

WATER & ENERGY

Energy Services Company Automates its Water Management System with MS Azure IoT and Gains Accuracy, Efficiency & Cost Savings

The Client

Our client is a publicly held geographically diversified oil and gas services company focused on completion fluids and associated products and services, water management, frac flowback, production well testing; compression services and equipment. Headquartered in The Woodland, Texas, and founded in 1981, they have 2,900 employees and operations on six continents.

Business impact delivered



Cost



Revenue



Speed-to-Value



Risk



Innovation

The Challenge

The strategic move to digital automation of water management

Our client's corporate strategies are focused on long-term growth. In sectors of their business, they strive to be a leader in executing transformational disruptive technologies. Since water management services are a \$23.6 billion market, the company focuses on value-added, differentiated, environmentally friendly offerings that will give them highest return on investment.

"The automation of our integrated water management systems with the branded automated control system is a key financial driver in our business. We have partnered with Infogain to provide the IoT automation technologies to support this business growth with a digital automation remote-control monitoring solution. The automation solution deployed by Infogain continues to deliver stronger operational efficiencies and significant cost savings," said Energy Services Company CEO.

Solution Approach

Monitoring water management across a vast area required a physical presence

Hydraulic fracturing, or "fracking" is the process of injecting pressurized water, sand and chemical additives into the ground. When pumped at a high pressure, rocks are wedged apart. This pressure causes cracks and fissures, leading to the recovery of oil and gas. The next step after fracking is efficient water management, which includes supply, transport, storage, treatment, and disposal of the water.

Our client offers comprehensive water management solutions to their customers that conduct fracking operations. While water does not reside at the same location as the fracking operation, the company had installed multiple stationary and mobile devices across the large area to monitor the fracking and water transport and disposal. For example, one device may be connected to a stationary water pump, while other devices were connected to field instruments, blending controllers or manifolds.

Due to the broad areas that are covered by water management, they relied on 2-3 employees to monitor the water operations. The approximately 9 devices used by the employees were manual -- Human Machine Interface (HMI) controlled, requiring human action, and lacked analytics and reporting capabilities. If the water flow would go to dangerous levels, it would have to be shut down manually in order to avoid an explosion.

The client wanted to add automation in order to improve their customer's experience by providing real-time water management information that could be addressed on the spot. They also wanted to give their customers added value with a product that includes insights into their data with business intelligence/analytics.

Innovative IoT Hub built by Infogain and powered by Microsoft Azure

The Infogain team analyzed the current state of existing water management monitoring and process automation solutions, control systems and devices. Infogain established and designed system architecture for the IoT solution which included an IoT platform, IoT connectivity, device provisioning, data and storage, and access management. In addition to device to cloud communication and security and compliance.

The Microsoft Azure IoT hub was leveraged as the central location for telemetry and data collection from stationary and remote devices, that included water pumps, field instruments, blending controllers and manifolds. The Azure IoT hub is a cloud hosted solution backend with robust capabilities to connect to virtually any device. The hub could also scale to handle more jobs.

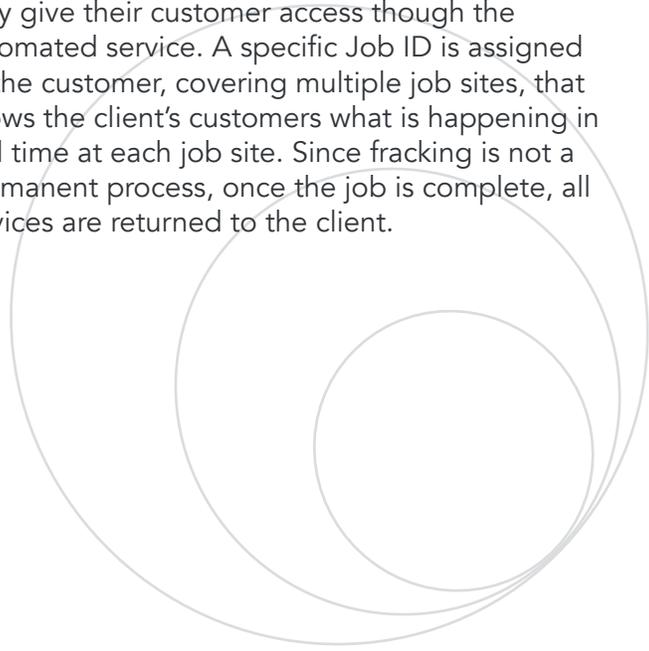
The [Azure IoT Hub](#) serves as the nerve center to process queues, trigger actions and monitor the health of the system. The solution leverages the highly scalable Azure App Service Platform as a Service (PaaS) as its foundation and Infrastructure as a service (IaaS). The client's devices are connected to the Azure IoT Hub, which provisions, authenticates, and manages devices at scale and in a highly secure manner. Infogain also leveraged open Azure IoT Device SDKs to facilitate the connection of any device. From the Azure IoT Hub, data moves through Azure Stream Analytics for both cold (instantaneous, real time analytics) and hot-path analytics, i.e., anomaly detection, and simultaneous distribution of data to storage.

Azure stream analytics service was used to process the significant amounts of data flowing through the Azure IoT hub, and take real time actions or move them to a back-end MongoDB database. Push notifications from the platform were implemented through Azure Notifications hub.

Deep dive into automating water management with IoT smart device connectivity

Imagine many devices, whether handheld or stationary, that could not talk to each other. With the water management in a fracking operation, the flow of water into the fissure or crack in the earth uses certain blend characteristics to get a specific conductivity to slow or stop this flow of water. With the Azure IoT hub, Infogain built a virtual connection between these devices. This is all done through the Azure IoT portal connection in the cloud. For example, with approximately 9 automation rules built in, if something would happen to the flow, then the pumps could be shut down automatically, eliminating the need for someone to be physically at the pump to shut it down.

Every device has its own internet connectivity via WIFI modules. Using IoT connectivity protocol, and approximately, every two seconds, telemetry data is sent to all the device hubs; then this data gets processed into real time alerts and email notifications. The Infogain team built different Azure modules, including customer device management, that allows for customer admins to view all jobs and their statuses from multiple job sites. The client has access to all the data, and they give their customer access through the automated service. A specific Job ID is assigned to the customer, covering multiple job sites, that shows the client's customers what is happening in real time at each job site. Since fracking is not a permanent process, once the job is complete, all devices are returned to the client.



Key Goals & Objectives

Corporate goals for developing the IoT platform:

- Design and develop the MS Azure platform for future trademark
- Match the competition by placing data in the Cloud
- Offer customers a modern way to review and use critical data for water management
- Quickly get started and scale the platform to meet business needs

Automated Control System Features

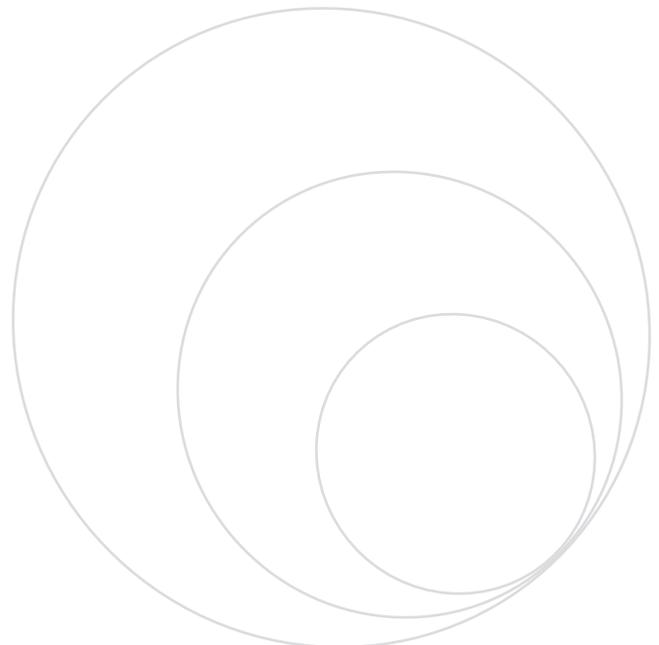
- Cellular (or optional satellite) connectivity
- Centralized, holistic view of multiple components
- Consistent water properties for improved compatibility with frac additives
- Customized daily reports sent electronically
- Localized safety features that function regardless of connectivity
- Remote, off-site control of discrete assets

Key Business Benefits

- Precise, real-time control over water, transfer, water recycling, and sand management
- 24/7 access to digital twins for real-time monitoring of operations
- Up to 50% in personnel savings
- Up to 30% reduction in fuel consumption
- Reduced environmental and human risk

Technology Stack

- **Database:** SQL server 2017, Mongo DB 3.0, Mongo Atlas
- **Development Environment:** Visual Studio 2017
- **Version Control System:** TFS – Git
- **Task/Issue Tracking System:** VSTS
- **Framework:** MVC 6, .NET Core 2.1, Angular5, Node JS



Accessing the power of the cloud-based water management Azure dashboard

The automated control system's cloud-based dashboard is connected by cellular or satellite link to field equipment sensors. The client's customers are able to view details from their fracking operations 24/7 regardless of the location or time via a dashboard. The dashboard displays the operating metrics of each asset in real time, providing immediate access to readings including inlet and outlet pressures, fluid composition, water conductivity, storage level, and equipment status and performance.

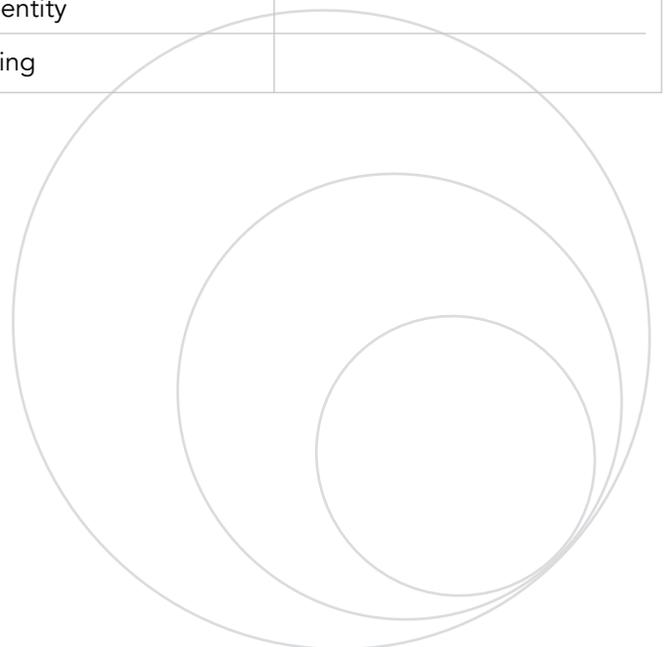


Additional technologies connected to the automated control system, and viewed on the dashboard include:

- **Automated Pumping Systems** to view immediate control of pressure and flowrate, as well as real-time monitoring of pump speed, flowrate, inlet/outlet water pressures, water temperature, engine performance, and engine fuel level.
- **Automated Blending System** that measures input and output water conductivity in real time to automatically adjust input ratios, and the patented on-the-fly blending manifold, which blends fresh and produced water streams into an optimal fluid for fracturing.
- **Oil Recovery After Production Technology Oil Separation System** to ensure treatment performance and compliance with regulatory storage requirements.
- **SwiftWater Automated Treatment System and On-the-Fly Treatment Systems** provides web-based real-time monitoring and control technology with 24/7 access to treatment and recycling operations. This provides a transparent and on-demand view of the chemistry applied to treat the water and its effectiveness.
- **Automated Sand Management** minimizes the need for on-site personnel to weigh tanks, dump the sand, or perform other routine tasks. The dashboard enables remote monitoring and control in real time, providing technicians with accurate, no-risk command of sand separation.

MICROSOFT AZURE IOT COMPONENTS USED

Cloud Service	Service Category	Provider
Azure Key Vault	Security + Identity	Microsoft Azure
Storage (Blob)	Storage	Microsoft Azure
Mongo DB Atlas	Databases	MongoDB
Redis Cache	Databases	Microsoft Azure
Stream Analytics	Data + Analytics	Microsoft Azure
Azure App Service	Internet of Things	Microsoft Azure
(Web Apps)	Web	Microsoft Azure
API Management	Web	Microsoft Azure
Azure IoT Hub	Internet of Things	Microsoft Azure
Azure Functions	Compute	Microsoft Azure
Visual Studio Team Services	Developer Tools	Microsoft Azure
Azure Application Insights	Developer Tools	SendGrid
Sendgrid Email	Monitoring + Management	Plivo
Plivo SMS	Notifications	Entrust Datacard
Security Certificate & Code Sign	Notifications	Highchart
Highchart	Security + Identity	
	Data + charting	



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