White Paper

Performance-Based Industrial Infrastructures

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What's Inside:

Performance-Based Industrial Infrastructures

1. Background

For the better part of the last three decades industrial companies have been struggling with the issue of getting their plant level automation systems and their business information systems to effectively interoperate in order to improve the performance of the overall business. Many different approaches have been attempted over different time frames, and yet for the most part the results have been somewhat discouraging. A new approach is emerging in the industrial marketplace that holds considerable promise. This approach is based on the availability of performance-base industrial infrastructures that are designed to enable effective decision making at all points in industrial operations and effective reporting of results. Both effective decision making and effective reporting are required to optimize the business performance of industrial businesses.

2. Reporting-Based Infrastructures

In the 1970s most of the pressure for plant floor to business integration appears to have originated at the business management levels in industrial operations as they strove to have better and more accurate business reporting based on the data commonly stored within the control systems. The challenge presented to both the information technology (IT) and automation engineering professionals was to provide the business applications with the data required to provide the improved reporting systems. To a large extent the technologists viewed this as a data movement challenge with the objective of moving large quantities of stored data in the control systems into the IT domain. This led to a system infrastructure sometimes referred to as the "Vacuum Cleaner Approach" (Figure 1).

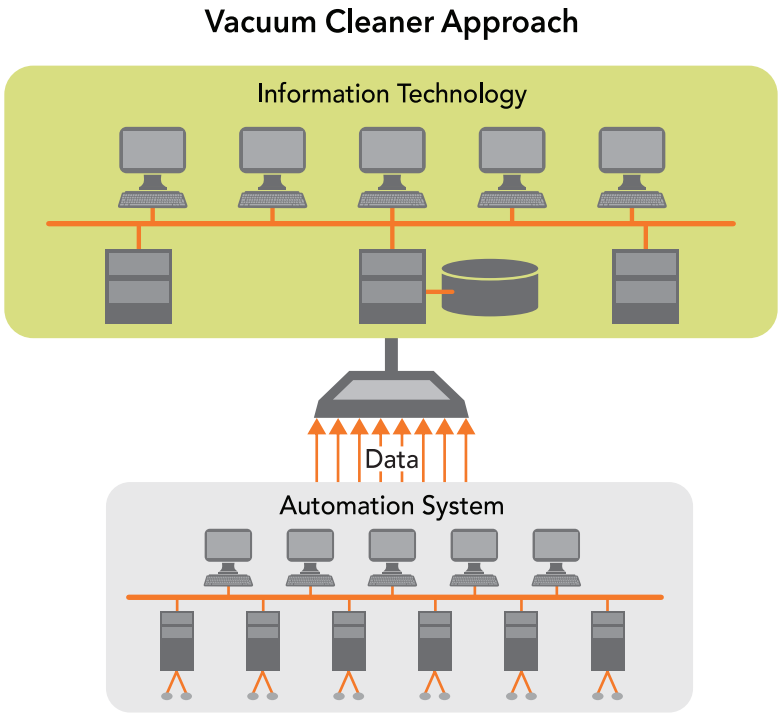

Figure 1

The concept behind the Vacuum Cleaner Approach was really quite simple. It was to move the vast quantities of process data onto a storage device in a minicomputer connected into the IT network. Software was developed in the minicomputer (DEC PDP of VAX or HP) environment to connect into the installed distributed control systems (DCSs) and suck data from the DCSs on a periodic basis and store the data in a circular file on a disk of the minicomputer. The data sets moved from the DCSs to the minicomputers were typically periodic snapshots of multiple data values from across the plant. The file on the minicomputer was set up so that each file record represented a time slice for the data in the plant. The file size determined the number of time periods of data stored on the minicomputer disk. Once all the records had been written into the file, the software would just circle back to the beginning of the file

and start writing over the data one record at a time according to the period of collection. The idea was that this plant data would now be available to the IT system and could be accessed whenever the IT system required. From a pure technologists perspective this seemed to have met the need.

Unfortunately, the Vacuum Cleaner Approach was, for the most part, an abysmal failure. Studies showed that the vast of the data stored on the minicomputers' disks were overwritten before it had ever been accessed. Part of the problem was that although all the data the IT reporting system required may have been available there was no context to the data and the IT team could not figure out how to make use of it. This was a classic example of a technologists "solution" to a business problem. It is important to realize, though that even if the Vacuum Cleaner approach had worked as anticipated, it would have merely provided the data necessary to improve the business reporting of the industrial operations, not the performance.

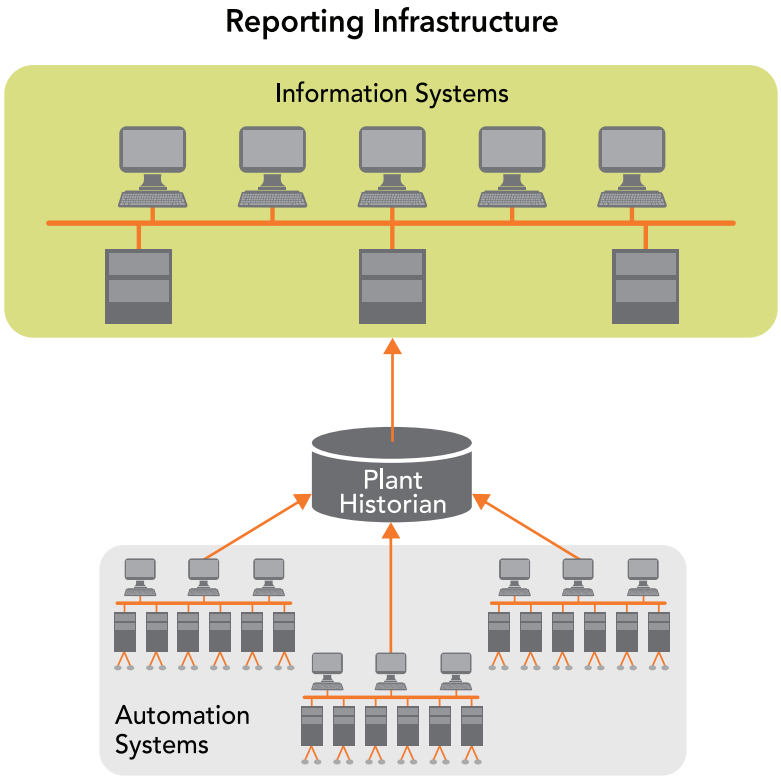

Figure 2

With the failure of the Vacuum Cleaner Approach, considerable effort was invested to provide a reporting infrastructure that would be much more effective. The approach that is primarily used today (Figure 2) involves the deployment of plant historians between the automation systems and the IT systems. Many plant historians (Industrial SQL, PI, InfoPlus 21 etc.) have been developed to be able to connect into a number of different automation systems to gather plant data and store it into their historical plant database. Software has also been developed (MII, Wondeware® Intelligence etc.) that, among other functions, connects the historians to Enterprise Resource Planning (ERP) software and provides contextualized data access routines to allow effective extraction of the historized plant information required for reporting. With the recent advent of transactional service oriented architectures, such as NetWeaver from SAP and IBM's WebSphere, easy connection into the breadth of ERP functionality was enabled. The connection ability of the plant historians to the automation systems coupled with the connection ability of the intermediate software applications that sit between the historians and ERP software provides a fairly robust and easy to implement and use infrastructure that make plant level data available to the business reporting systems.

3. Decision-Based Infrastructures

There are two fundamental requirements from industrial information processing systems; providing information for reporting and providing information for real-time decision support. Typically the timing requirements are quite different for these two. Reporting functions are typically done on human schedules with the timing requirements defined by human transactions. Therefore reporting systems are often referred to as transactional systems. Decision support systems on the other hand are typically done according to operational conditions or events and require the operations personnel to respond immediately to have the desired impact. Therefore, these systems are typically referred to as real-time systems.

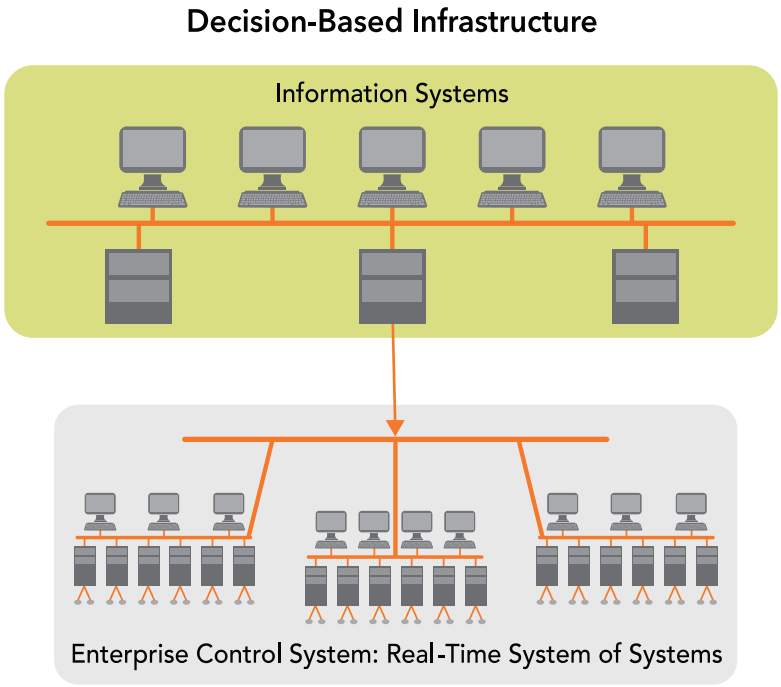

Figure 3

A weakness was discovered when Reporting-Based infrastructures were utilized to support operational decision making. The weakness was that although the Reporting-Based infrastructures offered a high degree on connectivity and provided a multitude of data paths, moving the real-time information up through the near real-time process historians introduced a lag to the data which negatively impacted decision support at the front lines of plant operations. In other words, the information for real-time decision support wasn't arriving in real time. Initially many industrial companies overlooked this weakness because they at least had a level of information not previously available and even if it was a bit late in arriving, it was better than before. Although this is true, the economic, safety and environmental impact of delayed decision making was found to have serious implications in a number of instances. This is not to imply that the Reporting-Based infrastructures are not necessary – they are. But they are just not sufficient for optimal business operation and profitability.

For real-time decision support a new and different infrastructural approach was required. Effective real-time decision support information typically involves data originating within the control systems, the ERP software and perhaps even external sources. Since the requirements from the ERP level are typically transactional in nature, the transactional interfaces developed for Reporting-Based infrastructures sufficed, as long as they were developed to be bidirectional. The real problem came at the real-time system level. Most industrial companies had acquired a multitude of real-time systems and software developed by multiple vendors over a 30 year period, that are still operational within the different plants across the entire enterprise. These installed real-time systems were not designed to interoperate with each other and pulling them into a single computing domain was extremely costly from both a time and money perspective. Reducing this cost was essential to the development of effective Decision-Based Infrastructures.

This was accomplished through the development of industrial service oriented architectures, such as ArchestrA®, which enabled the cost effective implementation of a real-time system of systems, commonly referred to as an enterprise control system, across each plant and across entire industrial enterprises. The availability of enterprise control system technology enabled the cost effective real-time communications at the plant floor level across entire plants and enterprises with multiple installed automations systems. It also provided data normalization across these disparate systems which had never previously been available. This, combined with the connectivity to the ERP level, and toolsets such as real-time workflow execution provides the basis for real-time decision support systems encompassing multiple technology domains.

4. Performance-Based Infrastructures

It is important to note that both reporting and real-time decision support are critically important requirements for industrial operations. Therefore the ideal industrial infrastructure would be one that combines the strengths of the Reporting-Based and Decision-Based infrastructures into a single, comprehensive industrial infrastructure. Such a composite infrastructure is referred to as a Performance-Based Infrastructure (Figure 4).

Effective Performance-Based Infrastructures provide the support for the reporting requirements of an industrial operation while simultaneously providing support for effective real-time decision support throughout each plant and across the enterprise. There has been considerable debate among technologists in industries in favor of either Reporting-Based or Decision-Based infrastructures for effective performance optimization. The truth is that neither is sufficient in its own right. A comprehensive Performance-Based Infrastructure is the ideal starting point for industrial companies looking to optimize profitability in the difficult global markets of today.

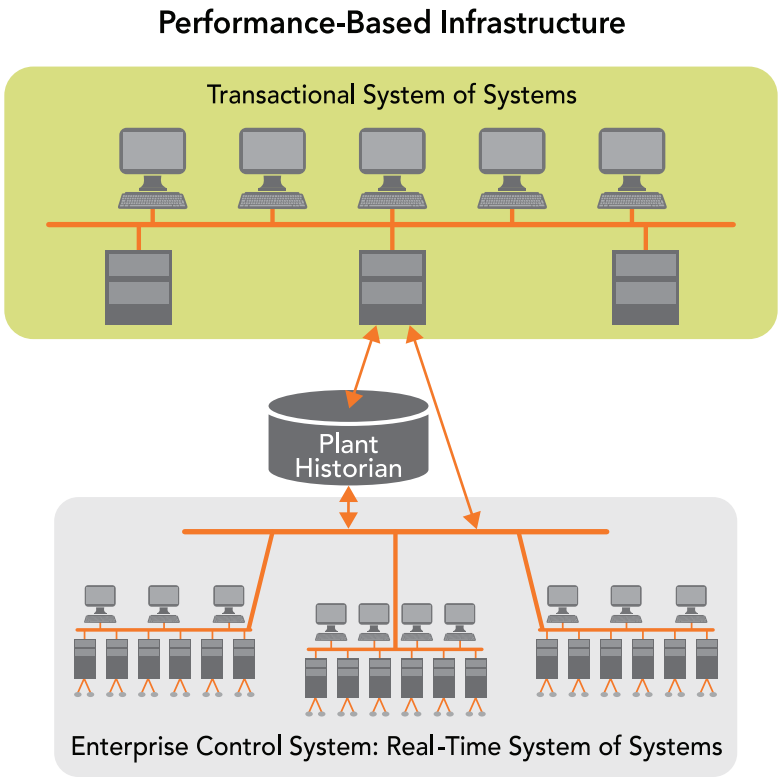

Figure 4

5. Conclusion

Industrial computing architectures and infrastructures have evolved significantly in just the past decade. Infrastructures that support effective operational and business reporting provided an excellent starting point for Performance-Based industrial companies. The shortcomings of these Reporting-Based infrastructures, in terms of being able to provide decision support information throughout the operation in a time frame that enables optimal results – in real time – have been satisfied by the emergence of industrial decision support infrastructures founded on Enterprise Control System technology. By merging these two infrastructural approaches into a single Performance-Based Infrastructure, industrial companies finally have the basis for using computer based technologies to continuously optimize the profitability of their operations while effectively reporting their results.

Invensys Operations Management has long pioneered the development of Performance-Based Infrastructures. In addition to supporting Reporting-Based infrastructural capability with Industrial SQL plant historian and Wonderware Intelligence, we also developed InFusion™, the world's first Enterprise Control System. The InFusion Enterprise Control System utilizes the ArchestrA Software Technology to easily and affordably combine automation, manufacturing and business systems so they function as one comprehensive enterprise-wide operations management system, the first true Performance-Based Infrastructure. Invensys Operations Management also offers Business Value Consulting to help industrial companies drive optimal real-time profitability from all operational assets across industrial enterprises.

The bottom line is that industrial companies looking to optimize their bottom line should look to Invensys Operations Management.

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