

## ESSENTIALS OF THE 'IIoT-READY' MACHINE

A Control Design Essentials Guide, by the editors of Control Design

### About the Control Design Essentials Series

The mission of the *Control Design Essentials* series is to provide industrial machinery designers with an up-to-date, top-level understanding of a range of key machine automation topics. Our intent is to present essential engineering concepts in a concise, non-commercial fashion, together with a review of the latest technology and marketplace drivers—all in a form factor well suited for onscreen consumption.

Check in at [ControlDesign.com/Essentials](http://ControlDesign.com/Essentials) for other installments in the series.

—The Control Design Editorial Team



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# THE RISE OF THE 'IIoT-READY' MACHINE

**N**ot so long ago—in the dim and distant days before the Industrial Internet of Things (IIoT)—an Ethernet port hung off an industrial machine's programmable logic controller (PLC) was about all the out-of-the-box connectivity that an industrial asset owner/operator could expect of its OEM suppliers.

Sure, a network connection remains a necessary first step in surfacing time-series machine data to the rest of the enterprise, en route to realizing the promise of the IIoT. But it simply isn't sufficient. Machine builders are used to dealing with the broad diversity of operational technology (OT) data sources, drivers and communication protocols. But in the world of the IIoT, they also must negotiate connectivity via an array of top-side IT interfaces, from MQTT and OPC UA to database- and application-specific application programming interfaces (APIs).

Each new machine, therefore, might still require days or weeks of custom integration work to plug and play with a plant's existing automation and information infrastructure. And while maintaining these linkages in working order might ensure lifetime employment for one's local systems integrator, a new class of embedded software application—part historian, part analytical engine, part operator interface and part fault-tolerant integration platform—is allowing industrial OEMs to build "IIoT-ready" machines that can much more easily and flexibly be integrated into a plant's existing automation and information infrastructure.



# ESSENTIAL FUNCTIONALITY

**F**irst off, this new breed of IIoT-ready machine includes the gateway functionality needed to broker secure communications among a broad range of OT and IT systems. This includes an added layer of out-of-the-box, drag-and-drop integrability with not only plant IT networks but enterprise software applications and databases as well.

Second, as automation and information system architectures push analytics and visualization ever closer to the industrial network's edge, the IIoT-ready machine comes prepared to take on this local level of machine intelligence—including such tasks as predictive maintenance and energy management—and communicate the recommendations of its local analyses up into users' enterprise systems. Third, the IIoT-ready machine ensures the integrity of time series data conveyed to enterprise systems—even in the face of intermittent losses of network connectivity.

Finally, the IIoT-ready machine comes ready to satisfy not only the production optimization demands of its end-user masters, but also provides a means for industrial equipment manufacturers to securely gather field data from their fleets of globally deployed assets. This shared infrastructure opens the opportunity for users to collaborate more closely with their equipment suppliers and tap them for assistance on an ongoing basis. It delivers asset expertise to the plant in a way that simply wasn't possible before, and even paves the way for "as a service" relationships between users and equipment makers.

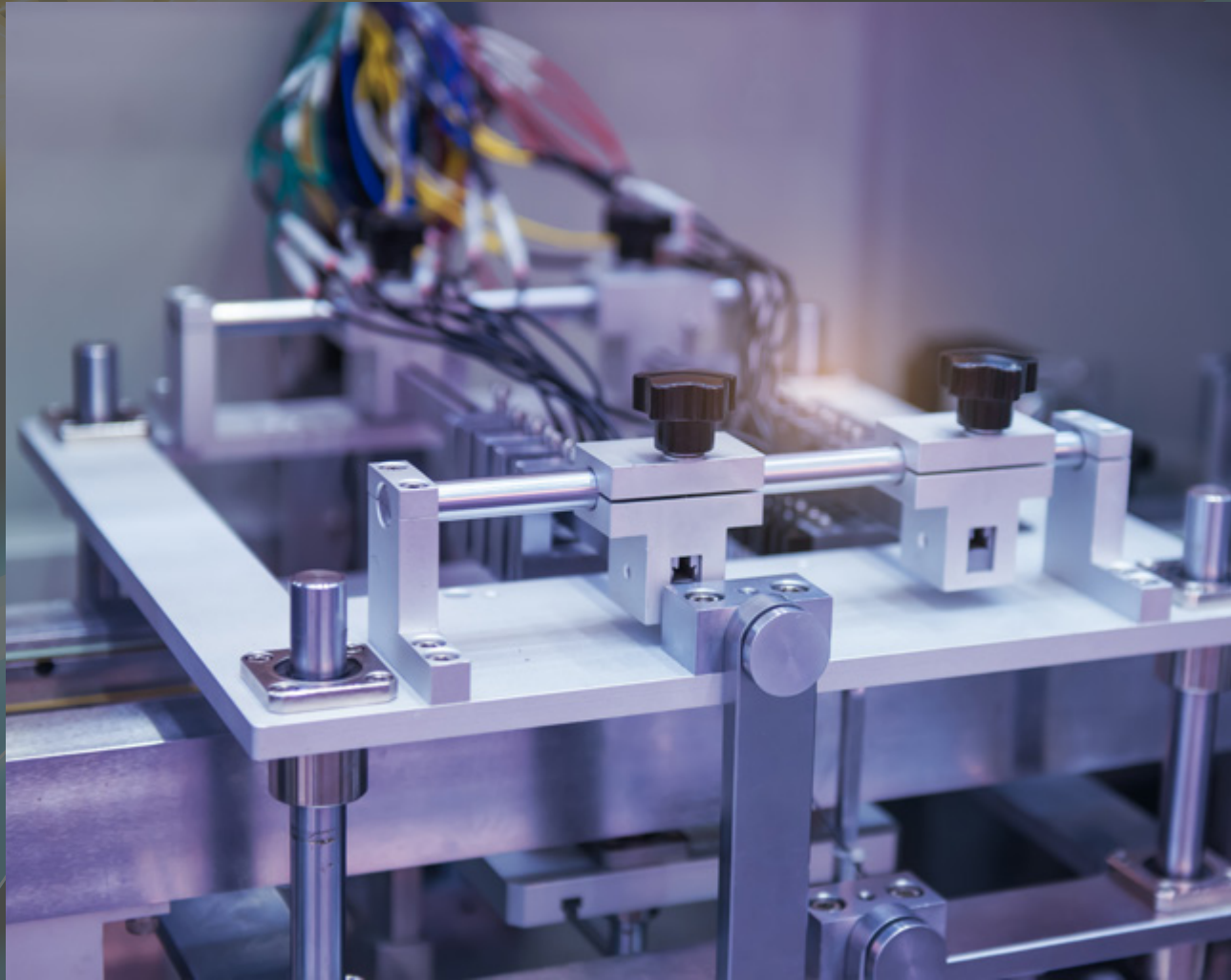


# A BRIEF HISTORY OF HISTORIANS

The dawning age of big data has clearly captured the imagination of mainstream analysts and the business press for the past several years. For them, big data underlies the next generation of information-driven enterprises for which decision-making will increasingly be driven by sophisticated algorithms acting on enormous and growing volumes of data thrown off by myriad interconnected digital systems. But for process manufacturers and other industrial organizations, big data is not an unfamiliar challenge. Indeed, since the 1980s, we've relied on historians to capture and manage large quantities of data related to manufacturing operations.

More than just a database, a traditional historian is better characterized as a specialized software application optimized to efficiently gather, store, retrieve and display time-series data. In short, they work in conjunction with automation systems and other real-time data sources to capture time-series data at designated time intervals. Operators, engineers and managers, in turn, can view trends and track key performance indicators (KPIs) in near real-time. A growing array of analytical applications, too, have long been used to glean insights from historian data, allowing the diagnosis and prediction of issues ranging from equipment failure to quality excursions.

Today's historians, however, have evolved to the point of being decision-making platforms in their own right. Previously separate analysis and visualization functions are now embedded within these increasingly capable platforms. Companies now use them to diagnose process issues, predict maintenance problems or develop energy strategies. Historians still capture data, they also function to some degree like applications. In addition, a growing array of analytical applications can supplement decision-making and business processes being managed at the 'historian' level.



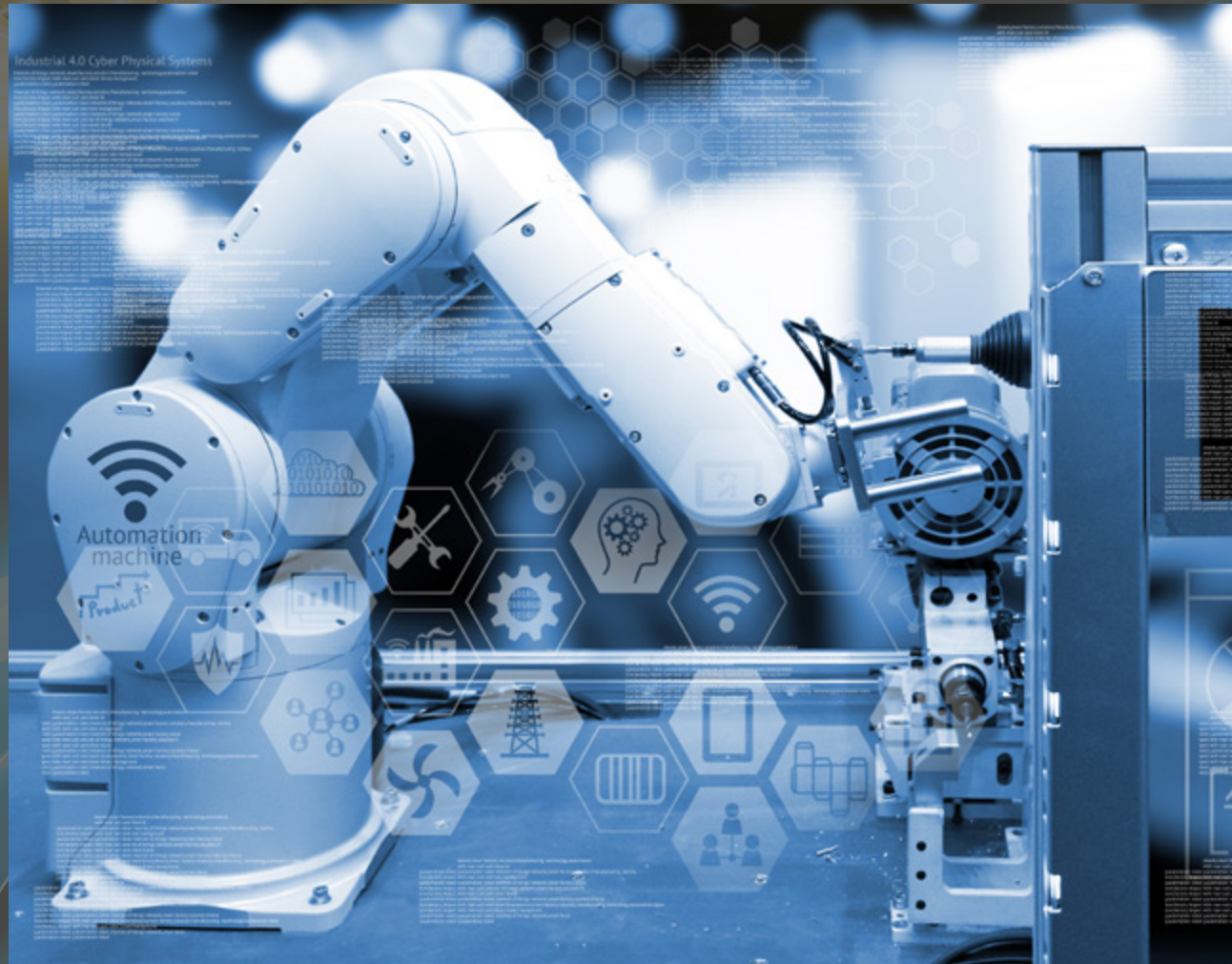
# THE HEART OF THE IIoT-READY MACHINE

Today's increasingly powerful edge devices, have added new scalability to the traditional historian architecture, allowing the IIoT-ready machine to run a local historian instantiation that works in tandem with enterprise-level historians. This concept of distributed historization is at the heart of the IIoT-ready machine and its relationship with the larger organization.

For starters, a local, "on-machine" historian can provide a machine operator with trends and KPIs even as an enterprise historian tracks consolidated performance at plant and corporate levels. But it can also issue alarms and diagnostic, problem-solving alerts as well as tap into the connected-services expertise of the machine manufacturer.

Data integrity is an essential aspect of the data-driven organization. If users cannot trust that data is accurate and complete, the full potential of the IIoT will never be realized. Thus the importance of a distributed information architecture that can bring together diverse and even geographically distributed data sources that may communicate via satellite or over commercial wireless phone networks.

Historian functionality onboard the IIoT-ready machine forms the basis for local analysis and visualization, but also "stores and forwards" operational data to a central historian. If the network connection goes down for some reason, the local historian continues to store data, acting as a buffer until network connectivity is restored. In this way, no information is lost, even if network reliability is spotty.



# ANALYTICS & VISUALIZATION

**W**hile loss-less data accuracy and integrity are critical deliverables of the IIoT-ready machine, so too is accessibility. After all, what good is perfect historical data if it can't be easily used by personnel at all levels of the organization to make better decisions?

In addition to employing industry standard protocols and proprietary device drivers to gather data from sources, the IIoT-ready machine must leverage industry standards for back-end integration. And while it may offer its own options for trending, visualization and reporting, it should also make its data available to other applications through standard interfaces. Connectivity agents that automatically set up and maintain integration with key enterprise applications further streamline integration and maintenance tasks.

Whether fully distributed across the enterprise or operating on a standalone machine, analytics based on historicized data can open new doors to process understanding. Operators can examine the conditions leading up to the last process upset. How might it have been avoided? Production managers can compare past runs against today's effort. Were there temperature excursions that caused quality to fall short? Historical data, captured in real-time and presented in context, makes it easier to identify trends, uncover root causes, and pursue process improvement strategies. In the end, isn't that what the big data fuss is all about?



# SHARED INFRASTRUCTURE, COMMON GOALS

Perhaps for as long as industrial machine builders have existed, they've had the desire to see into the operation of their machines after they're deployed at customer facilities. Indeed, for OEMs with far-flung fleets as well as for owner/operator companies with multiple sites and corporate engineering centers, visibility into the operation of remote assets presents a compelling business case.

With a historian on board to capture and properly structure operating data, the hardest part of machine problem-solving has already been achieved. Secure connectivity can then allow a remote specialist to tap into that data, troubleshooting and solving an estimated 60% to 70% of operating problems without the need for support personnel to travel across town—or around the world.

Further, machine builders are realizing that remote access to machine data opens up a new vista of proactive and preventive services it can bring to bear on behalf of its customers. Access to field data also allows OEMs to iteratively improve the design and performance of its next generation machines.

Today's IIoT-ready machine securely facilitates that collaborative information access by both parties through a shared data infrastructure. Asset owners can turn to their equipment suppliers and service providers for insightful, actionable recommendations to improve the overall performance of their processes. Machine builders, in turn, can better understand the performance requirements of their customers and offer new services that advance the goals of both organizations.



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