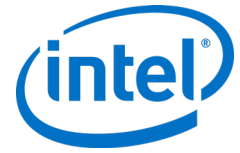


ExxonMobil Pursues Industrial Systems Innovation



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Customer Spotlight Webinar

Mary Killelea: Welcome, everyone. Thank you for joining us for Intel's customer spotlight series. This series highlights innovative industry-leading companies that are undergoing digital transformations, have tackled business and technology challenges and created new opportunities using Intel data-centric technologies and platforms. Today, we are excited to welcome ExxonMobil for a conversation on advanced open process automation. Today's host is Tim Crawford. Tim is a strategic CIO advisor that works with enterprise organizations. Tim, I'll turn it over to you now to kick off today's conversation.

Tim Crawford: Thanks Mary, and welcome everyone to today's webinar. I'm excited to join this conversation and bring in a few of our colleagues from ExxonMobil to talk about innovation, and specifically around industrial control systems. It's a very interesting space and we're going to get into that conversation. But just to kind of set the stage, we will take about 40 minutes for the core part of the conversation with our participants, and then we'll take about 15 minutes toward the end for the Q&A. So, first, let me go ahead and say that we have with us from ExxonMobil's Research and Engineering Group, Nick Clausi who's the Vice President, Kenny Warren, the project sponsor, Don Bartusiak the Chief Engineer of process control and Brad Houk, the open process Automation Project Manager.

Gentlemen, welcome to the program today.

So, as we're getting started here, let me kind of jump into who we have in the room, and then also talk about setting the stage—more of a foundation for folks on the call. So, you may understand who ExxonMobil is, but Nick, maybe you could take a minute and help people get familiar with the ExxonMobil brand, and also introduce your specific group at ExxonMobil.

Nick Clausi: Sure, Tim, thanks. I think most people will recognize ExxonMobil as one of the largest publicly traded energy providers and chemical manufacturers. Our team and Research and Engineering within ExxonMobil is really tasked with developing and deploying technical solutions to what we refer to as the dual energy challenge. That is providing energy as well as chemicals to a growing population, while at the same time reducing emissions. Our research and engineering group is at the forefront of those new technologies and what we're going to talk about today, open process automation is a great example of one of those technologies. It's aimed at the process control space, it's going to allow us to be more efficient in operating our facilities, and I think just as importantly, it's going to lay a foundation for future innovation in the process control area.

Tim Crawford: As part of that, I kind of want to jump to the next question a bit and talk about the problem itself. So, let me switch to Kenny, the project sponsor, and Kenny, maybe you can help us understand the role of industrial control systems and the challenges that ExxonMobil was facing as part of that.

Kenny Warren: Sure. Now, ExxonMobil like many in our industry, has a large base of proprietary control systems at our manufacturing facilities, our refineries and our chemical plants worldwide. These have served us well with high availability, stable, and safe operations at all our plants. But our installed base is decades old, and the challenges we face is a high cost of replacement and the limited capability to access the current technology, especially in a very dynamic future with more data analytics, sensor capability, wireless and growth in computing power. So, as we go about replacing our existing systems, we will require a more flexible, open system that positions us for the future with an architecture that allows innovation and value capture. In addition to that we are investing in grassroots facilities. We look at old PA systems as a mechanism to increase value creation across our asset base for those new facilities as well.

Tim Crawford: So, Kenny as part of that. I'd like to maybe spend a minute understanding how you got to this space in terms of the problem you were trying to identify and how it manifested itself. Can you maybe take a minute and talk about that?

Kenny Warren: So as we were getting close to looking at our spend over the next several years as the obsolescence kicks in, we saw that we had a fairly large expenditure that we had to make, and when we looked at it, and we also looked at some of the capabilities that we saw that we would need in the future. It caused us to pause a bit and look at what our alternatives were, and we relied on some of our senior experts in the space to look at the possibilities, to make the business case and then we launched the program.

Tim Crawford: Okay, great. So, I'm going to switch gears once again. And as we kind of go beyond understanding the challenge and the problem that ExxonMobil was trying to solve for, Don, I want to switch to you a bit and talk about innovation. Innovation is something that organizations are trying to capture and really harness as part of their transformation. How is ExxonMobil engaging the role of digital and emerging technology through the use of newer technologies like IoT and Cloud and wireless and AI as a means to innovate in this space while still addressing the problem that Kenny had outlined?

Don Bartusiak: I think the first thing that needs to be said is just to note that in industrial control systems, we've had a network of things, since digital technologies came in the form that we had in the 1980s. So, notice that the network of things that we have is that those networks are vendor proprietary and non-interoperable, which is good in one sense and that's controllable, deterministic, etcetera. But it's a big barrier against innovation. This is really one of the fundamental business problems that we're trying to address and solve with the open process automation initiatives. Let me comment on each of the four technologies that you mentioned, I'll go after wireless first.

So, we're very aggressively pursuing wireless technologies in manufacturing both for wireless connections to sensors for what we call final control elements, things like valves, the change in the rate of flows, [fluids]. And also, we're using wireless means to enable a mobile workforce. The specific technologies that we're using for the digital instrumentation are derivatives of the Wi-Fi technologies that people are familiar with in your consumer experience, but there are some technical differences there. The other wireless technology that we're really looking at with quite interest is the development

of 5G for example, and I know that's an area of acute interest to Intel as well. But 5G is still out on the horizon.

The Wi-Fi derivatives we're aggressively investing in today—on IoT and Cloud—the interesting thing to note there is, that's a build out from the IT types of technologies both down to the edge and also up to the Cloud. That was really appealing to us from an industrial control perspective is, that opens the door to a lot of very powerful technologies that we haven't really been able to access because of the closed and proprietary nature of the systems that we've had in the past. So, that's the upside. But it's important to note that in an industrial control context, cybersecurity is a very real concern for us. We are talking about risk to life, risk to our neighbors who live near our manufacturing facilities and we take that responsibility very seriously. So, as we pursue these new technologies, it's always done with the constraints and the realities that we have to do it in a secure way. The last technology of artificial intelligence that I would say represents a new frontier for us in terms of mathematical methods and automation, begins to approach solving our business problems.

AI is not new to us. My first assignments with ExxonMobil back in the 1980s actually were to see if we could use the AI technologies of the day, we did a bunch of things, but nothing really stuck. The neural nets of the days were really not that powerful, but things are different now. A lot of the technologies that were developed in commercial and consumer applications have really taken the technology to a new level, and we're really, really excited about that. With my team here, one of our biggest portfolio areas is seeing if we can reduce these AI technologies to practice with industrial control use cases.

Tim Crawford: Don, could you take a minute and just explain what you mean by that?

Don Bartusiak: Tim, I'll comment. People have heard that the term digital twin is an easy-to-use buzzword. I will assert that in control, we had digital twins for several decades, we have a whole suite of sophisticated mathematical model-based technologies, we model the dynamic behavior of our processes, and we use those models to control and optimize our facilities, but I think we've kind of reached a very high degree of maturity with those types of technologies. Where we have the next plateau of accomplishment, the next gaps to close are in the things that are difficult to express in any equations. It's very analogous to the business, the challenges in autonomous driving where you have to know how to respond to these edge cases that you don't necessarily know—you don't see them so often that you can describe them in math, but you still can respond in an automated manner. That is a general description of the types of use cases that we're going after now.

Tim Crawford: I see. Okay, great. So, bridging that, that's a lot of technology, a lot of innovation to bring in, and one of the questions I always ask is your role and it takes a village, right? It's the old adage, it takes a village, meaning, it takes more than just one organization to make this happen. So, as we start to think about the partnership that you have with Intel, can you take a minute and share your perspective on your partnership with Intel, and specifically, how the open process automation forum kind of fits into that?

Don Bartusiak: I guess the story with Intel begins in 2014. Our R&D team here, it was a very important thing that we did, we had basically a skunk works type of operation and we took half a dozen or so of our engineers, we brought some outside industry consultants in and we wrote a set of papers that defined the functional characteristics of what we wanted in the system that Kenny described that we needed. We wrote those articles, and we started sharing those articles with industry, and we didn't actually approach Intel with our first outreaches, in terms of who we were talking to, but Intel taking its own initiative asked us for those reports and articles, and then came back to us with really some of—what was really astonishing to us. They had taken our reports and articles on our requirements, the business problem we were trying to solve and why we were doing this. At Intel's own initiative in an astonishingly short period of time, this was a couple of months, basically showed us a working prototype of a part of our reference architecture that we call the distributed control node.

You can generalize it as an edge control device. The characteristics of that device—that prototypical device—were really quite astonishing. We took Kenny out to the [Chandler] labs and we were all just blown away quite frankly, it was an amazing event. So, that's how we got started with Intel. Now to connect it to the industry standards organization which we call the open process automation forum, so Intel today is playing a leadership role in that standards activity. I want to acknowledge the contributions of [Curt Smith] from Intel's industrial solutions organization who's one of the co-chairs of the Technical Working Group of the OPA [Open Process Automation] forum. The abiding contributions that we're seeing from Intel, I would say take two forms, one is showing us the possibilities to bring technologies into our space that we really weren't aware of. One general category is network function virtualization technologies, where with virtualization software-defined networking, technologies that Intel is really strong in showing us what's possible to do in ways that we really hadn't considered, so that'll be one area.

The other area, and I guess this is kind of core to the way that Intel influences the marketplace, showing us the way in terms of how do we affect this business transformation, it's more than the technology, you have to build that ecosystem to affect this transformation and to sustain it over the long term. Intel's experience in affecting these types of transformations is another area that I would highlight that we're really benefiting from Intel's contributions.

Tim Crawford: Don, you talked about this importance of standards. And it's a great segue into my next question, which centers around the importance of standards, where the OPA comes in as well as standards and just the collaborative nature of the space. You talked about the issues around vendor proprietary systems and shifting to OPA, the role of Intel. Can you share your perspective on the importance specifically around standards and collaboration in the space, and why this is so important, especially in an area that you're playing in these process systems?

Don Bartusiak: Yes Tim. We realized very early in our R&D program that the magnitude of the change that we were asking for that we needed to really fundamentally solve our business problem was too big for us to really do on our own. We realized that very early. So, we really started looking outside of our immediate experience space. And a very significant event for us was in 2013, we really discovered a business transformation that took place in the defense avionics industry, which transitioned from a long

series of closed proprietary, they use the phrase stove pipe solutions. So, what was happening is the buyer was basically paying for like the same radar system on a new aircraft. Every time there was a new aircraft when really nothing changed in the radar system. So, we said hey, that's very analogous to our business problem. And so, we saw how the avionics industry approached the solution to the problem, which was through modular, open, and interoperable systems defined by standards, defined by industry standards and procurement specifications that required those standards to be used to sell defense avionics solutions.

That's really what got us started on the collaborative consensus-based industry standards route that we're pursuing. The keys to success there are a critical mass of demand for change from the end users from the buy side. That's really where it starts, but the actual standards process itself requires collaboration and consensus among the whole market, if you will, the end users, the system vendors, the hardware suppliers, the software suppliers, and the systems integrators. So, the outcome that we aspire to get really like a win-win solution for the willing participants in this transformation. That's the big picture for what we're doing around collaboration and standards.

Tim Crawford: One of the things that you've said, I know in the past and in some of our past conversations is the importance that you really can't do it unilaterally and that the long-term effects and that collaboration is really important to maintain its sustainably long term.

Don Bartusiak: Right, Tim, we know that we can't do this alone. We at ExxonMobil can't do this alone. The industrial control, the distributed control system marketplace is about a \$15 billion a year industry, we're only a single digit percentage of spend in the space. I knew we had to reach out to others, but what we know is that each end user company has similar problems to ExxonMobil's. They might not have it with the same degree of acuteness or urgency that we have, but we all know that we all share the same pain points. So, that's the common bond among the end users. For us to achieve that critical mass of demand from the buy side, the customers. It's really essential for us to reach out across all of the industry sectors that use this type of industrial control system. So, it's not just an oil and gas thing, it's chemicals, it's pharmaceuticals, pulp and paper mining, and electric power generation. We've reached out across all of those industry vertical sectors, and if you look at the membership of the OPA forum, you'll see a good sampling across the industry verticals into the OPA forum.

Tim Crawford: Don, one of the things that I can imagine someone thinking is, well, wait a second, this is intellectual property for our organization, why would I get involved in OPA or share some of my findings with some of my competition in the same industry? What have you found from your work with the OPA and along those lines are addressing that kind of question?

Don Bartusiak: That's a good one. Let me address it from two perspectives. One from the users' perspective. So, the systems themselves are just—they're enabling infrastructure, so the way that we work with our peers let's say, in the standards activities, we don't share what we're doing applications wise with our competition, but don't we all need this infrastructure? So, that's the nature of our collaboration. That's where the common ground is, where we can work together. With the suppliers it's a different perspective. They're probably more threatened by this but the ones who are willingly

participating in this, they see this as a change that's common and they want to be participating in the change rather than be victims of it. That's the basis I think, for the collaboration among the supply side of this market. It's important to understand that we're not talking about open sourcing everything. The standards are largely about the interfaces between the components that make up an industrial control system.

The inner content, the core intellectual property still protectable, licensable, capable of generating revenue, both from the hardware and software products, as well as the services required to integrate a system that will work for the end user company. So, that's how we answer the question about the intellectual property. It's certainly protectable, it's licensable, you can generate revenue and earnings with it, and that's the nature of the ecosystem that we're trying to build.

Tim Crawford: That's great. And that's really, really good to hear. I think that's an important message for folks to walk away with. As we wrap on the main part of our conversation. I want to bring Nick into the conversation a bit and talk about what's next. So, as we think about how ExxonMobil properly made some great strides to address some of these challenges. What's next in terms of innovation and collaboration?

Nick Clausi: I think Don mentioned, we view the OPA project as a truly breakthrough program for industry, not just our industry, but a multitude of industries out there that utilize this type of equipment. We view this as an enabling investment. That quite frankly, it lays the groundwork for future collaboration and innovation based on rapidly advancing digital capabilities. The foundation of open standards is being created and is going to attract new innovators and innovators that are quite frankly finding it difficult to play in the space right now, because of the close nature of the hardware and software, and it's new innovators that are going to get attracted to the space that ultimately delivers value to not only ExxonMobil but to all the folks that participate and use these types of systems. A company review of technical innovation is core to our business and a key driver for competitiveness. So, OPA is really an investment that fundamentally, as I mentioned in the first question lays the groundwork for that continued innovation that ultimately helps us meet our company objectives of supplying need, the global energy demand as well as chemical demand.

Tim Crawford: That's great to hear. So, with that, I want to shift to our Q&A session. The first question, and maybe I could pitch this to Brad. Brad, one of the things that's come up in our conversations is how ExxonMobil thinks about prototyping in your R&D process. Can you talk a few minutes about your R&D process, the prototyping and how the project around industrial control systems kind of fits into that?

Brad Houk: Sure, Tim happy to. So, ExxonMobil uses a structured stage [gated] process to develop technology. Process is really designed to confirm key assumptions and reduce risk during each stage of development. We've applied ExxonMobil standard in R&D process as we work towards converting Open Process Automation from vision into reality. So, specifically what have we done? Well, within OPA we started in development with a proof of concept, really looking at some key technical feasibility issues. Once we were able to demonstrate that we had confidence we could move forward. Then we moved into a prototype system, again, expanding our confidence and technical feasibility of the system, in

demonstrating from key concepts we build on our prototype. So, our next step that we're currently starting on will be to build a test bed, the test bed provides the basis for actually conducting a field trial. So, to round the development process, we've got key requirements in each [gate]. We tried to eliminate risk and improve our confidence that we're on a path for success.

Tim Crawford: So, I have another question related to that. What are the keys to success for having Open Process Automation systems becoming a viable option for widespread commercial use? I think that relates to the OPA, but also the openness of the ecosystem. Can you try and address that question as well?

Brad Houk: Sure, Tim. As we look around other industries, with that hard data that says, technically we can move from Closed Proprietary Systems to Open Standards Based Systems. But there's really three things that have to happen in industrial process automation area to achieve success. The first one Don's talked a lot about, is the need for the industry to align on standards that support interoperability and portability, it's only through the successful distinction or identification of the standards can you go forward in a standards-based system. The second item key for the end users, is an end user must be able to demonstrate that we can generate more value with an open standards-based system than we can with a closed proprietary system. Ultimately transition on what we buy will be determined by where we see the value. So, we've got to have the use cases and they will demonstrate there's more value with an open standards-based system compared to a closed proprietary system.

The third thing that really touches on overall supply demand balance is suppliers must be able to transition from their current business model, that really depends upon selling a closed proprietary system and ensuring customers are committed to long-term support of that proprietary system, moving towards the business model that utilizes openness and standards and still have a system where they can—through their components that they sell and the services they provide—a viable business model. So, this gets back to what Don talked about from a win-win situation. End users can get more value from the system, and the supplier still has a viable business model.

Tim Crawford: Yeah, you're right. And Don did talk about that. Talked about the challenges with the proprietary systems, but then the opportunities that came from those open system architectures and ecosystems. Our next question touches on something that is central. I think, regardless of what type of innovation or technology talk about cybersecurity is upfront and in your face. How will modern cybersecurity threats be addressed in an open process automation system?

Brad Houk: So, this is the priority for Open Process Automation from the very beginning. It was part of the original motivation for moving from our historical closed proprietary system where security was often bugged on or added on as an extra. The standards that are being developed by an Open Process Automation form will leverage the best available requirements on security from currently available organizations like IFA. So, we believe that if we follow the standards, we incorporate into our open process automation structure, the open systems will be more secure than what we currently have today on the marketplace.

Tim Crawford: Great. Our next question talks about some forward-thinking pieces that I want to be sensitive to the fact that ExxonMobil is a public company. Can you share how you view ExxonMobil's role with the OPA moving forward?

Brad Houk: Sure, we've got a multi-year history in this, so we've got a huge investment. We're committed to seeing OPA being a success. Specifically, we can say we expect to continue to lead the industry through early testing, that's our components and the standards. You may have heard a little bit about our collaboration partners, we brought in other end user companies that we're partnering with, to accelerate the development of the test bed. So, we can support parallel field trials going forward. And then the key thing that we also believe ExxonMobil is doing is that we will continue to be a leading voice for end user requirements as this form develops the standards.

Tim Crawford: That's great. Our next question also thinks looking forward a bit, but from a strategic standpoint, what are some of the ExxonMobil strategic commitments, and I think this is one area that may tie into innovation and tie into OPA to the next in your partnership.

Brad Houk: Nick has talked about the importance of technology to ExxonMobil, Don talked about our commitment to innovation. As a research and engineering organization, we're committed to creating a competitive advantage for manufacturing facilities through the use of automation and process control technologies. Going forward, we think some of the big opportunities are in the use of artificial intelligence and machine learning. These are potential new big applications that can have a significant impact on how our assets perform. We believe having access to an Open Process Automation system is foundational to our future automation activities. So, Open Process Automation is foundational and a key to going forward. So, in order to meet our commitment of having competitive advantage related to automation and process of control.

Tim Crawford: Great. So, with that, I need to wrap up our conversation. Nick, Kenny, Don, Brad, thank you so much for taking the time to join the conversation today. Mary, I'm going to turn it back over to you to close this out.

Mary Killelea: Wonderful. Thanks again for joining everyone, appreciate you attending. Please look for other exciting customer spotlight conversations that highlight data-centric innovation coming up in the New Year. Thanks, everyone.

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