VANTIQ

Building Innovative Solutions for Today's Smart Factory and Supply Chain

February 2018

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The Rise of the Fourth Industrial Revolution – Industry 4.0

"In short, software is eating the world." - Marc Andreesen, Wall Street Journal August 20, 2011

A new competitive landscape has emerged in the manufacturing sector that is being referred to as Industry 4.0 or Smart Manufacturing. This term describes the emerging trend in the industrial space to create an intelligent network of connected "things" and people to create a smarter, more efficient and automated manufacturing industry.

Advances in the adoption of technology, the use of IoT, new mathematics and algorithms to make systems autonomous is providing big dividends already. A Price Waterhouse Cooper survey has shown companies that are very advanced into the digitization effort ("First Movers") are three times more successful and realizing 30% higher revenues and 30% reduction in costs then their competitors [1].

Connected systems are providing a new context for how people interface with systems. Examples include augmented reality (AR); an excellent example is provided by a McKinsey report where pickers stocking pallets reduced errors rates by 40% using see-through displays to build stronger, more efficient pallets [2]. Smart, connected systems are allowing machines to handle dangerous and repetitive tasks while people remain connected to these systems to monitor their operational efficiency, maintain and service systems, and handle all the unexpected and unknown scenarios that automated systems are not yet intelligent enough to adapt to.

A Rapid Paradigm Shift for Manufacturers' Supply Chains

"Perhaps the single most dramatic example of this phenomenon of software eating a traditional business is the suicide of Borders and corresponding rise of Amazon. In 2001, Borders agreed to hand over its online business to Amazon under the theory that online book sales were non-strategic and unimportant. Oops." - Marc Andreesen, Wall Street Journal August 20, 2011

The story of Borders and Amazon is an incredible history lesson. The changing pace of technology is very rapid, as everyone knows, but its not simply about adapt or die. It's about investing in the right future at the right time. Identifying what are today's trends in the industry and applying them in meaningful ways. Making big investments and expecting big results in both revenues, cost reductions and efficiencies [3].

A tangible example of this is the supply chain. This is an area where solutions that introduce IoT, autonomous and connected systems are beginning to emerge as a focal point to early digitization adoptions as the impact is immediate, especially as the challenges with supply chains are self-evident and the technology solutions to solve these problems have been so lacking.

Imagine a company that builds steering wheels for the automotive industry. This manufacturer must work with raw materials suppliers to build their steering wheels, the factory floor production facilities to processes, build and assemble the steering wheels, a warehouse to store them until a car maker purchases them, and the shipping and logistics to deliver them to customers.

All throughout this supply chain there are risks and problems. The steering wheel manufacturer must work with several raw materials suppliers, each one of these suppliers must provide quality materials on time. The production facility must take the raw materials and produce the steering wheels on a schedule as the automotive companies will simply find another steering wheel maker if late deliveries impact their tightly bound production schedules. All the while the delicate balance between what has been sold and what has been produced is subject to the natural chaos of the world as weather conditions can, at any time, impact the delivery of inbound materials or outbound steering wheels. People may get ill and not show up for work, automated machines break down, trucks get flat tires, and so on.

How does Industry 4.0 address these types of challenges? Let's examine them one by one.

- Suppliers of raw material can provide data to the OEM such as real-time tracking of logistics data, quality and test results of materials, and external threats can be monitored between the supplier and OEM with automated alerts and notifications to the OEM when potential risks to the supplier network are determined.
- Sensors and IoT devices are hooked up to manufacturing equipment which in turn use machine learning (ML) algorithms to create reliable predictive maintenance models, thus reducing unexpected downtime of production equipment while maximizing the lifetime of parts used in those machines.
- IoT devices are used with products and pallets to track their location in real time. An unexpected delivery delay of one pallet of steering wheels to an important customer may result in rerouting a different pallet, an operation that could be performed simply by a connected person using their mobile phone while at home.
- All the connected systems are pulled together into an 'enterprise nervous system' (ENS) which is software that performs several functions such as monitoring the real-time production capacity and utilizes Big Data systems to create predictive algorithms to better determine production schedules over time, so that factory production and customer expectation are always aligned.
- ***Businesses reduce uncertainty and replace it with predictability even in the chaotic uncertain storms that surround supply chain.***

The supply chain itself is an area where technological advances are just now starting to catch up to current capabilities and the emerging value is clear. The connected networks provide useful information to systems that can be turned into either autonomous decision making in real time or utilize connected people who can interact with these systems simply and easily through their mobile phone to make smart decision using the contextual information provided by these connected systems such as resourcing shipments.

Business Benefits Behind Implementing a Smart Supply Chain

"Companies in every industry need to assume that a software revolution is coming." - Marc Andreesen, Wall Street Journal August 20, 2011

The benefits of such systems are even greater than suggested in the fictitious scenario. In a complex supply chain scenario an OEM may have hundreds of raw material suppliers, have multiple factories all over the world - some of which could be interdependent on one another (i.e., Leather for the steering wheel is cured and cut at one location and shipped to another for assembly), unexpected changes to the customer's order as demand goes up and down unexpectedly, an assortment of logistics and shipping companies and systems can all be connected to provide real-time and accurate situational awareness about the entire supply chain from grain of wheat growing in the field to loaf of bread sitting in a shopping cart at the local grocery store.

OEMs can also use such systems to reduce counterfeiting and gray market problems. A combination of technologies can be put to use to reduce losses in this area specifically. Here are just a few examples:

- Track and trace using barcodes or RFID's. Even high quality digital images can verify the authenticity of products worldwide. These systems are used to detect counterfeit parts or gray market sales of products that have been purchased in one country and resold in another.
- GPS sensors on pallets and shipping containers can connect to local cellular networks internationally to identify their location and eliminate gray market transfers.
- Photo identification services can crawl the internet looking for pictures of knock offs or suspicious products and alert investigators when matches are detected.

These are just a few ways IoT devices, sensors and new technologies can be brought to bear on the issue of black and gray market counterfeiting. Brand protection officers can also receive alerts in real-time when situations are detected to act on them in a timely manner. For example, if a pallet of products bound Germany ends up in Canada or when an RFID scan of a shoe by a potential customer triggers an algorithm searching for knock off products using faked RFID chips. The response time of the investigation team will be critical in order to identify the source of the counterfeiting before the operation relocates which makes real-time analysis and communication paramount in this aspect of the supply chain.

Industry Experts' Validation of Smart Factories

"Over the next 10 years, I expect many more industries to be disrupted by software, with new world-beating Silicon Valley companies doing the disruption in more cases than not." - Marc Andreesen, Wall Street Journal August 20, 2011

Challenges with Industry 4.0 adoption still exists. Organizations are still determining where such technologies can be applied to them and what the business outcomes will be of such investments. The technology challenges are also as great. The people tasked with investigating these solutions have to identify how to handle problems such as connectivity, security and reliability. These challenges are not unlike other emerging technology trends that have occurred such as the move to the cloud and adoption of 'big data', and many new vendors are emerging on the scene who solve these problems and will help accelerate Industry 4.0 adoption.

One such example of where solutions are being built for tomorrow's factories is the UI Labs in Chicago. This is an industrial and university cooperative that was founded to explore innovative new technologies. A visitor to this location will find a mix of students and industry professionals designing digital solutions in a R&D setting that might include million-dollar CNC machines, assembly lines, conveyor belts, precision nanoscale measuring devices and more. This is a facility where ideas meet actual factory floor equipment to produce real Industry 4.0 solutions.

VANTIQ was recently able to participate in some of these R&D solutions. One example with McKinsey Inc centered around the assembly of air compressors which utilized a CNC milling machine to cut aluminum parts that then went through a manual assembly line to complete. Many different sensors on the CNC and the assembly line to monitor the performance of both to gain useful insights for example; What if the CNC machine is offline how does this impact the assembly line, how does this impact our production capacity and the delivery schedule and what else can we learn from this information about our operational effectiveness and where we can remove bottlenecks and make improvements?

McKinsey has a research team working at this facility and VANTIQ has been participating with them to provide elements of the software solution. McKinsey is researching many different types of Industry 4.0 applications such as sensors to monitor efficiency of assembly lines, the operational performance of CNC milling systems and others. They represent one portion of this environment where millions of dollars are being invested by the DoD and private industries like Siemens and Caterpillar in a shared collective work environment to create the latest leading-edge solutions.

What is VANTIQ?

"Over the next 10 years, I expect many more industries to be disrupted by software, with new world-beating Silicon Valley companies doing the disruption in more cases than not." - Marc Andreesen, Wall Street Journal August 20, 2011

There is one common element to all the Industry 4.0 initiatives. They all require software. As the Marc Andressen quotes from 2011 have shown, software is a critical part of the future of these systems. The technology that enables the connected network of devices to interact and interoperate will be driven by software. The ability to include people into the connected networks will be driven by software.

Software will be everywhere. It will run in the data-center, in the cloud, on edge devices, on small ARM systems, and your mobile phone. Software will cover everything from analytics, predictive maintenance, and artificial intelligence to the more basic mobile applications, business rules, and reporting - but it will be everywhere, and it will be the glue that sticks the Industry 4.0 solutions together.

VANTIQ fits into the Industry 4.0 initiatives on the software side. VANTIQ is a low-code, event-driven platform that is designed for mission critical application that can be run anywhere in a fully distributed fashion.

VANTIQ's mission is to provide organizations with a way to build very complex applications quickly and easily. The low code element of the platform was created to provide this. More and more connected systems lead to more and more complexity as you now have to deal with a multitude of protocols and environments that need translation back and forth. Creating systems that can handle the

scale of IoT devices is also a challenge which is why VANTIQ was built as a fully asynchronous event-driven platform. Building asynchronous event-driven solutions is also incredibly complex which is why the VANTIQ platform was built from the ground-up to abstract away the complexity of building these types of systems using a low-code platform with web, mobile and analytic application support.

Reliability and scale where also built into the VANTIQ platform architecture from day one. The VANTIQ co-founders Paul Butterworth and Marty Sprinzen realized what Marc Andressen said, that software will run everywhere and needs to run everywhere. VANTIQ was built as a fully distributed system, which means the ability to deploy applications built on the VANTIQ low-code platform to thousands of locations with the push of a button, to run on edge devices, at remote data centers, and multiple cloud environments.

This capability is so powerful one could write business logic to monitor and report on IoT data in a single instance of VANTIQ running on the cloud and with a single push of the button deploy that code to 1000 live edge nodes without ever having to shut down a single system. Additionally, the ability to perform federated queries allows a centralized location to aggregate data across all or select sites.

The power of VANTIQ is the ability to meet the heavy software demands of Industry 4.0. With a high-productivity platform providing rapid time to market, event-driven architecture providing scale and performance for IoT, with a mission critical, secure and reliable infrastructure and fully distributed capabilities to take advantage of the demands of trends like edge computing to create worldwide, intelligent networks.

Contact VANTIQ for a Smart Manufacturing/Supply Chain demo today and see how we quickly developed a Industry 4.0 applications using VANTIQ's rapid development platform!

[1] https://www.pwc.com/gx/en/industries/industries-4.0/landing-page/industry-4.0-building-your-digital-enterprise-april-2016.pdf

[2] https://www.mckinsey.com/business-functions/operations/our-insights/manufacturings-next-act

[3] https://www.pwc.com/gx/en/industries/industries-4.0/landing-page/industry-4.0-building-your-digital-enterprise-april-2016.pdf page 22