Case Study

A Case for Digital Interoperability

To survive in today's very competitive market, energy organisations need to perform in the most effective and efficient way throughout the lifecycle of a project or an asset. To achieve this, information must be shared across operational areas, and across the organisations involved in the value chain. But data about processes usually exists in localised organisational silos, and a lack of interoperability – of a shared language to communicate data – has caused extensive challenges across the energy sector, as it has in many other industries.

The Challenge

Many companies are investing in advanced analytical capabilities to remain competitive. But the limited interoperability of both data systems and the analytical methods that then use the data to interpret and give oversight of a process is severely limiting the sector's ability to make good decisions about the system as a whole. The insights that could be achieved from advanced data analytics solutions are most powerful if the entire system can be considered.

For example, the February 2021 Texas electric grid blackouts that left more than 4.5 million homes without power and killed at least 246 people, exacerbated significantly by a lack of information/analysis sharing between natural gas production plants and the power grid.

Traditional risk management frameworks cannot reflect the cumulative effect of interconnected risks in the absence of interoperable analytics. Individual risks at the component level may not be considered significant based on their local likelihood and impact, but their significance may change if the risk analysis can be aggregated and cascaded to the system level by assessing how various localised risks are connected.

The Solution

The issue of interoperability between systems is being addressed by the Open Industrial Interoperability Ecosystem (OIIE) Initiative led by MIMOSA, which combines a portfolio of existing industry standards to achieve system-of-systems data interoperability in energy, petrochemical and asset-intensive industries.

This project extends the OIIE framework (published as part of ISO/TS 18101-1:2019) to provide standards-based interoperability for data analytics. Moving a level beyond sharing data, it lets analytical and management systems, the software interfaces, communicate directly.

Interoperable analytics will allow the sharing of results between multiple data analysis methods, to provide a more holistic view of the outputs produced by different analysis tools. Interoperable analytics will inform not only individual components but can aggregate results to give a picture of the complete system across a range of different contexts, for example reliability, efficiency, or safety. By sharing and aggregating the analyses produced, the entire system can be examined, for better strategic analysis and decision making.

High-priority use cases for analytics interoperability are being identified in collaboration with industry partners. These example cases are being specified using the OIIE framework, using industry-agreed data interoperability standards. This specification will then be used to select an appropriate set of existing software practices and standards for analytics interoperability, as the basis for an open specification.

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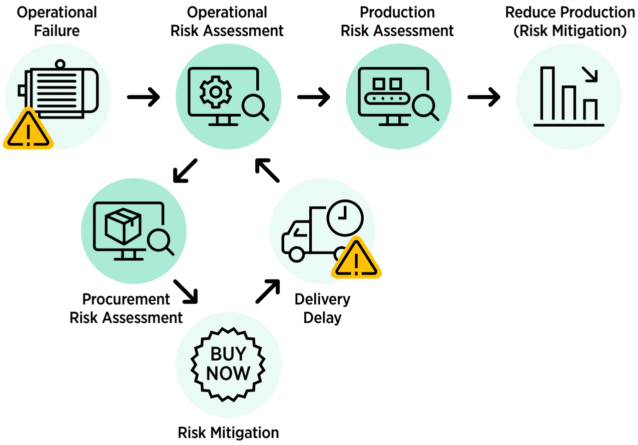
Outcomes and Impact

Given the interconnected nature of critical infrastructure in the energy sector, the ability to model, monitor and manage risks, and assess the impact of risk not only on individual components, but on the entire connected system and system-of-systems, is critical to avoid the potential for cascading failures.

A pilot implementation of an example case focusing on operational and reliability risk has already been demonstrated, using a Coal Seam Gas (CSG) Well risk model and operational data provided by industry partner Synengco. The interoperable analytics framework provides the ability to model, monitor and manage risks and assess the impact of risk on the capability of each component such as an individual motor, and beyond that to the risk within the system. This is considered across four dimensions: horizontal (assessing one component in different contexts or with different methods), vertical (aggregating individual component risks into larger systems to determine the risk at a system level), temporal (variation in risk across the asset lifecycle) and uncertainty associated with different risk measurement techniques.

The CSG Well risk pilot illustrated the pipeline of analytics used to calculate the probability of failure for each component using real data, and cascaded this up to an analysis of impact of such a failure at a system level. An example based on a motor failure showed how the risk can grow, from having minimal local impact to major system impact, and how a dynamic risk assessment can be used for systematic decision making to better use resources across the entire system.



Using a risk modelling and assessment framework using interoperable analytics, critical infrastructure owners will get a better understanding of the vulnerabilities and dependencies in their own systems, and can address those risks to make their infrastructure more resilient.

Future Horizons

Having demonstrated how individual component risks can be connected and analysed to provide a measure of overall system risk, the next step is to link the operations risk management system to procurement risk models. This will enable the triggering and prioritisation of new component procurement as necessary to mitigate risk and return the overall system efficiency to a maximum. The pilot will also be extended to link to production risk management systems, enabling the coverage of eventualities such as if a motor fails and procurement cannot replace it within the required time, so that production schedules may be adjusted accordingly.

While these pilot studies have been developed using operational data from Synengco, a future aim for the project is to run a pilot implementation of the open specification on a real-time process, such as the H2Xport pilot plant under development at Queensland University of Technology, and the Kwinana Energy Transformation Hub to demonstrate its use in analysing real, complex data systems.

Using the OIIE Use Case Architecture for these pilot implementations ensures that the underlying scenarios and events that define each use case are characterised in a highly structured interoperable format that can be re-used for future applications. Once developed and validated, OIIE use cases, scenarios and event specifications arising from this project are published on the OpenO&M website for industry to access and implement with their systems. For example, the standards-based interoperable interfaces produced in this project will be leveraged to provide a concrete application in another FEnEx CRC research project with INPEX, where they will demonstrate dynamic work order prioritisation by bridging the gap between siloed reliability and risk models.

"The benefits that come from a comprehensive digital interoperable environment are better decisions that improve risk, financial performance and environmental performance while freeing up knowledge workers to focus on higher value activities. In our experience this provides a 10-fold return on investment for most operations."

Synengco

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