

# PLANT-TO-BUSINESS (P2B) INTEROPERABILITY USING THE ISA-95 STANDARD

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*ISA-95 is now highlighted as a standard interface specification to secure interoperability for P2B (Plant-to-Business). We have developed an integration platform according to this standard to integrate ERP (Enterprise Resource Planning) and MES (Manufacturing Execution System) in short term and low cost.*

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## INTRODUCTION

Global market pressures are causing businesses worldwide to strive to lower manufacturing costs and to become more agile companies in order to quickly respond to changes in market demands and to fend off competitive threats. Yokogawa's customers in all industries and markets are responding to this pressure by working to more closely integrate their plant manufacturing systems with their enterprise wide business systems in a seamless manner. This integration has historically been very difficult and costly to accomplish. Recently a standards based approach has been recognized as a more efficient method to integrate these disparate systems.

This paper discusses how the manufacturing industry is responding to these pressures by using the ISA-95 standard to integrate their plant and business systems and how Yokogawa has responded to our customer's needs by offering products and services to help them accomplish their business goals.

## CURRENT STATE OF P2B INTEGRATION TECHNOLOGY AND MARKET

Major manufacturing companies, like companies in other industries, use a type of computer system called Enterprise

Resource Planning (ERP) systems to automate typical business functions such as accounting and financial reporting, human resources, and purchasing. In manufacturing companies ERP systems have been extended to be used for ordering raw materials, tracking work in progress, and coordinating the shipment of finished goods to customers. This has led to the use of ERP systems in coordinating with upstream and downstream supply chain partners.

Manufacturing companies have long desired to better integrate their manufacturing plants, often widely distributed geographically, within their ERP system. The key manufacturing plant systems to be integrated with ERP systems are Manufacturing Execution Systems (MES) and Process Automation Systems (PAS). Depending upon the industry the terminology may differ, for example in discrete manufacturing industries the term MES is widely used as they usually do not have the sophisticated PAS systems found in most process manufacturing plants. Yokogawa's process customers usually want to integrate their CENTUM CS 3000 Distributed Control Systems (DCS) and Exaquantum Plant Information Management Systems (PIMS) with their ERPs as these systems perform the MES system functions. In this paper, we will use the term MES to refer to our customers PAS and PIMS systems.

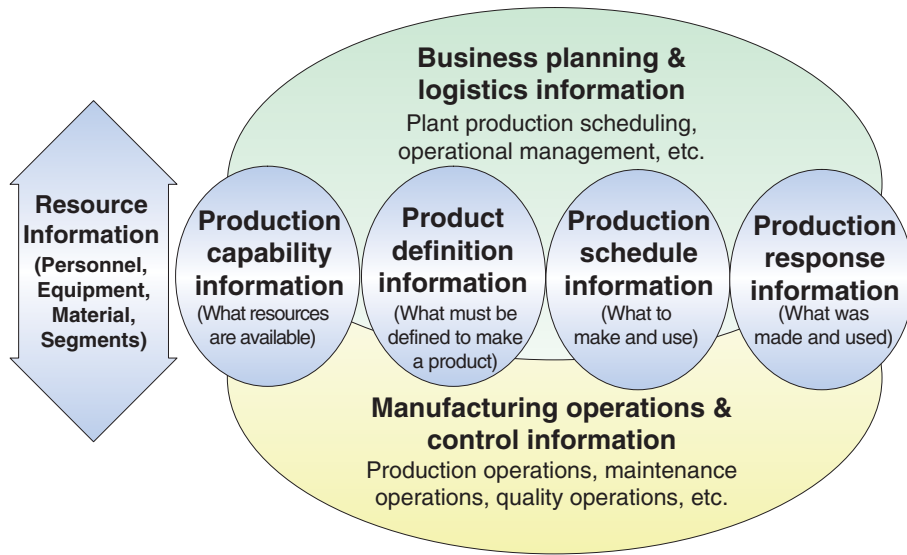
There are many suppliers of ERP systems and some companies utilize proprietary in-house developed business systems. However, one company, SAP, has the largest market share, specifically in the process industries where the clear majority of process manufacturers use the SAP ERP system.

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**Figure 1** ISA-95 Categories of Production Management Information

Other leading ERP suppliers in western markets are Oracle, Microsoft, and Infor.

Historically manufacturing companies have attempted to integrate their ERP and MES systems with little success and often high cost. In the late 1980's and early 1990's the term Computer Integrated Manufacturing (CIM) was popular. Many companies attempted to implement CIM systems and while there were successes the point-to-point custom integration software proved to be more expensive and difficult to implement and maintain than the rate of return would justify, as evidenced by the lack of adoption of CIM in the mid and late 1990's. In 2004 SAP estimated that among the manufacturing customers using SAP's ERP software there were approximately 14,000 manufacturing sites, yet less than 10% of those sites were integrated with the ERP. This figure is likely to be accurate industry wide, not just among SAP users.

In recent years there has been recognition among manufacturing companies, ERP suppliers and MES suppliers that the previously used customized, point-to-point interfaces are not an adequate solution. Instead there is a strong need to have interoperability between these systems based upon widely adopted standards. Supporting this trend has been a growing demand by business executive for real-time, manufacturing oriented, key performance indicators (KPIs) to make the current plant status more visible to business managers. In the mid 1990's the ISA, an automation industry professional organization, started developing a new standard called ISA-95 to address these needs.

The release of the ISA-95 standard in 2000, updated in 2001 and 2006 coincided with the IT industries move to XML (eXtensible Markup Language) and the use of web services to exchange business data, both internally within a business and externally or B2B (Business-to-Business). There is a strong trend

developing among all types of companies, including process manufacturers, to use standards based data exchange using web services and XML in order to make the exchange of all types of data more efficient, lower cost and more agile, or easy to adapt to changing business needs.

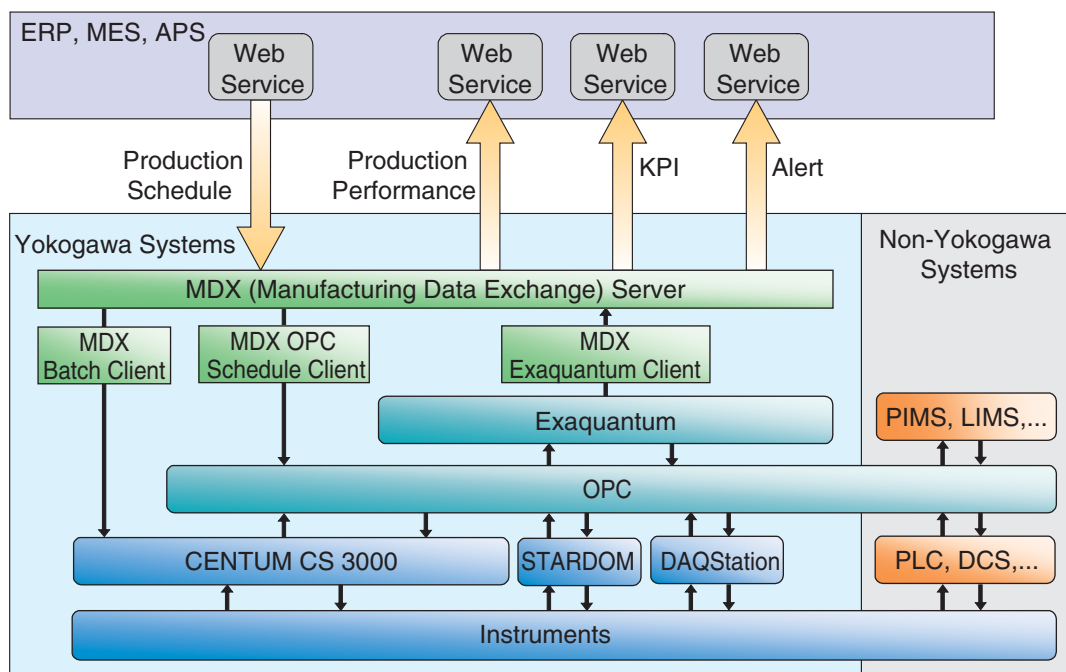
### **ISA-95 ENTERPRISE – CONTROL SYSTEM STANDARD**

The ISA-95 standard is a consensus standard developed by the ISA's Standards & Practices Committee Number 95 (SP95). The SP95 committee is made up of representatives from manufacturing companies, MES system suppliers (including Yokogawa), ERP system suppliers and industry consultants. The ISA is also affiliated with ANSI (American National Standards Institute) and IEC/ISO, so the standard is also a U.S. standard as well as an international standard. The international version is called IEC-62264 and is a dual logo IEC/ISO standard, although globally it is typically referred to as ISA-95.

The goal of the SP95 committee in developing the standard was to reduce the risk, cost, and errors associated with implementing interfaces between business and manufacturing operations & control functions. This would enable enterprise systems and control systems to inter-operate and be easily integrated.

The ISA-95 standard is a multi-part standard. Parts 1, 2 and 5 define the exchange of production data between business and plant systems. Parts 3 and 4 will address typical MES functions and expand the work done in parts 1, 2 and 5 by additionally defining the exchange of maintenance, inventory and quality data between business and plant systems.

The ISA-95 standard provides a high level, logical, model for organizing the exchange of data between business and plant



**Figure 2** Manufacturing Data eXchange (MDX) Architecture

systems. Figure 1 shows the categories of production management information the ISA-95 standard defines for exchange between business and manufacturing systems. This standard approach to organizing data exchange is valuable for planning and specifying integration projects.

The ISA-95 standard by itself is not sufficient for implementation, this is why the WBF (World Batch Forum) created the B2MML (Business To Manufacturing Markup Language). B2MML is an XML implementation of the ISA-95 standard that provides a common XML data structure for use by ERP and MES vendors as well as manufacturing companies. B2MML has been adopted by most major process automation suppliers and by SAP thereby providing wide adoption in the process industries. As an XML implementation B2MML is compatible with web services which fit in well with the shift to Service Oriented Architectures (SOA) by major manufacturing companies.

Functionally the most widely used facet of ISA-95 and B2MML are the download of production schedules from ERP systems to MES systems and the upload of production performance information from MES systems to ERP systems. This key functionality enables corporate level planning and scheduling functions to have an automatic, two way, link with the manufacturing system thereby enabling faster transfer of manufacturing instructions (e.g. orders) to plants and the real-time, or near real-time, transfer of actual manufacturing results to business systems which are used for KPIs and increasing management visibility into the plant.

After the key scheduling/performance facet of production management is implemented many companies are looking to increase the exchange of Plant Asset Management (PAM) data

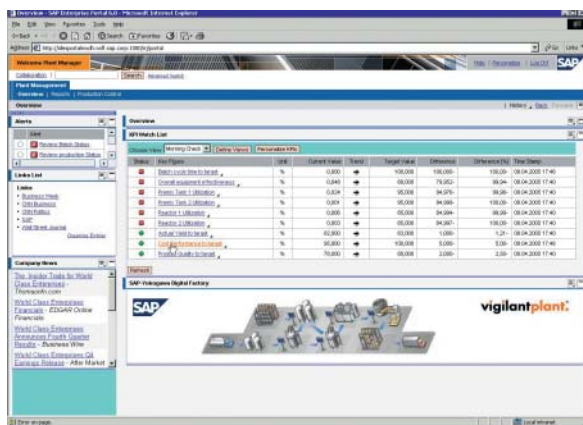
between plant production/maintenance systems and Enterprise Asset Management (EAM) systems. The enhanced exchange of asset management data is expected to increase reliability, providing business with more accurate plant capability forecasts and reducing maintenance costs.

## MDX (MANUFACTURING DATA EXCHANGE)

In response to our customer's requests for help integrating their Yokogawa DCS and PIMS systems to their ERP systems we have developed MDX (Manufacturing Data eXchange). MDX is an integration platform that layers on top of CENTUM CS 3000 and Exaquantum providing standards based web service interfaces to ERP systems, and if needed other MES systems.

MDX is designed as a COTS (Commercially Off The Shelf) IT product in order to have it readily accepted by our customer's IT departments. Key considerations are: support for XML; web services; ability to operate in a network DMZ (a network area separated with firewalls from all other systems); SOAP and major IT platforms such as SAP's NetWeaver product. Acceptance by our customer's IT departments is critical since MDX will not operate in the isolated manufacturing domain where our control system products function, rather, MDX will connect the manufacturing domain with the enterprise domain, so it must be easily accepted by both groups.

To aid in the acceptance by our traditional manufacturing domain customers MDX supports standards such as ISA-95 and B2MML which originated in this domain as well as support for OPC which is the most widely adopted communication protocol in the manufacturing domain. Support for OPC enables MDX to work with any major PAS, PLC, or MES system, not just



**Figure 3** KPI Data from Exaquantum & CENTUM CS 3000



**Figure 4** CENTUM CS 3000 Graphic in NetWeaver Portal

Yokogawa's products. Therefore Yokogawa's MDX product can serve as the primary Plant-to-Business integration platform for a company by using standards such as ISA-95, B2MML and OPC to bridge the gaps between manufacturing and business systems. Figure 2 shows the MDX architecture and how it can work with different manufacturing systems using OPC while providing standards based XML web service interfaces to ERP, or other MES, systems.

MDX is designed to be a solution platform, currently providing support for production management interfaces. Extended support to include maintenance, inventory and quality data is planned. The MDX design allows for additional XML based standards to be supported with minimal changes to the MDX product. MDX acts as a broker to receive and dispatch application specific data between ERP systems and manufacturing systems,

A typical type of data MDX can send to the ERP system is KPI data to provide business managers with real-time visibility into the manufacturing process. In conjunction with SAP, Yokogawa has demonstrated passing KPI data from CENTUM CS 3000 and Exaquantum to the SAP ERP system where it is displayed in real-time on SAP's KPI displays. Figure 3 shows a typical SAP NetWeaver Business Portal display of KPI data that was calculated in CENTUM CS 3000 and Exaquantum and sent to SAP for display. Building upon the data exchange technology SAP and Yokogawa also demonstrated user interface integration by displaying live CENTUM CS 3000 operator displays in the SAP NetWeaver Business Portal as shown in Figure 4. This visual integration enables our customers to make manufacturing

information available to the right person in the business no matter where they are and helps to knock down traditional walls between manufacturing and business groups. In 2006 MDX was certified by SAP to be "Powered by NetWeaver".

## CONCLUSION

Process manufacturing companies are increasing activity to integrate their plant and business systems. Yokogawa is responding to this trend by developing products such as MDX which can bridge the traditional gaps between the business and manufacturing domains by supporting standards important to each group. MDX provides a configurable solution platform for Yokogawa's operation groups to build integration solutions for our customers. It is our hope that our customers will find MDX and a standards based approach to integration to be a desirable and efficient business solution. ◆

## REFERENCES

- (1) ISA, [www.isa.org](http://www.isa.org)
  - (2) OPC Foundation, [www.opcfoundation.org](http://www.opcfoundation.org)
  - (3) World Batch Forum, [www.wbf.org](http://www.wbf.org)
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