



OpenO&M™ for Manufacturing

OpenO&M™ for Manufacturing is a Joint Working Group within OpenO&M that serves as an umbrella organization of like minded standards and industry consortiums working to enable the open flow of information between operations and maintenance organizations and systems in manufacturing industries.

OpenO&M

OpenO&M stands for Open Operations & Maintenance. It is an industry initiative dedicated to improving the operation and maintenance functions in the manufacturing, facilities and military domains. OpenO&M is not a standards group; rather it is a collection of standards and industry consortiums collaborating to provide a harmonized set of information standards and technologies for the exchange of Operations & Maintenance (O&M) information.

OpenO&M operates in each domain with a joint working group made up of organizations serving the domain. The domain focused joint working groups gain key synergies by leveraging each others technologies, experience and knowledge. The intention is not to create giant, over-reaching, standards; rather it is to offer domain end users a harmonized set of data exchange standards while avoiding duplication of each others work.

The joint working groups are:

OpenO&M for Manufacturing Joint Working Group

The OpenO&M for Manufacturing joint working group works to provide manufacturing companies with improved standards and technologies for exchanging manufacturing operations and maintenance data. The Manufacturing joint working group covers all types of manufacturing from discrete to process, including non-traditional manufacturing processes such as oil fields and waste water treatment. This working group addresses the global manufacturing industry. The joint working group members are MIMOSA, The OPC Foundation, ISA (ISA88 and ISA95 committees), the WBF, and the Open Applications Group.

OpenO&M Facilities Joint Working Group

The OpenO&M Facilities joint working group fosters integrated data exchange between operations and maintenance activities to enable facilities operators to optimize resource utilization and optimize operational planning and scheduling with their clients leading to optimal allocation of critical path resources (e.g. space, equipment) and energy management. Driven by the U.S.'s National Institute of Building Sciences' (NIBS) Facilities Maintenance and Operations Committee (FMOC) the Facilities joint working group's other members are MIMOSA and the OPC Foundation.

OpenO&M Military Joint Working Group

The OpenO&M Military joint working group works to integrate operational and maintenance data on military platforms ranging from individual combat vehicles to Army Battalions to Naval warships. O&M data integration will enable mission planning and scheduling systems to provide near real-time mission optimization. The Military joint working group is focused on the needs of the U.S. military; members are MIMOSA, the OPC Foundation, the Army Software Engineering Directorate (SED) and the Navy Total Open Ships Architectures (TOSA) program.

Figure 1 illustrates the organization of OpenO&M's joint working groups. OpenO&M was founded by MIMOSA and the OPC Foundation. These two groups provide core asset management knowledge and data connectivity experience and technology which all three joint working groups build upon. As each of the joint working group's domains involve life-cycle management data NIBS is shown as a unifying organization between the working groups. The three joint working groups operate independently, yet they collaborate, sharing members and knowledge. All joint working groups are represented at the annual OpenO&M meeting – OpenO&M Week.

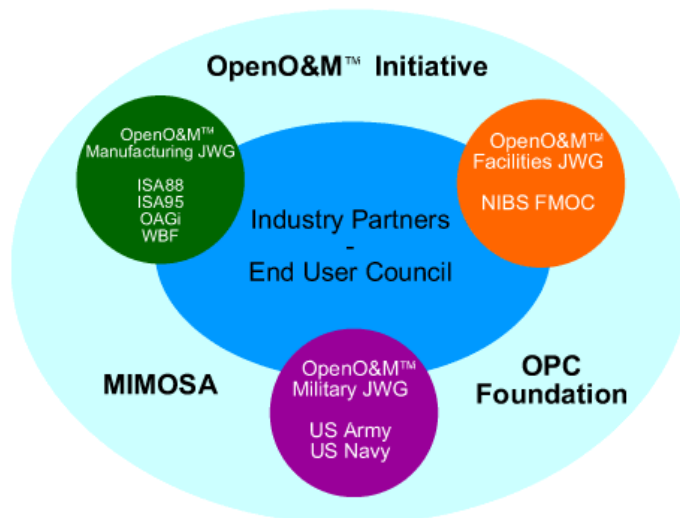


Figure 1 OpenO&M Joint Working Groups

OpenO&M refers to the overall organization, spanning all three joint working groups, however within each joint working group's domain the term OpenO&M is commonly used to refer to the joint working group. Only when multiple joint working group's or domains are being discussed are the joint working group's identified as the Manufacturing JWG, Facilities JWG, or Military

JWG. A brief description and web site URL for each member organization is provided at the end of this Executive Summary.

OpenO&M is asset centric in that assets must be maintained in order for them to be available to operations to complete its mission. No matter whether operation's mission is to fulfill an order for a specific customer by a committed date, operate a company in a building, deliver a package, or to mount a patrol on land, air or sea, assets are required to be available to complete it. The mission of OpenO&M is to foster the exchange of the operations and maintenance data required to make organizations more efficient.

The OpenO&M Organization

OpenO&M is an initiative, not an organization. It operates as an umbrella group for its member organizations, enabling them to jointly build domain awareness of the benefits data exchange using open standards.

For legal purposes the OpenO&M trademark is owned by MIMOSA, which also hosts OpenO&M week during its annual meeting. There are not dues, all OpenO&M activities are performed by volunteers from the member organizations, or from those organizations respective member companies.

OpenO&M does not set the agenda of, dictate the work of, nor control the content of work products produced by member organizations. Rather, OpenO&M fosters networking between member organizations with the goal of member organizations collaborating where they feel it makes sense to harmonize their data exchange standards and technologies, leveraging each others work products and knowledge, and promote a unified package of standards addressing operation and maintenance needs in different domains.

Each OpenO&M member organization operates independently, serving its core constituency. Yet working together the member groups offer work products branded as OpenO&M in order to present a unified set of standards. Examples of work products are:

- Whitepapers
- Consulting services for pilot and showcase projects utilizing standards from multiple OpenO&M members
- Participate in industry conferences and exhibits to present and demonstrate examples of how OpenO&M can provide interoperability between systems.

More information can be found at the OpenO&M web site, www.openoandm.org and at the member organizations web sites listed at the end of this whitepaper.

OpenO&M for Manufacturing

OpenO&M for Manufacturing is a joint working group within the OpenO&M initiative. OpenO&M for Manufacturing works to provide manufacturing companies with improved standards and technologies for exchanging manufacturing operations and maintenance data.

The Manufacturing joint working group covers all types of manufacturing from discrete to process, including non-traditional manufacturing processes such as oil fields and waste water treatment, in all areas of the world.

The joint working group members are

- MIMOSA
- OPC Foundation
- ISA (ISA88 and ISA95 committees)
- WBF
- Open Applications Group.

Working together under the OpenO&M for manufacturing umbrella these groups are each developing data exchange standards and technologies that complement each other and together provide more complete coverage of operations and maintenance data exchange than any one organization could provide individually.

Figure 2 illustrates how the individual OpenO&M member organization's standards and technologies map into the manufacturing domain.

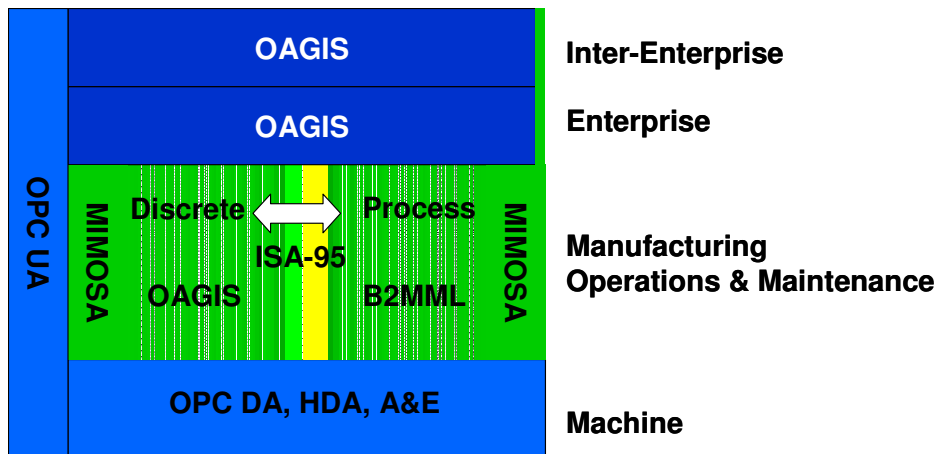


Figure 2 OpenO&M for Manufacturing Domain Mapping

In the center the ISA95 standard, published by the ISA95 Enterprise – Control System Integration standards committee, defines a technology and vendor independent set of models and terminology for exchanging data between enterprise and manufacturing systems. These models span all manufacturing vertical industries in process and discrete industries.

B2MML, the Business To Manufacturing Markup Language and OAGIS, the Open Applications Group Integration Specification are XML schema implementations. Both of these XML schema implementations are focused on data payloads and do not define data transport technologies. B2MML is an XML schema implementation of the ISA95 standard. Like ISA95 B2MML can be used in a wide range of process and discrete industries, with wide usage in the process industries. OAGIS provides a wide array of XML schemas packaged as Business Object Documents (BODs). OAGIS BODs include support for ISA95 but also provide data exchange standards beyond the scope of ISA95, such as engineering change notification which is very important in some discrete manufacturing vertical industries. OAGIS BODs also provide extensive data exchange coverage for business system data exchange, both intra-enterprise and business to business inter-enterprise. Together ISA95, B2MML and OAGIS provide extensive coverage for exchanging operational data between manufacturing systems.

In their Open Systems Architecture for Enterprise Application Integration (OSA-EAI) MIMOSA defines standard data exchange messages covering maintenance and asset management activities. Since OSA-EAI is asset centric it can be applied in a wide variety of domains, as evidenced by its use in the OpenO&M Military and Facilities joint working groups. In the manufacturing domain it provides coverage for maintenance and asset management data exchange for all process types and in all industry verticals. In Figure 2 MIMOSA is shown on both sides of the Discrete↔Process spectrum since its maintenance and asset management functions are not dependent upon the operational characteristics of industry verticals as much as the OAGIS and B2MML standards are. The OSA-EAI standard defines multiple data formats, the most common format today being XML schemas.

The ISA95, OAGIS, B2MML and MIMOSA standards define data payloads but not the transport of the data. This was done to enable their wider application using different transport technologies. The OPC Foundation brings to OpenO&M for Manufacturing a widely accepted, industrial strength, transport standard. With over 300 members creating products supporting OPC technology it is the de facto standard for data exchange at the plant level in the manufacturing domain. The OPC Foundation's most widely used specifications are DCOM based. They are:

- OPC Data Access (OPC DA) is used to move real-time discrete data values such as a flow rate or temperature reading. OPC DA is often used to provide people with a view of manufacturing conditions or to collect data for preservation, analysis or reporting.
- OPC Historical Data Access (OPC HDA) is used to exchange previously collected time series data values. OPC HDA provides a uniform method to move any number of time based data values, such as used in time based line charts.
- OPC Alarms and Events (OPC A&E) is used to exchange alarm and event notifications on demand. OPC A&E messages consist of a collection of timestamps, strings and numerical values that taken together document an event in time. OPC A&E is used to exchange manufacturing alarms and alerts, user actions, informational messages and tracking/auditing messages.

In Figure 2 these three OPC specifications are shown on the lowest level of the domain map since they serve the backbone for shop floor manufacturing systems. The OPC Foundation has recently released the OPC Unified Architecture (OPC UA) which is shown on the left side of the domain map. OPC UA expands upon the logical functionality of the OPC DA, HDA and A&E specifications in a web services implementation. As web services and XML become more widely adopted in business and manufacturing systems OPC UA will provide a secure, industrial strength, web services based transport technology enabling all systems in a manufacturing enterprise to interoperate. OPC UA includes the ability to include information models defined by data payload standards such as ISA95, OAGIS, B2MML and MIMOSA's OSA-EAI into the OPC environment.

The combination of the OpenO&M member's data payload standards and transport technologies will result in the wide coverage of the manufacturing domain's operation and maintenance data exchange requirements implemented in a uniform, secure, industrial strength, transport mechanism.

Cross-Industry Synergies

The individual standards published by OpenO&M members enable interoperability and cost savings, effectively lowering the total cost of ownership by manufacturing companies of operations and maintenance systems. Additional interoperability and cost savings can be achieved as multiple standards within an industrial space work together instead of being discrete domains requiring integration by individual companies as point solutions.

OpenO&M for Manufacturing member organizations work together to leverage each others technical knowledge and industry expertise. Examples of OpenO&M cross industry synergies include:

- Condition Based Operations (CBO) - Integrated data exchange between operations and maintenance domains enabling near real-time, capabilities forecasting and operational optimization.
- Collaborative Asset Life-cycle Management (CALM) - Standards based information exchanges between design, build, commission, O&M, decommission and remediation phases of a manufacturing plants life-cycle.
- Universal Identification (UID) – Unique identification throughout an asset's life-cycle enabling asset traceability through supply and support chains cutting across all industry groups.
- Vendor and product neutral method of Condition Based Maintenance (CBM) enabling linking with third party logistical and maintenance support organizations.

OpenO&M synergies also extend to codifying the data exchange standards as IEC and ISO international standards. Formal international standards provide increased recognition and adoption within manufacturing companies.

One example of OpenO&M's international standardization effort is the work being done by ISO's Diagnostics & Maintenance Application Integration Working Group (ISO Technical Committee 184 Sub-committee 5 Working Group 7 - TC 184 SC5 WG7) in the ISO 18435 Industrial automation systems and integration -- Diagnostics, capability assessment, and maintenance applications integration -- Part 1: Overview and general requirements draft standard. Figure 3 is from this draft standard and shows how the OpenO&M concepts are being incorporated in the standard. This figure shows how operational and maintenance activities interact with high value activities such as capability assessment, order fulfillment, asset prognostics, health, quality, safety & environmental management, asset condition monitoring and sample/test/diagnostic & quality monitoring.

Activity Domain Integration Diagram

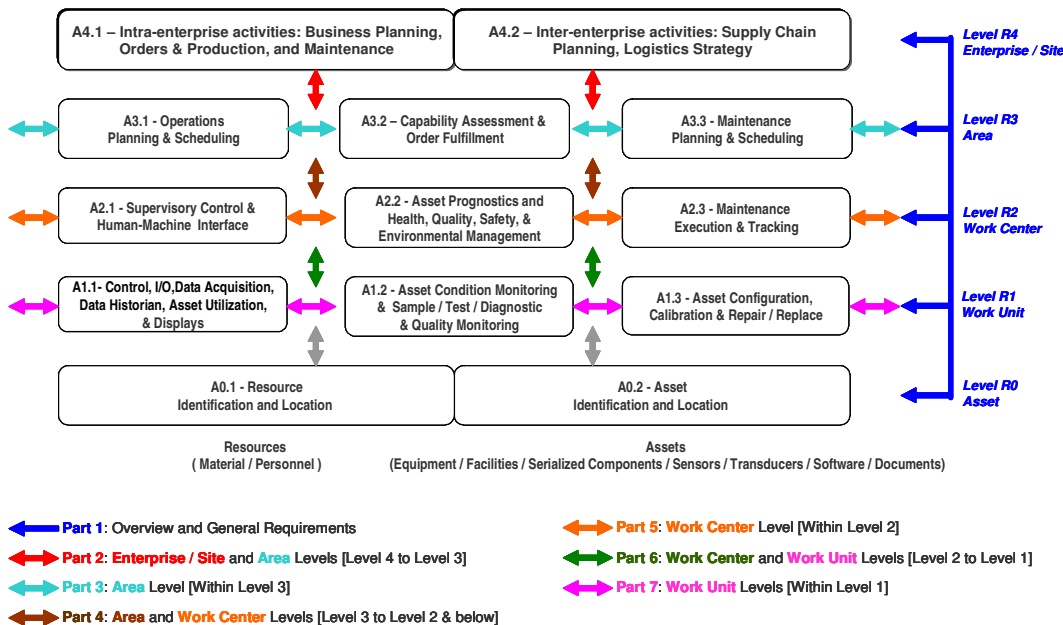


Figure 3 ISO 18435 Diagram (Draft)

Other examples of OpenO&M's international standardization support is the submittal by the OPC Foundation of the Unified Architecture specification to the IEC's 65E TAG for fast track consideration as an IEC standard and the IEC's adoption of the ISA95 standards as the joint IEC/ISO 62264 standard.

Activities

OpenO&M sets visions and goals to further data exchange standards available for manufacturing. OpenO&M member organizations develop and maintain the standards. This is



not a one step or simple process; rather it is an on-going continuous improvement process to set ever higher interoperability goals, yet doing so in small enough increments to allow industry to benefit from implementations.

To support this continual improvement process OpenO&M pursues several activities, including:

- Publishing whitepapers,
- Evangelizing data exchange standards in the press, at conferences and in presentations to manufacturers,
- Encouraging and supporting pilot and showcase projects utilizing data exchange standards,
- Leading the development of international data exchange standards, and
- Reaching out to other industry consortium and standards groups to build momentum for a harmonized set of manufacturing data exchange standards.

End User Council

The OpenO&M end user council enables manufacturing companies to collaborate with each other and to provide OpenO&M with requirements and direction. The end user council is open to all end user manufacturing companies with an active interest in lowering the total cost of ownership of their operational and maintenance systems. The end user council is focused on practical benefits, achievable for today's cycle of projects. This is a source of feedback to the OpenO&M continuous improvement process and a means to build awareness within the manufacturing domain of the benefits of standardized O&M data exchange.

OpenO&M Industry Partner

As OpenO&M™ for Manufacturing grows we have come into contact with like minded industry and standards groups. In order to broaden the OpenO&M umbrella other groups focused on the open exchange of industry data are welcomed as OpenO&M Industry Partners.

OpenO&M members and Industry Partners collaborate, exchanging technology and expertise, to develop broader data exchange standards, both within the operations & maintenance area as well as in other areas of importance to manufacturing companies.

Conclusion

OpenO&M™ for Manufacturing is dedicated to continuously improving the ability for manufacturing end user companies to exchange operational and maintenance data in an open and cost effective manner. The collaboration of member organizations, Industry Partners and end users build a comprehensive network providing results for today and a vision for tomorrow.

OpenO&M Member Organizations

FMOC

www.nibs.org/fmoc.html

The Facility Maintenance and Operations Committee (FMOC), a body operating under the auspices of NIBS, provides industry-wide, public and private support for the creation of higher quality facilities through improved maintenance and operation. In order to achieve this purpose the FMOC has the following objectives: 1) To increase maintenance and operations influence in the facility acquisition process; 2) To promote the sharing and integration of facilities maintenance and operations procedures and information; and 3) To identify and disseminate "best" practices for the maintenance and operations of facilities.

ISA

www.isa.org

ISA is a leading, global, nonprofit organization setting the standard for automation by helping over 30,000 worldwide members and other professionals solve difficult technical problems, while enhancing their leadership and personal career capabilities.

MIMOSA

www.mimosa.org

MIMOSA is a not-for-profit trade association dedicated to developing and encouraging the adoption of open information standards for Operations and Maintenance in manufacturing, fleet, and facility environments.

NIBS

www.nibs.org

The National Institute of Building Sciences (NIBS) was authorized by the U.S. Congress in the Housing and Community Development Act of 1974, Public Law 93-383. In establishing NIBS, Congress recognized the need for an organization that could serve as an interface between government and the private sector. The Institute's public interest mission is to: improve the building regulatory environment; facilitate the introduction of new and existing products and technology into the building process; and disseminate nationally recognized technical and regulatory information.

OPC Foundation

www.opcfoundation.org

The OPC Foundation is dedicated to ensuring interoperability in automation by creating and maintaining open specifications that standardize the communication of acquired process data, alarm and event records, historical data, and batch data to multi-vendor enterprise systems and between production devices.



Open Applications Group

www.openapplications.org

The Open Applications Group, Inc. (OAGi) is a not-for-profit open standards group building process-based XML standards for both B2B and A2A integration.

U.S. Army Software Engineering Directorate (SED)

The United States Army Software Engineering Directorate (SED).

U.S. Navy Total Open Ships Architectures (TOSA) Program

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WBF

www.wbf.org

The Forum for Automation and Manufacturing Professionals, is dedicated to supporting the process automation and operations needs of the technical and management professions in process manufacturing.

Abbreviations and special terms

B2MML	Business To Manufacturing Markup Language
ISA	Instrumentation, Systems and Automation Society (Professional society)
ISA88	Multi-part ISA standard for Batch Control Systems, developed by ISA88 standards committee
ISA95	Multi-part ISA standard for Enterprise-Control System Integration, developed by ISA95 standards committee
MIMOSA	Machinery Information Management Open Systems Alliance, an industry consortium
OPC	The OPC Foundation, industry consortium
OSA-EAI	Open Systems Architecture for Enterprise Application Integration
WBF	Professional society
XML	World Wide Web Consortium's eXtensible Markup Language

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Pertinent Standards

The following standard groups, standards and publications are pertinent to OpenO&M for Manufacturing and its member organizations.

IEC 62264, Enterprise – control system integration (International version of ISA95)

ISA95, Enterprise-control system integration

ISO 13374, Condition monitoring and diagnostics of machines – Data processing, communication and presentation

ISO 15296, Industrial automation systems and integration – Integration of life-cycle data for process plants including oil and gas production facilities

ISO 18435, Industrial automation systems and integration -- Diagnostics, capability assessment, and maintenance applications integration

ISO 18436, Condition monitoring and diagnostics of machines – Requirements for training and certification of personnel

ISO TC 184 Sub-Committee 5 ((TC184 SC5) Architecture, Communications, and Integration Frameworks

ISO TC184 SC5 WG7 Diagnostics & Maintenance Application Integration Working Group

ISO Technical Committee 184 (TC184) Manufacturing Asset Management Integration Task Force Total Life-Cycle Summary

MIMOSA's Open Standard Architecture for Enterprise Application Integration (OSA-EAI)

OPC Foundation's Unified Architecture Specification

Open Applications Group Integration Specification (OAGIS)

WBF's Business To Manufacturing Markup Language (B2MML)

Additional OpenO&M Publications

Condition Based Operation

Collaborative Operations & Maintenance Using MIMOSA's OSA-EAI and ISA95/B2MML



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September 11, 2007

SP88 ISA's Standards & Practices Committee number 88

ISASP95 ISA's Standards & Practices Committee number 95