



Intelligence without Boundaries™

The Intelligent Edge: WORK-IN-PROCESS VISIBILITY

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Executive Summary

To stay competitive, today's lean manufacturers need to provide real-time visibility on work-in-progress to their personnel to immediately react to changes and address problems. To stay compliant and provide better customer service, the same manufacturers need to track the parts, components, or raw materials that make up the end product without impacting their operations and increase their costs.

Existing WIP visibility solutions are complicated by the need to integrate shop floor data gathering with various back-end systems from ERP to accounting and logistics and still provide local, actionable data to shop floor operators and supervisors. This level of integration is extremely difficult and expensive to achieve so, as a result, many manufacturers have a mix of disconnected shop floor and ERP information silos. This scenario limits the amount of useful and timely information available to floor personnel and management. Furthermore, isolating data processing from the production floor and a lack of standardization in devices and user interfaces make it very difficult to maintain real-time WIP data without seriously impacting production efficiency. The addition of barcode scanners has enabled more information to flow from production floor but has the disadvantage of adding extra manual steps to the process.

Real-time, visibility on materials, process, or machine interactions can be leveraged to fix real-time production problems by quickly identifying the source, enable product recalls, or validate the end product for customers who are increasingly demanding detailed knowledge on the contents, delivery dates, and history of the material, parts or end products they are buying. A contactless solution based on RFID, Wi-Fi and sensor technologies will accomplish all this without impacting the manufacturing process.

Work-In-Process Visibility for Lean Manufacturing

Reduce Waste

Originally when Sakichi Toyoda, the founder of Toyota Industries, and his engineers enumerated the principles behind the Toyota Production Systems, they may not have thought that their manufacturing improvements philosophy would endure and have such a profound impact on manufacturing for nearly 100 years. Today's Lean Management programs derive in large part their process management initiatives from Toyoda's vision. One of the main goals of the Toyota Production Systems was to eliminate waste. The elimination of waste improves quality, reduces production time and helps control costs to eventually improve customer value. Seven types of waste referring to equipment, material and people exist: over-production, motion, waiting, conveyance, processing, inventory, and rework.

Smooth Production Flow

The other key contribution from Toyoda was the concept of smoothing production that goes beyond the manufacturer's four walls to include suppliers as well. Increasing smoothness reduces quality issues and the waste associated with them. The most important principle applied to the smoothing of work is the concept of pull production that determines the supply, or production, according to the actual demand of the customers. The other principle is to give machines enough intelligence to notify humans of exceptions. Humans are much more effective dealing with exceptions than they are with repetitive activities. Automating routine activities while focusing humans on abnormal conditions improves throughput productivity and reduces errors.

Real-Time Visibility

The simplified implementation of the concepts of Lean Manufacturing is focused on getting the right things, to the right place, at the right time, in the right quantity to achieve perfect work-flow while minimizing waste and being flexible and able to change. From a manufacturing operations manager point of view getting the right thing, to the right place, at the right time, in the right quantity, starts with knowing where the work is, at any point in time and what needs to be done. In other words, lean manufacturers need to have real-time visibility for their work-orders, parts, materials from suppliers and equipment to be able to apply intelligence based on customer demand to reduce waste and smooth production.

Current Work-In-Process Solutions

Manual Process

Most of the current commercially available work-in-process tracking solutions rely on manual entry of job information into a computer or a handheld device. More advanced implementations use a barcode reader to track work-order, job router, employee, parts and work stations. In each case, the tracking requires a manual intervention from an employee and line of sight with the identifier or barcode affixed on the assets being tracked. Any manual process is subject to errors, delays, and tampering which translate into reduced profitability, speed to market, and customer satisfaction. If only a single stage of the manufacturing process includes a manual data capture, the entire visibility process is now dependent on the accuracy and timeliness of this entry to be accurate. This has three important consequences for companies implementing Lean Manufacturing processes.

First, manufacturers are working on historical data or in the best cases on near real-time data for analysis and planning purposes. As a result, often problems are found after they occurred and the cost of fixing them goes exponentially high with the time it takes to identify them.

Second, intelligence cannot be applied to processes and machines due to the lack of integration and real-time data. In the past, intelligent automation has introduced new supervisory functions that analyzed, identified, and corrected abnormal conditions. As equipment became more sophisticated and more collaborative, it is now requiring real-time data feeds from other system to rapidly adapt to new conditions.

Third, all the current shop-floor tracking solutions require significant process changes to integrate the new data capture elements requiring expensive changes in the way people and machines work. This requires additional training and is taking people's attention away from the main production tasks. More importantly, all of the new processes have to be understood, appreciated, and embraced by the employees who build the products and therefore own the processes that deliver the value.

Total Cost of Ownership

Data integration represents probably the most complex issue facing operations managers who want to get more visibility in their manufacturing processes. The data integration challenges are diverting precious resources away from the production goals to be spent on one-time type of integration that will become obsolete as soon as new devices or technologies are introduced. The pace of IT innovation has put tremendous pressure on the manufacturing shop floor as Lean Manufacturing initiatives are trying to leverage new technologies such as RFID, wireless, smart devices and enterprise integration. According to a recent Aberdeen report¹, data integration now represents over 60% of the costs of any automated data capture project.

Handheld devices, barcode scanners, sensors, and other data capture devices often use different connectivity mechanisms including serial, radio frequency, wired and wireless Ethernet technologies that create islands of isolation at the edge of the network, on the shop floor where these devices operate. The management and integration of these new smart devices are also taking time away from the core production activities. The new sensors and devices are also requiring new investments to build-up the new edge networks and to support the rapidly changing technologies.

With the addition of new devices at the edge of the enterprise networks, IT managers are faced with the challenge of rapidly changing landscape surpassing the existing difficulties of managing a desktop and

¹ Aberdeen Group: Can RFID Deliver the Goods? The manufacturer's visibility into supply and demand

server environment. The increased threats from security breaches and viruses creating broadcast storms are delaying the deployment of smart devices which could help operations managers increase their much needed visibility on the work-floor.

In order to fulfill an ever changing set of customer requirements, assembly line processes need to be flexible to adapt to these rapid changes. This is also true of the systems in charge of tracking work-orders, parts, and other assets. Most of the existing implementations are based on difficult and time-consuming tasks to re-configure the work-flows and often necessitate new expensive development and testing to support the new assembly processes.

All the different integration points listed previously require computing and storage platforms for their deployment, thus adding to the cost of the equipment but most importantly to the cost of managing the solution after its deployment. These direct costs can represent 40% of the total cost of an automated work-floor. Another important component of the total cost of ownership, often difficult to measure and rationalize, is the consequence of the decisions made for the labor and capital costs and includes the over-stocking due to lack of real-time visibility on inventory as well as contracts lost because of erroneous lead-times.

Expensive Shop-Floor to Top-Floor Integration

With almost no exception, the work-in-process visibility manufacturing initiatives have so far taken a top-down approach to solving the tracking of work-orders, people and assets. Vendors of back-end infrastructure such as ERP, MRP and WMS, have seen the bridging of the shop-floor with the back-end as a key initiative to stay in the driver seat and monetize the Lean Manufacturing trend. The proposed solutions always revolve around the application requiring the devices and logic at the edge to adapt to the application's architecture.

A first consequence of this approach is that it always results in lengthy and expensive projects where the majority of the investments are spent on the customization and configuration of the back-end infrastructure with little consideration for the device, data, security and work-flow integration.

The other important effect of this back-end application-centric strategy is that most of the logic and the data processing are taking place away from the edge where the action is. As a result, real-time cannot be achieved, scalability is quickly becoming a serious deployment issue, and flexibility is now a distant goal.

Restricted Visibility

Early on, Toyoda had envisioned that smooth production flow was achieved not only throughout the factory but also in collaboration with suppliers. Manufacturers benefit from reducing waste and smoother production but the benefits are even greater when their suppliers are following the same principles to improve their own production. This virtuous circle fosters more collaboration, encourages lean thinking up and down the supply chain, and helps develop stronger relationships by reducing supplier turn-over. Eventually, when production flows perfectly there is no inventory and efforts are expended on what customers value the most.

Today's work-in-process tracking solutions offer no visibility outside of the four walls of the production environment. This dramatically limits the benefits one can produce by implementing one of these solutions. Delays, material shortages, and priorities cannot be handled until they become real-problems that need immediate attention and stop the production. The cost of fixing these problems after they hit the production represents another order of magnitude compared to what it would have cost if they had been addressed as soon as they became visible in the supply chain.

Achieving Automated Real-Time Visibility

Contactless technologies enable automated real-time data capture

Innovation in contactless technologies has brought reliability and accuracy to industry-strength levels and significantly reduced the cost of solutions based on RFID or Wi-Fi. Radio-frequency based hardware and software are accelerating new manufacturing processes that do not require line of sight and manual intervention anymore to read information on fast moving objects or groups of items in large quantity. Not only contactless technologies are speeding up process, but they are making them more reliable and tamper-proof. By focusing humans on value-added activities instead of repeatable tasks, the manufacturer is improving productivity (faster, fewer errors) but also increasing workers' motivation and limiting undesirable behavior.

Real-time intelligence on the shop-floor

Real-time data capture will not achieve any of the manufacturers' goals if the processing of the information is handled by the back-end infrastructure. This is not a question of application performance and network latency that could be solved with better computing and networking resources, but rather a fundamental architecture decision to distribute processing where the action is, at the edge of the network. Not unlike the mainframe to client-server transition that occurred in the past, the back-end to edge processing transition is about to happen with new disruptions in the approach of automation and collaboration on the shop-floor and the supply chain. Processing of data at the edge of the network empowers employees and managers with real-time data and provides them with the ability to make changes before it's too late. This change of architecture has the potential to bring productivity and collaboration improvements to levels not seen since the introduction of the personal desktop.

Integrating real-time supply chain information

The current collaboration process between suppliers and their manufacturing customers is limited to the purchase order (PO) and advanced shipping notice (ASN) communications. A supplier starts the production when the PO is received and notifies that the product is being shipped to its destination through the ASN. The time in between the PO reception and the ASN creation and the variations that comes with it represent quite simply one of the largest opportunities for the manufacturing industry to improve productivity and reduce costs.

Examples abound of manufacturers spending employees' extra-time to achieve a production milestone assuming components for the next step will be delivered as planned only to discover that the resources could have been allocated to another critical task while waiting for the parts to be completed at the supplier's facility. Conversely, suppliers would benefit even more to know when a part is consumed by their customer's production process instead of waiting for a PO to come from the back-end system.

OMNITROL Work-In-Process Solution

The OMNITROL WIP Visibility solution offers discrete manufacturers the ability to manage and view all aspects of their manufacturing process from PO to finished product and maintain pedigree data (component lot number, machine operator id, and inspection records). The OMNITROL solution, based on RFID, Wi-Fi and sensor technologies can deliver clear business value through:

- Yield increase
- Improvement in manufacturing cycle
- Improvement in on-time delivery
- Lot and serial number traceability to finished parts
- Increase of customer satisfaction by providing real-time order status and delivery dates

In addition to these business benefits, the OMNITROL WIP Visibility solution offers manufacturers additional freedom and flexibility to easily deploy a low risk, scalable, standalone, turnkey solution that minimizes the risk of complex backend IS/IT integration. The OMNITROL solution also has a peering network for effortless scalability and can easily support additional applications such as asset management solutions that can be seamlessly integrated without impacting the existing functionality.

Based on the award-winning OMNITROL application appliance, the OMNITROL Real-Time WIP Visibility solution provides complete application, network and device integration at the edge of the enterprise network, allowing manufacturers to accelerate innovation and realize new business efficiencies through the deployment of RFID, Mobile Computing/Scanning, WiFi, Sensor and related applications and technologies.

Conclusion

To fully deploy core Lean Manufacturing techniques, manufacturers require a real-time, edge of the network, WIP Visibility solution. Utilizing RFID, Wi-Fi, and sensors in this system ensures that the current manufacturing process is not impacted by data entry or scanning requirements.

The OMNITROL WIP Visibility solution operates on the plant floor and engages the production personnel directly, ensuring that continuous improvement data is delivered to those that must implement the changes. The system tracks work-orders in real time as they migrate from cell to cell and is able to tweak the entire production line to recover from upstream or downstream problems quickly and autonomously. Production issues are handled in real-time well before they end up in the daily or weekly reports in the ERP system. Lastly, the system can retain historical records of production data and pedigree to ensure the integrity of the product and provide the optimal path for remediation should products fail in the field.

Implementing this solution at the edge of the network with the OMNITROL appliance ensures a cost effective approach and out-of-the-box functionality while delivering a scalable platform that can support the ever-changing requirements of a dynamic Lean Manufacturing process.



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David is responsible for defining and executing Omnitrol Networks' worldwide product and marketing strategy. David brings 15 years of strategic marketing, sales, and engineering experience in developing high-growth industry solutions.

Most recently, David was Director of Strategy and Marketing for the telecommunications industry group at Sun Microsystems where he successfully repositioned the company in the OSS/BSS, SDP, IMS and wireless data markets. During his tenure at Sun, David held technical and sales management positions including head of the team developing Sun's telecommunications solutions.

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