# I4.0 & THE PROCESS INDUSTRIES

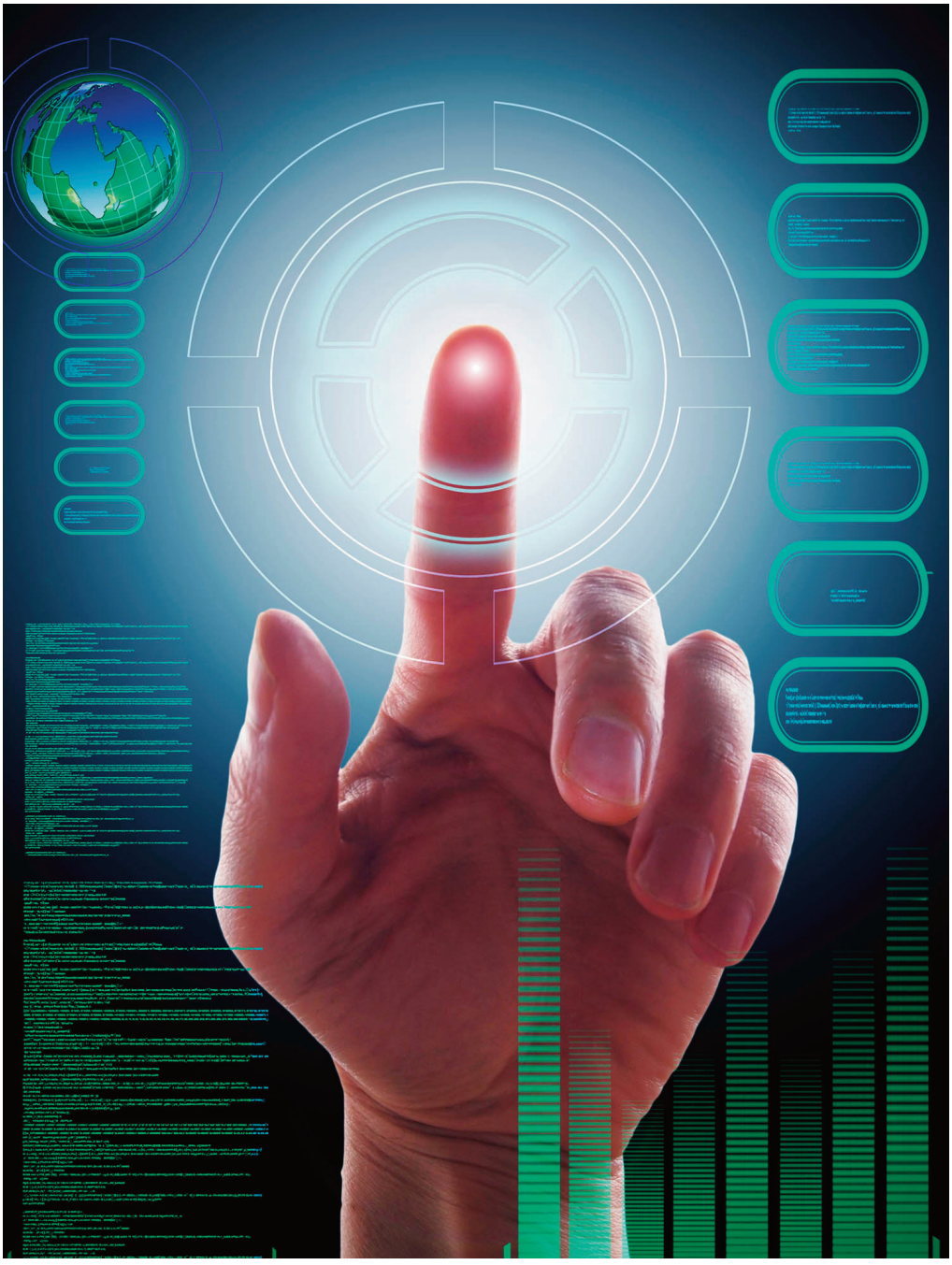
*Trade association for instrumentation, control, automation and laboratory technology, GAMBICA recently published a white paper, 'How will the fourth Industrial Revolution change process manufacturing for the better? - An Industry Perspective' by Sebastian Amos, Sector Head – Process Control & Instrumentation. Here, we highlight some of the main points*

Industry 4.0 aims to extend and integrate further attributes of the smart factory model. At the manufacturing level it provides a digital history of product from manufacture to scrappage/disposal along with operational data, component and asset locations, both in the process design and the physical space. This data crosses all areas that are critical to the design and service lifecycle, but with a focus on better integration of data and availability of information.

RAMI4.0 has developed a 3D architecture model that references lifecycle, hierarchy and layers, as shown far right. The process industries will relate to this model with little issue but it is complex, especially at the application level.

So, what are the benefits to the process industries of this evolution and is it more than simply documenting formally what is already done in the sector today?

I4.0 is intended to create digital description rules for a technical object throughout its entire lifetime. This task will take assets from the physical world and



***I4.0 IS INTENDED TO CREATE DIGITAL DESCRIPTION RULES FOR A TECHNICAL OBJECT THROUGHOUT ITS ENTIRE LIFETIME***

represent them in the virtual world, where an asset is defined as "whole installations or parts thereof, electronic modules, subsystems and systems, machinery, plants and networks, services, concepts and ideas, plans, archives and programs". In effect, a digital model of the complete process.

Amos suggests that the process industries have been doing this already. The use of data warehouses for the storage of detailed information on an asset (drive, valve, instrument), networks managed by an IT department, services managed pre- and post-installation using asset management systems and of course, the complete solution design stored as application software images, drawings and manuals. The only difficulty being the integration of the different packages required to manage this solution, especially if an end user wants to use 'best of breed' technologies.

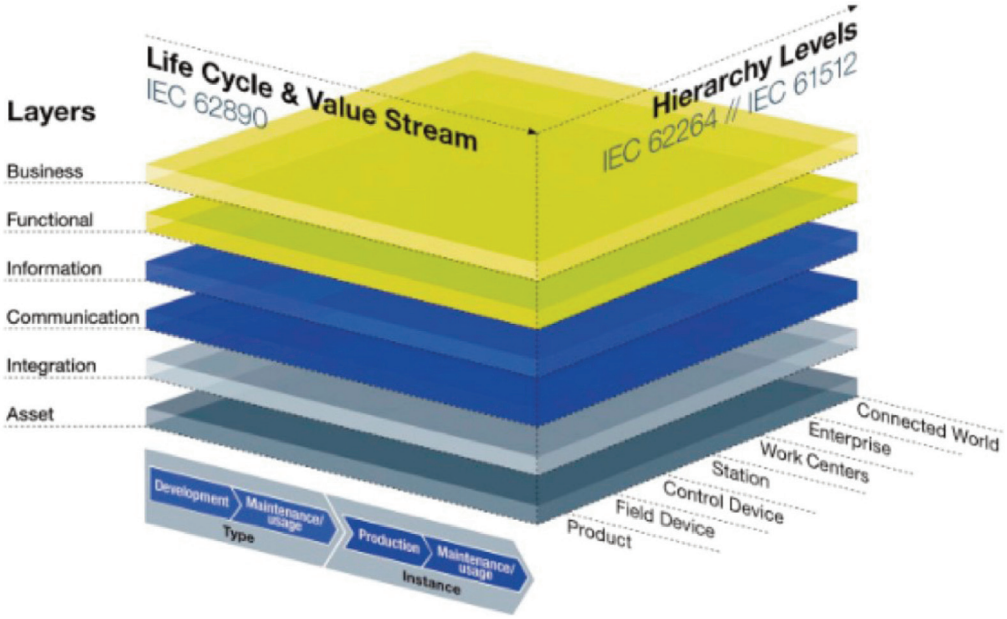
## DATA

For I4.0 to work, it requires data and the definitions of the types of data. While valid, this fails to address the most common problem in Industrial Process Control; no one wants the responsibility of filling in the base data.

It is time consuming and often missed as a cost at the start of any project. The RAMI4.0 defines 4 levels of data: basic, mandatory, optional and free properties. Many asset management systems have been sold only to fail where no commitment is made to management resource to maintain it. I4.0 addresses the need but provides the escape clause by defining 'optional' and 'free'. It will be up to industry to act upon it.

RAMI4.0 has data structures for equipment; if this is to work well, data on each asset needs to be available and fully populated with the asset, either on-board where it can be accessed over the network, or on the internet as a downloadable document. Data entry during design is significantly reduced, possibly only to the level of formal name, address and location.

Industry will need to consider the following:




***START TO LOOK AT PHYSICAL I/O BECOMING A THING OF THE PAST***

- Where an instrument is intelligent and has network connectivity, data is embedded and can be requested by the main IT or asset system. Where not, the manufacturer supplies the data from a web based file
- The data structure needs to be standard so any device can be purchased and integrated regardless of manufacturer
- Take the opportunity for developing self-aware, plug and produce solutions, i.e. put the instrument on the network, it lets the relevant applications know where it is and starts operating.

Networking will be required from the basic instrument and onwards up the network and powered networks, for example Ethernet Powerlink are starting to become available and reliable.

As a suggestion, Process Industry equipment suppliers will need to look at a product development plan that takes this into account.

They could provide an asset which only has a digital connection. For an industry brought up on 4-20mA this is a huge change, but such a solution would enable the asset to transmit its PV and status on a regular basis and respond to a background configuration request. The key benefit here is that no longer do applications such as Asset Management or Historians need to extract their data through various layers, with the possibility that the data received has been corrupted or sanitised by the systems in-between, but they get actual live data. True producer/consumer.

Start to look at physical I/O becoming a thing of the past. Instrumentation takes the readings and reports the values digitally. Control setpoints to drives or valves, for example, are transmitted digitally. Even real I/O modules that would be needed for none communication enabled equipment, would communicate digitally. The days of the marshalling cabinet are numbered, which was a view of Fieldbus which may have arrived before the networks and processing power was sufficient to realise the idea, especially with larger systems.

What we now aspire to is a fully digital network that is secure, fast and resilient and that exceeds the available solutions of today. Each asset is known about on the network, documented automatically and has its full lifecycle managed. Not only that, but the I4.0 approach reaches into the application software control solutions and so on.

## MANAGEMENT & SECURITY

If the development of a secure and highly available Ethernet based network is required, manufacturers of Industrial IT solutions need to embrace these demands and supply them.

Industry 4.0 is a full mix of broadband internet, industrial and office network requirements. All have a different focus. In particular, office/database systems have occasional high bandwidth demands whilst industrial networks have steady demands. Internet suppliers have demand throttling. There cannot be any favouritism in design and management of such networks, thus manufacturers will need to amalgamate their IT and OT departments and work closely with external broadband suppliers. Without this, the move from an ISA95 model to a flatter I4.0 model will be very difficult.

Security then becomes an issue. RAMI4.0 makes a statement concerning who should have access to the data. In reality, there is no real reason why everyone should not see everything, but only certain people can modify it. This would reduce the administration of a system. Network security overall will develop with cloud based computing having to prove its

security and thus data access managed under this remit.

## DRIVERS FOR MANUFACTURERS

The key drivers are productivity and efficiency. Industry 4.0 and RAMI(4.0) when applied to the process industries, could provide cradle to grave management of an entire operation. Innovators and suppliers see that best of breed sells, as integration is a given. Maintenance solutions are inherently self-configuring. Design, implementation and commissioning costs are all reduced as are delivery time.

To achieve full I4.0 benefits, developments will be required in:

- Process Analysis, Digital Virtual Models and Forensics. There is already a wealth of data available in various production databases and historians. The higher the quality of data coupled with more analysis, including the ideas around forensic process analysis, using cloud services to perform this, the higher the quality of product. The key costs here will be the implementation of a database structured to use both existing data and that from new I4.0 instruments. Whether this is generated in house or externally becomes a management decision.
- Predictive maintenance. This has already been discussed above and today, there is still a reluctance for companies to configure and use in anger PM solutions, still relying on reactive maintenance and redundancy of key components. I4.0 will help but the investment will require not only money but a change in mind-set.
- Demand forecasting using more widespread data can significantly improve the production cycle. There are many examples of how this is done today, though the processes are not specifically integrated. For example, Google can report on the number of queries for the common cold remedy. This data can be used for supermarkets to increase their stocks and for manufacturers to increase production to meet the anticipated demand. So, demand forecasting from external data into the business models managed under I4.0 would be an asset for devising a truly accurate production cycle.
- Supply chain planning becomes part of the demand planning cycle. If the raw materials suppliers are integrated into the production facility's demand plans, they can also increase or decrease production accordingly. This follows through to the downstream supply chain from factory to customer. Again, this will require the transport companies to be integrated into one system.

All of the above require significant investment in tools that will collect, analyse, report and initiate activities across the supply chain. However, this is one of the more costly areas of investment. It requires hardware in the form of large database support systems, analytics software, IT infrastructure, Security and people.

***You can download the full paper at: www.gambica.org.uk/resourceLibrary/gambica-does-i4-0-apply-to-the-process-industries.html***