manufacturing operations, driving them to become increasingly lean and agile.

To meet the goals of operational excellence, manufacturers must be able to fully utilize the information in all of their control and information systems. Achieving this level of utilization requires the ability to easily integrate various control and information systems. Significant advances supporting information exchange have been made in recent years within the application areas of advanced process control, finite scheduling, asset management, statistical process control, and supply chain integration. However, the integration of operations and maintenance (O&M) related information has lagged behind these other areas of information exchange, limiting opportunities to make business operating decisions that depend on integrated O&M information.

In today's world of interdependent supply chain partners and O&M outsourcing models, the limitations also have significant implications that reach beyond the bounds of any single enterprise into the extended enterprises of which they are a part.

In a more practical scenario, this problem can be represented by an unexpected equipment failure during the execution of a planned production order. It is clear that this is going to impact operations in the enterprise. However, that same impact is now propagating up and down the entire supply chain with potential financial implications including penalty costs and loss of business.

This is an overview of how three industry organizations—MIMOSA, the OPC Foundation, and the ISA's SP95 Committee—are working together to provide the process industries the capability to openly and securely exchange O&M information.

Maintenance: Ever increasing importance

As today's business environment of lean manufacturing sites, build-to-order manufacturing models, just-in-time delivery of parts and ingredients, and integrated supply chains combine to permit reduced inventory levels, they also cause the costs of unexpected equipment failures to skyrocket.

If an equipment failure causes a key part or ingredient to be delivered late or at diminished quality, an entire production run can be negatively impacted with a significant loss in profitability. In this context, failure includes any change in equipment performance resulting in unacceptably low production quantity or quality, as well as equipment performance resulting in unacceptably high safety risks, manufacturing costs, or environmental impact.

Inventory can be used as a buffer to partially offset the risk of diminished production, but in the pursuit of operational excellence, this is a costly step backward. The ability to anticipate and prevent unexpected equipment failures by performing maintenance based upon actual equipment condition information and operating parameters can lead to both reduced maintenance costs and lower equipment failure rates. It also enables superior operational decision-making because equipment availability forecasts are more reliable, making production schedules more accurate. Enhanced decision support systems (DSS), leveraging all enterprise information, are the key to economically managing these

issues.

The ability to perform maintenance based upon actual asset condition information is called condition based maintenance (CBM). Using CBM-related information along with other operating inputs to optimize operating decisions for an effective enterprise is known as condition based operations (CBO). The discussion that follows focuses on the use of CBO in process industries to enable more economically efficient production.

Condition based operations

Condition based operations involves using current O&M information to make the best economic decision for the business.

From the production operations management perspective, scheduled production is viewed as a time window (e.g., two shifts, one week) where production runs are scheduled on equipment, or assets. Production in a given period is often constrained by equipment availability during the same period. Production plans and detailed production schedules, even when created based upon planned maintenance schedules, are often disrupted by asset failures. In addition, even the most careful maintenance scheduling usually only includes coarse input from operations and on-going business requirements (e.g., critical and highly profitable orders on tight schedules).

As a result of these lurking threats, the confidence in meeting a production schedule decreases as one looks further into the future. This loss of confidence (or reduced visibility) is partially a result of not being able to accurately predict asset health and maintenance requirements during the schedule period.

Figure 1 represents this scenario by depicting the expected capacity of a manufacturing facility plotted over time. The variations in height of the expected capacity indicate changes due to projected asset availability. The horizontal dashed line indicates the maximum capacity for the facility if all the assets are available. Therefore, the area between the expected capacity and the maximum capacity indicates capacity that is not expected to be available for production. The loss of confidence in the expected capacity in the future is represented by the brown shading (degree of uncertainty). It becomes more pronounced over time, indicating an increasing chance that unexpected disruptions to the schedule could occur in the future.

The aim of CBO is to enable better informed operational decision-making, resulting in optimal production by leveraging CBM-oriented information. At the enterprise level, CBO extends both the accuracy and the time period of the forecasts that are critically dependent on equipment resources in order to enable the economic optimization of the entire production process. Individual users, such as production planners, may wish to see a more accurate capacity forecast only within their normal planning horizon.

Figure 1 illustrates such a capacity forecast with decreasing visibility into the future, similar to the decreasing visibility of a long-term weather forecast. CBO will clear the shadow as much as possible to enhance the visibility and reduce the uncertainty of the forecast. A capabilities forecast would extend the concept to include qualitative production information and possibly provide options to use other manufacturing resources with similar capabilities in order to enable economically optimized operating decisions.

Industry solution

The OpenO&M For Manufacturing Joint Working Group was formed by three nonprofit organizations—MIMOSA, the OPC Foundation, and the ISA SP95 Committee. They are

collaborating to provide the standards and technology that form an interoperable framework for the exchange of O&M information—the OpenO&M Framework. The OpenO&M Framework enables the exchange of operations and maintenance information horizontally and vertically within an enterprise as well as between supply chain partners as appropriate. The collaborative approach will harmonize the various existing standards from these organizations and jointly develop future standards as needed.

MIMOSA and the OPC Foundation have established the OpenO&M initiative as an industry-neutral approach for enabling the open enterprise integration of O&M information. ISA's SP95 Committee is the key industry partner to enable OpenO&M standards to be properly applied to the manufacturing and processing industries, thereby enabling CBO for industrial enterprises. This approach to harmonize these standards enables both end-users and solution providers to take advantage of the proven standards and specifications from the three organizations today while providing a clear path forward to richer capabilities in the future without the risk of obsolescence.

Within a commercial enterprise, individual manufacturing sites will benefit from the OpenO&M Framework, which is an enabler for CBO, CBM, and collaborative asset lifecycle management (CALM) strategies. The wider application of the framework can also be made to the entire enterprise supply chain and supporting infrastructure covering fleets, facilities, and manufacturing plants in both public and private sectors.

Industry standards enable integration

The implementation of CBO in a single manufacturing site, or throughout an enterprise, requires the broad-based integration of O&M information from a variety of sources. Without a widely accepted standard for O&M information this implementation requires the development of numerous point-to-point interfaces as shown in Fig. 2 .

The MIMOSA organization, the OPC Foundation, and the ISA's SP95 Committee intend to provide a framework to enable the integration of operations and maintenance systems by harmonizing their standards and specifications. This framework will permit system vendors and manufacturing companies to build one interface for each operations and maintenance system. This single interface, called OpenO&M, will enable the system to exchange O&M information with any other control or information system resulting in lower integration costs and deployment time. The numerous point-to-point interfaces in Fig. 2 will be replaced by the single interface shown in Fig. 3 .

MIMOSA's Open Systems Architecture for Enterprise Application Integration (OSA-EAI) defines XML schemas for the exchange of maintenance information critical for implementing CBM and CBO such as condition based monitoring, asset based registry, and maintenance work and parts management.

The OPC Foundation's OPC interface specifications are the de facto standard for exchanging data between disparate systems in the manufacturing industries. By using OPC technology, OpenO&M will be using the most popular method of communication at the control and manufacturing execution system level thereby reducing the amount of work required to adopt it. The use of OPC also enables the use of state-of-the-art technologies such as Web services and the ability to provide secure data exchange.

The ISA-95 Enterprise-Control System Integration standard provides a standard definition for the vertical exchange of manufacturing data between business and control systems as well as on-going work to define a manufacturing operations standard. The ISA-95 standard has been accepted by the IEC and ISO as the joint-logo international

standard IEC 62264. The ISA-95 standard will enable OpenO&M information to be exchanged with manufacturing operations and business systems.

The collaboration effort among these three organizations will integrate the MIMOSA and ISA-95 data exchange formats and will utilize the OPC interface specifications as the "pipe" to transport the information between systems.

In the complex environment of a plant, O&M information needs to be exchanged horizontally and vertically as shown in Fig. 4 . The client-server technology of OPC will be used to exchange OSE-EAI and ISA-95 format data as required by an enterprise's information needs.

Key enabler for world class manufacturing

By providing the right CBO information to the right person at the right time, the implementation of the OpenO&M Framework enables manufacturing organizations of all sizes to become world class—delivering high-quality products on-time and at a lower cost. This enables their enterprises to be more effective, profitable, and competitive in the marketplace. The Framework accomplishes this by dramatically reducing the cost of implementing and maintaining integrated multi-vendor O&M solutions.

CAPACITY FORECAST

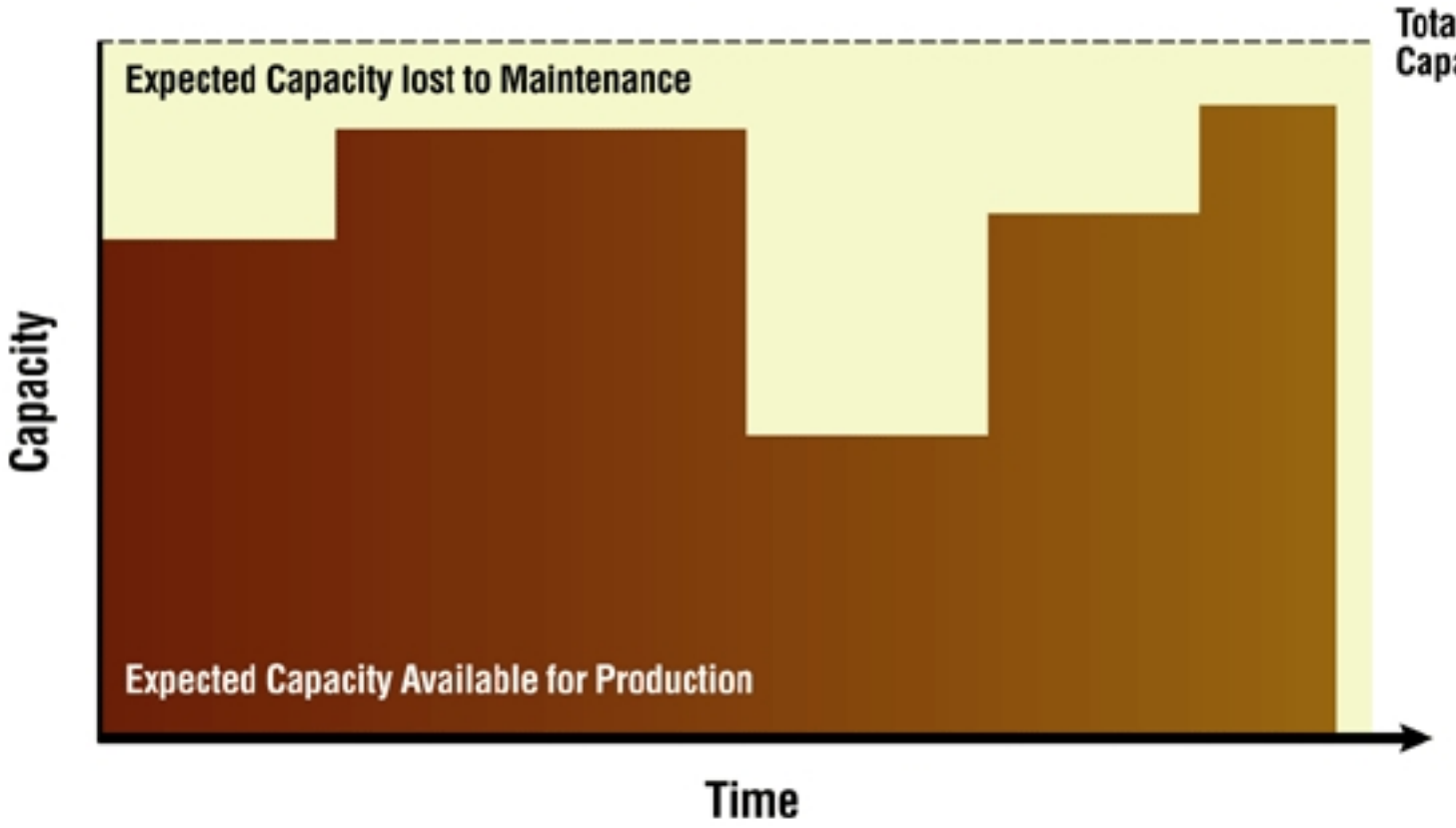

Fig. 1. Confidence in the forecast decreases with distance into the future.

back to article

FROM AN INTEGRATION NIGHTMARE

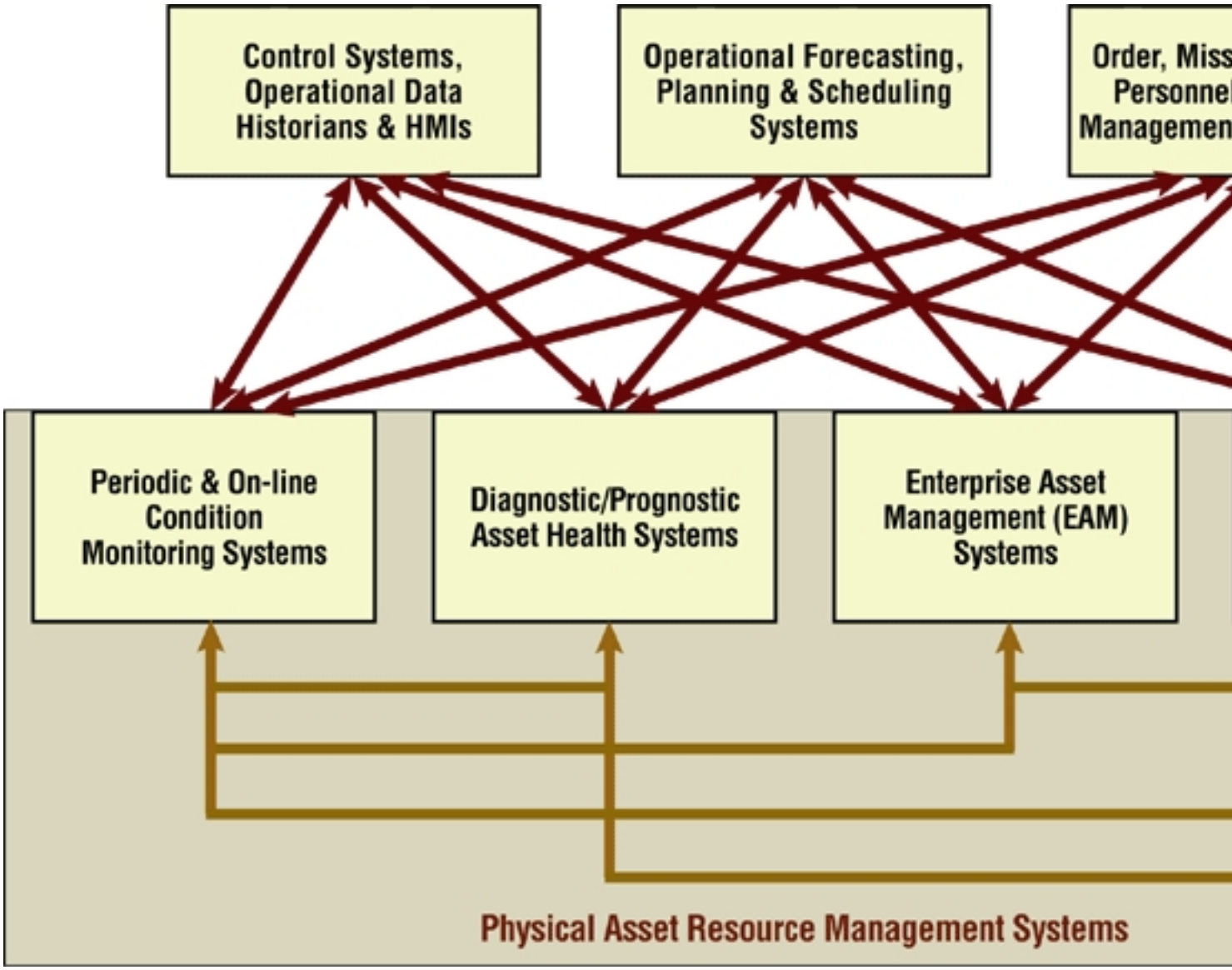

Fig. 2. Without a widely accepted standard for O&M information, the implementation of condition based manufacturing requires the development of numerous point-to-point interfaces.

[back to article]

TO AN INTEGRATED SOLUTION

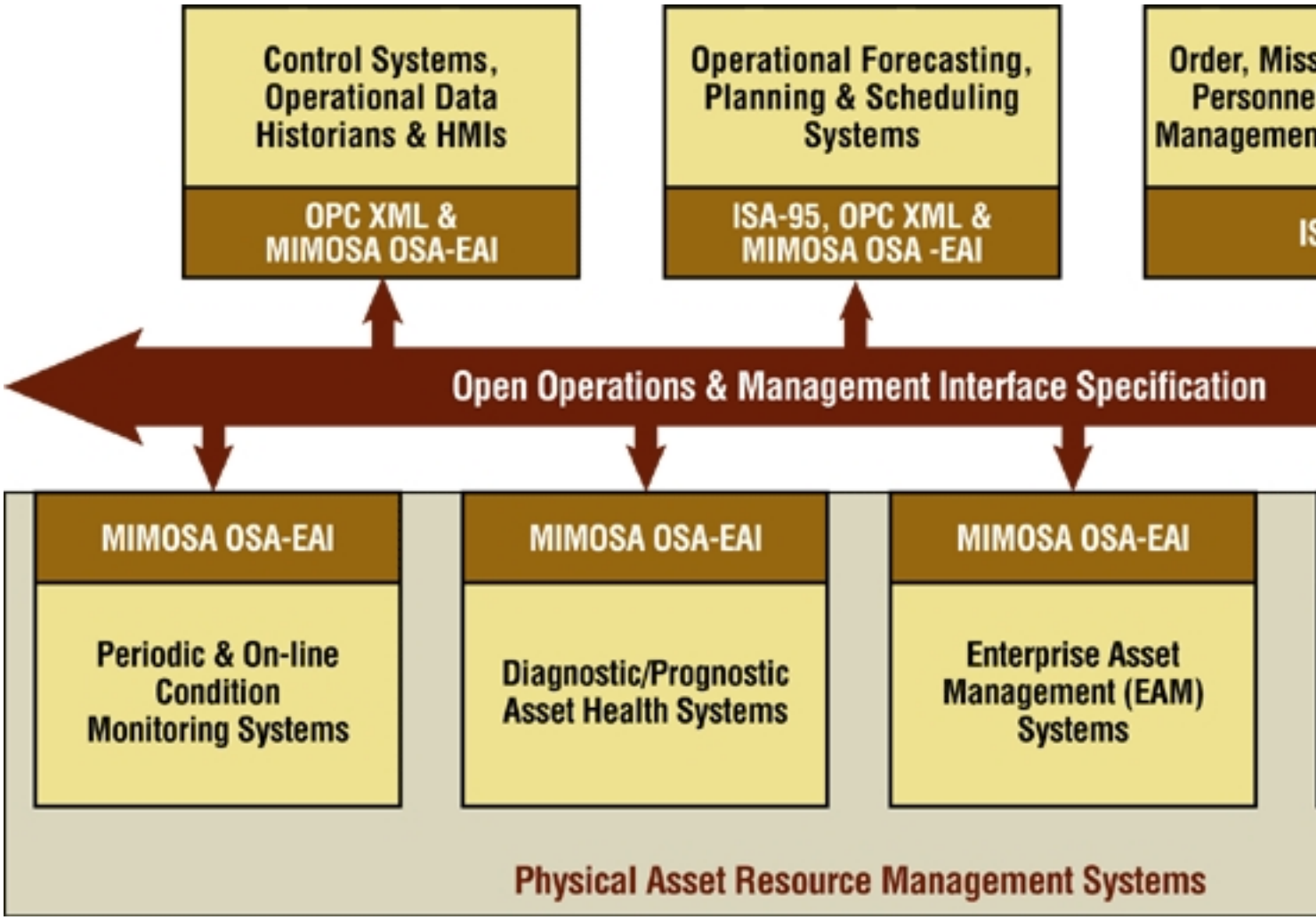

Fig. 3. The acceptance of the OpenO&M Framework will permit system vendors and manufacturing companies to build a single interface for each system for information exchange.

[back to article]

ENTERPRISE SYSTEMS INFORMATION NETWORK

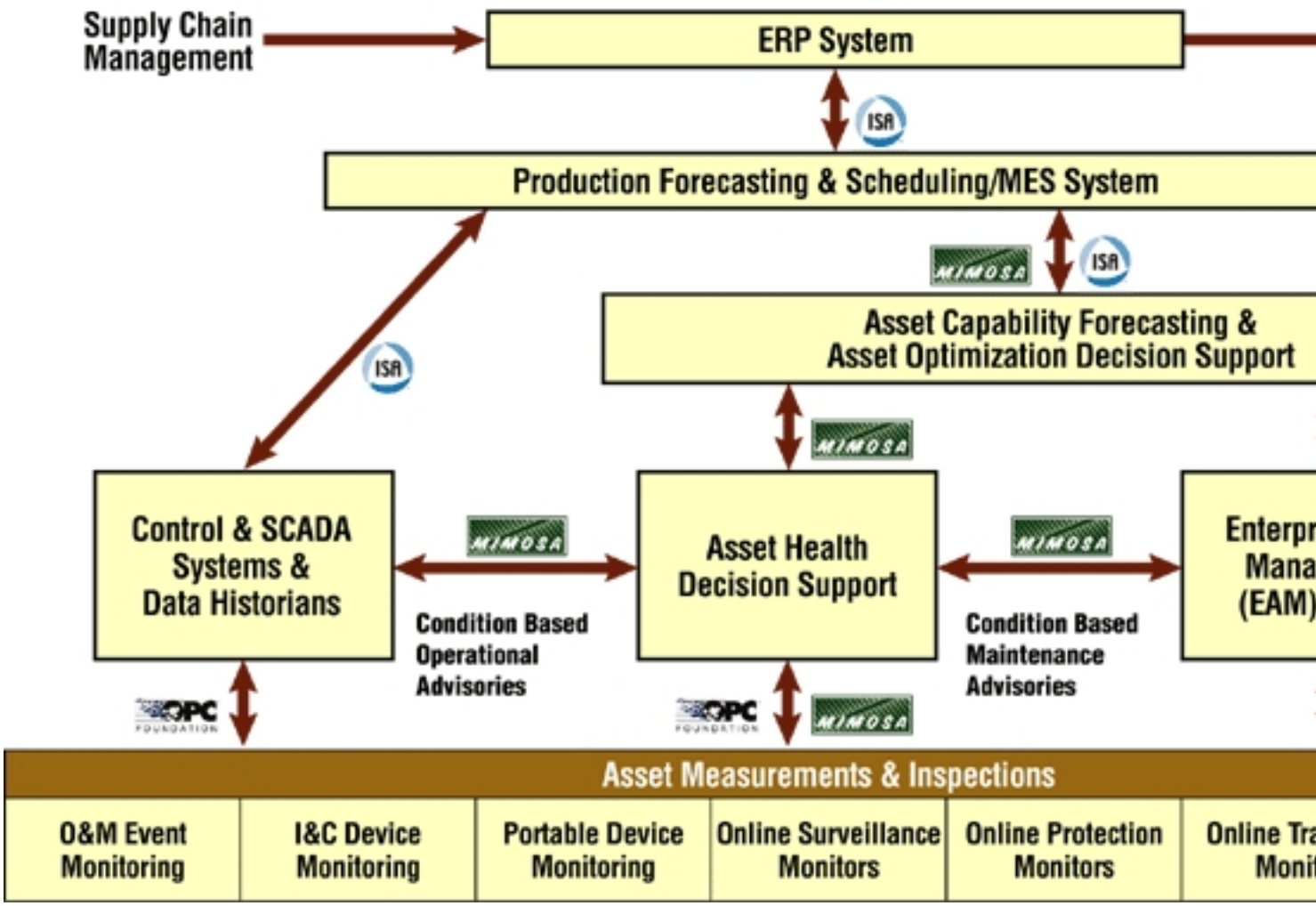

Fig. 4. The client-server technology of OPC will be used to exchange OSE-EAI and ISA-95 format data as required by an enterprise's information needs.

[back to article]

The OpenO&M For Manufacturing Joint Working Group

Three nonprofit organizations—MIMOSA, the OPC Foundation, and the ISA SP95 Committee— compris

The Machinery Information Management Open Systems Alliance (MIMOSA) is a not-for-profit trade asso
www.mimosa.org

The OPC Foundation is dedicated to enabling interoperability in automation by creating and maintaining www.opcfoundation.org

The Instrumentation, Systems and Automation Society (ISA) is a global, nonprofit, educational organizat www.isa.org

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