Executive Summary

Industrial manufacturing across all segments - batch, continuous, discrete - are facing similar challenges. Aging, proprietary process control systems, some 20 to 30 years old, are stifling productivity and innovation.

Under ever-increasing pressure from shareholders and competitors, the "C-suite" is demanding more from their corporate assets. Executives are seeing the gains being achieved in Information Technology (IT) through open architectures, open interfaces and open source:

- Increases in operational benefits from improved capabilities
- Improved cybersecurity
- Reduction in capital expenditures
- Reduction in lifecycle costs

They are now expecting the same from their Operations Technology (OT). However, the closed process control systems currently in place are hard to maintain, expensive to upgrade, and do not allow easy insertion of new technologies.

The Open Process Automation Forum (OPAF) is addressing these challenges through the development of a "standard of standards" for open, interoperable process control systems.

In this white paper we'll examine three business and operational models, and explore how the work OPAF is doing can help accelerate industrial manufacturers' achievement of the gains described above.
Building a Case for Open Systems

Industrial entities across all sectors are diligently working to improve productivity of their manufacturing assets. However, the state of their current process control systems makes this a difficult, if not daunting task. Add to that the diverse nature of different manufacturing models (e.g., batch, continuous, discrete), and achieving a common framework for achieving corporate business and operational goals is very difficult.

Many technologies, initiatives and standards now dot the landscape: Industry 4.0, Internet of Things (IoT), Industrial IoT (IIoT), digital transformation, edge computing, cloud computing, to name just a few. In addition to management pressures for improved efficiency and productivity, operators are also challenged with selecting the right choice of next generation process control systems architectures and standards.

But the real question facing operators is "do these new open systems really make a difference?" Already faced with day-to-day operational challenges, operators are somewhat dubious of open systems claims of productivity gains, and reluctant to transition out of their traditional, yet typically unproductive, operational model.

The three models presented in this paper demonstrate how the application of open architectures, standards and systems can reduce risk, shorten adoption cycles, increase efficiency, and most importantly, improve profitability.

The "CapEx" Model

Whether your manufacturing process is batch, continuous or discrete, you are faced with a very common challenge. Building a new production facility requires a lot of capital, takes a long time to complete, and has a long life expectancy characterized by diminishing value over time.

The diagram in Figure 1 typifies the traditional industrial CapEx model. A very large upfront investment is required, during which time there are limited to no returns in terms of efficiency of the assets. Once the facility is completed, ongoing investment somewhat levels off, and efficiency reaches its maximum level, and then maintains that level over years.
At some point in the future, the facility undergoes "modernization", which requires a shutdown period. During this time, a large investment is made to upgrade every system. This large investment is due to the fact that the process control systems are so tightly coupled that they can't be incrementally upgraded. You simply can't take one component out because the whole system would become inoperable. After the modernization event, the facility returns to a steady state in terms of efficiency, hopefully at a higher level than before.

Compounding the current CapEx model is that when modernization events occur, the old systems are typically replaced with "new" systems from the same vendor, that are very similar in function and have a closed, proprietary architecture. So, in effect, the efficiency of the plant will never improve over time, and at some point will be faced with another modernization event.

The OPAF CapEx model significantly changes the overall lifecycle investment and efficiency model.

**Figure 1 - Typical CapEx model for investment and ongoing operations of an industrial production facility**

**Figure 2 - The OPAF CapEx model for investment and ongoing operations of an industrial production facility**
From the very beginning of the investment cycle, open systems provide significant benefit in that they force competition among process control system suppliers. This in turn reduces the initial capital outlay and helps shorten the design and build phase.

The second major difference in the OPAF model is ongoing capital investment. Rather than a very large modernization event, continuous improvement can be made across all process control systems over time. By utilizing open systems, operators can choose "best of breed" solutions that can be non-disruptively integrated into existing operational models. Since these solutions are built on an open platform, new functionality can be easily introduced, which increases automation and continually improves plant efficiency. And, as with the initial investment, open systems drives competition among process control system suppliers, reducing cost, but more importantly, increasing profitability.

The "Data" Model

As seen across every industry, open systems go hand-in-hand with open data.

There are a lot of standards around open data that allow sharing among systems, which has delivered a significant breakthrough in productivity - to such an extent that data is often referred to as the "new gold."

Manufacturing companies spend huge amounts on data collection. Sensors of all kinds are found in every stage of manufacturing processes. They can easily number in the tens of thousands in large systems such as oil refineries, continuously generating time series data which is collected and stored in gigantic "data lakes."

Process historians collect thousands of data points per minute, storing them away on disks. Unfortunately, this data may sit on those disks for years. It may be used for some initial trend graphs, but it typically provides little value beyond that initial analysis.

The key to unlocking the true value of data is to make it "actionable." Actions that come in two forms: real-time data which provides control, and transactional data, which enables management decisions.

To make data actionable, a control loop model must be applied to its lifecycle.
Open data is the new norm
- Huge ongoing investment in data collection
- Data moved to cloud for analysis
- New AI tools for gaining insight
- Close the loop by adopting modern, open control systems for process improvement

**Figure 3 - OPAF unlocks the value of data by defining open systems that enable the deployment of control loops in process control systems**

By utilizing process control systems that adhere to open standards, with open application programming interfaces (APIs), data can be collected and easily shared among not only among process control systems, but also the entire process automation lifecycle:

- Locally for immediate operational decisions to avert safety and security risks, maintain performance tolerances, alert for potential failures, etc.
- In big-data clouds for deep analytics, arificial intelligence and machine learning
- In back-end systems for mission critical business operations (e.g., billing, auditing, compliance)
- In business analysis systems for trend analysis, ROI calculation and what-if scenarios

Regardless of the life cycle stage, the key to improving the value of data is the measurement, collection and sharing at the right place and in the right timeframe to make better decisions, increase safety, improve efficiency, reduce risks (environmental, cybersecurity, etc.), and most importantly, increase profitability.

**The "Efficiency Frontier" Model**

Manufacturing processes can be very diverse. Batch, continuous and discrete manufacturing models are driven by different business, market and governmental factors. But, they all have a common goal: increase the efficiency of the manufacturing facilites and processes. The broad industry question becomes "how can diverse industries with different corporate goals, investment strategies and business models be strong advocates for a common set of standards?"
For Pharmaceutical companies, the decision to invest in new manufacturing (plant) facilities and select manufacturing control systems typically occurs very late in the product lifecycle. The vast majority of the product lifecycle effort goes into development, testing and regulatory approval. Since the production of a new drug “batch” may be fairly short, these companies prioritize flexibility and agility over long-term efficiencies.

Oil and Gas on the other hand focuses on very long-term product lifecycles with the goal of getting to “steady state” and then optimizing for efficiencies over time through incremental changes. However, these companies are not without risk from outside factors such as environmental regulations, security, and natural disasters. Downtime in the continuous manufacturing model is unacceptable, so change occurs infrequently.

The key to achieving efficiency when both agility and stability are required is the adoption of flexible process control systems. But, if the control systems continue to be developed and optimized for each specific industry segment, then the ability to choose best-of-breed solutions and ultimately increase competition is lost.

To mitigate this problem, two things must occur. First, new process control systems must be built on open, extensible architectures that are anchored in well-defined standards. This will ensure that process control systems can be “repurposed” across multiple industries, and will enable continuous improvement across varying product lifecycles and operational models.

Second, the focus on efficiency alone needs to shift to efficiency and profitability. CFOs should begin evaluating investments decisions based on maximum impact with least risks. By implementing open systems that allow continuous incremental improvements, these decisions can be made faster, and their impact of profitability can be more easily determined.
The Open Process Automation Forum

OPAF, which is part of The Open Group, is an open, collaborative standards-focused body comprised of some of industry’s most prevalent technology thought leaders and pioneers, all working together to drive the creation of open, standards-based process control systems that will benefit process manufacturers across multiple segments. Members come from everywhere across industry, including end-users from multiple segments, hardware & software vendors, solutions providers, systems integrators, industry analysts, academia, and standards organizations.

Operate at optimal performance

- Mitigate future, unseen risks
- Keep processes at competitive peak
- Implement continuous innovation
- Remove pain of switching costs
- Consequently, invest more in control technologies over life of plant

Figure 5 - Open systems, as those defined by OPAF standards, enable continuous improvement, which changes the efficiency frontier to a profitability frontier

The Open Process Automation Forum

Collectively Redefining The Future Of The Process Industry
OPAF was formed in 2016. The initiative was spearheaded by Exxon Mobil, who has long called for the development of an open process control framework that would replace closed, proprietary control systems that drive up costs, stifle innovation and limit options end users have because they’re locked into the systems that were installed years, or even decades ago.

CPLANE.ai is proud to be a participant in helping OPAF shape the future of industrial process automation. We participate in both the business and technical working groups, co-chairing outreach and systems management sub-committees.

To learn more about OPAF, please visit: opengroup.org/forum/open-process-automation-forum
About CPLANE.ai

CPLANE.ai orchestrates and manages highly distributed clouds for Edge Computing, IoT, Industrial IoT, MEC, Fog, and intelligent edge applications. We eliminate the complexity and reduce the cost associated with deploying cloud resources to millions of Edge Computing end points, allowing enterprises and service providers to focus on value added business, IT and OT services.

To learn more about our fully-integrated cloud orchestration and software-defined networking solutions, visit us at: www.cplaneai.com

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