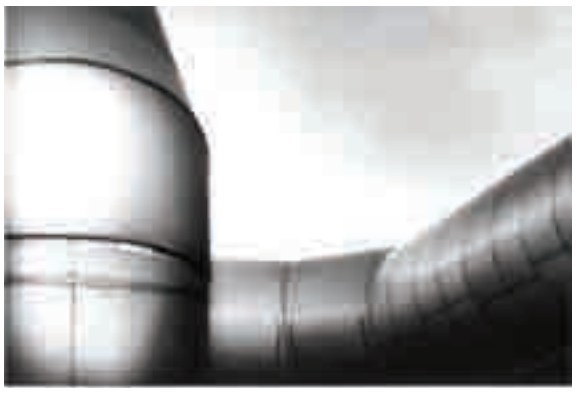
IT and Automation Systems in the Petrochemical Industry

Colin Thurston, Director of Product Strategy, Thermo Fisher Scientific
1601 Cherry Street, Suite 1200, Philadelphia, PA 19102 Tel: +1 215 964 6020 Email: marketing.informatics@thermofisher.com
Andrea Carlini, R&D systems and Automation Support, LyondellBasell Industries,
P.O. Box 2416 3000, CK Rotterdam, The Netherlands Tel: +31 10 275 5500



Data management within the petrochemical industry occurs on different levels at different stages of the production process. Each data layer provides information that is used in the layer above to make decisions within that domain. Industry IT and automation systems can be broadly categorized into three areas:

- Real time control and monitoring systems, e.g. SCADA, are used to provide basic control, monitoring and plant safety functions. They provide a continuous flow of data, but have limited reporting and analytics capability.
- Plant automation management systems sit on top of the control systems and usually provide additional functions such as data history, mass balance calculations, production accounting, performance management, optimization, HSE (health, safety and environmental) management and laboratory information management systems (LIMS). These systems enhance the plant operations by delivering information to plant management to get more from their plant and assets (e.g. enhance revenue, reduce losses, support in decision making and more).
- Enterprise Resource Planning (ERP) systems cover functions such as financial management, human resources, supply chain distribution, stock control and material management. Their objective is to provide information that helps manage enterprise and executive business issues, thereby allowing companies to stay competitive and progressive (e.g. decision support, performance management, growth).

Integration Challenge

Most IT and automation systems supplied to plants are an agglomeration of disparate and independent systems from different suppliers and vendors, selected on a 'best of breed' basis as each unit is commissioned in the plant. This approach tends to result in limited or compromised benefits because the systems are viewed in isolation rather than as a single integrated solution. Examples of compromises of inefficiencies include additional error-prone manual entry or transfer of information, data inconsistency/duplication and restricted functionality between systems.

Adding to these difficulties is the lack of communication and awareness between the different products from market leading vendors. Each system is typically implemented by different types of vendors, consultants and suppliers who are specialized and do not have a view of the needs, technologies, and requirements of the other layers of information technology already in place at a petrochemical processing plant. The result is that design work, integration, system capabilities and the basic technologies implemented can often lack the necessary features for true integration, resulting in gaps, overlaps and redundancy. The deviations and shortfalls vary in their extent depending on the age of the plant, when the automation and ERP systems were installed and the products selected. While each of the automation layers described above serves a different purpose and may be supplied by different classes of suppliers, they are still interrelated and require bi-directional data integration to deliver tangible benefits to the plant. The lack of a coherent strategy for systems, instrument or software integration results in one or more of the following:

- Data redundancy stemming from the same data existing in different systems
- Master data being defined several times within different automation and IT systems affecting data integrity, consistency and increasing the maintenance overhead
- Additional cost for integration/interfaces between the different systems
- Fragmented support from vendors or IT personnel not fully trained in all the various systems
- Complex software upgrades required for disparate systems originating from different vendors
- Error-prone manual work due to a limited data exchange and availability at all levels for all systems/users
- Difficulty in implementing new requirements
- Inability to fully benefit from the capabilities and data of real-time systems
- Mis-match of terminology between similar systems
- ERP systems failing to benefit from the referential and dynamic data of the automation systems

One of the challenges in systems integration is deciding on the optimum architecture, integration tools and method of IT automation systems. Although the above systems serve different functions and fall under different classes of IT and automation, they are all very much related and must communicate. They share and use a significant percentage of the data structure, entities and data types.

In petrochemical plants most applications need data on the plant hierarchy and entities such as plant configuration areas, equipment definition, streams definition etc. At least 20% of the tables that store this information are shared between two applications. In addition, multiple systems offer source data for common reporting, data warehousing, data mining and analysis. They use the same hardware, networking storage systems and are similarly developed or implemented using open software systems and technologies. This commonality amongst the systems provides a solid foundation and justification for better and seamless integration. By leveraging and sharing the data more informed decisions can be made about operational conditions at a much faster rate.

Integration: LyondellBasell Industries

Headquartered in The Netherlands, LyondellBasell Industries is one of the world's largest polymers, petrochemicals and fuels companies. It is the global leader in polyolefins technology, production and marketing; a pioneer in propylene oxide and derivatives; and a significant producer of fuels and refined products, including bio-fuels. LyondellBasell has combined annual revenues of nearly $45 billion, delivered from more than 60 manufacturing sites in 19 countries on five continents.

LyondellBasell Industries has a wide range of software provided by a large number of suppliers and sometimes the same kind of information is managed by different applications across different sites. This unsystematic way of doing business is a consequence of many mergers and acquisitions related to its global strategy, but still works well at a local level.

Andrea Carlini, R&D Systems & Automation Support in Product & Application Development at LyondellBasell explains: 'LyondellBasell has several major sites, and the applications which we run on those sites are more critical than others. Our key concern is continuity and some sites operate stable applications that have been running for nearly 15 years."

LyondellBasell's plant information management utilizes the PHD (Honeywell) and PI (OSI) applications, and are mostly used with their default features for the collection and analysis of process data. For laboratory information management and control, LyondellBasell utilizes Thermo Scientific SampleManager LIMS software. LyondellBasell also uses the SampleManager Instrument Management module for instrument data acquisition and control and Thermo Scientific Atlas chromatography data system to collect and process the large volumes of chromatography data generated.

Approximately 20 years of knowledge is stored in a single database within the organisation, and various sets of easy-to-use tools are used to query, analyze and report on that data quickly and without complex algorithms. The structure of the data is simple and effective, and with the history and experience of usage, the staff need not learn additional software or tools.

Carlini added: 'Almost all other software including some leading ERPs like SAP suffer expensive migrations and updates, some others just die because the supplier has been merged and the application terminated by commercial needs. Thermo Scientific SampleManager LIMS and Thermo Scientific Atlas CDS give us the ability to maintain the same user operability while extending functionalities and keeping maintenance costs at a minimum level. The major advantages of their usage include cost, stability and fitness for purpose." He continues "To ensure we are using the best systems in LyondellBasell, we have evaluated both PI and SampleManager LIMS against competitive products and found that the market cannot deliver benefits to meet our expectations and that competitors offer less testing of their products and fewer evaluation tools. The stability and longevity of the application is a major benefit to us, as is being up to date and efficient in providing and managing the results."

Due to staff's continuously internalized knowledge and ongoing enhancements to Thermo Scientific SampleManager LIMS, LyondellBasell has a LIMS that has evolved with the company's needs and is reflective of the infrastructure requirements that have helped this company become a leader in its field.

Conclusion

Petrochemical organizations should consider their overall systems, how each system is or can be connected to the overall systems structure, and its benefit to the organization. Careful consideration must be placed in the investment in IT and management systems that sustain potential future demands of the company and have the capacity to accommodate IT additions and alternative systems, creating as little disruption to the information management as possible. Efficient integration and appropriate interfacing, creating seamless IT communication, is essential for achieving streamlined data management and successful business management.