

OIL & GAS

Real-time Hydraulic optimization: How vNode revolutionized Oil & Gas well drilling with innovative IIoT and PLC Control Solutions

Turning challenges into opportunities: The successful integration between National Oilwell Varco and vNode in advanced Hydraulic drilling management.

INTEGRATOR



Project

In the competitive Oil & Gas sector, National Oilwell Varco faced the crucial challenge of optimizing well drilling in real-time. The need to measure flow, velocities, and manage depression during drilling drove the search for advanced solutions. This case highlights the successful collaboration between National Oilwell Varco and vNode to develop an integrated hydraulic model with a PLC-based control system from Siemens.

Solution

The implemented solution involved monitoring, signal processing, algorithms, and actuator control, allowing for precise response according to hydraulic model predictions. The choice of vNode as an IIoT solution proved pivotal as it offered an agile and comprehensive alternative, speeding up development and ensuring stability.

Successful replication in multiple projects underscores the solution's robustness, paving the way for efficient and flexible operations management in the Oil & Gas industry. This development not only overcame technical challenges but also laid the groundwork for continuous evolution in National Oilwell Varco's operational practices.

Client & Partner

National Oilwell Varco, headquartered in Houston, stands out as a leading company in the Oil & Gas industry. With a solid track record, the company specializes in well drilling, covering everything from exploration to production. Their commitment to innovation and efficiency has positioned National Oilwell Varco as a benchmark in seeking advanced solutions to optimize operations in such a dynamic and challenging sector.

The company distinguishes itself through its proactive approach to adopting cutting-edge technologies, leading it to seek strategic collaborations, such as the prominent one with vNode, to stay at the forefront of the ever-changing energy industry landscape.

Objectives

Real-time operational optimization

Enhance drilling efficiency through precise measurements for instantaneous decisions.

Seamless integration

Achieve efficient integration between the hydraulic model and PLC-based control system for immediate adjustments.

Advanced pressure management

Implement real-time advanced pressure management to ensure operational stability.

Replicability and scalability

Develop a replicable and scalable solution for multiple instances and projects.

Reduction of development time

Minimize development time by choosing vNode as a proven solution, accelerating implementation, and mitigating risks.

Challenges

Complex integration

Overcome the complexity of integrating a Siemens PLC control system with a hydraulic model, including protocol conversion.

Rapid and stable development

Balance the challenge of speed and stability when considering development from scratch using only Siemens PLCs.

Efficient data management

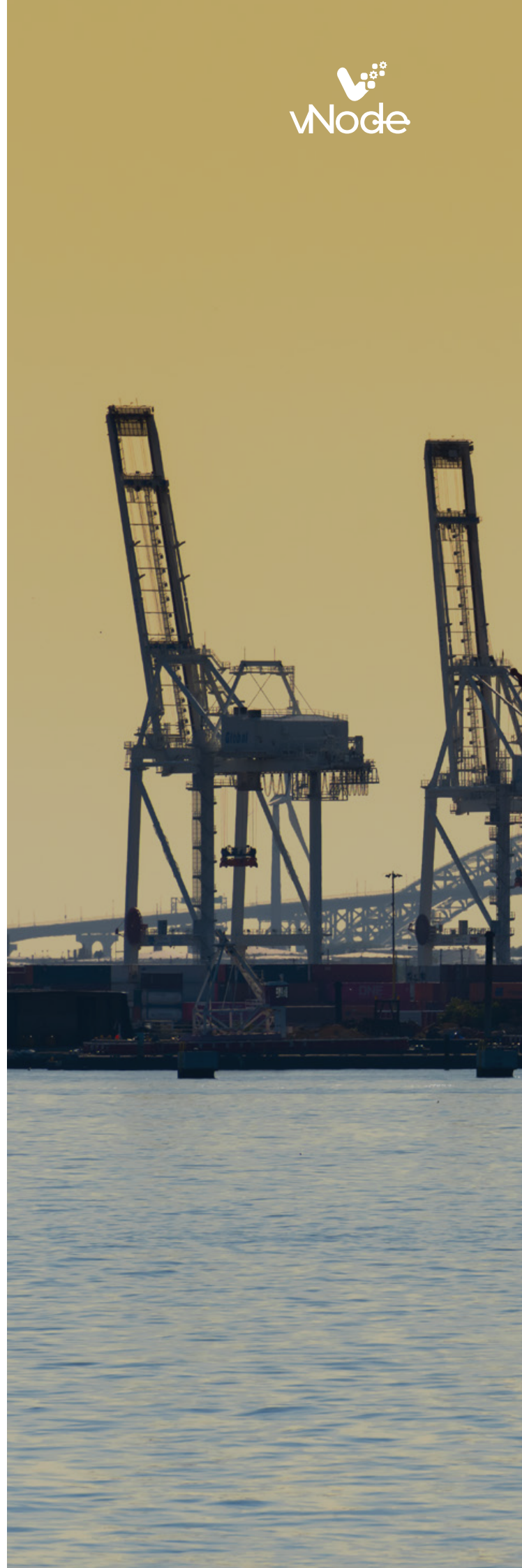
Handle the need to manage and convert data between the control system and hydraulic model using Web Services and JSON.

Real-time operational stability

Ensure system stability in real-time by incorporating algorithms and actuators to respond to hydraulic model predictions.

Time pressure in development

Deal with time pressure associated with developing a new project, seeking a functional, fast, and stable solution.



Results



Operational optimization

The successful implementation enabled real-time drilling optimization, improving efficiency and decision-making.



Successful integration

Efficient integration between the hydraulic model and Siemens PLC-based control system was achieved, ensuring seamless communication.



Precise pressure management

The implemented solution allowed for advanced pressure management during drilling, reacting accurately to hydraulic model predictions.



Proven replicability

Successful replication in various projects demonstrates the robustness and replicability of the solution for different instances.



Development time reduction

Opting for vNode resulted in a significant reduction in development time, accelerating implementation, and ensuring system stability.

Background

In its quest to improve well drilling management, National Oilwell Varco faced challenges in integrating a Siemens PLC-based control system with a hydraulic model. The complexity of protocol conversion and operational stability were critical points to overcome.

In this context, the choice of vNode as a reliable solution was based on the need for agility and stability in project development. Unlike the option of developing from scratch with Siemens PLCs, vNode offered a proven and comprehensive product.

vNode's ability to seamlessly integrate with Siemens PLC-based systems proved to be a determining factor. The solution not only efficiently addressed the complexity of communication protocol conversion but also demonstrated replicability and scalability across multiple projects.

Lead Control Systems Engineer at National Oilwell Varco, highlights, *"vNode, being a platform with multiple solutions, allows concentrating all industrial communication functionalities in a single node."*

The flexibility and accessibility provided by vNode, especially in handling communication protocols and accessing databases, aligned perfectly with National Oilwell Varco's specific needs.



Solution

The project implementation began with a detailed analysis of National Oilwell Varco's requirements, focusing on integrating the hydraulic model with the Siemens PLC-based control system. vNode was selected as a reliable solution due to its proven agility and stability.

The development and integration phase included configuring vNode to facilitate communication and protocol conversion. Comprehensive testing and adjustments were conducted to optimize algorithms and configurations.

Lead Control Systems Engineer at National Oilwell Varco, explains, *"vNode's flexibility was crucial in implementing our solution. This system stands out for its stability and simple configuration, allowing us to quickly adjust to our requirements without demanding excessive time."*



Project Implementation was carried out in several crucial phases:

Phase 1: Analysis and design

A comprehensive analysis of National Oilwell Varco's requirements was conducted, emphasizing the need to integrate the hydraulic model with the Siemens PLC-based control system.

A detailed plan was designed to address the complexity of protocol conversion and establish the foundations for efficient integration.

Phase 2: Selection of technologies and equipment

Siemens S7 PLCs from the 400 and 300 series were used for hydraulic management, leveraging their robustness and versatility in industrial applications.

vNode was chosen as the solution for integration and IIoT management, leveraging its proven capability and flexibility in communication with Siemens PLCs.

Phase 3: Development and integration

vNode was configured to facilitate communication between the control system and the hydraulic model. This involved implementing compatible communication protocols and creating effective interfaces.

Comprehensive testing was conducted during development to ensure interoperability and proper data conversion between different systems.

Phase 4: Implementation of algorithms and actuators

Advanced algorithms were integrated for real-time pressure management during drilling.

Actuators connected to the control system responded to hydraulic model predictions, allowing for dynamic and precise adjustments.

Phase 5: Optimization and continuous adjustments

Iterations were carried out to optimize algorithms and configurations, ensuring an efficient and precise real-time response.

Continuous adjustments were made to improve operational stability and adapt to variations in well conditions.



With the implementation of this comprehensive operational transformation, the following benefits stand out:

1. Enhanced operational efficiency

The project led to a substantial improvement in National Oil's operational efficiency. The ability to make precise real-time measurements, thanks to the integration of the hydraulic model and the control system, has redefined decision-making during drilling operations. The company experienced a notable reduction in drilling times, optimizing processes, and increasing overall productivity.

2. Agility and reduced development time

The strategic choice to integrate vNode not only ensured system stability but also significantly accelerated the project's development time. National Oilwell Varco avoided the risk associated with developing from scratch and leveraged a proven solution, reducing time-to-market and enabling rapid adaptation to changing industry demands.

3. Effective replicability and scalability

The implemented solution proved highly replicable and scalable. National Oilwell Varco's ability to successfully replicate the project in multiple instances not only saved time but also established a robust framework for future scalability. This has simplified implementation in new projects, providing a comprehensive and adaptive solution to each context's specific needs.

4. Transformation in pressure management

Advanced pressure management during drilling, supported by precise algorithms and dynamic actuators, has marked a significant shift in National Oilwell Varco's safety and operational stability. The ability to react in real-time to hydraulic model predictions has minimized risks and contributed to a safer and more controlled operational environment.

5. Continuous technical support

Lastly, the collaboration with vNode didn't end with the initial implementation. National Oilwell Varco has experienced continuous technical support, ensuring that any subsequent challenges are effectively addressed. This support relationship has been crucial in maintaining the system's strength and reliability over time.

A background image showing an industrial site, likely an oilfield, with various structures and cranes silhouetted against a sunset sky. The text is overlaid on this image.

"The implementation of this strategic project not only solved technical challenges but also generated a series of significant benefits for National Oil," emphasized by Lead Control Systems Engineer at National Oilwell Varco.

The project implementation not only addressed technical challenges but also yielded a series of outstanding results that significantly impacted National Oilwell Varco's operations:

1. Comprehensive and functional integration

A successful and seamless integration between the control system and the hydraulic model was achieved, overcoming technical challenges and establishing a new standard in system communication.

2. Replicable efficiency

The successful replication of the project in multiple instances demonstrated the efficiency and robustness of the solution, facilitating implementation in new projects, saving time, and resources.

3. Operational transformation

The combination of technologies and efficiency achieved transformed how National Oilwell Varco approaches well drilling, positioning the company as a leader in the industry with an innovative and efficient approach.

4. Continuous improvement

Iterations during the optimization phase allowed for continuous improvement in operational efficiency. The system's adaptability to face changing challenges and evolve over time was evident.

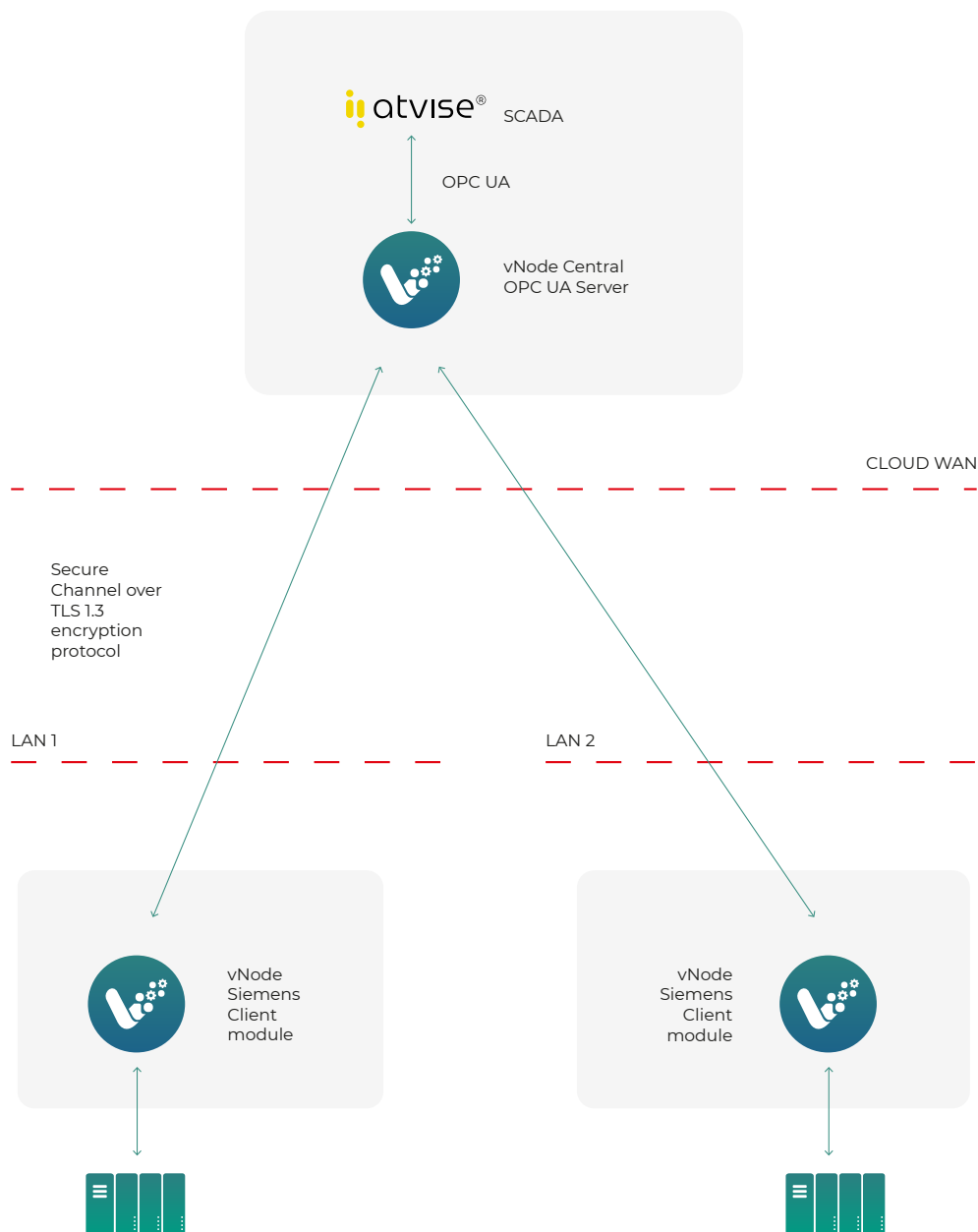
5. Adaptation to well variations

The ability to dynamically adjust algorithms and actuators allowed for adaptation to specific variations in each well. Operational safety and stability were improved under diverse conditions.



In summary, the results obtained not only encompass technical functionality but also drove an operational transformation in National Oilwell Varco, positioning it as a benchmark for efficiency and adaptability in the Oil & Gas industry.

Lead Control Systems Engineer at National Oilwell Varco, emphasizes, *"Based on the good results obtained, we will use vNode for data transmission through the cloud."*



Partner



NOV is a company that provides technology-driven solutions for the global energy industry, with over 150 years of innovation experience. Its focus lies in enabling customers to produce energy safely and with minimal environmental impact. The company plays a crucial role in improving operations in oilfields and contributing to the transition towards a more sustainable energy future.

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