How to Model your Goods-to-Person System for Higher Picking Performance

Sponsored by:

SSI SCHAEFER

Presented by:

Dave Simpson
Director of Applications Engineering

Content

- ASRS variety
  - Power vs. performance
  - Tradeoff considerations
- Selection process
  - Operational factors
  - Picking methodologies
  - Fulfillment partitioning
- Design factors
  - Throughput efficiency
  - Storage sizing

What Drives Performance

Avoid the pitfall of pairing the wrong operation to the wrong system configuration!

Q: Which of the following is faster?

? Car #1: 7,000 HP Engine

? Car #2: 700 HP Engine

? Car #3: 400 HP Engine

Storage & Retrieval Engines

There are many ASRS "*engines*" in the marketplace today.
Each has value in the correct application,
and there is no "*silver bullet*".

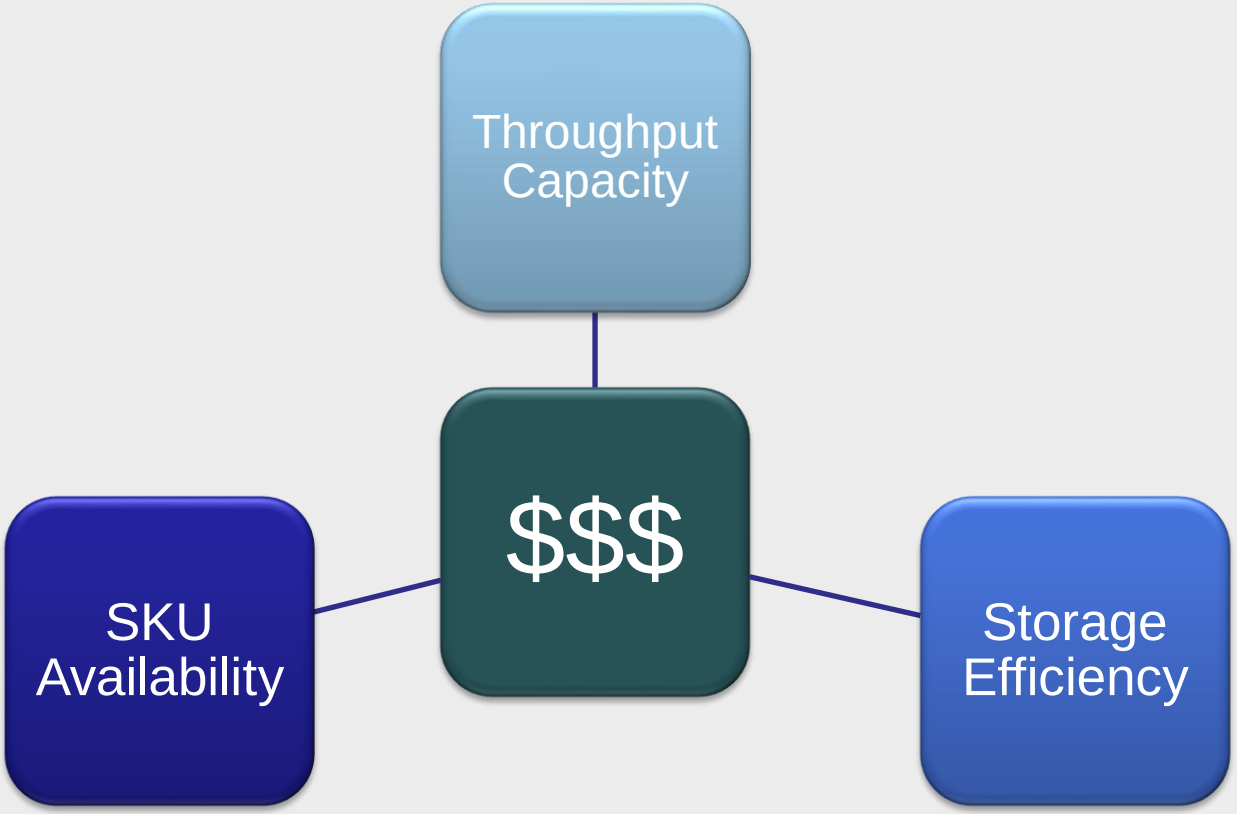







Considerations

For each ASRS technology, there is tradeoff in terms of:



Selection Process

Technology selection is always driven by application.

Critical steps for selecting proper technology include:

Step 1: Define your operation

Step 2: Plan your picking process

Step 3: Apply fulfillment partitioning

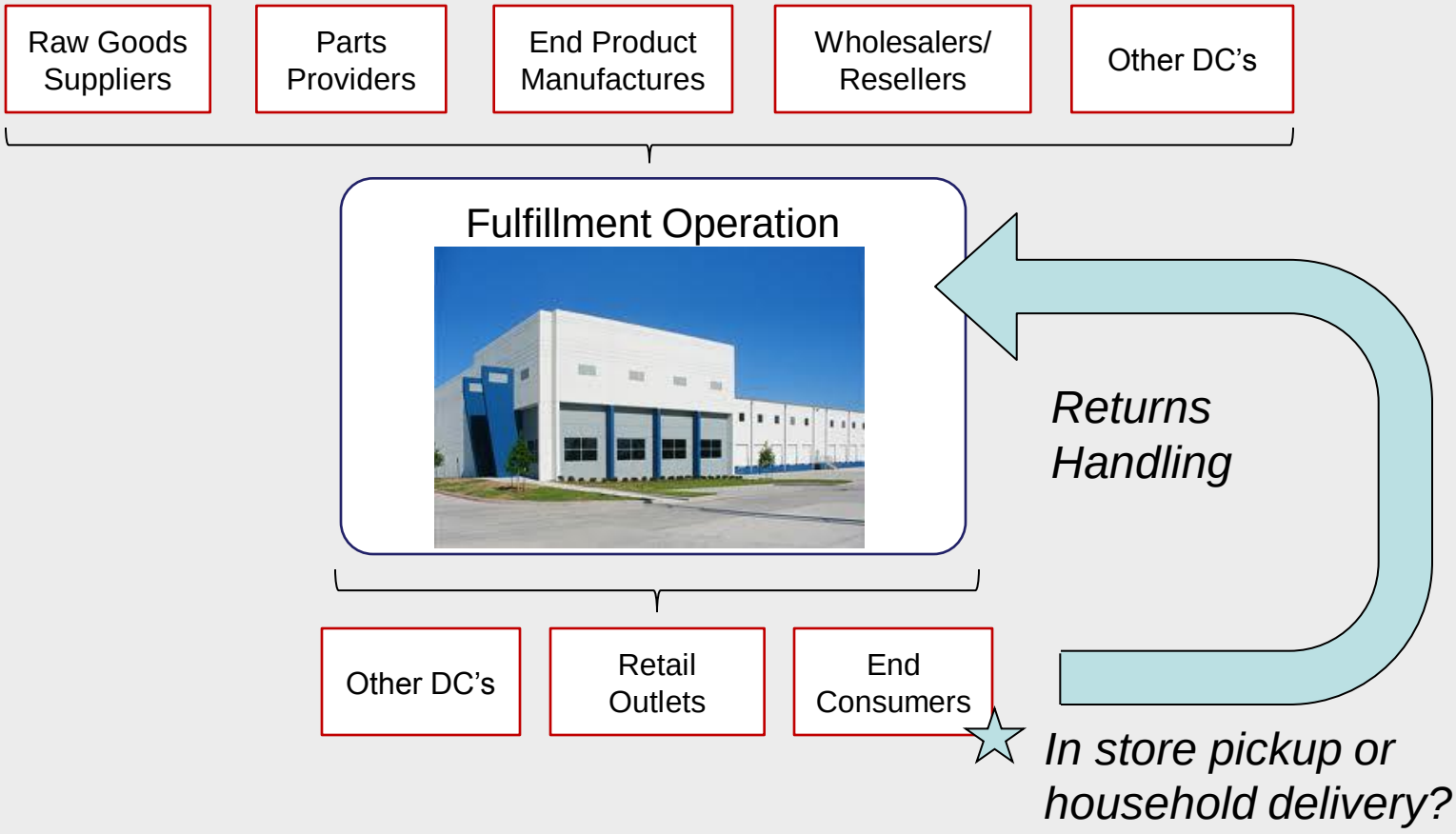
Step 1: Define Your Operation

Every operation is different, but each can be fairly well defined by the following framework of information:

☆ a. Supply chain positioning
b. Existing infrastructure/ implementation constraints
c. Operational planning (order cutoff, hours of operation)
d. Inventory segregates
e. Load definition
f. Value added processes (inbound/ outbound)
☆ g. Key data
☆ h. Distributive analysis

Supply Chain Positioning

Who are the upstream suppliers and downstream customers?



Key Data

Inventory on Hand

Inventory on Hand	Avg	Peak
Total Items on Hand	16,198	17,332
Total Qty on Hand	1,289,332	1,397,780
Cube [ft³] of Stock	60,096	57,747

Order Fulfillment Data

Key Order Data	Avg Day	Peak Day	Avg Hour	Peak Hour	P:A
Orders	24,508	34,311	1,634	1,906	1.4
Order Lines	63,721	82,347	4,248	4,575	1.3
Order Quantity	86,023	111,168	5,735	6,176	1.3
Active SKUs	4,934	6,168	329	343	1.3
Cube [ft³] Shipped	4,010	4,907	267	273	1.2

Growth

Growth Forecast	Growth/Yr	# Yrs	Total
Total SKUs	3.50%	5	19%
Active SKUs	1.50%	5	8%
Orders	5.00%	5	28%
Order Lines	5.00%	5	28%
Quantity	5.00%	5	28%
Total SKUs	3.50%	5	19%

Revealing Characteristics

Example Data

Key Order Data	Avg Day	Peak Day	Avg Hour	Peak Hour	P:A
Orders	24,508	34,311	1,634	1,906	1.4
Order Lines	63,721	82,347	4,248	4,575	1.3
Order Quantity	86,023	111,168	5,735	6,176	1.3
Active SKUs	4,934	6,168	329	343	1.3
Cube [ft³] Shipped	4,010	4,907	267	273	1.2

Moderate volume of outbound shipping units

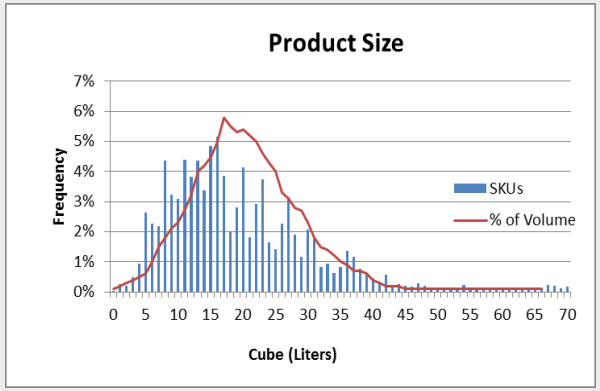
Small order sizes (2.6 SKUs/ order) Probably a lot of single line orders

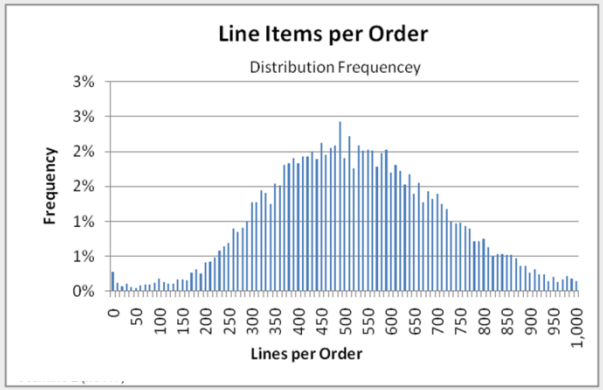
Frequent reuse of same inventory items.

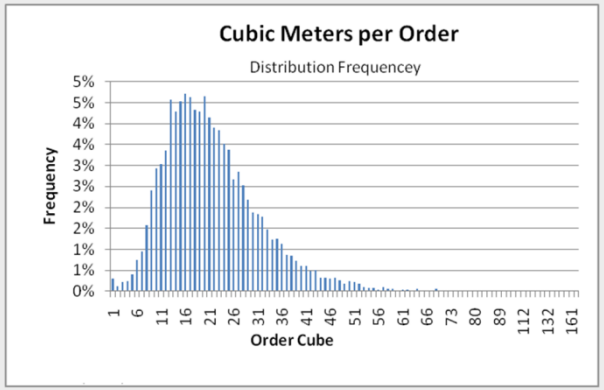
Inventory likely follows a bell curve around 80 cubic inches per piece shipped (slightly larger than a liter bottle)

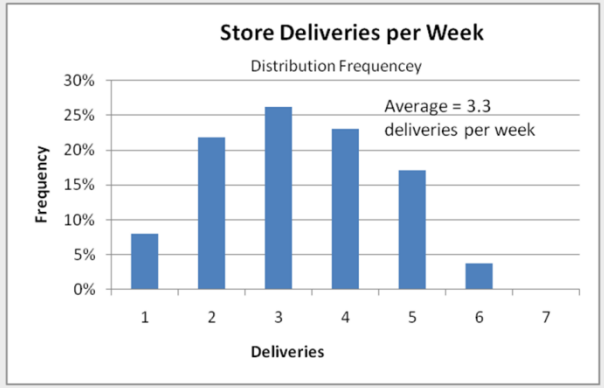
Distributive Analysis

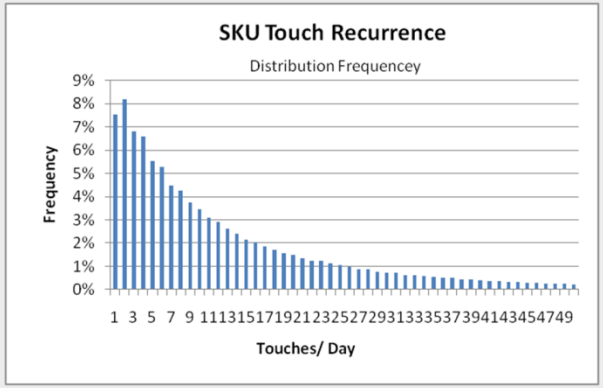
When line item data is available, a distribution analysis provides even greater insight. Some examples include:

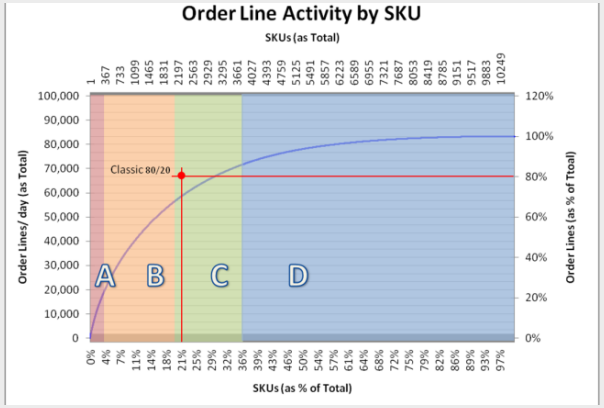






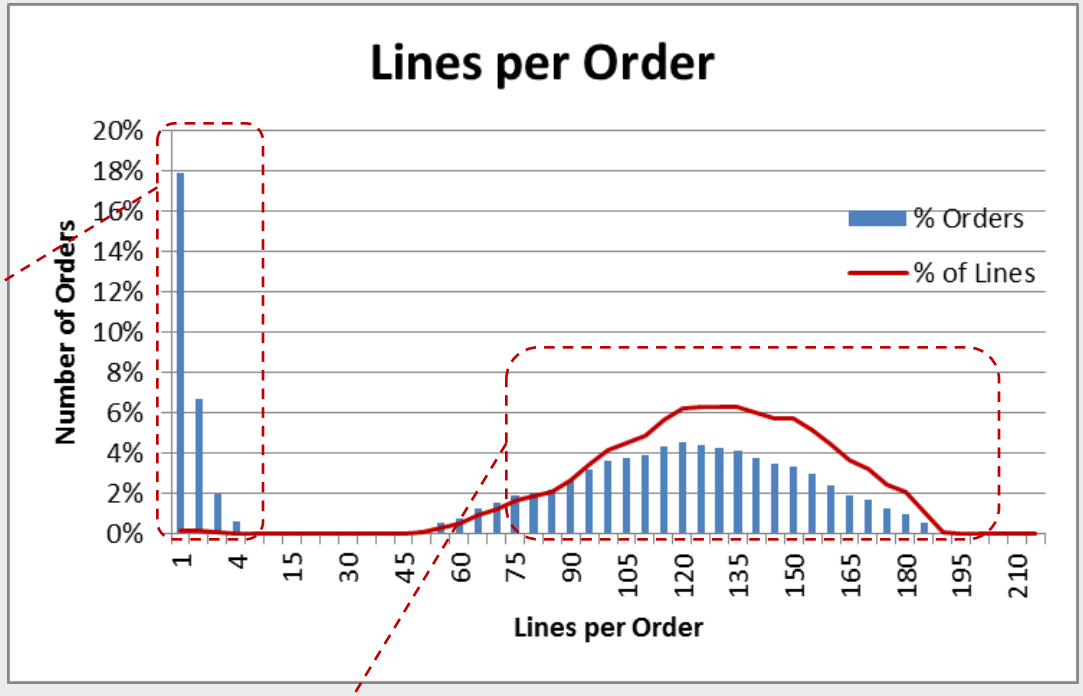






Revealing Characteristics

Example: Distribution Analysis of an Operation that Serves Both Retail and e-Commerce



e-Commerce Subset:
18% of all orders are single line. Collectively eCom accounts for 27% of orders filled, but only 1% of total lines picked.

Retail Subset:
73% of orders, 99% of order lines.
Average order size for a retail outlet is 120 items.

Selection Process

Selecting Proper Technology:

- Step 1: Define your operation
- Step 2: Plan your picking process
- Step 3: Apply fulfillment partitioning

Design Factors

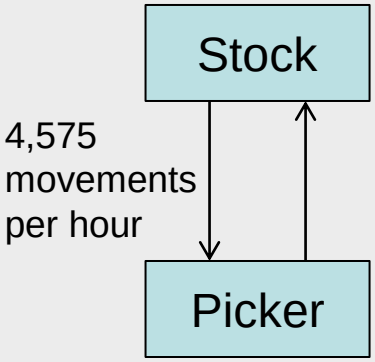
- Throughput efficiency
- Storage sizing

Discrete Pick vs. Batch Pick

*At the heart of order selection is getting specific inventory to its shipping container. This fundamental principle is represented by **Order Lines & Active SKUs**.*

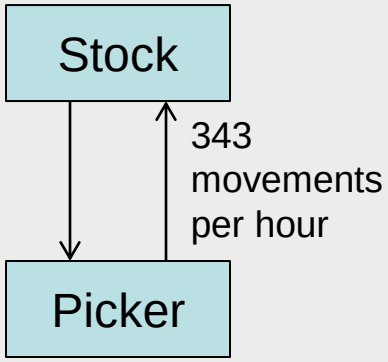
Key Order Data	Avg Day	Peak Day	Avg Hour	Peak Hour	P:A
Orders	24,508	34,311	1,634	1,906	1.4
★ Order Lines	63,721	82,347	4,248	4,575	1.3
Order Quantity	86,023	111,168	5,735	6,176	1.3
★ Active SKUs	4,934	6,168	329	343	1.3
Cube [ft³] Shipped	4,010	4,907	267	273	1.2

Option 1: Discrete Order Pick
(1 trip for every order line)



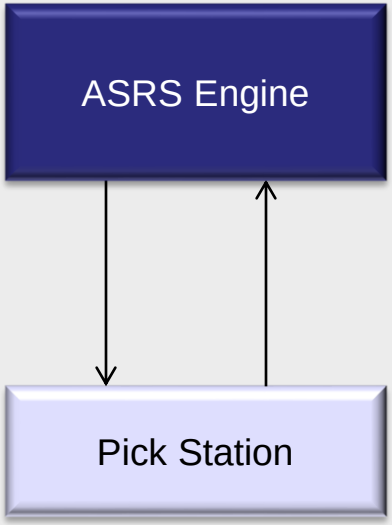
Often a Hybrid approach based on Waves or Batch Groups

Option 2: Batch Pick
(1 trip for every SKU)



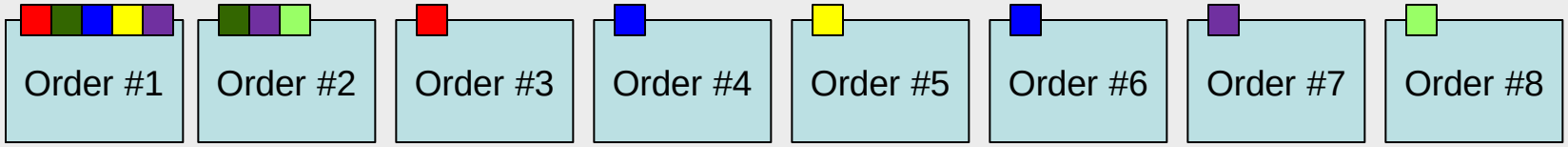
Batch Picking Considerations

For multi line order structures, batch pick effectiveness is limited by the number of concurrent open orders.



It is also important to consider swap out time:

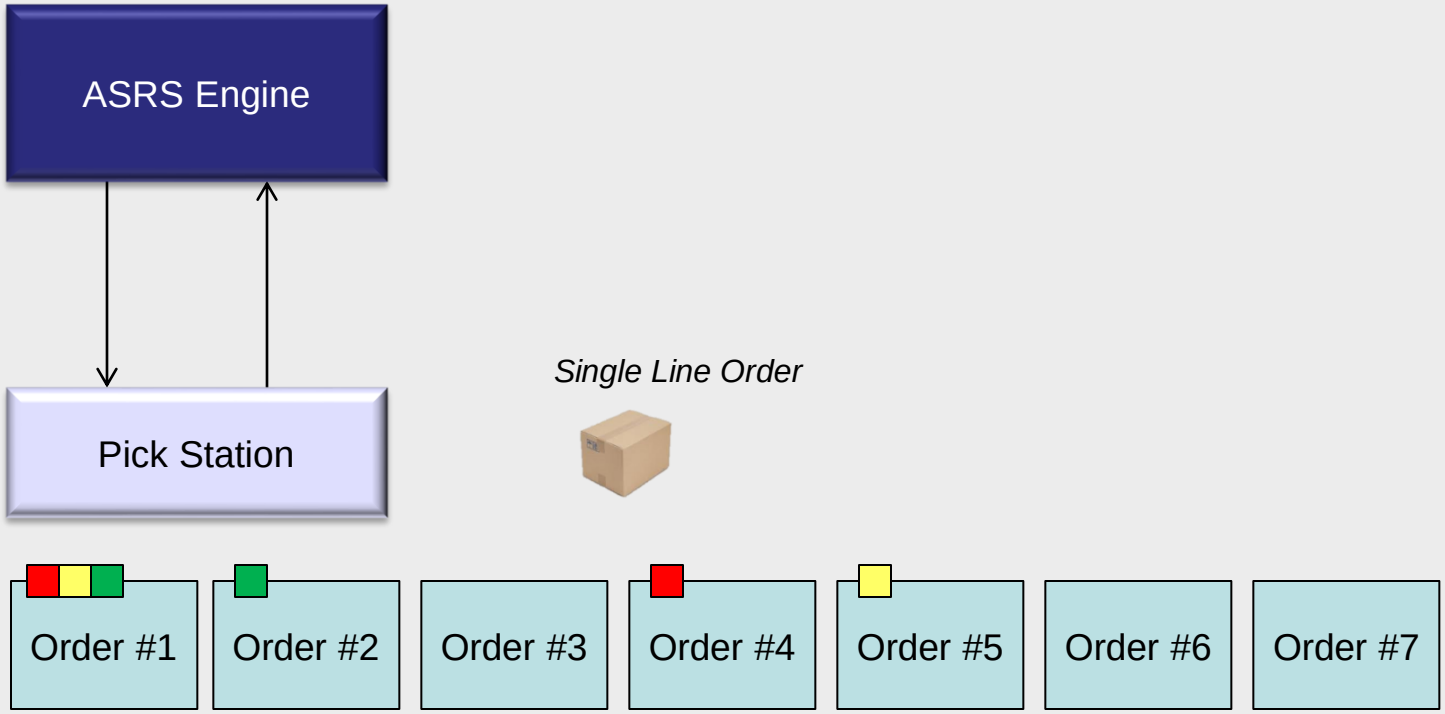
- For large orders (Retail) the “order slot” may dwell for a while collecting items
- For small orders (e-Commerce) the “order slot” will swap out quickly



Order Complete

Batch Picking Considerations

Single line orders inner mixed with multiline orders create good opportunity for batch pick.

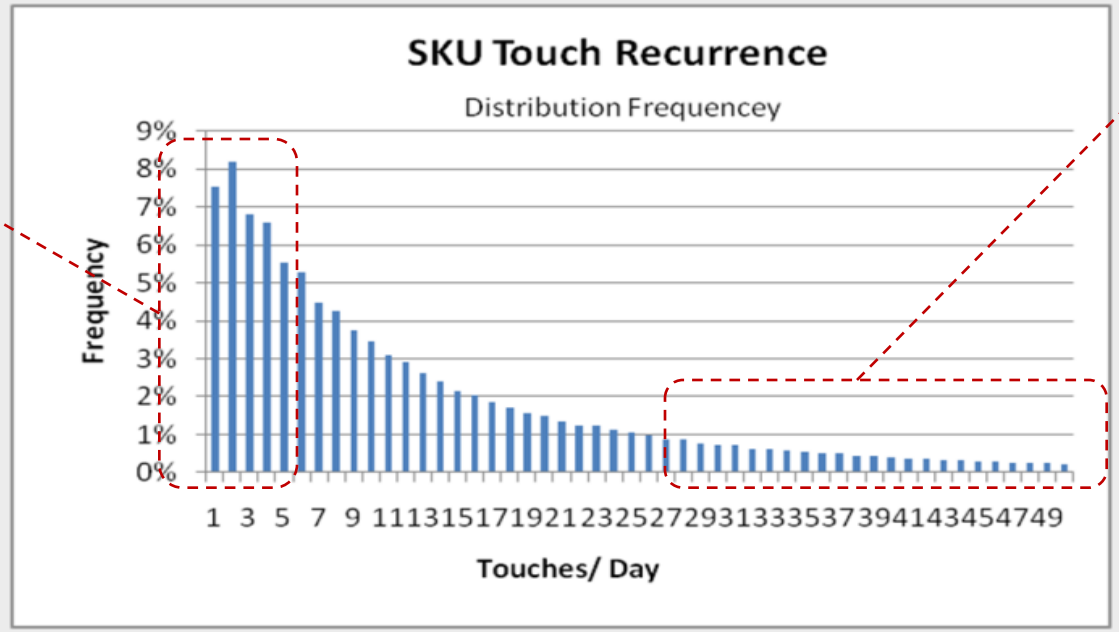


Evaluating Batch Opportunity

Batch picking can be very effective, but there are limiting factors:

- Order release times (once per day vs. multiple times per day)
- Single line order mix (several orders for specific, single SKU)
- Possible trending away from single line orders toward multi line
- SKU touch recurrence (following is a very typical chart)

Limited batch opportunity for items touched 2,3,4.. times per day.



Good batch opportunity for items touched dozens of times per day (fewer candidates, but high percent of volume)

Selection Process

Selecting Proper Technology:

- Step 1: Define your operation
- Step 2: Plan your picking process
- Step 3: Apply fulfillment partitioning

Design Factors

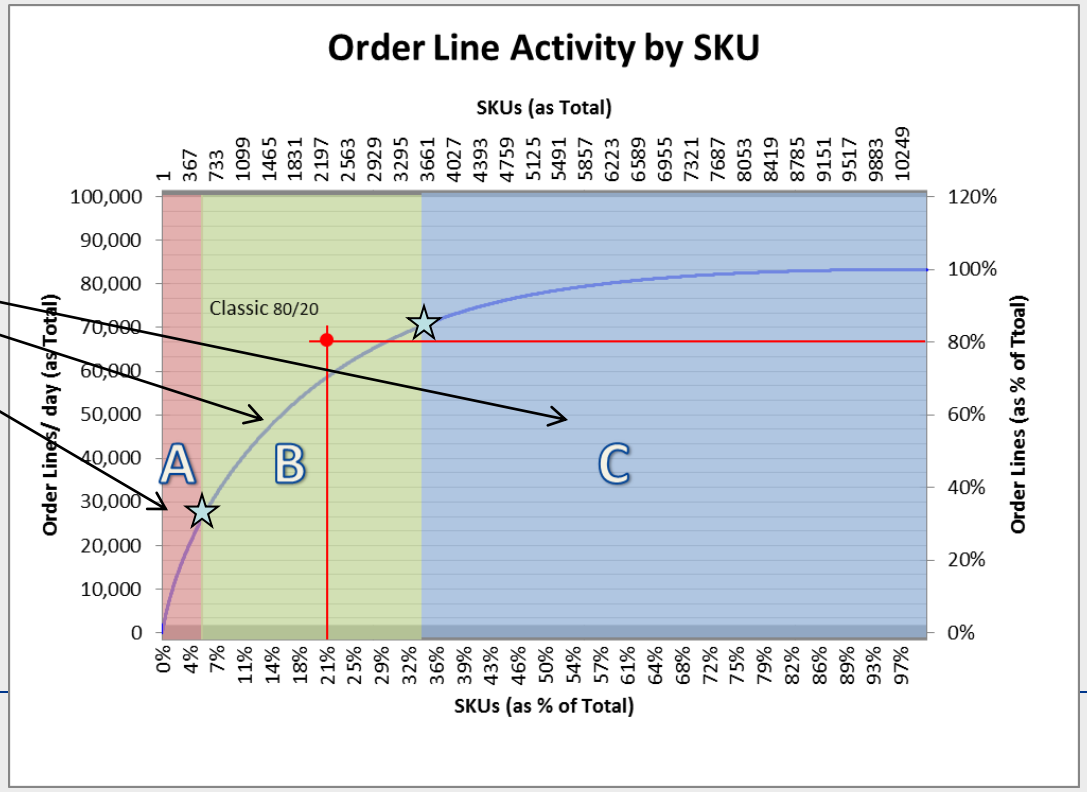
- Throughput efficiency
- Storage sizing

Fulfillment Partitioning

Example:

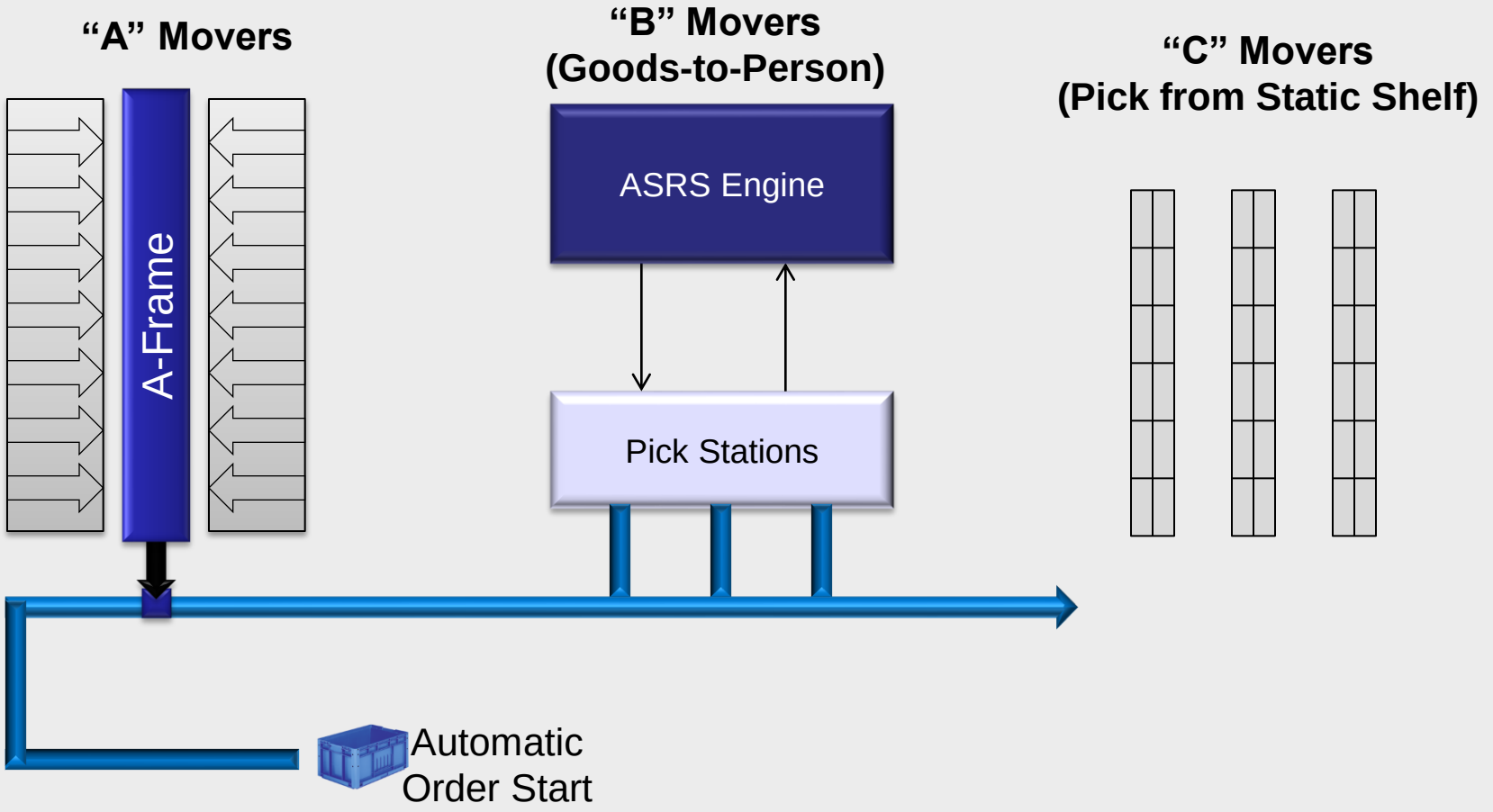
- "A" movers (top 500 items): 5% of SKUs, 30% of throughput
- "B" movers (middle 3,000 items): 30% of SKUs, 55% of throughput
- "C" movers (bottom 7,100 items): 65% of SKUs, 15% of throughput

It is often more cost effective to apply a different fulfillment strategy to each subset



Fulfillment Partitioning Application

Example of possible configuration for “A”, “B” and “C” items



Selection Process

Selecting Proper Technology:

- Step 1: Define your operation
- Step 2: Plan your picking process
- Step 3: Apply fulfillment partitioning

Design Factors

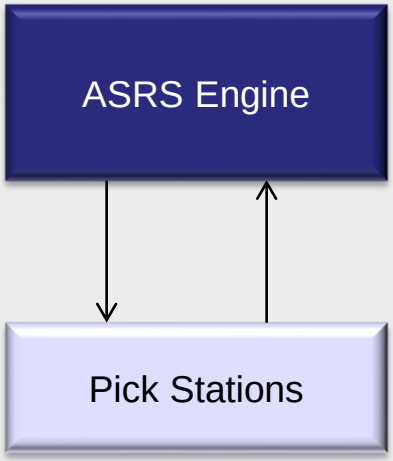
- Throughput efficiency
- Storage sizing

Design Factors

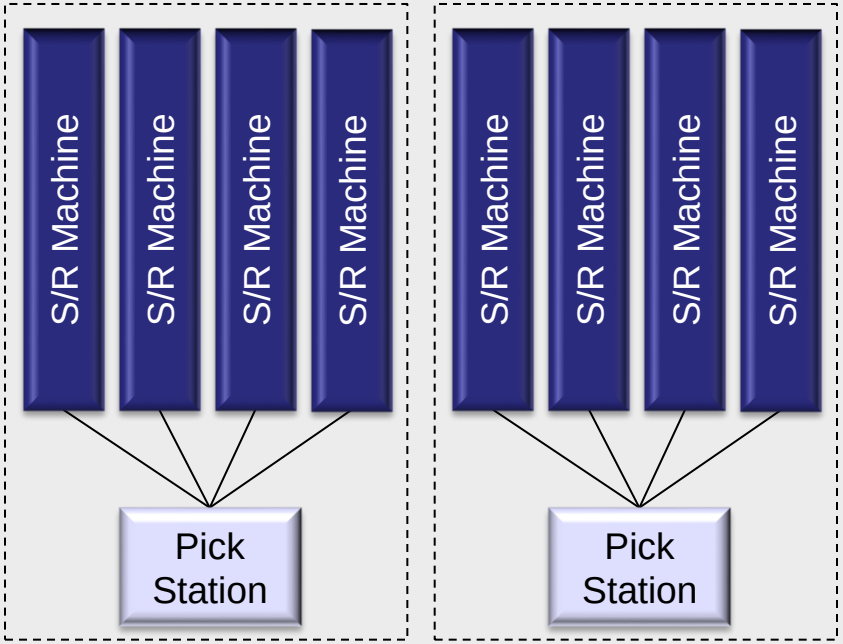
Total system throughput is determined by:

1. Machine performance (i.e. cycle capacity of the S/R machine)
2. Efficiency factor (i.e. ability to work unrestricted)

Conceptual



Actual



Design Factors

Total system throughput is determined by conditions that create a “throttling” effect on the ASRS, including:

- Work rate of operator, affected by ergonomics and general pick station design
- Sufficient number of open orders at the pick station to allow all machines to work unrestricted

Common “choking conditions” include:

- Sequencing of inventory to a workstation with limited number of put positions (inventory for subsequent orders cannot get released).
- SKU representation (for a group of orders, some aisles feeding the workstation lack inventory and therefore sit idle for a period of time).

Selection Process

Selecting Proper Technology:

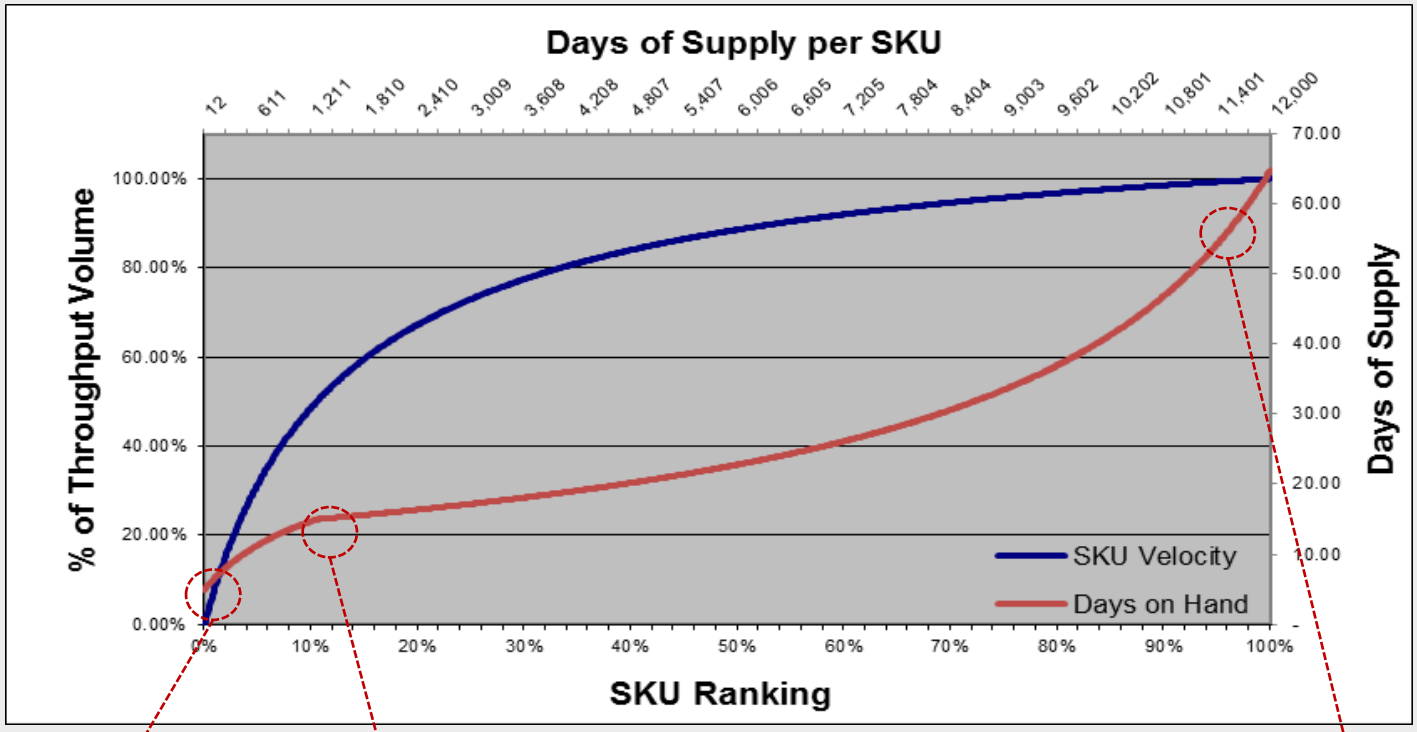
- Step 1: Define your operation
- Step 2: Plan your picking process
- Step 3: Apply fulfillment partitioning

Design Factors

- Throughput efficiency
- Storage sizing

Storage Sizing

What does it mean to have “18 days of supply”?



Fast Movers:
4 to 5 days

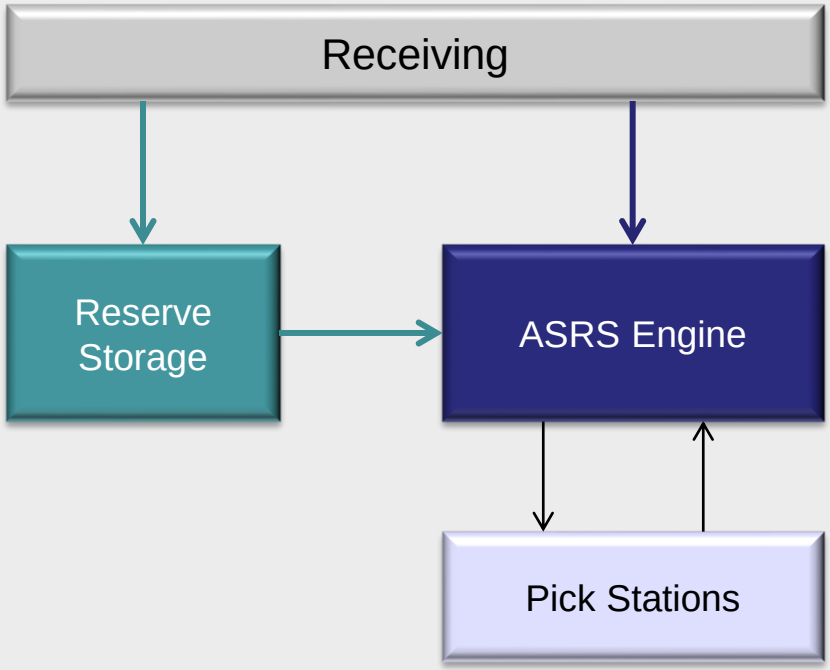
Medium
Movers: 18 days

Slow Movers:
60+ days

Storage Sizing

How many days of supply in your ASRS vs. Reserve storage? Considerations include:

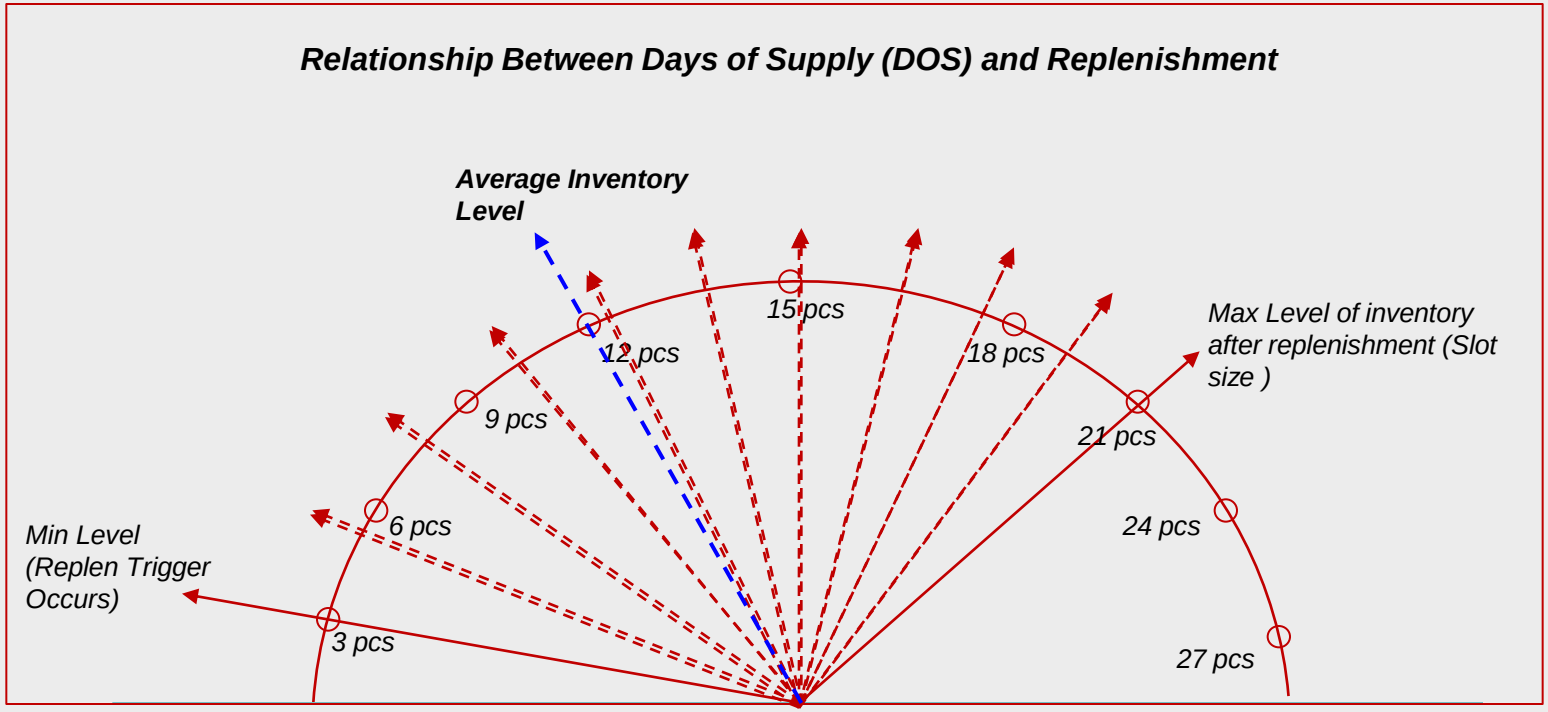
- Cost of storage
- Cost of additional touches



Which inventory subset (fast, medium or slow movers) would be better suited to flow directly into the ASRS vs. flowing through reserve storage?

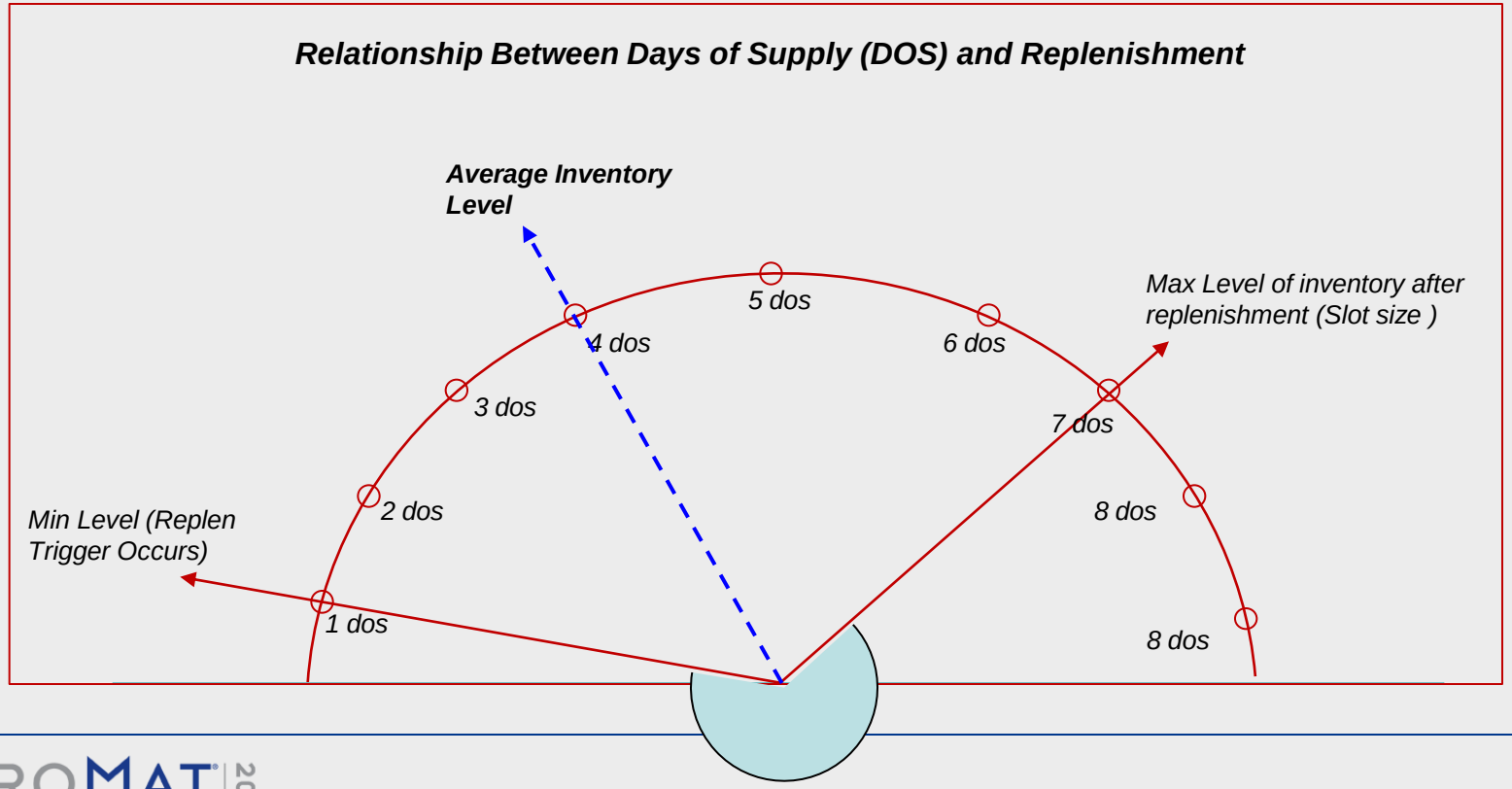
Inventory Lifecycle

- Whether static shelving or tub storage the inventory lifecycle is driven by the two simple configuration parameters: Replen Trigger and Replen Size
- Inventory levels oscillate between min. and max. levels. A large sample would reveal an average inventory at the midpoint between these limits.



Pieces on hand represent days of supply (dos). Sample scenario:

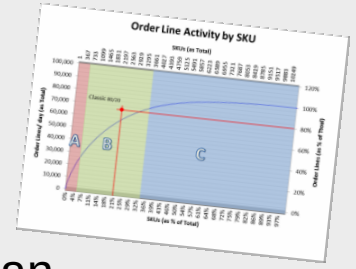
- Replenishment threshold is 1 DOS
- Average inventory level is 4 DOS
- Replenishment size is 6 DOS (SKU touched every 6 days)
- Average stock does not equal replenishment frequency!



Key Takeaways

1. Pair the technology to the operation
   - There are many good technologies, but you wouldn't go to the Baja 1000 with a Formula 1.
   - Order profile, inventory complexity, service level, etc. have high impact

2. Batch pick where possible, but be aware of limiting factors
   - Order release times, order size, SKU recurrence, etc.



3. Don't limit yourself to a single technology
   - Split the Pareto curve and treat fast movers different than slow movers, as long as it is cost effective to merge them.

4. Design with ergonomics and efficiency in mind
   - Avoid the conditions that choke the performance of your ASRS engine such as poor workstation design, limited put positions, SKU availability, etc.

Questions?

ProMat 2013
AN MHIA INTERNATIONAL EXPO
McCORMICK PLACE CHICAGO JAN 21-24
www.ProMatShow.com

SSI SCHAEFER

For More Information:

Schaefer Systems International, Inc.

www.ssi-schaefer.us

Booth #2003

Speaker:

Dave Simpson
Director of Applications Engineering
dave.simpson@ssi-schaefer.us