ASSET MANAGEMENT SOLUTIONS AND PLANT RELIABILITY

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INTRODUCTION

Over the last few decades we have witnessed an unprecedented revolution in data availability and processing relative to manufacturing and management. What characterizes this revolution is the shift, in one lifetime, from being starved for data to being overloaded with data. Data gathering in the past -- just like condition monitoring -- was labor-intensive, with one reliable collection method: 'walk-around' data collection. At times, it was difficult to realize that data was staring us in the face; other times we could clearly see the data, but it had limited value to us since it exceeded both our level of knowledge and our ability to process it with software tools.

This revolution was characterized, in its early days, by Jurassic data processing departments with the now virtually extinct, mainframe computers. As we managed to put **data** into context, the concept of data slowly evolved into the concept of **information**. This is today's era, typified by the abundance of process control systems, smart equipment, condition monitoring solutions, and analytical systems, to mention only those more readily encountered in the world of manufacturing.

However, it appears clear that a third wave of this revolution is about to hit us. This is the transition from the information era into the **knowledge era**. This era is characterized by the availability of information and by its effective application in a decision-making context. As promising as it is, this wave appears to be coming at a much weaker momentum than the previous two, and perhaps it can use some momentum. In a paradoxical way, too much information and too many sources of information have taken us back where we were when we struggled to get any data at all! Modern manufacturing systems, let alone enterprise systems, operate like islands of information, preventing us from making sense of this abundant information and turning it into the knowledge we require to run our operations more efficiently. So what are we to do?

If we accept that “islands” of information are main obstacles, preventing us from making sense of what information we have today; then “bridges” are a natural remedy to connect these islands. Cynics will say we already have too many bridges. Every system comes with a customized API (Application Programming Interface) that claims to make it accessible to any other system. Of course, nobody mentions that changes or revision updates of any one of these systems will often render an interface obsolete and make access to data almost impossible. Clearly, the means of removing the obstacle of customization is to define standards that allow all manufacturers to move data in similar formats. Then, manufacturers can focus on what information is delivered, and not have to worry about how to deliver that information

On the other hand, standards are usually slow to implement and represent a compromised solution that makes no one completely happy. Standards also tend to be out of date by the time they are published. In such muddy waters a phenomenon known as “de-facto standards” usually emerges. De-facto standards are relevant, contemporary, cutting edge solutions, and people can make (or save) money by embracing these solutions. If we look at today's process control industry, there are a number of such de-facto standards: HART for device and process parameters, Ethernet with IEE 802.3 for the hardware/network transport layer, and TCP/IP for the network/ communications layer. FOUNDATION Fieldbus is emerging as a digital communication protocol, and in the area of software interfaces, OPC (OLE for Process Control) promises to deliver seamless interfaces between software applications at very little cost.

However, de-facto standards are enabling technologies and what ultimately counts in manufacturing are solutions that incorporate these enablers. These solutions are what we seek to deploy in order to change information into knowledge. We have said that by putting data into a semantic context, we created information. If we have sufficient amount of information that we can put into a decision-making context, we have knowledge. Well, let us put this in the context of plant management and plant / equipment reliability.

PLANT RELIABILITY AND MAINTENANCE

Maintenance, as a plant or corporate function, has always been a method of ensuring that the plant, or the individual equipment, operates reliably. It also endeavors to minimize variability as well as to keep the plant up and running. Maintenance is defined largely by the quantity and quality of data available for diagnostics; when we struggled to get data, the most logical way to deploy maintenance was to implement **reactive maintenance** strategies. Since we had no clue what was going on in our plants, the most logical approach was: 'if it ain't broke, don't fix it'.

As enriched data turned into information and became more easily available, a new concept called **predictive maintenance** was invented. Now that we had information and we knew better what was happening with our equipment, we needed a more efficient way of ensuring and prolonging equipment health. Various **predictive maintenance** strategies have been developed. What

made this development possible was the availability of information from multiple sources, enabling technologies, and the ability to put this information into a decision-making context. We are now in possession of sufficient knowledge to predict equipment failures and to schedule maintenance to minimize the impact (or occurrence) of such failures.

Now, the abundance of available information, enabling technologies, and smart solutions from different manufacturers are creating an era of knowledge, where equipment can be maintained intelligently. We can predict equipment failures and we can focus our maintenance dollars in activities that warrant the investment. By capturing essential bits of data related to key pieces of equipment, and by managing that data to be forewarned about the deteriorating condition of certain equipment, a predictive maintenance environment can be established so that process reliability can be maximized.

Recently manufacturers have developed software tools to support these maintenance strategies. These software systems take us into a new era where knowledge and systems get automatically integrated, facilitating the advent of special plant expert systems and a new integrated enterprise. Of those tools, Fisher-Rosemount's Asset Management Solutions (AMS) provides a comprehensive real-time surveillance of intelligent, microprocessor-based field devices and management of the data they generate.

ASSET MANAGEMENT SOLUTIONS

Fisher-Rosemount's AMS is a versatile PC software that allows users to configure field devices, perform loop tests, check device status, and automatically document all maintenance activities associated with field instrumentation. AMS users can also automate most activities related to calibration. Users can track calibration schedules, set up test definitions, define calibration schedules, upload and download data to calibrators, and analyze the results of calibration tests. AMS supports HART®, FOUNDATION™ fieldbus, and conventional field instruments. It is a complete asset management approach to all field instruments.

With AMS, users can integrate diverse technologies and device management functions into a single platform, providing online access to field instrumentation and capturing all maintenance-related information about plant devices on a single database (see Figure 1). A great deal of information about each instrument is organized and processed to accommodate various maintenance functions.

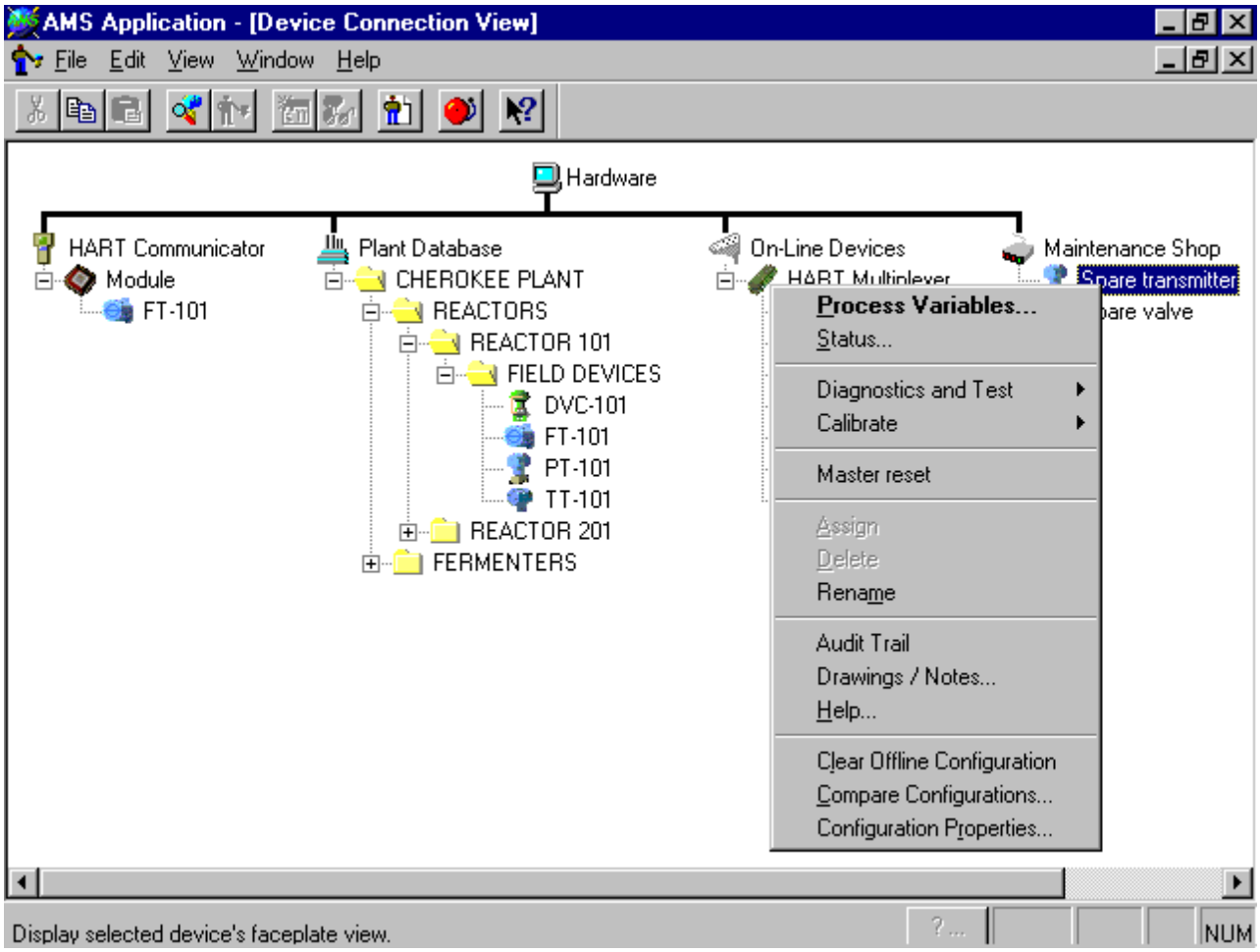

Figure 1. AMS gives users the ability to communicate with live instruments in the field, and to access all instruments' historical records. By simply clicking on an instrument icon all information, including device status, is instantly available.

Similar software tools provide equivalent functionality to AMS' for other equipment in a plant. Computational Systems Inc. (CSI), for example, has a complete Reliability-Based Maintenance™ solution for rotating equipment. Designed to support equipment monitoring, data management, data analysis, and reporting for predictive maintenance programs, RBMware™ consolidates predictive maintenance technologies (vibration analysis, infrared thermography, oil analysis, ultrasonic scanning, motor diagnostics, equipment balancing, and laser alignment) for rotating equipment. These technologies jointly provide a complete picture of rotating equipment health in a plant. The RBMware software enables users to "watch" all monitored equipment and obtain detailed information about individual pieces of equipment.

With the advent of these dedicated, highly specialized, and complex systems for monitoring and diagnostics of different types of equipment, the challenge has become integrating and, more importantly, processing information to provide more comprehensive diagnostics. Fisher-Rosemount and CSI have introduced an interface between AMS and RBMware to specifically address

that challenge. The implications for greater plant equipment reliability are staggering:

- A ***single user interface*** between AMS and RBMware now exists, coordinating the predictive maintenance of instrumentation, valves, and rotating equipment in a single software package. All the asset management benefits of AMS are combined with RBMware's rotating equipment functionality, bringing us closer to having a complete solution to plant maintenance.

- The ***integration of these two complementary software packages*** gives users the ability to correlate events in the process that involve both rotational equipment and process instrumentation. You can pinpoint with greater accuracy what is happening with instruments, valves, and rotating equipment that are part of the same control loop or production process. When such equipment operates together, it can be difficult to rapidly and accurately identify a malfunction, but this becomes a rather simple task when status reports from all devices are interconnected by software and appear on the same application window.

- An ***integrated audit trail*** provides the documentation needed to meet specific regulatory requirements and to document maintenance.

THE AMS/RBMware HOST SYSTEM INTERFACE

Together, AMS and RBMware form a powerful diagnostic combination, featuring:

- ***Access to availability and reliability information*** about field instruments and plant equipment from a single PC

- ***Up-to-date warnings*** about equipment problems and alarm status

- ***The ability to launch RBMware*** reliability-based software from an AMS application, see Figure 2.

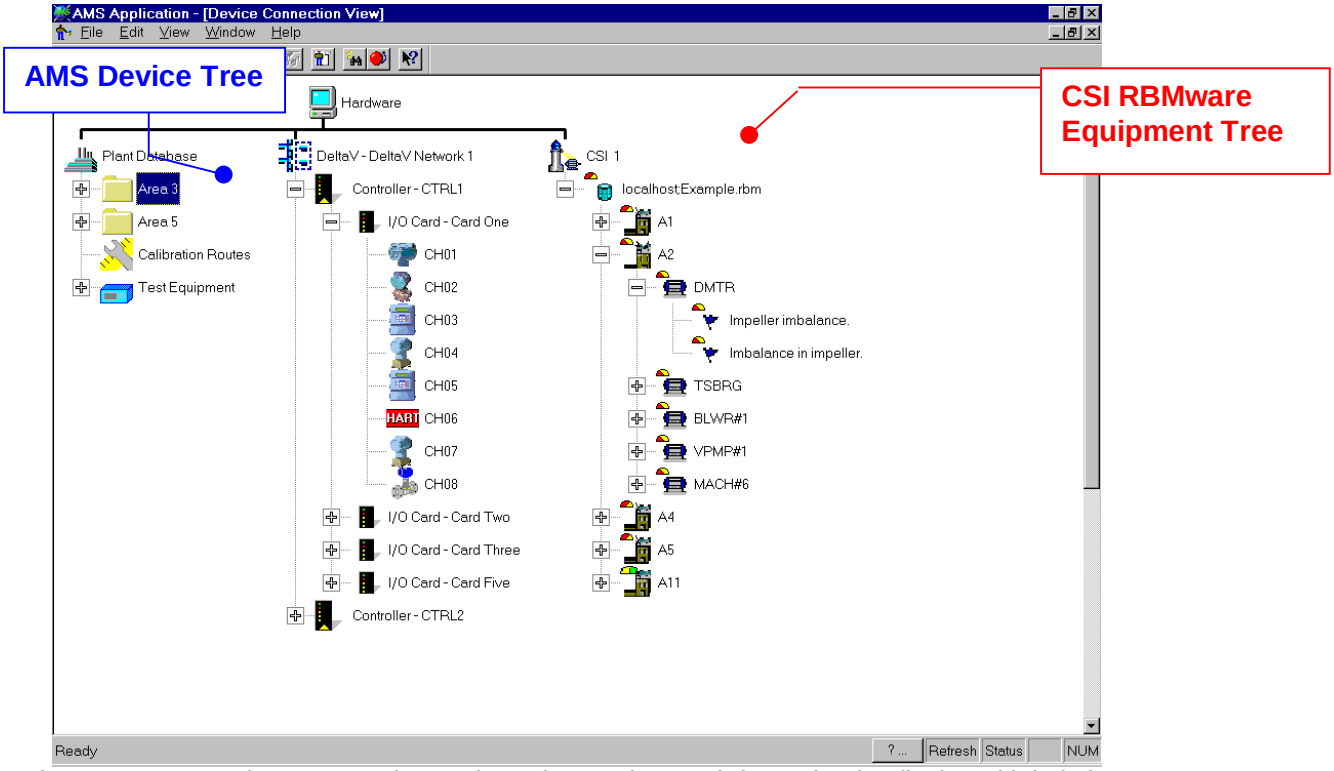

Figure 2. Process instrumentation and rotating equipment information is displayed jointly in a single user screen with the AMS/RBMware interface

ASSET MANAGEMENT AND ERP SYSTEMS

Today, plant reliability is more of an enterprise issue than ever before. The CEO's and the financial fraternity in major blue-chip companies have completed their ' supply-chain management' revolution. Needless to say, smaller and mid-size companies are catching up and, no doubt, it will take much less time (and money) for them to be where the large corporations are today. The major benefits of ERP (Enterprise Resource Planning) systems, such as the systems from SAP, JD Edwards, Peoplesoft, Baan, Oracle, and others, are twofold. On one hand they put a firm foothold on enterprise costs, and on the other hand they have the potential to convert the whole company into a ' real-time enterprise' .

Engineers in process control are accustomed to this real-time world, and indeed without various control systems, real-time control and manufacturing would be impossible. However, the corporate world has existed without that benefit, and as a consequence, the level of customer service varied a great deal from one vendor to another. ERP systems are aiming at recreating this real-time dimension on the corporate level, and although they do not operate in milliseconds like a distributed control systems what they deliver is close enough to the real-time concept in a corporate context.

Thanks to ERP systems, we now have instant knowledge of our product availability (in addition to half a ton of financial information) and scheduling possibilities. However, our ability to make product is linked directly to our ability to sustain plant integrity and reliability. This is why plant reliability is a

corporate issue. If we have no assurances about reliability, enterprises are no longer 'real-time', and we cannot talk about integrated enterprise.

In addition to knowing the level of our inventory, our delivery commitments and our production schedule, we also need to know about plant availability. Armed with this information, we can manage a real-time enterprise and service to our customers becomes second to none. Obviously, plant availability depends on plant and equipment reliability, which means that we need to have such information if we want to 'upgrade' information to knowledge. Tools, such as AMS from Fisher-Rosemount, enable us to achieve this.

In the future in appears inevitable that another layer of information consolidation and integration will surface. This consolidation of knowledge will enable enterprises to operate in real-time, and with a level of customer service never experienced before. Most importantly, it will transform us from product providers into service providers. No need to remain anybody that services usually get premium prices over products!

CONCLUSION

The last few decades showed dynamic and almost nonlinear development paths for making information available from multiple sources to multiple clients. Beside all the positives, this proliferation of information 'clogged' our ability to segregate the relevant from the not-so-relevant information and today we are struggling to cope with the information overload. Various vendors realized that there was an opportunity and launched products and solutions for integrating information and enabling a move toward a real-time enterprise.

AMS from Fisher-Rosemount is a par excellence example of such solutions. It brings information from various types of equipment in a plant into one single user interface. AMS also provides “hooks” with high-level enterprise systems, and it promises to become a knowledge integration station of the future. Various parameters, such as plant availability, process variability, plant reliability and regulatory compliance become easily verifiable and integrated into a broader real-time enterprise.