GET READY FOR THE NEXTGEN E-COMMERCE AUTOMATION REVOLUTION

SSI SCHAEFER
White Paper

NOV. 2018

How to Plan for 1 Million+ SKUs and Units / Day Throughput – Even with Labor Shortages.

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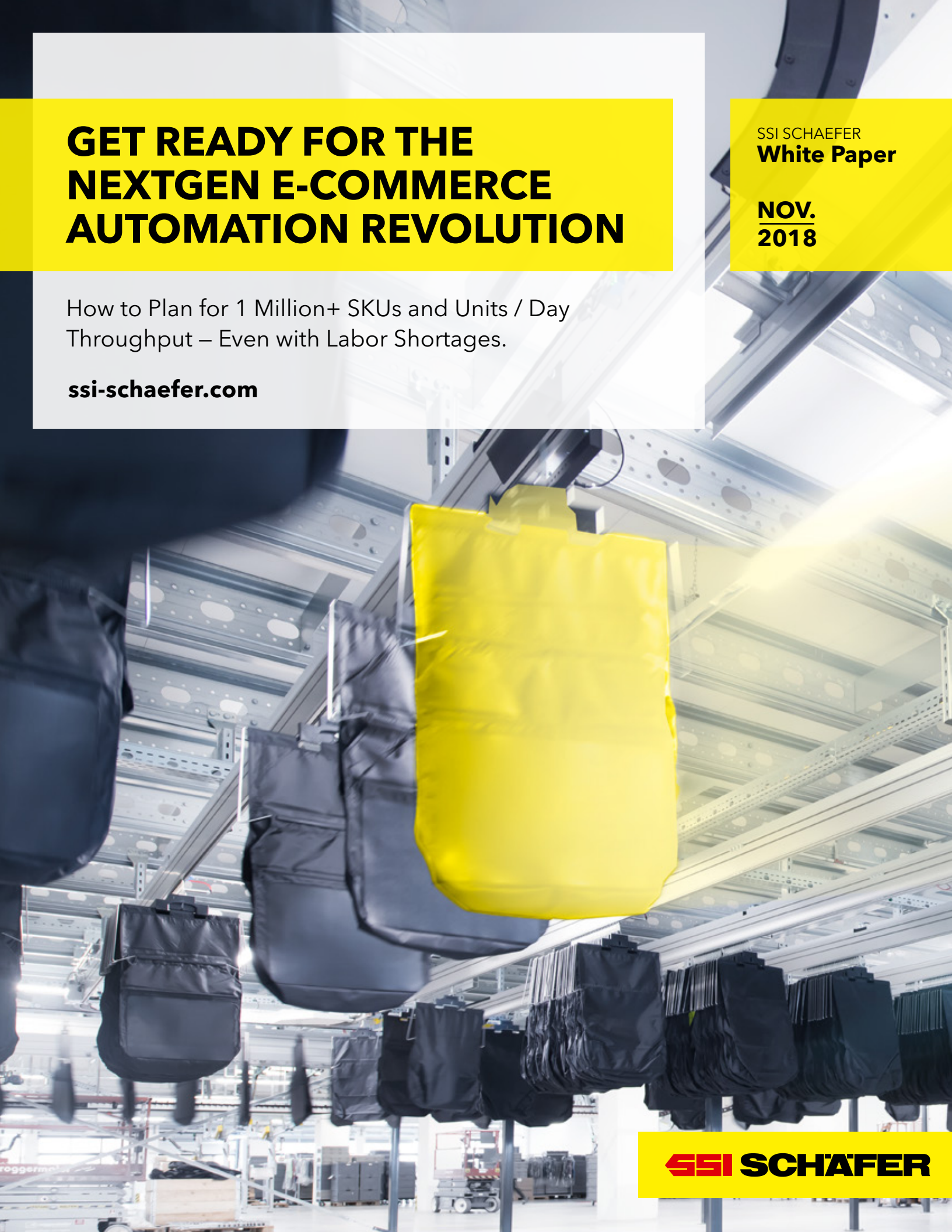


SSI SCHÄFER

KEY CHALLENGES FACED BY OMNI-CHANNEL RETAILERS STRIVING FOR A COMPETITIVE ADVANTAGE

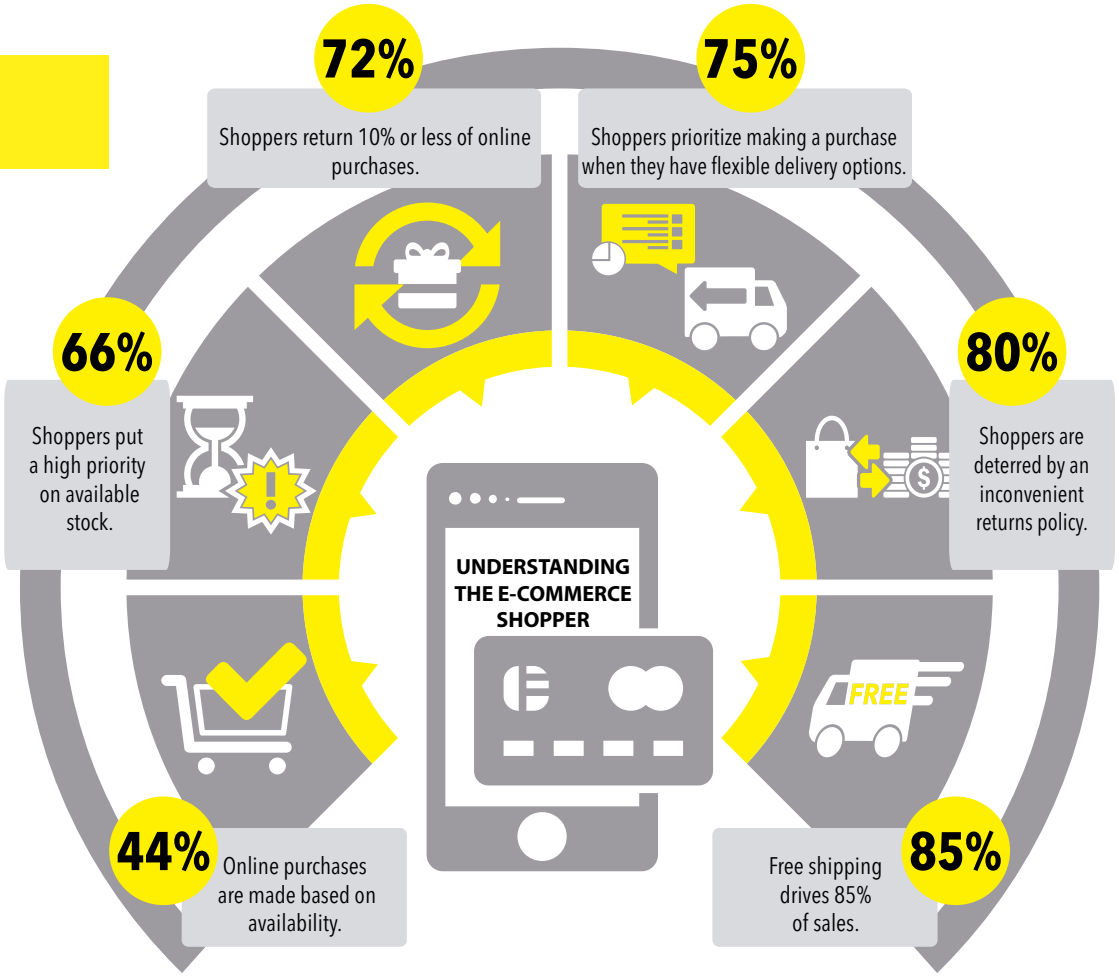
E-commerce has grown tremendously in the past few years, and shows no sign of slowing. Indeed, the National Retail Federation's 2018 economic forecast projects that overall retail sales will increase at a minimum of 4.5% over 2017, with online sales—a part of that overall number—increasing by 10% to 12%.

Further, the U.S. Census Bureau's first quarter 2018 report estimated retail e-commerce sales at $123.7 billion, a 16.4% jump over the first quarter 2017.

As consumers increasingly flock to the Internet to shop, their expectations of both e-commerce and omni-channel retailers are expanding. Thanks to what's been termed "The Amazon Effect" by researchers at Millennial Marketing, 37% of today's consumers—regardless of their generational demographic—expect to be able to purchase a virtually unlimited selection of items in any given category from any single online retailer or marketplace.

Online shoppers—notably 66% of the rising Generation Z/iGen demographic of consumers—want very few products to ever be out-of-stock. (As much as 44% of a retailer's sales are lost due to out-of-stock inventory.)

All e-commerce consumers expect their purchases to be delivered in extremely compressed timeframes (as in next-day or same-day shipping eligible), accurately and on-time. More than 85% say free shipping (or a low minimum order



value required to receive free shipping) is either important or very important. More than 63% say it is either important or very important to have options in where they both receive shipments (home or office delivery, locker delivery, order online/pickup at store) and can easily return (via parcel shipping or return to store) items.

For omni-channel retailers—those with traditional brick-and-mortar storefronts that have online shopping options in an effort to attract and retain customers—the pressure from larger retailers is immense. Yet, they must find ways to compete in order to stay relevant and in business, or risk closures. Throughout 2017, and already in 2018, numerous retailers have declared bankruptcy and/or shuttered physical stores. Among them: Macy's, J.C. Penney, J. Crew, Abercrombie & Fitch Foot Locker, Best Buy, Toys 'R' Us, Sears, Kmart, and more.

To meet these challenges, retailers are creating new supply chain strategies, featuring a mix of store fulfillment, regional fulfillment, and centralized fulfillment of a large number of SKUs. Retailers are attempting to find a balanced approach in SKU breadth and depth at these facilities, optimizing for critical elements such as order lead time and transportation costs. In a balanced strategy, there is significant incentive to explore the concept of large fulfillment centers that not only have the breadth and depth of SKUs to serve the next generation of e-commerce consumers, but do so in a way that takes advantage of modern technologies and meets the requirements of today's business climate.

When designing a fulfillment center solution that can enable an omni-channel retailer to successfully compete within the NextGen retail landscape, a range of challenges must be addressed.

REQUIREMENTS AND CHALLENGES WHEN DESIGNING A NEXTGEN E-COMMERCE FULFILLMENT CENTER

- **SKU Capacity**: The capacity to actively store and access considerably more stock keeping units (SKUs) than ever before—up to one million plus in one facility—and to service both e-commerce customers while replenishing brick and mortar stores. In addition, storefronts must be able to adequately accommodate additional SKU selection above and beyond physical inventory capability or that of a regional DC.
- **Surge capacity**: The flexibility to accommodate both daily demand and handle peak seasons, including back-to-school and holidays.
- **Order variety**: The need to handle a variable number of pieces per order to support different order profiles for various times of year, including promotions.
- **Labor constraints**: The ability to achieve high throughput in one of the tightest labor markets. Plus, extreme difficulty in finding and retaining warehouse labor—particularly in regions where parcel shipping hubs (and many other warehouses currently reside). Many employers need to provide a more desirable work environment to attract better labor.
- **Prioritization**: The capacity and flexibility to handle priority orders that can come in at any time, such as for the customer who pays extra for next-day shipping by noon, meaning the order must go out by 3 p.m.
- **Flexible and Scalable**: Forecasting e-commerce growth is nearly impossible. NextGen solutions must be flexible to change with order dynamics, but intelligent enough to leverage historical data with the capability to scale to meet future demands.
- **Space constraints**: Spec builds are a frequent requirement for retailers looking to rapidly expand footprint and service. Unfortunately, spec buildings often have less than 1 million square feet and clear heights of only 36' to 40', which make implementing a solution difficult.
- **Stock capacity**: Must have the ability to hold 15-20 million units of inventory in active status, to enable the responsiveness and depth needed to make it through major peaks, such as Black Friday volumes.

This white paper explores the limitations of current e-commerce and omni-channel distribution and order fulfillment systems. In addition, it takes an in-depth look at how to evaluate various logistics concepts coupled with real-life application challenges and introduces NextGen automated handling systems and companion software. This white paper does so with the concept of stocking 1 million SKUs and moving them at rates of 1 million units per day with just 1-hour lead time and minimal labor requirements.

CURRENT AUTOMATED FULFILLMENT OPTIONS

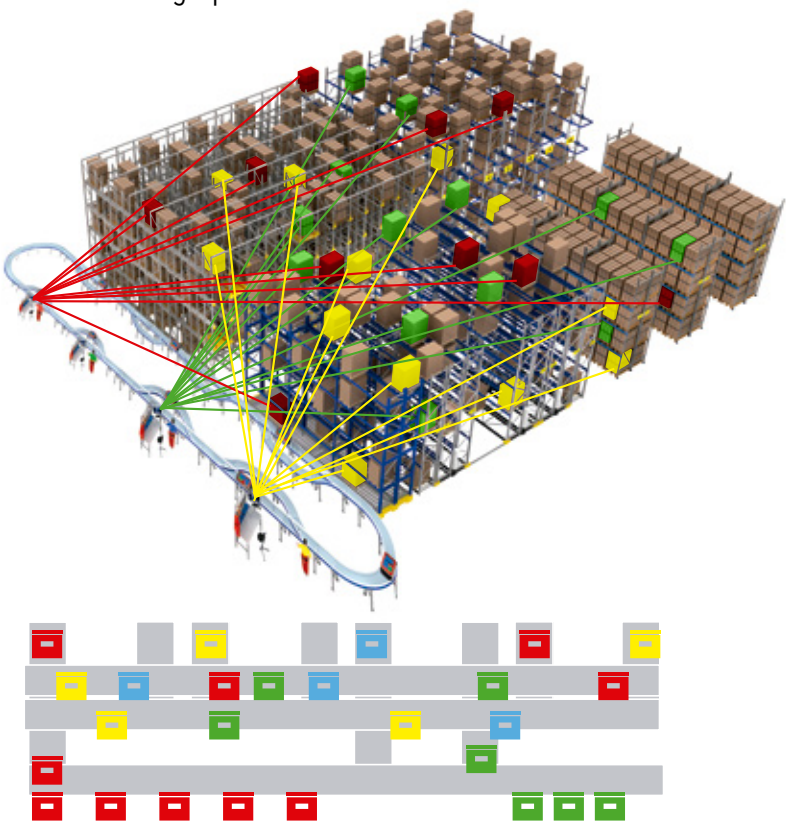
Discrete Picking
In a discrete picking operation, operators or robots pick orders from stock individually. This means that all items must be consolidated, and sortation at unit level is not required. Its roots are in retail order fulfillment, where a higher number of units per order line makes this an efficient way to fulfill orders.

Whether the solution deployed is a shuttle- or crane-based automated storage and retrieval system (AS/RS) as shown in Figure 1, the number of movements and touches associated with handling throughput of 1 million unit picks per day will ultimately overwhelm the system. With an order profile close to 1.1 units per line, even the systems with very high speed connectivity between zones cannot be easily or cost effectively scaled.

The high number of supply tubs or cartons generated in this concept (due to consolidation of inventory at a specific location) creates a very difficult flow to manage effectively at this throughput level and with this order profile. With robotic based systems or 3D shuttles, other challenges such as traffic management of the robots or the number of transfer locations can become bottlenecks.
For lower throughput systems or systems with different order profiles, these systems can be very effective while maximizing the productivity of available labor, as shown in Figure 2.

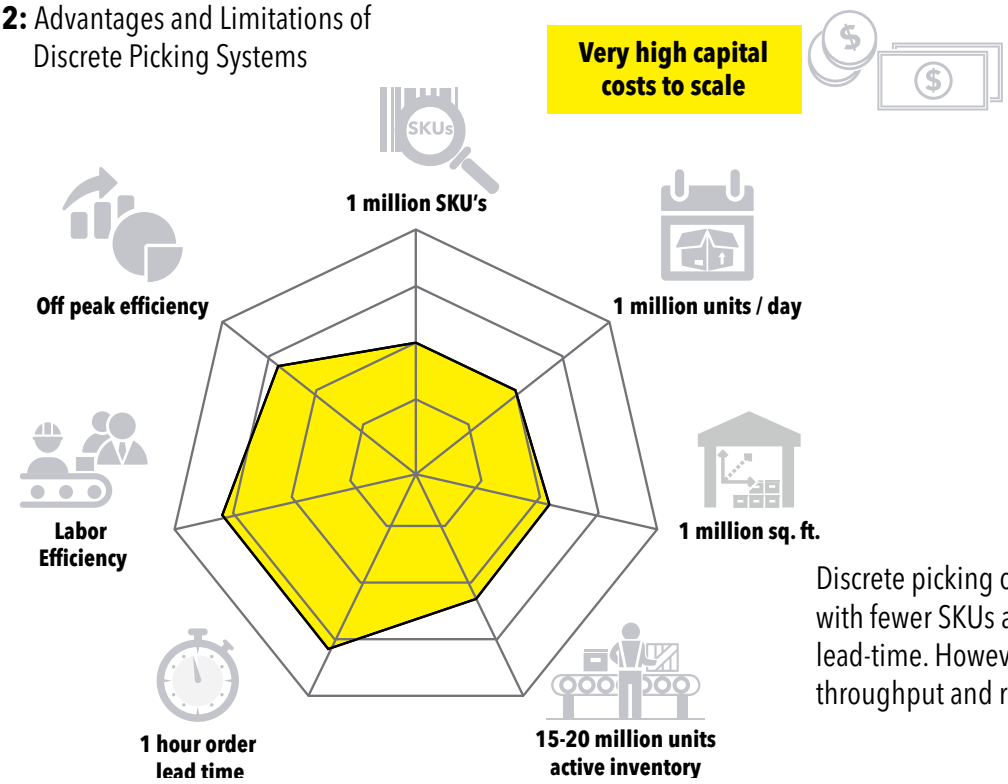
In high throughput discrete picking systems with many SKUs, getting the appropriate number of supply tubs or cartons to the correct pick location becomes very difficult due to the order profile, irrespective of technology.

Figure 1: Discrete Picking Operation



In this graphic, supply tubs carry inventory for specific orders (indicated by like colors) on a conveyor system in front of an automated storage and retrieval system (AS/RS). As the number of orders increases, supply tub traffic coming to a pick station increases, which can create bottlenecks.

Figure 2: Advantages and Limitations of Discrete Picking Systems



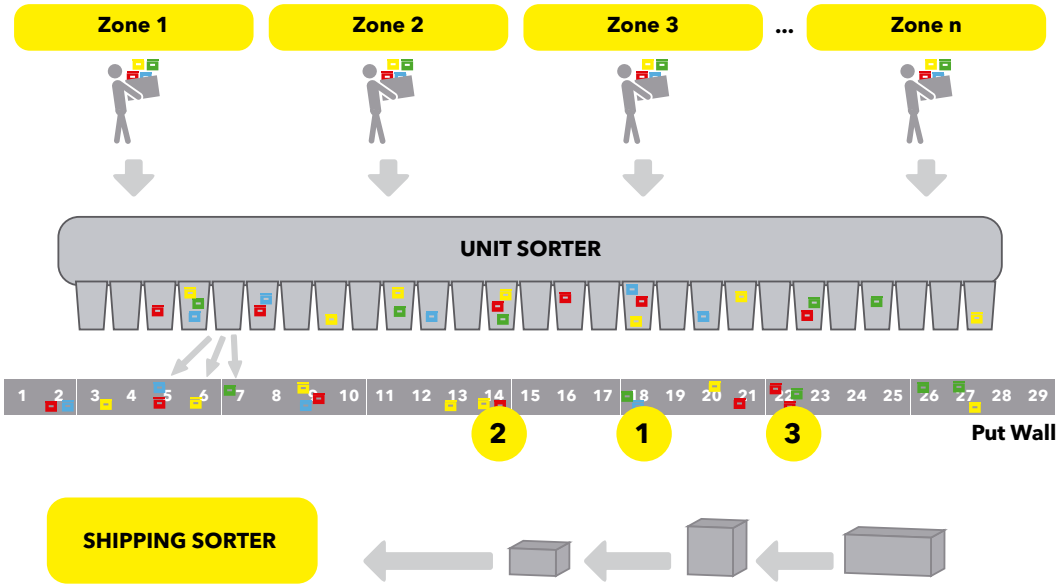
Discrete picking options work well with fewer SKUs and feature fast order lead-time. However, they fall short on throughput and require more space.

Legacy Batch Pick Sortation

In this concept, single items are picked together from legacy storage systems such as pick modules (irrespective to individual order) and then taken to a loop or line unit sorter for consolidation via put wall or directly at pack-out, as shown in Figure 3. Although this type of solution can suitably handle up to 300,000 units per day, it doesn't easily scale to 1 million units per day. The "batch tail off effect," and it's associated impact on manpower requirements and utilization of equipment, combined with a lack of resiliency to SKU proliferation, hamper the concepts scalability against the listed requirement (see Figure 4).

The concept also struggles with storage density, and can't provide enough days on hand to make it through peak season. In fact, a senior vice president of logistics for a major retailer who evaluated this concept as a potential solution to meet his NextGen e-commerce fulfillment operation goals said, "Our traditional e-commerce batch concept would have required over 2 million square feet and thousands of people to scale to 1 million units per day. Aside from this, we don't believe it scales above 300,000 units per day."

Figure 3: Legacy Batch Pick Sortation Operation



The number of sort/put destinations limit the batch size. This limitation produces a low pick density, unproductive picking, and a large labor force. Inefficiencies compound when large labor forces get too far out of sync and orders cannot be cleared.

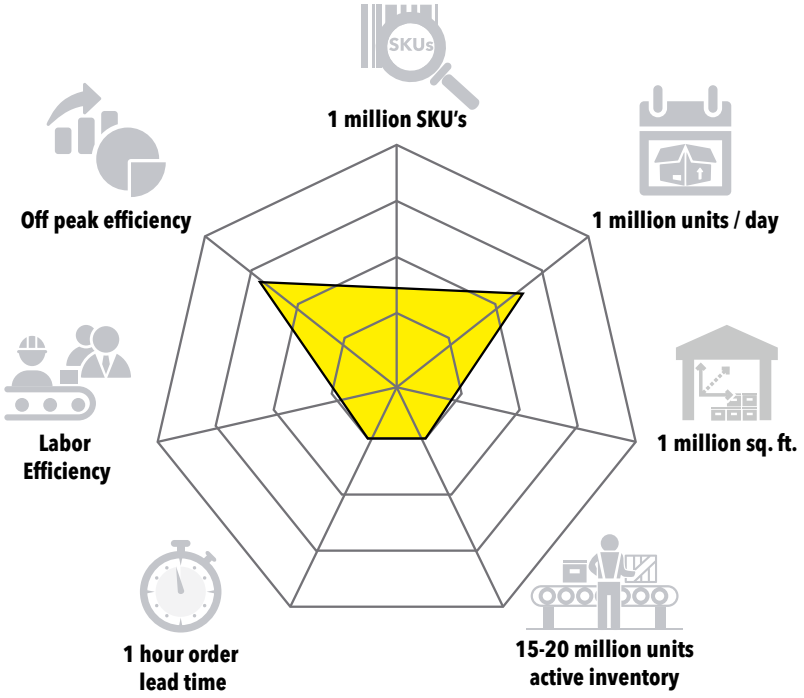
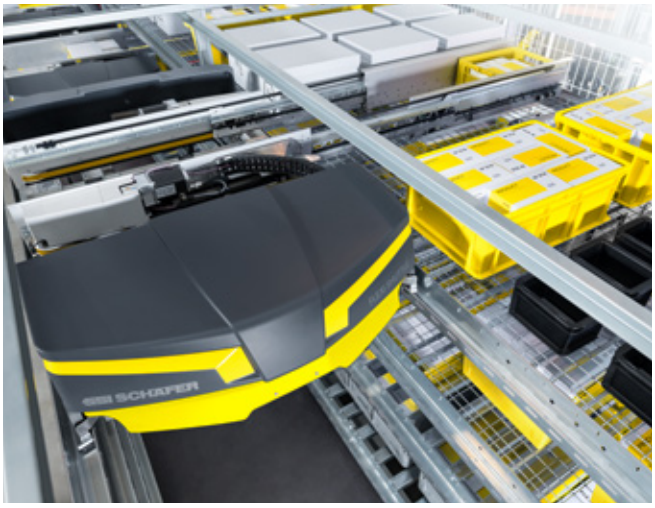


Figure 4: Advantages and Limitations of Legacy Batch Pick Sortation Systems

Legacy batch sortation systems have the capacity to handle large throughput and provide off-peak efficiency, but fall short in several key requirements.

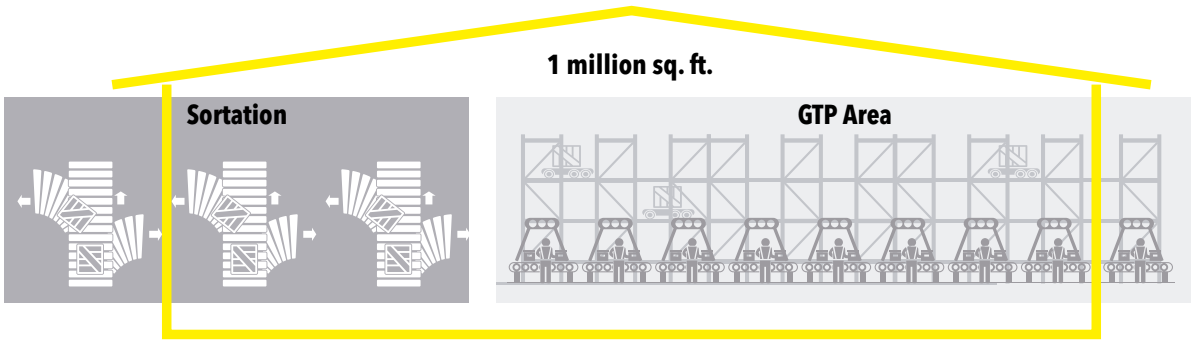
Waveless Goods-to-Person (GTP) Automated Picking. As one of the newest solutions aimed at e-commerce challenges, waveless GTP picking systems provide incredibly dense storage while reducing touches by delivering required SKUs directly to an operator from an AS/RS system. Once delivered, the operator picks items for large groups of orders at a workstation, providing substantial increases in efficiency and throughput compared to legacy batch sortation.

However, to handle 1 million different units efficiently requires multiple sortation systems—which physically won't fit in a given 1 million square foot distribution center, as shown in Figure 5. Further, travel distances from point of pick to shipment become too great to effectively meet order lead times, while the labor involved in staffing each module and in consolidating multi-unit shipments must be both skilled and plentiful (see Figure 6).



High-density tub and carton storage provided by an AS/RS system allows for sufficient quantity of stored units during peak periods.

Figure 5: Waveless Goods-to-Person Picking



Waveless GTP picking combined with legacy sortation nearly meets throughput requirements for 1 million units, but this can't be done in 1 million sq. ft.

Figure 6: Advantages and Limitations of Waveless Goods-to-Person Picking

Waveless goods-to-person picking meets the majority of requirements, but requires in excess of 1 million sq. ft at these volume levels and will struggle to meet 1-hour lead time requirements.

PRICE OF SINGULATION

Inside a fulfillment center, the most expensive thing one can do is singulate an item and preserve the singulation throughout the process. Purely from an efficiency and throughput standpoint, it is much more effective to transport and process in bulk. The demands of e-commerce are such that during fulfillment of orders, there isn't the luxury of moving load units in the form of a pallet or even a carton. This function is best done at an item level.

From a cost and efficiency standpoint, the first priority of the operation is to singulate orders as late in the process as possible and at the lowest cost. One of the biggest cost factors for singulation is labor. However, the square footage required for singulation, along with the equipment costs and the footprint associated with automated equipment, are all items that need cost review.

When considering traditional sortation options, various technology options exist. Due to capacity and density of exits, loop sortation is frequently used in high-speed unit sortation (cross belt, tilt-tray, etc.) These loop sortation options feature a high level of induction throughput generated by operators and highly automated conveyor equipment, with the goal of preserving singulation from induction to packing by placing an item on a tray. Single items are then sorted to a chute, where groups of orders accumulate prior to final sortation and pack-out. Typically, the singulated items are placed on the sorter tray in a position parallel to the ground, spreading out and taking up a small percentage of a larger tray footprint.

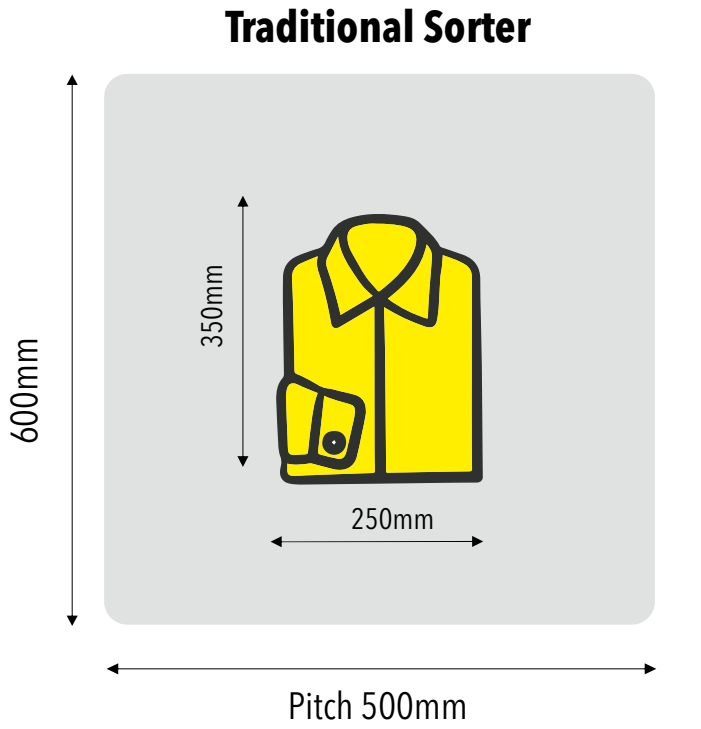
Items on the sorter frequently travel long distances and take up a small percentage of the chute volume where they are sorted. If a solution contains put walls to increase picking efficiency and takes the order consolidation function away from the chute, additional labor is required.

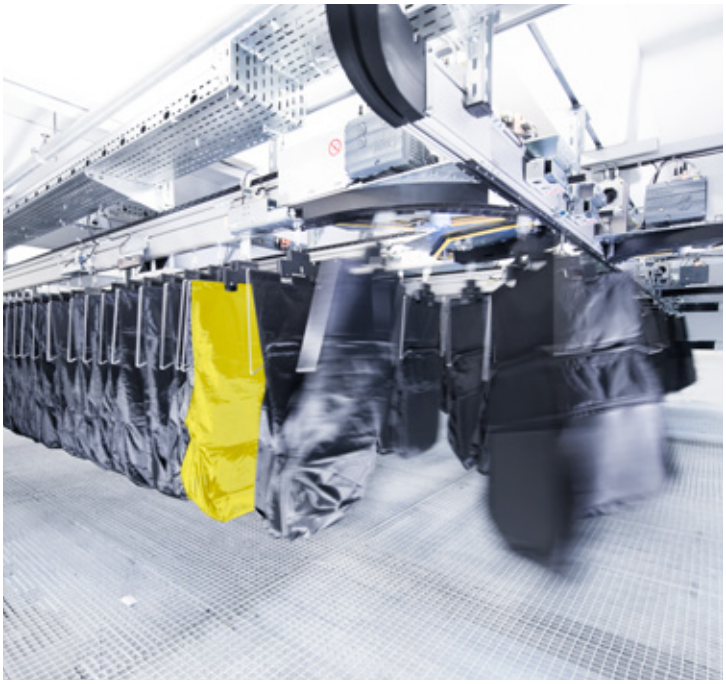
Put walls allow for greater flexibility as compared to chute only order consolidation. However, to fully mimic the performance of a system featuring complete singulation throughout the order fulfillment process, there can only be one order per chute; systems with put walls have 10 to 50 (full) orders in one chute requiring additional fine sortation. Every time an item is put on a tray in a traditional

process, that tray is occupied until it is sorted (a coupling together of throughput and singulation). The problem quickly becomes space, labor, and the ability to have only a finite number of trays per square foot in a building. We refer to this issue as the density of singulation in automation, or more simply put, the price of singulation. This price also includes the ensuing building footprint costs.

As seen in Figure 7, a T-shirt placed on a traditional sorter takes up a footprint of 600mm x 500mm, despite its comparatively small size. If we take the item and turn it vertically into a hanging sortation system, such as a pocket sorter, one can singulate seven items in the same footprint.

Figure 7

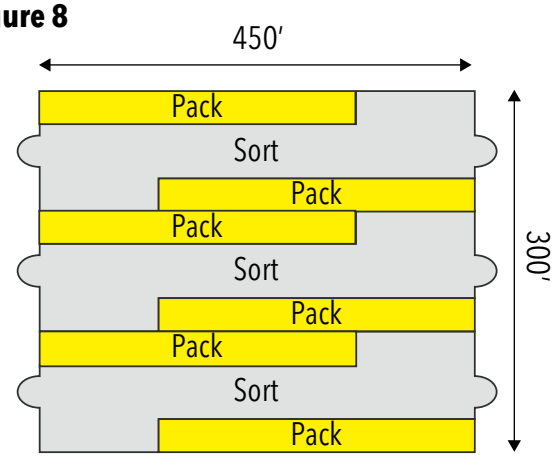




With the requirements already described, a large amount of buffering, sequencing, and sortation throughput is needed in the system for processing, which encompasses a significant amount of warehouse space. A system utilizing traditional loop sortation utilizes a significant amount of warehouse floor space at these throughput levels, as seen in figure 8.

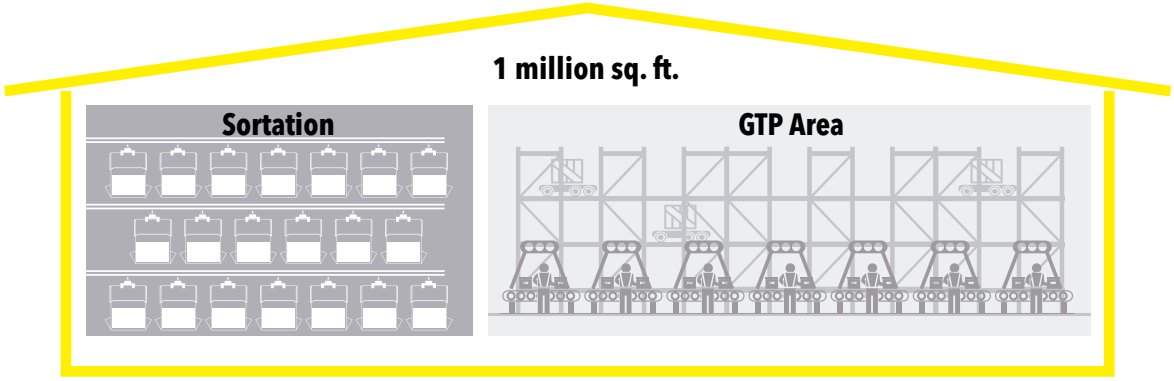
Using a pocket sortation system with the given requirements, warehouse size is reduced by approximately 10%. According to Compass International, the average price of warehouse construction is approximately $100 / sq. ft. in North America. This represents $10 million in savings for warehouse construction costs. Furthermore, the space saving solution allows for deployment within a 1 million sq. ft. building, which is the maximum size available on the spec market.

Figure 8



Since most spec buildings today are built at or around 1 million sq. ft., using traditional loop sortation could limit location options and/or reduce speed to market. In the NextGen solution featuring dense automated storage, automated pocket buffering, sequencing, and sortation, the solution can fit into a 1 million sq. ft. spec warehouse by taking advantage of the previously non-productive vertical space inside the warehouse.

Figure 9: Pocket Sortation System



THE NEXTGEN SOLUTION: AUTOMATED POCKET TECHNOLOGY IN COMBINATION WITH HIGH THROUGHPUT AND HIGH DENSITY STORAGE SYSTEMS

Offered as a new approach for tackling a critical piece of the supply chain problem for omni-channel retailers, automated pocket transportation, buffering, sequencing, and sortation technologies (frequently referred to as pocket sortation or pouch sortation) consists of overhead circulation conveyors as the primary load carrier. This system completely automates a wide variety of e-commerce warehouse functionality, including the buffering, sequencing and sortation of orders. When used in combination with waveless order processing software, high-performance asynchronous picking is achievable. In addition, entirely new functional capabilities become possible, including pre-picking of fast movers, automated and prioritized returns processing, and the highest possible level of order priority flexibility. This system transports items held in hanging pouches as shown in Figure 12.

In combination with high-density shuttle storage systems the pouch sortation solution offers omni-channel and e-commerce fulfillment operations a variety of advantages (see Figure 10). First, it eliminates the multiple touches typically associated with traditional inventory storage and order fulfillment, which have these steps: receiving, putaway to reserve storage, selection for forward picking, cart-based picking, conveyance and sortation to consolidation areas, manual consolidation, and packing. Instead, items are deposited into pouches directly in active picking or even upon receipt for returns and AA movers and are not removed until pack-out—dramatically reducing labor requirements and providing singulated fulfillment. Picking and packing can even be automated with robots or co-bots instead of handled manually.

Additionally, as a module based system, it can easily expand to throughputs of 1 million plus units per day. Each load carrier can be singulated, sorted, buffered, and sequenced according to SKU velocity or to accommodate shifting lead time priorities. Pocket sortation systems have a superior price of singulation, and due to their modular nature and independent

Figure 10: Concept Elements Pocket E-commerce

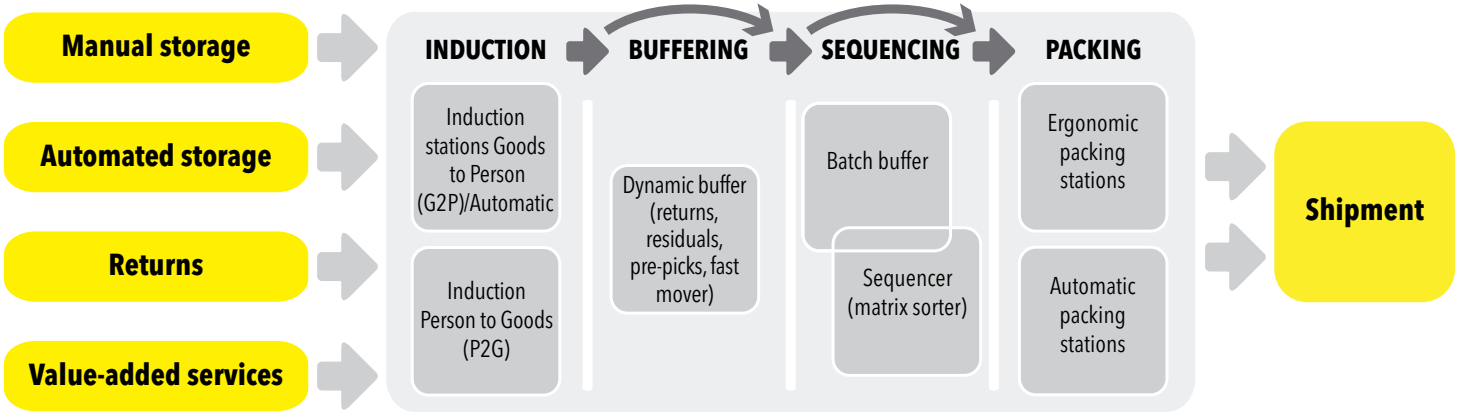


Figure 11: Advantages of Automated Pocket Sorter Technology

Automated pocket sorter technology meets or exceeds all of the demands for a 1 million-plus SKU facility when combined with high throughput high density storage systems.

subsystems, the system functions as more than just sortation. Additional buffering singulation can be added without adding throughput – also not possible with loop sortation systems.

Integrated diverters ensure easy access to all stored items and allow full connectivity to all locations. Meanwhile, various automatic functional modules within the pocket system allow for true NextGen functionality such as predictive picking and 1-touch processing of returns. Because of extremely high storage capacity and throughput capability of the total system, retailers can consolidate multi-location networks into a single, centralized location to significantly reduce operational costs. This provides superior SKU availability and service to customers, which outflank competition with reduced logistics costs throughout the year. Reduced costs, increased performance, and less risk exposure to labor markets allow for competitive logistics advantages and bottom line impacts.

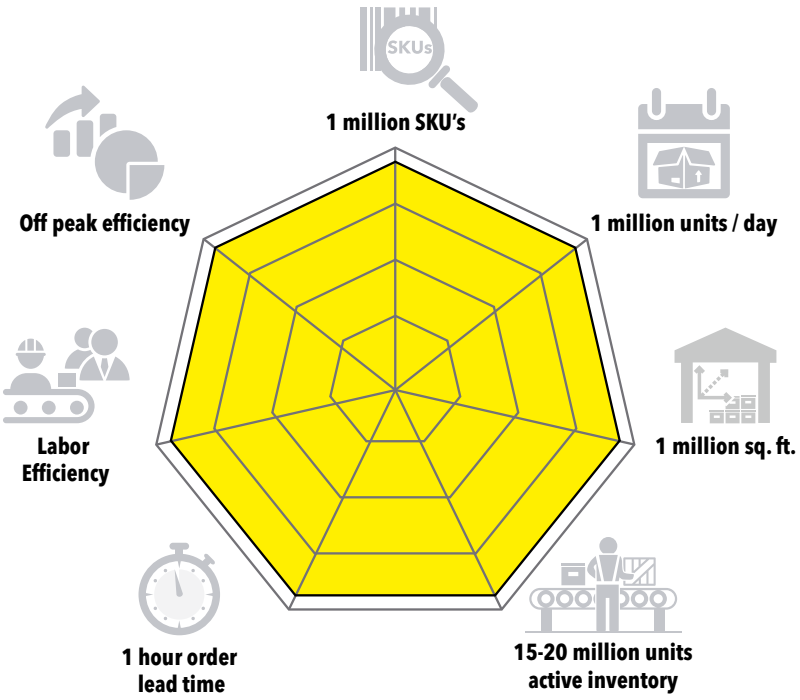


Figure 12: Automated Pocket Sorter Technology

SUPPORTING THE SOLUTION WITH NEXTGEN SOFTWARE

To make handling 1-million-plus SKUs in a single facility with pocket sorter technology feasible, it also requires a new software approach that surpasses the limitations of legacy systems. Critical to the successful operation of this type of NextGen e-commerce or omni-channel facility is unified control via a centralized warehouse execution system (WES).

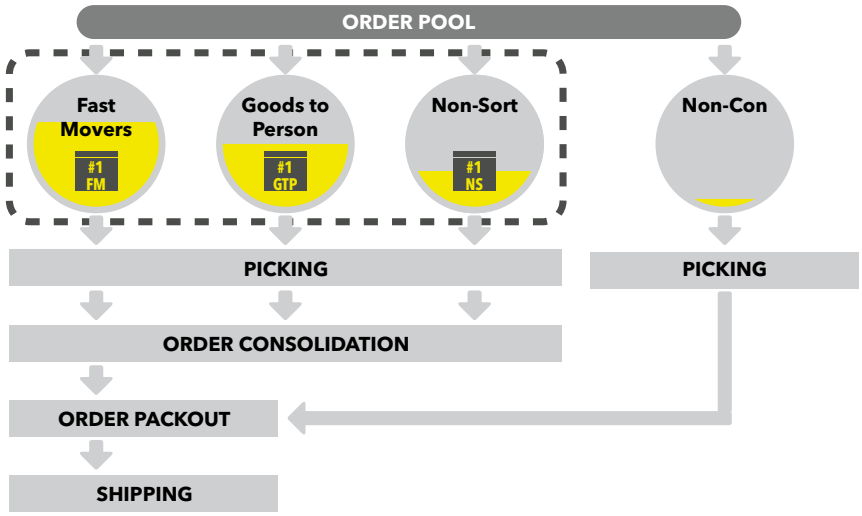
In order to continuously process and analyze operational flow and make as many as 200 different decisions per second for dynamic inventory allocation, the system needs a variety of inputs. With real time information from warehouse management systems (WMS), warehouse control systems (WCS), transportation management systems (TMS), yard management systems (YMS), and labor management systems (LMS) flowing into the WES, the overarching software can synthesize and unify system actions based on millions of data points to manage the daily order pool.

Furthermore, this capability allows active decision making within the system based on pre-set parameters. For example, pick workstations can replenish the dynamic buffer directly from the pick workstation and hold predetermined amounts of certain SKUs that may not have inventory allocation to final order.

This allows the dynamic buffer to automatically complete orders that contain those fast moving items, essentially allowing an opportunistic "free-pick" from the storage system, which helps make that subsystem more efficient. Exceptions are managed easily and quickly because all major functional systems utilize the same database structure. And, based on prioritization settings, returned products deemed resalable can flow directly into the dynamic buffer and be tagged and selected as the next item to fill an order.

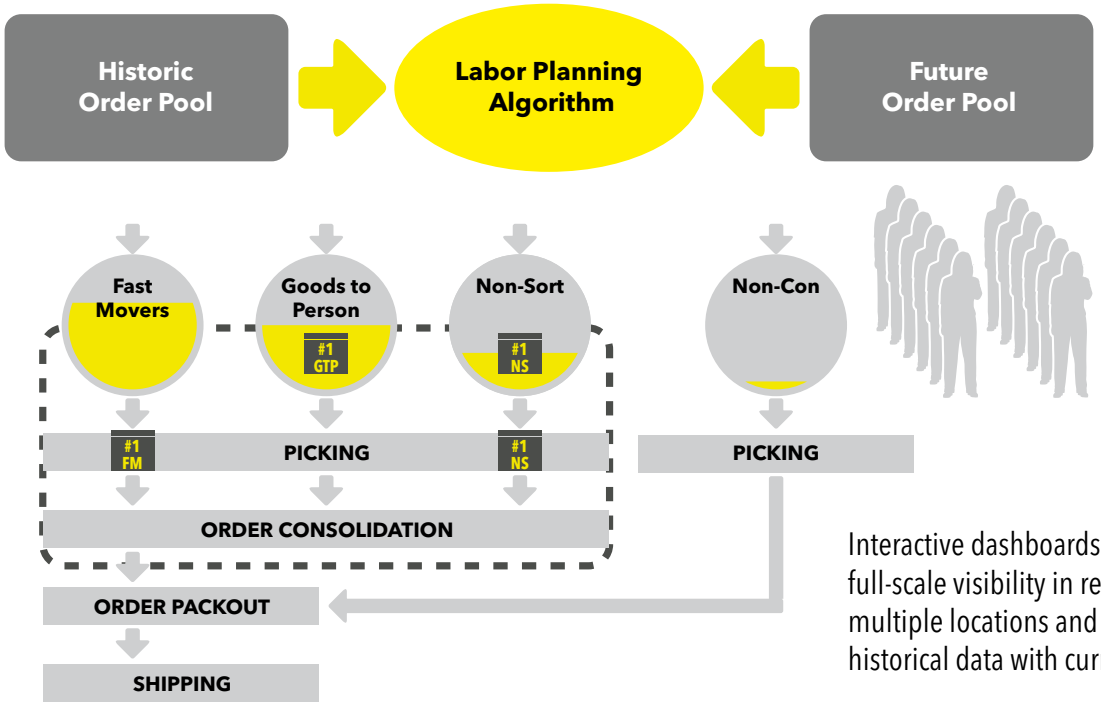
Additionally, the WES continuously reconciles incoming orders against the existing order pool. The software quickly shifts orders based on priority, bringing required inventory to packers that may not be as busy to meet shipping cut-off times. Because each order pool has its own optimization logic, depending on picking methodology, this enables later order cut-off times for priority orders. This sequence ensures customer delivery expectations are met, as shown in Figure 13.

Figure 13: Order Pool Management, showing a typical shuttle pocket system accounting for very fast movers (e.g. pallet pick), goods to person picking (for the majority of items) and non-sort for heavy/oversize



Finally, although these systems have a low staffing requirement, managers can precisely schedule and allocate labor resources. Via an interactive dashboard that provides full-scale visibility in real-time, managers can compare current work against historic data and assign workers (or robotic picking resources) to different areas within the system as needed, as shown in Figure 14. An integrated LMS allows managers to measure operator performance and easily implement incentive programs to further boost throughput and productivity—as well as improve attendance and retain both long-term and short-term seasonal employees.

Figure 14: Labor Allocations Based on Historic and Current Order Pool Data



Interactive dashboards provide full-scale visibility in real-time across multiple locations and compare historical data with current situations.

EVALUATE OPPORTUNITIES FOR NEXTGEN RETAIL ORDER FULFILLMENT WITH SSI SCHAEFER

The **SSI Carrier** intelligent and modular pouch sorter system for e-commerce and omni-channel distribution can achieve throughput of 50k load carriers per hour plus with its modular matrix sortation capability. Capable of transporting a broad range of items weighing up to 6.5 pounds (3 kilograms)—including shoes, electronics and other devices, toys, household goods, cosmetics, and garments. In addition, the system effectively integrates returns for immediate inventory availability. When combined with high storage shuttle systems like the SSI Cuby or Flexi Shuttle and the WAMAS® integrated software suite, the NextGen systems from SSI SCHAEFER provide competitive logistics advantage.

SSI Schaefer Systems International is the leading designer of sophisticated automation systems, provides storage and material handling, engineers and manufactures reusable packaging and waste technology solutions to businesses throughout North America. Schaefer Systems International designs innovative intralogistics storage and automation picking solutions for all types of industries. Schaefer Systems International is part of the SSI SCHAEFER Group, a global leader in logistics and materials handling founded in 1937 with 10 manufacturing facilities and offices in over 70 locations worldwide.

For more information about the impact this solution can have on your NextGen omni-channel or e-commerce fulfillment operations, contact SSI SCHAEFER at **info@ssi-schaefer.com** or visit **ssi-schaefer.com.**

ACHIEVING SUCCESS IN E-COMMERCE

Every business is different, but achieving success in a click-to-ship retail business can be tough. To achieve true differentiation, retailers must keep customers satisfied. Loyalty programs, faster fulfillment, variety in inventory, and the ability to return goods are all part of a comprehensive strategy. Increasing order fulfillment, order accuracy, and reduced labor can give you a competitive edge.

That's where SSI SCHAEFER can help.

ABOUT THE AUTHOR

With almost twenty years of international experience in both the logistics and aerospace industries, Andy Williams maintains an intense intellectual curiosity about complex systems with a focus on adding value for clients and colleagues. Andy has a talent for helping Fortune 500 companies realize the benefits of cutting edge logistics concepts while enabling lean principles and technologies.

Over the past several years, Andy has lead international teams responsible for engineering some of the largest automation systems ever built for e-commerce and omni-channel fulfillment. He manages design and implementation for some of the world's most respected companies, and is currently focused on working in the apparel, food and beverage, food retail, healthcare and cosmetics, industrial and retail/wholesale industries. Andy assists companies who wish to automate their supply chain, and who are in need of WMS, WCS, WES, and LMS systems to manage e-commerce or streamline distribution processes.

Andy is currently the Vice President of the Automated Systems Group in North America for Schaefer Systems International, Inc. and holds a Bachelors of Business Administration from the University of Georgia, where he majored in International Business.

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REASONS WHY YOU SHOULD CHOOSE SSI SCHAEFER:

- **Stability:**
  As a financially independent family business, SSI SCHAEFER is committed to long-term solutions. You can trust that our team of experts will be there for you tomorrow and in years to come.
- **Efficiency:**
  SSI SCHAEFER solutions are scalable and can grow as business increases. Upgrades and retrofits are always available to meet customer demands.
- **Quality:**
  As a specialist in automation, SSI SCHAEFER provides a single-source solution. As an original equipment manufacturer, SSI SCHAEFER guarantees quality and the right solution for your needs.
- **Reliability:**
  Thanks to our worldwide customer service and support network, SSI SCHAEFER ensures a smooth operation of your system.
- **Know-how:**
  SSI SCHAEFER solutions are always up-to-date with the latest technological standards and are easily integrated into an existing IT landscape.
- **Global Network:**
  As an international company, SSI SCHAEFER has local offices worldwide. With over 70 locations, our team of experts speak your language.

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