

Advanced Analytics, Machine Learning, and Situational Awareness for Manufacturing Data

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Keywords

Advanced Analytics, Machine Learning, Digital Analytics, Digital Transformation, Process Analytics, Self-service Analytics, Seeq, Data Cleansing, Process Historian, Real-time Data Historian, Artificial Intelligence

Summary

Advanced analytics is a key innovation for digital transformation. Most companies want to find solutions to empower their employees to quickly find insights, rather than waste a lot of time searching for, filtering, and cleansing the available data. They want smarter, easier-to-use tools and solutions that can help their employees – including subject matter experts (SMEs), engineers, and managers – find, understand, and take actions to solve their day-to-day problems.

[Seeq Corporation](#) recently briefed ARC Advisory Group about new enhancements and features of the company's advanced analytics applications that enable insights on manufacturing data, increasing data discovery for collaboration and data-driven decision making. Seeq applications are transforming the industry with some unique capabilities and enhancements already proven across multiple use cases.

While many industrial companies are rolling out pilots and enterprise analytics projects, it is important for users to understand the features and capabilities of the analytics offerings. The analytics technology suppliers are improving and enhancing capabilities and taking advantage of newer technologies; open source, time-series databases; Big Data and machine learning; better connectivity; and new platforms to improve ease of use. But, as

a user, how do you know what features and capabilities are important? Can you connect to the data sources you need easily? Can you easily repair or cleanse data that is bad? What algorithms do you need? What questions should you ask? Perhaps most importantly, does the solution apply to the specific needs of process manufacturing industries?



The Problem

Most process industry companies have collected years of time-series historical data from thousands of data points, but lack a solution to analyze the data quickly and effectively. This can make it challenging to not only find insights in the data but also to predict outcomes. Additionally, it is difficult to determine value or have an impact on the outcome of in-process batches or processes because it takes so long to find the insights.

The Solution

Using advanced analytics to dig into production data can help operators, engineers and managers identify where variability might be occurring in the process. Seeq Corporation, formed in 2013, provides an advanced analytics solution for manufacturing data that accelerates insight for industrial companies that are “drowning in data and starving for information.” Seeq designed its applications to be intuitive and visual. They leverage innovations in Big Data and machine learning. Seeq is being used to solve a variety of industrial problems across many different industries and the company can point to a relatively large number of use cases.

Organizations are using Seeq to find insights that improve production and business outcomes that typically affect yield, quality, uptime, and safety. Seeq can be used to cleanse the data, analyze and determine process issues, and then report and share the findings with other employees. The application is easy to use with interactive trending, charting, annotations, and searches. Seeq works with all leading storage platforms for time series data without having to move, duplicate, or transform the data and – according to the company - provides a comprehensive solution with features for monitoring, collaboration, scripting, and integration with business intelligence applications. Historical data can be accessed from the real-time database (such as OSIsoft PI) or read into Seeq in near-real-time as the data arrives in the historian.

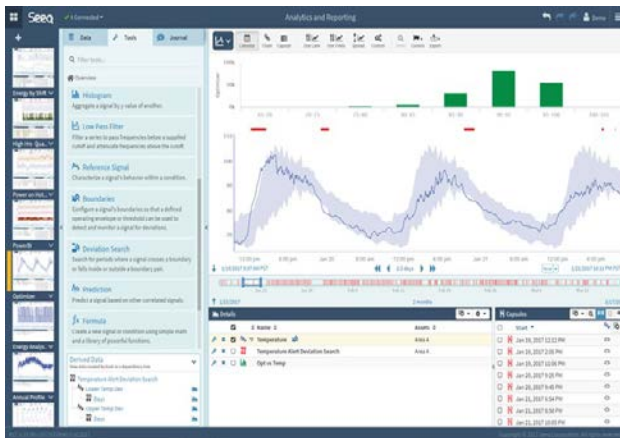
Supporting multiple historians or data stores simultaneously avoids the need to duplicate data to contextualize, wrangle, or harmonize the data, which typically requires manual effort and can add costs by increasing data storage requirements and bandwidth consumption.

Capabilities and Enhancements

Seeq releases new versions every quarter adding enhancements, features, and support for new use cases. In its latest product release, Seeq has added Organizer and Workbench features for publishing and organizing analyses (e.g., time index by batch). The company has also added new machine learning algorithms and a software-as-a-service (SaaS) offering on Microsoft Azure. Seeq's latest product release also enables access to more data systems. According to the company, the new release provides the capability to expand "from being the eyes in the plant, to the eyes of the business enterprise-wide."

Seeq Workbench

Seeq Workbench addresses the challenges of time-series data by eliminating hours and days of subject matter expert (SME) time that would otherwise



Seeq Workbench for Historical, Near Real-time, and Predictive Analytics

be required to find insights in process operations and manufacturing data. A digital display pane enables the user to easily overlay "capsules," making it easier to compare historical data, production runs, and other differentials. Data in the Seeq display pane can be customized, aligned, and annotated. Time periods can be captured in capsule time displays and other charts such as scatterplots and histograms – all in an easy-to-use format. Views are based on conditions or changes in boundary conditions which are defined

by the user, such as an asset state, or time period like a shift, weekday, or weekend.

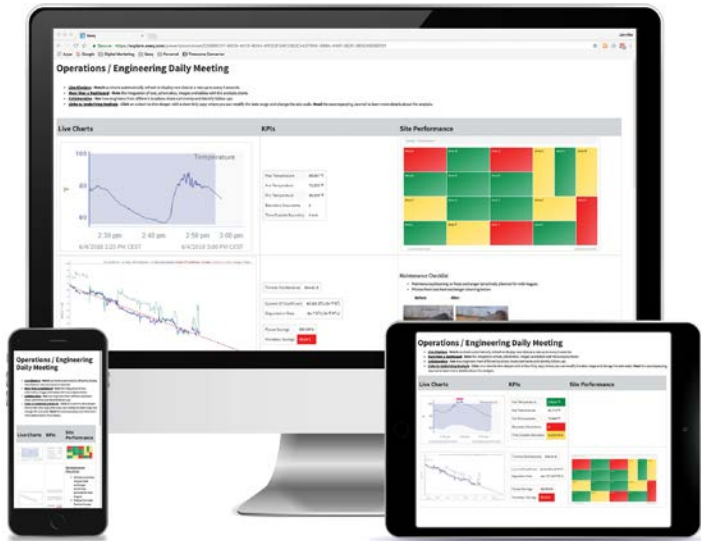
Other Workbench features include:

- Collaboration features such as real-time screen sharing with colleagues and the ability to easily share workbooks
- Support for easier knowledge capture: searchable documents that describe an analytics effort and re-use formulas and searches
- Additional integration with products such as the OSIsoft PI System (including the ability to read and write Asset Framework data), and Inductive Automation's Ignition SCADA system

- Ad hoc calculations with integrated formula editor
- Extensibility with business intelligence tools like Microsoft PowerBI, Tableau, and Spotfire
- A complete REST API for integration with SDKs for both programming (C#, Python, Java) and statistics (R, MatLab) products

Seeq Organizer

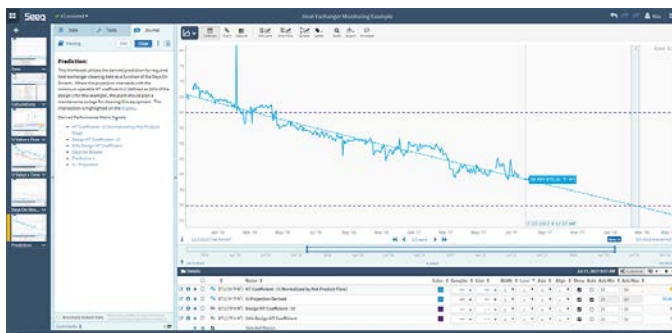
Seeq Organizer enables users and managers to publish time-relative summaries of Workbench analyses with updates that link back to the original



Seeq Organizer Can Publish Workbench Analyses to Users on Any Device

data simply by clicking on the link and drilling down. Organizer enables users to publish analyses through web-based PDF and near-real-time web charts for organizational access and execution on the insights. Organizer documents may include any number of elements, including rich text, images, and a variety of Seeq analytics – scatterplot, trending views, bar charts, and scorecard elements. They are used in anything from daily stand up meetings to weekly or monthly reports, or summaries that are generated at the end of a batch or process. Additional features include

the ability to access Seeq analyses and explore the data further from any device and on any format (mobile device, tablet, mobile phone, etc.)



Users Can Predict What Will Happen in the Future

Seeq uses machine learning (ML) models such as regression, principal component analysis, and other algorithms to analyze data relationships and contributing factors. The application can also integrate any ML or artificial intelligence (AI) algorithm or model with Azure ML Studio, Python (using Seeq REST API), or other third-party AI offerings, such as SparkCognition and Falconry.

Users may also deploy first-principle models based on operating boundaries and modes and excursions from the operating envelope. Another supported option is statistical process control to determine expected operating boundaries and predictive algorithms for determining what will happen within the boundary conditions. Seeq Organizer can be applied to large sets of assets and enable the user to see all assets in one view. Additionally, the user can drill down to the problematic asset using a tree map or other tool.

Data Quality: Finding Good and Bad Data and Knowing the Difference

Unlike the stock market, past plant performance is typically a strong indicator of future performance. Looking back at historical data can often



Seeq Can Be Used to Fix Data Gaps or Dropouts, Smooth Data and Model Data Gaps

provide additional insight. Identifying which operations had issues and reviewing the production data enables users to identify critical process parameter (CPP) profiles. These can then serve as indicators of future performance or provide insights for better real-time process decisions.

However, bad data in equals bad information out. As Michael Behounek,

Senior Drilling Adviser at Apache Corporation remarked, *“Data quality is key to any simulation or modeling project. If your data is not valid, then your models do not and will not work. The Seeq application promises to enable our engineers to speed up the data cleansing step before populating our models. We have a lot of*

data and want a reliable method to move forward.” Seeq users can quickly define what good data is from the dashboards and fix gaps, remove outliers, etc.

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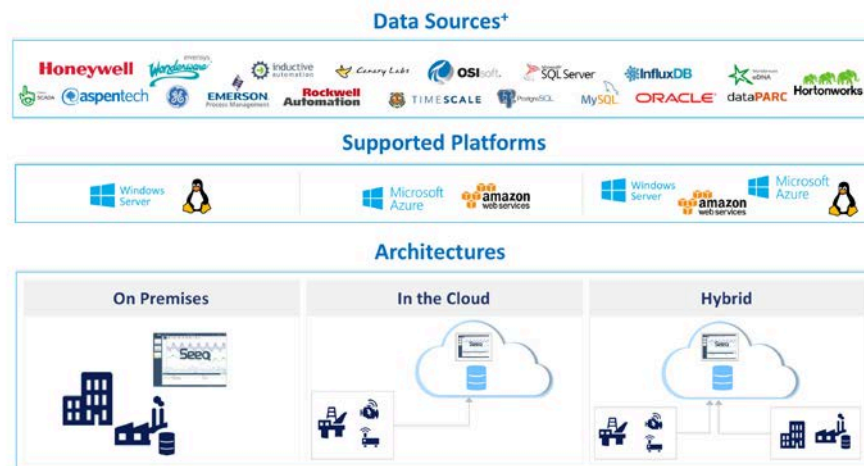
The software uses machine learning to replace bad data with predicted “good” variables based on the data model. For example, when someone is cali-

brating a sensor and sets it to manual, the data flatlines and generates “bad” data that does not reflect the actual process. Seeq can predict what the values should have been if the sensor had not failed or was not being calibrated and fills in the data gaps using predictive analytics.

Data Connectivity

Data connectivity continues to be a factor for analytics because of the diverse data sources and many new sensors. Seeq can connect to and present data from one or many different data sources, including historians and other time-series data sources.

Seeq can connect to many different data sources including many real-time databases such as OSIsoft PI System, AVEVA/Wonderware Historian, Honeywell Uniformance PHD, Emerson DeltaV and Ovation, Inductive Automation's Ignition, AspenTech IP 21, and GE Proficy. Seeq also has connectivity to open source systems such as InfluxDB and Timescale and HortonWorks, and a connector SDK to build additional connections to manufacturing and business applications such as EAM, ERP, MES and other systems.



Seeq Connects Data from Most Historians and Other Data Sources

Extensible and Scalable

Seeq has connectivity to relational data sources (such as MSFT SQL Server and Oracle), CSV files, and support for a variety of business intelligence tools such as Excel, Power BI, and Tableau. The software has a full-featured scripting environment for formulas and calculations that can be scaled up or out to handle complex calculations. A REST API also supports all Seeq capabilities and includes SDKs for C#, Python, Java, and other analytics programs like R and MatLab.

Ease-of-Use Technology with Self-Service Tools

Seeq has a reputation for being easy to use and intuitive for the users - operators, process engineers, SMEs, data scientists, and plant managers. The company's goal is to empower organizations with self-service tools that can help them get more value out of existing data and improve operational efficiency. The information can be easily shared and used to notify the right person at the right time.

Seeq can be used to find data correlations, relations with other data, data clustering, and analysis and send the results to the right people in the right format. Being able to easily find correlations by time, limits, or patterns using high-value algorithms and Azure Machine Learning Studio (and making the results available in contextualized language text) can save hours of engineering work.

As an HTML 5 application, Seeq can be used in any modern browser and uses a workbook/worksheet to save the information. Its Google-like search engine allows users to quickly find data and analyze and display the results for any time period.

Partnerships

The company's technology partners and SI partners around the world include Alkemy Innovation, Casne Engineering, Dimension Software, and Radix (all were at OSIsoft PI World). Process automation vendors are also starting to embed Seeq into their products, such as the Schneider Electric EcoStructure Profit Advisor.

The company's use cases span a variety of process industries, including pharmaceuticals, water utilities, power generation, renewables, and oil & gas.

Summary and Recommendations

Seeq applies its innovative analytics and machine learning technologies to empower all types of users to transform industrial process data into useful information and actionable intelligence to improve execution, drive down costs, and increase earnings.

Given the challenges that most industrial companies face today to improve production and compete globally, the focus for using analytics should be on

the user experience and gaining actionable insights from process data. Solutions should be intuitive and designed for operating and manufacturing companies and the unique challenges of the data and workers.

Leveraging both the expertise of the engineers and machine learning innovations, leading-edge solutions like Seeq can enable organizations to gain intelligence from operations and obtain business value very quickly.

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While many advanced analytics are complex to set up and use – requiring a data scientist – Seeq designed its software to be easy to use by a variety of employees in a plant, making it easy for them to find insights in their data, without having to involve the data scientists.

Regardless of the technologies used in data analytics applications, the goal should be to make the solution accessible and provide insights to users who may not have extensive data science expertise. This is what Seeq is all about.

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