Modernizing geoscience on an agile data science platform

IBM, Red Hat and Intel team up to build a scalable, AI-driven hybrid cloud offering for the oil and gas industry

IBM

Featured collaborations and products:

- Intel OpenVINO
- INT IVAAP
- Red Hat® OpenShift®
- IBM® Open Data for Industries
- Open Group OSDU™ Data Platform

Digital energy in a changing world

Oil and gas operators who want to succeed in a changing world will need to adopt data-driven technology platforms. These platforms are holistic and robust enough to capitalize on the exponential technologies of today while maintaining flexibility to enable the energy transitions of tomorrow. By adopting them, operators will be able to incorporate and leverage vast amounts of data, modernize their IT infrastructures, and drive digitization for sustainable transformation.

Industry challenges in driving digitization

Scaling and modernizing legacy infrastructure can be particularly challenging within the oil and gas industry. For operators, the challenges have been felt for over five decades. They have made significant past investments in the creation and acquisition of diverse, data-fueled portfolios of petrotechnical tools, software and technology—in turn, these portfolios required robust IT infrastructure to support the size, scope and diversity of their operations.

These investments in highly specialized exploration and production (E&P) software, as well as significant customizations within subsurface interpretation workflows, helped drive intellectual property (IP) and increase the value of operators' asset portfolios. Typically, specialized subsurface software relies on data models that are implemented in proprietary databases, effectively locking away data within the specialized application. This has contributed to deep silos across domains, between disciplines, and within oil and gas organizations.

The Open Group OSDU Forum: An industry standard data platform to drive transformational technology

The Open Group OSDU Forum has come at a critical time to drive the industry forward through the creation of a unified scalable data foundation that is accessible through a set of APIs, and advances industry data standards to leverage the full spectrum of subsurface and wells data. Production and facilities data schemas are planned for later in 2021, and the future focus is on new and evolving energy sources such as wind, solar, LNG, hydrogen, and more. One of the main advantages of the OSDU Data Platform is that it can help drive collaborations across the oil and gas ecosystem to spur innovation and overcome challenges, both for current E&P workflows and the new workflows that are necessary for a low carbon future.

Innovation no longer occurs at the data platform level. It has moved to the application level where added-value workflows can drive innovative solutions. As operators adopt the OSDU Data Platform standard, they will have access to a vast portfolio of open source and vendor-led applications without having to build architectures to support these unique value-add services.

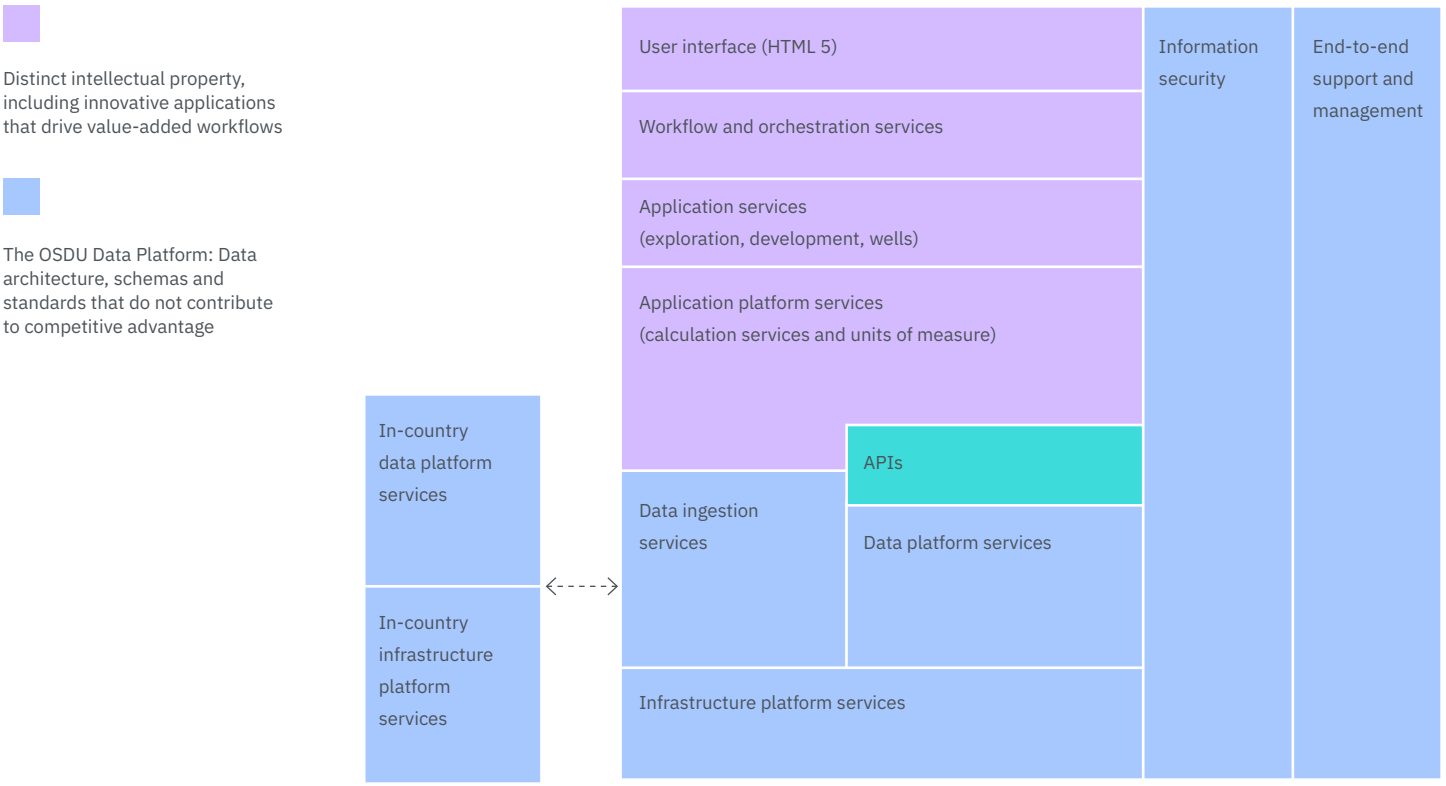

Figure 1. High-level overview of the Open Group OSDU Data Platform

Democratizing data science and unleashing AI through a hybrid cloud OSDU Data Platform

IBM and Red Hat joined forces to deliver the only market-ready hybrid cloud implementation of the OSDU Data Platform. It is built on Red Hat OpenShift—the leading data science and enterprise Kubernetes container platform—and fully integrated with IBM's AI-powered hybrid cloud platform, IBM Cloud Pak® for Data. This implementation enables the industry to leverage hybrid cloud to modernize legacy infrastructure capabilities without incurring re-platforming costs. In addition to modernization, operators can now infuse AI into workflows securely and exploit data wherever it resides—whether that's OSDU data or data in ERP, asset performance management, production operations, and real-time systems.

The IBM and Red Hat implementation of OSDU Data Platform, called IBM Open Data for Industries, powers a unified operational experience across hybrid cloud or at the edge. This can include in-country cloud to accommodate data residency and regulatory requirements. Ultimately, the IBM solution enables flexibility as well as strategic control over infrastructure, cloud and vendor landscapes.

Furthermore, Intel is collaborating with IBM and Red Hat to deliver a fully hybrid cloud-to-edge OSDU-enabled industry offering. This offering powers a unified environment to drive AI, accelerated data analytics and high-performance computing (HPC). By leveraging Intel's AI-optimized Xeon Processors with the Intel Open Visual Inference and Neural Network Optimization (OpenVINO) toolkit, operators can benefit from Intel's performance optimizations built for OpenShift and IBM Cloud Pak for Data. As IBM, Red Hat and Intel have shown, collaborations are key to driving success of the OSDU Data Platform—their shared goal is to make edge computing and connected hybrid clouds more secure, open and flexible with complete interoperability.

Intel OpenVINO: A toolkit for the development and deployment of visionary solutions on Intel platforms

The OpenVINO toolkit helps optimize computer vision inference models that use artificial intelligence and machine learning (AI/ML) on Intel platforms. It focuses on models that have already been trained, and applies capabilities learned after training a neural network to yield results. The Intel distribution of the OpenVINO toolkit enables the optimization, tuning, and running of comprehensive AI inference using the included model optimizer and runtime and development tools.

By optimizing for Intel-based hardware, efficiencies can be achieved for both compute time and cost. To quickly leverage the OpenVINO capabilities there is a Helm-based operator that can be deployed both on OpenShift and directly on Intel-based runtime hardware to build optimized models.

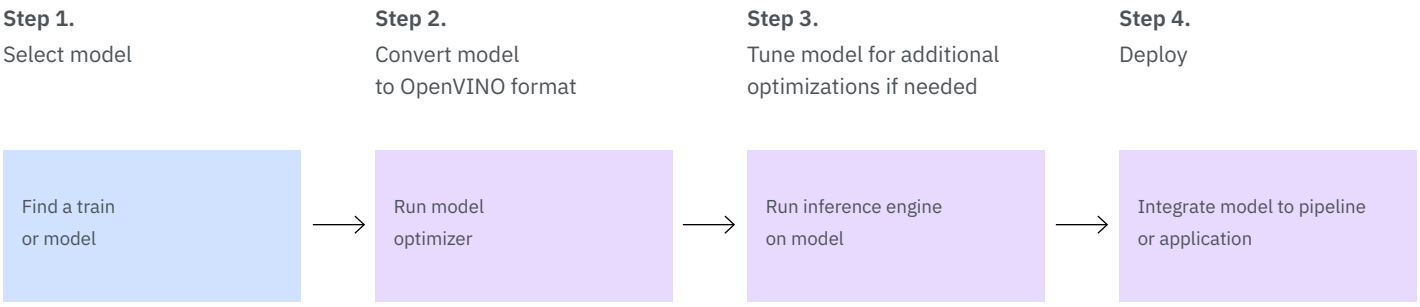

Figure 2. Simplified OpenVINO workflow

Data science tools and platforms: Scaling geoscience

The oil and gas industry has made progress in demonstrating business value with data science tools and platforms across the E&P lifecycle. This progress has been supported by advances in high performance computing, AI and ML, and cloud technologies. Significant new capabilities include the data-driven AI/ML capabilities in cloud platforms that accelerate advanced data analytics through AutoML or predetermined data science algorithms for specific use cases.

Proven business value was quickly achieved in areas such as well spacing, sand fracking in unconventional wells and predictive maintenance with electrical submersible pumps (ESPs) and compressors. Further strides have been made in the digital oilfield arena, including deep functionality within workflows as well as data science integration and physics-based models.

Seismic interpretation: Beginning the next fundamental shift

The domain of seismic interpretation—the tedious manual task of picking faults and horizons within sections to ultimately build an earth model that identifies proven hydrocarbons—is undergoing a fundamental shift. The application of AI/ML to uncover hidden patterns and correlations enables geoscientists to gain visibility into complex relationships between geologic features and seismic data. Because artificial neural networks learn by example and can solve problems with diverse, unstructured and interconnected data, deep learning (a subfield of ML) is an exciting technology for seismic interpretation.

Geoscientists have benefitted from innovative work within supervised and unsupervised ML models for seismic interpretation, including improving the agility and the number of iterations. Some examples include: seismic facies classification through convolutional neural network (CNN) approaches, reservoir characterization with multivariate principal component analysis (PCA), and self-organizing maps (SOM) approaches to identify key attributes.

Collaboration use case: Seismic interpretation with the OSDU Data Platform and INT IVAAP

As an example of the power of IBM Open Data for Industries, consider how Intel and IBM have partnered with INT—a widely adopted oil and gas visualization software provider for more than 30 years—to deliver an end-to-end workflow using INT IVAAP for upstream data visualization.

Thanks to its hybrid cloud foundations, this implementation of the OSDU Data Platform can easily be applied as a supervised deep learning approach to locating subsurface features, such as a salt dome. Furthermore, deploying an optimized model generated from OpenVINO on the platform can accelerate the end-to-end seismic interpretation workflow.

Figure 3 shows an INT IVAAP data visualization output of a salt formation which is processed from a Jupyter Notebook in IBM Cloud Pak for Data on Red Hat OpenShift.

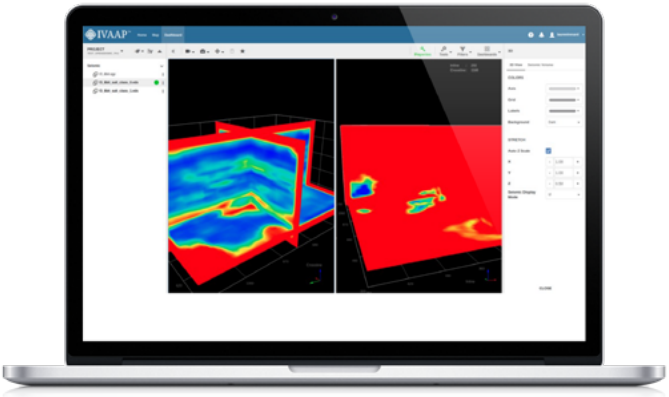

Figure 3. IVAAP visualization of OpenVINO inference output of salt domes

The data was visualized using INT IVAAP to locate the seismic information by navigating through the IVAAP geospatial interface. Once the data is selected in the IVAAP project, it can easily be retrieved within the OSDU delivery API for use in a Jupyter Notebook where the OpenVINO libraries are available.

The seismic inference workflow integrates INT IVAAP visualization for the selection of a data and AI model, and integrates to an IBM Open Data for Industries instance within a Jupyter Notebook for inference processing. The inference results and statistics can be viewed within IVAAP visualization for quality inspection. This complete AI inference workflow—from the data and model elections up to display of inference results—can be easily leveraged to other data types and inference models. In addition, it can be extended through to additional subsurface inference workloads from data QC to interpretation and extrapolation.

Conclusion

The oil and gas industry needs to leverage advanced technologies to solve current workflow challenges, and this collaboration between IBM, Red Hat and Intel through the OSDU Forum is designed to help meet that need. It delivers a unified environment to accelerate data analytics and high-performance computing within hybrid cloud environments—ultimately supporting AI/ML and deep learning techniques that have the power to improve the quality, speed, and accuracy of seismic interpretation. By applying data science and increasing accuracy in the identification of hydrocarbons, these technologies can even help reduce environmental footprints. Looking to the future, these models and learnings can also be applied to new and future energy sources.

For more information

To learn more about the IBM Open Data for Industries workflow and other AI-related news:

Sign in to Seismic Interpretation OpenVINO toolkit through Intel DevCloud →

Watch the GitHub demo →

Explore IBM Open Data for Industries →

Review the OpenVINO Model Server Operator in Red Hat Registry →

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