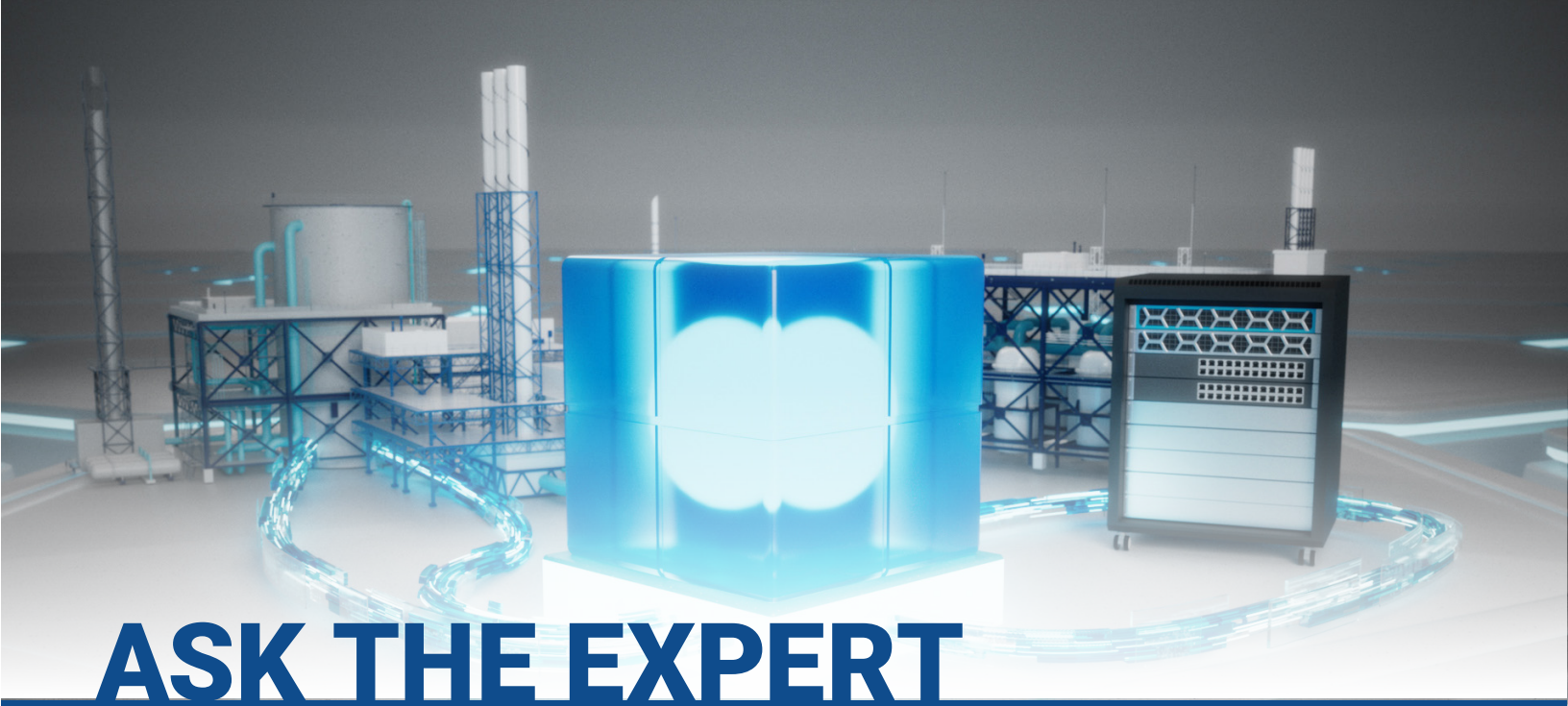
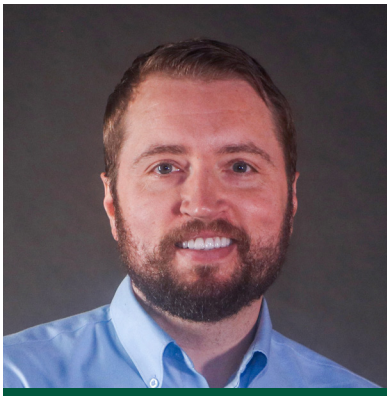


ASK THE EXPERT

The Software-Defined Controls (SDC) Revolution is Here, It's Just Not Evenly Distributed



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While the built-for-purpose distributed control system (DCS) and programmable logic controller (PLC) are not going away, distributed, software-defined controls (SDC) will soon take on an increasing share of the manufacturing automation workload.

These new controls are:

- **Distributed:** Control workloads can be placed where they make the most sense for the application, rather than tied to specific hardware locations
- **Software-defined:** Control software is decoupled from dedicated controller hardware
- **Universal:** Built for a future of interoperable control that can operate across hardware platforms and vendor ecosystems

But which manufacturers will make the transition when, and why? In this Ask the Expert, we talk with Michael Tworzydlo, Emerson Product Marketing Manager, who is responsible for Advanced Control solutions in the DeltaV™ Automation Platform portfolio, including the new DeltaV IQ Controller. Tworzydlo helps manufacturers make the jump to distributed, software-defined controls, which replace or augment traditional PLC and DCS architectures through scalable, software-driven automation. Decoupling control software from hardware helps manufacturers meet burgeoning processing demands while reducing physical cabinet space, wiring, and deployment time.

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What technological changes have made SDC systems preferable to legacy controllers?

SDC will come to market first among elite and highly complex manufacturers feeling unique pressures. But one factor that affects everyone the same is improved server technology that enables commercial off-the-shelf hardware (COTS) to perform control functions that previously required built-for-purpose controllers. Modern control platforms can dedicate compute resources to control applications, reducing variability and preserving deterministic performance while benefiting from standard server infrastructure. Latency and jitter have been minimized with advancements like Linux real-time (RT) runtimes, which enable the reliable, consistent timing and sequencing of tasks necessary for industrial automation.

This comes just in time for manufacturers who want to run more aggressive artificial intelligence (AI) applications for predictive models, state-based automation, predictive maintenance, advanced process control, and AI-driven operational workflows.

These modern software-based controls can also enable server virtualization so manufacturers don't need a dedicated server per application and can increase utilization of compute resources.

Which industries or types of manufacturers will benefit most from SDC?

Organizations with larger and more complex control systems that they push to the limit will probably move further and faster in this direction. We see a lot of these companies in petroleum refining, chemicals, specialty chemicals, power generation, mining, and life sciences.

But across industries, companies that are scaling up in general may find themselves outgrowing their current systems, as their need to add capacity runs up against the lack of scalability. Those involved in contract or custom process manufacturing and others with shorter manufacturing runs will appreciate the ramp-up time for software-defined controls, which can be compressed from weeks of design, procurement, and installation to minutes.

As technological barriers fall, what are the upsides to SDC? What metrics should be used to justify the investment?

The most compelling benefit of software-defined control is often not the controller itself, but the infrastructure that no longer has to be designed, purchased, installed, powered, and maintained. By reducing controller cabinets, wiring, power distribution, network infrastructure, and associated engineering effort, manufacturers can lower both project costs and deployment schedules. Common justification metrics include reductions in cabinet count, engineering and commissioning hours, installation labor, physical footprint, and total lifecycle cost, along with the increased agility to expand or modify the system through software rather than new hardware deployments.

Additionally, software-defined control establishes a strong foundation for the future by making it easier to move contextualized operational data from the field to edge and cloud environments, where it can be leveraged by analytics, AI, digital twins, and advanced optimization applications. This enables operational capabilities to extend beyond the control room, allowing organizations to improve decision-making, collaborate more effectively, and support and optimize operations from anywhere across the enterprise.

What barriers do manufacturers still face in adopting SDC?

Software-based control is not entirely new — manufacturers have been using it since the 1990s to varying degrees. But relying on virtualization and modern software architectures and server technologies to deploy control workloads is relatively new for operating technology (OT).

The fact that virtualization technology has historically fallen under information technology (IT) teams, while process control has fallen under OT, can be one barrier to adoption — failing some type of OT/IT convergence or harmonization, it might fall between chairs or engender a turf war over which group owns the project and budget.

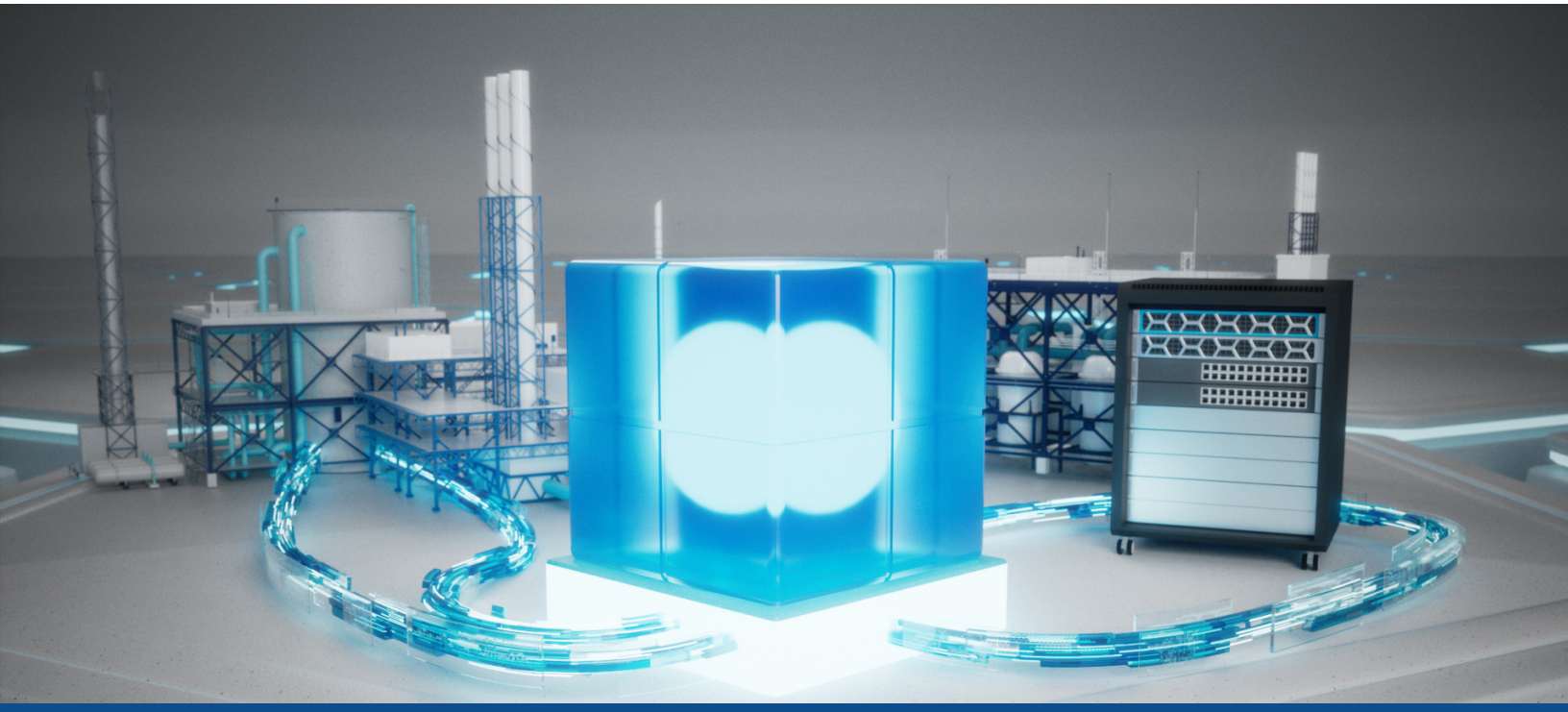
But the upsides of decoupling control logic from hardware include consistent deployment, faster startups, and safer updates, all while preserving the deterministic behavior required in industrial control systems.

OT teams have other hurdles to clear, including shorter controller lifecycles versus the 10+ years they are used to. Integration with legacy hardware is another barrier. Even after addressing any communication protocol issues, they must build confidence internally in an integration with legacy control architecture. Will it function as it should? Executives may also call into question the security of software-based controls and should press each vendor on their approach to protecting mission-critical infrastructure across the organization.

Trust is essential even beyond issues like security and integration — this is a relatively new technology, and those who are early to the table will realize advantages before their competitors. This requires, however, foresight and clear thinking on the part of corporate leadership.

What steps should manufacturers take to select a vendor and prepare a move to software-defined controls?

Success with any OT or IT project is never an accident. Before moving in this direction, a team should not only identify measurable project goals that tie back to ROI, but also assess their network readiness. Do they have the required switches, cabling, and other infrastructure in place? How will they handle compatibility between software-defined and traditional control systems? And while interfaces of software-defined controls can be intuitive, a team will need some training on the underlying server technologies, network management, and maintaining the server infrastructure.



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