Bently Nevada
a Baker Hughes business

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Integrated Asset Performance Management …an introduction to analytic insights

Asset performance data is traditionally siloed and disconnected from the greater asset management ecosystem. This rich performance data lives in separate databases on the Plant Operations network, making it difficult to access. Bently Nevada delivers asset performance management (APM) solutions through our flagship System 1 Integrated APM software platform. System 1 seamlessly connects to a comprehensive suite of inhouse designed and manufactured edge sensing and protection devices in addition to 3rd party data sources and software applications. This rich technology framework digitally connects the traditionally siloed functions of Asset Strategy Management (ASM), Asset Condition Monitoring (ACM), and Maintenance Work Execution with the greater ecosystem of Industrial Asset Management applications. This connected ecosystem enables System 1 customers to maximize productivity through intelligent risk-based reliability management.

Analytic Insights use the data unified by System 1 Integrated APM to drive efficient work prioritization, case management, and work execution across a customer's enterprise. This solution provides operators with a robust connection gateway with standard cloud to cloud interfacing, enabling seamless interoperability from the Integrated APM solution to Enterprise Asset Management (EAM) and artificial intelligence (AI) platforms. Please see our introductory article on Integrated Asset Performance Management for more details on ASM, ACM, Defect Elimination and Work Execution.

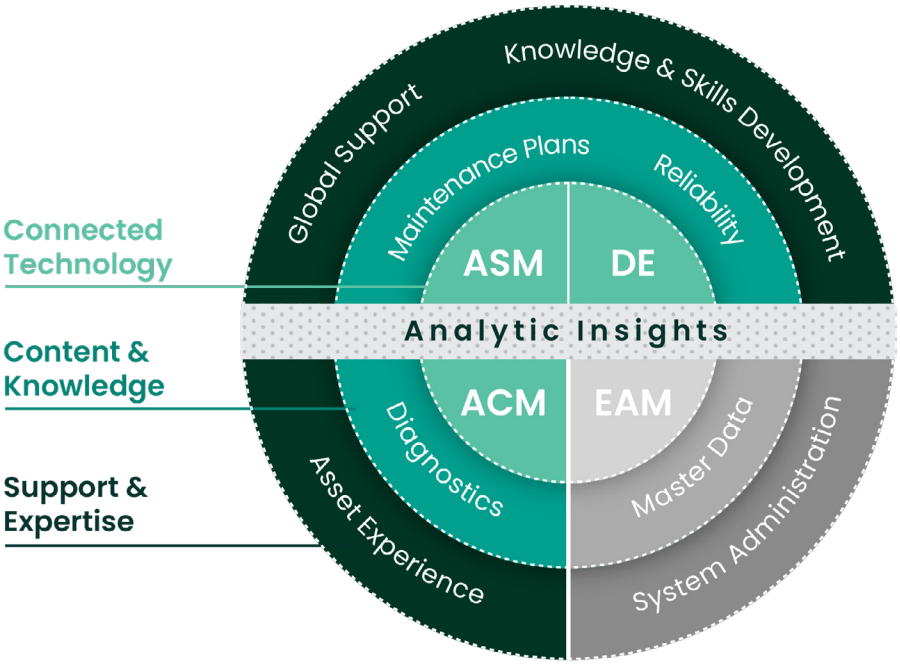


Figure 1. System 1 Integrated APM Ecosystem

System 1 analytic insights

Analytic Insights utilizes data collected by System 1 to provide users with a suite of analytics solutions developed to solve complex problems. These solutions enable predictive alerts for asset health and leverage advanced analytic techniques bolstered by physics-based failure mode categorization.

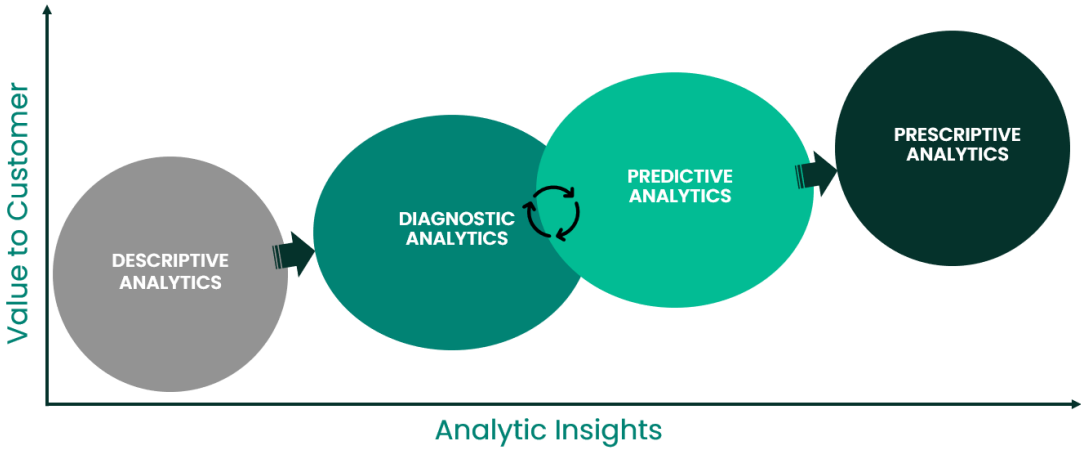
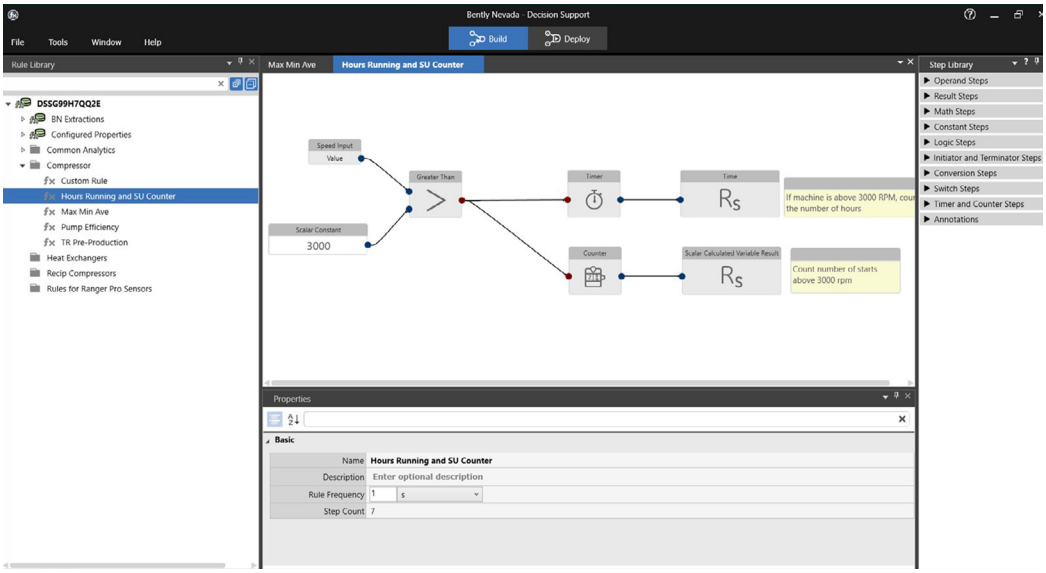


Figure 2. Four Types of Data Analytics

Traditionally over the past 20 years, System 1 analytic capabilities have focused on descriptive and diagnostic analytics, leveraging high resolution data and a first-principles approach to detect and alert machinery faults and failure modes. The System 1 Integrated APM framework provides data reconciliation across traditionally siloed System 1 servers. Access to this central database expands analytic capability and introduces the opportunity to use machine learning and artificial intelligence for quicker and more scalable insights. Analytic Insights provides users the ability to create and deploy their own rules, but also has a suite of pre-packaged analytic offerings.

Decision support developer

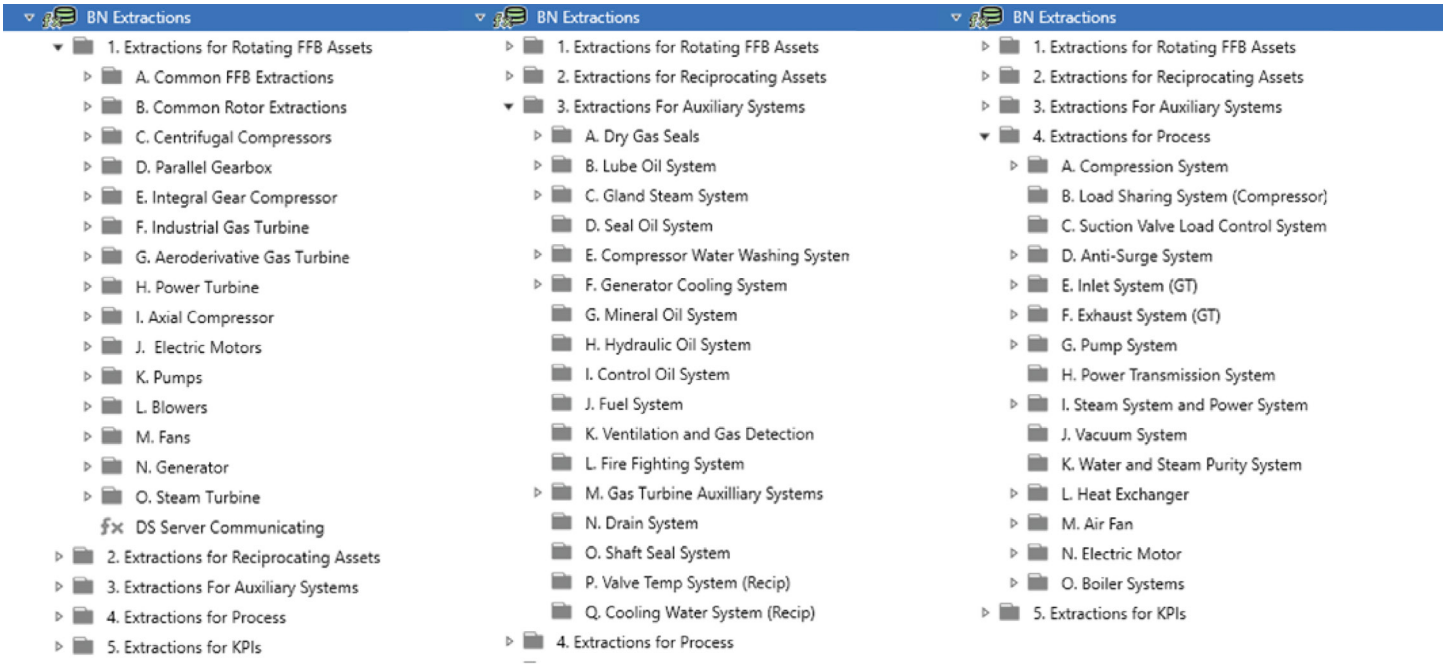
Decision Support Developer allows users to create custom analytics to detect changes in machine and/or process response, operational KPI's such as: machine running time, count of startup/shutdown events, performance data, failure mode detection, and many other insights where automated analytics are required. The Build environment of Developer has been designed as a no-code/low-code interface to allow end users, with a variety of backgrounds, to create analytics and understand analytics created by others. The simplicity of creating, deploying, and modifying analytics does not require a background in programming languages. Developer can be deployed on the control network and / or business network.



Decision Support Developer Build Environment Displaying a Running Hours and Startup Counter Rule

Embedded Extractions

Developer includes a library of pre-configured rules called extractions. The extraction rules use the same Bently Nevada methodology taught to our customers and machinery diagnostic personnel, combining measurements, statuses, reference values, and configured properties, to produce a simple set of values that physically represent the behavior of the asset. These rules are available to the end user to gain new insights into the behavior of machines, auxiliary systems, process conditions, and KPI's. The Extraction Library includes approximately 400 pre-built extractions:



Decision Support Analytics

Decision Support Analytics are pre-packaged analytic offerings that can be deployed on-premise or on the cloud via System 1 Integrated APM that solve problems focused on specific asset health and performance known failure modes. Bently Nevada organic solutions as well as solutions developed with partners (i.e. BHC3) make up the pre-packaged analytics. The solutions leverage 60+ years of Bently Nevada experience and are designed to detect failure modes and provide health insights for a variety of equipment types.

Capabilities & benefits:

- Eliminates tedious manual review of data to identify problems allowing end user staff to increase productivity
- First principle approach delivers actionable information to operators and personnel rather than statistical probabilities and intermediate results
- Ensures anomalies do not go unnoticed though continuous and automated review of data
- Ability for end users to modify Bently Nevada algorithms to meet unique business requirements or diagnostic approach

The below highlights a partial list of assets covered by Decision Support Analytics:

- Industrial Gas Turbines
- Axial & Centrifugal Fan / Blower
- Aeroderivative Gas Turbines
- Gear Box
- Power Turbines
- Generator
- Centrifugal Pumps
- Integral Gear Compressor
- Electric Motors
- Steam Turbine
- Axial & Centrifugal Compressors
- API Reciprocating Compressor

Expanding analytic insights:

Bently Nevada is expanding our Analytics library and capabilities to include the use of machine learning and artificial intelligence to build new Analytics with enhanced features and capabilities. By combining best practices from our proven first principle approach (leveraging Decision Support Extractions & failure mode detection) with artificial intelligence and machine learning, Bently Nevada will offer enhanced Decision Support Analytics supported by 60+ years of deep domain knowledge. Two examples include the Bently Performance Analytics (for thermodynamic performance monitoring) These solutions, tied to the Integrated APM enterprise layer, will be released in Q1 2022 as cloud-based analytics. While these solutions currently exist in the Bently Nevada portfolio for on-premise applications, the new System 1 technology stack and approach allows Bently Nevada to provide additional capabilities requested by global customers including:.

- Data reconciliation
- What-if analysis

These solutions add new benefits as they're able to replace missing or invalid input data utilizing machine learning. Customers can also evaluate what-if scenarios in an easy-to-use dashboard.

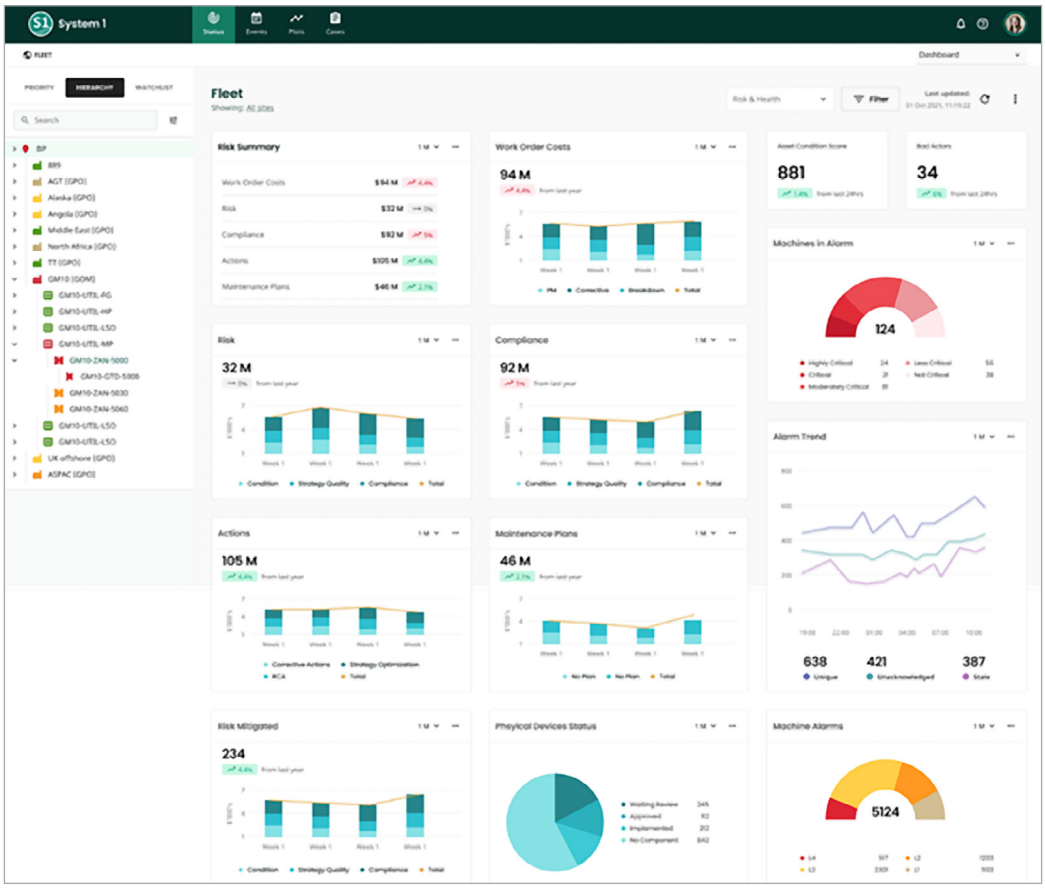


Figure 3. System 1 Integrated APM web-based KPI Dashboard

In addition to Bently Nevada organic solutions, the Analytic Insights pillar includes analytic solutions developed with partners. Bently continues to partner with C3.ai to bring integrated System 1 + BHC3 solutions to our customers. Specific trials this year have been focused on establishing streaming connectivity between the two applications and using the high-quality data acquired by System 1 to feed BHC3 Reliability models.

On October 26th, Baker Hughes announced an investment and multi-year commercial alliance with Augury, a leading machine health solution provider. For a review of this announcement, please click here. The alliance with Augury will bring a new capability to the Bently portfolio, specifically focused on scalable monitoring and detection of balance of plant equipment. The Augury solution combines sensors with powerful AI capabilities and collaboration tools to help teams understand which machines are at risk and when.

Closing remarks

Analytic Insights serves as a functional capability pillar that extends across the products that make up the System 1 Integrated APM ecosystem. Analytic capability at the edge and enterprise levels allows us to solve customer problems independent of their architecture. The focus is to create value by:

- Providing both on-premise and cloud-based analytic solutions
- Offering various capabilities and options that are fit-for-purpose to solve customer problems via first principles, modeling and machine learning and artificial intelligence
- Integrating data from multiple sources for enhanced insights
- Simplifying implementation time for analytic solution on lower cost-of-failure assets

Analytic Insight solutions will be offered as part of System 1 Integrated APM ecosystem to leverage data from critical data sources and produce visualization inside one comprehensive solution. Bently Nevada continues to expand our analytic capability to solve complex customer problems. Stay tuned for analytic solutions coming to the market in 2022 and beyond

Hayley Stephenson

Senior Product Management Manager
Bently Nevada, a Baker Hughes company.

E hayley.stephenson@bakerhughes.com

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