WHITE PAPER

ORDER STREAMING

Unified Fulfilment Planning & Optimisation

An intelligent approach to optimising order fulfilment in the warehouse, with machine learning that maximises efficiency, productivity and profitability while simultaneously processing retail, wholesale and direct demand.

THE NEW NORMAL

Committing to omnichannel fulfilment means delivering products and services to the customer where they want, when they want and how they want them. The disruptive impact that digital commerce has had on distribution has been nothing short of revolutionary. The last decade has introduced more extensive and more frequent demands on the supply chain than the entire century before it, almost all of it the direct result of a single catalyst — the modern consumer. And the acceleration of those demands does not appear to be slowing. E-commerce continues to grow at three to four times the rate of traditional commerce, which is causing a significant increase in small, business to consumer (B2C) orders and resulting parcel shipments. Though often viewed as a 'retail' phenomenon, it actually impacts nearly every industry. Even though e-commerce is driving an increase in smaller, direct-to-consumer orders, modern distribution centres (DCs) still need to deal with large business-to-business (B2B) orders as well, often at the same time.

Historically, warehouse flows were designed for single channel fulfilment, generally made up of large volume shipments. And thus the 'wave' was born — the most optimal way to fulfil large, bulk orders that have long fulfilment time horizons. With the growth of digital commerce, however, many brands, suppliers and even manufacturers are challenged to handle an increasingly large number of small shipments direct to the consumer. To deal with the trend, many distribution solution providers modified existing processes to try and handle smaller shipments with much shorter delivery time commitments. Most simply took the traditional wave-based approach to work release and accelerated the process to essentially create more 'waves' that cycled over a shorter period of time. This 'wave-less' approach meant fulfilment cycles were shorter, so small, fast shipments could be accommodated, but at the expense of efficiency in bulk order fulfilment. As a result, many organisations created entirely independent facilities to handle B2C orders as opposed to B2B orders, which duplicates stocks and resources, and requires significant capital investment.

At Manhattan, we recognised that trying to maintain the status quo in the face of omnichannel commerce was inefficient and often resulted in the costliest of outcomes, disappointed customers. To improve throughput, profitability and customer satisfaction with maximum utilisation of warehouse space, stock, labour and automation, we had to look beyond the constraints of traditional processing. We removed the shackles of legacy workflow limitations and created something new.

However, in order to deliver optimisation on a new level, real-time inputs from every aspect of the DC are required, from traditional automation to robots to the devices carried by the workforce. The problem is that different types of automation and devices do not naturally communicate. They are not aware of each other, much less the supporting workforce. So, we created a warehouse execution system (WES) within Manhattan Active® Warehouse Management. It has been engineered from the ground up to work with any type of automation, robotics or IoT device. It doesn't matter what kind you have or how much of it you use. And only Manhattan Active WM has it.

Manhattan Associates®

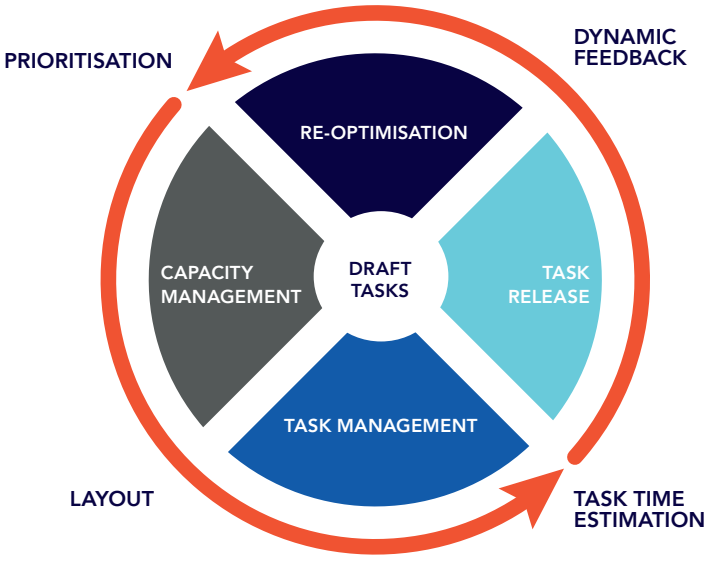
WELCOME TO ORDER STREAMING

Order Streaming technology within Manhattan Active WM takes a different approach when it comes to orchestration logic by constantly ensuring real-time alignment between orders to fulfil and available stock, while synchronising labour utilisation and equipment availability. Manhattan Active WM is the first and only data-driven warehouse management solution that knows how to learn and adjust orchestration logic in real-time to maximise asset utilisation.

Order Streaming is powered by several adaptive work-planning and task-execution engines, which use a set of native optimisation algorithms and machine-learning techniques to learn and adapt based on the current and expected state of the distribution centre. Traditional 'push' workflow systems solely based on fixed, rule-driven paradigms were never engineered for modern commerce, as they are difficult to configure and incapable of responding to the dynamically changing fulfilment priorities.

Manhattan Active WM with Order Streaming technology, however, continuously evaluates and adjusts the execution plan, allowing immediate responses to pull signals triggered by resource availability. Advanced modelling and optimisation algorithms work together to analyse the multiple objectives of minimising cost and maximising service levels by simultaneously deciding:

1. Which orders to select for processing based on order priority and cut-off time, stock availability and expected resource capacity
2. What the most efficient tasks to minimise travel on the floor and maximise pick density are
3. Which tasks to release to the floor for execution to ensure labour efficiency and work saturation



EXECUTION-DRIVEN PLANNING

Order Streaming monitors every aspect of the warehouse in real time. As workers and machinery begin to process and execute work released to the floor, data is sent to the work-planning engine to understand the speed of execution and remaining capacity within the system. Accurate measurement of remaining capacity requires two pieces of information. The first involves the physical availability of resources, such as the number of workers and open sorter chutes and pick faces. The second is a prediction of how long it should take to complete the pending work, which has been broken down into a set of tasks. When it comes to how long it takes a person or piece of material handling equipment to do a given task, labour standards are utilised within a traditional WMS.

Manhattan Active Labour Management has the capability to use standards to understand exactly how long a task should take based on the distance to be travelled, where an item is placed on a shelf, and the size and shape of the item to be picked. These are defined specifically for each warehouse and operational preferences and are highly accurate when done correctly. However, implementing personalised labour standards can entail a time-consuming and costly effort, and as such they often do not include all the pieces of work needed to execute tasks that utilise material handling equipment. Moreover, standards tell how long it should ideally take to complete tasks individually, not how long they are actually taking at any given point of time.

To overcome the lack of standards or incomplete standards, Manhattan uses machine learning to carry out task-time estimation. As workers, or machines, execute tasks, the system records each action and learns to organise and predict patterns that contribute to variability in any task execution. Over time the system understands how to anticipate how long a given task will take based on the actual combined results of item characteristics, number of stops on the task, distance travelled, location information, and day of the week and hour of the day. In essence, the solution is smart enough to adapt when precise labour standards are not available to ensure optimal workflow.

ADAPTIVE WORK PLANNING WITH OPTIMISATION

The adaptive work-planning engine within Order Streaming provides the ability to precisely regulate the correct amount of work at the right 'pace' on the floor, so that specific fulfilment decisions can be selectively delayed, taking advantage of the execution feedback or changes in the order pool due to new order arrivals. Because of this flexibility, orders not yet executed continue to be evaluated and re-prioritised until the time is right for release, which results in the desired outcome of continuous streams of work to the floor.

To achieve maximum utilisation, Order Streaming uses mixed integer programming (MIP), the same optimisation widely used in advanced production-scheduling systems, to decide exactly which orders are ready for tasking and which tasks are ready for release to the floor during continuous re-optimisation cycles. This modelling capability enables Order Streaming to fulfil orders that maximise priority and throughput with regards to stock and resource capacity constraints and downstream impact in the most efficient manner.

The Order Streaming task creation process utilises proprietary learning logic based on adaptive large neighbourhood search (ALNS) to combine orders and sequence them into highly efficient tasks. This approach to pick-path optimisation not only minimises distance travelled, it maximises pick density by intelligently grouping orders based on their priority, pick equipment and conveyance capacity. Order Streaming utilises a robust distance calculation framework within the Manhattan Active WM warehouse mapping capability, which considers details such as aisle travel direction and equipment restrictions.

Once certain tasks have been selected for release to the floor, the system is saturated with just the right amount of work, balancing demand, supply and resources. By releasing the optimal set of tasks, Order Streaming orchestrates and smooths the flow across any number of defined work areas; synchronises the simultaneous execution of replenishments, and picking and packing activities; eliminates bottlenecks; and reduces manual interventions such as ad-hoc replenishment requests and frequent workforce transfers across zones.

At the same time, Order Streaming is already re-initiating the planning cycle, updating order and relevant replenishment priorities, and dissolving any obsolete tasks based on real-time updates. For instance, out of 500 potential tasks that could be worked on, when the priority of the tasks and the capacity available in the system is considered, only 50 are dropped to the floor. The other 450 orders stay in a state of continuous re-planning. Any new order arrival, or change in the execution state and performance, is considered by the recursive planning cycle, which results in a continuously adaptive work-planning process.

SMART TASK EXECUTION

Order Streaming also enables the dynamic creation and adjustment of pick paths on the fly, responding to pickers' spontaneous decisions such as combining multiple pick totes into a pick cart, to execute multiple tasks together. Order Streaming eliminates the need to slow down pickers to accommodate changes to the plan, instead using scalable machine learning with the flexibility to respond to reasonable ad-hoc decisions made by the worker. Order Streaming learns to utilise the ingenuity of the workforce.

COMMAND AND CONTROL

Order Streaming reimagines what the workflow within the DC can be, and with that must come a new way to monitor and manage that workflow. And just like Order Streaming, we have left behind the constraints of the past.

Unified Distribution Control (UDC) within Manhattan Active WM is an intuitive interface with actionable data visualisation allowing supervisors to see, diagnose and act upon all warehouse processes, from any location. The responsive experience is the same on both desktop and mobile devices, which means no IT integration, no limits to functionality and no learning curve for supervisors.

PARTNER WITH MANHATTAN ASSOCIATES

Only Manhattan Active WM with Order Streaming technology is capable of going beyond the constraints of the past, using advanced science and real-time data to execute the continuous planning-while-executing workflow optimisation required today. Order Streaming technology from Manhattan Associates is the most advanced approach to fulfilment optimisation ever created.

No one is as focused on client success as Manhattan Associates. Working with some of the most sophisticated distribution operations in the world for 30 years has equipped us with the insight and understanding to continuously remaster the art of fulfilment.

We take pride in helping our clients solve unsolvable problems, overcome their greatest hurdles and deliver exceptional experiences for their customers. Contact Manhattan Associates today to discover why our solutions are at the heart of fulfilment for the world's most iconic brands.

Find out more at **manh.com/en-nl/order-streaming**

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