“Realizing the Economic Benefits of Interoperable Facilities Management Systems.”

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Abstract:

This article focuses on the delivery mechanism for HVAC control and energy management systems, here after referred to as Facility Management Systems. In the past, these systems were delivered by branch offices of the product manufacturers. Starter systems were sold competitively at very low margins, and non-competitive relationships between buyer and manufacturer were established due to the proprietary nature of the communications protocol used by the digital devices in the system.

Advances in communications standards, particularly the emergence of Lonworks and BACnet as interoperable protocols have made competition for system additions and alterations possible. This article discusses the use of this new technology in creating a “ durable competitive environment” that will allow the system to remain cost effective over its entire lifecycle. This is accomplished by creating Facilities Standards which define the technical and commercial “rules of engagement” required to manage a multi-vendor environment

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We who focus on the bits and bytes of system delivery tend to forget that were it not for the potential economic power to be gained by the application of interoperable technology, the topic would be of little interest to the people who buy Facilities Management Systems (FMS). “Economic power”, for the purposes of our discussion is defined as the clout carried by the end user when competitive bidding for system additions, alterations and service is viable.

Further, the facts are that the mere existence of interoperable technology alone, and it’s undisciplined application will not guarantee that the economic power defined above will ever be realized by the end-user.

The two additional elements necessary for an end user to attain economic power are the creation of a “competitive environment” that results in an economic opportunity for potential suppliers and, just as important, participation in the process by the end user at a technical level not previously necessary.

Creating the Open Environment

First lets define what we mean when we say “open” and “closed” systems. From the perspective of the end-user, these words are important more for their economic connotations than their technical meaning.

For the purposes our economic discussion, an “open” system is simply one whereby the end user retains his ability to competitively bid system additions and alterations and service if he so chooses - with a “closed” system, he cannot.

Looking at how any FMS is delivered, we can identify several distinct delivery “elements” - products, engineering, installation, service. In order to achieve the ability to maintain the cost-effectiveness of any system, we need to create an environment where there are no barriers to competition in any element of the delivered system.

First looking at the “products” element, we see that we can almost accomplish our competitive environment without interoperable technology. If an end user standardizes on a single product line, and that product line is made available by the manufacturer to everyone in the marketplace at the same price, then the argument can be made that, per our definition , this system delivery element is “open” whether interoperability is a feature of the product line or not. Why? Because applying the product line will create no barriers to competition by limiting or controlling its availability to the companies that compete for the work, by the product line manufacturer, or his distribution chain.

Why then isn’t this commonly applied as part of an “open” solution for FMS? First, the traditional manufacturers of these products began sourcing these systems through manufacturer-owned branch offices when these systems were first offered in the marketplace in the early 70’s. Although it is pure conjecture to think that delivering systems in this manner was a deliberate marketing plan to build a captive base, the facts are that there *is* a captive base, and many product lines are sold through controlled distribution – branch offices or exclusive franchises that control access to the parts and pieces necessary to support and expand existing systems. Second, even if a product line were offered through a pure “retail”, or over- the- counter-type distribution methodology, standardizing on that product line makes the end-user dependent on a single manufacturer for all future benefits of technology improvements for his system.

The product line used is only one element of a delivered system. All FMS product lines require added value by the implementer in the form of programming and engineering before they can be use for their intended purpose. If all the software tools required to develop the programs that make the products work, and if all the engineering data required to correctly apply the product line were made available to all potential implementers at the same price and under the same terms, then the engineering element of a delivered system would be “open”. Control of these tools, and the product line by the “branch distribution channel” mentioned in the last paragraph are the chief ways that traditional implementers keep their systems closed.

Moving on to the installation element, if a neutral set of “rules of engagement” or Standards is created so that no economic advantage or knowledge barrier comes to exist when a system addition or alteration is accomplished, then this element can be deemed “open”. Such a set of Standards for the facility would need to create a level playing field, from a contractor’s perspective, so that when a project is bid and lost, future economic opportunity at the site remains intact. Such Standards would include not only commercial terms and conditions, resolving such potential problems as Warrantee conflicts, but also technical direction on how the system software is to be designed and documented so that each bidder for each new project will be able to incorporate where the last project ended in his bid for new work. If a facility is to be served from several sources, it is common sense that without a set of Standards it would be very easy to create, even innocently, a knowledge barrier that is just as effective at discouraging competition, as use of proprietary products and communication protocols.

Removing the competitive barriers in the service element of a delivered system is an extension of the installation element concepts mentioned above. Usually the programming software required to interrogate, trouble shoot, and repair the existing system, is the same software required to engineer the system. If this is available on the site, along with the programming database, and all installed system application programs, to all potential service providers, then the service delivery element of an installed system can be deemed “open”. Currently, service competition is limited by control of the tools. Service employees in traditional branch office distribution channels sign agreements forbidding them to own software tools for the closed systems they service, if their employment with that manufacturer terminates.

A new system delivery paradigm

The world is changing. Dissatisfaction with predatory pricing practices associated with the traditional branch office delivery paradigm, created an economic opportunity in the marketplace. Two approaches to capitalizing on the opportunity exist. First, one company has responded with a set of products that are really a subset of the traditional delivered system. The communication chips that are installed in typical product lines, along with all the software required to make these communications chips communicate with each other has been developed and sold to traditional product line manufacturers, and many new players, allowing them to sell new “open” products into the same marketplace that first expressed the need for change. Second, a communication standard has been developed and championed by a large dissatisfied end-users group desiring the economic power discussed above. This users group has elicited support from the consulting engineering group and a growing number of manufacturers who see the economic opportunity to also sell “open” products into a marketplace that is dissatisfied with “closed” product offerings.

From the above, it can be argued that most of what it will take to create an open environment has at least as much to do with changes in the way systems are delivered, as the use of interoperable technology. Certainly the way that systems are delivered needs to be altered, if the economic benefits of open systems are to be realized.

Fortunately, a distribution model exists right now that can be used to create a competitive environment for Facilities Management Systems. Analyzing the way that Industrial Process Control Systems are delivered in the marketplace yields a model that is totally applicable. Let's look at typical industrial control system delivery elements:

Industrial programmable logic controllers (PLCs), the analogy to the DDC controllers that make up a FMS, have always been sold as "retail" products. PLC manufacturers do not leverage their products by selling through Branch offices, and installing and servicing systems. PLC manufacturers also sell the development software and training required to implement their products to anyone with the desire, and money to buy them.

The other major component of an industrial control system, Graphical User Interface (GUI) is also sold as a stand-alone retail product, not packaged with the controllers and sold as a system, as in the case of FMS. This is a particularly important feature, as the GUI is a point of commonality for all system additions. When an installed system is expanded, the GUI is almost always updated as part of the expansion project. We will come back to this point later.

The installation element of industrial system delivery is also more loosely bound than the traditional commercial system approach. Typically, a Systems Integrator buys the PLCs and HMI products and programming tools, adds value by programming the devices, creates software files and installation drawings, and then subcontracts the installation to an electrical contactor and supervises the work. In many instances, the end-user performs much of the service for the work. This paradigm is in contrast to commercial system installations, where the branch office of the product manufacturer passes through the products from the factory, adds the engineering value, installs the system with it's own forces, and services the system for its lifetime.

It is commonplace for Industrial customers to develop "plant standards" for their control systems, particularly for systems controlling processes that are not obscure, and which require periodic expansions and /or alterations. The underlying reasoning for these standards is that it is assumed that system expansions and service for the system will be supplied from multiple sources. Although systems are also becoming more "open" in the industrial world, typically plant standards are built around the products of a single manufacturer. This manufacturer makes his products and training available to all Systems Integrators who desire to compete for the work in the plant. A "competitive environment' exists, wherein if an SI loses a project, he does not lose future opportunities at the plant.

The lesson learned from analyzing industrial and commercial system delivery elements, is that in order to create the "competitive environment" for FMS, we need to ***unbundle***.

Conceptually, using interoperable technology helps to unbundle the “products” element of the delivered system. Interoperable devices do not have to be purchased from a single manufacturer. “Best of Breed” product selection is possible. Choices can be made based on performance, features, and price rather than compatibility. The availability of any product used in a system cannot be withheld from any potential implementer.

In the case of Echelon’s Lonworks family of communications hardware and software, the purveyor of the interoperable technology is unbundled from the purveyor of the products. The software that “binds” the interoperable products together, and the training required to perform the task is not withheld or controlled in the interest of controlling distribution, or precluding competition.

Additionally, since development costs for the communications capabilities in a FMS are a significant part of overall product development costs, using Lonworks reduces the economic entry barrier for new “specialty” manufacturers into the marketplace. This will tend to further reduce the cost of products due to competitive pressure at this level.

Unbundling at the “installation” element is a matter of re-introducing “plant standards” as “facility standards”. Besides applicable commercial terms and conditions, the technical content of “facilities standards” needs to be germane to the technology used – in our case, either BACnet or Lonworks, and the standards must pre-qualify an array of acceptable products. Additionally, facilities standards should determine qualifications for SI’s who will compete, including training and experience with the technology selected. A common format for all engineering documentation must be described, and standard commissioning and acceptance procedures defined, so that all expected costs can be estimated fairly by the competitors. In order to induce competition over the life of a system, a durable economic opportunity must be created for the implementers.

Opening up the Closed System

It is safe to say that no proprietary “closed” system currently installed is so “far gone” that a transition plan cannot be developed. Costs of the transition will depend on the age of the existing system, whether protocol conversion devices (gateways) exist that can be used to salvage existing digital hardware, and the condition of the existing installation. Much of the cost of a system is the installed sensors, actuators, and interface devices. Replacing the existing digital controllers with new “open” controllers, while reusing most of the rest of the installation, is sometimes the most viable plan.

A common element of any transition plan is installing a GUI that is independently supportable from multiple sources. There are many mature products on the market now, with excellent feature sets, that can be engineered to duplicate most of the functionality currently possessed by an existing “closed” FMS. It should be noted that certain technical features, such as the ability to program field controllers, and save controller programs from the GUI may not be possible with the new “open” system.

The reason for a mandated new GUI is economic. Since every system addition will include upgrades to the GUI and network, if the GUI can be serviced by only one source, then the only viable bid response for the whole project scope of work will be from that source. The old adage for this idea is “He who controls the GUI controls the site.” Software “drivers” exist for both interoperable control protocols (BACnet and Lonworks) that can be added into the software development for the GUI.

Two basic economic plans can be used to begin the transition. The least painful is to specify an open system for a moderate to large-scale addition to the facility or a new building on campus. Specify a Graphical User Interface (GUI) that is independently supportable from the control system, and for sure, integrate it with the (assumed) existing IT communications backbone. Develop and specify Facility Standards. The cost of these Standards should be taken from operating budgets since they will be amortized over all future work.

The second, more painful plan is to fund the GUI, network, and Standards out of the operating budgets. Plan on at least a 50K$ expense for a multi-building campus. If money is very scarce, install the GUI, and put off spending on the Standards until a project of some size evolves, then included the Standards under the consulting engineering budget for that project. If planned capital improvements exist that include budgets from the existing “closed” system supplier, it is safe to assume that some transition expenses can be absorbed due to savings in these projects, once a competitive environment is in place.

Under either plan, as soon as the potential for competition is introduced, new options exist- either system can be expanded, and bids can be taken from the existing “closed” system provider and a selected group of “open” system providers. The cost of support services and systems work from the existing supplier will plummet when faced with the competitive environment created by the transition plan. The cost of services for the “open” system will remain competitive.

Developing Facilities Standards for a “starter” system will be less expensive that integrating a Standards document into an existing facility. A detailed needs analysis will be required for an existing facility with a “closed” FMS to determine the functions of the existing system that are used and desired, so that this functionality can be carried forward.

End-user participation

In the past, mitigating the pain of living with the high cost of a closed system was the “comfort” of detachment. Since with a closed system, the source for all future work on the system was determined when it was first purchased, there was no economic motivation to learn the technology under which the system runs. Such is no longer the case. New products are being developed all the time. Enhancements and improvements in both FMS standards (BACnet and Lonworks) are happening often. New products are being introduced daily. While the degree of “future-proof insurance” can be improved by

artfully constructing Facilities Standards so that participating SI's are required to assist in keeping up with changes in the technology, nothing is a substitute for a client's working knowledge of how these systems work. There are many sources of information that discuss the topics in non-technical terms. See for example www.Lonmark.org, www.Echelon.com . The old adage holds true – Knowledge is Power.

What this buys you

Any economic treatment of this topic should include an attempt to quantify the costs and benefits that are gained by creating the "open environment" discussed above. It's a fact that for a given system, arriving at an exact estimate of savings will be impossible in most cases. Either the system is "open", and competitive bidding either occurs or is always available to keep "unhealthy tendencies" in check, or the system is "closed" and pricing reflects these "unhealthy tendencies". Even a proprietary bid response has constraints, however the constraints lie mainly in the mind of the bid provider, and not in the bid acceptor. From experience, competitive margins often range from 15 to 20%. Non-competitive margins can exceed 50%, depending on the circumstances.

There is no free lunch. Setting up Facilities Standards for a system, using a qualified consultant can range in cost from "free", if you can convince a qualified SI that you trust to set this up for you for a small system, to $50,000 +/- for a major project renovation or campus project.

To close on the topics of costs and benefits, once the motivation to "lowball" a bid in order to set up a non-competitive relationship with a starter system is removed by the disciplined application of interoperable technology, common sense tells us that first costs for new FMS may actually rise. This concept should be understood before deciding that interoperable systems are the only way to go for new system specifications. At least during the market evolution to open systems for the next few years, proprietary systems, with their simpler programming methodologies, can still be less expensive to deliver. Additionally there are many more potential providers of proprietary systems than qualified SI's.

If the system is simple and will not be significantly altered during it's lifecycle, then a proprietary "closed" system may still be the wisest economic choice. Remember also, however, that the paradigm is shifting. Eventually, interoperable systems will become the conventional way all FMS are delivered. If you have the budget to spend the extra 5% to 10% it takes to get an interoperable system, you are investing in future-proofing your system.