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OpEx Data to Knowledge — and Profits

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Abstract: There is more data generated by modern control systems in a day than was generated in a year just decades ago, yet the same control systems are unable to take full advantage of it. Data without relevant context has negative value and must be integrated with other data from higher level systems to be useful. This paper will discuss how data integration across systems and organizations converts data into knowledge and knowledge leads to profits.

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1. A Brief History

Humans throughout history have continued to increase the amount of data they generate and want to store. Early humans passed on knowledge via stories, relying on repetition and memory, then came paintings on caves, clay, bark, papyrus etc. These provided a more permanent record of accomplishments. However as the archaeologists know interpreting these records for their intent is not an exact science. Without knowing the language and more importantly the context in which it was presented the records makes it difficult to get the full meaning of the message.

The same trends and truths apply to control systems. In the beginning, control was implemented manually with local indicators, and the operators then periodically adjusted parameters based on the rules developed from past experience.

Evolution of control continued with the use of pneumatic local control loops, often with chart recorders. This freed up the operator's time and allowed them to run more processes at the same time in addition it also increased the capacity of the system and allowed the plant to be operated it closer to design specifications.

The introduction of the electronic controller and Distributed Control System allowed the same operator to monitor even more loops. Additionally the computer itself was

able to both monitor and control multiple loops. This enabled the optimisation of the process against an array of constraints rather than a single point as was the case with most pneumatic control.

This evolution has continued with the availability of 'Smart' transmitters that share more information than just a process variable with the host control system.

The latest generation of field devices use bi-directional digital communications between the host, themselves, and each other. This provides the ability to continuously update the process variable and device status every update cycle and provide many more parameters when required/requested.

However, just because all this data is available does not mean that it is all appropriate to a particular installation.

2. Data Overload

If data is not presented in the right context, it is just a number. Or put another way, unless all the "1's" and "0's" that make up the data stream can be interpreted correctly they are simply just noise.

This is why control systems contain graphics, tag numbers, along with process values arranged in some fashion to show relationships between field values and the process as well as how various parts of the process interact with each other. Understanding the relationship between various pieces of data and placing them in context converts the values into useful information.

Control systems, since the introduction of pneumatic controllers, have also added another important capability, that of data storage/history.

Chart recorders, strip charts, and trend plots are all ways of archiving data for future reference.

3. The Importance of History

Historic data can indicate if; the process is changing, determine the relationships between different data points, and highlight if the changes are the same or different from similar situations in the past.

It is this history that allows operators to understand the context of the information being received, thus giving the ability to convert the information to knowledge. This data archive is also normally used as the first tool to troubleshoot or analyse for possible ways to improve a unit's operation.

Modern 'smart' transmitters, include as part of the additional information they make available, maintenance history, limited process variable history and use this information to analyse their own operation for potential problems. The resulting indication of 'device health' is the first step and input in improving the operational effectiveness of future plant operations.

For example, this device “health” or “status” (Good, Bad, or Out Of Service (OOS)) signal can be used by applications like a discrete input to notify an application or control algorithm to either ignore this input or turn off the calculation when the data on which it is based is questionable or bad.

4. Operational Savings

Studies have determined that by using this information in conjunction with higher refresh rates and the improved accuracy of digital field devices a 1 — 2 % improvement in a facility’s throughput can be achieved.

In addition, a number of studies have shown that as much as 63% of requested maintenance is not required. Since most of this type of maintenance is ‘emergency’ or breakdown maintenance it is also the most expensive type of maintenance to perform with a resultant ‘double whammy’ to a facility’s operations expense budget.

The next most often applied use of the status and diagnostic information from field devices is to capture it with an asset management or computer based maintenance system. These computer based maintenance systems are used to gather the device status/diagnostic information. This when used as the basis for predictive maintenance practices result in the following savings opportunities:

- Predictive maintenance is less expensive than emergency maintenance because of:
 - Reduced warehouse inventory
 - Avoidance of “Rush Order” premium payments
 - Reduced overtime
 - Enables the concept of campaign maintenance
- Research from Automation Research Corporation indicates savings from implementing an integrated predictive management system as follows:
 - 30% increase in equipment productivity
 - 20% increase in worker productivity
 - 10% increase in equipment life
 - 10% decrease in defects
 - 20% decrease in down time
 - 25% reduction in inventory costs
 - 50% decrease in unplanned shutdowns
- Overall maintenance reductions of 25 — 78%

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- 90% reduction in troubleshooting time.
- 25 — 90% reduction in plant start-up time.
- Control Loop Maintenance Ranges
 - Reactive 40 — 90%, industry average 60%, target 10%
 - Preventative 10 — 60%, industry average 30%, target 40%
 - Predictive (Reliability Centred) 0 — 10 %, Industry average 10%, target 10%

In addition changed work practices such as operator/technician can be considered.

5. Data Overload

One negative impact of all the additional digital data is the potential for information and alarm overload. Therefore Alarm Management is another tool used to prevent this situation from being a deterrent to the effective use of a digital control system.

The underlying principle of alarm management is that “a single alarm is sent to the person who can or must act on that alarm to correct the situation and minimise its impact.” This means that a maintenance alarm is sent to the maintenance department or work order system rather than to the panel operator. Also when an alarm event does occur, only one instance of the alarm is triggered to the Operator display / HMI. Thus if the system is configured correctly, that alarm is the “first in” or “root cause” alarm.

Time stamping of all Fieldbus communications can assist in identifying and capturing the true “first in” alarm/incident. This of course will also help to identify and confirm the root cause during subsequent incident investigations, thus saving many hours time for the investigating engineers and specialists. Of course, in the event of litigation this information will also be helpful in verification of the events that actually occurred and their sequence.

Alarm management by itself has been shown to contribute to the reliable operation of a facility through increased uptime resulting in savings in the order of several million dollars depending on the facility.

6. Knowledge Management

The third form of information management, “knowledge management,” is the capturing, retention, and redistribution of the learnings and experiences of an organisation so that it can be used again in similar situations. The most rudimentary form of knowledge management systems are a company’s operating procedures.

With the present workforce demographics showing a turnover of as much as 50% of the workforce to retirement in the next decade, along with trends to reduced staffing

levels and higher turnover rates among remaining staff, the net result is a smaller less experienced workforce. Many organisations are purchasing and installing software based knowledge management systems as a way to systematically capture and disseminate these best practices before it leaves with the next retiree or resignation.

There is little information available on the economic returns of knowledge management systems, yet companies obviously value this experience, otherwise why pay older workers higher salaries than new graduates?

Despite this, the number of knowledge management systems being installed continues to grow since the payback is increased availability and uptime of a facility.

7. Conclusion

Like the well known “Moore’s Law” of computer processor speed improvements, the data ‘explosion’ is unlikely to abate. This makes it increasingly important that the systems and tools are in place to translate this data into information that can be used efficiently to convert the information into knowledge which can be reflected as profits enabling future investment and growth.

8. References

Fiske, Tom, “*The Path to Reliability*,” Hydrocarbon Engineering, June 2003

O’ Brien, Larry, “*Best Practices for Maximizing the Value of Fieldbus Implementations*,” 2004 Foundation Fieldbus General Assembly End User Council Meeting, <http://www.fieldbus.org> February 2004

Engineering Equipment Users Association (EEUA), *Publication 191 “Alarm Systems: A guide to Design, Management and Procurement,”*

Torres, Linos, “*Operational Excellence*,” South Cone Emerson User Group, June, 2004