Harnessing the Power of Big Data for Digital Manufacturing

by John Hubert and Chad Markle

In our introductory article about the Birth of Digital Manufacturing, we provided a glimpse into the future – our view of what the world of digital manufacturing might look like ten years from now. In that view of a potential future, fictional CEO Connor Smith described Entity-X's remarkable transformation from a small fabrication plant to a thriving multi-billion-dollar company producing smart connected products for businesses and consumers. Key to that transformation was Entity-X's smart use of data, which fundamentally impacted all phases of the product's entire lifecycle, from ideation, to design, to manufacturing, to in-field support.

Our story is not just fiction. These changes are already happening – companies are already taking advantage of the confluence of emerging new technologies such as IoT, Cloud computing and big data to gain new insights and provide compelling new products and services. Of all these new technologies, big data may prove to be the one with the broadest impact on the largest number of companies. More than likely, your company will face not only exciting opportunities for innovation, but also terrifying threats to your business.

So, as a leader of engineering, manufacturing or operations, what should you do?

What is Big Data?

Big data is any data that’s too big to be handled by traditional database technologies, where the bigness is measured along three primary dimensions:

1. **Volume** – The shear amount of data to be stored and processed
2. **Velocity** – The required speed of data flow, including input/output, processing, and storage
3. **Variety** – The variability (and unpredictability) of the kinds of data to be stored and processed

For example, consider the GE Durathon battery plant that collects data from more than 10,000 sensors in real time. This system has high Velocity due to the data being generated and processed at a rapid rate, high Volume due to massive amounts of data accumulating over time, and high Variety due to different sensors generating many different data formats.

Traditional database technologies simply can’t handle the extremes along any of these three dimensions, so entirely new types of technologies have emerged over roughly the last 15 years, with more emerging rapidly. And there is no one-size-fits-all technology – different kinds of big data problems require different kinds of solutions, and in most cases a mixture of solutions is required. For example, maybe the battery plant has different databases for real-time control of operations vs. batch processing of analytics.

As the Volume, Velocity and Variety of data continues to explode, so does the array of big data technologies. In fact, according to a recent IDC forecast, the Big Data technology and services market will grow at a 26.4% compound annual growth rate to $41.5 billion through 2018, or about six times the growth rate of the overall IT market.

What does all of this mean to you? As you work to define and execute your big data strategies and plans, you will likely continue to be faced with a rapidly changing technology landscape, with new problems to be solved and new technologies presenting new opportunities for innovation.

Educate Yourself

Of course you’ve been hearing all the buzz about big data for several years now, but do you really know what it means, what kinds of problems it can solve, and what opportunities it presents to your company? Do you have a deep understanding of what your company and other companies are already doing with Big Data? These are important questions to answer, and they are moving targets, so you need to get educated and stay educated.

Establish a Cross-functional Big Data Team

You next step should be to ensure that your company is taking a holistic view of big data, and to consolidate any existing silos of big data activities and expertise. Don’t limit yourself to thinking that big data is only about analytics or only for sales and marketing, and don’t leave it to IT to figure out your big data strategy all by themselves. All aspects of your business will be affected, so you need a cross-functional team effort to develop and execute a comprehensive business strategy and plan regarding your data sets. This team needs to range from strategic business thinkers to PHD data scientists, and should include translators – people with expertise in both analytics and business who can bridge the communication gap between data scientists and business leaders. Beware that people with deep expertise in analytics are
The wide array of technology choices may seem daunting. Here are some suggestions to help you get started:

will need to do your homework and stay on your toes. The technology and services will grow at 21.7% CAGR for batch processing and analytics than real time operations. This would be the domain of some kind of NoSQL database, of which there are several flavors. Babybook, a web application created by Entity-X, allowed parents to create video/photo albums, track baby’s health statistics, and interact with their pediatrician to ensure their child’s health. And imagine that millions of parents are using this application at once. That’s not the domain of Hadoop, which is better suited for batch processing and analytics than real time operations. This would be the domain of some kind of NoSQL database, of which there are several flavors. Babybook, a web application created by Entity-X, allowed parents to create video/photo albums, track baby’s health statistics, and interact with their pediatrician to ensure their child’s health. And imagine that millions of parents are using this application at once. That’s not the domain of Hadoop, which is better suited for batch processing and analytics than real time operations. This would be the domain of some kind of NoSQL database, of which there are several flavors. Babybook, a web application created by Entity-X, allowed parents to create video/photo albums, track baby’s health statistics, and interact with their pediatrician to ensure their child’s health. And imagine that millions of parents are using this application at once. That’s not the domain of Hadoop, which is better suited for batch processing and analytics than real time operations. This would be the domain of some kind of NoSQL database, of which there are several flavors. Babybook, a web application created by Entity-X, allowed parents to create video/photo albums, track baby’s health statistics, and interact with their pediatrician to ensure their child’s health. And imagine that millions of parents are using this application at once. That’s not the domain of Hadoop, which is better suited for batch processing and analytics than real time operations. This would be the domain of some kind of NoSQL database, of which there are several flavors.

If you think of big data technology as “Hadoop and analytics,” then your view is too narrow. There are many different classes of big data problems that require different kinds of technology solutions. For example, imagine if the Cloud Baby product had a web application called Babybook that allowed parents to create video/photo albums, track baby’s health statistics, and interact with their pediatrician to ensure baby’s health. And imagine that millions of parents are using this application at once. That’s not the domain of Hadoop, which is better suited for batch processing and analytics than real time operations. This would be the domain of some kind of NoSQL database, of which there are many choices. And the list of big data technology choices is exploding. The research firm IDC forecasts that the market for big data technology and services will grow at 21.7% CAGR, or about six times the growth rate of the overall information technology market. So you will need to do your homework and stay on your toes.

The wide array of technology choices may seem daunting. Here are some suggestions to help you get started:

1. **Start Small.** Look for early wins that you can showcase and promote within the organization.
2. **Use strategy to guide your technology objectives.** Ensure senior executives in charge of important initiatives are engaged. Avoid unbridled technology quests.

3. Get some help at first. Consider hiring some outside expertise to help you get started, and build your internal expertise over time. The supply of experienced data scientists and practitioners is scarce.

4. **Think carefully about what to build vs. buy.** Right now you might have to build a lot yourself, but that is changing rapidly, which could actually be an advantage to later adopters who buy instead of build.

5. **Use the Cloud.** Don’t even think about doing all of this on premise. In the cloud, the security is better, the economics are better, and it’s much faster and easier to get started and to experiment. Consider packaged services that include both infrastructure and software in a PaaS or SaaS model, such as Amazon’s AWS IoT.

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**Think Big, but Start Small and Start Now!**

All of the steps mentioned above will take time to accomplish and will be ongoing. These steps are important – you need a business strategy and plan to guide your efforts, and you need to avoid letting big data efforts drain resources away from critical small data efforts. But don’t let that stop you from starting now. Start small with a new product idea, just like Entity-X did with Cloud Baby. Research, experiment, prototype. And most of all, innovate!

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**References:**

- A Look Ahead: An Interview from the Future on the Birth of Digital Manufacturing
- Volume, Velocity, Variety: What You Need to Know About Big Data
- Gartner Says CIOs and CDOs Must ‘Digitally Remaster’ Their Organizations: Gartner Predicts 25 Percent of Organizations Will Have a Chief Data Officer by 2017
- IDC Research: Forecast of Big Data Technology Growth
- In praise of “light quants” and “analytical translators”
- Big data: The next frontier for innovation, competition, and productivity
- Sodium Battery Technology Improves Performance and Safety

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**More Reading:**

- A Look Ahead: An Interview from the Future on the Birth of Digital Manufacturing
- Two Ways IoT is Disrupting (and Helping) the Manufacturing Process
- The Manufacturing Executive’s Primer on Digital Innovation

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*Originally published on May 2nd, 2016*

What's your view? Add your question or comment
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