The ABCs of Industrial IT

Staff Report

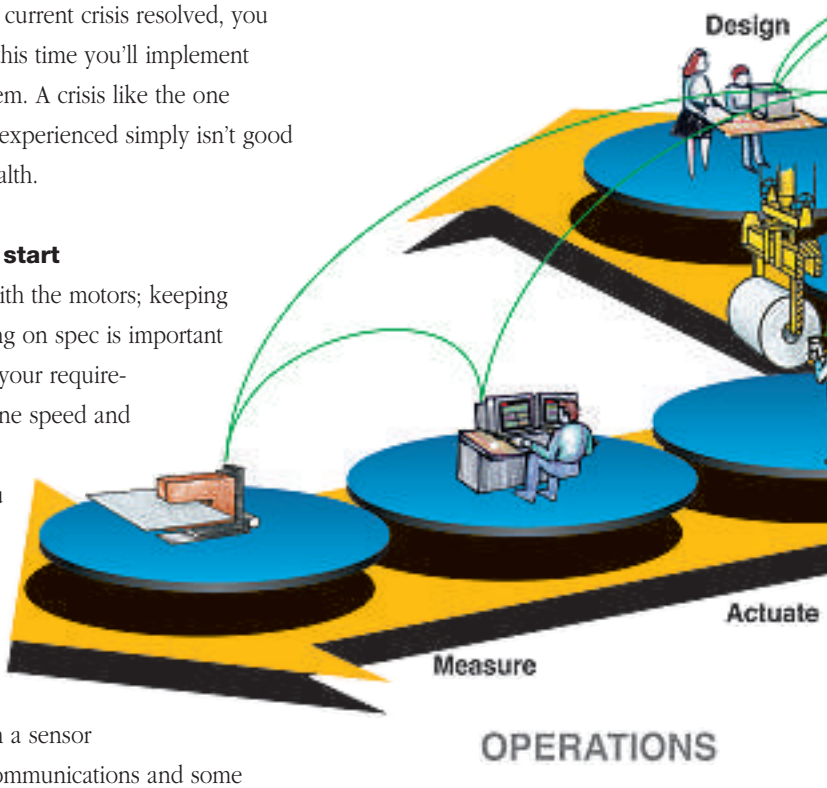
Over the last year, much has been written in these pages about ABB's Industrial IT initiative. But, as with many revolutions, it is often difficult even for participants to appreciate the real scale and significance of the events unfolding around them. So that the true significance of this massive commitment on ABB's part does not leave the non-expert behind, we are pleased to offer this 'Layman's Guide to Industrial IT'.

Picture a big paper plant. You are the production manager and something has suddenly gone wrong with one of the main components, causing production to suddenly cease in one area of the factory. Loss of production, even for a short time, means loss of money. The primary concern for you and your engineers is getting the problem fixed as quickly as possible. But before that can happen, you must first gather specific information about the failed component – for example, detailed drawings, the setpoints and configuration, and the maintenance log. You know that the information you need is spread between several different people and several different computers using different applications. You've got to track down the people who have the information – assuming, that is, they are in the factory. Just collecting the required information will more than likely take up the majority of the total downtime.

Wouldn't it be wonderful to simply walk up to a computer and at the click of a mouse be able to collect the necessary information in two minutes rather than two hours (or more)? When you get the current crisis resolved, you swear that this time you'll implement such a system. A crisis like the one you've just experienced simply isn't good for your health.

Where to start

You start with the motors; keeping each running on spec is important to meeting your requirements for line speed and production rate. So you get in an external company to equip critical motors with a sensor package, communications and some software. The company runs a fieldbus back to the main control room and installs some Windows software, enabling you to monitor the motors and



spot coming trouble or to be informed of a problem immediately.

Remembering the difficulty of locating relevant information, you also decide to scan in all the documentation for these motors – operator handbooks, specifications, electrical circuits, mechanical layout, spare parts lists, supplier information, maintenance schedules, receipts, invoices and so on.

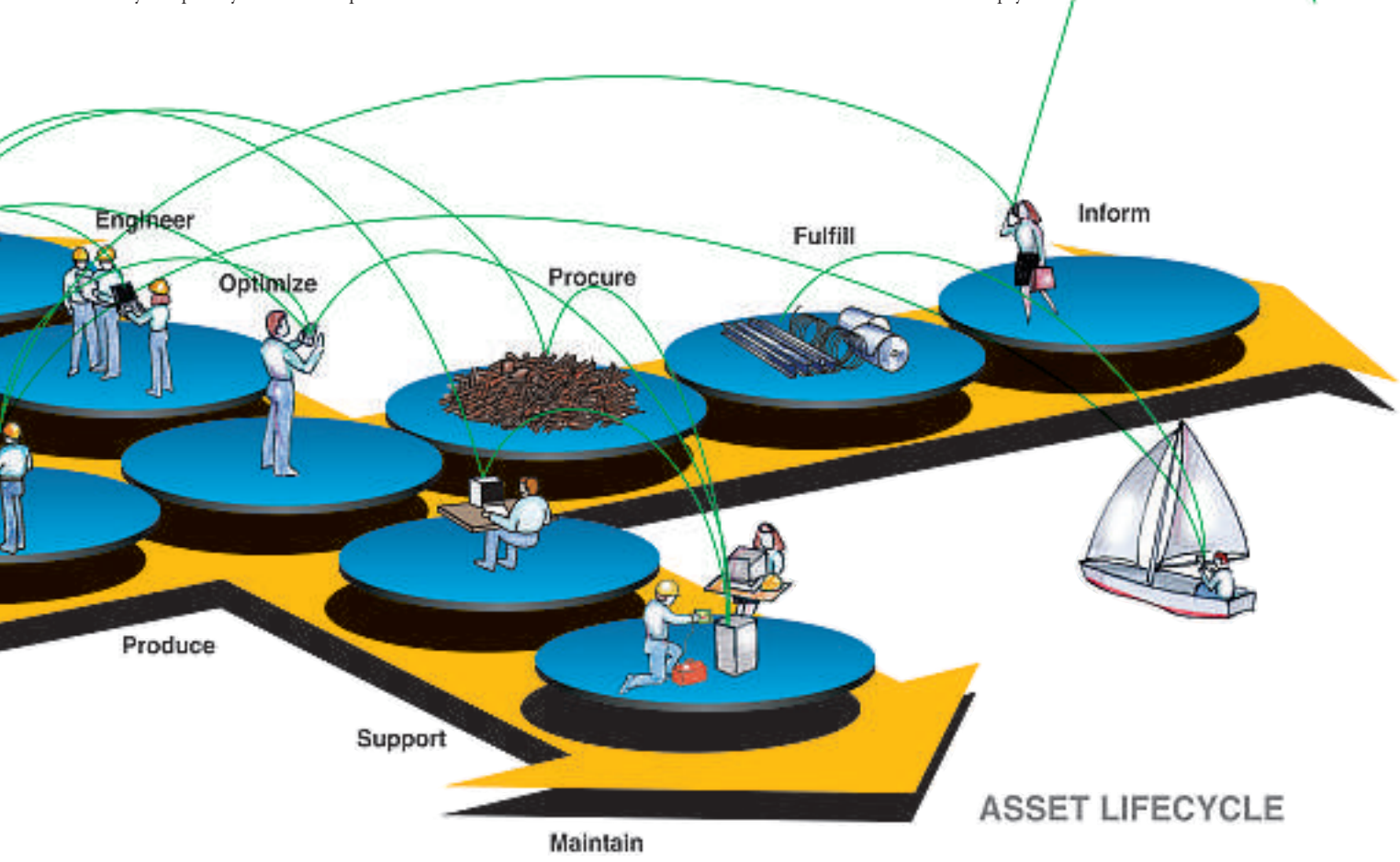
You modify the Windows program so that when you move your mouse over a diagram of the plant motor layout, you are able to call up any of the scanned information. Further, should a motor breakdown require a new part, you need a way to quickly check the spares situation. What better way than to directly link to the factory inventory computer system. Taking this a step further, suppose the required part is not in stock? Rather than fill in different time-consuming forms, you get the local IT department to implement a software routine that automatically orders the part via the procurement system.

Your colleagues are impressed by what you have managed to achieve, but more importantly, your usually impassive boss is highly excited. You tell him that you can apply the same procedure to the pumps, power supplies, HVAC systems, infrared dryers, pulp supply, and so on. 'Information at the click of a button' has become yours and the company's in-house catch phrase.

A great plan . . . but do you have the time to 'information enable' every plant device on your own? Will such custom solutions lead to an explosion of complexity?

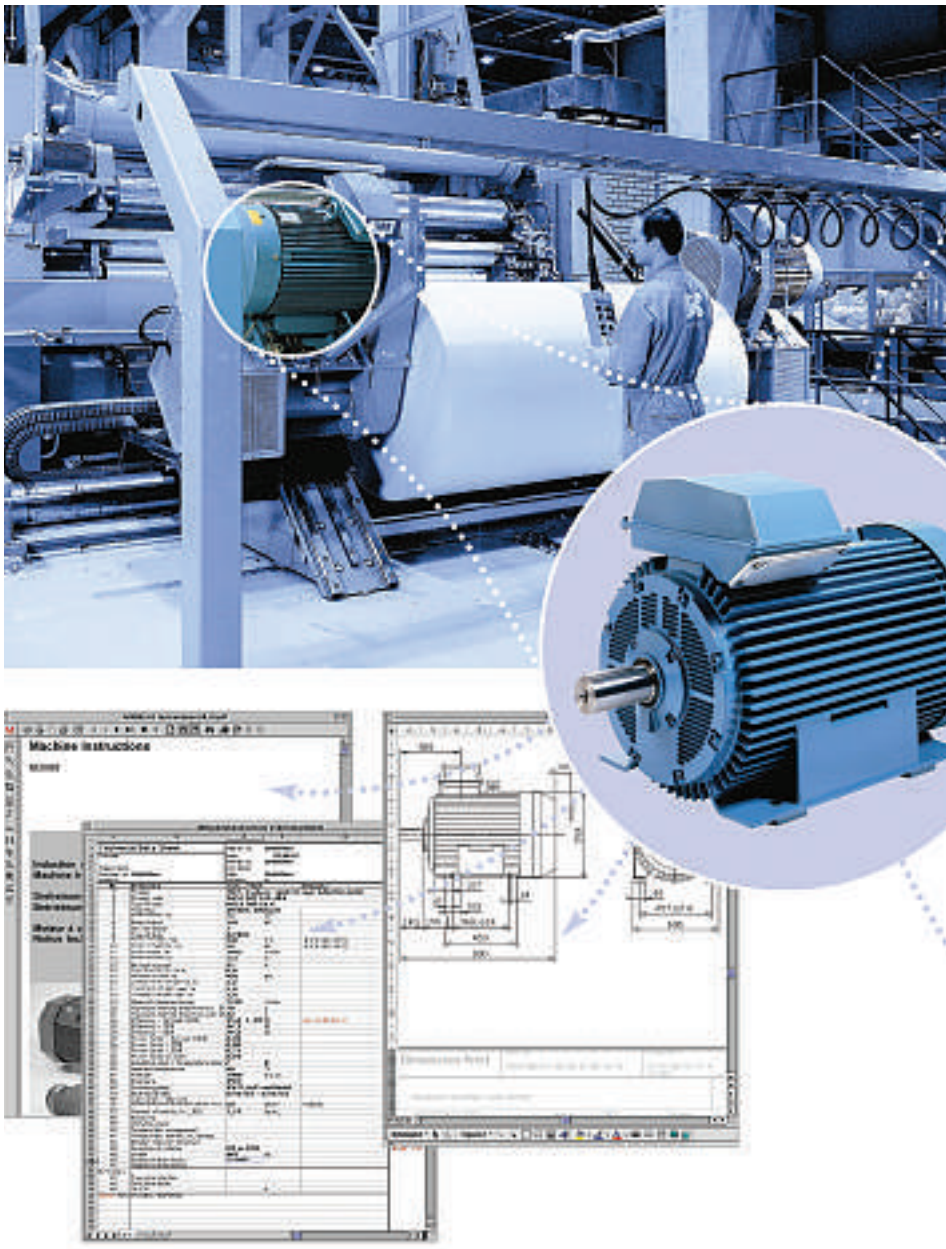
The grand scheme . . . .

The solution, you realize, would be for your equipment supplier companies to make their products not just compatible, but design them so they would fit into the grand scheme of real-time information management. This doesn't simply mean that a new motor



would have the diagnostics and sensor package already built in; it would also automatically register its place in all the IT systems necessary – in maintenance, the documentation library, the spare parts inventory, or wherever. Just think about bringing home a new printer and plugging it into your PC, and how Windows does all the hard work of installing and registering it.

But what does this mean in the industrial world? It means that you have a Windows Explorer type program which shows not just folders, files and disk drives, but presents the entire production facility and all associated information in the same easy-to-navigate fashion. At the click of a mouse, you can delete an outdated device. By clicking again, you can insert a new device, specify type and location, and bingo! the new device has been registered in all the relevant parts of the IT system. In the meantime, the maintenance crew has installed the physical device and you're all set to go. *Plug and Produce* deployment!

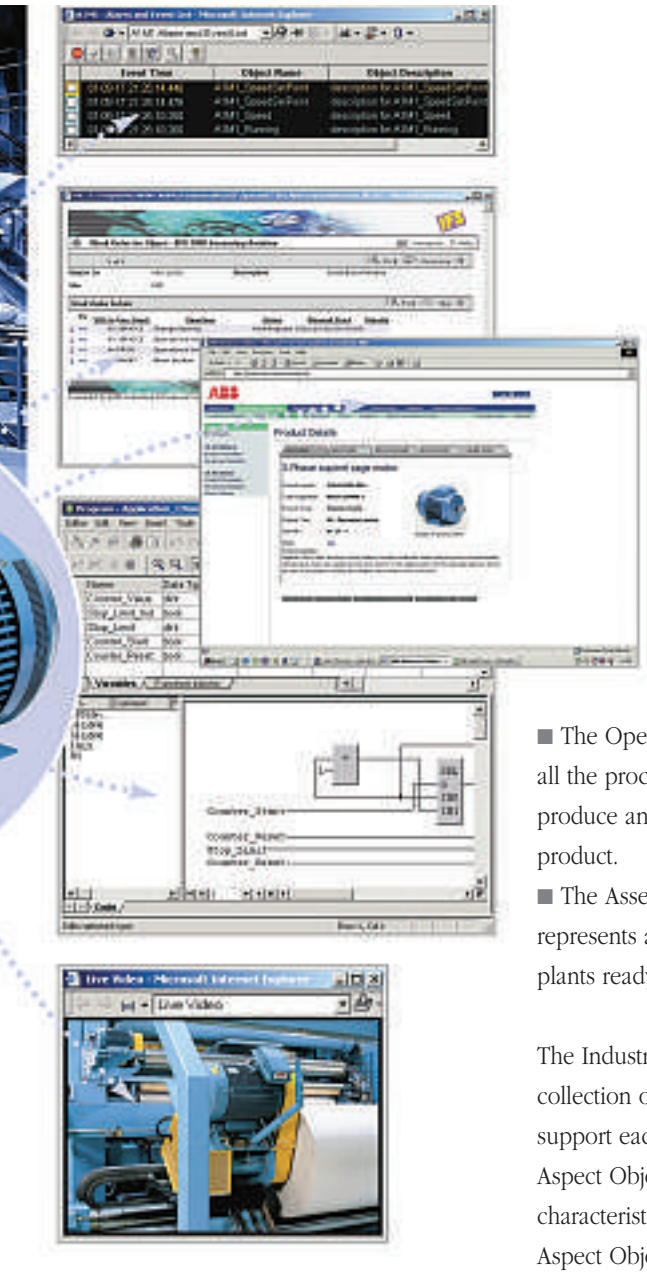


Sounds good, doesn't it?
But is it doable?

The fact is, it is being done. This scenario describes the Industrial^{IT} commitment from ABB in a nutshell!

So what is Industrial^{IT}?

Industrial IT is an information architecture for seamlessly linking multiple applications and systems in real-time. But what does that mean? You're familiar with the way everyday Microsoft PC applications like Excel, PowerPoint and Word all work together and make you more productive. If you want to add another MS Windows-based application, you just insert a CD-ROM into your PC, transfer the necessary software and continue working. The Windows operating system does all the necessary integration. ABB's goal is to deliver advanced, pre-engineered products that are equally ready-to-use and are *reusable* across many tasks. These products will be easier to configure, install, and move



around within the business enterprise, and they will provide their owners with *real-time* information.

The Industrial IT Value Chain can be described in two dimensions (see figure on pages 6 and 7).

■ The Operations Dimension represents all the processes needed to develop, produce and deliver a successful product.

■ The Asset Lifecycle Dimension represents all tools required to keep the plants ready to produce.

The Industrial IT concept defines the collection of information required to support each plant component as an Aspect Object™ – containing all the characteristics – or Aspects of the device. Aspect Objects can also be things such as finished products, raw materials, sales and manufacturing orders. In the scenario at the beginning of this article, the failed plant component and the various electric motors could each be represented by Aspect Objects, containing all the real-time information connected with a particular device. This might include design drawings, control diagrams, maintenance information, location, quality information and configuration information – just like the documentation you manually scanned in for the motor.

For an idea of why this is useful, let's go back to the example of a printer installation for your PC; the job is made much simpler since all the necessary information (fonts, drivers, diagnostic software, etc) is provided on the CD ROM delivered with the printer. These files are considered Aspects of the printer, which is itself considered an Aspect Object.

But it is important to realize that an Aspect is not just the real-time information connected with a particular Aspect Object; it also defines a set of software functions that create, access and manipulate this information. For the printer, font information could be an Aspect, as could the printer software driver which accesses and manipulates the fonts by using them to determine the appearance of the printed text.

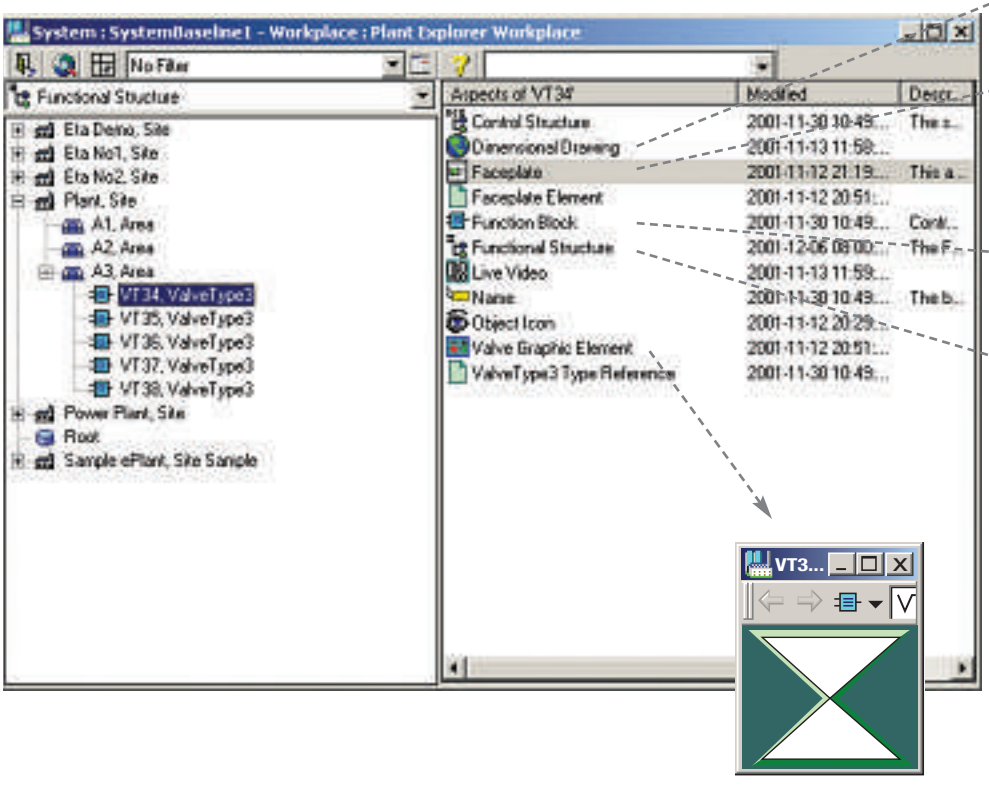
Under Industrial IT, it is possible to implement these Aspects using many different applications (eg, Word, Excel, etc), existing as well as new ones, from ABB, third parties and customers, now and in the future. It is possible to do this without changes to the applications. It is not necessary for all these different applications to be even aware of each other, but they must cooperate to provide an integrated view and functionality of the Aspect Object.

The individual Aspects are enabled by software systems known as Aspect Systems, each of which stores, manages and presents information in its own optimal way. Several Aspects may share the same Aspect System. For example, a report package is used to implement the production report Aspect and the quality report Aspect of a particular Aspect Object like our motor, and a process graphics package implements all the operator graphics Aspects like the graphic display, control faceplate or display element.

On a technical level, the Aspects interact with specific software components to provide the functionality associated with that particular Aspect. For example, if I want to see a particular Aspect Object description, I simply click on the description Aspect and the software components will connect to and display the correct file.

In the ABB Aspect Object architecture, Aspect Systems (like the process graphics and the report package examples above) cooperate with each other without knowing who or how many there are. When an Aspect System is installed, it registers with the Aspect Directory (see below) all interfaces that it supports. When an Aspect System wants to perform an operation that involves actions from other Aspect Systems, it 'asks' the Aspect Directory for references to these other Aspect Systems. But remember, this will only happen if the system has been properly configured. To give an example, suppose I want to change a set value on a particular device: I click on the relevant Aspect, which is implemented using the process graphics Aspect System, and I change the value. Now I want to be sure that the new value will change automatically in other Aspects. This means my system must be set up such that the process graphics Aspect System will contact the Aspect Directory looking for references to other Aspect Systems that need to change the set value. We can also say that the Aspect Directory is the component that keeps track and stores the association between Aspects and Aspect Objects.

This is how a change to one component in the factory would be broadcast to all the other system components that need to know.

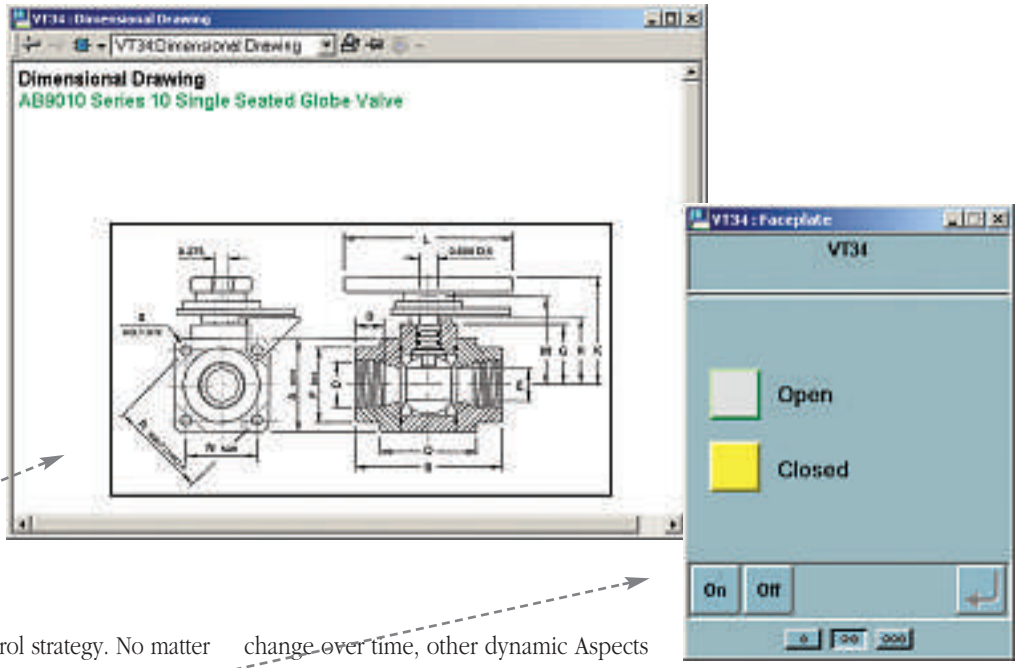


The beauty of Industrial IT

Let's go back to the paper plant where you are the production manager to see how this works in practice.

With so many components in your system, locating, collecting and updating all relevant information is a headache. You need a system whereby all your plant's Aspect Objects integrate together so that you can access them in a straightforward way.

With Industrial IT, once a device is physically in place in the plant, the plant engineer can simply copy and paste the Aspect Object (corresponding to the physical device) into the overall system



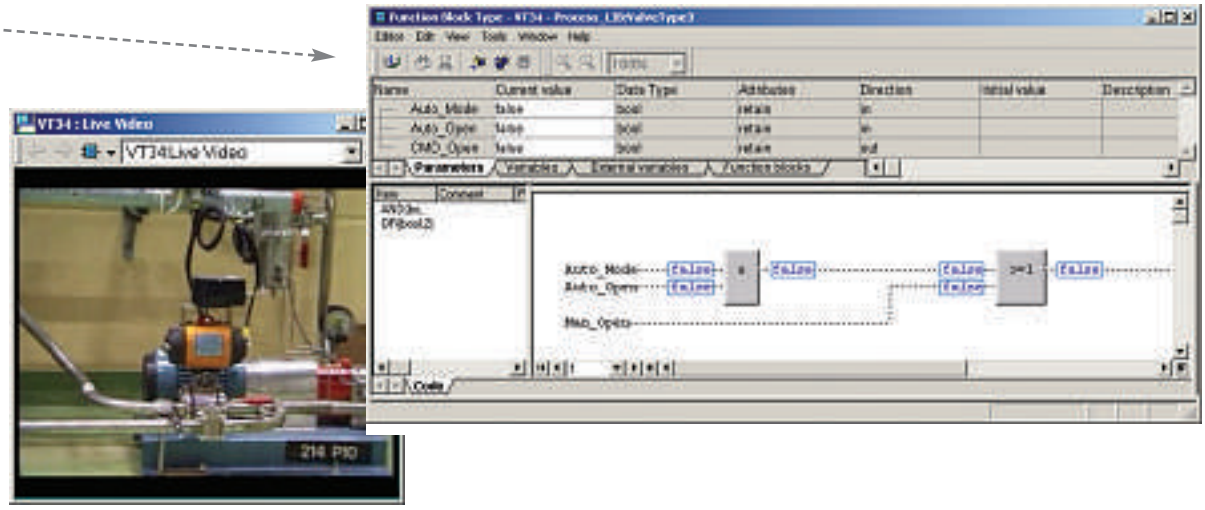
monitoring and control strategy. No matter where each device is deployed, one 'click' on the Aspect Object provides a link to its Aspect information. Via the Aspect Directory, all the other relevant parts of the system are informed of the change.

Exchanging information

Although certain Aspects, for example drawings, instructions, etc, may not change over time, other dynamic Aspects such as the configuration, measurement values and equipment status must be frequently updated. The Industrial IT architecture provides a way to automate this process, and to help various devices exchange real-time Aspect information. This is facilitated by:

■ A growing portfolio of compatible products from every ABB business area, pre-engineered to work together by taking advantage of Aspect Object functionality.

■ A common ABB architecture – called the Aspect Integrator Platform (AIP) – that will be the standard for every ABB product. More on this later.



Industrial^{IT} certification levels

Information (Level 0): To become Industrial^{IT} Level 0: Information enabled, a product must have the following aspects:

- Product Identification
- Product documentation:
  1. Product data sheet or technical reference manual
  2. Installation and commissioning manual
  3. Application manual
  4. Operating manual
  5. Maintenance and service manual
  6. Declaration of conformity regarding CE marking
  7. Environmental product declaration
  8. Environmental information
- CAD Data
- Technical data and product classification

Connectivity (Level 1): Having Level 1 certification means that the product can be connected to and work well in an Industrial IT system. This means that the product has all the level 0 characteristics, plus:

- Hardware can be physically connected via defined and approved interfaces.
- Software can be installed and handled in a consistent manner.
- The product does not introduce disturbances to the environment in which it is inserted.
- Basic data can be exchanged via defined protocols.

Integration (Level 2): As well as having all the characteristics of levels 0 and 1, a product that is level 2 certified will also guarantee that:

- Extended data (status, maintenance, etc) can be exchanged via defined protocols.
- Aspect System functionality is available.

Optimization (Level 3): Certification to level 3 means that a product, when integrated into an Industrial IT system, is capable of all Industrial IT functionality.

By the end of 2001 nearly 800 ABB products were Industrial IT Enabled – just the beginning in a dramatic transformation of ABB technologies toward this important new standard.

From now on all new ABB products, whether software, hardware or services, must carry the ABB 'Industrial IT Enabled' symbol, indicating that the product has the ability to be combined with other Industrial IT products in a 'Plug and Produce' manner.

In order to carry this symbol, all new (and most current) ABB products will be assessed at ABB test centers for formal compliance with Industrial IT standards. This assessment determines how well a particular product interacts with other products, and how easily it can be integrated into a larger system. Products having a low level of integration (ie, products that do not exchange information with other products) are certified 'Level 0: Information Enabled'. Products aiming for a higher degree of integration and interoperability with other products are certified at one of three higher levels (see box).

Tout de suite

To ensure the correct deployment of its Industrial IT products toward every link in the customer value chain, ABB has defined 30 functional categories – or Product Suites – into which each Industrial IT enabled product is now placed. A product can reside in just one of these product suite 'folders'. These include:

Design^{IT}: The products in this suite are used to design primary equipment, process trains, plants and supporting systems. Products include process and plant design software, services and consulting.

Operate^{IT}: This suite covers products that facilitate interaction between

automation systems and human operators. Products include Human Interface Consoles, handheld terminals, WAP phone interfaces and panel instrumentation.

Produce^{IT}: Here you will find products used to improve the planning, scheduling and manufacturing of customer end products, including the procurement of raw materials. These include batch, electronic batch records, and manufacturing of cells or lines.

Protect^{IT}: Covers products needed to protect against faults in the operation of equipment and facilities and ensure personnel safety. Products include LV, MV, HV protection systems, emergency shutdown, fire and gas safety systems.

Optimize^{IT}: Includes products for tuning, improving or optimizing production systems or end products. Examples are process, asset or enterprise optimization software solutions.

Complexity adieu

Integration of all these 'enabled' products by means of their associated Aspect Objects and Aspects is the job of the Industrial IT Aspect Integrator Platform. The AIP is one of the key elements in the entire Industrial IT architecture.

Integration via the AIP is important, but also critical for the user is how the data is structured: Although the various Aspect Objects and their associated software may reside on multiple networks or computers, each Industrial IT Aspect Object carries with it the built-in collection of Aspects. Data need be entered only once for use throughout the system, and real-time information on each plant component is just a click away. In fact, on closer inspection, we find that an Aspect Object can fit into many different data structures.

And this is a quite unique strength of ABB's Industrial IT, one which enables the user to finally conquer the complexity of his industrial plant. Instead of being confronted with one complicated and monolithic data system, the user can simply go into the ABB Plant Explorer (the 'Windows Explorer' of the Industrial IT world) and arrange the various Aspect Objects in an easy-to-navigate structure which suits his particular needs.

Thus, the control engineer can pick a structure which shows where a software function or hardware device can be found in the control system – giving managers and programmers the information they need to develop, troubleshoot, and maintain their system. By arranging elements in various structures, it is possible to model or reconfigure many types of plants, equipment, products, processes and procedures. The maintenance engineer needs to see the plant in a different way – perhaps by physical location of each device, so he chooses a different structure; a financial analyst may be more interested in how the different devices stack up in terms of performance or cost, and so on. Everyone is happy.

This powerful ability to configure and use a data structure depending on context from a choice of five, ten or even more structures eliminates complexity for the user. This is the tool our paper factory manager in the example at the beginning of this article was striving to build. Had he used ABB's Industrial IT instead of creating a custom solution, his colleagues in every part of the plant could have also benefited from his efforts.

The ABB Plant Explorer

The navigation software of these Object structures, the ABB Plant Explorer, is built on Microsoft's Windows Explorer technology, and at a first glance it even looks like MS explorer. However, the Plant Explorer does not organize information simply into files and folders, but into an actual plant hierarchy, allowing you to create, delete, copy and move Objects and Aspects at the click of a mouse. A search engine for Aspect selection and data previews is also available.

In short, Industrial IT will bring significant benefits to manufacturing and process plants, ranging from easier deployment of 'information enabled' products to easier integration of products from multiple ABB business areas and ABB partners. Managers will find their plant operation simplified through access to real-time information. Productivity will be optimized not only through better interaction among plant components, but through much easier engineering of new systems. That's the beauty of Industrial IT from ABB! *(ck, ab)*