Warehouse / Distribution Center

Deployment Environment Guide

Contents

Preface

This "Deployment Environment Guide" is intended for the use of Intermec and Channel partner staff that are preparing to call on Warehouse and DC operations customers. This guide is not a quick white paper; the goal is to provide a comprehensive review of Warehouse and DC organizations and applications so that sales staff have enough knowledge to feel confident calling on customers in an industry where they may not have prior experience.

After reading this guide, you should be familiar with:
- Environment terminology
- Typical job roles, applications, and tasks involved
- Common problems and challenges encountered, with emphasis on those that can be addressed by Intermec
- Specific interests of the three buyer types (Economic/Business, User, and Technical/IT)
- Industry segmentation
- Market trends that are driving change

This guide can't teach you everything about the Warehouse/DC, but it will give you enough information to engage in meaningful application conversations with your customer.

Environment Overview

A Distribution Center (or Warehouse/distribution center) is a specialized building that receives products in bulk from manufacturers then re-distributes them at the right time and in the correct quantities to retailers and wholesalers, or directly to consumers. A distribution center can also be called a DC, warehouse, CD – for Center Distribution in non-English speaking countries, a fulfillment center, a cross-dock facility, a bulk break center, or a package handling center. The name by which the distribution center is known is commonly based on the purpose of the operation. For example, a "retail distribution center" normally distributes goods to retail stores, an "order fulfillment center" commonly distributes goods directly to consumers, and a cross-dock facility stores little or no product but distributes goods to other destinations.

Since a large retailer might sell tens of thousands of products from thousands of vendors, it is highly inefficient to ship each product directly from each vendor to each store. Distribution Centers were developed to solve this specific problem. Many retailers own and run their own distribution networks, while smaller retailers may outsource this function to dedicated logistics firms (known as "third party logistics", or 3PL) that coordinate the distribution of products for a number of companies.

A typical distribution network set up by a major retailer will have DCs located at geographically important locations around the country, with each DC serving a number of stores in its region. While retailers are an easy example to understand, companies in other segments will have similar distribution network configurations. In some cases, companies will have very large centralized distribution centers that serve retail stores and customer sites directly and deliver goods to smaller more regionally located distribution centers or warehouses that can serve local customers. These networks may be referred to as hub-and-spoke networks or central/regional DC operations.

Suppliers (or vendors) will ship truckloads of products to the distribution center. The distribution center breaks those large loads into the appropriate amount for each customer location and ships the proper quantity when ordered. A single DC might serve anywhere from a few to hundreds of customer or store locations.

There are many types of DC's with many variations in terms of goods handled. Within all that variation though, research by VDC, Warehouse Education Resource Council (WERC), ARC, and Aberdeen conclude that six essential processes – receive, put away, replenish, pick, pack and ship – are almost universal activities across all industries. CG brand owners can go to market using two-tier distribution (from CG manufacturer directly to retailers) or using three or more tiers of distribution (through distributors, wholesalers, etc) or can use a combination of methods. A two-tier distribution model would be represented as:
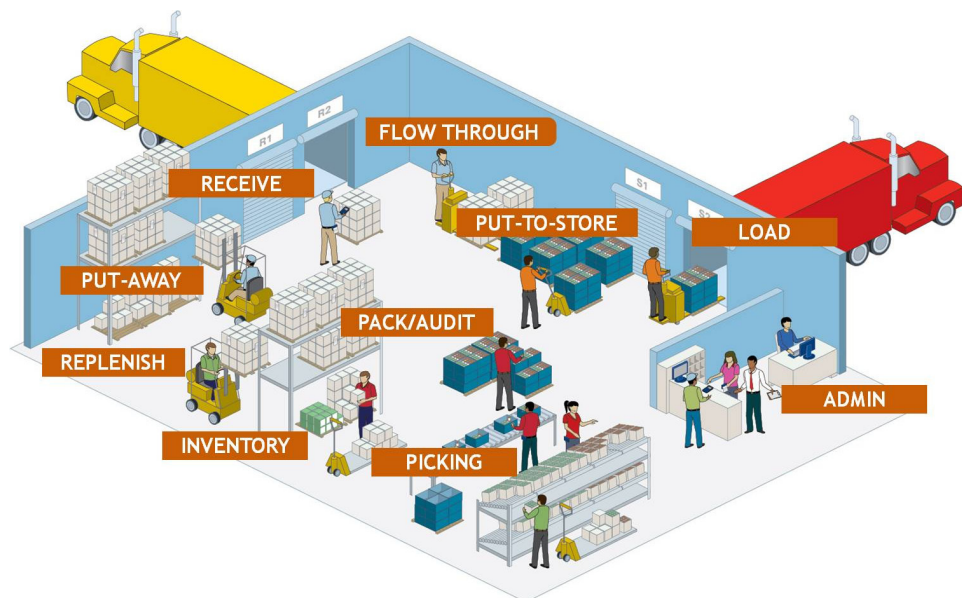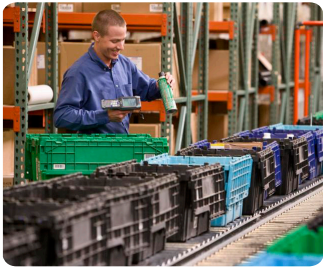

Figure 1. This illustration is a high-level representation of a typical warehouse/DC operation

Setting aside the administrative functions within a typical DC, the "workflow" related activities shown in Figure 1 could be grouped as:
- Inbound Apps - includes receiving, put-away, replenishment, and inventory
- Picking Apps – Picking stands alone as a critical function in virtually every DC (except pure cross-dock operations)
- Outbound Apps – includes flow-through, put-to-store, pack/audit and loading

Many operations prefer to group or refer to applications by type such as "forklift apps," which might include put away, replenishment, flow through, put-to-store, cross-dock and loading. These tend to have very similar user and mobile computing requirements.

Often neglected, but many times very important are the 'other workflows' and applications such as returns processing, administrative and other general supervisory work. A simple and often overlooked workflow is the relatively simple function of the day-to-day management of mobile computing equipment. This administrative operation and how products are stored, batteries charged, equipment assigned during shift changes, etc. will often be a quick way to assess the care and detail with which great operations differ from those that are less meticulous and organized. A world class operation will have a very clean, organized equipment storage and retrieval process, battery charging and spare equipment management system.

The Warehouse Management System
Nearly every "logistics or workflow" related activity in a DC is driven by Warehouse Management System software, also known as the WMS. At the highest level a WMS will:
- Manage all orders to vendors.
- Plan, schedule and track when goods arrive at the DC (Receive) from vendors
- Direct and track where the goods are stored in the DC (Put Away)
- Consolidate orders from all customers
- Plan and schedule the optimal order selection process required to fulfill customer orders
- Direct the picker (or Order Selector) to pull the right goods in the right quantity (Pick)
- Direct the packing and shipping workers to consolidate the selected items for a customer order into a specific packing unit (pallet, tote, box, other) and ensure the orders are moved to the right shipping location with the correct shipping information (packing slip, barcode shipping labels, etc.)(Pack and Ship)

DC Metrics
Virtually every DC is in a constant struggle to increase customer satisfaction while reducing costs. Under the premise that "one can only manage that which can be measured," distribution operations executives and managers tend to pay a great deal of attention to a variety of performance metrics.

Figure 2 shows the top ten most popular performance metrics used by distribution operations from a mix of markets and industries including retail, third party logistics/warehouse, medical device and pharmaceuticals, transportation service providers, general manufacturing (a mix of consumer products, high technology, automotive, aerospace/defense and general manufacturing) and an "other" category based on industry research provided by WERC, the Warehouse Education and Research Council and *DC Velocity* in the *WERC Watch Spring 2010 – A Periodic Assessment of Industry Trends* publication.

Figure 2 indicates that the most popular operating metrics are mixed between categories that address external customer needs (customer and quality)

TABLE 8. TOP 10 MOST POPULAR MEASURES USED – 2010			
Metric/Metric Category	% Using	2009 Rank	2005 Rank
1. On Time Shipments – **Customer**	85.8%	2	1
2. Order Picking Accuracy – **Quality**	73.2%	1	6
3. Average Warehouse Capacity Used – **Capacity**	70.4%	3	10
4. Annual Workforce Turnover – **Employee**	60.2%	5	7
5. On-time Ready to Ship – **Outbound Operations**	58.8%	7	–
6. Peak Warehouse Capacity Used – **Capacity**	58.7%	8	–
7. Fill Rate – Line – **Outbound Operations**	57.7%	6	–
8. Dock-to-stock Cycle Time, in Hours – **Inbound Operations**	56.2%	9	–
9. Inventory Count Accuracy by Location – **Quality**	53.0%	–	–
10. Order Fill Rate – **Outbound Operations**	50.7%	4	9

Figure 2. Top 10 most popular measures used in 2010.

and internally focused operating objectives (outbound and inbound operations and capacity). Great operations achieve a delicate balance between minimizing operating costs while ensuring superior customer satisfaction. These two objectives are both critical to success and tend to pull distribution operations in opposite directions.

TABLE 7. QUINTILE PERFORMANCE CLASSIFICATIONS FOR METRICS						
COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5	COLUMN 6	COLUMN 7
Customer Metrics*	Major Opportunity	Disadvantage	Typical	Advantage	Best-in-class	Median
On Time Shipments	Less than 95%	>= 95 and < 98%	>= 98 and < 99%	>= 99 and < 99.8%	>= 99.8%	98.5%
Total Order Cycle Time	Greater than 96.7 Hours	>= 51.5 and < 96.7	>= 28.4 and < 51.5	>= 24 and < 28.4	< 24 Hours	48 Hours
Internal Order Cycle Time	Greater than 48 Hours	>= 24 and < 48	>= 24 and < 24	>= 8.2 and < 24	< 8.2 Hours	24 Hours
Perfect Order Completion Index	Less than 83%	>= 83 and < 90.2%	>= 90.2 and < 95.6%	>= 95.6 and < 99%	>= 99%	93.1%
Lost Sales (Percent of SKUs Stocked Out)	Greater than 5.6%	>= 2 and < 5.6%	>= 0.5 and < 2%	>= 0.01 and < 0.5%	< 0.01%	1.4%
Backorders as a Percent of Total Orders	Greater than 5.4%	>= 2 and < 5.4%	>= 1 and < 2%	>= 0.2 and < 1%	< 0.2%	1.5%
Backorders as a Percent of Total Lines	Greater than 7.6%	>= 2.1 and < 7.6%	>= 1 and < 2.1%	>= 0.2 and < 1%	< 0.2%	1.4%
Backorders as a Percent of Total Dollars/Units	Greater than 5.6%	>= 3 and < 5.6%	>= 1 and < 3	>= 0.5 and < 1	< 0.5%	2%

Figure 3. Comparisons of customer focused performance metrics

Figure 3, also from the WERC report noted above, compares customer focused operations metrics for Best-in-Class operations (Column 6) with companies in the median performance range (Column 7). Additionally it compares the Best-in-Class to the typical performance range (Column 4). The other columns define ranges of performance metric achievement as it compares to column 6. So companies that have performance metrics in Column 2 are categorized as having a major opportunity to improve vs. Best-in-Class companies. Those in Column 3 are at a 'Disadvantage' vs. the Best-in-Class and so on. The key take away from this table is depending on the metric, there can be a wide range of performance between companies. A consultative sales process would focus on understanding how a prospective or current customer defines their key operational metrics and where they fall on this performance scale. Raising these performance metrics as areas of pain currently and/or areas for improvement will enable a salesperson to add significant value with solutions that improve these processes and workflows.

When selling to a Warehouse/DC, the driving business needs and business initiatives that lead to or around which you can create Compelling Events are almost always based on a desired improvement in one or more of the metrics listed in Figures 2 and 3 above and the associated operations and financial metrics from the same WERC study found in Appendix A.

It is strongly recommended that sales people familiarize themselves with these key operating metrics provided in the WERC study as they will form a strong basis for understanding the processes that drive successful operations and will be important to engage particularly the user and economic buyers in issues that are likely keeping them up at night.

Detailed Environment Description
Key Applications Common to Warehouse/DC Operations:

Receiving
Receiving is the process of confirming that you received what you ordered from the vendor or supplier. Does the product received match the purchase order? The main receiving priority is to validate you have received the exact order and move the incoming goods whether pallets, cartons, totes, boxes or other as fast as possible from the incoming trucks to the storage, staging, or shipping areas in your warehouse. Every stop, every move, and every use of a temporary staging area requires space and time. The more you touch or handle product in any way, the more opportunity for product damage, difficulty in locating stock, and errors and by default increased labor, inventory and other costs.

When a typical DC receives, counts, and inspects thousands of items from hundreds of vendors whose own pick/pack/ship practices are all different, receiving can be one of the most complicated warehouse processes. Any errors in this phase will have a ripple effect that can impact all other areas in the DC. In addition to the physical process impacts, data from receiving determines when/how vendors are paid (directly impacting cash flow), potential rework costs, and incorrect inventory exposure. Picking and outbound process efficiencies start with receiving. Receiving best practice means moving items to their next location with as few touches – as little labor – as possible.

Good receiving also starts with good labeling; both with vendor labels and those used to map to internal inventory systems and locations. Depending on the WMS receiving module, typical pallet labels (generally applied at the receiving station) would likely include:

- Shipper/supplier information (company name, tel. number)
- P.O. number, date, lot codes
- Pallet and/or case level quantity
- Product (SKU) number and description
- Pallet, case, each unit level ID or SKU numbers

In many receiving operations, portable printers can enhance pallet labeling productivity and accuracy by eliminating travel and ensuring the right label is applied to the goods received in real-time. An effective receiving system also includes a well-labeled facility. All storage and staging areas such as aisles, slots, rack bays, shelves, put-to-store floor locations through to the shipping dock doors are likely to be labeled with large, easy-to-read both human readable and barcoded location labels. Voice picking processes also typically uses randomly assigned two- digit human readable location ID check-digit labels. And larger barcode "license plate" labels scan-able from 30-50 feet are recommended to identify high bay inventory locations.

Multiple industry studies confirm that paperless data acquisition processes based on scanning, voice and/or RFID are the most accurate and error-free methods of receiving and subsequent handling of goods. To maximize productivity and accuracy of the entire operation, top DCs always begin with the labeling process at receiving. While it may sound simplistic, the rewards of reduced receiving errors are very high. WERC studies show that receiving is an area where benchmarking and performance measurement are particularly important. Refer to the WERC materials to see the specific measures and industry benchmark metrics.

Flow Through

This is a process that occurs when typically full pallets are identified by their ASN's (advanced shipping notices) and taken from receiving directly to a 'put' location rather than being "put away" into the general inventory locations. A flow-through "Put" location is provided by the WMS for a given order. The put location is likely to be at a shipping dock door for a specific customer order. If timed correctly between receiving and shipping, a full pallet can be received and loaded directly into an out-going truck with one physical movement. This is often called 'cross dock' in parcel and other trucking/transit related operations. Many times pallets with high velocity or fast moving goods are 'broken' and cases from the pallet are 'put' to a 'flow through' location or into lines arranged in front of dock doors where items are temporarily staged, then built into new pallets for immediate shipping. The remaining cases that do not 'flow through' from the received pallet are put away into inventory.

Flow through is a great process for many DC's because less is always more - less handling, less mistakes, less damage, etc.

Put-Away

Put away is the function of moving received goods from receiving locations to inventory storage locations. In most cases, the location for each item depends on its "velocity." High velocity items (those that are fast movers rather than slower movers) will be stored closer to the packing/loading stations. However, there are many other process engineering issues related to optimal put away location. Grouping similar items and locations into categories, understanding dimensions, weight, unit of measure (eaches, cases, pallets, etc), temperature requirements, whether it can be mixed with other items in a location, whether it is rackable, max stack height, max quantity per location, hazard classifications, finished goods or raw material, etc. Another factor is item velocity and size particularly for smaller items and each pick products that can be stored in high density areas for fast picking with little to no travel time for those doing the picking.

Most WMS applications enhance the put away process by including down-stream activities into the logic and decision process. For example, put away decisions include which location to pick from, replenish from/to, and in what sequence these events should occur and whether the put away is system directed or user directed.

Below are some additional requirements that can impact put away logic.

- **Location Sequence.** This is the simplest logic; define a flow through the DC and assign a sequence number to each location. In order picking this is used to sequence picks to flow efficiently through the DC. The put away the logic would look for the first location in the sequence in which the product would fit.
- **Zone Logic.** Breaking down storage locations into zones can direct picking, put away, or replenishment to or from specific areas of your warehouse. Since zone logic only designates an area, combining this with some other type of logic is required to determine exact location within the zone.
- **Fixed Location.** Logic uses predetermined fixed locations per item in picking, put away, and replenishment. Fixed locations are most often used as the primary picking location in piece pick and case-pick operations, however, they can also be used for secondary storage.
- **Flex Location.** Flexible locations generally refer to areas where products are not stored in designated fixed locations and may be temporary. Like zone logic, some additional logic is needed to determine exact locations.
- **First-in-first-out (FIFO).** Directs picking from the oldest inventory first.
- **Last-in-first-out (LIFO).** Opposite of FIFO. This might seem strange, but an example might be an operation that distributes perishable goods domestically and overseas. LIFO is for the overseas customers (because of longer in-transit times) and FIFO for domestic customers.
- **Reserved Locations.** This is used to predetermine specific locations to put away to or pick from. An application for reserved locations would be flow through, put-to-store, and traditional cross-docking, where an inbound shipment can be moved to specific outbound staging locations or directly to an awaiting outbound trailer.

Picking

Picking, more formally known as "order selection", is the process of extracting goods from DC storage locations to fill orders from specific customers. The ability to quickly and accurately pick orders is the most labor-intensive, skill-intensive activity in the warehouse. The result is that it represents as much as 55% of the typical warehouse operating expense. Because of these issues, picking is clearly THE big issue for most operations.

As the order picking process involves significant cost from labor content, costs of incorrect items picked, any secondary audit processes required and the potential for returns or losses due to incorrect products that are not returned and/or not paid for, the impact on customer satisfaction levels is significant. There are a number of picking methods and technology solutions available. The methods for order picking vary greatly. The characteristics of the product being handled, total number of transactions, total number of orders, picks per order, quantity per pick, total number of SKUs, value-added processing activities such as kitting or private labeling, and handling of piece pick, case pick, or full-pallet loads are all factors that affect the method for order picking. Many times a combination of picking methods is needed to handle diverse product and order characteristics.

> **Selling Key:** Voice picking has become the fastest growing new methodology for all varieties of picking applications. Intermec's acquisition of Vocollect, the world's leading voice picking solutions company is a strong statement validating Intermec's leading position in the warehouse deployment environment. Please see the Voice/Warehouse Application sales kit materials on Insider for more specific information about voice picking.

The illustration in Figure 1 above shows two kinds of picking - a typical case pick and an "each" pick process from flow racking. The case picking illustration is from pallets that have been 'broken' on the ground floor of the primary inventory racks on the center left side of the illustration. Cases are usually picked from the floor location, or 'slot,' and loaded onto a pallet jack. In this process, the pickers are building the pallet as they go and will typically be directed by the WMS to deliver a full pallet (or the complete order) to a dock door location associated with a specific ship-to customer at that time.

The "each" pick example, lower right on the illustration, is from the flow racks (sometimes called gravity flow racks) on the lower right side. Flow racks use gravity to 'flow' cartons on rollers from the higher back side of the flow racks to the lower front. Cases for the flow racks are usually picked and transported from the slot locations in the case pick area to the rear of the gravity flow racking. This is usually a system directed replenishment process. As full case packs reach the pick face of the flow racks where they can be accessed by the picker or order selector, the picker usually discards the empty case and cuts open the next new case to access the lower level packaging items.

The piece or "each" pick items are selected from there and the process simply repeats itself. Key objectives in order picking best practices include increased productivity, reduced cycle time, and increased accuracy.

- **Productivity.** Productivity in order picking is measured by the pick rate. Piece pick operations usually measure the pick rate in line items (from the order) picked per hour while case pick operations may measure both cases per hour and line items per hour. In pallet pick operations the best measure is pallets picked per hour. Productivity includes the time it takes to physically travel to the item's storage location, select and handle the item (or the total of the items on a given order) to be loaded or packed on a pallet as an example, and taken to the final destination location.

- **Accuracy.** Regardless of DC operation, accuracy is always a key objective. Virtually every decision made in setting up a warehouse or DC impacts accuracy. From product location and numbering scheme, slotting, /pick face labeling, product labels, and even lighting, all these elements of DC design impact picking accuracy. Technologies that aide in picking accuracy include voice picking systems, barcode scanning and imaging, pick-to-light systems, and even counting scales. Other major factors include employee training, strong accuracy tracking and accountability methodologies including audits and pay-for- performance incentives.

- **Cycle Time.** Cycle time is the amount of time it takes from order entry to shipping the order. Customer's expectations for service levels vary, but inventory turn metrics, lean and just-in-time inventory practices and as well as same day shipment business models has put greater emphasis on reducing cycle times from days to hours or minutes.

Some important things to understand and note about customer operations are the types of picking methods being utilized. Are they doing full pallets (common in CPG), partial pallet, full cases, broken case, and/or piece or each picking (usually single items from within the case pack level)? Another important consideration is how many temperature zones are there? The three typical temperature zones are Freezer, Chiller (typically refrigerated temperatures for fresh foods) and Dry (ambient). The temperature zones tell you a lot about the operation from a point of work and workflow basis. Naturally freezers present challenges to equipment and people and are typically more difficult than dry areas. Chiller and dry are fairly similar in terms of people/equipment challenges.

Basic Order Picking	**Total Orders:** Low **Picks Per Order:** Moderate to High
Batch Picking	**Total Orders:** Low **Picks Per Order:** Moderate to High
Zone Picking	**Total Orders:** Moderate to High **Picks Per Order:** Low to Moderate
Wave Picking	**Total Orders:** Low to High **Picks Per Order:** Moderate to High

Figure 4. Decision criteria behind the selection of a picking method.

The table in Figure 4 shows some of the basic decision criteria behind the determining the appropriate picking methodology. Each of the picking processes noted above are explained below.

Basic Order Picking. In the most basic order-picking method, product is stored in fixed locations. An order selector typically picks one order at a time made up of one to potentially many items following a sequential process to the pick locations until the entire order is picked. The picking sequence is typically determined, optimized and managed by the WMS system and the picker is guided by the WMS process flow. The order picker will normally use some type of pallet jack, picking cart, tote or box into which items selected are put. This basic order picking method can work well in operations with smaller total numbers of orders and higher number of picks per order. Operations with low picks per order may find the travel time excessive in this type of methodology. Picking operations with large numbers of orders will find that the congestion from many pickers working in the same areas slows down the processing.

Piece-Picking: Piece picking, also known as broken case and Pick/Pack operations, describes systems where individual items sometimes called 'eaches' are picked. Eaches are usually defined as the lowest level SKU or smallest individual packaging unit. So an example of a piece pick unit level in a CPG warehouse operation might be the small, single serve package of potato chips. The case level would be some multiple of the individual piece packages like 48 pieces in an overpack unit. Piece pick operations usually have many SKU's (000's), smaller quantities per pick, and shorter order fulfillment cycle times. Mail order catalog companies and repair parts distributors are good examples where you might find piece pick operations. A common piece picking methodology is called pick-to-tote. This is especially common for operations that have many SKU's, but generally small amounts in each order. An example of typical operations that would use pick-to-tote applications would be chain drug stores, pharmacies, office products and tobacco retail outlets. Totes provide an extra level of protection for the items being shipped and are re-used by these operations. Each tote typically has a unique barcode label or RFID license plate number. At the beginning of the pick process the tote barcode label or RFID tag is scanned to 'induct' the tote into the system and automatically matches the order number with the items to be picked for that order to the tote. This serves as a closed loop system that helps track product throughout the supply chain.

As with the general picking methods, the piece-picking technology and equipment used will also depend on a variety of factors. Some of the technology and equipment used includes:

- **Static shelving.** The most common equipment for storage in piece pick operations, static shelving is designed with depths from 12" to 24". Product is either placed directly on the shelving or in corrugated, plastic, or steel parts bins. Static shelving is economical and is a good method where there are few picks per SKU or where parts are very small. Picking technologies favored for static shelving are voice and barcode scanning.
- **Flow rack.** Flow rack, sometimes called gravity flow rack, is similar to static shelving with the exception that rather than shelves, there are racks tilted at an angle from back (higher) to front (lower) with small rollers on the racking. Product is stocked from the rear of the flow rack and picking is done from the face. Product can be stocked in cases, cartons or small totes or bins. If the product is stocked in an overpack like a case, typically the pickers will break the overpack unit to access the 'each' or piece level package unit. As a carton or tote is emptied, it is removed from the rack and another one will roll into place. Carton flow rack is most useful where there is a very high number of picks per SKU. Picking technologies favored for flow rack are barcode scanning and voice.
- **Carousels.** Carousels are similar to equipment used by dry cleaners to store and retrieve clothing. They have horizontal racks hanging from them that can be configured to accommodate various size storage bins. Generally an operator will run 2 to 4 carousels at a time avoiding the need for the operator to wait while one unit is turning. Carousel picking is usually performed in batches, with orders downloaded from the host system to the carousel software. Horizontal carousels are most common in picking operations with very high number of orders, low to moderate picks per order, and low to moderate picks per SKU. Horizontal carousels provide very high pick rates as well as high storage density. Picking technologies favored for carousels are voice and Pick-to-Light (PTL) systems. Barcode scanning with handheld computers can be used, but a wearable scanning solution such as a ring or back of hand mounted scanner/imager used in conjunction with voice is more effective and more common.
- **Barcode Scanners.** Though very useful in increasing accuracy levels, bar-code scanners in a fast-paced piece-pick operation tend to become cumbersome and can significantly reduce pick rates. The reason for this is the high amount of product handling required and the ergonomic penalties of having a scanner in the hand while picking. Scanners are better suited to case pick, pallet load, put away, and order checking operations and in selected picking situations where the actual speed required in the picking function is mitigated to some degree with travel times.
- **Voice-Directed Picking.** Voice technology is very effective in both productivity and accuracy across all the picking applications. Voice picking is unique in that it combines the speed of listening and talking without having to look at, read and interpret instructions on a piece of paper or display, working with your head up with visual contact on the point of work, and having the hands free to accommodate all forms of ergonomic product handling. In short, voice is has been proven in thousands of installations and varied applications be the most productive and also most accurate of the picking processes. Some customers may have high density picking operations using PTL. They often cite their preference for PTL saying that it is faster. This is not the point to address with PTL users when comparing voice. In fact, most of the older PTL systems have a limit as to how many people can work in one zone of the lights. This is a limiter on the total throughput of the system. With voice one can put as many people into a pick zone as can fit which usually greatly exceeds the number of pickers a PTL system can support. See the Warehouse/Voice Application Guide and supporting materials on Insider for more specific voice picking information.

- **Pick-to-Light (PTL).** Pick-to light systems consist of a complex system of lights and sometimes LED displays mounted on the front facing rack edge for each pick location. The system uses software to light the next pick and display the quantity to pick. The picker goes to the location, presses the 'off button' on the light and picks the quantity shown on the display. Since a significant amount of hardware is required for each pick location, PTL systems are effectively static inflexible systems, more costly to implement and maintain, and suffer from switch and light failures, they are almost only cost justifiable where very high picks rates per a limited number of SKU's can be located in a densely packed, small area occur. Also, in batch picking, put-to-lights for placing items into the totes on a pick cart is effective.

Batch Picking / Multi-Order Picking. In batch picking, multiple orders are grouped into small batches. An order picker will pick all orders within the batch in one pass using a consolidated pick list. Usually the picker will use a multi-tiered picking cart maintaining a separate tote or carton on the cart for each order. Batch sizes usually run from 4 to 12 orders per batch depending on the average picks per order in that specific operation. Batch picking systems may use extensive logic programmed to consolidate orders with the same items. In operations with low picks per order, batch picking can greatly reduce travel time by allowing the picker to make additional picks while in the same area. Picking multiple orders at the same time requires systems and procedures to prevent mixing of orders. In very busy operations, batch picking is often used in conjunction with zone picking and automated material handling equipment. In order to get maximum productivity in batch pick operations, orders must be accumulated in the system until there are enough similar picks to create the batches. This delay in processing may not be acceptable in same day shipping operations.

Zone Picking. Zone picking is the order picking version of the assembly line. In zone picking, the picking area is broken up into individual pick zones. Order pickers are assigned a specific zone, and only pick items within that zone. Orders are moved from one zone to the next as the picking from the previous zone is completed (also known as "pick-and-pass"). Usually, conveyor systems are used with totes or boxes or cartons to move orders from zone to zone. In zone picking it's important to balance the number of picks from zone to zone to maintain a consistent flow. Zones are usually sized to accommodate enough picks for one or two order pickers. Creating fast pick areas close to the conveyor is essential in achieving high productivity in zone picking. Zone picking is most effective in large operations with many SKU's, high total numbers of orders, and low to moderate picks per order.

Wave Picking. Wave picking is a variation on zone picking and batch picking where rather than orders moving from one zone to the next for picking, all zones are picked at the same time and the items are later sorted and consolidated into individual orders/shipments. Wave picking is the quickest method (shortest cycle time) for picking multi-item orders. However the sorting and consolidation process can be tricky. Operations with high total number of SKUs and moderate to high picks per order may benefit from wave picking. Wave picking may be used to isolate orders by specific carriers, routes, or zones.

Case-Picking: Case picking operations tend to have less diversity in product characteristics than piece picking operations, with fewer SKUs and higher picks per SKU.
- **Basic Case-Picking method.** This is the most common method for case-picking operations. Rather than product stored on static shelving, case-pick operations will have the product stored in pallet racks, the bottom row of pallet racks called 'slots', or in bulk in fixed or temporary floor locations. The simplest picking method is to use a hand or motorized pallet jack and pick cases out of slots and bulk floor locations. Barcode scanning and voice picking are the preferred picking technologies for productivity and accuracy.
- **Zone/Batch/Wave Picking.** All these picking types can be used for case-picking operations. This is typically done in pick-to-belt with automated sortation system configurations where cases are automatically transported, run through a barcode reader/diverter system, and directed down conveyor spurs to pallet build locations. These pallet build areas are usually terminated near outbound dock doors for ease of loading. The process of building the pallets from the cases diverted down the spurs is also known as "line-loading." Barcode scanning and voice picking are both all used effectively in these scenarios. PTL is sometimes used, but less frequently.

Technologies commonly used in Case-Picking include:

- **Paper Lists.** Believe it or not, there are many companies from small mom and pop operations to Fortune 1000 companies that still use paper pick lists. Paper lists or the use of small adhesive backed label sheets with item information printed on them are surprisingly fast when used by a highly skilled picker. The downfall of paper systems is accuracy. This method tends to be the least accurate of all methods and is extremely difficult and costly to do real-time reconciliation for incomplete or short orders.
- **Pallet Racks.** Pallet racks are the most common storage system for case pick operations.
- **Bar-code Scanners.** Barcode scanners are frequently used in case-pick operations. Since the time to physically pick the product is higher in case-pick operations, the time spent scanning tends to have less impact on productivity and gains in accuracy are substantial over paper-based processes and can outweigh a reduction in productivity.
- **Flow rack.** Although flow rack rarely applies to case pick operations, in some operations pallet flow rack or push back rack can be useful.
- **Voice-Directed Picking.** Voice technology is very effective for case picking as product handling productivity is enhanced with both hands free to lift typically heavier cases in a safe and ergonomic way. Also, having the picker's head up at all times is a strong safety benefit particularly with motorized equipment like pallet jacks.
- **Automated Conveyor (belt) and Sortation Systems.** If using zone or wave picking, automated conveyor and sortation systems will likely be a part of the system. In case picking, you may use standard conveyors to transport individual cases or unit-load conveyors to transport pallets.
- **Lift Jacks.** As previously mentioned, hand operated or motorized pallet jacks, man-up order selectors, and man-up turret trucks are the vehicles of choice for case-pick operations.

Full-Pallet-Picking: Full-pallet picking is also known as unit-load picking. The systematic methods for full-pallet picking are much simpler that either piece pick or case pick, however, the choices in storage equipment, storage configurations, and types of lift trucks used are many.

- **Basic Pallet Picking.** This is the most common method for full-pallet picking. Orders are picked one at a time. The order picker will use some type of lift truck, retrieve the pallet load and stage it in a shipping area in a staging lane designated for that order, or just pick and load directly into an outbound trailer or container.
- **Zone and Wave Picking.** Pick zones can be used in wave picking for pallet-picking operations. The storage area is broken into zones to eliminate multiple lift-truck operators from picking in the same aisle. The lift truck operator may pick the pallet and deliver it directly to the designated staging lane or place it on a unit-load conveyor that will deliver it to the sorting/staging area.
- **Task Interleaving.** Task interleaving is a method used to combine picking (usually pallet picking) with other fork lift applications like replenishment and put away. Warehouse Management Systems (WMS) use logic to direct a lift truck operator to put away a pallet or conduct a replenishment of a pallet on a high rack location to a slot (floor location) en route to the next pick. Often an inventory count or cycle-count can be interleaved with put away, replenishment and picking applications. Task interleaving greatly reduces travel and helps to optimize labor and equipment flexibility and task response times.

Technologies commonly used in Pallet Picking include:

- **Pallet Rack.** There are numerous pallet rack configurations used in full pallet operations, from standard back-to-back single pallet depth configurations to double-deep rack, push-back rack, drive-in/drive-thru rack, and flow rack.
- **Automatic Storage & Retrieval Systems (ASRS).** Unit-load ASRS when combined with unit-load conveyors and sortation systems can provide fully automatic pallet picking operations. And the ability to store product in racking up to 100 feet high gives excellent storage density. ASRS systems are used effectively in full pallet operations to defray labor costs. While extremely costly and complex mechanically, ASRS systems can be economical over longer payback periods.
- **Automated Conveyor and Sortation systems.** Automated conveyor and sortation systems can be combined with ASRS units or used in conjunction with manual picking with lift trucks in zone/wave picking systems. Either the ASRS or the lift truck operator delivers the pallet load to the conveyor. The conveyor system then delivers the pallet to the shipping area where it is either manually sorted by lift trucks into the designated staging lane, or a sortation system automatically sorts into a staging lane. Staging lanes can be equipped with automated or gravity fed unit-load conveyor.
- **Lift trucks.** The lift trucks used for pallet picking will depend upon the storage configuration.

Task Interleaving. Task interleaving describes functionality that mixes dissimilar tasks such as picking, replenishment, inventory/cycle counting and put away to obtain maximum productivity. Used primarily in full-pallet-load operations, task interleaving will direct a lift truck operator to put away a pallet on his/her way to the next pick. In large warehouses this can greatly reduce travel time, not only increasing productivity, but also reducing wear on the lift trucks and saving on energy costs by reducing lift truck fuel consumption. Task interleaving is also used with cycle counting programs to coordinate a cycle count with a picking or put away task.

Replenishment. In the case of high velocity items the DC may have two storage locations; one that is convenient for the pickers to access (typically the floor slot location), and one that is farther away but has more storage room (typically the upper rack levels where full pallets are stored). Replenishment is simply moving goods from their storage location to the convenient pick location. Replenishment is typically done by the same staff that handles put-away; pickers would rarely be involved in replenishment.

Cycle Counting. Cycle-Counting is the practice of taking frequent partial inventory counts. Most WMS will have some cycle counting functionality. Modifications to cycle counting systems are common to meet specific operational needs.

Cross Docking. In its purest form cross-docking is the action of unloading materials from an incoming trailer or rail car and immediately loading these materials in outbound trailers or rail cars thus eliminating the need for warehousing (storage). In reality pure cross-docking is less common in distribution centers and more common to trucking depots and freight consolidation points. Most "cross-docking" applications in a DC are more closely aligned with 'flow through' applications where the operations require staging areas where inbound materials are sorted, consolidated, and stored until the outbound shipment is complete and ready to ship. True cross docking in a typical DC environment requires extremely good management of receiving and outbound timing and places a high degree of importance on the WMS and shipping coordination to accomplish.

Pick-to-Carton. For parcel shippers, pick-to-carton logic uses item dimensions/weights to select the shipping carton prior to the order picking process. Items are picked directly into the selected shipping carton rather than being picked and given to someone else to Pack. When picking is complete, dunnage is added and the carton sealed eliminating a formal packing operation. This logic works best when picking/packing products with similar size/weight characteristics. In operations with a very diverse product mix it's much more difficult to get this type of logic to work effectively.

Slotting. Slotting describes the activities associated with optimizing product placement in pick locations in a warehouse. There are software packages designed just for slotting, and many WMS packages will also have slotting functionality. Slotting software will generally use item velocity (the frequency with which the item is picked), cube usage, and minimum pick face dimensions to determine best location.

Yard Management. Yard management describes the function of managing inventory and equipment such as tractors and trailers parked outside the warehouse. Yard management when directed at vehicles and rolling stock is generally associated with cross docking operations and may include the management of both inbound and outbound trailers.

Labor Tracking/Capacity Planning. Some WMS systems provide functionality related to labor reporting and capacity planning. Manufacturing operations use similar logic in their planning processes. Basically, you set up standard labor hours and machine (usually lift trucks) hours per task and set the available labor and machine hours per shift. The WMS system will use this information to determine capacity and load. The need to factor in efficiency and utilization to determine rated capacity and time and motion studies of specific work flows by product type and variation of weights, sizes, and handling characteristics makes developing true engineered labor standards a difficult task. Most advocates of labor tracking and engineered labor standards use it for individual productivity measurement and to establish labor forecasting standards to help manage overtime and other variable labor costs. Many WMS applications maintain enough data to create general productivity reporting. But to really address some of the more sophisticated and powerful labor planning needs, a specific labor module is usually required along with time-and-motion data.
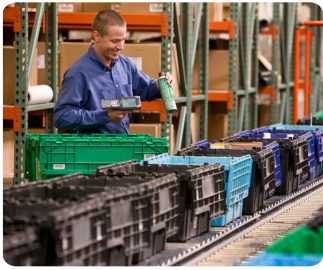
Why Intermec?

Positioning and Differentiating Intermec
Intermec has great products and great experience...but the competition can make those claims too. Intermec's unique Value Proposition is that our complete offering – a total solution of hardware, software, and services – delivers both superior employee effectiveness and TCO. In most cases, this includes important value delivered by an ISV or reseller to complete the whole product solution.

Intermec's Warehouse/DC Elevator Story
Situation: Like many businesses, Warehouse and DC operations deal with ongoing economic uncertainty. In order to thrive, they need better control of inventory and operating costs, while maintaining or improving customer satisfaction.

Conflict: Unfortunately, customer satisfaction and operating efficiency both depend on one of the most expensive elements of every warehouse or DC operation – a strong, agile, well-trained, motivated labor force.

Resolution: As the only vendor providing every key building block for a rugged mobile business solution, Intermec has solved this difficult problem. Our purpose-built products are managed and supported by our unified software and services platform, and are backed by a one-stop support infrastructure through our global reseller network

Benefit: By focusing our design on the user first, each Intermec solution element adds to optimized worker performance. By offering all the key components, we are able to ensure the lowest TCO from one generation to the next. Intermec has redefined the rules for TCO and, more importantly, the Total Customer Experience.

Buyer Profiles

User Buyer – (COO, VP Service, VP/Director of Field Services)
User buyers are usually the 'instigators' for bringing new technologies, processes and investments into the operations of the warehouse/DC. Primarily driven by hard ROI calculations, proven performance metrics improvement, TCO and employee satisfaction, user buyers strive to optimize workforce efficiency and motivate their workers. Giving their workforce the right "tools" to do their job is a stated goal. The old adage for any operations executive is that happy workers who believe that management are doing their best to invest in their success will be the most efficient, cost effective and productive workers.

In many cases, user buyers will have worked their way up from a warehouse floor worker role, such as picking. Some will come with operations and business degrees from prestigious universities. They are always very practical, no-nonsense people very much in tune with and empathetic to the difficulties of the work. They respect excellent, productive, caring workers. They will tend to view solutions from the typical worker's perspective, and feedback from their staff is important in their buying decisions. They may request a pilot of the solution proving out the benefits before accepting it. The user buyer wants to ensure that the system will be easy to learn and will result in improved scores on all the key metrics for which they are responsible.

User buyers want DC staff to be focused on completing the work; not distracted by issues with technology. Ease of use, superior ergonomics, simple interfaces, and high quality products will go a long way with this buyer. Any "paperwork" is also seen as a necessary evil, and they are all for anything that reduces it or makes it easier.

User buyers are faced with widely varying workforces. They may have older workers who have tribal knowledge and know to take shortcuts and work around the system. This is both good and bad depending on the operation. Older workers are also the most difficult to enable with new technology. Their learning curve is greater, they have difficulty reading small displays, and they may be set in their ways. They have been doing things one way for years and may not see the need to change. User buyers are sensitive to this so they focus on things like ease of use and adaptability.

The user buyer typically will have more than one native language in any given DC. And many times depending on the country, the number of languages can be up to 10. Low wages and difficult working conditions often attract immigrant workers that are not fluent in the official national language.

Just as often as having older workers, these jobs attract many younger workers that are technology savvy and take upgrades to equipment and process improvements in stride. The issue with these workers is they tend to be less loyal and jump to other jobs/companies. And these are often the type of workers that make up the part-time or casual labor force required to meet peak production periods. This makes managing turnover and reducing training costs around language and new workers very important. It can take weeks or months for a new worker to reach target productivity levels. Training aids and knowledge management solutions will shorten the learning curve for new staff. Additionally, one of the most compelling payback elements of a voice solution is the reduction in training. Proven field results indicate new workers with no experience can attain full target productivity and accuracy within hours or a couple days at the most. New technologies for on-demand learning (i.e. video aids, electronic training material), and access to product training specialist personnel during roll-outs of new product solutions are of strong interest to user buyers.

Ergonomics of equipment handling and usage are very important to user buyers. They will be interested in all aspects of the ergonomics of product solutions. The less impact the equipment has on the user, the better productivity and other benefits will accrue to the user buyer. Safety issues and the costs related to worker injury and associated insurance costs are also a concern.

Lastly, when considering solutions for their operations, user buyers want as low of a total admin exposure and 'hassle' with the least amount of administrative overhead as possible in the systems they buy. Most DC's have very little IT support and the relative complexity of some solutions, whether it is managing the computers on the network, managing the equipment check in/check out processes, battery charging to assure full-shift use, having the software managed properly, accessing spares, managing labels and all other product-centric impacts on their admin staff is critical. In this category - less is more. The more we can address these issues and the ease-of-use of our products and services, and the more convenient we can make it for our resellers to provide very high levels of service if/when there is an issue – the better.

Economic Buyer (CEO, CFO, VP Finance, CIO)

TCO and ROI are primary considerations for this buyer. The economic buyer needs to be convinced that an investment in technology will achieve a rapid ROI within the operation. The economic buyer will compare initial pricing and TCO with the competition. They will want to understand all the expected costs of the full solution, both hard and 'soft' costs that impact the long term TCO. They are very hard-nosed, financially driven decision makers. Convincing the economic buyer will likely require detailed calculations of ROI and TCO. Most often, the financial justification will be needed to move your project and/or investment to the top of the list of the competing investments. The economic buyer's role is to allocate resources within the operation. Only those investments that can compete effectively with the other options and choices will receive approval.

Facing the high cost of skilled staffing is a key concern. How can our solution speed work and improve accuracy for a wider range of employee skills? This buyer will be eager to see how less skilled and less experienced workers can be made more effective through the use of our tools.

Creative financing may arise in discussions with the economic buyer. Equipment leasing and payment terms may be of interest. Managed services may be attractive, especially for companies that are short on capital and resources.

Economic buyers are sensitive to and understand the total life cycle of investments. They are going to want to squeeze every drop of reliability and performance out of the solution and sweat the assets as a matter of principle. That said, they do expect to migrate to new products at some point and any evidence that we can provide that will mitigate migration costs at that time can add significantly to the ROI and TCO analysis. Economic buyers tend to have a strong vested interest in the success of the technical and user buyers in major investment decisions they make. Consequently it is critical to have the support of both the user and technical buyers for our solution.

Technical Buyer – (CIO, VP IT)

Technical Buyers are typically called on to render the official technical opinion of the prospective solution vendors. They are almost always capable of saying "no" to a vendor or solution. And in many if not most cases in the warehouse buying cycle they do not by definition have the ability to say "yes" to an investment. That is the role reserved to the economic buyer. However, the technical buyer is highly influential and must be a willing recommender of any warehouse/DC technology investment, regardless of how persuasive and powerful the user buyers are in the equation. Technical buyers are primarily concerned about integrating and supporting all elements of the system. They will examine how well each solution element performs and how well it ties into existing systems. They will want to be sure there is a clear path for installing, maintaining and supporting, and then migrating the solution (prepare – perform – protect).

When their own IT organization is not capable of developing and supporting the warehouse system, technical buyers need find a partner they can rely on. They typically start with their existing WMS or ERP provider. Having a strong endorsement from the WMS provider of choice, or more importantly having the WMS reselling our solution as their lead and preferred solution will be the most influential with the technical buyer (and frankly the other buyers as well). In most cases, they do not want to build out a bunch of point solutions and try to cobble together a whole solution from disparate parts. They want to buy a cohesive, highly stable, reliable, and well (inexpensively) supported full solution.

Technical buyers will compare hardware specifications with competitive offerings to make sure they are getting the relevant specs on the equipment necessary to meet their technical requirements. They will often be asked by the economic buyer to produce the 'specifications comparison checklist' and may tend to take the importance of bits and bytes to the illogical extreme, if simply to justify a vendor preference. This tendency must be overcome where we don't have a significant product superiority situation by mitigating any specs or technical concerns with other supporting systems and services values. The importance of providing a strong, technical life-cycle argument regardless of individual product technical or performance superiority is always a consideration.

The technical buyer may also be responsible to the operations team (user buyers typically) for supporting new users on IT systems and networks. This means that technical buyers will raise concerns about ease of training as well as ease of use.

Having a stable mobile computing solution is one of the technical buyer's biggest concerns. Technical buyers know that if any technical systems problems arise, they will be on the firing line to get the problems resolved. DC operations are by definition mission critical. This is where the value of the reseller (primarily the WMS and/or warehouse systems integrator) relationship and confidence with all aspects of the Intermec value proposition are important.

Technical buyers will vary in their desire to stay ahead of the pack with technology. As in any industry, some will be early adopters who want to be first with the new technologies. Others will want to move with the majority of their peers, waiting for the early adopters to first prove the technology. These are the customers who will want to hear about your success stories for other similar businesses and companies they view as their peers. Most of the warehouse/DC technical buyers (and economic and user buyers) will be in the majority vs. early adopters.

Target Segments

The targeted segments below describes the vertical segments found within the warehouse/DC deployment environment. While not exhaustive by any means, these are the primary segments to address with our solutions platform. They are noted in order of importance based on overall size and concentration of business within the Tier 1 and Tier 2 accounts, economic factors that increase the need for higher levels of mobile computing automation investment, and the relative ease with which they can adopt our recommended solution sets. This list is globally applicable.

Primary Segments:
- Grocery Retail/Wholesale
- General/Specialty Retail
- 3PL
- CPG
- Food Service
- Pharmaceutical/Healthcare Distribution

Additional, but generally secondary segments include:
- Automotive Supply Chain
- Catalog Retail Operations
- Electronics Distribution
- Discrete Manufacturing
- Convenience Store/Petrol Forecourt Operations

Compelling Events/Market Drivers

There are multiple situations that can lead to compelling events. All are dependent on specific segments and will require significant discovery to uncover for each prospect or customer. A few of the more common current issues are:
- WLAN refresh
- Current products refresh
- Significant improvements from voice picking processes
- Food track and trace processes (currently voluntary in most countries)
- WMS replacement to a new vendor
- Implementation of a new ERP with integrated WMS component
- Extension of key WMS functionality not currently in use
- Extension of voice processes to inbound and outbound applications
- Dissatisfaction with existing technology providers
- Desire to address fluctuating customer base and portability of equipment/software from site to site (primarily 3PL need)
- Move to opex based purchasing model
- Acquisition and/or facility expansion
- Facility repurpose/retrofit
- New forklift purchase

Sales Opportunity and Engagement Qualification

Also see Voice/Warehouse application guide for examples on Insider.

Qualification: To determine the end user's current buying preference, it is ESSENTIAL that you identify the WMS software systems vendor to the end user. This knowledge is necessary to properly manage the engagement, direct the sales cycle, and avoid unnecessary channel conflict if one or more of our existing reseller partners or ISV's are in the account.

If they use a 'best-of-breed' WMS solution from a Tier 1 or Tier 2 vendor, and they are still getting support (on a maintenance contract) from their WMS provider, chances are the WMS provider would be their historically preferred vendor from which to purchase Intermec products and services. This is because in most cases DC operations like to have one "throat to choke" if anything goes down in the operation. Warehouse/DC operations are by nature "mission critical". If they go down and miss orders and shipments to customers/stores, that is a major and extremely costly business disruption. Generally speaking, if this relationship is intact and healthy, the WMS reseller is our preferred channel.

If they are no longer receiving support for the WMS from the original vendor, they are likely maintaining the code themselves or are using a specialty VAR or systems integrator. In this case, developing a clear understanding of their preferred vendor is critical. Note that this type of situation may indicate they are comfortable to unbundle key elements of the solution. It is important to reinforce the full suite value proposition we provide to ensure they can receive the maximum value from whichever channel they prefer.

The next question to determine if they do not have a strong relationship with an existing WMS provider is whether they have a significant investment in material handling or automation equipment and software, and if so from whom did they buy it? Generally these solutions interface to the WMS and are driven from the business logic within the WMS. The material handling solution software will operate equipment such as automated sortation, ASRS, and other common automation products. Many times these systems integrators or vendor companies are a preferred vendor for Intermec products and services. It is critical to qualify if one of these vendors is involved and whether they are a preferred channel for the customer.

Once these primary channel related questions are answered, the general qualification of the prospect or customer (as noted above and in the customer facing deck and support presentation deck instructions document) can begin.

Appendix A:
Additional information can be found at the sites below:
http://www.intermec.com/partner-files/sales-resources/misc/en/WERCwatch-Spring-2010-final.pdf