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Shell Leverages Data to Transform from Reactive to Predictive Operations

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Overview

ARC Advisory Group analysts attended the OSIsoft EMEA Users Conference in Berlin, Germany in September 2016.

OSIsoft recently held the EMEA Users Conference at Berlin, Germany. This insight covers Shell's experience in successfully working alongside OSIsoft for improving its digital capabilities. Shell aims to transform its operations from reactive to predictive by recognizing data as an asset and deriving maximum value from it.

John de Koning, Technology Manager, Foundation Services, Shell Global Solutions, spoke at the conference about the company's goal to transform its enterprise operations from reactive to predictive, by treating data as an asset and deriving maximum value from it. For this massive project, Shell leveraged OSIsoft's PI Collective and Asset Framework (AF) to collect and structure data for further insightful analysis. The company also carried out a proof of concept project (POC) of applying business analytics to operational data on a use case of carbon capture and storage at its facility in Canada, for which it utilized OSIsoft's PI Integrator for Business Analytics for integrating PI System data with Microsoft Power BI.

The Business Case for Predictive Operations

Shell is an innovation-driven global conglomerate, and invests more than $ 1.0 billion globally in R&D each year. One aspect is to improve asset performance by leveraging the huge volume of data generated in plants and achieve a gradual transition from a reactive to a 'predictive' organization.

"The business needs for operations or maintenance are where and how to quickly access information about the operation", Mr. de Koning explained.

"Is the operation on target? How does it compare to similar operations? What is the health status of the equipment? How can downtime be prevented?" These are questions that need to be answered quickly and efficiently at the local and enterprise levels.

In the past, Shell answered these types of questions by implementing islands of systems, including several brands of historians for data collection. Other software applications such as ERP or LIMS were added and used on a local basis and based on these capabilities, local Shell staff included further functionalities and analyses to do their tasks. But with the growth of the enterprise and the interest in data, a need for interfacing between all these local systems arose that turned out to be very complex. Realizing that having each plant designing and implementing systems, and that integrating the existing patchwork of systems was not effective, the company changed its approach about five years ago and devised strategic responses to data usage.

Source: Shell

Shell recognized that along with physical assets, data is a vital asset and if managed properly, it would help in achieving its plant and enterprise-wide goals. According to Mr. de Koning, it's important for personnel to easily access local and global data across the enterprise, without reinventing the wheel each time. Efficiency in retrieving data and performing analyses is critical in times of depressed oil prices. Reducing latency in taking action can help in preventing unplanned equipment downtime, and improving asset performance. Comparing equipment across plants, gives opportunities for improving the overall plant performance. The power of predictive analytics would further add to the effectiveness of responses.

The Foundation: Data Integration and Access

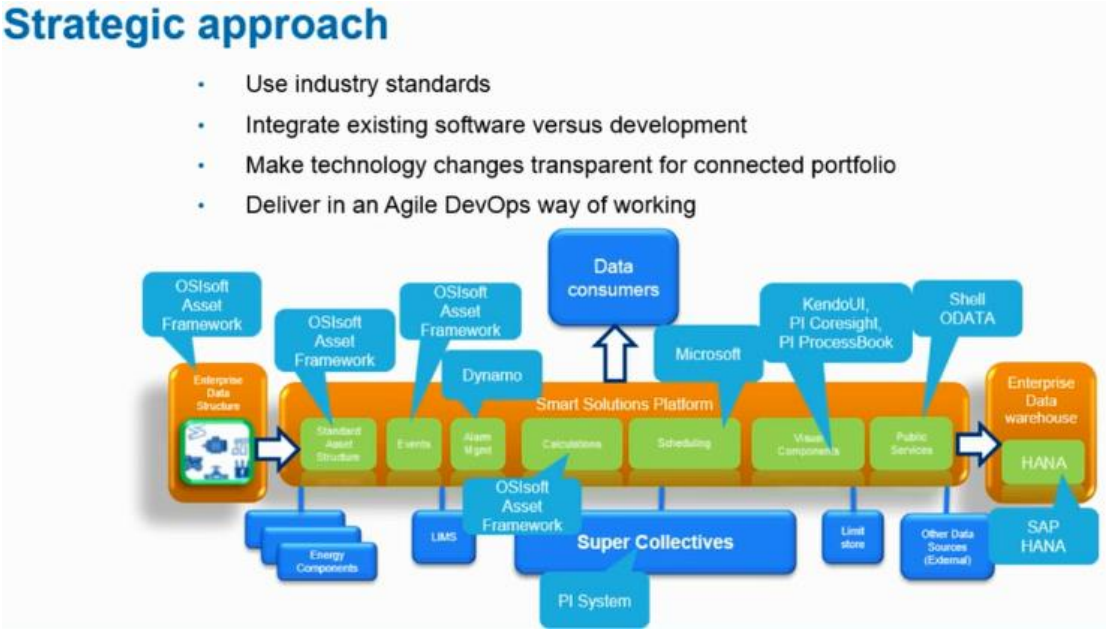
The first step in the series of strategic responses by Shell was to collect operational data and make it available globally. The company standardized on the OSIsoft PI System and partnered with OSIsoft for real time data collection. Shell created PI System Super Collectives. These are PI Servers holding all operational data for a line a business globally. ARC's under-

standing is that these are replicated from the local PI Servers. These collectives currently process close to 7 million tags together, with an update frequency of 1 to 60 seconds.

Asset Framework

AF normalizes tag and asset naming, units of measure, and times zones. This is fundamental to the ability to standardize and enable collaboration across people and systems.

To dramatically improve the ease of interpretation and access, a uniform data model was created and implemented in Asset Framework (AF). For each type of equipment, a standard data structure was defined, capable of modeling all possible instances of similar equipment type. With this in place, it becomes straightforward to compare equipment performance worldwide, because local tags are now organized per a global uniform standard, and have gained meaning for all users in the organization. Data modelling is very crucial as a basis for smart solutions, said Mr. de Koning. "If the same asset definition and data modeling is used for equipment throughout the organization, then the benefits are immense," he mentioned. Creating the data model took Shell several years by several teams. Mr. de Koning recommended designing this step carefully, and executing it systematically and thoroughly, or else one would be inviting a serious risk of failure.



Shell's Architecture for Data Integration and Access

Other components found in the "Data Integration and Access" layer are event detection and advanced calculations, also using OSIsoft's AF, and alarm management using Honeywell's DynAMo. Finally, OSIsoft PI

Coresight and PI ProcessBook plus Telerik's KendoUI are used for data visualization.

Mr. de Koning commented that putting all data types in a data collective for time-series is not effective, which is why the data layer connects with SAP HANA for relational data. This allows combining efficiently real-time information in the context of the assets, with events and maintenance records from SAP, as meaningful input to predictive analytics solutions.

Data Modeling and Asset Models

Data modeling in the sense of Shell's presentation is creating a generic data structure for each type of equipment that will fit each physical occurrence of the equipment type. This needs to be distinguished from a model of an equipment instance, a set of values in the data structure. These objects can be smart for example by containing analytics.

Shell also uses AF to reference data in stores other than PI Systems, for example for static data such as limits, found in separate 'limit stores' and LIMS. Shell's ODATA query tool can access the layer and find data across these sources based on the standard data model structure in AF.

Shell leveraged as far as possible off-the shelf solutions and software to reduce development and maintenance costs. This entailed integration of the software components. In the case of the OSIsoft PI System, integration required a small customization. Mr. de Koning stressed that strong partnerships with suppliers, and their alignment with Shell's vision and expected outcomes are the key success factors in implementing a roadmap.

Smart Applications for Business Value

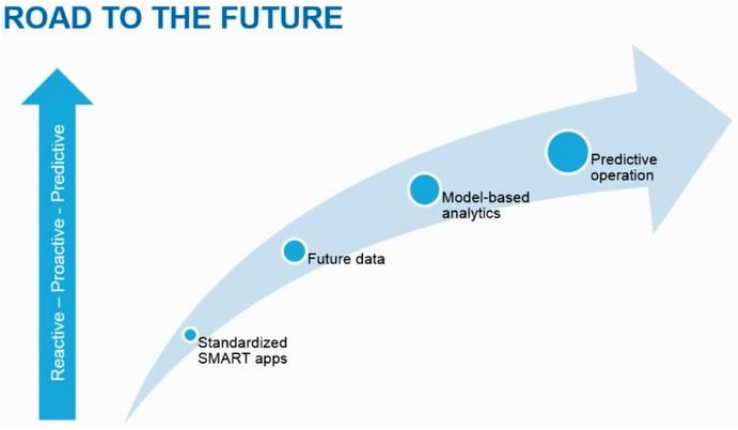
The company built portals with advanced capabilities such as proactive monitoring, exception-based surveillance for reservoirs, and condition based maintenance monitoring. When adding complex calculations with MATLAB, for example to monitor rotating equipment or fouling of heat exchangers, Shell found that creating one calculation with input from a standardized data structure, enabled the calculation for thousands of equipment of this type in many facilities. "The work load was reduced from years to days", Mr. de Koning said.

Shell currently adds complex model-based analytics using MATLAB and R programming languages, taking the first step in 'predictive operations' and aims to make use of those tools for a new, asset-oriented way of working.

From Model Based Analytics to Predictive Operations

The most recent step Shell took in their transition towards predictive operation is to test the use of Business Intelligence tools, to provide 'free format data analytics and reporting' as a self-service for a broad range of users. Shell wanted this reporting to be easy to use, including the data cleansing and preparation, the actual analyses and sharing of the results.

For testing predictive operations, Shell undertook a POC applied to carbon capture and storage at the Albian oil sands bitumen production in Canada. When upgrading by hydrogenation, CO_2 is emitted as a byproduct of the hydrogen production. To reduce contribution to global warming, the captured and compressed CO_2 is injected and stored in a geological formation about 2300 meters underground. For regulatory and environmental reasons, field instruments monitor the gas concentration at the wellhead. MATLAB calculations estimate from measured concentrations and weather information whether CO_2 concentrations remain within allowed limits.



Source: Shell

Shell installed OSIsoft's PI Integrator for Business Analytics to transfer selected data from the PI Supercollective to Microsoft's Power BI analytical tool. The company made, amongst others, graphs of CO_2 concentrations over time, which compared the results from different instruments and compared concentrations day by day.

Shell found the installation of the Integrator took less than four hours; it could build reports within another four hours and considered this very fast. The results could easily be displayed in Power BI, and easily shared in HTML5 format on any portal. Shell appreciated the flexibility of setting refresh rates and selecting data using filters, without any coding. As the test finished ahead of schedule the company implemented a supply chain use case with the same success.

Shell considers the POC to bring data analytics to a broad audience as successful. The company aims to use the application for stock management

and logistics, as well as margin visualization. Shell will conduct further tests with other Business Analysis tools such as Element Analytics

Conclusion

In the case of Shell, the strategy of transforming a reactive mode of operation to a predictive mode of operation aims in the first place to reduce downtime, and dramatically increase the efficiency in retrieving and analyzing operational and maintenance data. Mr. de Koning's presentation indicated that despite the clear vision, the journey was hard work, "Shell has examined and sifted through numerous ways of achieving the desired results, and selected the best option that worked for it." This also implies that other companies may need to find their own optimal solution, adapted to their own strategies.

Recommendations

Operational and maintenance data is an enabler for organizations to respond proactively to both internal issues and external challenges. To leverage this asset in a global organization in an efficient way, companies must:

- define a digital roadmap consistent with the company strategy, which includes a solution architecture that can accommodate for a "develop once, deploy global" approach to smart add-on solutions;
- preferentially use common off-the-shelf software;
- make data globally accessible and interpretable based upon a uniform asset-based data model; and
- leverage data in smart applications for performance analytics (reporting), predictive analytics and prescriptive analytics to operate with foresight and deliver business benefits.

This article was written by ARC Advisory Group based on a presentation we witnessed at the OSIsoft Users Conference for EMEA, and may not completely reflect Shell's opinion.

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