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A true ‘digital handoff’ can yield a horn of plenty

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We like to think of our enterprises as already threaded by fully digital processes. After all, we use e-mail, web conferencing and instant messaging every day. But e-mail with a PDF attachment is not a true “digital handoff” of information between departments.

It is a step above a plastic inbox with stacks of paper mail but still a far cry from the goals of a true structured digital communication for smart manufacturing—a communication that is published by one system and received and parsed automatically by several systems, including internal and external systems in the manufacturing value chain.

A better example of a structured communication is a news feed federated and published via RSS in a standard XML structure. The standard structure for these feeds enable subscribed sites to easily filter and aggregate data from multiple sources.

Smart manufacturing systems need these types of structured digital communications to enable new levels of automation and analysis. These digital handoff capabilities have been pursued under the title of the “digital thread” and have been spearheaded by the aerospace and defense industry. However, these concepts and technologies are gaining interest beyond A&D and are converging with the digitally connected ecosystem goals of smart manufacturing.

Digital Thread

The digital thread refers to the communication framework that allows a connected data flow and integrated view of the product’s data throughout its lifecycle across traditionally siloed functional perspectives.

The digital thread concept raises the bar for delivering the right information to the right place at the right time. In a digital thread, the product’s data “travels” along with the physical product and evolves through data collected at each step of its manufacturing process. By “travel” we mean that the data needs to be easily accessible at any time during production and referenceable to each product’s lot or serial number.

Today, there is a lot of manual interpretation, transformation, and translation of data between engineering and manufacturing systems. In addition to being inefficient, each

time data is manually converted from one format to another, it introduces a chance for misinterpretation and error. For example, in current processes, CAD models need to be manually converted to (a) computer numerical control (CNC) programs for machining, (b) coordinate measurement machine (CMM) programs for inspection, and (c) manufacturing execution system (MES) illustrated work instructions for assembly. During these manual processes, the associativity to objects in the CAD model is usually lost. When a CAD model revision comes down the pipe, the engineers and programmers must do a thorough review of the entire model to avoid missing anything instead of concentrating with confidence on a few highlighted revised areas. In future processes, with structured digital handoffs, systems will be able to easily highlight revisions, do impact analysis on downstream programs and instructions, and facilitate the automated incorporation of changes.

The digital thread will provide a formal framework for the controlled and automated interplay of authoritative technical and as-built data with the ability to access, integrate, transform and analyze data among disparate systems throughout the product lifecycle. The scope includes as-designed requirements, validation and inspection records, as-built records, and as-tested data. For some products, the thread will continue into the product's service life.

A digital thread is expected to:

- Improve product quality by avoiding mistakes in manual translations of engineering specifications;
- Improve the velocity of new product introductions and the communication of engineering changes along the product value chain;
- Increase the efficiency of digitally capturing and analyze data related to product manufacturing, and
- Let manufacturers deliver new services to customers along with physical product.