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System 1* Evolution - Part 1

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System 1* Evolution – Iteratively Designing a World-Class Condition Monitoring Solution

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Where are we today?

Background

GE's Bently Nevada released Version 1.4 of the System 1* Evolution (Evo) Software in January 2015. This progression demonstrates the continued investment in our next generation condition monitoring (CM) platform that is building and expanding off the highly successful System 1 Classic and Ascent solutions.

This new version represents a substantial step forward in terms of usability, capability and accessibility. We would like to thank our engaged user base for partnering with us to drive a lean and iterative product development process!

Current Solution Offering

The latest version of System 1 Evo rounds out the core capabilities required to operate a comprehensive walk-around condition-based maintenance (CBM) program leveraging Bently's line of portable data collectors (PDCs).

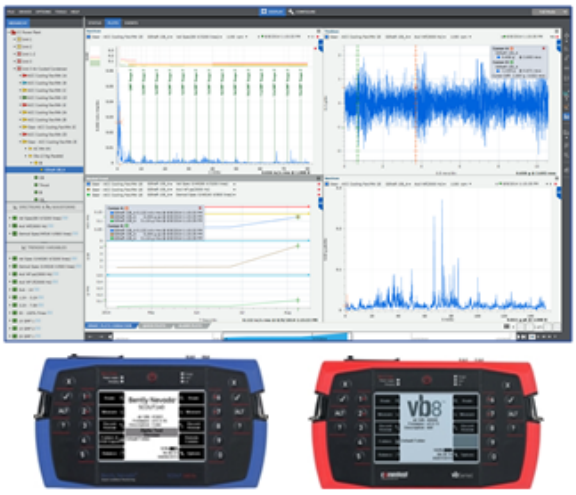

Figure 1: Evo with PDCs

Key Capabilities Added in Version 1.4

- Client/Server Deployment
- Database Backup/Restore
- Copy and Create New Database
- Wet and Dry Screw Compressor Models
- Spectral Band Bar Graphs
- Remote Communication with PDCs
- Ethernet Communication with PDCs
- Export of Views with Copy/Paste
- Configurable Number of Cursors

Leveraging FastWorks to Implement User-Driven Product Development

The FastWorks Process

System 1 Evo development is following the FastWorks design process, which is summarized in Figure 2. This process puts a heavy emphasis on defining a clear problem statement, continuous user research and validation, and pragmatic decision making. The strength of this engineering practice is quick release cycles and continuous involvement with users; they are an extension of the engineering team. Who better to help shape requirements and validate the product capabilities throughout the development cycle than actual end-users?

Applying FastWorks to System 1* Evo

Identifying an Opportunity

For many years, there had been a strong pull from Bently Nevada's install base and prospective customers to provide a best-in-class CM offering for general purpose equipment to complement the System 1 Classic CM strength for Turbo Machinery and Reciprocating Compressors. Market conditions and user feedback suggested that the existing solution required significant improvements to both hardware and software in order to achieve the right value proposition and bolster the adoption of System 1 as a plant-wide solution.

The identification of this opportunity coincided with our technical leadership’s recommendation to start work on the next generation System 1 Platform to leverage the latest advancements in technology. Delivering a best-in-class plant-wide solution thus became phase 1 of the System 1 Evolution program.

Conducting Initial Research

Before committing engineering resource to a new PDC hardware and software platform, an extensive user domain analysis (UDA) was conducted in order to understand the user’s ecosystem, work practices, preferred existing software platform, and CM requirements for general purpose equipment. Key findings from this research include:

- Existing hardware platform is out of date (Slow Data Collection, Non-Standard Measurements)
- Existing software platform lacks industry standard anti-friction bearing CM capabilities
- Existing software platform does not facilitate efficient CM database creation & maintenance

- Existing software platform is challenging to use, particularly for common daily tasks

Embracing Human Factors and Design Thinking

Developing a best-in-class solution requires more than a one-time research effort, particularly when it comes to creating a highly usable system that achieves smooth integration with existing work practices. Following the initial round of research, Bently Nevada hired human factors and user experience (UX) professionals to lead the user research and UX design components of product development going forward.

The science of conducting effective user research and design requires a cross-functional team capable of understanding the customer's economic considerations, the user's domain, and how to extract the requirements necessary to enable efficient work practices. The addition of these disciplines to the Bently Nevada technology team has greatly improved its ability to perform these tasks.

Infusion of Energy through an Acquisition

A key part of the FastWorks process is speed to market. In some cases a strategic acquisition can provide the right solution more effectively than developing it organically. This was certainly the case when GE acquired the Commtest business and added it to the Bently Nevada portfolio. Commtest is an innovative company with an excellent line up of products, people, and brand recognition that were already disrupting the established market space.

System 1 Evo, which merges the core strengths of the System 1 Classic and Ascent platforms will enable our customers to manage one software solution capable of best-in-class CM for the range of assets found in the typical industrial plant. Users will benefit from a single ecosystem with standard interaction models, whether they are monitoring a general-purpose pump with anti-friction bearings or a high-speed turbo compressor with hydrodynamic bearings.

Rolling Out the First MVP

The first Market Validation Product (MVP) was rolled out through a pilot program to several willing early adopter customers interested in partnering with Bently Nevada to help shape the future product. Filling the role of an early adopter is not easy, as it requires a substantial time commitment; the early adopter must be willing to use the MVP and provide clearly articulated feedback that can be assessed by the product manager and associated stakeholders. The early adopters selected for this program have been extremely engaged and continue to act as partners in the development of System 1* Evo.

Each pilot site was visited by members of the System 1 Evo stakeholder team to kick off the initiative and conduct additional UDA work, usability analysis, and requirement collection. The site

visit included installing the MVP software, configuring a pilot database, collecting data in the field and a cursory round of data analysis. After the initial kick off concluded, the program was continued remotely, allowing for ongoing feedback and feature validation.

While the initial pilot findings established that System 1 Evo had great promise, the collected feedback identified many missing capabilities and usability challenges. The goal of providing a best-in-class general purpose CM solution required iteration based on the feedback, and therein lies the beauty of the FastWorks process (Build-Measure-Learn).

Iteration

The FastWorks process of continuous iteration began immediately following the start of the pilot program. Stakeholders evaluated the feedback and adjusted the requirements for the next release accordingly. This ongoing effort involved maintaining close contact with pilot user's updating their software for each subsequent release, and continuing to validate features and functionality. The feedback kept pouring in, and as necessary, adjustments were made to the product and its backlog.

Version 1.4 of System 1 Evo represents over a year of iteration based on user feedback, and as a result of this collaboration the product has matured considerably. We will continue to engage users and iterate when necessary to ensure that Evo continuously improves and becomes a world-class condition monitoring solution.

What is on Deck for 2015?

GE's Bently Nevada has adopted the FastWorks process of development, where users play a centralized role in capability design and validation. We appreciate that ensuring value requires understanding the user's daily tasks, processes, and goals so that the solution can be designed to enable efficient work practices. System 1 Evo Version 1.4 represents a major milestone in this process by offering a comprehensive CM solution for general purpose equipment monitored by our PDCs.

While we will continue to expand the capabilities for general purpose equipment and iterate as necessary based on feedback, the primary focus in 2015 will be turbo machinery CM, the traditional strength of Bently Nevada's portfolio. The same rigor has been applied to user research and preliminary design for this next phase in the System 1 Evo development.

Key themes identified thus far pertain to how the solution co-exists within our user's ecosystem. A heavy focus has been placed on accessibility, where we intend to provide the option to replicate System 1 Evo data to the business network, deliver a mobile application, and provide the option for a web-based client. These new capabilities will be layered on top of a best-in-class CM solution with the user focus on capability and usability that should now be expected.

The first round of pilot testing for the turbo machinery offering will commence in 1H 2015, and we are currently in the process of identifying engaged users to participate in the program, contact your local representative if interested.