TECHNICAL NOTES

VASAN014

Continuous Processing Using A Sorter

Distribution centers often increase the productivity of labor-intensive piece-picking operations by clustering (or batching) multiple orders and picking them together. As the number of clustered orders increases, pickers become more productive because they spend less time walking between picks. The size of these order batches can be greatly increased through the use of a secondary sort using devices such as a tilt tray or Bombay sorter.

Sorter-based operations cluster orders using two different kinds of processes: Batch processing and continuous processing. This paper describes the differences between the two processes.

Application Example

The application case to be presented in this paper is a distribution center servicing a retail chain of 3,000 stores. Replenishment orders are available daily from store's cash registers. Replenishment to the retail chain stores is mainly in less than full-case quantities (eaches or pieces). The distribution center operation uses a tilt tray sorter with 1,000 chutes. Each chute is assigned to a particular store for the duration of the fulfillment of that store replenishment order. Items are picked using printed pick lists and delivered to the sorter in pallets, cases or as individual pieces to fill the 1,000 clustered orders.

Batch Processing and "Waves"

The most common way to operate sorter-based systems is to create batches or waves. The work is organized in waves where:

Wave Orders = Number of Sorter Chutes

Day Waves = Day Orders / Wave Orders

In this type of operation waves are very well differentiated. The next wave may not start processing until the previous wave is completed. In theory, the number of clustered orders is equal to the number of sorter chutes; however, as a wave approaches completion, individual orders start completing and the actual number of clustered orders decreases.

Straggler items are a major problem in batch processes. As the next wave cannot start until the previous wave completes, a large number of pickers could be idle waiting for the stragglers of the previous wave to reach the sorter. While sorter utilization can reach almost 100% during the sorting of the initial portion of the wave, during wave transitions the utilization can drop to almost zero. This situation is like the old elementary school math problem asking for a solution of how fast a car must travel to make an average speed of 60 miles per hour over a distance of 30 miles if during our journey we stop for 15 minutes for a break.

The net effect of wave transitions can reduce the effective utilization of the sorter to 60% or 70%. With a device as expensive as a piece sorter such a low utilization is a serious problem.

Batch Processing Implementation – living with wave transition

In this example, daily delivery to each of the 3,000 stores requires that the sorter operate with at least 3 waves since the number of stores is 3 times the number of sorter chutes. To minimize the effect of wave transitions it may be possible to create queues where work continues during transitions or to organize work such that staff is either reduced or re-assigned to other functions during idle times. Minimization efforts of the effects of wave transition are normally accompanied with double handling and inefficiencies of their own. In the end, wave transition low sorter utilization is normally accepted as just a "fact of life".

Batch Processing Implementation – living with limited sorter chutes

Many sorter systems were initially designed to have a sufficient number of chutes to allow all daily orders to be picked in one single batch. Although this method did not eliminate the wave transitions, staff could be released as the daily work subsided leaving only a reduced staff to deal with handling the end of wave stragglers. This situation works perfectly in situations where there are a sufficient number of available chutes. However, in our example, since the

number of stores is three times the number of chutes, the use of this solution requires limiting the delivery to only 1,000 stores daily. The stores receive a delivery once each three days. This method eliminates the issue of low sorter utilization, but accepts limited delivery cycles as a "fact of life".

Continuous Processing Implementation

- There is a permanent pool of orders (stores) pending to be processed.
- Orders can be pulled from stores as often as needed. Pulled orders are added to the existing orders in the order pool.
- There is a circular list of stores indicating the sequence in which orders are processed.
- The sorter processes 1,000 stores simultaneously. Every time that a chute is freed the current order for the next store in the list is assigned to that chute.
- Every time that a store is assigned to a chute, inventory allocation is re-calculated.
- Every time that a picker drops product (pallet, cases, or pieces) a new pick list is printed in real-time based on the last inventory allocation. If picking zones are falling behind the other zones, the software identifies the unbalancing and relocates pickers to correct the problem.
- All 3,000 stores can be serviced every day.

The main difference between continuous and batch processing is the absence of waves in a continuous process. In a continuous process as soon as an order completes and frees its chute a new order is assigned to the chute. This means that in a continuous process the number of clustered orders is always equal to the number of sorter chutes.

Straggler items do not go away in a continuous process. However, a continuous process can handle stragglers a lot better than a batch process. In a continuous process, straggler items only affect the orders they belong to and the chutes where those orders are assigned, while the other chutes can continue working without any interruption. Pickers never become idle waiting for other pickers to catch up with them. A smooth continuous process should allow the sorter utilization to reach a steady-state utilization close to 100%, allowing the distribution center to maximize the benefit of the device and its investment.

Conclusion

Distribution centers have used piece sorters to cluster large number of orders for a long time. When the practice started, pickers used pick lists printed in batches long before the actual transactions were executed, dynamic allocation of sorter chutes was not feasible, and inventory allocation for orders could not be executed in real-time as transactions were executed. Batch processing should be considered a remaining trace from those old times.

Continuous processing is far superior to batch processing. With today's existing resources there is no need to continue using batch processing. Low productivity wave transition times can be eliminated, idle workers waiting for others to catch up can become productive, customers (stores in our example) can be serviced better.