

WHITEPAPER

The rise of IIoT: A watershed moment for utilities

Digital transformation at JEA

Executive summary:

Every industry is grappling with the rise of the Industrial Internet of Things (IIoT). The increasing availability of low-cost sensors and the development of new analytical tools for making use of the data they produce is driving organizational change across a diverse range of industries. But in a broader landscape being transformed by data, water utilities face their own unique challenges in adopting digital transformation strategies.



Water utilities must maintain resilient operations even in the most challenging situations.

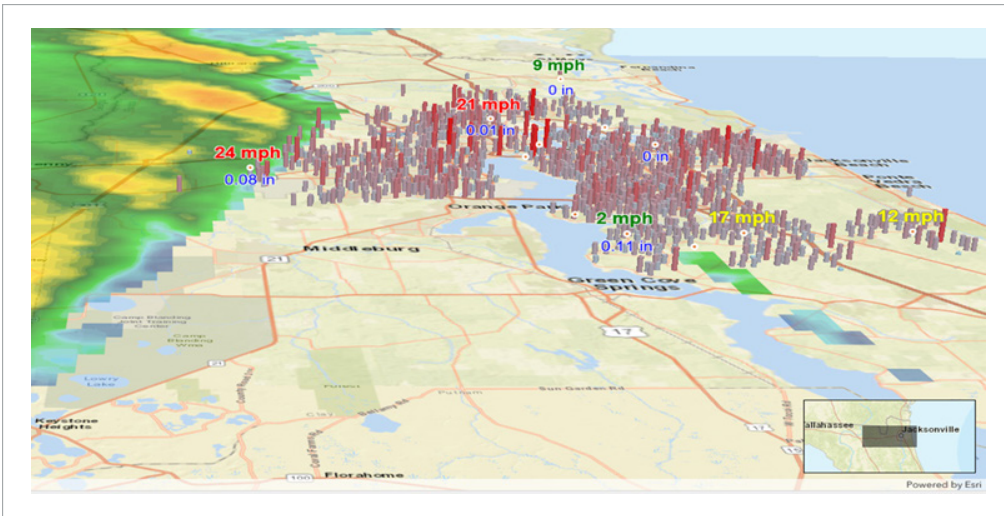
As providers of essential and highly regulated services, water utilities must maintain resilient operations even in the most challenging situations. Most are operating with aging infrastructure and legacy systems that place intense demands on maintenance and other resources. Physical assets are spread out across large territories, making it difficult to integrate data from the “edge” in real time. Climate change is increasing the frequency of extreme weather events and accelerating the impacts of weather on physical assets while also making it more difficult to analyze and predict environmental conditions.

Alongside these challenges, water utilities also have a heightened responsibility for communicating in real time with first responders and the public during disaster events. Digital transformation can be a tremendous support to those efforts, especially when real-time data can be integrated with GIS and weather data in clear, accessible visualizations.

Utility companies are aware of the promise and power of digital transformation: 79% see IIoT as important. But 61% struggle with accessing data.

Information is collected in a wide variety of formats, both manual and automatic, and integrating data from proprietary sensor networks, SCADA systems, weather stations, maintenance logs, and a variety of other sources in real time can be a challenge. More than 60 percent of utilities are also concerned with security and privacy. In the rush to adopt new digital tools, it is important for utilities to have safeguards to ensure that data cannot be exploited or accidentally overwritten.

For water utilities as well as other complex businesses, the key to making intelligent use of data is adopting a secure but accessible data structure that serves as a single source of truth across the enterprise and enables the real-time analysis and visualization of large quantities of data from a wide variety of sources. JEA, a large power and water utility headquartered in Jacksonville, Florida, is using the PI System™, integrated with real-time environmental data and GIS, to develop new tools for maintaining enhanced situational awareness across a large territory during both normal operations and disaster situations.



Bringing data in from multiple sources provides real-time situational awareness at JEA's emergency operations center.

Managing data from edge to cloud

A community-owned utility that provides power, drinking water, and wastewater services in northeastern Florida, JEA is the largest community-owned utility in Florida, and one of the largest in the United States. JEA's water system serves 357,000 drinking water customers and 279,000 sewer customers across four counties. With 37 water treatment plants and about 1,500 individual pumping stations across an 850-square-mile territory, it has historically been a challenge for JEA to keep track of conditions in the field in real time, especially in fast-moving storm situations. In recent years, JEA has worked with the PI System to develop solutions that enable the utility to identify problems in the field quickly, prioritize action, and communicate vital information to officials and customers.

JEA is using Asset Framework, the contextualization layer of the PI System, to maintain a "digital twin" of the utility's assets in the field. Individual pumping stations, plant equipment, pipes, and other assets are replicated virtually within the data system, and the real-time data flowing into the PI System from them can be presented with rich context about assets and their relationship to one another, along with weather information and other data from the cloud.

Each of JEA's pumping stations generates a stream of data including wet well levels, pump status, pressures, and fuel tank levels. A skilled operator with knowledge of the system can look at the wet well level of an individual station, measured in feet, and know whether the station is close to full. But by combining that data with contextual information about the capacity of each individual pumping station, and overlaying that information on a map, JEA has developed a more accessible visualization that displays "percent full" as a bar above the location of every station on the map. A map reader can use a slider to view only stations above a certain percent fullness so that areas that need attention can be identified quickly.

Mapping assets alongside environmental data is also helping JEA prioritize action during weather events. JEA has a policy of not dispatching crews to an area where wind speed is above 45 mph. But with assets spread out across a large area, from the coast to more inland regions, there can be significant variation in wind speed from one part of JEA's territory to the next. Maps that display real-time data on equipment along with real-time weather data help JEA managers identify areas that need attention and prioritize the ones that can be safely responded to. As the map visualizations have proved useful, the utility has installed additional weather stations in strategic locations for a more fine-grained view of conditions across the territory.

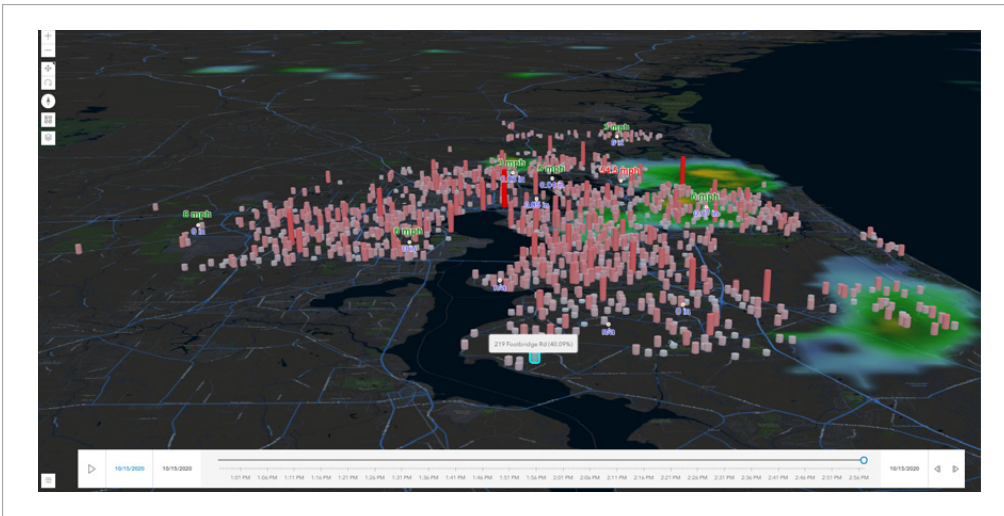


Hurricane Matthew: A turning point for JEA

When a natural disaster strikes in the United States, an Emergency Operations Center (EOC) will typically be established by the local, state, or federal government: a central location where government agencies, utilities, first responders, and others involved in disaster response will gather to share information and coordinate response. The scale of the EOC and the agency responsible for running it will depend on the scale of the disaster itself. As a local utility, JEA has a seat at the table when an EOC is established in the greater Jacksonville area.

In 2016, the Florida coast was battered by Hurricane Matthew. Widespread flooding, storm surges, and high winds caused extensive damage and power outages across the Jacksonville area, challenging JEA's response capacity.

A particular challenge for JEA during the aftermath of Matthew was the task of keeping track of which pumping stations were still without electrical power. Every four hours, JEA engineers would run a report drawn from SCADA data showing the pumping stations that did not yet have power restored, and would deliver that report to officials at the EOC. But there was a puzzle in the data: some pumping stations appeared to have power restored, but by the next report four hours later, these stations would be offline again.



JEA uses data from IoT sensors to help it mitigate risk during hurricanes and other storm events.

The SCADA report wasn't telling the full story. For some of the pumping stations that appeared to be operational, the power lines had yet not been restored. The stations were being visited by roaming crews with generators who would pump the station down and then disconnect the portable generator. By looking only at the SCADA data, the engineers were missing problems at pumping stations that were being serviced in the field.

This was a situational-awareness issue that could be solved with better access to real-time data. Drawing on the lessons of Matthew, JEA engineers built a visual display in the PI System that combined the SCADA data from the pumping stations with data coming from two-way smart meters and overlaid it on a map of all the pumping stations. By looking at both kinds of data in real time, JEA engineers can now see at a glance which pumping stations have access to line power, which are being served by portable generators, and which are without power entirely.

By the time Hurricane Irma hit JEA's territory in September 2017, the real-time map showing power supply at pumping stations had been up and running for about a month. JEA relied heavily on the display during both Irma in 2017 and Hurricane Dorian in 2019 and used it to communicate with public officials and first responders during the disasters.

Over the past several years, JEA has used the PI System to develop other apps and dashboards that display real-time data coming in from remote sensors and systems in the field, and the utility is developing more tools for situational awareness. These visual displays of data are useful during normal operations and critically important during a storm or other natural disaster when field operations are challenging and high-quality, real-time remote data becomes integral to effective response.

In 2020, the COVID-19 pandemic has been an unexpected real-world demonstration of the value of remote data in enabling utilities to respond flexibly to new challenges. JEA engineers now rely more heavily on information coming from remote sensors and collaborate from home offices using real-time data in the cloud. As a single data hub that can be accessed through a web interface or custom app, the PI System is designed to allow remote access to data flowing from a diverse array of proprietary networks and systems without compromising security.



Building resilience with data

Having achieved results in harnessing real-time data to enhance situational awareness and prioritize action, JEA is moving toward expanding its data-gathering capacity. A major project now underway for the utility is expanding the number of pressure sensors in pipelines across the drinking water grid. JEA has about 300 pressure sensors and plans to deploy more than 1,500 over the next several years. With more sensors distributed throughout the water grid, JEA will be able to pinpoint the location of leaks with greater precision and respond to problems before they impact operations. The utility plans to use the PI System's alert-notification capabilities to detect anomalies automatically and alert operators to potential trouble spots in the system. A similar project is also underway in JEA's sewer mains, which have about 130 pressure sensors.

As JEA continues to move forward along the digital transformation journey, the utility is enhancing the scope and resolution of real-time data across its territory and combining that data with analytical tools that enable prioritization, communication, and rapid response. Extreme weather and aging infrastructure are a challenge every utility must contend with, but by using real-time data to drive intelligent action, JEA is making its physical plant more resilient in the face of adverse situations and more agile in responding to them.

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