COGNITE

DATA-DRIVEN SMART MAINTENANCE:

THE NEXT GENERATION OF EQUIPMENT MONITORING AND MAINTENANCE OPERATIONS

CONTENT

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THE NEXT GENERATION OF EQUIPMENT MONITORING AND MAINTENANCE OPERATIONS

Introduction

Smart Maintenance is a set of data-driven opportunities that increase uptime, boost performance, reduce over-maintenance, and improve planning.

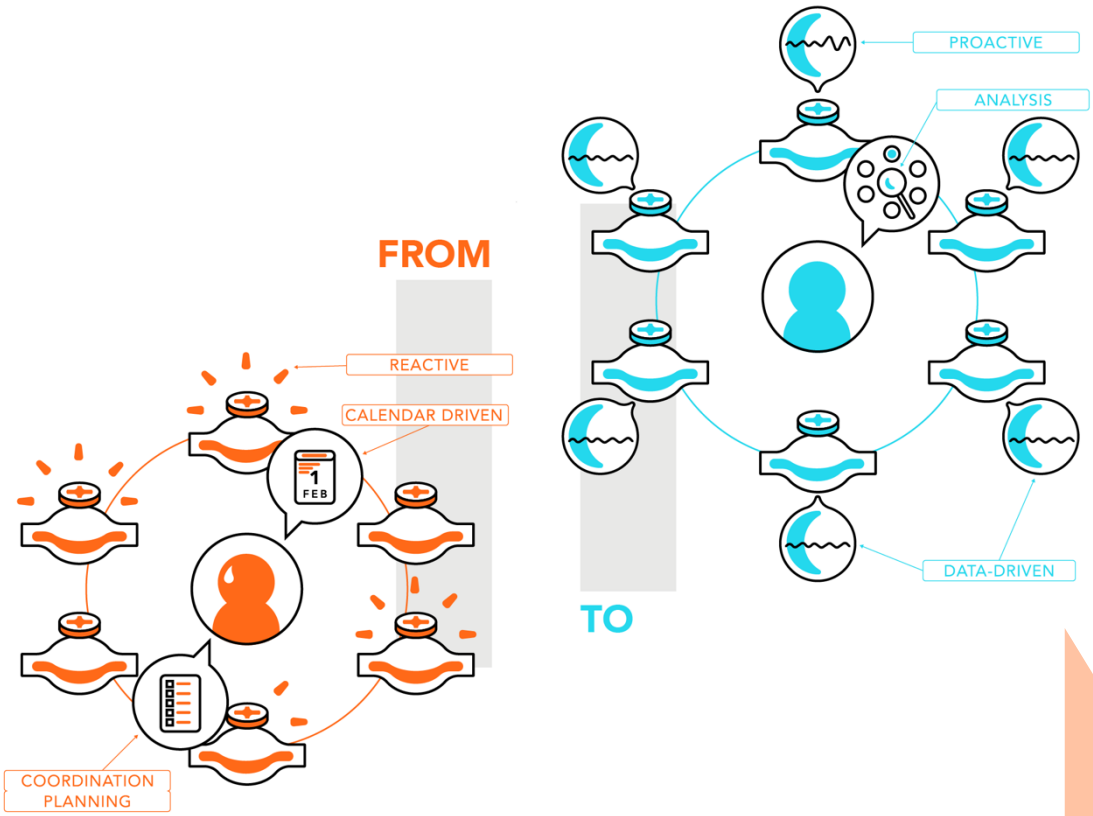
But for too many companies in heavy-asset industries, Smart Maintenance is an opportunity that remains unseized.

There are many reasons why industrial companies haven't been able to scale Smart Maintenance:

1. **Choosing the wrong use cases, often because of a lack of in-house analytics competence.**
2. **Development issues, sometimes connected to the complexity and time required to build the necessary data models.**
3. **The lack of an appropriate hosting environment to deploy the models.**
4. **Forgetting to change as an organization, shaking up work processes and management structures to support a data-driven way of working.**
5. **Finally, not focusing on the scalability of solutions from the beginning. Case studies, pilot projects, and proofs of concepts must be scalable to maximize their value.**

This paper will explain how Cognite's Smart Maintenance Service Line helps customers solve these issues and capture value. Through a combination of subject-matter expertise and technological solutions such as Cognite Data Fusion (CDF), a data package that supplies contextualized data to drive industrial applications that increase efficiency and drive revenue; and Asset Data Insight, a dynamic application for operations and maintenance enabling real-time health-overviews and analysis, Cognite lays the foundation for companies to extract the massive value potential in Smart Maintenance.

From Reactive to Proactive



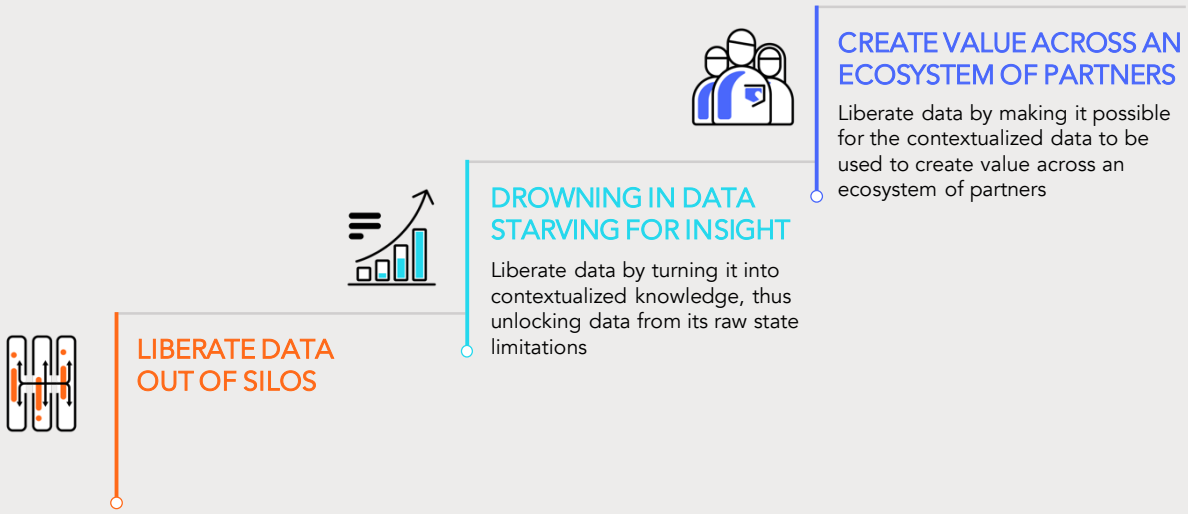
Smart Maintenance will substantially impact how companies in heavy-asset industries operate. Today, many companies run large maintenance operations with distributed ownership. Information such as equipment health history, sensor data, and documentation are locked away in different systems, meaning that alarms, calendars, and personal experience drive maintenance analyses and decisions – not data.

In addition to a lack of data, there is also a lack of communication; collaboration is hindered by too many middlemen and functional silos, coordination between maintenance and production optimization decisions is all but nonexistent, and Original Equipment Manufacturers (OEMs) are completely disconnected from maintenance work.

Smart Maintenance means a move to a smaller, more centralized maintenance operation with end-to-end ownership. Data is easy to access, and can be shared with technology partners and OEMs. Maintenance is performed proactively as a result of the actual condition of each component and data-driven analyses that flag potential problems before they happen. Communication flows seamlessly across the organization, making it simple to weigh costs and benefits to optimize operational decisions.

This transformation won't happen on its own. To unlock the insights that can transform their maintenance operations, companies in heavy-asset industries first need to collect, clean, and contextualize the data that their installations are already producing.

Cognite Data Fusion (CDF)



Few companies have successfully scaled Smart Maintenance. Of the many obstacles they face, one stands out: a lack of liberated, usable, and shareable industrial data.

Cognite Data Fusion (CDF) was developed specifically to tackle that challenge. With CDF, contextualized data is available as a service, easily shareable through a secure Application Programming Interface (API).

CDF integrates seamlessly with existing IT and OT infrastructures to liberate a wide variety of industrial data from separate, siloed source systems, collecting it all as a comprehensive set in the cloud, securely and without space limitations. It then automatically structures the sensor data in relation to other relevant data (e.g., process diagrams, 3D models, event data, and more). This contextualization process effectively creates a comprehensive digital twin of an asset or system, making data available in a way that's intuitive to the human user and to the algorithms at work behind the applications powering Smart Maintenance models.

Liberate Your Data

Where companies run into model development problems, CDF offers a solution:

PROBLEM

Data access is cumbersome, as information is stored across multiple data sources, potentially with different data owners and system experts.

SOLUTION

With CDF, companies get immediate access to historical and real-time equipment data through one standardized and well-documented API.

PROBLEM

Relevant data is hard to identify, as there is limited context available to allow rapid identification of all data relevant for one particular piece of equipment.

SOLUTION

With CDF, companies can identify all relevant data quickly, using data typing to identify all data relevant for the equipment.

PROBLEM

Labeled data is sparse, of low quality, or nonexistent.

SOLUTION

With CDF, customers can access data labels through the same interface as time series data, and its toolbox provides efficient labeling in cases of low-quality or nonexistent labels.

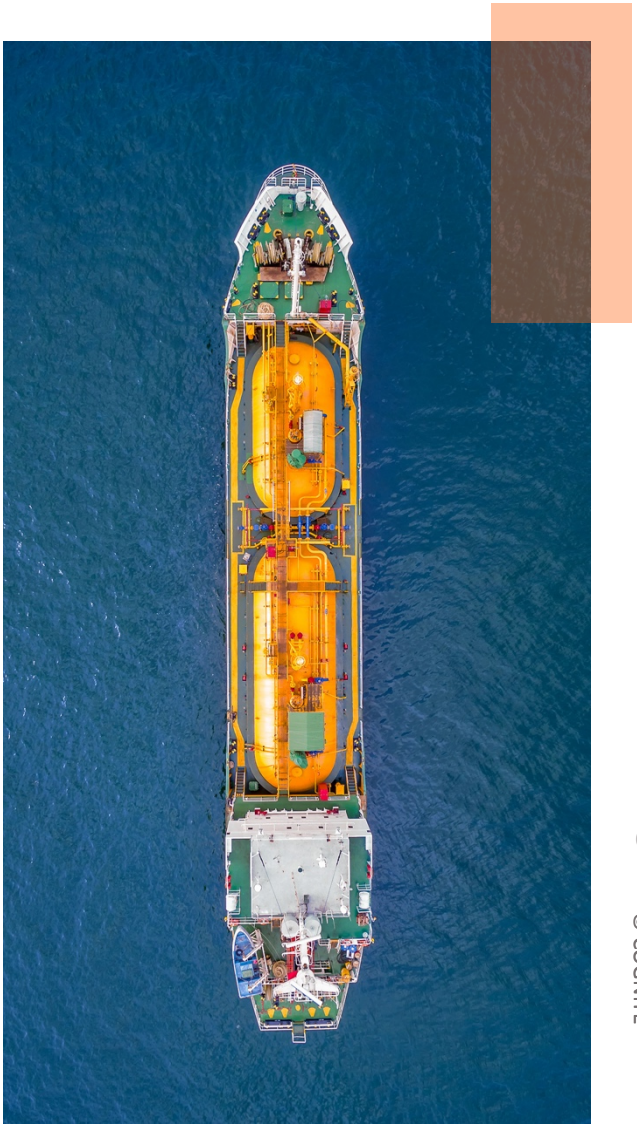
PROBLEM

Model development is slow as feature engineering on time series data is computational heavy and often done on local computers.

SOLUTION

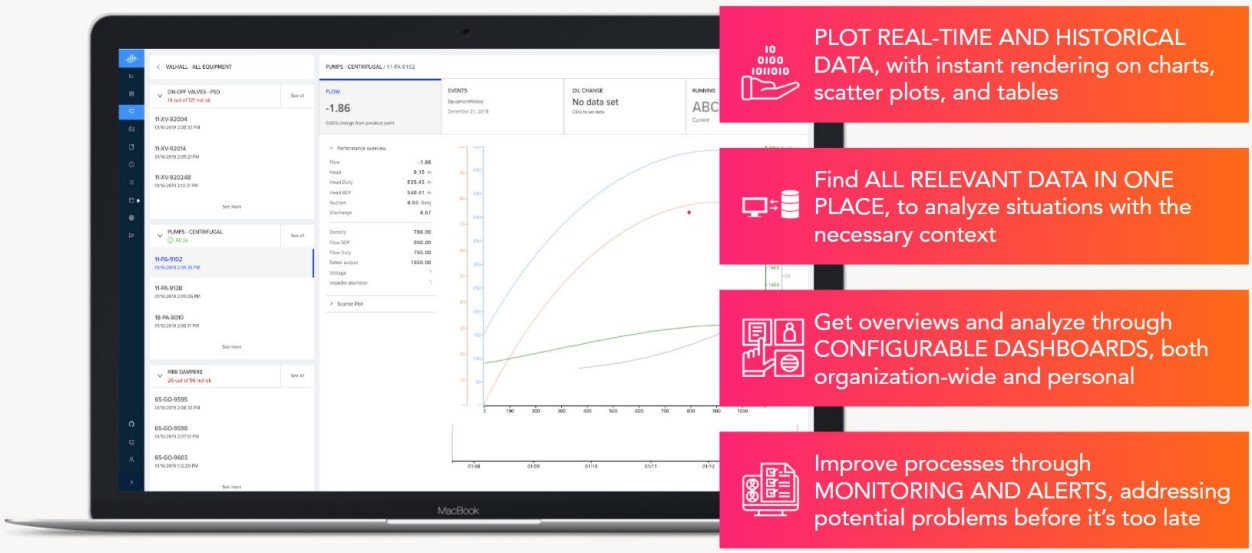
Companies can perform computationally heavy processes in CDF, tapping into the cutting-edge computational power and functionality of the cloud. Google Cloud Platform.

Data has the potential to be industry's most valuable asset. That's what Cognite Data Fusion reveals: A complete, virtual view of industrial reality – both past and present – made accessible and meaningful for humans and machines.



Asset Data Insight

ASSET DATA INSIGHT IS YOUR ENTRY POINT FOR SMART MAINTENANCE



Cognite Data Fusion (CDF) vastly improves companies' data science workflow. Once they have a pipeline of liberated, usable, and shareable industrial data in place, companies can then implement applications that accelerate solving Smart Maintenance use cases.

Asset Data Insight (ADI) is one such application. Developed by Cognite, ADI enables real-time health monitoring and investigation. Through in-depth data exploration, users are able to create detailed analyses and make informed, effective decisions at every level of an organization.

Asset Data Insight transforms the cleaned and contextualized data within Cognite Data Fusion into actionable insights via asset-centric dashboards that intuitively visualize links between different data sources.

By enabling users to create a model for one component and then roll it out to an entire installation, ADI minimizes the manual effort required from users, freeing up time for higher-level analyses and effective decision-making.

For problems that require deeper investigation, users can efficiently navigate from Asset Data Insight into specialized applications or dashboards such as Grafana and Power BI, among others.

Meaningful Health Overviews, Effective Investigation

Today, much of the maintenance work that heavy-asset companies conduct is governed by calendars. At set intervals, be it once a year or once a month, an information system will automatically generate a work order to check the health of a piece of equipment, and a field worker will complete the task. This causes over-maintenance, as workers spend time checking equipment that may be in fine working condition.

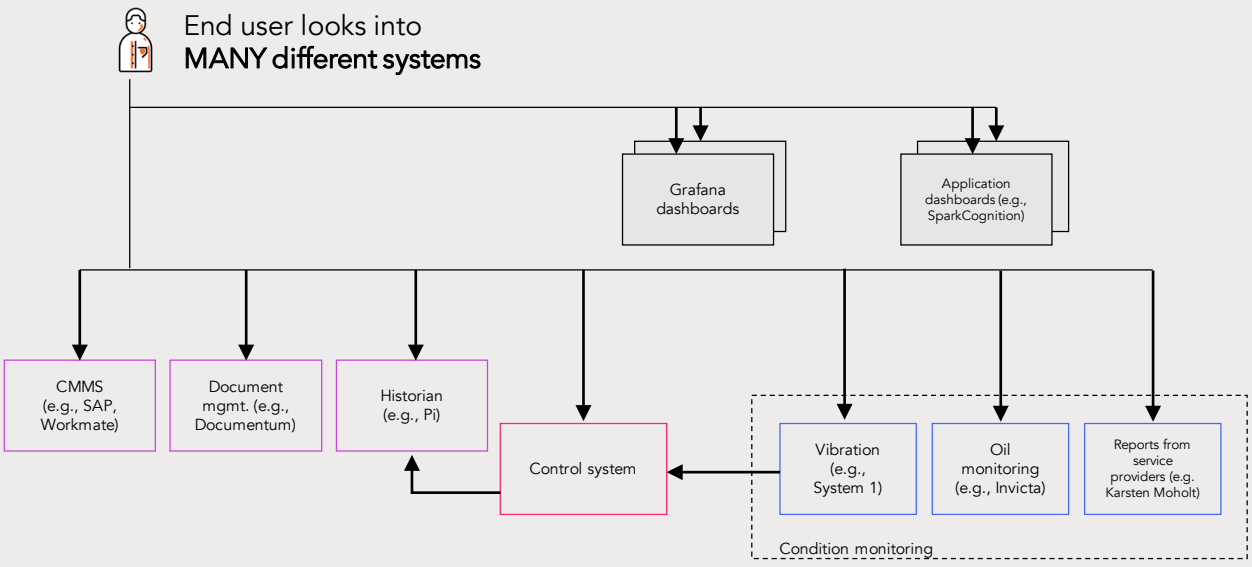
Then an alarm sounds on the installation. A pump has stopped functioning as intended.

One of the installation's maintenance workers – be it an asset maintenance manager, offshore planner, onshore equipment expert, or any one of the many users involved in maintenance – is on it. But in order to diagnose the issue, she has to consult several different systems that don't communicate with one another. She checks the equipment history, contained in one system. She looks at sensor time series data, stored in another system. She consults design information, design curves, and Piping and Instrumentation Diagrams (P&IDs), all located in separate PDF files.

This siloed approach to data management causes excessive downtime, as engineers spend excessive amounts of time identifying the problem before they can figure out how to fix it. And since an alarm can sound at any time, it upends maintenance schedules offshore and planning processes onshore. As a result, there is little time for advanced analyses or learning from previous cases of equipment failure.

> When I'm notified, it's too late to solve the problem. I wish we had the time and tools to catch problems before they affect our control room operators.
>
> *– Equipment Engineer*

WITHOUT COGNITE DATA FUSION AND ASSET DATA INSIGHT



All of these frustrations revolve around one issue: centralized and complete data access.

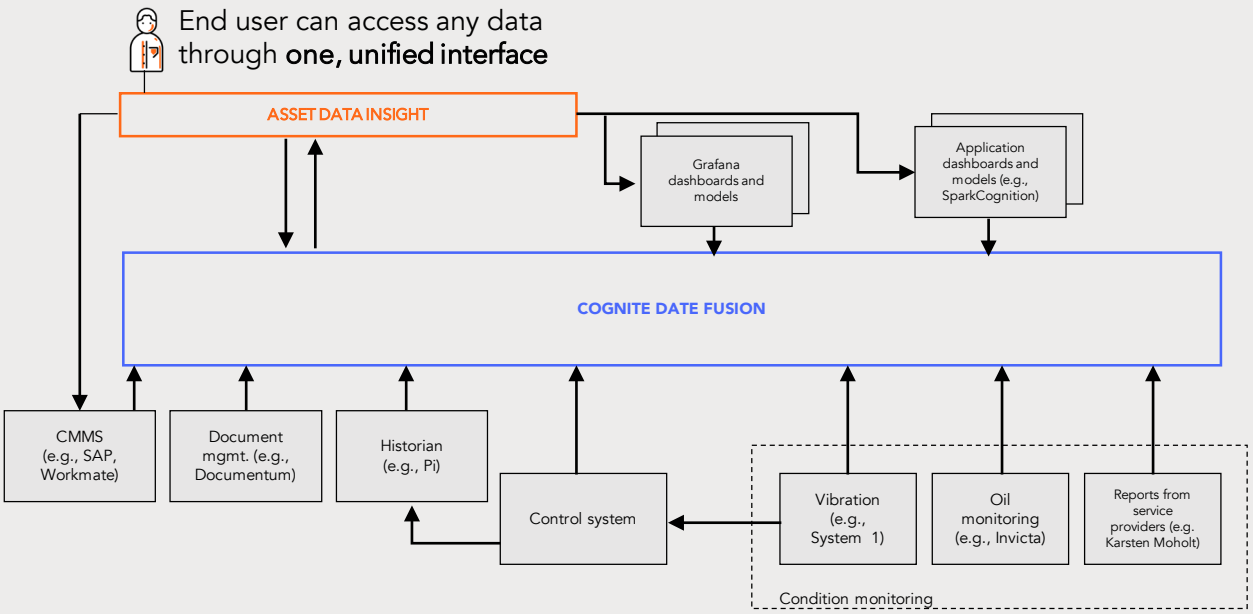
Asset Data Insight solves that issue. The application brings health monitoring insights from across an ecosystem of courses together into a single view, so that users can find the data they need in one application. Related industrial data in the same view provides the necessary context for users to analyze health monitoring insights and take quick actions.

These features help Asset Data Insight transform the workday and daily effectiveness of maintenance workers. Instead of leaping to action when an alarm sounds, maintenance workers can at any time access the application on a computer or handheld device to proactively monitor equipment health.

Through a combination of predetermined performance criteria and their own expertise, users can identify problems before they happen and arrange for them to be fixed, avoiding costly production shutdowns.

Greater data availability lowers the threshold for using data in day-to-day operations. Instead of being something reserved for office workers, data becomes another resource in the field worker's toolbox. This supports bottom-up digital transformation, ensuring that organizations change along with their maintenance routines.

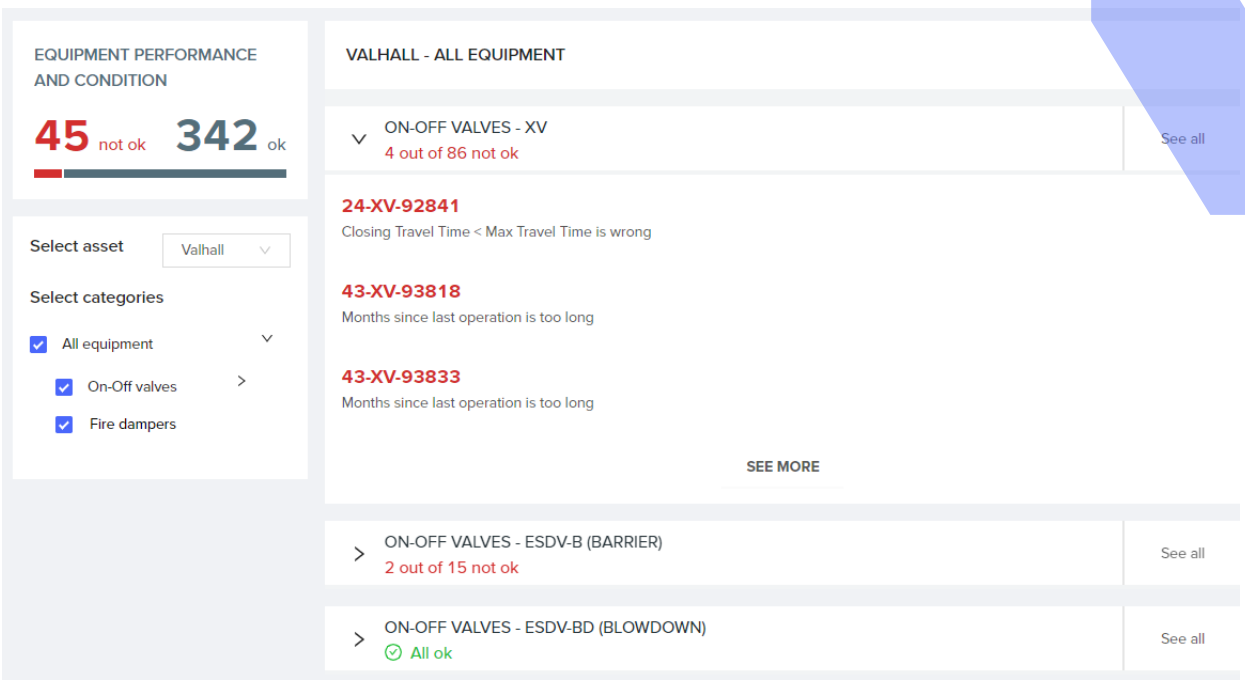
ACCESS ANY RELEVANT DATA THROUGH ONE UNIFIED INTERFACE



SMART MAINTENANCE IN ACTION

Smart Maintenance is not some far-off fantasy. It's industrial reality, happening at installations around the world, driven by digital frontrunners. The following collection of use cases demonstrate how companies in heavy-asset industries, powered by Cognite Data Fusion, can sharpen their competitive edge by maximizing their own capabilities with data.

How Cognite helped Aker BP save time and costs by automating maintenance



CHALLENGE

Undertaking PSD (Process Shutdown) valve testing on Aker BP's Valhall field used to be time-consuming work. First, engineers had to obtain a work permit to access Aker BP's offshore system.

Then, they had to use the system to pull up data on each individual valve, going one by one in the slow system until every valve that was scheduled for maintenance during that session had been checked. This approach meant that engineers were spending part of their shifts testing valves in good working condition instead of those in need of maintenance.

SOLUTION

Aker BP used Cognite Data Fusion (CDF) to automate and optimize the PSD valve maintenance process at the Valhall field. CDF captured data from Aker BP's control system, logging when valves were used and comparing the results to travel time criteria.

The data was then visualized in Asset Data Insight, an application for computers and handheld devices. The dashboard gave operators and first-line onshore support staff an easy-to-use dashboard for monitoring valve health.

IMPACT

By using Asset Data Insight to inform their maintenance routines, Aker BP's engineers were able to move away from manually checking each valve and toward prioritizing valves that were not meeting travel time criteria. This change was estimated to have reduced the number of hours that engineers spent on testing PSD valves a year by about 80 percent.

It also cut the number of annual maintenance checks by two-thirds, and the duration of an average maintenance session in half.

By reducing the time it took to check safety-critical equipment, Aker BP was able to reinvest those resources toward maintaining production-critical equipment.

Time reduction for an average maintenance sessions

Reduction in hours engineers spend on testing

Reduction in annual maintenance checks

How Cognite liberated data to provide fast, accurate condition monitoring

CHALLENGE

Aker BP granted its control system provider access to all Ivar Aasen field data. The company pulled process data through their control system and most of the third-party equipment data bypassing the control system and going straight to the information management system (IMS).

However, there remained several other systems, usually inaccessible to the company, that held potentially valuable data, such as work orders, work permits, document systems, HMS information, etc. Combining these sources would vastly enrich their solution.

SOLUTION

The control system provider turned to Cognite, whose cloud-native industrial data platform was already in operation across Aker BP's assets on the NCS.

Cognite Data Fusion offered the capability to collect, clean, and contextualize more various kinds of data automatically and without space limitations. With Aker BP's authorization, the company redirected their system to read the company's data from the CDF, including data types that had previously been outside of the company's scope.

For Ivar Aasen, this meant 150,000 time series, 20 billion data points, 400,000+ documents made available through a single, secure point of entry.

The control system provider estimates that attempts to run point-to-point integrations with all the individual source systems and ingest their data would have taken about 1,500 hours. The process of integrating with the CDF alone – pulling in all the same data – took only 200 hours. And a lot of that time was actually spent looking at the data and deciding how best to visualize it.

IMPACT

Artificial intelligence, machine learning, and tested algorithms are what make the IMS visualizations intuitive and effective. With rapid access to live and historical data, regardless of original source or format, via the CDF's single point of entry, the control system provider was ready to present its powerful processing, analysis, and display capabilities to Aker BP.

ARMED WITH THE POWER OF PREDICTION, THEY CAN ALSO

Boost safety by limiting the number of human personnel on the platform

Order fewer replacement parts and reduce the "just in case" stock

Deploy the right crew and tools when maintenance needs do arise

Bring down the cost of the consequences of equipment failure (i.e., unplanned downtime or production slowdown)

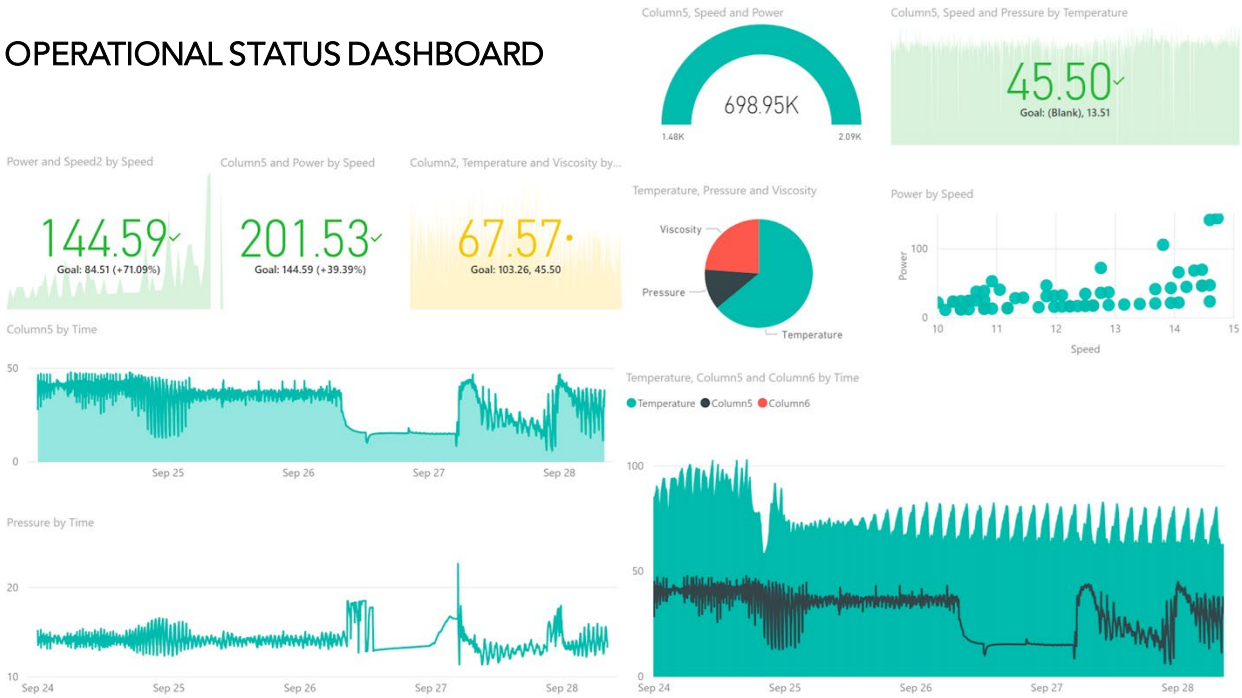
Especially in offshore environments, condition-based maintenance (and eventually, predictive maintenance) has the potential to revolutionize business models and reduce bottom lines.

How Cognite Data Fusion integrated Power BI's quick, off-the-shelf visualization

CHALLENGE

Over the last few years, off-the-shelf visualization from the likes of Power BI, Tableau, and TIBCO Spotfire has gained popularity. However, they are often not readily available to everyone in an organization.

OPERATIONAL STATUS DASHBOARD



SOLUTION

Cognite Data Fusion can make this technology available to all. Cognite developed a simple Power BI integration that allows any authenticated user to leverage the Power BI interface connected to Cognite Data Fusion via an authentication key. From there, the user can utilize the primary time series engine, as well as any other data they are permitted to access on Cognite Data Fusion.

IMPACT

Today, large-scale data visualization is available to all necessary users in the organization. In a simple browser view. This enables instant access to easy use cases, fueling creativity and innovation.

How Cognite Data Fusion enabled Framo and Aker BP to transition to a new smart service contract

CHALLENGE

Traditional industrial infrastructure has limited supplier relationships to a transactional format. The results include static reporting, uninformed maintenance schedules, and a waste of money and resources on both sides.

Framo is a global OEM providing pumps to the marine industry. Historically, they have been unable to access or leverage operational data for Oil & Gas. Data has only been made available for sporadic projects linked to specific, isolated events, such as equipment failure. If Framo were to have access to their clients' industrial data, past and real-time, they would gain the knowledge needed to improve and innovate on their existing products and services.

IMPACT

Now that real-time data is instantly available, users can experiment with advanced analytics and machine learning to deliver an improved performance and new products.

This new way of working lays a foundation for redefined business models, allowing OEMs to move from selling equipment to service-based offerings.

SOLUTION

Working closely with Aker BP, Framo utilized Cognite Data Fusion to access Aker BP's industrial data. With API access to Cognite Data Fusion, Framo was able to inform their product development.

Integrating with Aker BP's ERM system, they could set work orders and enable a feedback loop with design and engineering. From there, Framo was able to develop and launch more effective, service-based models informed by real-time data.

-30 %

Reduced maintenance

-70 %

Reduced shutdowns

+40 %

Increased pump availability

How Cognite Data Fusion enables quick maintenance overviews of critical equipment

CHALLENGE

Aker BP's offshore and onshore maintenance organization meets every Wednesday to discuss how to prioritize the maintenance of critical equipment on all its installations over the next week. In order to run an effective meeting, the organization creates and distributes a spreadsheet ahead of time that gives attendees an overview of the maintenance status of critical equipment.

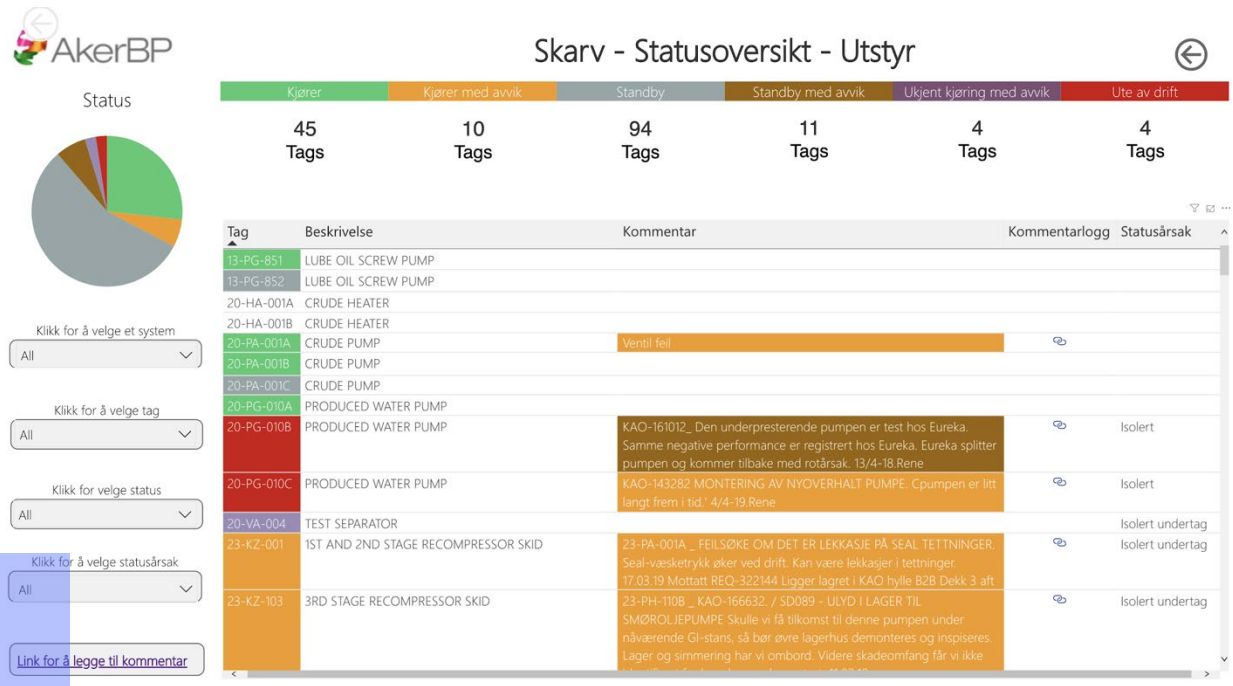
Assembling the spreadsheet is a cumbersome process that takes up to 15 hours a week, as the engineers responsible for it have to access a number of different systems to collect the required information, including lube oil charts, time series data, and maintenance work orders.

SOLUTION

Cognite liberated and contextualized data from four different source systems, streaming them in real time to a Power BI dashboard. The dashboard uses color-coded labeling to help the offshore and onshore maintenance organization decide where to focus its maintenance resources for the next week and discover opportunities for future maintenance work.

-15 hours

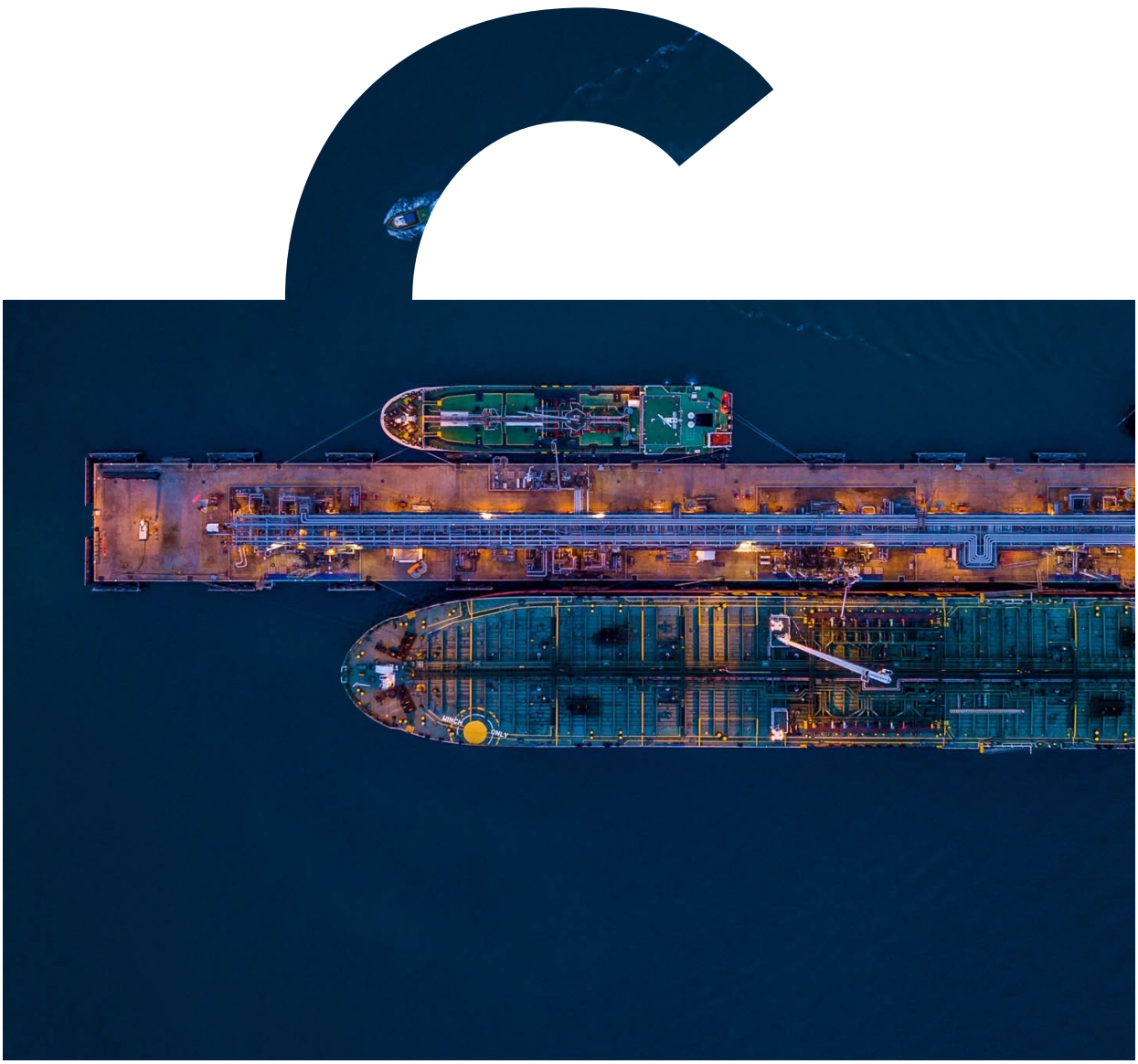
Time saved from automating data collection



IMPACT

The maintenance overview dashboard reduces the time that the offshore and onshore maintenance organization spends preparing for its weekly meeting, enabling the organization to focus on setting its maintenance priorities. In addition to providing an overview of critical equipment, the dashboard also allows for deep dives into individual work orders to find relevant information such as estimated time to completion.

Beyond reducing time-consuming administrative work, the dashboard helps Aker BP's larger maintenance and operations organization get an overview of the status of critical equipment, which makes operations more efficient.



HOW COGNITE SUPPORTS YOUR PURSUIT OF SMART MAINTENANCE

Smart Maintenance is the path to the next generation of equipment monitoring and maintenance operations.

Powered by future-proof technology designed to accelerate bottom-up digital transformation, Smart Maintenance secures both short- and long-term value generation for companies in heavy-asset industries.

Companies are already collecting the data needed to power this transformation. What they need are solutions that turn the data into liberated, usable, and shareable information.

THAT'S WHERE COGNITE'S SMART MAINTENANCE SOLUTION CAN HELP.

It begins with Cognite Data Fusion. CDF liberates a wide variety of industrial data from separate, siloed source systems, then automatically structures the sensor data in relation to the rest. This contextualization step makes data available in a way that's intuitive to the human user and to the algorithms at work behind the applications revolutionizing maintenance work today.

Asset Data Insight is one example of what companies can do with their contextualized data. With the ability to see all their industrial data in one unified interface, companies can rapidly scale their Smart Maintenance capabilities, creating one model for one component and then rolling it out to cover an entire installation.

But technology alone won't bring about this digital transformation. Our subject-matter experts will sit side-by-side with your own experienced staff to figure out what will deliver the most value for your organization. Together, we will streamline the Smart Maintenance use case process – from identification through delivery – so you can create end-to-end digital value in your operations as quickly as possible.

We'll tap into our ecosystem of partners to find the ideal partners to build models and supply analytics, ensuring that solutions get up and running quickly and continue to generate value.

Simple use cases such as those detailed in this white paper highlight the power of Smart Maintenance. By liberating and contextualizing data that previously was locked away in silos, companies in heavy-asset industries can slash the time it takes to complete routine maintenance process by more than half, increasing uptime and avoiding multimillion-dollar production losses.

The real potential of Smart Maintenance is in what we can build together. Get in touch with us today to start exploring the possibilities.

ALL ABOUT COGNITE

Our Vision

An industrial world powered by data and algorithms, freeing human creativity to shape a productive and sustainable future

Our Team

Cognite is a global software company supporting the full-scale digital transformation of heavy-asset industries around the world, from the U.S. to Japan to Austria to New Zealand. Our impressive interdisciplinary team includes more than 250 of the best software developers, data scientists, designers, 3D specialists, and industry professionals.

Together, we have built Cognite Data Fusion (CDF), a software package that empowers companies in industries like Oil & Gas, Energy, Shipping, and Manufacturing to extract value from their wealth of existing data by transforming it into useful information. CDF supplies data contextualization as a service, delivering reliable, meaningful data to industrial applications that increase safety and efficiency and drive revenue.

Curious about Cognite? Call on us!

These are just a few of our 250+ industry and tech specialists, all proud to be shaping the future of Oil & Gas.

Sander van der Meer Director of Executive Sales and Business Development

Sander spent 25 years in O&G and Power Generation with companies such as General Electric, Bently Nevada, and Emerson, working in engineering, services, and leadership roles. A former mechanical and control and monitoring systems engineer, Sander specialized in large rotating equipment such as turbines, compressors, and generators.

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Dr. Paula Doyle holds a PhD in Industrial Automation from the University of Limerick, Ireland. She has spent the last 15 years working in a variety of roles within the Oil & Gas industry, for ABB and Siemens, both in Norway and the Middle East.

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Jarle Skrebergene VP of Customer Success // EPC

Before joining Cognite, Jarle worked in Management Consulting in Arkwright and Deloitte and Business Development in Kongsberg Gruppen. He also specialized in EPC projects in Kongsberg Oil & Gas. Jarle holds an M. Sc. in Industrial Economics from NTNU.

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Marius Biermann Director of Customer Success in Industry Solutions

Marius started his career in the O&G service industry, first with Aker Solutions and later Schlumberger. Before joining Cognite, Marius spent three years as a management consultant in Arkwright Consulting. Marius holds a M.Eng. in Mechanical Engineering with Management from the University of Edinburgh.

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Jake Bouma Director of Condition Monitoring Services in Industry Solutions

With a background in nuclear physics and experience building data science teams across a number of industries, Jake has spent the last two years focusing on industrial equipment and predictive maintenance, seeing advanced analytics through from development to production.

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Anna Olsson Director of Partners and Alliances

Anna has held a diverse set of solution sales, product marketing management, business development, and leadership roles over her 20+ years in the software industry. She has a degree in Information Technology and started out her career as a developer. Today, Anna and her team focus on enabling a thriving partner ecosystem.

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Tatiana Moguchaya Vice President of R&D

Before joining Cognite, Tatiana worked with Schlumberger, managing the world's leading E&P software development, and with Microsoft – managing Norway's largest business areas to accelerate digital transformation with cloud, analytics, and big data. Tatiana holds MSc in Computer Science, Mathematics and Physics.

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