IBM Global Business Services

RFID-enabled returnable container management:

Solution to a chronic and wasteful automotive industry problem

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Automotive

Introduction

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This white paper discusses the challenges and opportunities of tracking returnable containers in the automotive industry. We begin by defining business issues in container management, then propose a process and technical solution that incorporates radio frequency identification (RFID) and asset management software, and finally discuss the business benefits for returnable container tracking with RFID technology.

Misplaced or lost containers have been an issue that the automotive industry has faced for several decades. However, it was not until recently that waste in container management has gotten executive attention. IBM and OESA hosted the industry's first Automotive Supplier Jam where 2,000 industry professionals from 150 organizations brainstormed online for three days. During this session, they identified container management as one of the critical industry pain points that requires a solution.

There are millions of containers in automotive supply chains. Lack of disciplined processes and poor visibility create waste in container management. Some auto manufacturers may well have over $1 billion invested in containers, but they have neither the visibility as to where these containers are at a given time nor the certainty of whether they have misplaced $100 million or $5 million worth of containers.

An appropriate solution would not only put an end to shrinkage, but help identify and isolate problems across the entire ecosystem. It would further allow the OEM to define optimal container quantities for the next program while reducing the cost of substitute packaging. Our experience and research indicates that up to 30% of containers are excess in manufacturers' supply chains.

Over the course of our investigation into automotive returnable container tracking, we have consistently found that most of the problems in today's business processes relate to a lack of visibility – the inability to see what is happening across an entire returnable supply chain in near real time. It often became apparent very early that automotive OEMs and their suppliers struggle with locating returnable containers and isolating issues when these containers are missing in the field.

This problem is caused by the highly complex environment in which millions of containers need to be handled at high speeds without automated business processes. Most automotive OEMs still employ manual methods in the entire process, and this leads to tracking errors and mishandling. It is not surprising that all the major automotive OEMs we talked to expressed similar challenges. For instance, a senior manager at a very large American manufacturer told us that he saw his own containers stacked high above the walls of a competitor's assembly plant. This is not an isolated incident, but it is symptomatic of what we have seen.

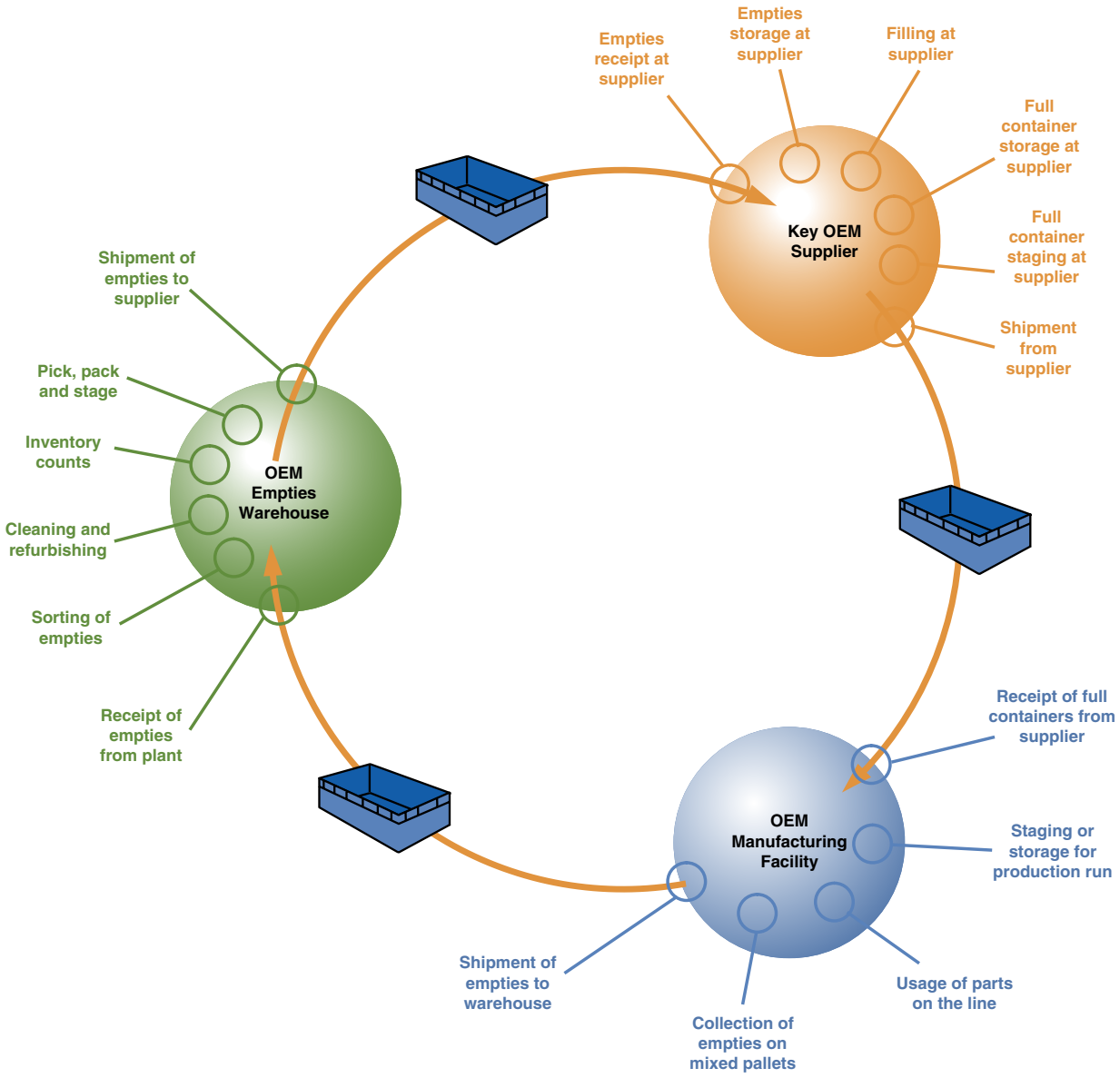
The nodes in the supply chain that do not share ownership in returnable containers are least likely to handle them with care. In the example above, a supplier simply shipped the containers to the wrong manufacturer who did not know what to do with them and stored them indefinitely on his lot. This white paper will illustrate how visibility technologies such as RFID can alleviate the pain points for auto manufacturers and enable highly efficient business processes that ultimately lead to a reduced cost of ownership for returnable containers in the supply chain.

The challenge of managing returnable containers

Most automotive parts are stored, shipped and consumed using returnable containers. These containers range in size from not much bigger than a shoebox to pallet-sized for larger parts. They are designed with specific vehicle programs in mind and are mostly used in conjunction with inserts that hold the parts and protect them from damage. These inserts also allow a container to be used for many different part shapes and sizes. Efficiency is in scale, and, in order to save money, automotive companies try to minimize the variety of outer containers by leveraging the same returnable container as much as possible.

In a typical supply chain, returnable containers are shipped on full pallets from an empties warehouse to the supplier, where they are filled with automotive parts and components that are then shipped to the manufacturer's assembly line. Once the parts in a container have been consumed, empties are shipped on mixed pallets to the warehouse (often operated by a third-party logistics company) where they are sorted, treated and refurbished. They are then reloaded on full pallets and are ready to ship out again to the supplier. In this system, there are several nodes where containers check in and out. These include sequencers, third-party logistics providers, suppliers' manufacturing facilities, OEM manufacturing facilities, OEM warehouses, etc. Figure 1 on the next page provides a high-level overview of the entire cycle and its main process steps, as they are relevant to the management of returnables.

Figure 1: Typical returnable container management cycle



The lack of proper container management leads to serious inefficiencies for the auto manufacturer. These inefficiencies include:

- Container cycle time and handling costs: Because of a lack of visibility, the speed of cycling containers through the system is not optimized. This results in more containers than manufacturers need. Additionally, the cost of managing and handling these assets often exceeds many times over the asset investment value. Faster cycle times for containers lead to improved use, fewer containers and less handling costs overall.

- Excess container inventory: In our work with automotive manufacturers, we found that container inventory is largely overstocked. In one project, we took 30% of containers out of the cycle and observed no effects to the operation, its efficiency, or its ability to cater to peaks in parts demand. Here, the lack of visibility clearly leads to mounting safety stocks, and it shows that the OEM did not fully know how many containers are truly needed in the process when they were initially purchased. The potential for savings in this area obviously goes beyond the one-time investment for new containers and includes factors such as inventory carrying cost, manual labor for handling unnecessary container inventory, and the cost of facilities that are larger than necessary.

- Container shrinkage and attrition: This is a highly sensitive issue and one that occurs at every major automotive OEM. Usually, OEMs purchase new containers every six to seven years and do so for a specific program, generally before the ramp up of a new model or manufacturing operation. Typically, OEMs order 10% to 15% more returnables than they actually need in order to account for loss and shrinkage over time. When containers are lost, it is often impossible to pin down the source, and, typically, the OEM will bear the cost. The reasons for returnable attrition are many and range from misshipment and misplacement to the use of returnables as work in process (WIP) storage at supplier facilities.

- Substitute cost: This becomes a very important factor over time when suppliers run out of returnables to ship parts to the OEM. Substitutes are one-time corrugated containers and add to the cost of the overall container management process. Obviously, substitute packaging comes into play when containers are truly missing. There are situations in which its use is fully justified, for example, when a lack of parts can bring a manufacturing line to a halt. We see the potential for improvement when substitutes are used because returnables were unnecessarily lost or misplaced.

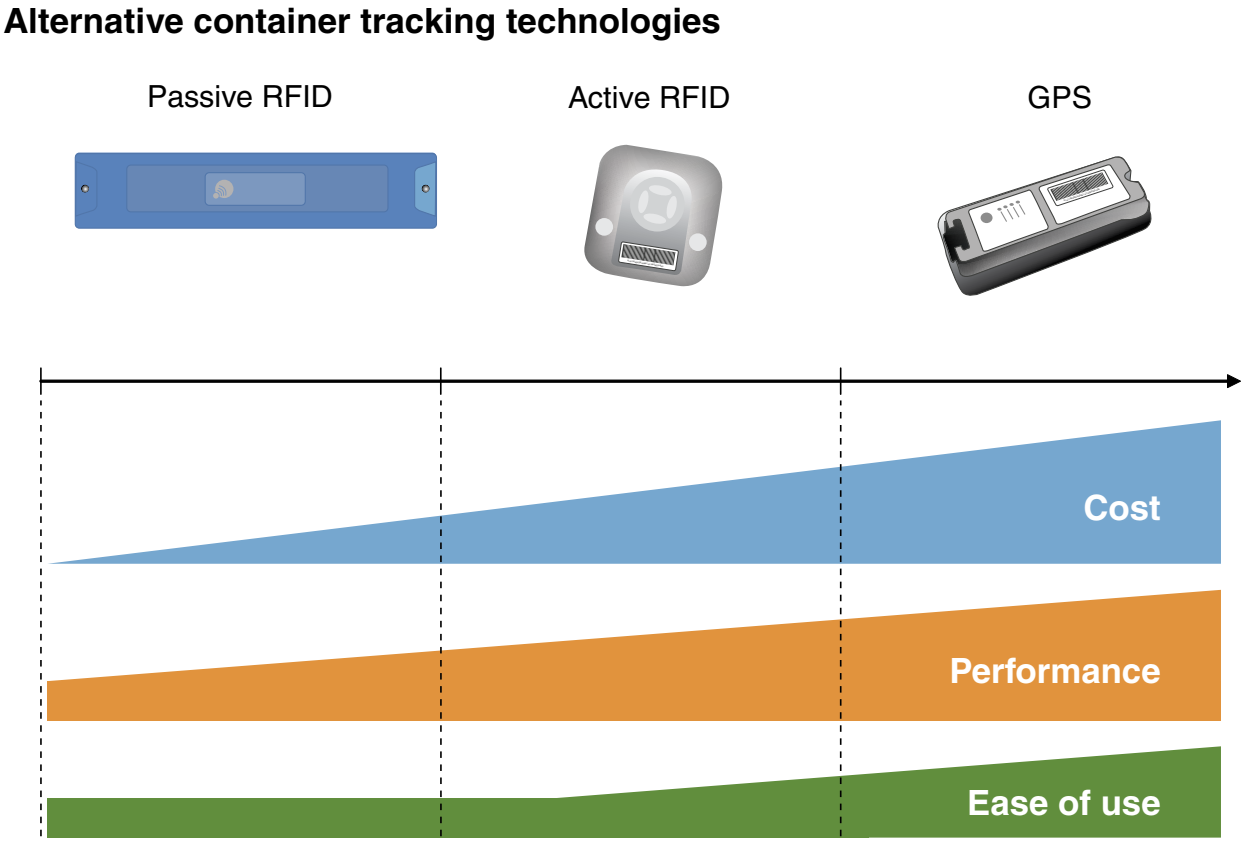
We will now describe a tracking technology that allows automotive OEMs to create visibility and thereby establish a sense of ownership for containers throughout the entire cycle.

RFID technology and its application to returnables tracking

Within the realm of tracking or visibility technologies, several can potentially lend themselves to container management. First is radio frequency identification. RFID is not a new technology and has been around for the better part of the last century. It was first successfully applied on British bombers during World War II as a means to distinguish friendly from enemy planes at night. Within RFID, there are passive and active kinds. The latter systems have batteries. In addition, there are GPS-based solutions that could be used for container tracking, and there are hybrids such as an active RFID system that leverages an existing wireless infrastructure.

As Figure 2 on the next page shows, there are many differences in these technologies, and this fact makes some of them less suited than others for container tracking. First, GPS is one of the best-known tracking technologies because it is widely used for navigation systems. Its main advantages are that it does not require a dedicated infrastructure and that it tracks containers anywhere outside of closed buildings or structures. A key disadvantage is that GPS requires line of sight to satellites. It is thus of limited use for a system that predominantly needs to function indoors. Also, the high cost of GPS tags is an important limiting factor. It is hardly feasible to equip more than a handful of containers with tags that cost several hundred dollars each. There is, however, an interesting application when the GPS units are used to perform spot checks. They do allow for visibility within a truck and in yards. Thus, when containers travel they can be seen and valuable data that can be used for diagnostics or process improvements collected.

Figure 2: Comparison of potential tracking technologies



Active RFID is similar to GPS. These systems operate with transponders that have a battery and usually reach several hundred feet between tags and readers. They are easy to deploy although a dedicated network of antennae and readers needs to be factored into the infrastructure cost. Within active RFID, a number of technologies operate in different frequency ranges.

The active RFID system best suited for tracking containers is based on ultra-wideband (UWB) technology. Their performance can be highly accurate, and they allow real-time tracking, for example, of forklifts as they drive around a facility. For container tracking applications, active RFID is still too expensive and provides features, such as real-time tracking, that are not needed to solve the problems outlined above.

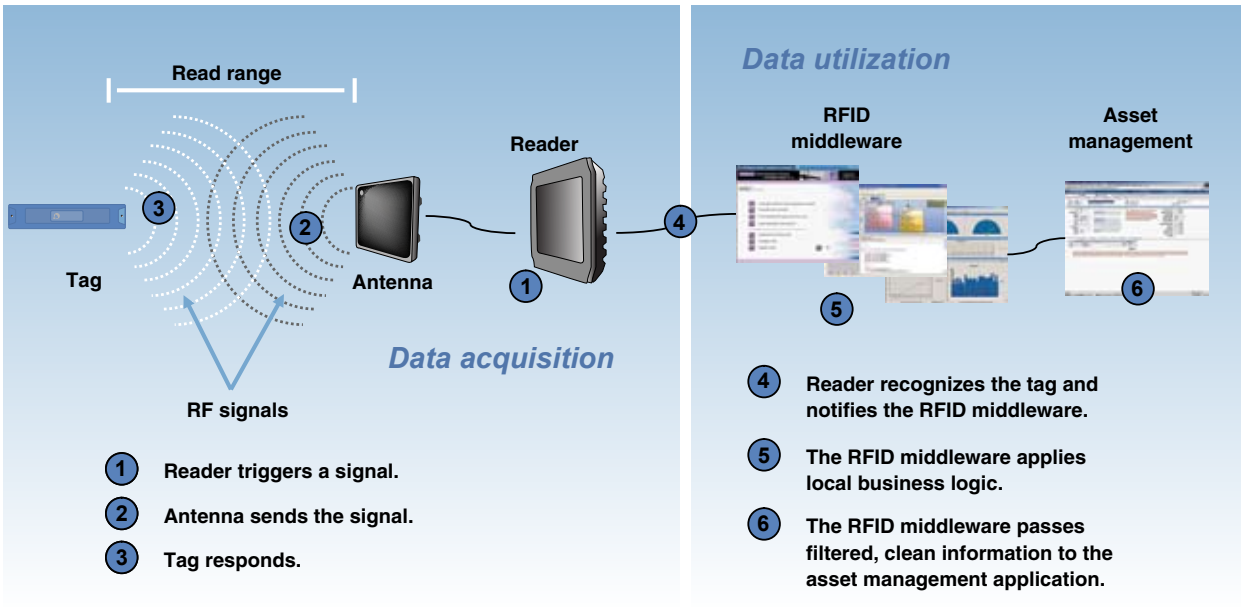
This leaves passive RFID technology, which is inexpensive when compared to the other two and which is also a highly reliable technology from the perspective of using tags for years without the need to exchange batteries or handle them in any other way. Just like active tags, passive RFID requires an infrastructure based on antennae and readers. These will read tags from as far as 18 feet away and thus can be used in a choke point application, for example, at receiving and shipping dock doors.

There is also flexibility, since there are a number of very good handheld readers on the market today that allow for mobile use of the technology. Mobile readers are an ideal solution for smaller supplier or OEM locations and in open areas where choke points do not make much sense.

In summary, only passive RFID provides an efficient technology solution for container tracking in the short- and medium-term. In the long-term, active tags may well become economically feasible and other, newer technologies, such as tags that communicate with each other rather than a reader network, may well become attractive alternatives.

Passive RFID technology rests on three main components: a small tag attached to something or someone, a reader that identifies tags in its proximity, and a computer system that processes information when tags are seen by readers. Figure 3 on the next page illustrates a simple passive RFID system where the reader initiates a conversation with tags in its proximity, receives the respective tag IDs (with data formatted as an Electronic Product Code), and hands the information to a RFID middleware platform, such as the IBM Premises WebSphere™ Server, which connects to a sophisticated enterprise-level asset management system, such as the IBM Maximo™ Asset Management Server. Asset management can perform a complex set of analytics and can provide either active alerts (i.e., lack of reconciliation of check-in and check-out containers) or on-demand visibility, depending on requests.

Figure 3: Overview of a typical RFID application

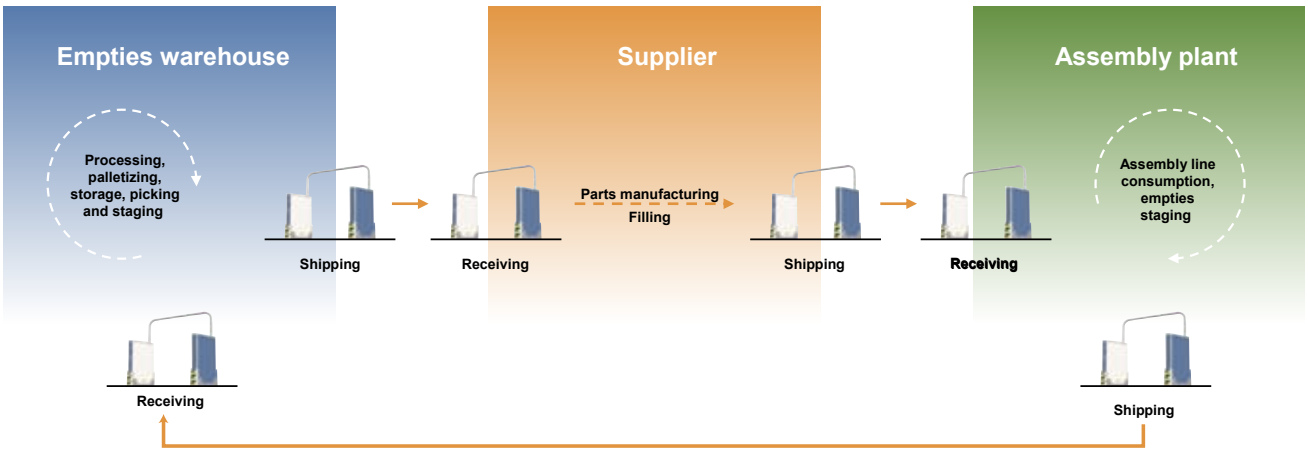


Most recently, RFID has been discussed in the light of Wal-Mart and the U.S. Department of Defense (DOD), the two largest supply chains in the world, who have mandated their suppliers to use the technology on all inbound shipments. RFID tags are attached to items, cases and pallets, and, when the items arrive at a loading dock, the tags can be read automatically alleviating the need for a manual, labor-intensive reconciliation.

However, that is not the primary reason why the two organizations have invested in this technology. The true value lies in the visibility that RFID provides – seeing inventory whether in motion or in stock at all times. They have installed readers at all major choke points and know exactly when and where an item was last seen. For Wal-Mart and the DOD, the technology ultimately enables more intelligent planning, inventory management and procurement.

The same can be said for the application of RFID to returnable containers. If OEMs place a tag on every container and install RFID readers at key choke points, they are able to know exactly when and where each container was last seen. Just think back to the issue of substitute packaging where suppliers charge the OEM for one-time corrugated containers because they do not have enough returnables in stock. If the OEM can check the number of containers shipped to the supplier in the asset management application, he can then establish that the supplier still has enough returnables. This is an excellent example of how RFID creates visibility that ultimately affects the shared sense of ownership among all partners in a supply chain.

Figure 4: RFID readers at key points in the supply chain



The processes for an RFID-enabled container management solution are fairly simple and straightforward, as shown in Figure 4. An OEM places tags on all containers and inserts. Reading the combination of container and insert tags allows the OEM to determine which returnable container type is on hand. RFID readers are placed at the inbound and outbound dock doors of the empties warehouse, at the receiving and shipping docks of key suppliers, at sequencers' and third-party logistics providers' facilities if they are used, and certainly at the OEM's manufacturing facilities. As pallets of empty returnable containers leave a facility, tags are read and associated with a specific shipment so that the OEM knows to which supplier the returnable containers are going.

Once the truck is loaded, all transaction-relevant information is passed from the RFID middleware to the asset management application, where the information is permanently stored and available for reporting and analysis. Naturally, a reconciliation between a returnable container order in a backend system and the asset management application or in the RFID middleware can be automated to a point where the warehouse manager receives an instant alert when too many or too few containers are about to be shipped to the supplier.

Once the truck arrives at the supplier's facility, readers will perform a second scan of the empty returnable containers and allow for a second reconciliation of what has been shipped. If the same containers do not show up at the manufacturing site within a reasonable time, then it is the supplier's responsibility to account for their whereabouts.

There is an interesting extension to the returnable container tracking: the supplier can now link the parts that go into a specific returnable container with the container tag and thus create an automated advanced shipping notification or ASN. As full returnables leave the supplier's facility, they are once again scanned and associated to a shipment. In this way, it is possible for the OEM to receive an automated estimated time of arrival (ETA) as well.

As the truck is unloaded at the assembly plant or line, the returnables are scanned and there is a reconciliation between what was shipped and what was received. The OEM now knows which returnable containers have been received and the receipt can be compared with prior shipments of empties to accurately establish how many containers of any given type are still in the possession of the supplier. By closing the loop up to this point, the OEM has full visibility into each container by supplier. Finally, as returnable containers are used at the assembly line, they are emptied and stacked on mixed pallets to be shipped back to the empties warehouse. In this last step, the warehouse can be notified of which empty returnables are moving into the warehouse next through scans of outbound RFID tags at the plant.

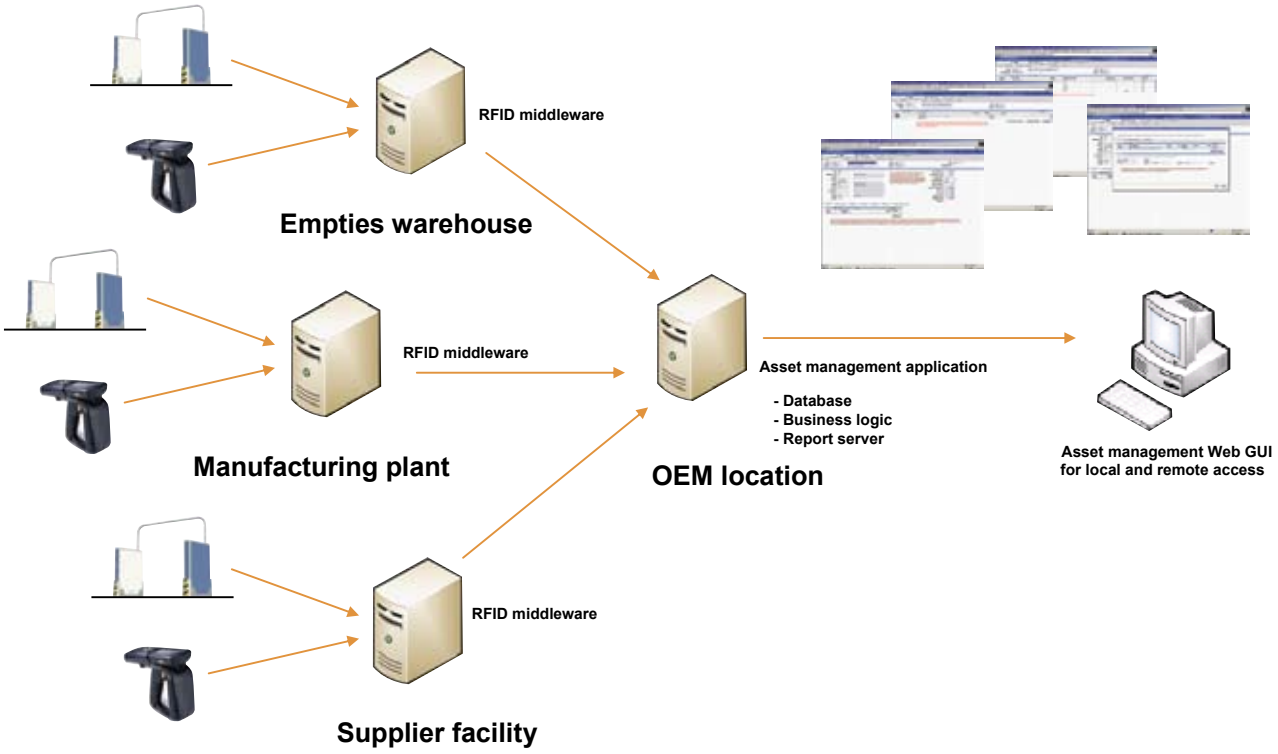
The visibility that this system creates allows for a shared ownership of returnables, which enables all participants in the automotive supply chain to handle each container to the best of their ability. We believe that this provides the foundation of a truly valuable returnable container management solution. However, the advantages do not stop here. Rather, they begin with data capture that is automated through RFID technology and are amplified through a sophisticated asset management application, which we describe in the next section.

Solution architecture for asset management

As mentioned, the automation of data capture is just one, albeit a necessary, ingredient to sophisticated returnable container management. However, receiving reliable, accurate and complete data from the field is not the end. Rather, additional value in returnable container management lies in how we leverage the data across multiple business processes, across several locations and in innovative ways. This is where the asset management software comes into play. Typically asset management applications are a sophisticated, enterprise-strength solutions that have been deployed across all industries and processes ranging from fixed to moving assets and from the management of manufacturing operations to vehicle fleets. In a nutshell, asset management is an application that resides on top of a data capture layer and provides further value not just in returnable container management, but also in many related areas such as parts management.

The general architecture for this solution rests on the combination of the RFID middleware layer with asset management on the application layer. Figure 5 illustrates this architecture and its key components. It is important to note that the RFID middleware can run as a local instance in each facility, but also as a central server if data speed and real-time requirements are not critical. In the example in Figure 5 on the next page, RFID tag reads are captured by the local instance of the RFID middleware where the data is filtered and smoothed to eliminate duplicate reads and to distill business-relevant events such as a returnable leaving the supplier's dock. All data is sent to the asset management application via a secure network and is processed there for reporting, alerts and backend system transactions.

Figure 5: Returnable container management architecture



With this architecture in place, the asset management application can manage the returnable container population in the entire system. An order for new empty returnables that need to be sent to a specific supplier can be generated in an ERP application that ties into the manufacturing planning and execution system, or it can be triggered by the supplier directly through a Web GUI, as shown in Figure 5. Once the order is received, the asset management application will identify the inventory in the empties warehouse and initiate the transfer of returnables. The user in the warehouse will receive a pick order for the containers. While it is possible to trigger pick orders based on serialized containers in the asset management application, e.g., FIFO or LIFO, we have not yet seen enough evidence that this feature is needed in automotive returnable container management applications. It would necessitate a serialized inventory control and thus a more sophisticated RFID system in the warehouse itself, which comes at a very high price.

Once returnable containers and inserts have been picked, shipment quantities and supplier information are handed from the asset management application to the RFID middleware server so that an easy reconciliation between the planned and actual shipment becomes possible. If the forklifts in the empties warehouse are also equipped with RFID readers, then it is possible to monitor and control the pick order itself. Otherwise, the required pallets are staged, and, once the truck arrives, an operator indicates on a handheld device or PC that the order will be shipped through a specific dock door.

This information is passed on to the RFID middleware, which now sets the RFID portals at the dock door into a read-ready mode. As pallets pass through the portal, the RFID tags on returnable containers are read and reconciled against the order. With the last pallet, the user can indicate to the RFID system that the shipment is now complete and the RFID middleware will perform an automated reconciliation to ensure that there are neither missing nor surplus returnable containers on the truck.

The system will indicate that all items have reconciled and that the system can prepare an ASN for the supplier, who now knows that the containers are on their way. In parallel, the RFID middleware will send the serialized ID for each returnable container and insert to the asset management application where the information is stored and further processed. The status for the shipped returnable containers changes from "in stock" to "in transit." This concludes the shipping transaction in the empties warehouse.

Important in this context is the integration between OEM and supplier systems that happens at the asset management application layer. Suppliers can access and manage their own returnable containers through a Web-based GUI that links into the OEM asset management application. Naturally, the supplier will only see data and be able to transact in the system as it pertains to himself.

Typical transactions include the transfer of filled containers to the OEM and the acknowledgment of empty returnable receipts. Likewise, suppliers will have a real-time view of the returnable container inventory that they still hold and they will be able to initiate shipments of empties to the OEM under exception conditions, such as when a different supplier or the OEM needs the containers out of the supplier inventory. In situations when container inventory is lost at the

supplier location, it is possible to generate invoices out of the asset management application to the supplier for the missing returnable containers.

The asset management application also allows the OEM to view the history of each returnable container. It is thus possible to derive performance data about the business process once the container's location has been established over the past few cycles. This is an important feature when linked with the management of the container's condition. The asset management application allows users to input and carry a wide variety of statuses in the system. These can range from trivial "new" versus "used" and "retired" to more specific assessments of a container's value.

A given container can be valued at a percentage of its initial monetary value, for example, which allows for a tight control of the overall cost of the container population. This feature is important when containers need to be accounted for and also when they need to be replaced. Container values can be set manually or automatically over a period of time or based on the number of cycles that the returnable container has performed. In conjunction with RFID, this feature can be used for returnable container refurbishment. For example, it can tell users to pull out a specific returnable container that has just completed a predefined number of cycles. Likewise, it may be of interest to a returnable container manager to take a handheld device, read the RFID tag, and view a history of the specific container, where it has been and for how long, when it was last used, and, potentially, even which parts it has carried over its life cycle.

This brings up another interesting point. Managing the contents of a container in the asset management application can substantially deepen the value of the returnable container management solution for the OEM. In a very simple example, the supplier can use a handheld RFID and barcode scanner that communicates via a cellular network to the asset management application at the OEM facility. The supplier scans the RFID tag on the returnable container or the insert and then scans each barcode for the parts that go into the insert. He can also set a quantity after scanning the first barcode.

The asset management application now creates a bill of materials (BOM) for each unique returnable container and is able to recall this data as soon as an ASN travels from the supplier to the OEM manufacturing plant. The latter will

receive an itemized report of which container holds which parts. This may well have an effect on the inline vehicle sequencing operation along the assembly line, especially when the OEM needs to ensure that the next available part is exactly the one required by the next vehicle coming down the line. Necessarily, a returnable container that has just been emptied will be relieved of its contents, and the system status is turned back to empty so that new parts information can be associated with the specific container during the following cycle.

Alerts and escalations are other key features that we have indirectly used for many of the use cases described above. The asset management application generates a variety of important alerts whenever things do not happen as planned. Typical examples of alerts and escalations are that a given returnable container has not moved in the system for a certain number of days. As we have discussed, this can trigger an inquiry when containers are shipped to a supplier, but do not return in time.

The combination of RFID technology with a sophisticated asset management application allows users to know where and when the container was last seen, which, in turn, provides the necessary information to take corrective action. Alerts are also useful when full returnable containers begin a journey by truck, but do not arrive as planned. In this case, the RFID middleware is able to immediately notify the user so that the issue can be investigated before the driver leaves the lot. In addition to real-time notifications, there is a need to leverage alerts in foresight of events that may take place at some point in the future. An example is the ability in the asset management application to predict that the next container order cannot be fulfilled unless a certain number of containers is freed up at the manufacturing plant over the next two hours.

The data management of returnable containers in the asset management application allows for the use of standard reports as well as for custom report development. It is possible to show the use of returnable containers per supplier, to report on suppliers that hold excessive returnable inventory and on those that take the most time to ship containers back. These analytics help isolate problems and develop lean container management throughout the system. Through the automation of data capture at each dock door in the system, it is also very interesting to draw conclusions on the loads of trucks and to potentially use these insights for route and capacity planning in the future. By measuring the time

between scans, the OEM gains further insight into the transportation system, for example, why certain routes might take more time than others. This can lead to further optimization in timing pickups and shipments.

Ultimately, detailed knowledge of how returnable containers move through the system allows reliable assessment of how many returnable containers are needed and helps reduce inventory as well as avoid excessive spending for the next program. The asset management application allows the creation of availability models, which, in turn, can be used for sporadic, ad hoc or continuous simulation of returnable container needs and peak (container management) system performance. It is obviously just as important to identify the least number of needed returnable containers as it is to identify potential situations in which the available container population may not suffice.

In summary, we have discussed some of the most important issues in automotive returnable container management. We have shown how RFID technology creates visibility throughout the process, which, in turn enables shared ownership of containers. And we have defined how the returnable container management system works. The following section aims to establish a high-level business case for a typical automotive OEM to illustrate the return on investment (ROI) and also to make a case for sophisticated returnable container management as opposed to a simpler process that is merely based on the automation of the data capture layer.

Business benefits and ROI

A business case is at the very core of every application innovation that companies invest in and implement. There is a considerable amount of risk in every project, and oftentimes not all benefits can be identified immediately. This is not necessarily the case for returnable container tracking. IBM has undertaken a number of successful returnable container tracking projects, and we have gathered a plethora of useful business case information that we will share in the form of a scorecard. What is interesting is that virtually all of our experiences have yielded similar results. This leads us to believe that the data has been reliable throughout and that the application context has been well understood.

One important aspect of assessing the value of an RFID-enabled returnable container management solution is that we need to take a close look at the entire process. It is not enough to isolate effects on returnable containers alone. Rather, we need to consider the effects of a returnable container management solution on planning, production, supplier efficiency and warehouse processes, to name just a few adjacent areas. There is a broad list of specific tangible benefits that can result from an RFID-enabled returnable container management solution:

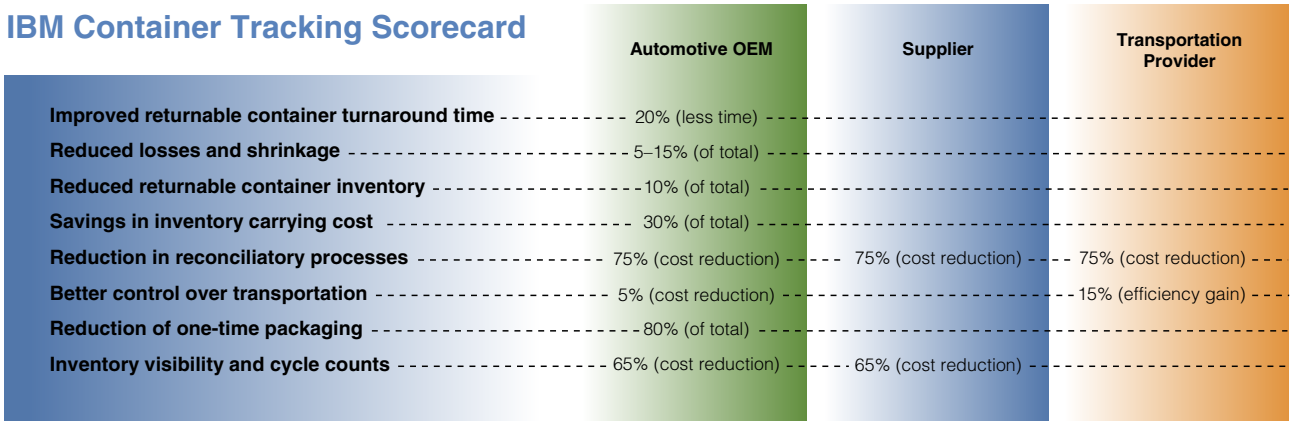
- Improved returnable container turnaround/cycle time: The faster containers turn, the fewer are needed. The solution reduces the total number of containers in the system and the initial investment. It also reduces the cost of handling unnecessary containers that have to be stored, cleaned and refurbished.
- Reduced container losses and shrinkage: The visibility enabled through RFID provides accountability. This, in turn, leads to more careful handling and to less shrinkage. It can also be argued that knowledge of the existence of the RFID system discourages mishandling.
- Cost recovery for lost containers: When containers are lost, it is apparent where they were last seen. Relevant stakeholders can be charged for containers that are lost in their facilities. We have seen losses of between 5% and 15% of all containers over the duration of a program.
- Minimized purchase of excess returnable containers: Excess container inventory is purchased as a safety stock since the right level of containers required in the system is not well understood. Tracking of containers helps define the precise number required for a program or supply chain.

- Reduction in substitute packaging: The solution helps eliminate substitute containers and packaging costs billed to manufacturers. Visibility coupled with optimization allows the right container to be at the right place at the right time.
- Savings in inventory carrying cost: With fewer containers in the system, the inventory carrying cost is also reduced. A reduction of containers by 30% in value terms with WACC of 10% can amount to sizeable carrying cost reduction.
- Reduction in container facility space: With fewer containers in the system, the need for facility space (empties warehouse, supplier yards) for containers is also reduced. This factor can substantially lower overall facilities costs including fewer personnel, forklifts and other equipment needed to manage containers.
- Reduction in reconciliatory processes: With the RFID system in place, automated alerts and escalations, such as containers being at a facility for more than 30 days, will eliminate the need for issue identification altogether and can automate the communication and resolution of issues when alerts are sent directly to the relevant stakeholder who has the containers.
- Transportation optimization: Optimization of the transport process is an added benefit of the RFID system. Knowing when shipments leave and arrive and the truck capacity for each load based on RFID tag reads are opportunities to exploit.

Apart from these benefits, there are several other advantages we have seen from the application of RFID technology to container management processes. These include enhanced data reliability, better requirements planning for new programs, the ability to locate a specific type of container for reuse or issue identification, more efficient refurbishment processes, optimized supplier processes, and centralized oversight of container management processes.

The exact benefits will vary to some degree based on specific situations. Most of them are comparable between OEMs when the calculation is normalized. Based on extensive project experience, IBM has created a returnable container tracking scorecard that illustrates the improvement potential for each of the benefits, as shown in Figure 6 on the following page:

Figure 6: IBM Container Tracking Scorecard



The scorecard should not express that we propose upper limits for each variable in the business case. Rather, we have assembled realistically attainable goals for each key performance indicator in the scorecard. A good example is the reduction of container shrinkage over the entire program life cycle by 5% to 15%, as mentioned above.

Finally, it is not just automotive OEMs who benefit. Suppliers stand to gain by broadening the RFID system into their own production processes as well as by adopting their own returnable container tracking systems. Logistics providers to a lesser degree also benefit, with better cubing and higher planning accuracy.

Conclusion and outlook

Looking back even a few years, RFID technology has come a long way, evolving from a niche technology to a process efficiency enabler that is now on the verge of becoming ubiquitous. Today, RFID tags are used in ski passes, football tickets and room keys for hotels. The two largest supply chains in the world have mandated the use of the technology, and there is a plethora of innovation underway in virtually all industries and application fields.

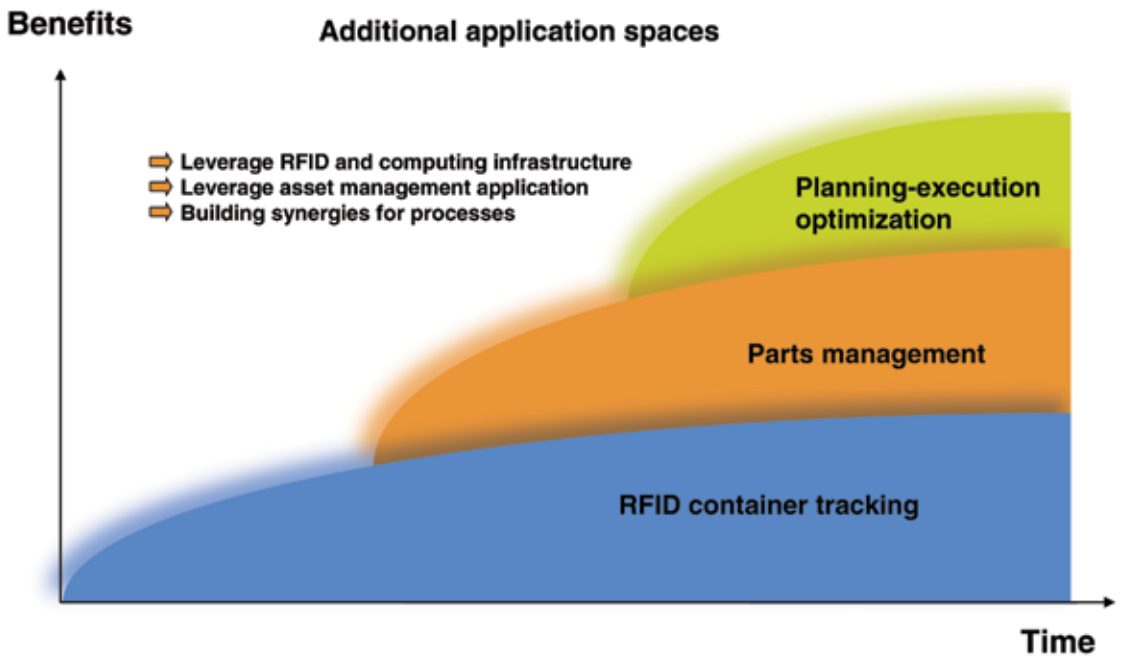
In the past, we have witnessed competitive pressures within an industry that lead to a viral effect for new technologies. Once a pioneering company first learns to exploit the benefits of a new technology, it gains cost and time advantages in key business processes. These gains lead to advantages that are monetized and leveraged as competitive advantages. Soon, all other competitors will have follow suit or face sustained disadvantages. The application of RFID technology to automotive container tracking is no exception to this phenomenon.

Within the automotive industry, and outside of assembly operations, we have witnessed the emergence of first movers for RFID over the past year or so. Application areas range from the tracking of engines in the plant, to managing yards for finished vehicles, to the inclusion of RFID tags in vehicles as their VIN, to the use of RFID in customer retention at dealerships and repair shops. All of these applications have shown not only great promise for competitive advantage, but they also have positive and highly interesting business cases. As we have shown in the previous section, the same is true for container tracking.

While RFID technology makes a difference in the way returnable containers are used throughout the automotive supply chain, it also provides the potential to save millions of dollars along the way. We have seen benefits that result from these projects right from the outset. Every improvement that follows, based on learning, discovery of new potentials for efficiency, and the ability to innovate on top of existing technology platforms, is an additional benefit.

The application of RFID and asset management applications to returnable container tracking is just a first step. Figure 7 shows several applications that can be built on top of returnable container tracking to leverage its infrastructure and its advantages even further. In this white paper, we have briefly outlined some of these capabilities, such as parts management. However, the asset management application along with RFID technology can be used beyond that for manufacturing or yard and fleet management.

Figure 7: Benefits capture over time



Once the existing infrastructure is put in place, all of these applications become available within a short time, and they not only carry their own business cases, but also contribute to container tracking by sharing the overall cost of the system. This creates a synergistic situation where the solution cost for returnable container tracking is reduced while new application spaces are fully leveraged.

In brief, the returnable container tracking solution discussed here is a platform for innovation. It not only eliminates waste by making the supply chain more efficient; it also offers follow-on opportunities that can deliver further advantages that result in further competitive advantages for the automotive industry.

About the Authors

Chris Hanebeck has well over a decade of experience in international management consulting, strategy development, change management and technology innovation. As an Executive Solution Architect in IBM's Wireless Practice, he is responsible for designing and implementing satellite, wireless, RFID and sensor technologies across industries and solution spaces. Chris has successfully completed projects for clients in the U.S., Asia and Europe, has authored over 50 publications, holds several RFID and wireless patents, and regularly speaks at major business and technology conferences.

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