



Case Study: netDNA Automates Water Management for Fracking & Water Transfer

*Automation reduces costs, improves
safety for unconventional natural gas
production in the Permian Basin*

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CASE STUDY: NETDNA AUTOMATES WATER MANAGEMENT FOR FRACKING & WATER TRANSFER

Automation reduces costs, improves safety for unconventional natural gas production in the Permian Basin

In the oil and gas industry, technological advances like hydraulic fracturing (fracking) and horizontal drilling have caused a boom in exploration and drilling. The initial “gold rush” approach to oil and gas development focused on people resources, with most work done manually. Technicians and operators in the field checked all equipment and processes and manually adjusted and controlled whatever needed control. Even data required for environmental compliance was generally acquired by hand.

But today, with greater labor uncertainty and higher but volatile prices, investing in automation is starting to make more sense. Increasingly, companies are looking to add automation in the field, especially for water pumping and treatment, key ingredients in successful unconventional oil and natural gas production.

But automation for assets located over a broad area isn't easy.

“Most automation companies don't understand the network piece,” notes Dan Arbeau, CEO of netDNA in British Columbia, Canada. With his background in automation, wireless, IT support, and networks, however, Arbeau was ready for the challenge. He started netDNA in January 2018 and has since added partners for additional capital and resources.

The company's focus is automating natural gas exploration and production, especially drilling. In 2014 Arbeau had automated a large pump for evacuating water from dams, a previously manual system that transferred water for fracking. The customer called again for help with a major project in the Permian Basin in Southern Texas, managing water at hundreds of drilling sites.

Water is essential for successful natural gas production by fracking, but until recently, all flow and level monitoring, pump control, and the like were typically done manually.

WATER, WATER, EVERYWHERE

Water is essential for successful natural gas production by fracking. The process typically involves water at every step:

- Pumping water to the drilling site
- Blending the water with proppant (sand or other particles that can't be compressed) and chemicals
- Injecting this fluid into the wellbore and rock formation at high pressure to create fractures
- Handling the fluid flowback that's returned to the surface and storing it in open tanks or pits
- Treating and reclaiming the water, which in addition to chemicals may also include hydrocarbons, salts, metals, and radioactive nuclides

Arbeau notes, “Ninety-nine percent of jobs in the Permian Basin have water pits.” Water sources are often not close to the drilling site, so water must be brought in. Pits are used to store water, blend water, handle flowback, and treat the used water. Until recently, all flow and level monitoring, pump control, and the like were typically done manually. Technology is sparse and mostly ad-hoc rather than planned, for example a technician monitoring a level and texting an operator to adjust a pump. Automated pumps, flowmeters, and level sensors are needed everywhere.

That's where netDNA comes in.

MOBILE TRAILER-MOUNTED PUMPING UNITS

netDNA's customer, [New Wave Energy Services](#), provides a range of fracking products and services in the U.S. and Canada, including water transport, modular tanks, and buffer tanks. In an industry with remote, widely separated, and changeable operations, mobility is essential. So New Wave designed large trailer-mounted units for water transfer, typically with four 500-800 HP pumps with 12-inch diameter inputs, and turned to netDNA to automate them.

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Solar-powered trailers provide mobility for remote operations.

Arbeau had used Opto 22 SNAP PACs (programmable automation controllers) on previous jobs. He appreciated their reliability and use of open standards, such as Modbus/TCP, for easier communication with other systems and equipment.

Arbeau had also heard about Opto 22's new *groov EPIC*® (edge programmable industrial controller), which provides additional communication, visualization, and security features for automation and industrial internet of things (IIoT) projects. For the remote communications and mobile nature of New Wave Energy's trailer-mounted units, *groov EPIC* sounded ideal.

Each New Wave Energy trailer-mounted pumping unit includes a diesel generator and pumps, controlled by a genset controller that talks Modbus/TCP. Arbeau added a *groov EPIC* processor and I/O modules on each trailer for additional automation:

- Analog inputs monitor discharge levels and suction.
- Digital inputs monitor flowmeters.

- Mechanical relay outputs open and close pumps via the genset controller.

In addition, the EPIC pulls data from the genset controller, including RPMs and associated telemetry, and publishes it to a central broker/server using its built-in open-source tool *Node-RED* and the publish-subscribe protocol *MQTT*. As of June 2019, six trailer-mounted units were in operation, with several more in the works.

PITS AND TANKS

In addition to the trailer-mounted units, netDNA also automates monitoring and control for pits and tanks using water.

Automating tanks improves safety as well as providing data faster, more easily, and more reliably. Tanks are monitored for levels, and pumps are controlled to make sure there are no spills. Tanks and pits are also monitored for air quality and hydrogen sulfide (H₂S) levels. H₂S is flammable and potentially deadly if inhaled, about as toxic as carbon monoxide. Instrumentation and automation help keep employees safe and improve environmental conditions.



Trailer-mounted pumping units are automated with a *groov EPIC* processor and I/O modules.

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At the pits and tanks, netDNA uses a SignalFire self-contained gateway for wireless sensors. The SignalFire talks Modbus/TCP to a local *groov* EPIC processor. Each EPIC publishes a variety of data tags from its pumps, again using Node-RED and MQTT: 15 telemetry data points; 10 stop, E-stop, and other commands; and more. Production data is also tracked and historized. If a spill or issue occurs, producers need to know exactly what the pumps were doing at any given time.

New Wave and their customers are pleased with the results, and Arbeau is pleased with the capabilities of the *groov* EPIC system.

“Some engine and pump companies are hungry for automation. Some have systems, but they don’t communicate with each other,” says Arbeau. “EPIC makes them talk.”

MOBILE HMI

In addition to automated monitoring, control, and data acquisition, the *groov* EPICs serve a custom web-based operator interface (human-machine interface, or HMI) for authorized technicians. netDNA developed the HMI using *groov View*, a tool included with the EPIC. The tool’s browser-based drag-drop-tag interface makes it simple to develop a custom HMI for PCs and mobile devices.

Each trailer unit is equipped with a radio IP (internet protocol) device that provides routing, 300 feet of wireless coverage, and power for a cell modem, which connects to the cellular WAN (wide area network). With the *groov View* HMI, authorized technicians in the field can use a tablet to connect to this network and run all 20 pumps in a system of pits, monitoring or changing RPMs, for example, from a single screen.

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- Dan Arbeau, CEO, netDNA



Pump and smart pump controller (side view)

PROGRAMMING AND DATA COMMUNICATIONS

The EPIC processor offers programming options, including flowchart-based PAC Control with optional scripting, any IEC 61131-3 compliant language (like Function Block Diagram and Ladder Diagram), or C/C++, Java, and Python via Secure Shell access (SSH) to its Linux operating system. netDNA chose to use PAC Control with its free Modbus Integration Kit, which simplifies communications with the genset controllers and SignalFire sensor gateways.

For data communications, netDNA takes advantage of the EPIC’s ability to use MQTT with Node-RED. MQTT is a publish-subscribe (pub-sub) method of communication originally developed for the oil and gas industry, and it has huge advantages for remote or wireless networks. If a network is low-bandwidth, unreliable, or expensive, or if distance makes a direct connection impossible, a pub-sub method is ideal.

Each client initiates communication to a central broker/server and then publishes data, subscribes to data, or both. The broker/server does not store data, but simply accepts and forwards data packets as required. Network traffic is reduced overall, because data is communicated on a report-by-exception (RBE) basis—that is, only when the data changes—rather than at regular intervals.

netDNA is also interested in looking into using Sparkplug messaging with MQTT, available in the *groov* EPIC with Ignition Edge® from Inductive Automation®. Sparkplug encodes the data payload and compresses it. It also tracks

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the state of clients to make sure all clients can deliver and receive data.

The EPICs on each trailer, tank, or pit publish data to the MQTT broker, and other EPICs subscribe to the data. For their broker, netDNA uses their own hosted secure MQTT server.

Each EPIC contains its own device firewall for data security. The data the EPIC publishes is device-originated behind its firewall, so no inbound port modifications to the firewall need to be made. Once the EPIC makes the connection with the broker, any return data the EPIC subscribes to is received securely over the same connection.

The system works remarkably well for remote, wireless control. Multiple pumps respond to sent commands within a second. To save bandwidth, netDNA sends data in tables instead of individual data points whenever possible.

LOOKING AHEAD

With *groov* EPIC and modern IIoT tools at his disposal, Arbeau spent only three weeks from initial hardware design to having a full system ready for pump control. And thanks to netDNA, New Wave Energy Services can now offer their customers monitoring and control that's faster and less expensive than their competitors.

"It's not that hard to outshine the competition," says Arbeau. "EPIC is helping me be successful."

For the future, Arbeau's dream is a multi-use automation black box: an open-chassis skid with EPIC "in the middle" and SignalFire connecting to wireless sensors. Arbeau envisions the skid used for projects not only in oil & gas, but also in agriculture, mining, and other industries with far-flung assets that need automation and data communications.

ABOUT NETDNA

netDNA provides reliable real-time control where and when you need it. As our name suggests, netDNA uses the building blocks of the internet to fuse hardware and software to build the next generation of solutions, services and products. Just as DNA is used as the foundation to create life, we apply the same principle to our work.

The business is a tech-based company offering a range of products and services to help enable industrial automation, providing tech-based support and services, security, and wireless instrumentation.

For more information, visit [netDNA.io](https://netdna.io) or contact us:

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ABOUT OPTO 22

Opto 22 was started in 1974 by a co-inventor of the solid-state relay (SSR), who discovered a way to make SSRs more reliable.

Opto 22 has consistently built products on open standards rather than on proprietary technologies. The company developed the red-white-yellow-black color-coding system for input/output (I/O) modules and the open Optomux® protocol, and pioneered Ethernet-based I/O.

Famous worldwide for its reliable industrial I/O, the company in 2018 introduced *groov EPIC*® (edge programmable industrial controller). EPIC has an open-source Linux® OS and provides connectivity to PLCs, software, and online services, plus data handling and visualization, in addition to real-time control.

groov RIO Ethernet-based edge I/O modules, introduced in 2020, include I/O and IIoT software in a compact industrial package that goes anywhere.

All Opto 22 products are manufactured and supported in the U.S.A. Most solid-state SSRs and I/O modules are guaranteed for life.



The company is especially trusted for its continuing policy of providing free product support, free training, and free pre-sales engineering assistance.

For more information, visit opto22.com or contact

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