Independent software for the Food & Beverage industry

A guide to flexible and sustainable automation solutions

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Introduction

Every Food & Beverage Plant faces challenges. Those challenges might include those that are common to most Manufacturing companies, for instance, the pressure to produce more, more quickly and at a lower cost or the need to integrate diverse systems and equipment from different manufacturers. Or, it might include challenges that are specific to the Food and Beverage sector, such as the need for greater flexibility in terms of production line changes (e.g. different packaging, different recipes, changes to food labeling) and the need to respond to demands for improved information (e.g. traceability, transparent processes).

It is our contention that Automation should help Plants to meet these challenges and underwrite the mission to support new ideas and objectives - not to limit them, and not to bring unnecessary and costly constraints.

Figure 1: The dynamic environment of the Food & Beverage Industry demands flexible automation solutions

Automation necessarily includes both hardware (such as measurement devices, PLCs, HMI panels, PCs etc) and software. In this paper we will look particularly at the software used for HMI/SCADA applications, Production Line Management, Equipment Performance Monitoring and Consumption Optimization.

Within the entire Process and Plant Automation system, each component – whether hardware or software - has its **own life cycle,** which potentially sets it at a different point in terms of innovation to the rest of the components within the Process and Plant Automation system.

In a Food & Beverage Production Plant, when new investments are considered, or simply when upgrades or maintenance operations are considered, there are important questions to be answered by the Production and Automation team:

- How can we best fulfill the industry requirement of ensuring Production operations are flexible and cost effective at the same time?
- How can we best integrate both existing and new production equipment from a variety of suppliers?
- How can we benefit from evolving automation technology without overloading the budget?

The answers to these questions will impact the decision about which Automation solutions will be selected to meet the immediate Plant requirements. But, it is our contention, that the most essential decision which influences all processes to come – from the planning, configuration and implementation steps of the project, right through to the achievement of the business objectives of the entire Food and Beverage Plant – is whether 'independent' software is going to be used or not.

What do we mean by 'independent software'?

When we use the term 'independent software' we mean to identify automation software which has characteristics such as openness, versatility and extensibility, and which has the power to directly impact on the flexibility and sustainability of the entire Automation System.

In this paper, we would like to show you how independent software can be identified and evaluated and why decision makers should attribute great importance to this evaluation process. We will do this by taking a look at three typical challenges an Automation team in a Food & Beverage Plant might face, namely:

1. Integrate diverse equipment within a Production Line Management System
2. Reduce the risk of a long production downtime due to a damaged HMI panel on a packaging machine
3. Manage a cost-effective extension of an existing Consumption Management System across an entire Production Plant

When time and finance are critical constraints, how can the effort of selecting an automation solution best pay off?

1. Integrate diverse equipment within a Production Line Management System

A typical Production Plant generally consists of both old and new production machines and equipment, devices and measurement instruments from a variety of different vendors. Each of these pieces of kit was selected because of its specific technical performance, its low repair costs and/or its low energy consumption.

In our example, due to the wide variety of generations and types of production equipment in the Plant, there are large number of different types of PLC that will need to be communicated with to deliver the necessary data acquisition and control.

The central part of the Production Line Management System is a PC on which SCADA software will run. As we know, there are several SCADA software applications available to select from.

Clearly, in our example, an important selection criterion is provided by the challenge to connect to such wide variety equipment. The risks of not considering this requirement include, but are not limited to:

TCO = Total Cost of Ownership

- A longer integration time
- Higher costs of integration (initially and for all future upgrades) reflected in a high TCO
- Complex on-going maintenance costs
- The full performance potential of installed hardware cannot be realized, which risks diminished profits as a result of poor hardware performance

What are the options?

When SCADA software is required to connect with a wide variety of diverse production equipment, one of the following scenarios usually arises:

a) No ready-made connector is available

Either a driver must be programmed or a database connection to another application or software needs to be established. In either case, the associated programming is very cost intensive work which requires expert know-how. If performed without necessary expertise, **the integration has questionable outcomes in terms of quality and reliability** and, potentially, a negative impact on all future maintenance work. This solution brings with it an uncertain budget, and uncertain results.

b) An OPC connection is available

Using OPC as a common standard is generally seen as a cost effective and standard way to connect to any device - at least, any which has an OPC server available. However, this extra layer between hardware and SCADA software is, inevitably, one more layer of complication and potential error or malfunction. **Additional maintenance work** is required. The connection is likely to have **lower quality and performance** than a direct driver because it cannot be guaranteed that the OPC connection covers the full range of the hardware's capabilities. Plus, supplementary costs for the OPC-related software license must be considered.

c) A direct driver is available

The direct connection usually offers the best value for the minimum investment. Ideally, the driver should be delivered by the vendor of the SCADA system to ensure quality and compatibility. A direct connection will offer **access to the full power of the hardware**, will have optimized communication for high performance, and can be used out of the box. Plus, it is usually automatically updated with every SCADA system upgrade. Moreover, the intelligent browsing and importing mechanisms of the PLC variables **minimize the engineering effort**.

Conclusion

Independent software is characterized by the availability of a large number of different direct drivers, together with OPC connection as fallback scenario for more 'exotic' devices. As a consequence, Production Line Management Systems built on independent SCADA software deliver both cost-effective flexibility and high quality integration – essential when dealing with a range of diverse production equipment.

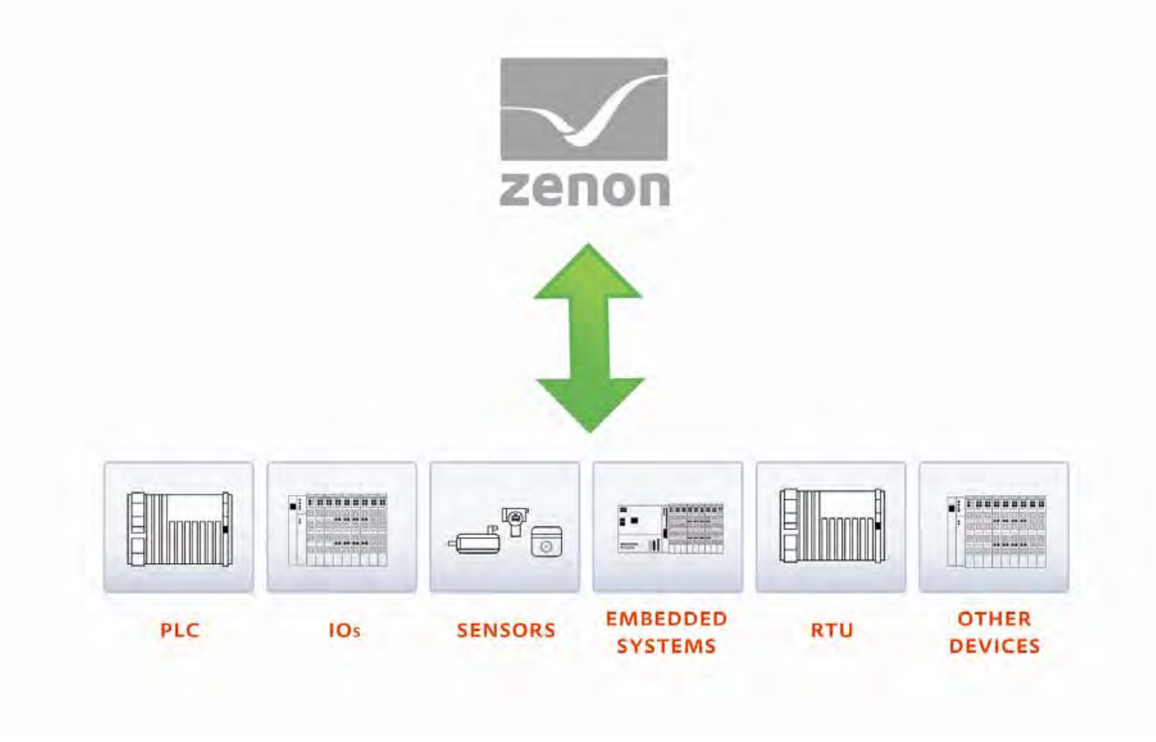

Figure 2: Hardware-independent software ensures universal communication and great performance when integrating diverse production equipment.

2. Reduce the risk of a long production downtime as a result of a damaged HMI panel on a packaging machine

An important part of achieving improved Overall Equipment Effectiveness (OEE) is ensuring good availability. Using our example of a food packaging line, working towards eliminating machine downtime is a vital part of ensuring good availability.

On our packaging line, once an HMI operating panel is damaged the machine typically cannot be operated and the entire line has to be stopped. The Plant's OEE value drops dramatically - quick intervention is essential in order to reduce the negative consequences.

What are the options?

The HMI/SCADA software powering the application running on the damaged panel plays a key role in determining the action that can be taken, how fast it can be taken and what the costs of remedial action will be. Possible courses of action include:

a) Wait for the delivery of a new HMI panel

This is, quite simply, not a realistic option for a Manufacturing Plant seeking high productivity – and must be **avoided**. The duration of the production stoppage is entirely dependent on the availability, delivery and replacement time of the new panel.

b) Use an identical panel from stock

This option eliminates the uncertainty associated with the previous course of action stemming from delivery and supports a quicker restart of production. However, it is often the case that heterogeneous machines are used in production and these may vary in terms of functionality, performance, age, brand and supplier. As a consequence, the diversity of HMI panels which would need to be kept in stock may represent **a significant drain in terms of both budget and logistical resources**.

c) Use a generic panel from stock

If the HMI/SCADA software is truly independent, it will be capable of running on different hardware platforms and at different screen resolutions. This means that a generic HMI panel (or even a normal PC) can be kept in stock as an interim solution for various machines in case of a failure until a replacement of the original panel is delivered and exchanged for it. In the case of a damaged panel, this panel is used and the adequate software project is put in operation.

If the HMI/SCADA software supports automatic adjustment of the screen resolution, even panels with different display sizes and resolutions can be used as replacements for the damaged HMI screen. This possibility comes as a result of the independence of the software and brings **quick and cost-effective** restoration of the machine operation and our packaging line. The delivery of the identical replacement panel is no longer of critical importance.

d) Use the redundancy of the HMI software

Independent software should dramatically reduce constraints when designing automation architectures - by allowing network implementation across HMI and SCADA applications and devices. Any software package should offer easy-to-configure capabilities for Client-Server implementations as standard and also, importantly, for redundant configurations.

When a machine's HMI software application is running redundantly using another HMI panel or even in a super-ordinate PC running a SCADA application, the damage of the panel will not affect or stop the production. As a result, productivity indicators will not suffer. However, bear in mind that using redundancy via a super-ordinate PC running a SCADA application, certain safety regulations need to be observed. This solution brings **maximum availability** of packaging equipment at **reasonable costs**, depending on the chosen network architecture.

Conclusion

The two latter solutions based on independent software vary in terms of cost and the optimization of equipment availability. In both, the key factor is technology; it must facilitate the use of an application on different operating systems and hardware platforms, whether stand-alone or as part of a network, including facilitating redundant architectures.

Figure 3: Independent software is designed to run on different operating systems and hardware platforms.

3. Manage a cost-effective extension of an existing Consumption Management System across an entire production plant

In this example, a Consumption Management System in a Food & Beverage Production Plant is to be the subject of a step-by-step development, as follows:

- Implementing new meters into a system to monitor the consumption of energy, compressed air, water, chemicals etc.
- Connecting to production equipment in order to improve the correlation between consumption and production
- Adding new production areas to the system, to extend the coverage of the consumption optimization process
- Involving new members of the production team in the tasks related to optimized consumption
- Delivering information to other systems such as ERP systems

It is expected that every step of development can be achieved without constraint, with reasonable engineering effort and with costs kept to a minimum.

What are the main software characteristics to be analyzed?

The software at the core of the Consumption Management System may or may not satisfy these requirements depending on the software philosophy. There are three key factors which influence the flexibility of the Consumption Management System, the speed of engineering and the amount of costs resulting from manpower, hardware and software needed for the system update:

a) Network technology

The step-by-step development of our Consumption Management System requires the solution to be extended across the entire Plant or Corporate Network. To chose an effective solution, the Automation team must ask how **sophisticated** is the software's network technology? How **easy to configure** are the Client-Server, redundant and Web-Server topologies? The answers to these questions will help the Automation team to identify the software which offers long term cost-effectiveness and flexibility.

b) Backward Compatibility

When a software doesn´t support the compatibility with previous versions or editions, the plant is under the pressure to choose between:

- Changing the software or updating the software version according to the release cycle of the software producer. Either way, this 'Hobson's choice' ('take it or leave it') translates into engineering and licensing costs which impact negatively on the Plant's engineering budget. The financial impact is even worse when these unexpected costs have not been foreseen or budgeted for.

- Accepting the current limitations and having no access to the ongoing software innovation.

A better solution would be to use a software solution that can run different versions within the single network. In this way, the Engineering **budget can be planned securely** and according to functional requirements.

c) Minimized engineering effort through the reuse of existing functionalities

The reuse of existing functionalities is key for optimized engineering and maintenance. There are different methods of reusing functionalities. The simplest way is to use a copy and paste function to copy project parts. However, advanced mechanisms may also be available which help to minimize the potential for error and optimize engineering effort still further. These include:

- Object orientated project components based on templates – for supporting **corporate standardization**
- Applications realized automatically with wizards – for **easy project roll out**
- Shared functionality across the network, for example, existing functions in an HMI can be reused at SCADA level without reengineering – for **a reduced cost of development**

Conclusion

These three factors are key to understanding the flexibility, speed of engineering and cost of the solution. Independent software is generally better placed to reduce the constraints on the user when creating and developing the Automation architecture.

In our example, where a Plant is optimizing consumption, the success of the five planned steps (to introduce new meters, link to additional production equipment and areas, roll out the system to new users and link to external systems, such as the ERP system) entirely depends on the open communication and flexible topology delivered by a truly independent solution. The benefits of open communication and flexible topology must be balanced with the need for tools designed to reduce the engineering effort and that allow Engineers to create great looking and highly functional graphical solutions through which operators enjoy great ease of use.

We believe the three key characteristics discussed above help to ensure this balance and provide the cost-effective flexibility needed when integrating comprehensive systems across entire Production Plants, as shown in Figure 4.

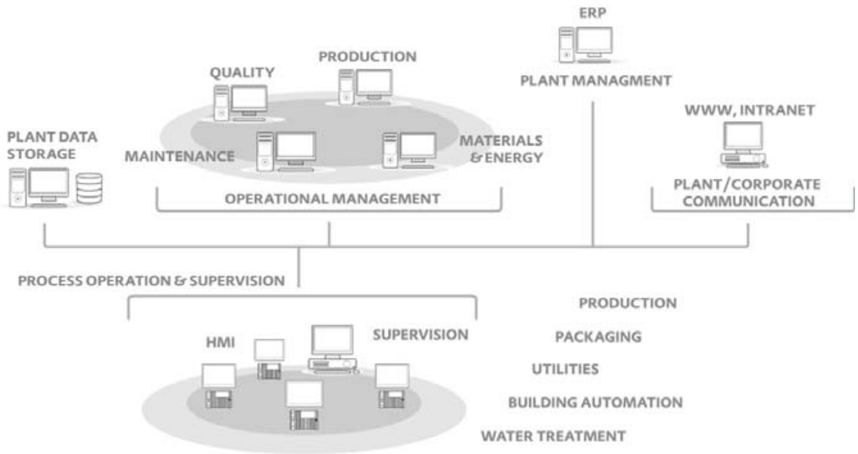

Figure 4: The entire Production Plant can be visualized in real-time, thanks to independent software with universal connectivity and enhanced network integration.

Summary

We have seen in this document how independent software can decisively support Food & Beverage Production Plants to achieve their business objectives. Based on these examples, five of the most important advantages that independent software can deliver are:

1. Efficient integration of the best individual hardware components – ensuring hardware can be selected according to performance rather than simply because it comes from a particular supplier.

2. A reduced dependence on hardware reliability.

3. A flexible approach to automation architecture, enabling systems to be designed in a way that best fits the Plant and its requirements and keeps Engineering costs to a minimum – and a low TCO.

4. The utmost flexibility in process and plant automation - even with limited investment.

5. A prolonged lifecycle for all automation components.

As evidenced in this document, the key to obtaining these benefits is to assess the independence of any Automation software which could be deployed. An independent solution will ensure maximum benefit for minimum investment and give greater freedom and flexibility to users.

Emilian Axinia, Food & Beverage Industry Manager at COPA-DATA is keen to hear your thoughts on, and experiences of, automation solutions in the Food and Beverage Industry; whether or not they are with 'independent' software. Please email: EmilianA@copadata.com.