

Sterling Selling and Fulfillment Foundation



Warehouse Management System Concepts Guide

Release 91

Sterling Selling and Fulfillment Foundation



Warehouse Management System Concepts Guide

Release 91

Note

Before using this information and the product it supports, read the information in "Notices" on page 103.

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Chapter 1. IBM Sterling Warehouse Management System System Overview

Business Challenges

Increasing customer demands and an ever-changing environment drives businesses today. Some factors that influence business processes are:

- mergers and acquisitions
- introduction of new products or product lines
- servicing new customers
- addition of new business channels
- consolidation of facilities
- business outsourcing

As businesses strive to keep pace with the changing environment, it is also imperative to keep operating costs low.

Businesses must manage inventory in a variety of facilities that may include Plant Warehouses, Regional IBM Sterling Business Centers, Stock Rooms, Stores, and Flow-through Distribution Centers.

Due to the disparate nature of these facilities, each facility employs different operational processes. This leads to complexity in operations and lack of centralized visibility, increased infrastructure costs, and quality issues.

Due to the variety of facilities in a complex warehousing environment, disparate systems are used throughout the network. This results in higher infrastructure and ownership cost at each facility. Integrating systems across disparate facilities becomes complex, and implementing business process changes is a challenge. The following figure illustrates a typical network built on disparate warehousing systems.

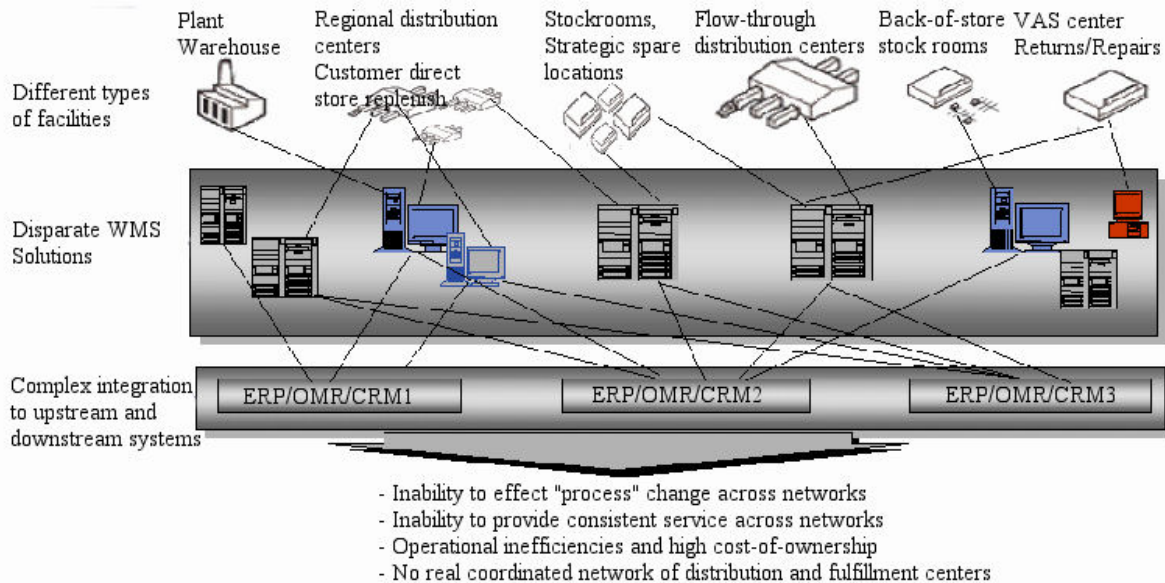


Figure 1. Network of Disparate Warehousing Systems

Offering complete visibility and automating operations in a complex warehouse environment requires thorough knowledge of business processes combined with state-of-the-art technology. An efficient warehouse management system helps businesses:

- Achieve increased productivity levels.
- Improve inventory accuracy.
- Adhere to varying compliance requirements.
- Manage logistics effectively.

Sterling Warehouse Management System Framework

The IBM Sterling Warehouse Management System (WMS) is a Web-based application that provides a comprehensive end-to-end solution helping businesses manage inventory and processes throughout their network, through a synchronized warehouse management system.

The Sterling Warehouse Management System is built using a robust architectural framework that provides enough flexibility to adapt to changing business needs. The following figure illustrates the various modules of the Sterling Warehouse Management System.

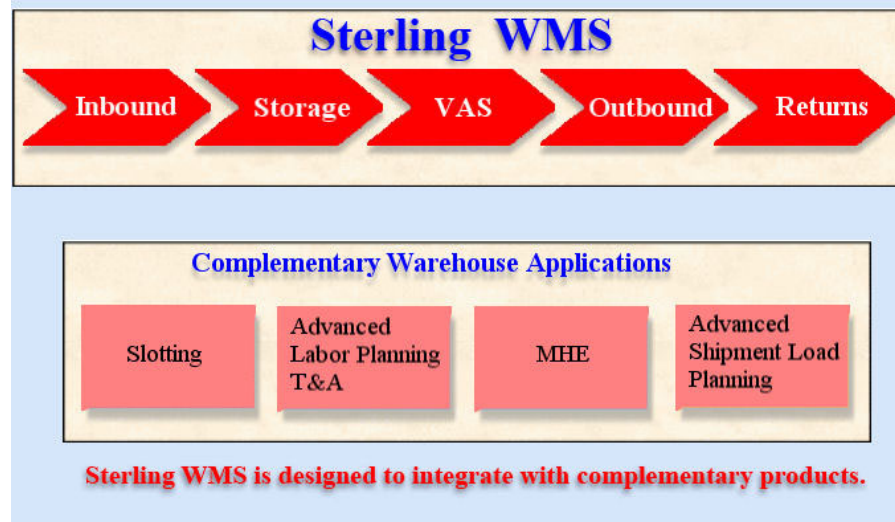


Figure 2. Sterling Warehouse Management System Advanced Functionality

The functionality performed by each of these modules are as follows:

- Inventory Control
 - Granular tracking of Inventory at a location, case or pallet based on item attributes including Lot#, Serial#
 - Putaway of inventory
 - Retrieval of inventory
 - Replenishment of locations
 - Count
 - Management, visibility and monitoring of inventory in a warehouse
- Inbound
 - Comprehensive visibility to inbound shipments
 - Pre-receiving
 - Shipment, PO, Blind receiving
 - Putaway of receipts
- Quality Control
 - Quality profiling
 - Quality Inspection
 - Comprehensive visibility to quality process
- Task Management
 - Task generation
 - Task assignment
 - Task interleaving
 - Management, visibility, monitoring of tasks in a warehouse
- Reverse Logistics
 - Returns pre-receiving
 - Returns receiving
 - Serial number capture
 - Disposition of inventory
 - Putaway of return receipts

- Value-Added Services
 - Kitting and Dekitting for static or dynamic BOM
 - Customer compliance such as special ticketing, security tagging
 - Support for Build to Stock, Build to Customer or Build to Order
 - Retrieval of component inventory
 - Putaway of kit inventory
 - Management, visibility, monitoring of all VAS activities
- Cross Dock
 - Opportunistic as well as planned cross dock
 - Product diversion to Cross dock staging or directly to outbound shipping lanes
 - Cross dock based on Items and for units, cases or pallets
- Outbound
 - Order release consolidation
 - Shipment routing
 - Grouping of shipments and wave planning
 - Constraint based real time optimization to suggest the best picking strategy
 - Containerization for optimizing packing and freight cost
 - Replenishment for demand
 - Picking
 - Packing
 - Outbound VAS
 - LTL/TL Shipments, BOL
 - Manifesting for Parcel Shipments
 - Trailer loading
 - Management, visibility, monitoring of all outbound activities

The Sterling Warehouse Management System is designed as a comprehensive solution to take care of all the functionality needs in a warehouse environment. It also provides the flexibility to model and implement customized needs. Rich in features and functionality, the modules of the Sterling Warehouse Management System provide the following key capabilities:

- Networked Solution
- Multi-Enterprise Management
- Process Centric
- Comprehensive Catalog Management
- Visibility
- Vendor Performance
- Customer Compliance
- Radio Frequency Identification Enabled
- Optimized Operation

Networked Solution

The Sterling Warehouse Management System is unique in its architecture - it is the only warehouse management system that is designed as a networked solution. It is built on a service oriented, component-based architecture. The following figure depicts the network solution design of the Sterling Warehouse Management

System.

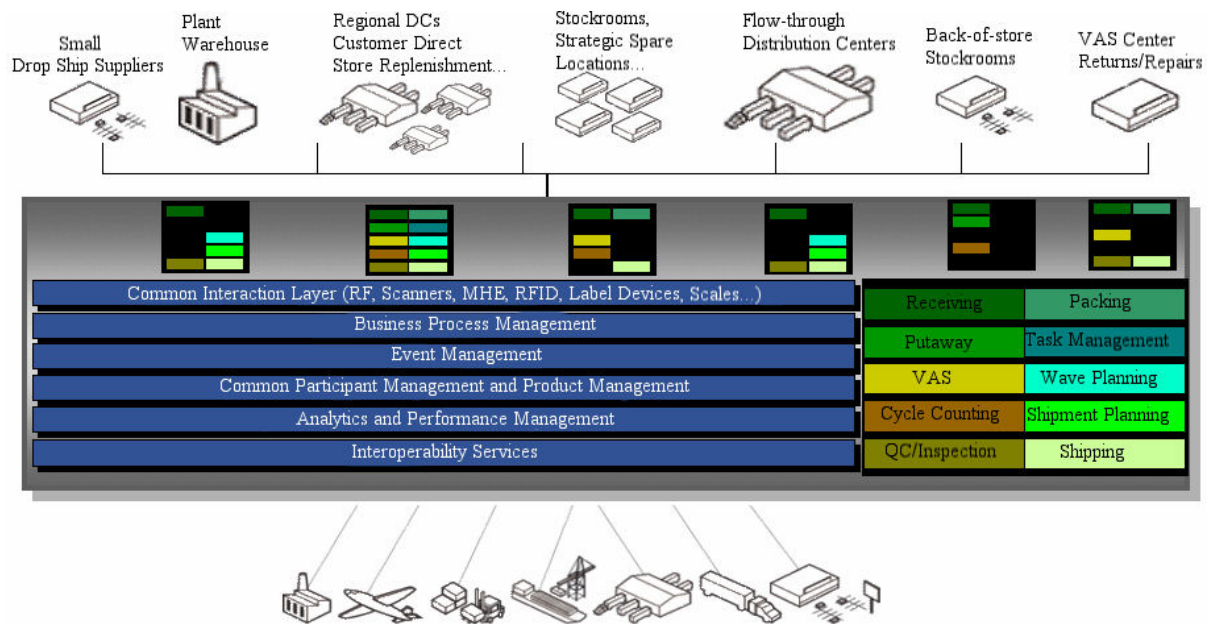


Figure 3. Sterling Warehouse Management System Component-Based Architecture

The Sterling Warehouse Management System provides low-cost of ownership, higher flexibility, and consistent customer service.

Multi-Enterprise Management

A business or business channel can be modeled as an enterprise in the Sterling Warehouse Management System, allowing warehouses handle inventory and processes uniquely for diverse enterprises. The Sterling Warehouse Management System can be easily configured to suit business needs and processes for each enterprise.

The Sterling Warehouse Management System provides for network-wide control through a common catalog of services for multiple enterprises within a warehouse ensuring optimal use of labor and assets despite process diversity.

Process Centric

The Sterling Warehouse Management System is process-centric, making it highly configurable. Traditional warehouse solutions are services-intensive, and provide data-centric configurations.

The process management model in the Sterling Warehouse Management System is optimized for supply chain operations, and integrates monitoring with event and task management. The process flow definition in the Sterling Warehouse Management System is highly extensible, which allows each implementation to incorporate custom logic necessary for keeping your competitive advantage.

The Sterling Warehouse Management System is adaptive to changes in facility and operations. It provides the ability to configure business processes for disparate facilities, such as Plant Warehouses, Regional Distribution Centers, Stock Rooms, and VAS Centers. The Sterling Warehouse Management System facilitates

incorporating changes in the network through virtual deployment of ship-nodes, inheritance of rules, and configuration deployment tools.

The net-native framework makes the Sterling Warehouse Management System highly interoperable, and provides for internationalization and localization. This networked solution is highly scalable, and provides a central control point to introduce new business processes, and technologies.

The Sterling Warehouse Management System thus provides flexibility for business demands, reduced implementation time, and rapid response to customer demands.

Comprehensive Catalog Management

The Sterling Warehouse Management System is built to track and control inventory of products/items across an organizational network. Various parameters and granular definitions bundled into the Sterling Warehouse Management System ensure consistent handling and measurement of inventory, and accurate handling of variable goods.

The Sterling Warehouse Management System provides the capability to improve inventory accuracy by tracking user-defined product attributes such as Lot Number, Serial Number.

Visibility

The Sterling Warehouse Management System enables effective management of warehouse operations by providing wall-to-wall visibility of all critical information about inventory, orders, shipments, or containers. A warehouse operation benefits from visibility into this process information. By leveraging the Sterling Warehouse Management System' Alert Framework, the process is proactively monitored for potential problems thereby enhancing productivity levels.

The Sterling Warehouse Management System provides Web-based consoles to monitor, control, and direct day-to-day operations. Consoles like Task Management, Wave Planning, Pick Planning, Event Management enable automation of daily operations.

The Sterling Warehouse Management System raises proactive and reactive events, and raises appropriate exceptions through the Event Management layer.

Vendor Performance

The Sterling Warehouse Management System provides features that include ASN matching, inventory disposition, and product classifications that allow for vendor rating and performance. Other features support tracking a carrier's capabilities for delivery compliance. Similarly, other partner's performance to agreement can be captured and reported.

Customer Compliance

The Sterling Warehouse Management System offers features to support unique customer compliance requirements such as labeling, value-added services, performance management, and business process design.

Radio Frequency Identification Enabled

The Sterling Warehouse Management System is designed to allow adoption of Radio Frequency Identification (RFID) technology, allowing definition of new RFID driven business processes in your warehouse operations.

Optimized Operation

The Sterling Warehouse Management System offers real-time, constraint-based optimization of processes in warehouse, reducing labor cost and improving productivity.

Sterling Warehouse Management System Ecosystem

The Sterling Warehouse Management System is a fully integrated warehouse management system offering advanced functionality to efficiently manage the most complex warehouse ecosystems. The Sterling Warehouse Management System offers completely adaptable solutions that can be tailored to fit most environments. The following figure illustrates the Sterling Warehouse Management System Ecosystem.

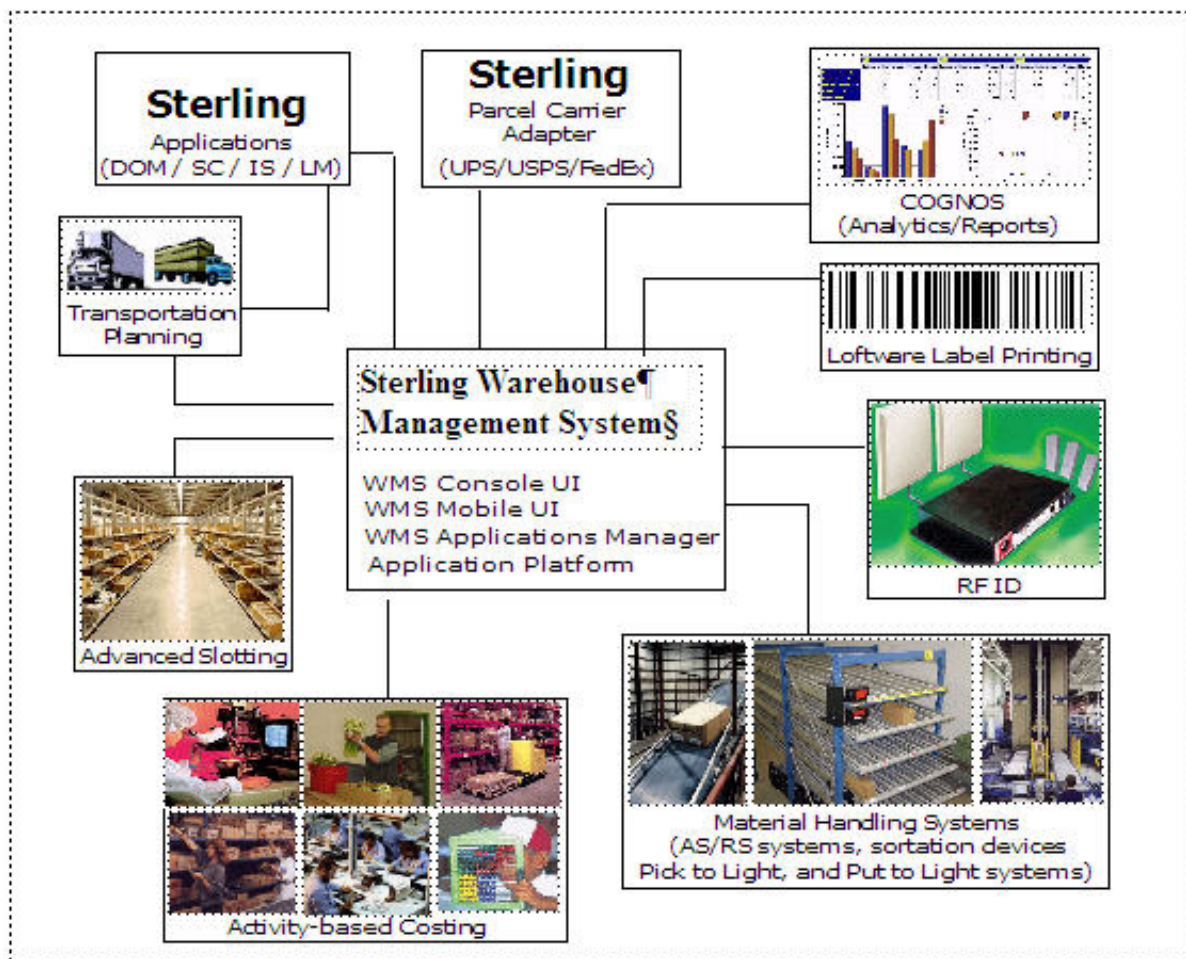


Figure 4. Sterling Warehouse Management System Ecosystem

Chapter 2. Multiple Nodes Access

Multiple Nodes Access

A warehouse user works in the context of one node. However, a situation may arise when the user has to work on multiple nodes. This is when the user has to switch between nodes to access multiple nodes. Sterling Warehouse Management System enables a user to access multiple nodes and perform various warehouse operations. After the user switches to a different node, all the transactional data that is displayed and recorded will be in the context of the node the user is currently working on.

Permission to access multiple nodes is based on the teams assigned to the users in the Applications Manager. Depending on the access permission granted to the team the user is assigned to, the user can access a set of nodes.

Chapter 3. Inventory Control

Inventory Control and Tracking

The Sterling Warehouse Management System provides comprehensive functionality to track, monitor, and maintain inventory in a warehouse. Inventory visibility is provided through consoles that provide granular information, as necessary.

The features provided by the Sterling Warehouse Management System for Inventory Control are:

- Real time and accurate inventory information
- Inventory tracking at a granular level
- Comprehensive inventory audit trail
- Comprehensive control of movements within the warehouse to synchronize the movement of products and real time information
- Complete management of transfer between warehouses
- Industry standard count procedures

The Sterling Warehouse Management System enables inventory tracking based on item attributes at a warehouse and location level. The Sterling Warehouse Management System provides various inventory tracking attributes, such as:

- Enterprise in a warehouse
- Product Class
- Inventory Status
- Unit of Measure
- Container
- First In First Out
- Receipt
- Country Of Origin
- Tag Number
- Serial Number
- Segment
- Expiration Date

Enterprise in a Warehouse

The Sterling Warehouse Management System is designed to support either single or multiple businesses or business channels in a warehouse. If any of those businesses require segregation of inventory, they are referred to as enterprises in the Sterling Warehouse Management System. The following figure illustrates multiple business channels in a warehouse.

The Sterling Warehouse Management System also tracks inventory of every SKU at a location level within the warehouse. A single location in the Sterling Warehouse Management System can hold multiple SKUs. Each location number is a combination of the zone, aisle, level, bay, and position parameters. Various location types at which inventory is tracked include:

- Pallet storage (Single deep, Double deep)
- Case storage

- Loose or Active Storage
- Floor level
- Carousels
- Flow racks
- Bins

The following figure illustrates multiple business channels in a warehouse.

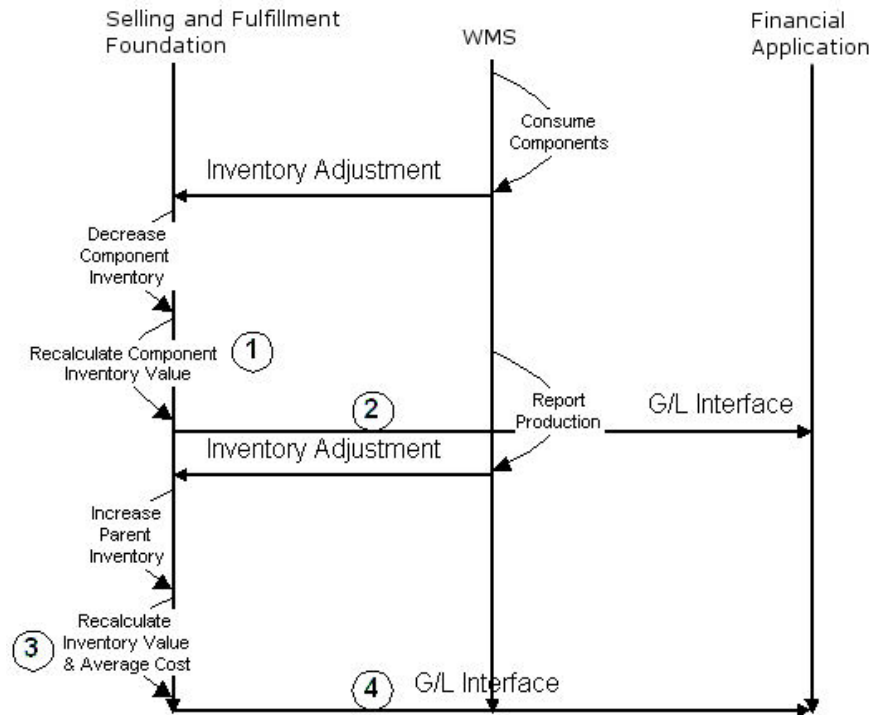


Figure 5. Multiple Enterprises in a Warehouse

Industry examples include:

- A manufacturer sets up a separate business channel for "Direct to Consumer". Same warehouse can be used to manage fulfillment for "Direct to Consumer" or "To Retail" channel.
- A 3PL logistics provider can service multiple clients from the same facility, which enables utilization of all resources in a warehouse across multiple enterprises.

The Sterling Warehouse Management System has the ability to track inventory for an enterprise down to a location level. This eliminates the need to have a zone configured for an enterprise. Similarly, an organization may have multiple business channels in the same warehouse.

The resulting advantages are better asset utilization, resource utilization and complete support for multi-tenancy.

Also, transfer of inventory between business channels in a warehouse does not require any physical movement of product.

Product Class

In a traditional warehouse environment, inventory of finished goods is represented as a good quality product. Inventory that fails quality control requires representation as bad inventory. For example, shoes with a different shade than what is specified. In best practice situations, these must be maintained and transacted with the understanding that it is bad inventory.

The Sterling Warehouse Management System maintains bad inventory under a different product class. This maintains item integrity and simplifies handling from a global inventory perspective. This also provides immediate visibility of SKUs at their product class level. An example of product class attribute is described in the following table.

Table 1. Product Class Attribute

Location	Node	Item ID	Product Class	On Hand Quantity
13C01	Memphis Distribution Center	ITEM1	FQ	100
		ITEM1	FD	20

Industry examples include:

- Finished goods marked as First Quality
- Finished goods marked as Factory Defects
- Finished goods marked as Irregulars

The advantages provided include a single item ID across multiple product classes.

Inventory Status

The Sterling Warehouse Management System is capable of tracking the inventory status of an item. The inventory status of an item influences the inventory as being allocatable or non-allocatable.

The Sterling Warehouse Management System allows specification of inventory status at a zone level.

For example, consider a warehouse that prefers only products to storage as eligible for order reservation. After receipt, the product is expected to be in 'Awaiting Putaway' status, and after move into storage the product is expected to be in 'Good Inventory' status.

In the Sterling Warehouse Management System, the receiving dock location or zone would be configured as 'Awaiting Putaway' inventory status and the storage zone(s) would be configured as "Good Inventory" inventory status. At the inventory status level, you would indicate that 'Awaiting Putaway' is non-allocatable and 'Good Inventory' as allocatable. An example of inventory status attribute is described in the following table.

Table 2. Inventory Status Attribute

Location	SKU	Inventory Status	Quantity
13C01	SKU1	Quality Control	100
13C02	SKU1	Good Inventory	20

Industry examples include:

- Good inventory
- Awaiting putaway
- Held under quality control
- Awaiting inspection
- Pending rework
- Scrapped

Unit of Measure

The Sterling Warehouse Management System tracks inventory at the UOM level. A UOM translates to the type of packaging of an SKU.

An SKU has its own basic UOM called as Inventory UOM in the Sterling Warehouse Management System. For example, the basic UOM for a shoe is EACH. Similarly that of metal sheets is a ROLL, a metal block is in cubic metres, milk in ounces or gallons or liters dependent on the region in the world. These UOMs are unique at a SKU level and define the lowest such measure that an item has. The following figure depicts UOM for various items.



Figure 6. Unit Of Measure (UOM)

Let us expand this concept a further. If you have an item, say milk, then a carton is either a half-gallon or a gallon or 2 gallons. Each of these is sold in supermarkets as individual measures. The Sterling Warehouse Management System supports this by having multiple Inventory UOMs for a single item. Another well-known example is a battery pack, sold as 4-pack, 6-pack, 12-pack. Needless to say, the beverage industry has made a 6-pack and a case (12-pack) very popular.

From the above discussion, it is apparent that each item has its own unique Inventory UOM, as well as, additional Inventory UOMs. The following figure depicts UOM for a 6-Pack and 16-Pack batteries.



Figure 7. 6 Pack and 16 Pack Batteries

Now let us consider inventory being received, procured and ordered. Typically, inventory is also received in multiples of inventory UOMs, for example, case of 4-pack batteries or a pallet of milk cartons. These measures further define alternative methods of addressing an Inventory UOM. They have a direct relationship to the inventory UOM. In the Sterling Warehouse Management System, these UOMs are called as alternate UOMs. Alternate UOMs are case pack of 20 6-pack batteries, half-pallet of 1 gallon cartons of milk, pallet of air-conditioners. The following figure depicts case pack UOM.



Figure 8. Case Pack

The Sterling Warehouse Management System therefore allows you to transact (receive, purchase, sell, move) inventory at UOM levels that are appropriate for the transaction, further removing the constraint of the way the inventory is stored.

The advantages of tracking inventory and alternate UOMs in inventory are:

- Ideally, in applications that cannot track multiple Inventory UOMs for the same item, a unique SKU is defined for each UOM. If you define separate SKU for each inventory UOM, warehouse would lose visibility for the product. Hence, tracking inventory with the same SKU and different inventory UOM provide correct visibility to the inventory on WMS and it represents the physical inventory.
- Ability to place and source orders at a higher UOM level and have the WMS translate those quantities to appropriate lower Inventory UOMs.

Container

The Sterling Warehouse Management System provides visibility to inventory at a container level. A container in the Sterling Warehouse Management System is a case or a pallet that is tracked by a License Plate Number (LPN) and may contain other cases or inner packs.

Single or Multiple SKU Case with LPN

The Sterling Warehouse Management System tracks a case license plate for multiple quantities of a single stock-keeping unit (SKU). Inventory tracking is maintained at the case with LPN level based on location attributes. This tracking could be disabled in the loose or active pick areas where individual items handled.

The Sterling Warehouse Management System also supports the breaking of a case at any location for partial retrieval or pick. The following table provides an example of single or multiple SKU case with LPN attribute.

Table 3. Single or Multiple SKU Case with LPN Attribute

Location	Case ID	SKU	Quantity
13C01	000091299	SKU1	10
13C02	00092146	SKU1	8
13C02	00092146	SKU2	5

Industry examples include:

- Case of 12 boots with an LPN
- Musical runs for footwear in cases

The advantages include tracking of unique UOM quantities by a case with LPN.

Single SKU case with inner packs

The Sterling Warehouse Management System is also capable of identifying the number of inner packs available in a case. An example of single SKU case attribute is described in the following table.

Table 4. Single SKU Case

Location	License Plate Number	SKU	Quantity
13C01	0913999	SKU1	100
13C02	0913997	SKU2	100

Table 5. Single SKU Case with Inner Pack Quantity

License Plate Number	Inner Pack Quantity
0913999	25
0913997	25

An example of single SKU case with inner pack quantity is described in the 'Single SKU Case with Inner Pack Quantity' table.

Industry examples include:

- Pens come in packs of 20, which in turn is placed in a larger carton

The advantages include ability to define and understand inner pack quantities.

Single or Multiple SKU Pallet with LPN

In addition to supporting a single item at case and pallet levels, the Sterling Warehouse Management System also supports multiple SKUs on a case and pallet with LPN as shown in the following figure. Inventory visibility is provided at the individual SKU in their respective quantities.

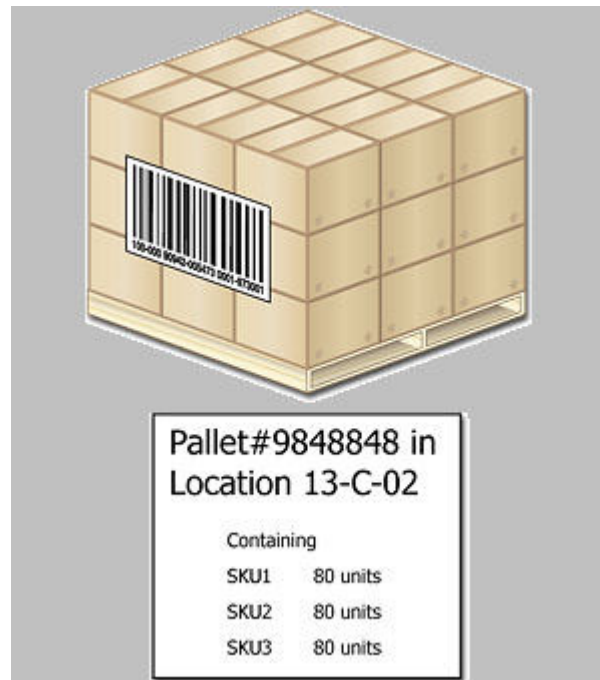


Figure 9. Single or Multiple SKU Pallet with LPN

Industry examples include:

- Pallet of calculators with an LPN
- Outbound or shipment pallets with LPN

The advantages include the ability to receive, putaway, retrieve and allocate product individually on a pallet with LPN.

Multi-level LPN

The Sterling Warehouse Management System tracks a case level license plate attached to a pallet for multiple SKUs as shown in the following figure.

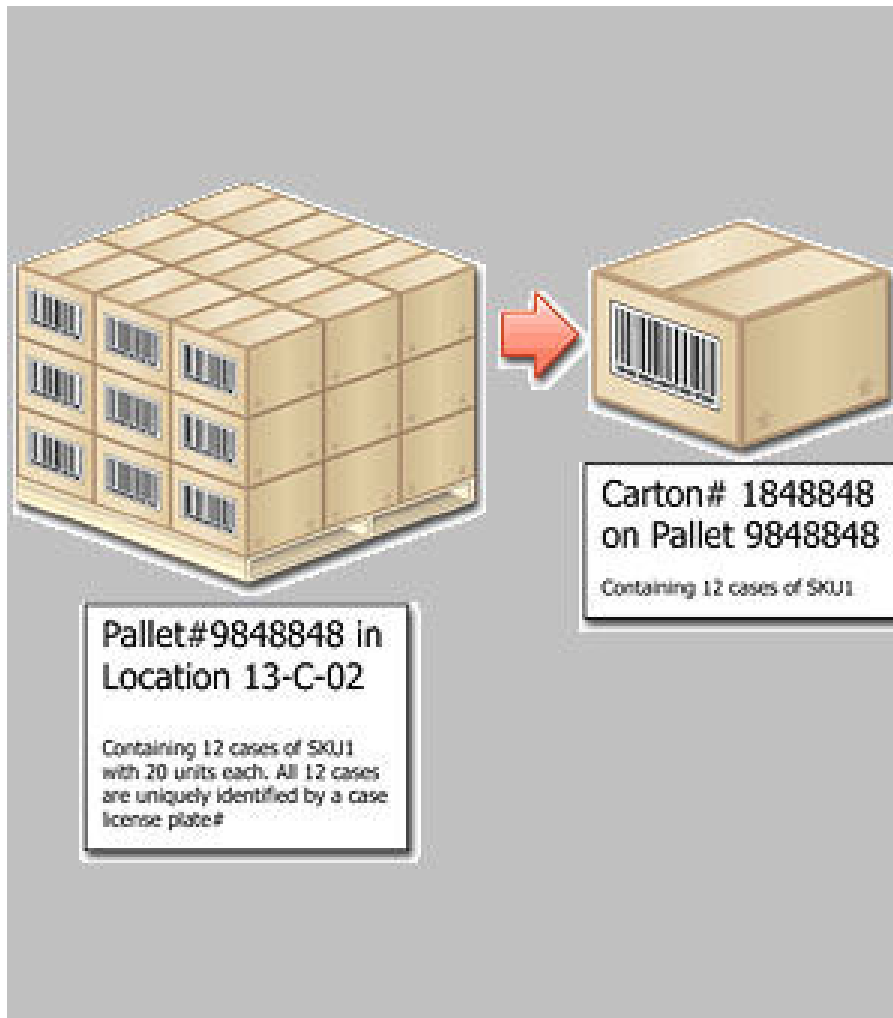


Figure 10. Pallet with Multi-level LPN

Industry examples include:

Complete outbound shipment with ASN compliance

The advantage include complete inventory tracking and ability to move inventory at both the pallet and case with LPN levels.

Case and Pallet with Unknown Contents

The Sterling Warehouse Management System tracks inventory for a case or pallet with unknown contents by using an LPN as shown in the following figure.

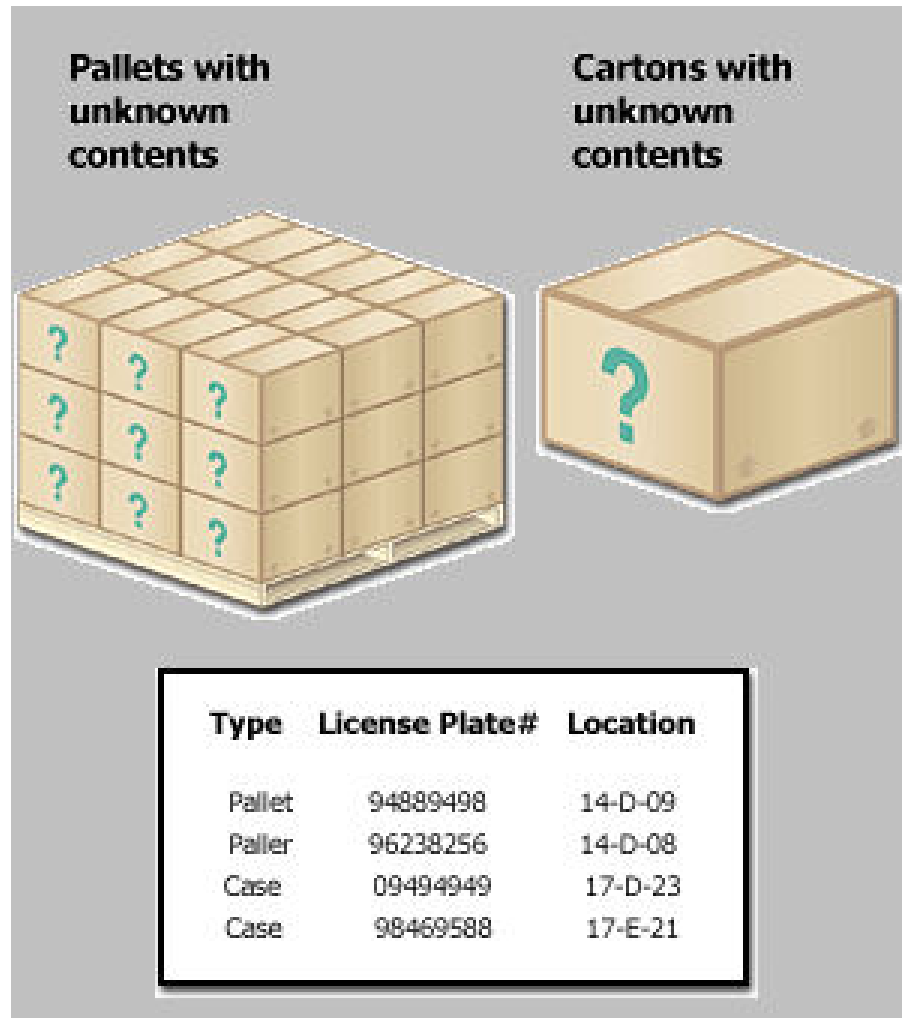


Figure 11. Case and Pallet with unknown contents

Industry examples include:

- Pre-receipt during returns
- Customers who do not require granular level details for outbound shipments
- Distro operations
- Flow through warehouses (parcel companies)
- Public warehousing

The advantages include:

- A case or pallet with LPN once assigned is re-usable across all processes and uniquely identifies the SKU(s) and quantity associated
- Usage of case or pallet with LPN allows warehouses to store and track inventory that has multiple COO, receipt number, serial number at a location
- A case or pallet with LPN may be reserved partially or completely for a movement or order
- A case or pallet with LPN simplifies the movement to that of scanning of a bar code. For example, a pallet with LPN containing 20 cases, when moved from one location to another, requires only the LPN to be scanned

First In First Out

A warehouse that calculates turnover of inventory requires ensuring that inventory is tracked using the First In First Out (FIFO) methodology. The requirement could be limited to a few items as well. The Sterling Warehouse Management System generates a unique FIFO number upon receipt of such items. The Sterling Warehouse Management System ensures that the oldest inventory is first allocated to orders.

All receipts received within a specified date period are assigned the same FIFO number. An example of FIFO attribute is described in the following table. The example considers the FIFO period as a month.

Table 6. FIFO Attribute

Location	SKU	FIFO Number	Receipt Date	Quantity
13C01	SKU1	2003011	11/15/2003	100
13C01	SKU1	2003011	11/18/2003	10
13C01	SKU1	2003011	11/28/2003	50
13C02	SKU1	2003012	12/10/2003	10

Industry examples include:

- Leather based products like wallets that lose color after a period of time
- Electronics like PDA and cameras have newer versions very often

The advantages include:

- Reduced obsolescence
- Ability to distinguish aged product
- Ability to identify velocity or inventory turnaround

Receipt

The Sterling Warehouse Management System identifies each receipt with a unique receipt number. This number is used to track inventory back to the shipment number. An example of receipt number attribute is described in the following tables.

Table 7. Receipt Number Attribute

Location	SKU	Receipt Number	Quantity
13C01	SKU1	200010101	100
13C02	SKU1	200010101	20

Industry examples include:

- Recall of specific shipments
- Post receipt quality inspections

The advantages include:

- Ability to track inventory by their shipment and/or receipt numbers in storage
- Ability to retrieve from a specific receipt for inspection
- Modify inventory status at a receipt level

The Sterling Warehouse Management System supports multiple receipt numbers at a location only when an inventory is maintained at a case or pallet with LPN level.

Country Of Origin

The Sterling Warehouse Management System tracks the COO of an item being received. COO is determined based on shipment details or purchase order details during receipt or manually entered in inventory adjustments. The values captured may be used for customer compliance. An example of COO attribute is described in the following table.

Table 8. COO Attribute

Location	SKU	COO	Quantity
13C01	SKU1	US	100
13C02	SKU1	CH	20

The advantages include:

- Segregate inventory by COO.
- Reduce manual determination of COO information for preparing international shipping documents such as Commercial Invoice.

The Sterling Warehouse Management System supports multiple COOs at a location only if inventory is maintained at a case or pallet with LPN level.

Tag Number

The Sterling Warehouse Management System allows tracking of inventory back to the exact batch it was manufactured through the usage of a tag number.

Lot Number

Lot number is a unique number allocated to one or more product during manufacture or assembly to enable traceability.

Industry examples include:

- Set of picture tubes received in a warehouse
- Pallet of keyboards on hold

Cut Lot Number

In addition to tracking the lot number, further granularity is achieved to a cut lot level.

Industry example include:

- Wood industry.

Dye Lot Number

In the clothing industry, most yarns require a dye lot number to ensure that all the pieces are the same color.

Industry examples include:

- Wallpaper
- Knitting wool

Coffee Grind Level

To ensure the best flavor in a cup of coffee, coffee needs to be ground well so that the proper amount of soluble material is extracted from the bean.

Industry examples include:

- Espresso machines require extra fine grind
- Coffee press requires coarse grind

Wood Grading

In the timber industry, wood is treated with chemicals that provide color, texture, strength, resistance.

Industry examples include:

- Air dried
- Kiln dried
- Chemically treated

Revision Number

Items that frequently undergo an engineering change are assigned with different revision numbers. The Sterling Warehouse Management System has the ability to record the revision numbers of such item.

Industry examples include:

- Spare parts industry
- Electronics

The Sterling Warehouse Management System allows the definition of a set of additional identifiers for specific items that needs to be tracked in inventory using the Tag attribute. This enables a warehouse to decide what attributes of an item needs to be tracked in inventory and allows a warehouse to track inventory at a granular level. An example of user defined attributes applied to an item is described in the following table.

Table 9. User Defined Attributes Applied to an Item

Item ID	Description	Additional Inventory Tracking Identifiers				
		Lot Number	Batch Number	Wood Grading	Grind Level	Cut Lot Number
M-239838	Men's Shoe					
P-29838	Picture Tube for 27" TV	4345688				
S018488	Motherboard for a Desktop PC	098675				
H-239848	Teak Wood			Kiln Dried		2314579
9238-39	Hazelnut Coffee Powder				Coarse	

The Sterling Warehouse Management System allows a warehouse to track additional attributes against these identifiers. For example, a warehouse may track

inventory by lot number for certain items. Additional attributes such as manufacturing date, manufacturing plant number can also be tracked against the lot number.

The advantages include:

- Visibility to location level inventory at most granular level.
- Ability to hold inventory based on additional inventory attributes. For example, warehouse may receive request from the manufacturing plant to put a specific lot number on hold.
- Ability to ship inventory of specific inventory attributes. For example, warehouse may receive order to ship an item of specific revision or lot number.
- Ability to specify on an order the requirement of a specific tag. The Sterling Warehouse Management System allocates all tag numbers to an order that does not have a specific tag.

Serial Number

Serial number is recorded at the point of receipt, inventory adjustments or during outbound shipments. SKUs that require serial number tracking are uniquely identified in the Sterling Warehouse Management System. Serial number tracking in the Sterling Warehouse Management System is provided at the global supply chain network level. The Sterling Warehouse Management System is capable of tracking serial numbers in inventory at a SKU and its components level as shown in the following figure.



Figure 12. Component Serial Number

Industry examples include:

- Mobile phones
- Telephones
- Automobile parts
- Demagnetized computer tool kit, which includes:

- Nine allen wrenches
- Six piece mini screw driver set
- Five SAE sockets, five metric sockets

The advantage include:

- Track at a serial number level for returns and recalls
- Ability to put specific serial number on hold
- Ability to ship specific serial numbers

Segment

A warehouse often performs specific value-added services before shipping inventory to specific customers.

Some examples of value-added services are:

- applying customer price tickets
- applying security tags
- printing company logo and name on the product

Performing value-added service is labor-intensive. If value-added services are performed subsequent to receiving sales order, then it may result in increased cycle time for fulfilling the order. In order to reduce order fulfillment cycle time, warehouse often perform customer specific value-added services for specific products ahead of receiving the actual outbound order.

The Sterling Warehouse Management System provides the ability to designate inventory that is reserved for a customer through the use of segments. An example of MTC segment attribute is described in the following table.

Table 10. Segment Attribute-MTC

Location	SKU	Segment Type	Segment	Quantity
13C01	SKU1 - Black Leather Wallet	MTC - Made to Customer	Cust-Name	100
13C02	SKU1 - Black Leather Wallet			200

In this example, 100 units of inventory in location 13C01 contains inventory that has Cust-Name special tickets. This inventory is allocated only to orders shipped to Cust-Name. Whereas, inventory in location 13C02 does not have any value-added services, and therefore can be allocated to other customers who do not require any value-added services.

A segment may also be used for in the "Made to Order" situation. Some examples of "Made to Order" situation are:

- Customer placing an order for a Desktop PC with certain configurations.
- Ordering shoes with certain parameters or specifications.

Warehouse may receive such "Made to Order" inventory through service providers built outside, or use VAS module to build order specific inventory. Inventory built for specific order may not be picked, packed and shipped on the same day. Therefore, a warehouse may need to stock such inventory subsequent to manufacturing or receiving inventory. The Sterling Warehouse Management System is capable of associating location-level inventory to a specific order to ensure that

inventory is allocated only to that order. An example of MTO segment attribute is described in the following table, which explains that location 13C01 is built for a specific order and is not allocated to any other orders.

Table 11. Segment Attribute-MTO

Location	SKU	Segment Type	Segment	Quantity
13C01	SKU1 - Desktop PC	MTO - Made to Order	Order Number 9012887	100
13C02	SKU1 - Desktop PC			200

Expiration Date

The Sterling Warehouse Management System tracks the inventory of items designated as time sensitive items by expiration date, and ensures that expired items are not allocated to any order. An example of expiration date attribute is described in the following table.

Table 12. Expiration Date Attribute

Location	SKU	Expiration Date	Quantity
13C01	SKU1	20 Dec 2004	100
	SKU1	25 Dec 2005	30

Industry examples include:

- Canned foods
- Processed foods (Milk, Meat)
- Pharmaceutical

Inventory Visibility in the Application Console

The Sterling Warehouse Management System enables inventory visibility in the Application Consoles at a very granular level. The level of visibility is based on the level at which inventory is tracked in a warehouse.

Visibility to inventory levels and respective attributes are provided through a console. The combinations of attributes are better illustrated through use cases or examples, which include:

- View inventory across all SKUs at the warehouse level for an enterprise
The criteria used include Enterprise, Ship Node.
- View defective inventory for a SKU for an enterprise at a warehouse that are in a specific type of LPN
The criteria used include Enterprise, Ship node, Item ID, Pallet ID, Case ID. In addition to this, if you want to view all items that are on Quality Hold, then use Inventory status as criteria.
- View all inventory built for a specific order, order type
The criteria used include Enterprise, Ship Node, Segment, and Segment Type
- View all inventory available in a specific zone
The criteria used include Enterprise, Ship node, and Zone.
- View all inventory for inbound shipment number or PO number

Criteria used include Enterprise, Ship Node and receipt number corresponding to shipment or purchase order number.

- View all location level inventories that have been frozen for pick
The criteria used include Enterprise, Ship node, check flag for frozen locations only.
- View all location level inventories that have been frozen due to count variance
The criteria used include Ship node and check flag for frozen locations only.
- View all inventory that has aged, say 30 days and older, in a warehouse
The criteria used include Enterprise, Ship node, Inventory age 'greater than or equal to' 30 days.
- View all inventory for a serial number range
The criteria used include Enterprise, Ship Node, Item ID, Serial number 'starts with' option.
- View all inventory for wood that has been kiln dried and has at least 10 pieces in a lot
The criteria used include Enterprise, Ship node, Tag Attribute - Kiln Dried 'equals' Y and Tag Attribute - Number of pieces 'greater than' 10.

In addition to inventory level attributes, the warehouse manager manages and views location level attributes to list the following:

- Locations that are empty and available across all zones or limited to certain zones.
- Locations that are frozen for picking or putaway.
- Locations that are empty and of high velocity.
- Locations those are empty in a specific area for frozen items or hazardous items.
- Locations that are sharing a staging location.

In addition to the features provided at the console or screen level, the viewing of data is limited to that of users permissions. In a multi-client or multi-enterprise scenario, a user assigned to a specific client can view only that client's inventory. This also holds true for out sourced providers having only access to inventory that they own (Vendor Managed Inventory [VMI]).

Inventory Audit

The Sterling Warehouse Management System audits all inventory transactions that occur in a warehouse. Audits are written in the Sterling Warehouse Management System for each transaction along with appropriate reference values and SKU attributes for tracking purposes. The combination of attributes are better illustrated through the following use cases or examples:

- View all transactions for a SKU for the last 2 days
Criteria used include ship node, SKU, date and time
- View all transactions for a shipment or order
Criteria used include ship node, shipment
- View all positive inventory adjustment done due to count errors
Criteria used include ship node, and task type
- View all transactions performed by a user today
Criteria used include ship node, user, date and time
- View all transactions for a tag number or serial number
Criteria used include ship node, enterprise, tag number, serial number

- View all transactions for an LPN
Criteria used include ship node, case or pallet with LPN

Cleaning out Accounting Bin

IBM Sterling Selling and Fulfillment Foundation provides the ability to clean or zero out accounting bin locations. Accounting bin locations are usually cleaned out by warehouses at the end of a physical or cycle count process in order to publish and reconcile inventory discrepancies between the systems.

Inventory Visibility in the Mobile Application

The Sterling Warehouse Management System provides inventory visibility using Radio Frequency (RF) devices through the Mobile Application. Using the mobile application, you can inquire into:

- Inventory that exists in a location.
- Items packaged into an inventory container.
- Locating the specific serial number of a serialized item.
- Inventory availability for an item.
- Shipment information for an outbound container.

The attributes are better illustrated through use cases or examples, which include:

- View the entire inventory available in a location.
The criteria used is Location ID.
- View the contents of an inventory container (Pallet LPN or Case LPN).
The criteria used is Container Number.
- Determine the location of a misplaced container or serialized item.
The criteria used is Container Number or Serial Number.
- View the inventory availability for an item in the warehouse.
The criteria used is Item ID.
- View the shipment information for an outbound container.
The criteria used is Container SCM.

Inventory Modifications

The Sterling Warehouse Management System allows modification of inventory through the Application Consoles. Inventory modifications in a warehouse are either initiated manually, or as part of cycle count or physical count process. Examples of inventory modifications are:

- Adjusting the onhand quantity of a SKU at a location or license plate (existing or non-existing LPN)
- Changing the inventory attribute without changing on hand quantity:
 - Tag number
 - Expiration date, FIFO date
 - COO
 - Product Class
 - Inventory Status

Sorting Before Putaway

The Sterling Warehouse Management System provides the ability to sort inventory in a warehouse based on location, zone, or set of zones where inventory needs to be put away. The user can then build pallets or cases for the sorted inventory based on the target location.

Putaway

The Sterling Warehouse Management System categorizes putaway request as a move from a particular location without necessarily specifying the target location. In situations, where the target location is not specified, the Sterling Warehouse Management System utilizes its putaway algorithms to determine the optimal target location(s).

A putaway request is either created automatically due to a related event that is carried out, or manually initiated by a user.

Some examples for automated requests include:

- Putaway from Dock—the receiving department requests the inventory department to putaway stock at the dock location, specifying only the receipt and dock-location. For example, the receipt of an item or closure of a receipt for a shipment initiates a putaway request.
- Putaway from Value-Added Services—the VAS department requests the inventory department to move stock out of a VAS location. For example, a work order completion creates inventory that requires move to storage locations.

An example for manual move requests include:

- Putaway after Quality Inspection—the inspection department requests the inventory department to move inventory that has completed inspection after receipt to the storage locations.

Putaway requests are placed in the Sterling Warehouse Management System task management, which utilizes constraints and preferences configured at the warehouse level to determine the optimal target location(s).

Putaway Algorithm

The Sterling Warehouse Management System putaway algorithm utilizes criteria that include SKU, packaging type, capacity constraints and sorting/sequencing strategy. The algorithm goes through all locations in a warehouse and applies or verifies constraints to arrive at the optimal location. The following figure illustrates the putaway algorithm.

- ◆ Locations in Warehouse
 - All locations in the warehouse
- ◆ Allowed Locations
 - Locations in particular zones
- ◆ Storage Constraints
 - Constraints such as do not mix Enterprise/SKU/FIFO
- ◆ Sorting
 - Nearest to Dedicated Locations
 - Best Fit / Least Put away

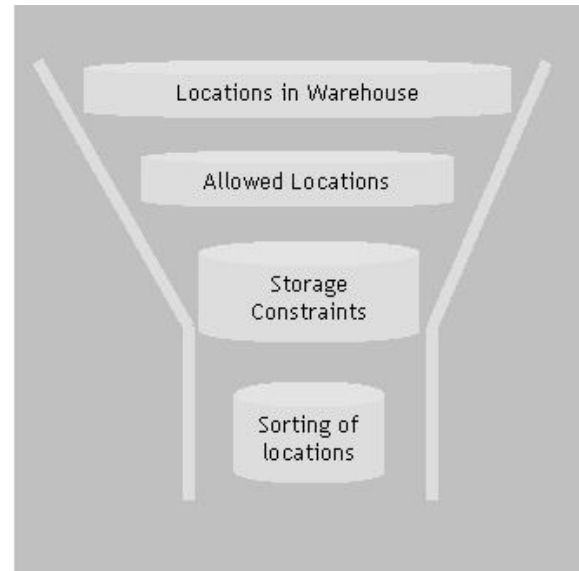


Figure 13. Putaway Algorithm

The putaway algorithm is initiated based on events that occur in a warehouse.

The business process configuration and algorithm answers the following questions:

- When to putaway?

Putaway inventory upon receipt or after inspection or VAS is complete. Another example is, initiation of a putaway request after completing VAS.
- What to putaway?

Putaway can be initiated for a SKU, case or pallet with LPN. It can also be initiated for Pallets or Cases that do not have contents. Each of these attributes influence the resultant locations.
- Where and how to putaway?

Constraints for storage, capacity and storage preferences are considered.

Storage Constraints

Storage constraints are specified in a warehouse to match an item or inventory attributes to a location. The Sterling Warehouse Management System ensures that constraints defined are not violated while suggesting putaway locations. Different constraints defined are:

Zone Dedication

A zone in the Sterling Warehouse Management System is a group of locations that have similar attributes. A zone in a warehouse is used to distinguish storage types or types of item stored.

- Ability to designate a zone to an enterprise.

An example is a 3PL warehouse that has multiple clients. When a zone is dedicated to a specific or set of enterprises, only products belonging to those enterprises is putaway into the zone.
- Ability to restrict a zone for a particular type of SKU or storage types

An example is a zone for hazardous or high-value items. When a zone is dedicated to a specific type of item, other types of products cannot be putaway into such zones.

Location level Dedications

A specific location can be dedicated to an item. This automatically restricts other items into the same location.

Zone level product mixing or segregation constraints

A warehouse can define additional constraints for each zone so that products with different inventory attributes are not putaway in the same location. These attributes include enterprise, SKU, and receipt number. An example of storage types and constraints are described in the following table.

Table 13. Storage Type and Constraints

Type of Storage	Constraints
Bulk Zone—Pallet Racks	Do not mix SKU and do not store products with different FIFO in the same location.
Active/Forward Pick locations	Do not mix Items. However, products with different FIFO/Receipt can be stored in the same location.
Bulk—Case Storage	Match item velocity to location velocity. It is acceptable to mix products in a location, but do not mix products belonging to different enterprises in the same location.

A warehouse that tracks inventory at a case or pallet with LPN could combine enterprises in the same location. This would result in better asset and resource utilization.

Capacity Constraints

A warehouse can define capacity constraint in terms of maximum weight and/or volume that can be putaway to a location. In addition to weight or volume, the Sterling Warehouse Management System allows defining capacity constraints in terms of number of units of a specific UOM. For example, a location may hold four pallets for all items except for some items that are large and can hold only one pallet.

Storage Preferences

In addition to defining constraints at zone or location level, the Sterling Warehouse Management System sets additional preferences specific to inventory type. An example of storage preferences is described in the following table.

Table 14. Storage Preferences

What to Putaway	Where to Putaway
All Pallets of Hazardous Materials	Putaway to zone 1. If there are no locations in zone 1, putaway to zone 2.
Camcorders	Putaway to zone 3, which is a lock and key storage zone. If there are no locations in zone 3, then putaway in zone 4.
All damaged products	Putaway to zone 5, which is designated for damaged products.

Table 14. Storage Preferences (continued)

What to Putaway	Where to Putaway
Refrigerated products	Putaway to Zone 6, which has freezer locations.

A warehouse configuration in the Sterling Warehouse Management System is illustrated in the following figure.

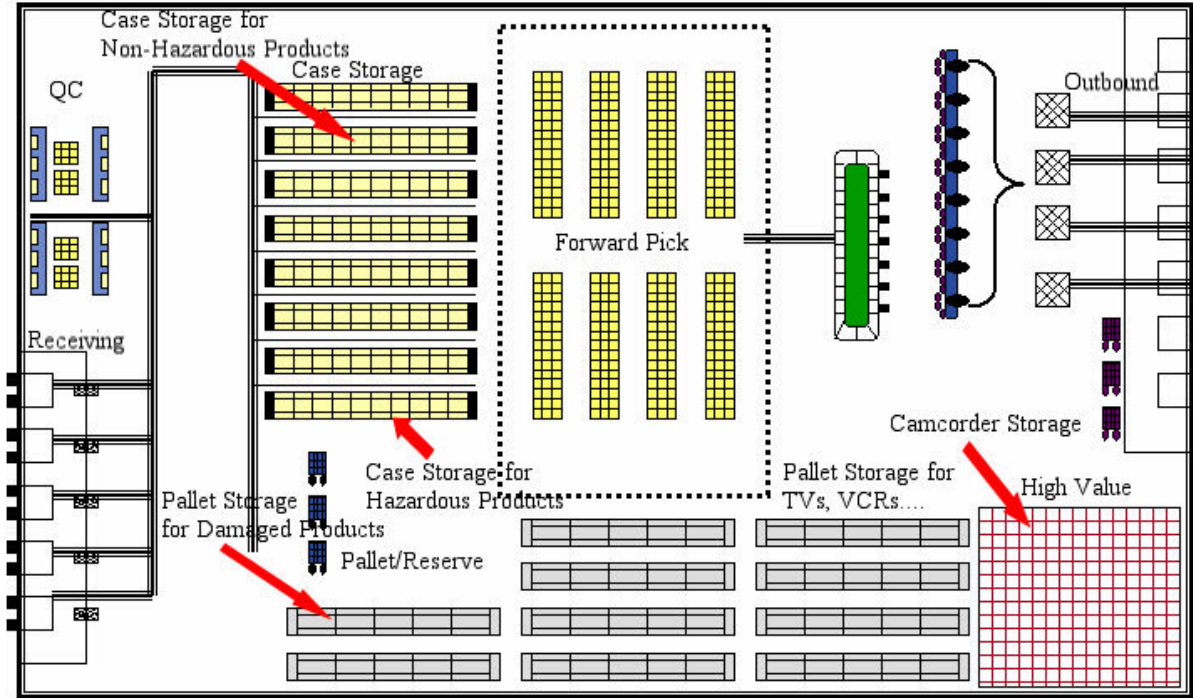


Figure 14. Warehouse Configuration in Sterling Warehouse Management System

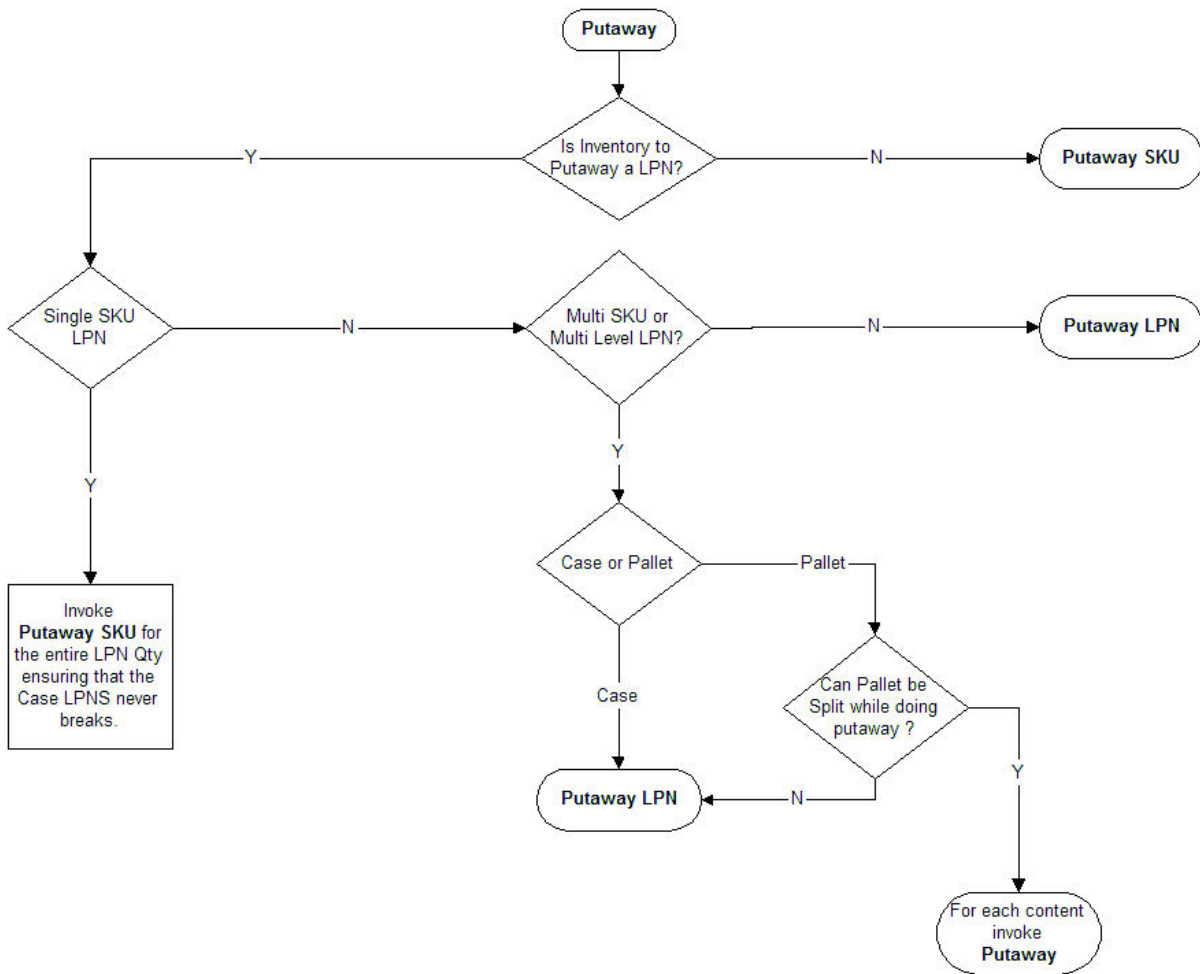


Figure 15. Putaway Algorithm

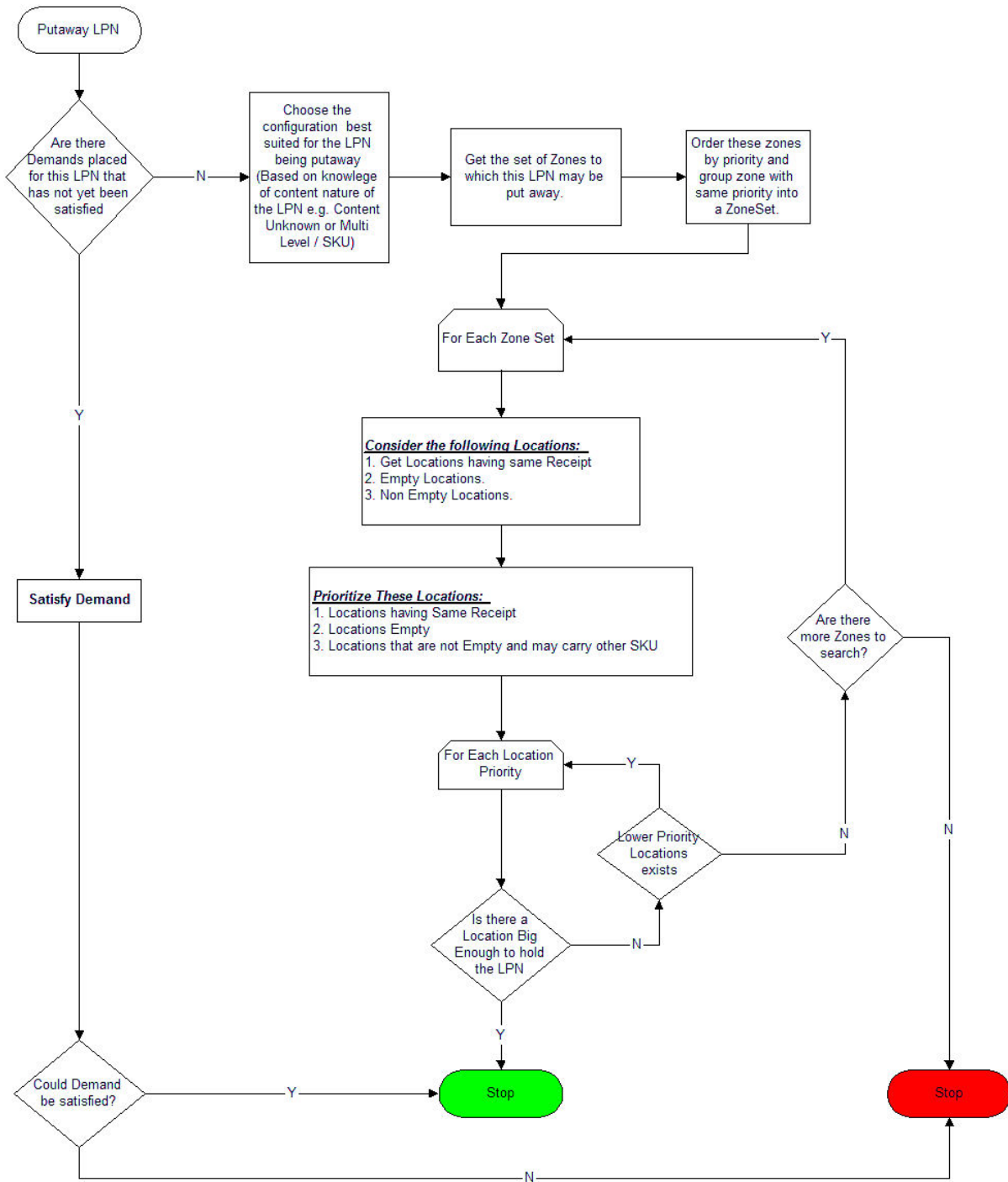


Figure 17. Putaway LPN

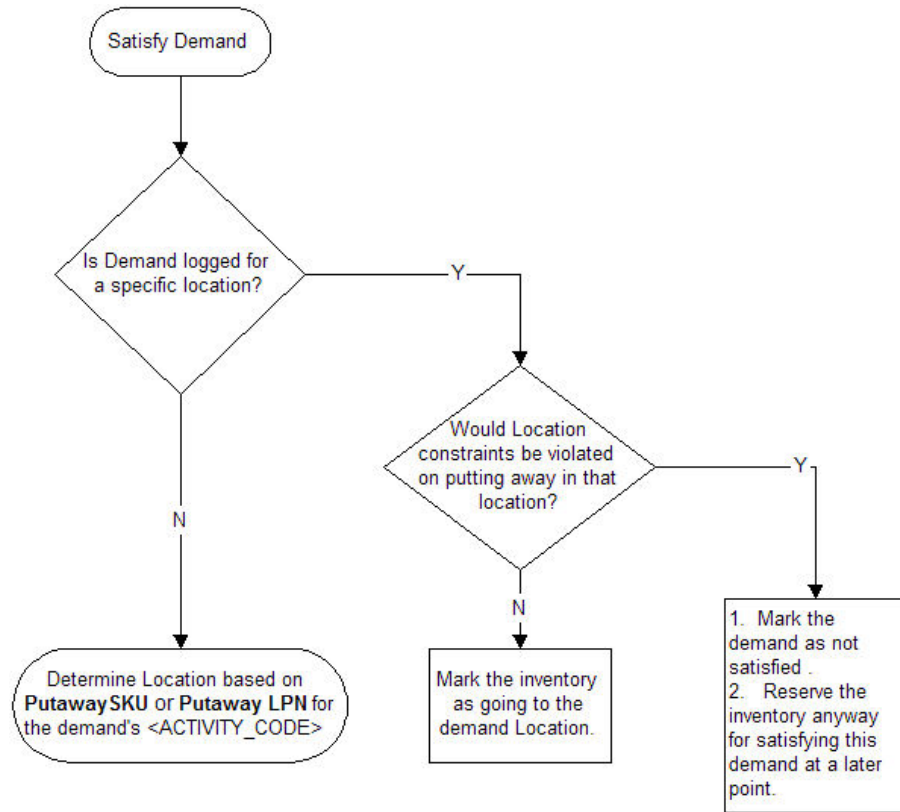


Figure 18. Safety Demand

Putaway Execution

The Sterling Warehouse Management System generates appropriate tasks for each putaway request. The Sterling Warehouse Management System Task Management is used to complete these tasks using printed move tickets, RF Mobile Terminal, or by integrating with Material Handling Equipment (MHE).

Execution of these tasks uses strategies that include:

- One request at a time—a user completes the request in one trip or multiple trips.
- Multiple requests at a time—a user completes tasks across requests in a single trip for more efficiency purposes. (This is very similar to a batch pick scenario.)

A putaway request may result in multiple steps being carried out. For example, usage of a drop-off location during inbound creates a two-step putaway task. (Dock to drop-off and drop-off to storage.)

The Sterling Warehouse Management System can be used to control putaway task suggestion by placing constraints based on a user or attributes, such as shipment number or work order number. For more information, see Task Management.

Putaway Visibility

The Sterling Warehouse Management System provides complete visibility to the status of putaway requests. The visibility is at a granular level indicating the request and attributes used to initiate the request.

The visibility to putaway requests is provided through console. Users view move requests by status or item, and source and target locations. The Sterling Warehouse Management System also provides audit trail views. The combination of attributes are illustrated through the following use cases or examples:

- View putaway requests that have exceptions for a receipt number
The criteria used include department, receipt number
- View open putaway or retrieval requests for a source or target location
The criteria used include department, status, and source or target location
- View audit trail for putaway requests of an inbound shipment
The criteria used include department and shipment number. The details page at the request level displays the complete audit trail

The Sterling Warehouse Management System also allows the cancellation of an entire move request or the removal of a part of a move request.

Retrieval

The Sterling Warehouse Management System categorizes a retrieval request as a move request to a particular location without necessarily specifying the source. In situations where the source location is not specified, the Sterling Warehouse Management System utilizes its retrieval algorithms to determine the optimal source locations.

A request can be specified at an item level with no attributes, even though inventory is tracked at a more granular level.

Some examples for automated requests include:

- Retrieval for Value-Added Services—The VAS department requests the inventory department to move stock to a VAS-station. For example, a work order initiates a retrieval request for move of inventory to VAS department.
- Retrieval for Replenishment—The picking department requests retrieval of items needed for a picking wave to their respective locations specifying the location and item to be retrieved. For example, a wave released initiates a retrieval request for inventory from bulk locations to pick locations.
- Retrieval for Shipment—The release of a shipment without using wave planning creates retrieval tasks that are directed to the appropriate packing zones. For example, customer pick-up scenario or for urgent orders.

Some examples for manual move requests include:

- Retrieval for Quality Inspection—The inspection department requests the inventory department to retrieve stock for a specific receipt and inventory status for inspection. For example, a defective inventory found results in a retrieval request for either remaining inventory in the location or for the receipt number of the inventory.
- Retrieval for Manufacturing—The manufacturing department requests for raw material depending on the consumption of raw material on the manufacturing lines.
- Retrieval for Manual Move Request and Execution—Ad hoc request to move additional inventory from one location to another. This is mainly to allocate space for new receipts received in a warehouse. For example, relocation of the last remaining pallet from a multi-deep pallet location to a single pallet deep location.

Retrieval Algorithm

The Sterling Warehouse Management System retrieval algorithm utilizes criteria that include SKU classification, UOM and zones, and sequencing strategies. The algorithm retrieves products from eligible locations in a warehouse and employs either the 'pick to clean' or 'least pick' methods. The following figure illustrates the retrieval algorithm.

- ◆ Warehouse Locations
 - All locations in the warehouse

- ◆ Filter locations by item classification and UOM
 - Locations in particular zones

- ◆ Sequencing locations
 - Pick to Clean
 - Least Pick

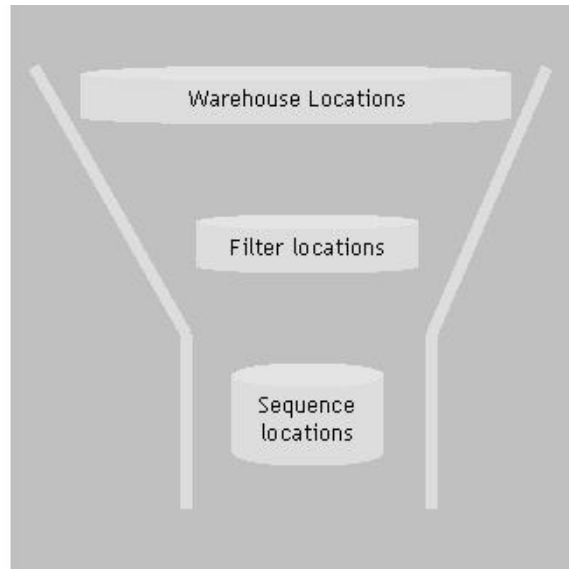


Figure 19. Retrieval Algorithm

The business process configuration and algorithm answers the following questions:

- What location do I retrieve to?
Retrieve to location corresponding to department that places request automatically or manually through move request. For example, VAS requesting for component inventory.
- What locations do I retrieve from?
Retrieval strategy values to determine the optimal zones to search for based on item classification and UOM.
- Which method do I use to retrieve from these locations?
'Pick to clean' method indicates that the system optimizes on a location becoming empty after quantity is retrieved, while also considering the least amount of locations to pick from.
'Least Pick' method indicates the system optimizes on the least number of locations that satisfy the retrieval quantity.

Retrieval Execution

The Sterling Warehouse Management System generates appropriate tasks for each retrieval request. The Sterling Warehouse Management System Task Management is used to complete these tasks using printed move tickets, RF Mobile Terminal, or by integrating with Material Handling Equipment (MHE).

Execution of these tasks uses strategies that include:

- One request at a time—a user completes the request in one trip or multiple trips.
- Multiple requests at a time—a user completes tasks across requests in a single trip for more efficiency purposes. (This is very similar to a batch pick scenario.)

The Sterling Warehouse Management System can be used to control retrieval task suggestion by placing constraints based on a user or based on attributes such as shipment number or work order number. These are further described in Task Management.

Retrieval Visibility

The Sterling Warehouse Management System provides complete visibility to the status of retrieval requests. The visibility is at a granular level indicating retrieval request and attributes used to initiate the request.

The visibility to retrieval requests is provided through console. The Sterling Warehouse Management System also provides an audit trail views for the move request. The combination of attributes are illustrated through the following use cases or examples:

- View open retrieval requests for a work order
The criteria used include department, status, work order number
- View retrieval requests by outbound shipment number on a wave
The criteria used include department, shipment and wave number
- View open retrieval requests for pallets or cases
The criteria used include unit of measure and status
- View open retrieval requests created by the user that was expected to finish in next 30 minutes
The criteria used include department, status, and finish no later than

The Sterling Warehouse Management System also allows the cancellation of an entire move request or the removal of a part of a move request.

Replenishment

In a warehouse as product is removed from a location, the inventory in that location requires re-stocking. This process is called as 'replenishment.'

A warehouse consists of zones that are classified for multiple UOMs. For example, a zone that holds units with UOM as EACH or a zone that holds cases with UOM as CASE or a zone that holds pallets with UOM as pallet. The replenishment strategy would involve a multi-step strategy covering moves from pallet storage to case storage or loose storage and from case storage to loose storage. This is called "multi-step replenishments" as shown in the following figure. In a scenario, where offsite storage is used, the first step of replenishment is to the pallet storage, thereby increasing one more step in the process.

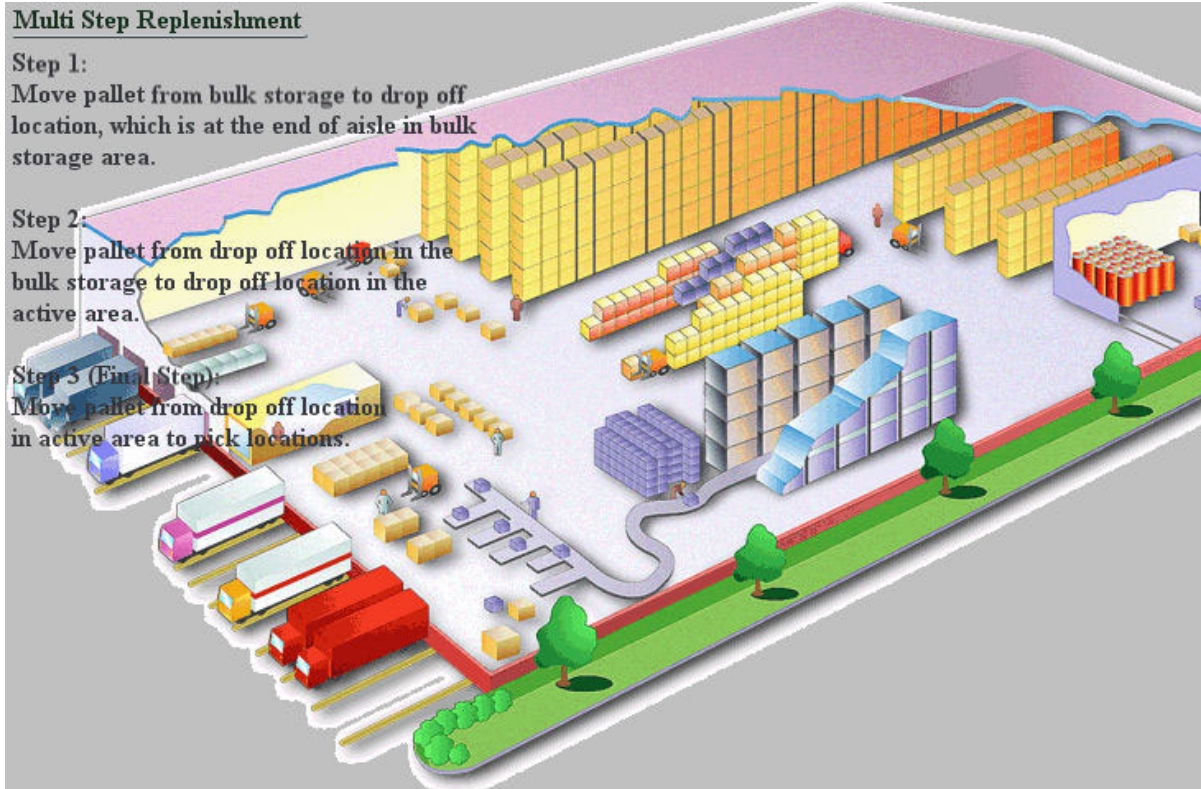


Figure 20. Multi-step Replenishments

The Sterling Warehouse Management System supports replenishments that are based on demand or inventory levels. The Sterling Warehouse Management System also allows placing ad-hoc requests for replenishment of locations.

In outbound planning, a replenishment request is created due to demand and the demand causing the inventory of a SKU at a location to fall below its 'minimum' level. Demand is created from work orders in VAS, shipments and wave. Demand is also created by a manual move request.

Inventory Level-Based Replenishment

Inventory level based replenishments are created based on inventory 'minimum' and 'maximum' levels defined at a location for a SKU and UOM. In a 3PL environment these levels may be specified at the company (enterprise) level.

Inventory levels are periodically checked through inventory monitor. The strategies used for inventory level based replenishment include Minimum/Maximum level triggers and top-off.

Inventory monitor raises an event when the net inventory at a location falls below the minimum level, or when there is no inventory. A request is placed for retrieval based on the event to replenish the location.

In addition, if the request is for a top-off, all locations that are below the 'maximum' level for the criteria specified are considered for replenishment.

In both the strategies location is replenished to the 'maximum level'.
(Replenishment Quantity = Max Capacity - Net Inventory).

Typically, top-off replenishments are chosen as end-of-day shifts or during 'graveyard' shifts.

Count

Accuracy of inventory level is critical to a supply chain. Inventory levels are the key to having better customer satisfaction, demand planning and lower labor costs. It is possible to reduce the human error factor while receiving and putaway of inventory to a location in a warehouse, by introducing packaging restrictions that include labeling, consistent marking and bar coding. Also, each move request in the system requiring location and the package being scanned reduces human error further.

However, it is common that a customer or consumer may order in quantities that is different from the package unit of measure. For example, shoes are usually packed in case packs. But, a consumer may order a single pair, which introduces the requirement to break open the package and introduce some human handling of product.

There are two types of count namely, physical count and cycle count.

Physical count is a process that is usually performed for a large area such as zone, or a warehouse. In physical count, users perform an inventory count typically stopping down the warehouse. After this count, activities pertaining to this warehouse can be resumed, for example, putaway, replenishment, retrieval, and so on, which the user would have stopped before starting the physical count.

Cycle count is a process that is performed periodically, usually for a small area such as location range. In cycle count, a user performs an inventory count with processes such as, putaway, replenishment, retrieval, and so on, running simultaneously.

A count system allows you to carry out counts in a planned or ad hoc manner. A common type of count employed is year-end inventories. While this is exhaustive, it is also time consuming, and does not ensure accuracy throughout the year. The other method is to only count items based on velocity or price every quarter. However, the best method is to ensure count performed periodically in the system. The count tasks may be either generated for a cycle count program, requested by the inventory control department ad hoc, or be initiated through system events that occur at a location level.

The Sterling Warehouse Management System allows count requests to be initiated through console on an ad hoc basis. Count requests can be generated automatically for a cycle count program that is employed at a node, or a set of nodes for an enterprise. System events like exception being recorded during an activity performed like putaway, retrieval or pick, or a location quantity dropping below minimum levels or at zero can also be used to initiate a count request.

Some examples of different count requests include requests to count:

- A location
- An item, product class, and UOM combination
- All received products based on purchase order or shipment using the receipt number
- An entire zone
- A case or pallet

- A product line or any other item classification
- A region level
- A node level or across nodes
- The location level, aisle, or bay level within a zone
- A range of locations

The Sterling Warehouse Management System allows priority to be placed on a count request and allows to place date and time based conditions for start and/or finish times. For example, user may request a count for a zone that has slow moving items and requests for count to start the next day assigning a low priority. The start and end time allows for planning and tracking.

The Sterling Warehouse Management System provides inventory monitors that raise events based on the location level activity for either minimum levels or a location that is at zero quantity.

The Sterling Warehouse Management System also requests users for confirmation whenever it detects that a location is empty after picking. If the user specifies that the location is not empty, an event is triggered that creates a count request. This ensures that a variance is detected at the earliest, even before the next cycle count is due. The confirmation is done during retrieval, replenishment, and picking. The user is not inconvenienced in any way; they can carry on with their allotted tasks after confirmation.

Tasks for a count request could be at a location, item, category of items, or container level, or in any combination of those based the on level at which the request was placed.

Count Execution

The Sterling Warehouse Management System enables the counting of inventory using any of the following methods:

- Count inventory using paper—this methodology shows the user the current inventory in a location, which can be altered while recording count.
- Count inventory real-time using RF mobile terminal—initially, this methodology is used for counting a blind count, which does not show the user the current system quantity. This methodology is the most accurate and exhaustive method to ensure that all users perform count accurately. This also allows for real-time inventory updates and the ability to interleave count tasks during the process of a regular workday.

In some warehouses, inventory is tracked at a tag number or serial number level. The count at these granular levels is cumbersome and requires opening of packages. In such situations, the Sterling Warehouse Management System allows for counting without specifying these granular attributes. However, variance resolution of these tasks has to be done at the granular level.

The following example explains count execution process:

For locations that are double deep or even quadruple deep in a case or pallet with LPN scenario, it is not physically possible to scan each license plate. In such a case, the Sterling Warehouse Management System allows count to be recorded at the SKU level without scanning individual case or pallet with LPN.

Variance

A variance can be classified as either resolvable or unresolvable based on the granular level of inventory information provided by a user when counting. When the user provides all the inventory details, such as physical count, tag number, serial number, expiry date, and so on, the system knows the exact current inventory availability in the system. As a result, the variance can be resolved by the system itself. If no granular information is available, the system is unable to identify the new items and the missing items. For example, in a warehouse where the inventory is serially tracked, resolvable and unresolvable variances can be explained in the following manner:

- If a count is performed and the number of items present in the system is equal, a variance does not occur.
- However, if a count is performed, and the count value is five, but the system shows it as four, the extra item will be marked as unresolvable because the serial information about the extra item is not available. Because of this, in the next level of counting, the user should scan the items to find the missing item, and after finding it, should mark the item as resolvable.

The count business process configuration allows for either another count task or a variance task to be generated. This is possible only if the quantity entered does not match the system quantity. Generation of another count task verifies the count completed by the first user. During this count system quantity is displayed.

The Sterling Warehouse Management System allows the following as a result of a count that has variance:

- Generate re-count task at a later time
- Accept count and generate variance task for resolution
- Accept count and adjust level of inventory only if acceptance criteria are met.

The Sterling Warehouse Management System provides acceptance criteria for variance at an item classification and value level. For example, a variance with value greater than 1000 USD for an item classified as high-value item is not accepted. But, a variance of less than 100 USD for low-value items are accepted automatically.

The Sterling Warehouse Management System can be configured such that all variances require manual acceptance. For example, 3PL where inventory ownership is at a customer level, variance acceptance is completed through a console.

A new count request can be made, if variances viewed are not acceptable.

Count Visibility

The Sterling Warehouse Management System provides complete visibility to both count request status as well as count results at the appropriate granular level. It also provides an ability to modify the count results after completion of the count task. However, you cannot modify the count result after performing the count verification.

Count Request Visibility

The count request visibility is provided through console. Count requests are searched for their status utilizing criteria. These combinations of attributes are better illustrated through use cases or examples, which include:

- View count request status made by a client user scheduled to end today
Criteria used includes Enterprise, Requesting user, Finish no later than
- View all open high priority tasks for across all clients
Criteria used include Priority and status range
- View all open tasks due to complete in the next two hours
Criteria used include Enterprise, finish no later than and status range
- View all open count requests for an Item, UOM
Criteria used includes Enterprise, Item ID, UOM and Status Range
- View status of all recounts issued for a receipt
Criteria used includes Enterprise, Receipt Number and Status Range
- View all requests made for a zone
Criteria used includes enterprise, zone and maximum records
- View all requests made for a region
Criteria used is enterprises across nodes

Count Result Visibility

The count results visibility is provided through a console. Count results are searched for their status utilizing criteria. These combinations of attributes are better illustrated through use cases or examples, which include:

- View latest count results for a particular enterprise
Criteria used includes ship node, enterprise, item ID, variance value as 'Any' and latest summary task flag selected
- View all variances at the node that have exceeded a specified currency value
Criteria used include enterprise and variance value with 'greater than'
- View all positive variances for a particular item, UOM
Criteria used include enterprise, item, UOM and check 'Positive' variance value
- View all variances for a particular enterprise

Criteria used include enterprise and check 'Any' variance value

Chapter 4. Inbound Planning

Inbound Planning

Many companies track their inbound planning and procurement costs in an attempt to reduce the cost of goods sold. The opportunity to reduce costs are enhanced by better visibility to both inventory holding and goods in transit, optimized transportation and lower labor costs.

A warehouse has visibility to inbound inventory upon creation of purchase order or transfer order. A merchandising or purchasing system owns the purchase order. A transfer order is initiated as an inter-warehouse transfer or a transfer after manufacturing process is complete.

The interaction between various participants in the supply chain may be achieved through collaboration or by manual methods. IBM Sterling Supply Collaboration achieves this by tracking the purchase order from the individual participant to the destination.

The Sterling Warehouse Management System provides Web-based, real-time visibility of the incoming inventory to a warehouse. This is achieved by downloading the inbound order from the appropriate host, either external merchandising or purchasing systems or from IBM Sterling Supply Collaboration.

Shipment and Dock Scheduling

The Sterling Warehouse Management System maintains and tracks shipment (ASN - Advanced Ship Notice) details from various sources. This provides a warehouse visibility to the Expected Time of Arrival (ETA). The Sterling Warehouse Management System has the ability to track shipment at all points in the supply chain. This enhanced visibility to shipment in the Sterling Warehouse Management System is used to prepare dock doors for receiving.

A shipment or inbound order contains item information and the expected quantity. There are situations when a shipment or inbound order contains additional details, such as case or pallet with LPN, lot numbers and serial numbers.

A carton can have SKU labels or a case with LPN label associated. These labels are generated at the origin warehouse or through the web through collaboration software. The pre-printed labels are industry practices employed to standardize inventory. It improves inventory accuracy and reduces labor costs. However, the Sterling Warehouse Management System allows for the manual creation of shipment when the information is not available electronically.

Once a shipment has been marked as shipped but before it has left the warehouse, a shipment can be unshipped and placed back into the status it was previously in before the shipment was marked as shipped.

The Dock Scheduling functionality of the Sterling Warehouse Management System enables you to manage all dock locations in a warehouse for receiving inbound shipments and shipping outbound shipments. The dock scheduling rules enables the user to specify number of days in advance to take a dock appointment.

The Sterling Warehouse Management System enables you to associate a dock schedule with a shipment or load. If scheduling is done for a shipment, the Sterling Warehouse Management System provides complete visibility into the shipment volume, weight, number of cartons available, and pallet information. Based on the Productivity Metrics (SAM definition), the duration of the appointment is also suggested.

Dock scheduling is based on the warehouse calendar associated with a dock and considers all working days and holidays, and shifts that are valid for receiving or shipping operations. Each dock can have its own calendar and shifts specified when they are available. You may also exclude certain docks from the scheduling process. For example, a warehouse may allocate one dock for UPS fluid loading, which may require one full day. In this case, dock appointment is not required for UPS fluid loading.

Each appointment is assigned a unique reference number. The time slot assigned for each appointment may vary based on the shipment size. For example, the duration for one appointment could be for 30 minutes and another appointment could vary between 45 minutes to 1 hour. Appointments can be changed to a future date in case the delivery fails. The Sterling Warehouse Management System creates alerts for such missed deliveries or pickups to ensure that new appointments are created. The Sterling Warehouse Management System also enables the cancellation of appointments that are already taken.

Due to additional resource constraints, a warehouse may not want to take more than a certain number of appointments at a given time. For example, if 20 docks are available for taking appointments, a warehouse may not want to schedule all 20 docks from 10:00 AM to 11:00 AM, as it may not be possible for a warehouse to unload all 20 trucks at the same time.

Appointments can be taken only for the number of days specified in advance.

Shipment and Inbound Order Visibility

The Sterling Warehouse Management System provides visibility to shipment and purchase orders expected into a warehouse. Visibility is provided at a shipment number level, purchase order number level inclusive of the status. The Sterling Warehouse Management System business process configuration allows to track all incoming shipments at each step in the supply chain. The combination of attributes is detailed through the following use cases or examples:

- View all shipments that are in-transit after clearing local customs
Criteria used includes status
- View all purchase orders for a particular item expected shortly
Criteria used include document type, item and status
- View all transfer orders that have been shipped from the regional warehouse
Criteria used includes document type, status range and origin node
- View status of a particular shipment
Criteria used include shipment number or a combination of tracking attributes such as Pro number, BOL number or trailer number
- View status of all purchase orders from a vendor
- Criteria used include document type and the seller

Chapter 5. Inbound Execution

Inbound Execution

Inbound execution is the completion of inbound planning process, which is receipt and putaway of inventory. Inbound execution is one of the most critical factors that directly influence the throughput of a warehouse. The impact of where and how inventory is stored in a warehouse directly influences the time taken to putaway, replenish and pick inventory. There is a significant amount of time that is spent in warehouse layout and configuration based on the type of inventory received, how the inventory is received, and the equipment used to receive and putaway inventory.

The receiving process in a warehouse involves acceptance of goods from the carrier and then the physical process of checking and receipt of inventory. The process of acceptance is to verify number of packages (cases or pallets) against the bill of lading or packing slip that the carrier provides. If an ASN is available for the shipment received, a preprinted sheet is used to verify the contents. The process used to receive inventory into a warehouse is completed through Radio Frequency (RF) Mobile Terminal, console or MHE like a receiving sorter.

For some inventory that is received in a warehouse the pre-packaging steps has to be performed before putaway. For example, in the parts industry, screws are received in large boxes or bags and are packaged into appropriate inventory UOM packs before putaway. These pre-packaging activities requires a different location to be allocated in a warehouse. The ability to automate these procedures based on the SKU being received significantly reduces labor requirement.

The Sterling Warehouse Management System provides comprehensive functionality to effectively manage inventory execution process. It also provides complete visibility to specific shipment available in the supply chain. The Sterling Warehouse Management System also enhances this visibility by tracking the acceptance of inventory from a carrier. This feature of the Sterling Warehouse Management System enables warehouses to pre-receive product based on the number of packages (cases or pallets) received and routes these packages to the appropriate business area. The Sterling Warehouse Management System business process configuration allows modeling of the physical process in a warehouse.

The Sterling Warehouse Management System also permits diversion of inventory received into the appropriate area based on quality profiles, cross-dock requirements or putaway preferences. It also allows to model a warehouse individually or distinctly from the other warehouses based on its layout and MHE deployments.

The information captured during the receiving process is visible through consoles for audit as well as tracking purposes. The ability to track individual activities in a warehouse allow for productivity tracking and reporting.

Pre-Receipt

The Sterling Warehouse Management System pre-receipt process enables a shipment to be marked as received at the package level. This process is followed in warehouses that have large receiving yard or area where shipments are offloaded before the receiving department starts the shipment work.

The Sterling Warehouse Management System allows recording of shipment level attributes during pre-receiving process that include trailer details and driver details. In addition, the actual date and time of pre-receipt is recorded to track carrier performance.

Receiving Preferences

The Sterling Warehouse Management System allows to control receipt process with the information that is available in a warehouse. It also supports the least automated warehouse through paper-based process and all warehouses up to the most automated, involving MHE for receipts. These warehouses however disparate, are modeled individually in the Sterling Warehouse Management System network.

A warehouse can identify its own receiving preferences to characterize the flow of inventory from the receiving dock to other departments and zones of a warehouse.

A receipt in the Sterling Warehouse Management System is made for a purchase order level or shipment level. The Sterling Warehouse Management System holds a case or pallet with LPN details at a shipment level, if available. It also supports blind receipts. Blind receipts are inventory that arrives in a warehouse without any information. A warehouse may use any or all of these methods to receive its inventory. The Sterling Warehouse Management System places constraints for each of these methods.

Quality profiles and SKU attributes influence the diversion of inventory to various areas of a warehouse. In addition, if there is a demand for a certain product or quantity, the Sterling Warehouse Management System creates cross-dock diversions during receipt. In addition, if there is a demand for a certain product or quantity, the Sterling Warehouse Management System creates move requests for diversion to the appropriate department during receipt. The diversions are displayed at the time of receipt of the container or SKU to place inventory received into appropriate pallets for putaway.

The Sterling Warehouse Management System supports planning for QC or cross-dock diversions for an item. These planned diversions could be for a specific inbound order or shipment, or across inbound orders or shipments.

The Sterling Warehouse Management System provides inventory receipt in a warehouse at most granular level. It also supports inventory receiving at an SKU and UOM level, case or pallet with LPN level. The Sterling Warehouse Management System has the ability to create new case or pallet with LPN, if necessary.

The receipt completion creates inventory at both location and warehouse levels. The Sterling Warehouse Management System uniquely identifies inventory by the attributes captured during the receiving process. For more information about

inventory attributes, see the topic, *Inventory Control and Tracking*. The Sterling Warehouse Management System provides visibility and tracking through consoles for receipt and inventory audits.

Receiving Exceptions

The Sterling Warehouse Management System tracks inventory receipt at a purchase order level or shipment level, and also maintains case or pallet with LPN level details.

The exception types that occur in a warehouse include receipt after the expected date, receipt of items that do not exist in the shipment, overages, shortages or damaged inventory. The Sterling Warehouse Management System tracks visibility of quantity received against a shipment that allows for overages or shortages to be tracked. This allows to track performance against a vendor.

The Sterling Warehouse Management System also records receipts against shipments and enables to correct manual receipt data entry errors. These modifications are reflected against a shipment or a purchase order.

Receipt Putaway

The receipt of a product initiates requests for diversion of product for putaway. Receiving preferences controls the timing of when a putaway request is generated. The request is generated when a receipt is complete or when the complete shipment has been received.

During putaway, the Sterling Warehouse Management System considers the preferences that are set up at an item and location level. This is completed on Mobile Terminal, or batch sheets, or integrated with MHE. The Sterling Warehouse Management System RF Mobile Terminal task management controls task execution.

A warehouse configuration may require inventory availability to be tied to when putaway is complete. The Sterling Warehouse Management System achieves this by using inventory status at the zone level as inventory availability is tied to inventory status. The task management of the Sterling Warehouse Management System utilizes this to move inventory to the appropriate inventory status.

Close Receipt

The closure of a receipt indicates completion of receipt against the ASN or shipment, and uploading of information to the host systems. The Sterling Warehouse Management System enables both manual and automatic closure of receipt. Manual closure of a receipt is initiated through a console. Automatic closure is based on business process configuration that checks for conditions, such as full receipt of quantity, excess quantity has been received, or putaway completion. The Sterling Warehouse Management System initiates closure of a receipt typically as an end of day process based on the warehouse requirements.

Receipt Visibility

The Sterling Warehouse Management System provides visibility to all receipts at most granular level. The visibility is provided at a level at which inventory has been received into a warehouse.

The visibility is provided through a console at shipment, receipt or purchase order level. Visibility into the audit trail is provided through inventory audit console. The following use cases or examples explain the combination of attributes in the Sterling Warehouse Management System:

- View all inventory for a specific shipment or purchase order number
Criteria used include Enterprise, Reference number as inbound shipment number or PO number
- View all receipts that are in progress at a warehouse
Criteria used include enterprise, ship node and status
- View particular shipment or purchase order serial number
Criteria used include enterprise, serial number

Chapter 6. Quality Control

Quality Control

In the supply chain today, products are being sourced from external vendors. These vendors vary from the highly sophisticated to the highly skilled but with low access to technology. A few manufacturers have chosen to send their representatives to each facility to oversee the quality and accuracy of the operation. Others have chosen to instill a high degree of checks when the product is received into their own facilities. Retailers also perform inspection to ensure accuracy and quality of the product they receive from the manufacturers.

The Sterling Warehouse Management System Quality Control (QC) helps address the quality control procedures that may be achieved at the receiving warehouse. The Sterling Warehouse Management System also ensures quality and accuracy of the product shipped out.

Quality Profiling

The Sterling Warehouse Management System Quality Control module allows profiles to be created for a specific vendor or item level. It also allows profiles at a vendor or item classification level. For example, all items that are high-value or vendors who are classified as yellow (to indicate vendors who have failed QC before). These pre-created profiles in any combination of the mentioned criteria eliminate manual intervention for normal operations.

Inventory upon receipt is marked for diversion using profiles that are created. The Sterling Warehouse Management System directs putaway of product to QC automatically based on the QC profile.

Quality Inspection

The Sterling Warehouse Management System provides the ability for a warehouse to inspect products in inventory.

The Sterling Warehouse Management System enables a warehouse to apply a disposition to the product. This results in inventory being classified into a specific inventory status, such as Awaiting Inspection, QC Hold, Good Inventory, Scrap. Inventory status may be applied to either at a location level or for a complete item in a warehouse. Further, inventory status may be restricted to a specific lot and even a specific serial number. Warehouse may define different reason codes and specify reason code and additional inspection comments while changing the inventory status.

Inventory status as described in inventory control has a direct relationship to the availability of the product. Any inventory status is categorized as 'not available' or 'available'.

A quality problem if spotted during inspection process or regular pick and pack process or during count may require additional inventory to be retrieved from storage. The Sterling Warehouse Management System allows for a retrieval request to be placed at the location, item level, or at the receipt number, lot number levels.

For example, safety recalls. Upon completion of ad hoc retrieval tasks, a putaway request can be placed for the putaway of SKUs in the QC location.

Inventory Visibility

The Sterling Warehouse Management System allows inventory tracking at its most granular levels, which include SKU, location and inventory status. The combinations of these attributes are better illustrated through the following use cases and examples:

- View all inventory that have been placed on quality hold due to vendor packing errors
Criteria used in location inventory console include enterprise, ship node and inventory status
- View all scrapped inventory in a warehouse
Criteria used in location inventory console include enterprise, node, inventory status
- View all inventory that was put on hold for a receipt number
Criteria used in location inventory audit console include enterprise, ship node, receipt number and inventory status.

Chapter 7. Task Management

Task Management

Task management enables you to manage all warehouse processes in order to optimize node throughput and maximizing worker efficiency.

Sterling Selling and Fulfillment Foundation enables you to define the type of task, schedule tasks, assign people to complete those tasks, and raise exceptions when they occur to alert appropriate personnel.

A task in the warehouse requires definition as to the type of resources (for example, worker or equipment) authorized to perform the task.

The application generates tasks to be performed within the warehouse based on certain events. For example, receiving triggers a putaway task, wave release generates picking tasks and inventory in a location reaching below defined minimum triggers replenishment tasks.

The application enables you to place resource constraints on a task in order to control when and who carries out the task. The dynamic assignment of tasks enables supervisors to reprioritize orders, resulting in automatic reprioritization of a worker's tasks. A process in a warehouse also has equipment constraints. For example, put away to a high-bay location requires the use of a man-up truck or a pallet-up truck operated only by authorized users.

A task is completed through a paper-based operation, a Radio Frequency (RF) mobile device, or material handling equipment. This enables task management to improve throughput of the least automated warehouse through paper-based operations to the most automated warehouse through RF mobile device and integration with material handling equipment. In the case of a paper-based operation, a batch is printed on request rather than printing up ahead. This enables reprioritization of orders, cancellation and modification of orders to be reflected immediately.

The application provides real-time visibility to task status. Task aggregation is also provided for each process and its unique parameters. For example, task visibility at a wave or shipment level.

Task Type

Each activity in the warehouse has unique characteristics and requires specific operating procedures. For example, picking requires moving inventory from one place to another while counting does not require moving inventory. Each type of activity is assigned a task type. Typical task types include the following:

- Counting
- Batch picking
- Order picking
- Retrieving cases for replenishment
- Retrieving pallets to the VAS department
- Packing all picked items into a pallet or carton

- Preparing carts with empty shipping cartons for picking
- Putting away pallets from the receiving dock

The application enables you to control task generation and execution at a task type level. The controls include the following:

- Should the task be batched?
- Does the task go through a drop-off location?
- Which pick strategy is to be used?
- Will the task assignment be controlled by the system or will a worker request the task?

Task Dependencies

Task Management enables you to manage warehouse operations such as picking, packing, and receiving. These operations are accomplished by completing a series of tasks. A *task* is a unit of work that accomplishes a goal. For example, completing an inbound putaway task accomplishes the goal of moving product from the receiving dock to a storage location. Tasks are composed of one or more consecutive steps.

A *step* is the most granular unit of work as defined in Sterling Selling and Fulfillment Foundation. For example, in order to move product from a receiving dock to a bulk storage location, an inbound putaway task can be composed of a two-step process: First, a pallet jack operator moves the product from a receiving dock to a staging location. Next, a fork lift operator moves the product to the bulk storage location.

Task Management enables you to create dependencies between groups of tasks, so that one group of tasks can be carried out only *after* completion of another group of tasks. For example, a warehouse may want to complete *all* of the picking tasks associated with a 10:00 a.m. shipment before beginning the picking tasks associated with a 4:00 p.m. shipment.

Task Assignment

Each type of process in a warehouse typically requires workers who possess a specific set of characteristics that correspond with the task to be performed. For example, computer kit assembly requires workers that understand how the electronic components are assembled; and picking expensive inventory, such as jewelry, requires security clearances. Each worker is assigned to complete tasks that match their own set of skills or authorization.

Skill Sets

Each worker may have skills that correspond with multiple task types. In addition, each worker's tasks are prioritized. For example, one worker must complete all putaway tasks before proceeding to replenishment, while another worker must complete replenishment tasks before proceeding to counts.

Zones and Locations

You can define within which specific zones a worker is authorized to perform tasks.

These constraints control what tasks are displayed to a user and in what sequence. A user on a RF mobile device is expected to login to a console that automatically directs them to perform a specific task. The following figure illustrates the task assignment process.

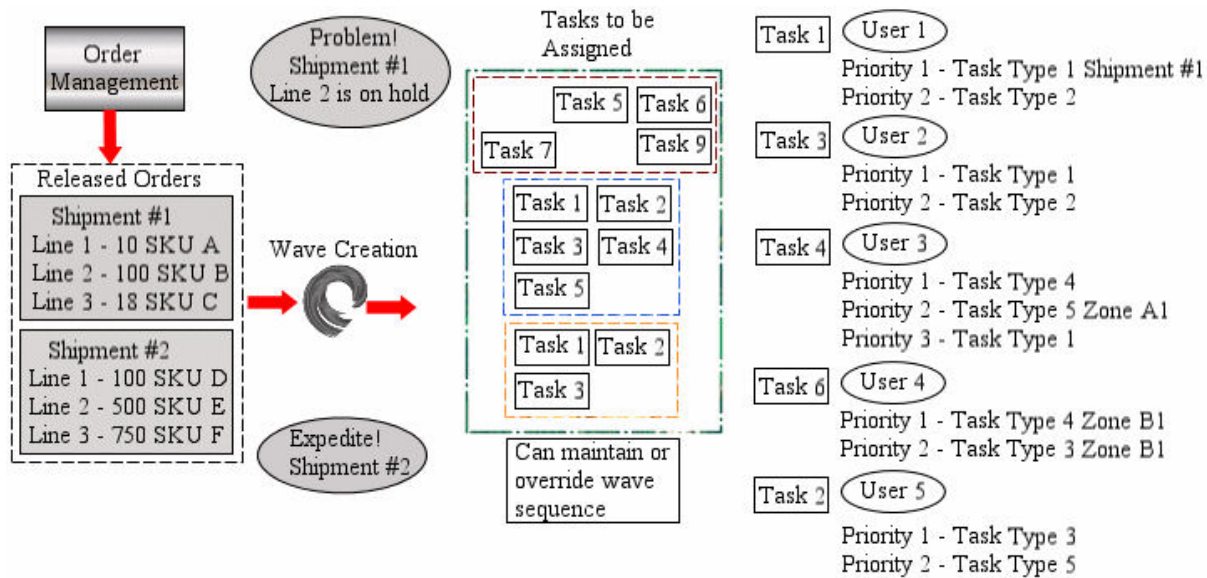


Figure 21. Task Assignment

You can define the maximum number of workers who can be assigned to perform specific types of task. For example, if a warehouse chooses order pick, only one worker carries out the given order. Or for trailer loading, a warehouse allows a maximum of three people to load a trailer.

The application automatically suggests the best possible match of task to worker, based on where the user is working and the type of equipment that the user has. The application optimizes task suggestion based on best sequence in which to traverse the location. Additionally, time constraints placed on a task are also adhered to.

The application has the ability to assign specific tasks and equipment to specific operators in a warehouse depending on their skill sets. For instance, the warehouse supervisor may assign putaway, picking, replenishment, and packing tasks to an operator. The forklift or grab truck may be assigned to perform the tasks. Another operator may be assigned to perform the final step of replenishment using only grab truck.

The application controls when a task is available for assignment. This availability is computed from associated date and time constraints for start of the task. For example, a putaway request from the quality control department is scheduled to start only during off-peak time. The task is suggested to all eligible users after the date and time specified. The expected finish time for a task can also be specified. For example, a move request to top-off high moving dedicated locations in the warehouse is expected to be completed during the lunch break while picking team is on the lunch break, then the application suggests tasks that are closer to their finish time.

You can define the number of users allowed to work simultaneously in an aisle or aisle-section. The application can suggest tasks from an aisle/location only if the number of users does not violate the maximum users allowed.

You can also permit only one user to work in a location at a time. The application cannot suggest tasks from a location, if another user is working in the same location.

Also, while depositing, the application can consider above settings and prefer a least congested aisle to suggest deposit tasks.

Task Execution

Regardless of the use of technology employed in your warehouse, a task can be completed by using any of the following techniques:

- Batch sheets
- Handheld RF mobile devices
- Material handling equipments

As tasks are completed, their status is tracked and may be audited. Task statuses including the following:

- Open
- Suggested
- In Progress
- Held
- Complete
- Cancelled

When assigning tasks to the users, the application suggests tasks to the users based on the skills set and constraints assigned to the users. For example, after a user picks up the first task of a truck load shipment, he is restricted to executing all tasks for that particular shipment before continuing to the next shipment in the truck load.

The Sterling Warehouse Management System also allows the user to choose the type of task to perform using the Mobile Application. When performing tasks, the Sterling Warehouse Management System allows the user to:

- Select the specific type of task to perform or the system suggests the next task to be performed by the user.
- Pick less than the task quantity when inventory is not available at the location for the task performed.
- Deposit quantity less than the system suggested quantity when the space in the location cannot be utilized for the task performed.

After the user completes all the tasks, the system suggests the next task to the user, when available. During task execution, the system audits exceptions and overrides, if any.

Task execution is better explained utilizing a process as a reference. Therefore, further constraints are better explained under each department. For example, putaway execution is detailed under inventory control section and receiving is detailed under the inbound execution section.

Task Management Visibility

The application provides granular visibility to the task. Tasks are viewed by task type and status. The following examples or use cases explain the combinations of attributes:

- View all pick tasks due to start in the next hour
Criteria used includes warehouse, task type, start task after date and time
- View all pick tasks associated with a particular SKU
Criteria used includes warehouse, task type, item and status
- View all pick tasks that are on hold
Criteria used includes warehouse, task type, reason code and status
- View all replenishment tasks associated with a wave
Criteria used includes warehouse, task type and wave number
- View all replenishment tasks associated with a location or zone
Criteria used includes warehouse, task type, target location, target zone and status

Batching

A batch represents a list of tasks that can be performed together. Only specific task types can be combined into a batch and each batch consists of only one type of task. The type of task is determined based on the pick strategy.

If a container and shipment has multiple types of pick tasks, the container and shipment is split into multiple batches and consolidation is required for packing and shipping. Batching is used in many scenarios, including the following:

- Outbound Shipments (with or without containers)
- Replenishments
- Work Order Pick
- Put away (Inbound, Work Order, Replenishment final step)

Batch Size

Batch size depends on the type of task. Batch size can be defined by various parameters such as the following:

- Maximum number of transactions (task reference such as wave number, containers, shipments or work orders)
- Maximum volume
- Maximum number of tasks

Batch size is also determined by the following factors:

- The capacity of the picking equipment used, since different types of tasks may require different sizes of carts
- The potential volume and dimensions of the shipping carton, when containerization is being performed
- The real volume and dimensions of the items, when being packaged into a shipment

The application assumes that picking carts are available for any number of batches created but does not consider the inventory availability of picking carts.

When a batch is created, it is not automatically assigned a specific cart number; however, during the picking process, a specific cart can be associated with that batch.

Equipment used for batching must have at least one location. Each cart can have multiple locations. When cart locations are defined, in addition to the maximum limits specified for the batch, the size of the batch is also restricted based on the cart location definition.

Batch Creation

Batches can be created manually or triggered automatically, and the algorithm for batch triggering is extensible.

Manual Batch Creation

During the manual creation of a batch, a user can scan a set of containers and shipments and request the application to create a batch based on those items. Or in a pick and pass environment, each picker in a zone may create a batch for efficient picking of multiple containers and shipments in a zone. Lists of containers and shipments for a batch can change from one zone to another.

Automatic Batch Creation

Automatic batch creation can be triggered by any of the following means:

- Created and printed online—when the user is waiting for the batch to print before executing the next receipt. For example, if receipts are recorded on a pallet, when a user closes pallet, all put away tasks for the pallet need to be batched together and printed immediately.
- Event triggered—such as Wave Release and ASN Closure.
- Time triggered—when batching is time triggered, batching may be triggered to run for a specific type of task. The maximum number of batches to be created can also be specified.
- Users may request creation of next batch for a specific task type. On request, the application creates one batch and print batch created. In this scenario, creation of batch is postponed until the last minute to gain maximum picking efficiency.

Cost Based Optimization

The Sterling Warehouse Management System optimizes the batch created by associating costs with criteria, which includes locations, aisles, zones and locations. The cost is determined by using the Standard Allowed Minutes (SAM) against the task type. The list of tasks to create a batch are run through multiple iterations in the cost based optimizer. At each iteration the previous iteration's result is further optimized. During each iteration the cost is compared and the least cost option chosen as the best batch.

During the process of optimizing the batch constraints standard constraints including a container not being split across batches or when creating a batch for order pick a shipment is not split across batches. Equipment capacity defined is considered to determine the maximum number of units or containers that can be on a batch. Additionally, task type configuration based on the maximum number of primary references is also considered to limit the batch size. For example, during outbound pick, shipment number or container number is referenced or during work order pick, work order number is a primary reference.

Batch Picking Execution

Picking for a batch can be through any of the following methods.

- **Printing Batch Sheets**—the application can print a batch sheet during any of the following events:
 - During wave release process
 - As and when batches are created
 - Users requesting next batch to print (dispatching a batch to printer)
- Users can carry out the picking process using printed batch sheet and report picking process to the application. The printed batch sheet can be formatted according to the type of batch as follows:
 - Batch of Containers, sort while picking
 - Batch of Shipments, sort while picking
 - Batch of containers, no sorting while picking
 - Batch of Shipments, no sorting while picking

When a batch sheet is printed, in addition to batch number, the application can print check digit and code mapping. In a paper-based picking environment, the user may be required to enter this check digit or code during batch confirmation. This is to ensure that batches are confirmed on system only subsequent to printing of the batch sheets.

Batch sheet printout also includes any special instructions (for example, put away, picking, packing) based on the following criteria:

- SKU being picked
- Customer
- Order

While confirming batch sheets, all exceptions such as short picks, over picks, and damages can be recorded and corresponding event or actions can be taken to address these exceptions.

Executing Pick Using Handheld Devices

Users can initiate pick for a batch by scanning a batch sheet or the application can suggest a batch to a user for picking. Picking can be completed using handheld devices by scanning location, item bar code, a shipment, and container.

Products picked may or may not be sorted during pick.

Executing pick using integration with external material handling equipment.

Pick batches created can be sent to external systems such as pick to light or other material handling equipment. Warehouse has the visibility to whether batch is sent to material handling equipment or not. Warehouse can re-send the data to the material handling equipment, if required.

Multiple-Step Execution

Picking a batch can include multiple steps. The application can track all steps for executing a batch. Different steps include:

1. Preparation of picking cart (placing empty containers or totes in a cart)
2. Picking of items to a cart

3. Packing containers in a cart
4. Closing containers

Productivity Management

The productivity management enables you to model warehouse activities and measure productivity of the workers performing their activities.

Activities are of different kinds. Based on the nature of each activity, different variables are captured to measure productivity. For example, the number of cases moved and number of locations visited. For each variable or dimension, a SAM (standard allowable minutes) is associated. The total minutes that may be credited for each task is a function of the variables and the SAM associated with them. A warehouse analyzes the time involved in doing each small part of an activity to define the SAM for each dimension.

The variables are a characteristic of a task type. Some task types require only a few of the variables. For example, the variable "number of locations visited" is applicable only to picking or replenishment tasks and not applicable to packing or manifesting process.

The application enables you to configure a list of variables that are applicable to a specific activity and define SAM to each variable in an activity. SAM is defined against a task type for determining the efficiency of a user. For example, a warehouse allows defined minutes to be at a location, time to pick a case and the time taken if aisles are being traversed.

The application issues time credits to users based on the actual tasks performed and SAM defined for each activity. This information enables you to perform the following worker-based activities:

- Identify labor efficiency of each user
- Compare labor efficiency between users
- Measure productivity associated with an activity and use this information to refine SAM
- Support activity based compensation
- Get daily feedback on performance relative to goals

Deriving Labor Standards

Sterling Selling and Fulfillment Foundation provides the ability to automatically derive labor standards based on the historical data of tasks or activities performed by warehouse users over a period of time. Labor standards are derived based on the following algorithm:

- For selected users, the set of tasks completed by each user in a shift, trip, or a day are grouped as samples.
- For every sample, collect the following metrics:
 - Time spent by the user to complete the task ("time").
 - Number of tasks completed by the user in the given period of time ("numTasks").
 - Distance covered by the user ("distance").
 - Number of locations visited by the user ("numLocs").
 - Weight borne by the user ("weight").

- Amount of time to credit to the user ("creditedTime").

You can collect these metrics for a user for various samples as illustrated in the following table.

Table 15. Sample-level Information for Users

Sample	time	numTasks	distance	numLocs	Weight	creditedTime
User A - Sample 1	T1	N1	D1	NL1	W1	C1
User A - Sample 2	T2	N2	D2	NL2	W2	C2
User A - Sample 3	T3	N3	D3	NL3	W3	C3

Assuming that the labor standards for a user are constant over a period of time, the user is given full credit at the start time. Therefore, credited time for the user is the same as the time taken by the user to complete the task.

- The credited time for each user sample is calculated according to the following expressions:

$$C1 = S_N \cdot N1 + S_D \cdot D1 + S_{NL} \cdot NL1 + S_W \cdot W1$$

$$C2 = S_N \cdot N2 + S_D \cdot D2 + S_{NL} \cdot NL2 + S_W \cdot W2$$

$$C3 = S_N \cdot N3 + S_D \cdot D3 + S_{NL} \cdot NL3 + S_W \cdot W3$$

where:

S_N = Allowed minutes per task

S_D = Allowed minutes per unit distance

S_{NL} = Allowed minutes per location

S_W = Allowed minutes per unit weight

C1 = Credited time for the first sample

C2 = Credited time for the second sample

C3 = Credited time for the third sample

The linear system of equations above is solved for S_N , S_D , S_{NL} , and S_W in such a way that the error $\sum (Ti - Ci)^2$ is minimum.

Ability to Set Standards for the Selected Users

Labor standards are derived by setting standards for given set of users. When deriving labor standards, you can set a user to be X % efficient based on the data collated for a user. In this case, the credited time for each sample is equal to $(X/100) \cdot T$, where 'T' is the actual time taken to complete a task.

Chapter 8. Consigned Inventory

Consigned Inventory

Consigned Inventory is a concept in which vendors own inventory for enterprises. The basic premise of consigned inventory is to delay the transfer of ownership and other transactions until the last point in Sterling Selling and Fulfillment Foundation.

This reduces the cost of carrying the inventory and the lead time.

The inventory organizations participating in consigned inventory are called consumable inventory organizations and consuming inventory organizations. A consuming inventory organization can choose a list of consumable inventory organizations to participate with.

Based on the rules configured during execution in the warehouse, the inventory get transferred from the consumable inventory organization to the consuming inventory organization.

The catalog organization can be different between inventory organizations, thus the same product can be modeled as different items in different catalogs. In such a situation, the system uses GlobalItemID (GTIN) to reference to these items.

Chapter 9. Reverse Logistics

Reverse Logistics

Reverse Logistics is the process of handling return of products from a consumer or a retailer to a manufacturer through the use of the supply chain. Reverse Logistics also encompasses recycling of packaging and containers, reconditioning or refurbishing of products and disposition of obsolete goods.

Reverse logistics is one of the least focused areas for many companies. However, the ability to recuperate assets and revenue in the supply chain is causing a refocus in this area. There is a lack of understanding of what is being returned and why. The strategies followed in reverse logistics are disparate due to the type of SKUs being handled. For example, an online consumable retailer and an electronics retailer.

The Sterling Warehouse Management System Reverse Logistics provides comprehensive capabilities to manage "end-to-end" process of reverse logistics for all types of companies including retailers, manufacturers and third party reverse logistics providers. The reverse logistics process covers all aspects like creating a return authorization, disposition of the product and the inventory returned is restocked, returned to vendor or scrapped.

The Sterling Warehouse Management System breaks up a return into individual SKUs along with their disposition. Visibility provided to the disposition in the returns department allows for aggregation and routing of inventory to the respective areas. Routing in the Sterling Warehouse Management System is a multi-step process that incorporates requirements like refurbishment and repackaging before an inventory is restocked. The additional fields inventory attributes recorded include reason code, lot number, revision numbers and serial number.

The granular visibility provided through recording of the information allows tracking of inventory from the time of receipt and through the multi-step disposition process before an item is putaway to the appropriate area. Audit trail is also provided to track activities performed at a granular level, which includes return number, item, reason codes, disposition, inventory attributes and user.

Many companies are unaware of the amount of inventory tied up in the return and repair process. High-value products and parts may sit in technicians' vans or inspection centers for weeks before they are sent for repair or returned to stock. Often these parts require no repair and could immediately be resold to another customer. The Sterling Warehouse Management System Reverse Logistics enables companies to effectively track items throughout the return and repair process and automates the procedures that return items to stock. Real-time status updates from service and repair organizations enable your company to truly leverage the reverse logistics cycle as a source of supply.

Receipt

A Return Authorization (RA) can be either created on IBM Sterling Reverse Logistics or downloaded from external host systems. There are situations when inventory is returned due to a customer refusal or without using the proper channels. The Sterling Warehouse Management System allows to create blind returns.

Pre-Receipt

The common practice is to temporarily stage packages that are returned for later processing. These packages may be putaway to specified areas to be retrieved later for inspection.

The Sterling Warehouse Management System allows for receipt at the number of packages level. A package, if necessary, is assigned an individual case or pallet with LPN label to facilitate retrieval and visibility. Business process configuration allows for a putaway request to be automatically initiated.

Return Receipt

A return in the Sterling Warehouse Management System is received based on the information that is available on the package or an item. SKU-level attributes also influence the method of receipt.

Receipt on the Sterling Warehouse Management System is completed through consoles. A RA worksheet can be printed for paper-based warehouses. A user scanning or entering either the return number, serial number, or container id initiates a receipt of the return. Capturing serial numbers are mandatory for serialized items and verification can be performed using extensibility against their original shipments. The Sterling Warehouse Management System also allows for integration with external systems to validated serial number. A case or pallet with LPN associated during the receipt process allows for tracking and movement of inventory. Inventory is tracked at the returns receipt location. In addition, other inventory attributes such as lot number, revision number are recorded, if necessary.

Business process configuration in the Sterling Warehouse Management System allows definition of the steps to be followed in a warehouse. The status of RA indicates the activity being performed or completed on the RA.

Disposition

The Sterling Warehouse Management System provides visibility to RAs that are pending disposition. A user issues a move request to retrieve RAs to continue with the inspection process. All tasks are created and monitored by Task Management.

The Sterling Warehouse Management System completes product disposition by associating a reason code and disposition code to the inventory. It also supports multi-step disposition for a SKU. For example, an item may require repairing, packaging and labeling before restocking. The Sterling Warehouse Management System business process configuration allows for status tracking at each of these steps.

The Sterling Warehouse Management System VAS process is used to generate work orders for tracking the repair process. A work order can span across multiple RAs.

The Sterling Warehouse Management System outbound process allows for transfer or repair orders to an external vendor. Transfer orders are used when products are returned to a vendor.

Return Receipt Putaway

The completion of the disposition process initiates the putaway of product. The putaway process can be automated through a move request or manually requested.

During putaway, the Sterling Warehouse Management System considers the preferences setup at an item and location level. For more information about constraints and preferences, see the topic, *Putaway*. This is carried out through Radio Frequency (RF) Mobile Terminal, batch sheet or by interfacing with MHE. The task management of the Sterling Warehouse Management System controls the task execution.

Close Return Receipt

The closure of a return receipt is based on business rules that are specified for a warehouse. Receipts may be closed either automatically on expected quantity being received, as an end-of-day process, or when putaway process is complete. Closure can also be initiated manually from the console.

The closure of a return receipt may be communicated to external systems. The closure of an return is initiated by external systems.

Receipt Visibility

Visibility to returns is provided through a console. The console is divided into search through the return as they are created, released and then received in a warehouse. This section refers to visibility provided to the receipt of a return in a warehouse. For more information about visibility provided for returns and its releases before receipt, see the *Sterling Selling and Fulfillment Foundation Reverse Logistics User Guide*.

The combinations of attributes used to search for a return receipt are better illustrated through use cases or examples, which include:

- View all returns received from a buyer in the last 30 days
Criteria used includes buyer, status and receipt date range
- View all returns where inspection is complete and for a particular disposition
Criteria used include disposition code and check 'Inspection Completed'
- View if a particular serial number was returned
Criteria used include serial number
- View the return associated with a particular LPN

Criteria used include Case ID or Pallet ID

Chapter 10. Value-Added Services

Using Value-Added Services

Value-Added Services (VAS) are performed to meet customer demands. They can be activities performed on a product before the product is delivered to the customer, or a provided service that is performed at the customer site.

Activities can be performed at all types of facilities including manufacturing facilities and flow-through or distribution centers. Some examples of VAS done at the vendor site are:

- A vendor applies a license plate number (LPN) label on a carton based on the manufacturer's specification.
- A manufacturer applies price ticket or SKU labels based on the requirements of a retailer.
- A warehouse builds a pallet using customer requirements.
- A warehouse applies security tags on a class of items before shipping to certain retailers.
- A warehouse assembles components and builds a kit before shipping.

Provided services are usually purchased by the customer for an additional fee. Some examples of activities that are offered as a provided service are:

- Installing a customer's home theater system.
- Providing maintenance to a furnace as part of a service contract.

Installing software on a new computer, and configuring the computer to work on a home network.

Some examples of how value added services are used within the manufacturing, vendor, or shipping facilities are:

- **VAS for stocking** — a facility performs the VAS operations for stocking periodically on the basis of expected demand for a product. For example, a warehouse ships pens, pencils and erasers separately. In addition, that warehouse may also ship a student package, which consists of 2 pens, 2 pencils and an eraser.
- **VAS for a customer** — this type of VAS operation is performed to meet specific customer requirements, such as special ticketing or security tagging. The Sterling Selling and Fulfillment Foundation allows the customization of inventory for a buyer at a node and ensures allocation to that customer. This scenario is referred to as **made-to-customer**, or **buyer compliance**. The customer usually makes repeated purchases of these specialized items. This type of VAS is performed in a warehouse based on the demand forecast to reduce order cycle time.
- **VAS for an order** — this is applicable when:
 - A customer selects a customization when ordering an item, like monogram on a shirt. The Sterling Selling and Fulfillment Foundation creates a work order to perform these services in a warehouse and ensures that inventory is allocated only to that order. This is also referred to as **made-to-order**.
 - A customer orders a dynamic physical kit and selects the required components for that item. The Sterling Selling and Fulfillment Foundation

creates a work order to assemble the kit and ensures that the inventory of the assembled unit is allocated only to that order. This is also referred to as **Built to Order**, or **made-to-order**.

- Inbound shipments that require packaging. Parts received that require packaging to a specified unit of measure.
- **Breaking kits or Dekitting** — this is performed on kits in inventory that are not required anymore. For example, inventory leftover from a seasonal promotion may be dekitted and the components can be used in other kits or sold individually.
- **Unit of Measure (UOM) Conversions** — a warehouse may create a work order to convert inventory from one UOM to another. For example, a warehouse may track inventory of screws individually as well as in packs of 50. A work order is created to convert single inventory units to packs of 50.
- **Gift Wrap Services** — a ship node may offer gift wrap services on items that are eligible for gift wrap. This flag is enabled for a node during Participant Setup for Sourcing/Scheduling Node Attributes.

Postponing Item Creation

One approach to providing Value-Added Services at the warehouse or other facility is to delay customization processes until an order is received. This is referred to as 'postponement'. The warehouse stores generic product awaiting the customer demand to customize the product. After receiving an order, additional services are performed on the generic inventory to convert the generic inventory into customer requested specific inventory. This increases the order cycle time while reducing the risk of unusable inventory. An example of a postponement process is shown in the following figure.

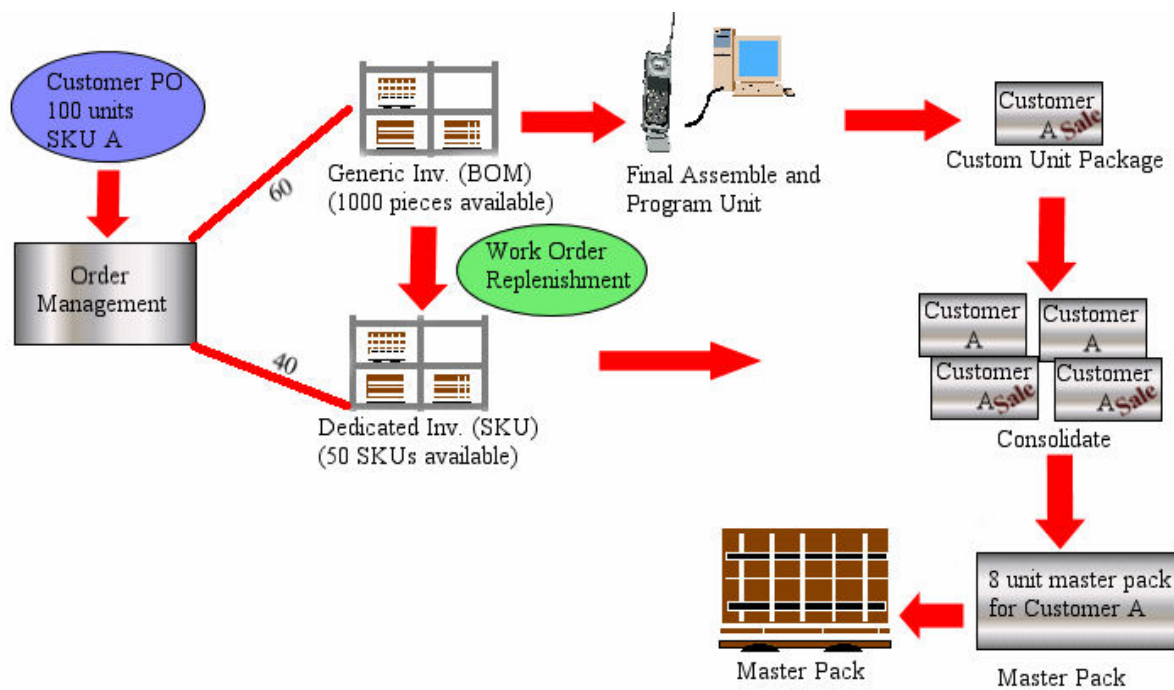


Figure 22. Postponement Process

In the Sterling Selling and Fulfillment Foundation, value-added services are executed by creating a work order. A work order is initiated automatically based

on a demand, or manually by a user. The Sterling Selling and Fulfillment Foundation manages the execution of a work order through retrieval of inventory to the VAS department, recording of completion towards the final inventory, and putaway of the product to appropriate departments.

Work Order Creation

A work order in the Sterling Selling and Fulfillment Foundation captures the activity required to perform a service. A work order is created in the Sterling Selling and Fulfillment Foundation by one of the following methods:

- Manual creation - A user initiates a request using the Work Order Console for repackaging, UOM conversions, labeling, or dekitting.
- Automatic creation based on Inventory levels - A request is issued by the inventory monitor in the Sterling Selling and Fulfillment Foundation upon minimum or maximum levels being reached for a SKU.
- Automatic creation based on an order - A request issued by a sales order for an item on the order. This typically occurs for **made-to-order** or **made-to-customer** items.

When a work order is created, it consists of one or more of the following types of services:

- Kitting Service - Assembling components for a kit item
- Dekitting Service - Disassembling a kit item. This may be done to acquire an individual component to complete another order.
- Compliance Service - Value-added services that should be performed to supply an item to a specific buyer for **made-to-customer** orders.
- Inventory Change - Converting inventory from one UOM to another.
- Provided Service - Service executed at a customer site.
- Delivery Service - Service executed for product delivery to the customer site.

One or more services can be included in a work order, and have a sequence number assigned which indicates the order in which they should be performed. Each service can contain one or more service activities, which specifies the category of activity, such as Assemble Components, Apply Logos, or Pack Components. Provided Services are not combined with other services.

Work Order Hold Type

The Sterling Warehouse Management System provides the ability to put work orders on multiple types of hold and manage them. An extensive search capability into work orders that are put on hold is provided. Visibility into a detailed history of all holds that were ever put on a work order is provided.

Work Order Execution

The Sterling Warehouse Management System allows a warehouse to select a group of work orders based on the work order attributes and release them for execution.

A work order may have one or more activities representing each step of physical work to be completed in a warehouse. For example, a work order for cell phone assembly involves placing of components into a unit box, actually assembly of components, frequency programming and testing.

The Sterling Warehouse Management System assigns specific VAS stations to each activity in the work order where VAS is performed based on the product. A cell phone assembly process differs from that of a radio assembly.

The Sterling Warehouse Management System retrieval algorithms are used to release the work order. Partial allocation of a work order is also permitted awaiting complete release at a later date or time. The algorithm used determines the optimal retrieval locations based on the quantities requested and the closeness to the VAS station. Inventory is retrieved to the VAS station. Components are retrieved using Radio Frequency (RF) Mobile Terminal, batch sheets or by integrating with MHE.

The Sterling Warehouse Management System triggers replenishment tasks for the forward pick locations, considering the demand placed during the VAS retrieval process and the minimum levels for an SKU at the location.

The Sterling Warehouse Management System Task Management creates and manages all the tasks related to VAS component retrieval. The Sterling Warehouse Management System uniquely tracks inventory that has been allocated to a work order. This allows complete visibility and control over the execution or cancellation of a work order or its tasks.

Work Order Activity Confirmation

A user confirms activities on a work order as per the BOM. The confirmation is a multiple step or a single step process. The Sterling Warehouse Management System allows service items to be associated with a work order. Each service item represents activities to be performed for the service. The work order confirmation is done either at an activity level or at the complete work order level. For example, first retrieve the boxes and the individual phones to place them in boxes. Frequency programming is done as a second step by a different group of users.

The Sterling Warehouse Management System displays all instructions (text and graphics) for the activity to be performed on the work order.

A case or a pallet LPN can be associated with the confirmation of an activity. This allows movement of product from one VAS station to another for subsequent activity. New serial numbers can be associated to the product during confirmation. Labels can be generated and applied to the product as required during the VAS operation.

Inventory is created for the parent SKU in the activity location. If a work order has components, the component inventory is consumed.

The work order status indicates the pending activity. The Sterling Warehouse Management System productivity tracks information related to work order at the activity completion level.

Putaway

The Sterling Warehouse Management System putaway algorithms are initiated either automatically upon work order completion or manually by the VAS department.

For work orders that are related to a sales order, putaway is performed to the appropriate packing or shipping area. For SKUs that are for future orders in a "Made to Order," are putaway to storage area for later retrieval.

For a build-to-stock work order, putaway is suggested to the appropriate storage areas.

Visibility

The Sterling Warehouse Management System provides work order visibility at a granular level. A work order consists of parent SKU, component SKUs and other attributes. The combinations of these attributes are illustrated through the following use cases and examples:

- View the status of all dekitting work orders for a particular shipment
Criteria used include node, enterprise, and service item group.
- View the status of the special ticketing work order for a case or pallet
Criteria used include node, enterprise, case or pallet LPN and service item group.
- View all work orders awaiting release and due to start later today
Criteria used include node, enterprise, status range and start no earlier than date and/or time
- View all open work orders that have 'cut paper' activity pending at VAS station one
Criteria used include node, enterprise, activity code and location

Chapter 11. Resource Planning

Resource Planning

The Resource Planning tool provides warehouses the ability to plan for expected workload and determine the number of resources required to complete the activity. Having visibility to expected resources enables a warehouse to accurately plan for overtime, temporary staffing, and so forth, thus optimizing resource costs.

The productivity of a warehouse is measured in terms of its efficiency, resources, and so forth. Planning aids warehouses in managing demands for their fulfillment activities. Appropriate outbound planning leads to significant cost saving as the warehouse has visibility to resource requirements well ahead of time. The warehouse can plan for on-hand shipments or for future demands predicted based on the historical data.

The planning module estimates resource requirements for all the activities performed in a warehouse such as:

- Replenishment
- Picking
- Packing
- Manifesting
- Shipping

The factors that affect planning are:

- The warehouse calendar, user calendars, equipment maintenance calendars
- Number of pack stations
- Number of docks
- Number of forklifts
- Number of staging locations

Depending on the available resources and constraints, you can yield results such as:

- The demand that can be satisfied with the available resources
- The limiting factors

Once the constraints are revealed, you can plan to see if you can do the following to fulfill the demand:

- Extend the shift hours
- Increase the count of resources
- Shuffle demands based on the requested ship dates to days that have optimum capacity

Managing Capacity

The demand requests such as shipment, workorder, and count request require resources from multiple resource pools to varying extents are required.

Based on the standard available capacity, you can verify if demands can be fulfilled with the available capacity. When the capacity falls short, the resources assigned to other pools may be pulled into this pool to cover its shortage.

Estimating Work

To fulfill demand requests such as shipment, workorders, and count request, resources from multiple resource pools are required. The resource planning of Sterling Selling and Fulfillment Foundation can be used to determine the various activities to be completed in order to fulfill the demand requests. Based on the labor standards defined, the time required for each activity can also be estimated.

Thus, the capacity required against each resource pool is estimated for each day.

Chapter 12. Outbound Planning

Outbound Planning

The productivity of a warehouse is measured in terms of its efficiency, inventory accuracy and order turnaround time. Order turnaround time is a critical factor in measuring customer satisfaction. It is critical for a system to mirror a warehouse process through each individual process at an order line level. The diverse nature of the operation ensures the need to simplify each process and automate the activities as desired.

Outbound planning decisions include:

- What orders do I consolidate?
- What is the most efficient shipping route that meets my customer's compliance and shipment specific requirements?
- What is the pick strategy that I would use to pick SKUs based on demand and my warehouse layout?
- What is the optimal set of locations that I would like to pick from to fulfill the demand?
- What are the constraints for containerization of outbound packages?
- How should I group by shipments for maximum efficiency?
- How do I restrict the number of parallel activities that are created on the system?
- How can I achieve this in a cost-effective and automated manner, with minimal intervention?
- How can I keep track of what is happening at a warehouse level?
Simultaneously, how can I view at a granular level across all the activities above?
- Each warehouse in my network has physical constraints, how can I plan my outbound shipments accordingly?
- How can I view, manage and monitor activities across all my warehouses?

The Sterling Warehouse Management System provides a complete solution to all outbound planning activities. The abilities are configurable at a warehouse level allowing for unique process definitions for a warehouse. The Sterling Warehouse Management System is a networked WMS solution that provides visibility across all warehouses in the supply chain. The following figure represents the outbound planning process provided in the Sterling Warehouse Management System.



Figure 23. Outbound Planning Process

The Sterling Warehouse Management System allows optimization of pick, pack and ship processes for shipments utilizing the attributes and constraints at a warehouse, shipment and item level.

The ability to specify each of the constraints at a warehouse level allows each warehouse to plan its optimization individually.

The following should be taken into consideration during the outbound planning phase:

- Grouping and Prioritization
- Accepting Waves
- Lane Assignments
- Releasing Waves
- Containerization
- Batching
- Printing Documents for a Wave

Grouping and Prioritization

The Sterling Warehouse Management System provides shipment selectors that groups shipments of similar attributes. A shipment selector consists of shipment item attributes used to distinguish and group shipments. A shipment group defined can have multiple shipment selectors assigned to it. For example, an emergency shipment group has shipments with Priority Code as 'E' or shipments expected to ship in four hours from now.

Shipment selector criteria includes:

- Shipment attributes including document type, Enterprise, priority, order type, shipment value, Buyer, and receiving node.
- Delivery attributes including mode and type of shipment, SCAC, and service.

- Ship to attributes including country and zip code (postal code).
- Turnaround time attributes including request ship date and cancel dates.
- Item classifications. For example, a heavy item in Electronics or a hazardous item in Chemicals.

A shipment selector is a combination of all defined attributes. For example, the 'Urgent Orders' shipment selector includes attributes such as order type, priority code, and requested ship date.

A shipment selector's ability to filter appropriate shipments for a customer or for an item classification is utilized to optimize the processes in a warehouse. For example, a warehouse may have a special group for its largest customer or for the most stringent customer or carrier.

Order releases are combined into shipments by either IBM Sterling Logistics Management or by an external system.

A shipment group also considers physical constraints specified at a warehouse level or at the group level for a shipment. For example:

- A warehouse that uses an outbound conveyor with chutes has a limitation on the total number of chutes used
- The number of locations in the 'put to light' system

These constraints applied to each shipment are rolled up to a shipment group level in order to limit the number of shipments released together. A wave is created based on the defined constraints.

Waves

A wave is an aggregation of picks across zones and orders that are consolidated to optimize pick and prioritize shipment. Wave planning is very effective in high volume pick or pack environments as it optimizes the labor costs. For low volume pick and pack warehouses (stores, stockrooms or low volume of orders), support customer pick-up or for one-off shipments (urgent orders), it may be more effective to release shipments individually rather than group into waves.

The demand at a wave level for a shipment is grouped and is further broken into the method of pick to be employed using Pick Strategy, and where to pick the inventory using Pick Location Assignment. Containerization process is also applied, if necessary, considering customer and SKU specific constraints.

It is important in a warehouse to manage the total work issued on the system at any given time. The Sterling Warehouse Management System allows control over the number of waves picked in parallel at a shipment group level. For example, a warehouse having 5 pre-defined shipment groups can ensure that each shipment group releases and picks only one wave by setting the values to 1 at a shipment group level.

Accepting Waves

Waves that are created can be released automatically or manually. Some warehouses may choose to monitor the waves that are created, and decide their manual release. This manual decision is called "accepting the wave". Shipments belonging to waves that are not accepted would be considered for inclusion into new waves.

The acceptance of a wave in the Sterling Warehouse Management System can be automatically or conditionally accepted based on constraints such as volume, weight constraints or configured to be always accepted non-conditionally depending on shipment group configuration. Also, you can accept a wave manually.

Lane Assignments

Lane assignment is typically used in warehouses that have either large number of shipments or carriers being used every day. Sorters may be employed to improve the flow-through of containers for these shipments after they are picked and packed.

Shipments are sorted either by carrier or shipments. However, shipments are first sorted by carrier to ensure that all shipments being shipped by a particular carrier are kept together to aid loading of a carrier's truck when it arrives. Then, shipments are sorted by shipments to ensure that shipments being picked from multiple zones in a warehouse are consolidated before shipping the shipment. In the case of LTL or TL shipments, shipments are sorted into pallets by scanning the containers. To aid this sorting process, the Sterling Warehouse Management System assigns lanes to each shipment. The following figure depicts a typical lane assignment in the Sterling Warehouse Management System.

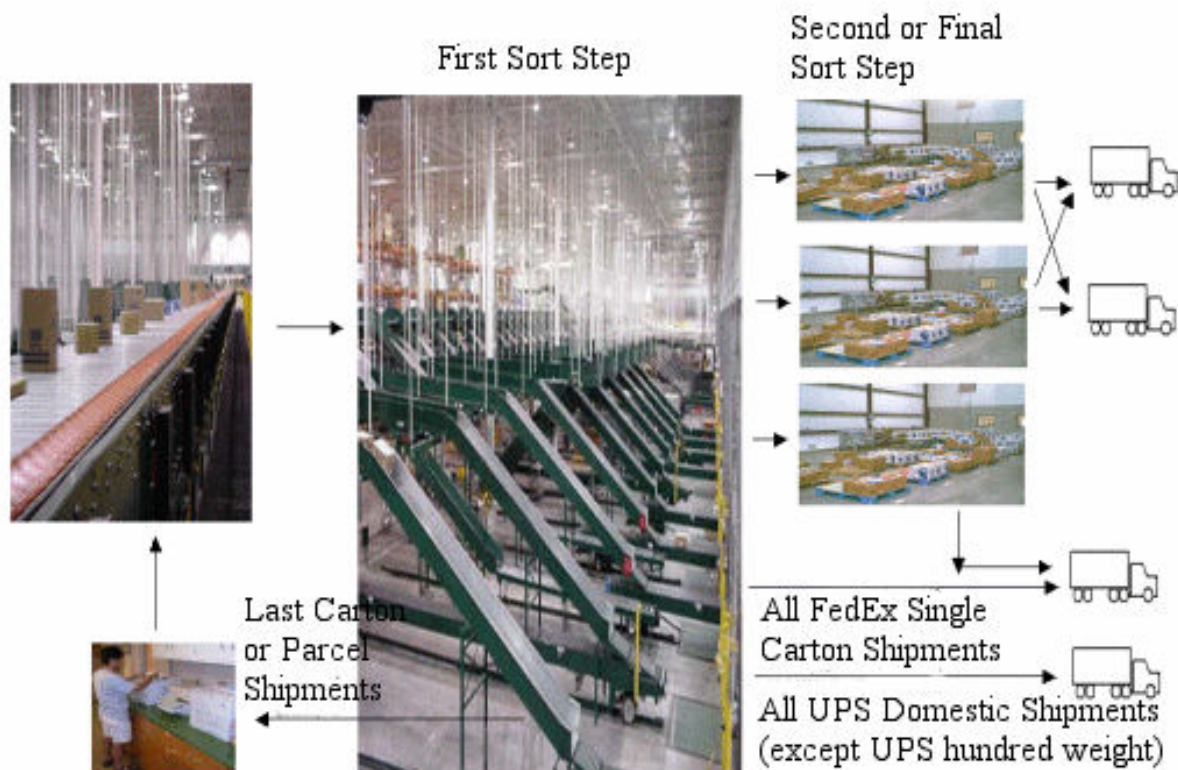


Figure 24. Lane or Route Assignment

Releasing Waves

A warehouse also specifies the release time for waves. For example, a shipment group specified for a customer specifying a particular 'day of the week', because the delivery date requires waves to be released on a specific day. The release schedule considers waves that have been accepted for release.

Shipments that do not have sufficient inventory are removed from a wave. For shipments that require segmented inventory, the Sterling Warehouse Management System automatically checks released work orders for excess inventory that may be available, and creates a work order for the remaining quantity, if necessary, to create segmented inventory to fulfill the shipment.

Based on the demand, the Sterling Warehouse Management System Release Wave searches for inventory at a wave level in specific zones, and creates pick tasks for available inventory.

Buyer Compliance

A buyer organization may choose to use units of measure defined in the buyer's catalog. In such a situation, at the time of picking it is ensured that products are picked in UOMs supported by the buyer organization. To achieve this, UOMs from the buyer's catalog is compared with the enterprise's catalog. The Sterling Warehouse Management System ensures that the UOMs defined in both the catalogs and with same quantities are considered for picking.

Over-Packing

The Sterling Warehouse Management System considers over-pack when UOMs defined in the buyer's catalog are not used. In such case, multiple smaller containers needs to be placed into a bigger container. However, this operation is optional and can be defined in the Pack Planning configuration at the node-enterprise level.

The Sterling Warehouse Management System allows the performance of over-pack on specific constraints like containerization, category, and volume. If UOM is not applicable for shipment line's containerization category (item classification for Containerization Category), the Sterling Warehouse Management System considers only those UOMs defined in the enterprise's catalog for picking. However, if over-pack is applicable, UOMs whose volume is less than over-pack volume are not eliminated during the picking process. By doing this, the Sterling Warehouse Management System ensures that the products are not picked in UOMs that require over-pack. The demand in these UOMs are picked as loose inventory, and therefore assists containerization in over-packing.

Pick Strategy and Processes

A Pick strategy is applied to waves to determine the pick processes and locations to use when picking inventory.

Pick strategy is comprised of:

- Pick Processes
- Pick Location Assignment

The most commonly used pick processes are:

- **Order Pick**—This pick process is applicable for warehouses that perform pick operations for a small number of orders, but high number of item picks for each order. Warehouses performing a low number of pick operations for an order find the travel time excessive. But, warehouses performing pick operations with a large number of orders find that the congestion from many pickers working in the same area slows down the pick process.

In the Sterling Warehouse Management System, pick tasks are sorted in the same sequence as defined in the pick flow. Users pick one order or shipment at a time from the assigned zones.

- **Batch Pick**—Multiple orders or shipments are grouped into batches. Constraints are defined at the batch level for zones, locations, and number of units. For warehouses that perform low pick operations for an order, this pick process greatly reduces the travel time allowing a picker to perform additional pick tasks when in the same area. Since multiple orders are picked at the same time, warehouses must ensure not to mix orders. In situations where same day shipping operations are critical, a balance between the optimal batch pick and shipping requirements must be achieved.
- **Item Pick**—Items across orders or shipments are picked from different zones at the same time and brought to the pack, sorting, or staging locations to sort and consolidate into individual shipments. These shipments are later moved to the respective pack locations for packing. Warehouses performing pick operations with low number of items and a moderate to high number of picks for each order and item, benefit from the item pick process.

Warehouses can determine the appropriate pick process based on the item and shipment attributes. All constraints and controls can be specified at the warehouse level to handle seasonal or occasional peaks as follows:

- Choose the item pick process:
 - When demand at an item category level in a wave exceeds the defined limits.
 - For items with certain attributes, or shipments with shipment level attributes such as single unit shipments.
- Choose the order pick process for items with certain attributes or shipments with shipment level attributes such as single unit or line shipments.
- Choose the batch pick process for regular and small orders. In the Sterling Warehouse Management System, you can specify zone-based picking as part of the batch pick strategy.

The determination of pick process is based on the demand, which eliminates the manual handling of end-of-month and end-of-quarter procedures.

Pick Location Assignment

The Pick Location Assignment (PLA) in the Sterling Warehouse Management System assigns locations to satisfy the demand. PLA is defined at the shipment group level and may be shared across multiple shipment groups.

When a shipment is added to a wave, the Sterling Warehouse Management System determines:

- The demand for each distinct item in shipment lines for shipments included in the wave.
- The inventory and alternate UOMs for items.

Identifying PLA Rules

PLA rules are defined for an item classification at the UOM level. A PLA rule points to a list of zones. Multiple PLA rules may be specified to ensure unique zone level constraints for each combination of item classification or UOM. For example, for SKUs stocked in pallets, cases, and loose units, you can define 3 distinct rules to cover zones that are applicable for each UOM.

The Sterling Warehouse Management System identifies the PLA rule for a wave by identifying the appropriate pick processes starting from the biggest UOM defined for the item.

If the pick process determination rules are not defined for a UOM, and if other conditions are met, the pick processes can be selected using any UOM.

Downgrading

About this task

Based on the demand, if the system determines more than one pick process for a UOM, the pick processes are evaluated in the following order:

- Item Pick
- Order Pick
- Batch Pick

Procedure

1. If the Sterling Warehouse Management System determines that the item pick process should be used, it:
 - a. Determines PLA from the UOM specified in the Pick Process Determination rules.
 - b. Processes all UOM conditions defined starting from the largest UOM (UOM that corresponds to the highest quantity).
 - c. Performs PLA for the demand.
 - d. Continues to process until the demand is completely satisfied or all UOM conditions are exhausted.
2. If the Sterling Warehouse Management System determines that the order pick or batch pick process should be used, it:
 - a. Determines PLA from the UOM specified in the:
 - Pick Process Determination rules (applicable only for the order pick process)
 - UOM Condition
 - b. Performs PLA for the demand.

Results

If a demand is not fulfilled by a pick process, it is carried forward to either the next pick process defined for that UOM. Otherwise, the demand is carried forward to the pick process defined for the next highest UOM.

The PLA algorithm checks for inventory availability in zones that are configured for picking.

Honoring Split Constraints

The Sterling Warehouse Management System validates the LPN split constraints defined at the zone and PLA rule levels. These constraints determine whether a license plate can be split during inventory allocation. If split constraints are defined at the zone and PLA rule levels, the system chooses the most restrictive constraint to ensure that constraints defined are not violated.

The Sterling Warehouse Management System enables you to specify the UOM for products stored at a zone. If a UOM is specified:

- Users pick products in multiples of the specified UOM or full LPNs of the same LPN type associated with the UOM.
- Users pick the entire quantity at the location if it matches the demand.

For example, there is a demand for 25 units (1 case). The pallet quantity is 100 and case quantity is 25. If pallets with cases are stored in a location and the corresponding zone has a constraint for storing products in multiples of case, the Sterling Warehouse Management System enables you to break pallets and pick cases from that location. If the zone is configured to store products in multiples of pallet, then breaking pallets or picking cases from that zone is not allowed. However, in both scenarios, the Sterling Warehouse Management System enables you to pick the entire pallet from the zone.

If a split UOM constraint is defined at a zone level, the UOM must be defined for all items in that zone.

Split constraints defined at the PLA rule level allow you to configure different task types for picking from an LPN or pick full LPNs from the same zone. This is achieved by creating multiple PLA rules for different UOMs.

Although replenishment strategies are configured, the Sterling Warehouse Management System does not perform demand-based replenishment for zones that have split constraints defined at the PLA rule level or zone level. The existing pending quantities are also not considered for allocation. This is to avoid violating a split constraint because the exact information about the incoming inventory is not available. However, you can replenish such zones using the location monitoring rules.

Locations with Inventory

When determining optimal locations, the Sterling Warehouse Management System considers order line attributes. The system also considers requested tag attributes, if available.

The Sterling Warehouse Management System enables you to specify zones with inventory, and utilize the dedicated and dynamic slots in these zones, if applicable. All zones are considered in equal priority, thereby honoring FIFO and ship by date.

The Sterling Warehouse Management System assigns pick locations for a zone based on the "Least Number of Trips" or "Pick-to-Clean" optimizations. The following scenario further explains these strategies:

Consider that there is a task to pick 35 units of an item. There are 5 locations in zone Z1 with their inventory picture as follows:

- L1: 40
- L2: 30

- L3: 20
- L4: 10
- L5: 5

For zone Z1, the following constraints are not defined:

- 'inventory is stored in multiples of pallets or cases' constraint
- PLA rule level split constraints

In this case, for 'Least Number of Trips' optimization, location L1 is suggested. For 'Pick-to-Clean' optimization, locations L3, L4, and L5 are suggested.

If an item is tracked by its FIFO number, or is a time-sensitive item, the location having the inventory with the minimum FIFO number or ship-by-date is suggested first by the Sterling Warehouse Management System.

The following figure illustrates the PLA process for a zone configured for item pick.

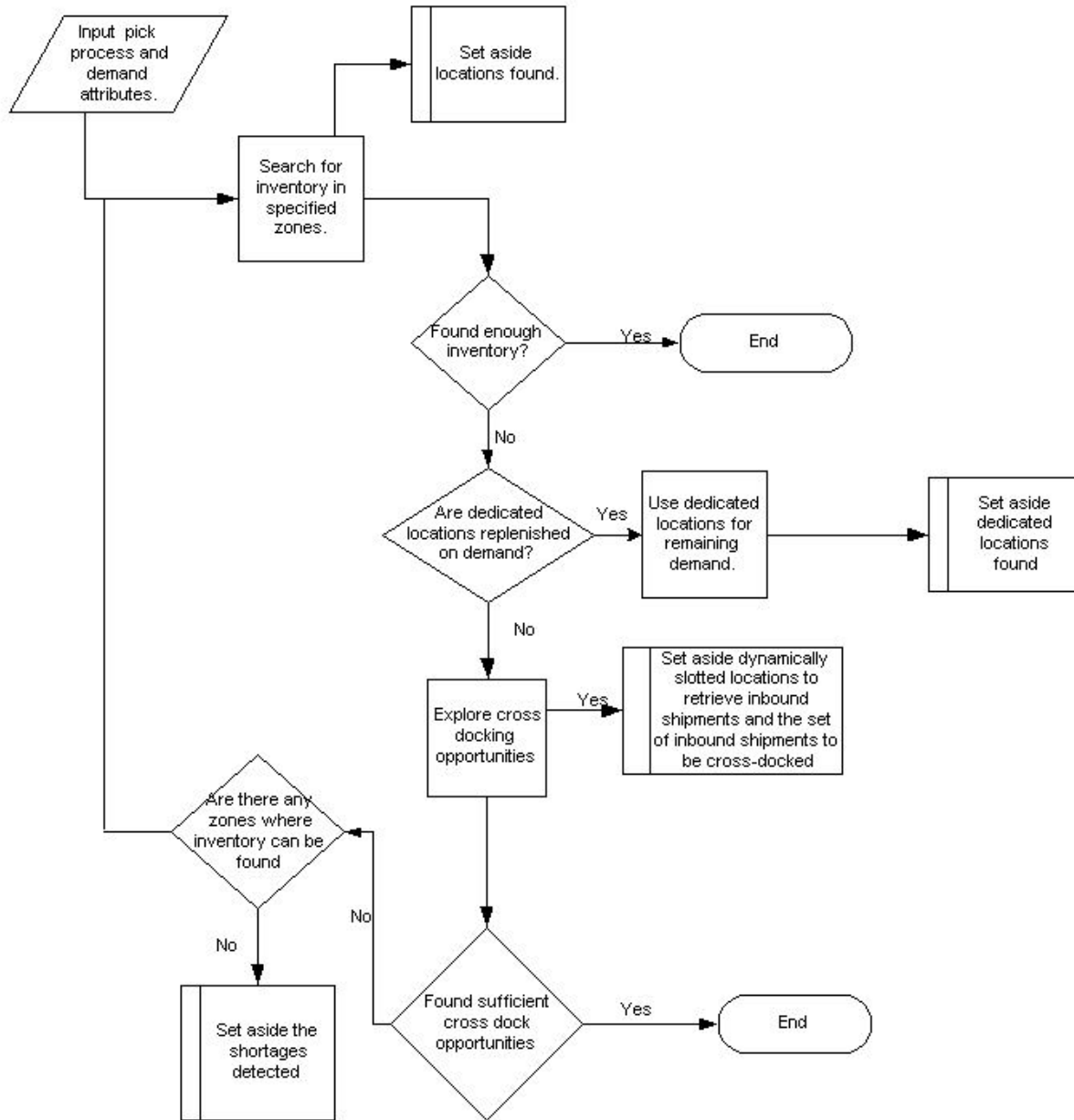


Figure 25. Pick Location Assignment for Item Pick PLA Rule

The following figure illustrates the PLA process for batch pick and order pick.

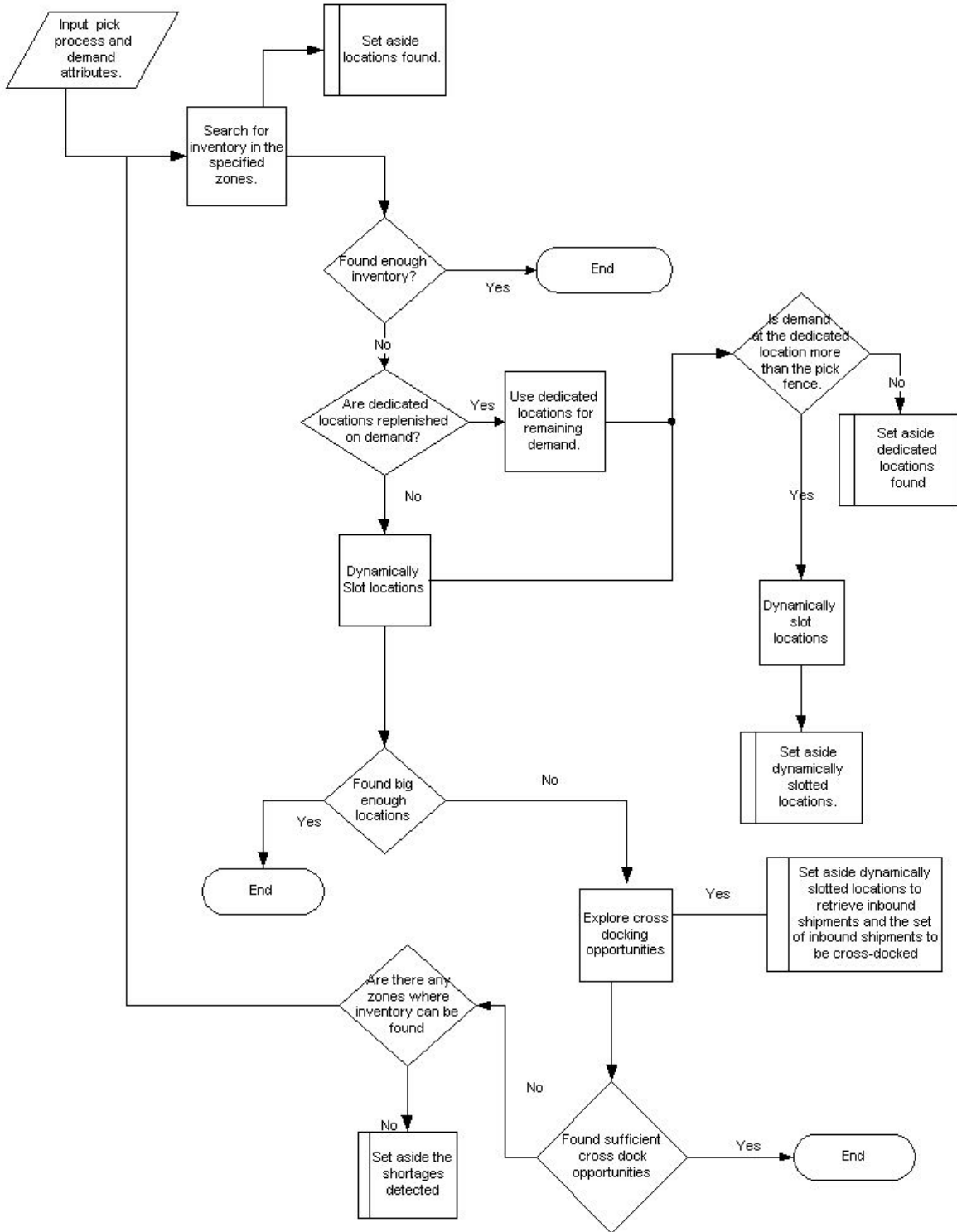


Figure 26. Pick Location Assignment for Batch Pick and Order Pick PLA Rule

Dedicated Locations

The Sterling Warehouse Management System allows the utilization of dedicated and dynamic slots in the zones specified, if applicable. If dedicated locations do not exist for the demand, locations are determined dynamically in the zones

specified. However, if dedicated locations exist, they can be allocated for the remaining demand. The Sterling Warehouse Management System ensures that sufficient inventory exists in bulk zones to replenish the dedicated/dynamic slot locations. It also allows the creation of a retrieval request for allocated demand to the dedicated locations. Dedicated locations that cannot be replenished for the entire demand results in PLA exception. The Sterling Warehouse Management System allows applying zone constraints only when locations are determined dynamically. It does not allow mixing of SKUs in dynamic slotted locations unless it is an infinite location.

Pick Fence Locations

During peak times for a SKU the dedicated and dynamic slot locations are too small to occupy the demand even at a wave level. In such situations, the Sterling Warehouse Management System allows defining pick fence and its corresponding zone. The SKU quantity is deposited to the pick fence location (typically a floor location), where picking tasks are completed. Pick locations that are found result in PLA exception, and the Sterling Warehouse Management System ensures that a retrieval request is created for the entire demand to the pick locations. However, pick locations that cannot be replenished for the entire demand also results in PLA exception.

Cross Dock Locations

The Sterling Warehouse Management System allows for inbound shipments at the warehouse to be considered as available inventory, after searching for inventory in other locations, as explained in the previous sections.

The task types that are assigned to each location are specified at a PLA rule level. This allows a warehouse to have a different task type for a pallet pick, case pick and loose pick, by utilizing the combination of UOM and zones.

The Sterling Warehouse Management System triggers demand based replenishment tasks for the forward pick locations, considering the demand placed during the PLA process and the inventory availability for a SKU at the location.

Replenishment

In a warehouse, as a product is removed from a location, the inventory in that location requires re-stocking. This process is called replenishment. Demand-based replenishment is initiated after PLA has specified the total demand placed for an item. A retrieval request is created by PLA for the demand.

The replenishment strategy is specified for a zone that requires replenishment. The zones to replenish from can be specified by the unit of measure that is required. For example, an active (loose) pick zone is replenished from case storage zone for the UOM specified as EACH, while the case storage zone is replenished from the pallet zone when the unit of measure is CASE. Additional zones can be specified as secondary preferences in both these cases. During the replenishment process, zone attributes such as round-off level, controls the optimal quantity suggested for replenishment. For example, in case storage zone, the quantity to replenish can be rounded up to a case quantity for the item, while in a pallet zone, quantity to replenish can be rounded up to a pallet quantity for the item.

The Sterling Warehouse Management System groups demand-based tasks based on the department requesting replenishment. For example, PLA for a wave creates both replenishment task and pick task. Typically, replenishment tasks are expected

to precede pick tasks for a wave. The Sterling Warehouse Management System may be configured such that pick tasks are kept on hold until inventory is replenished and made available for picking for the entire batch, shipment, or container.

Containerization

Containerization is the process of using standardized containers for the storage and transport of loose units from a warehouse. The containers used for containerization are defined in Catalog Management.

If you pack during picking, the results of containerization are used during picking. If you pack after picking, the results of containerization are used during packing. When packing is performed it is specified as part of the task type configuration in pick planning. This decision affects the way in which containerization logic works. However, the parameters that govern the logic remain the same regardless of when packing is performed.

The following constraints are evaluated during containerization:

- Buyer specific constraints include:
 - Whether the container requires shipment container marking
 - The level at which shipment container markings are applied
 - Whether items can be mixed in a case based on different parameters, such as item ID, mark for address, unit of measure
 - Whether items can be mixed in a pallet based on different parameters, such as item ID, mark for address, unit of measure
- Warehouse/Enterprise specific constraints include:
 - Whether items can be mixed in a case based on different parameters, such as item ID, mark for address, unit of measure
 - Whether items can be mixed in a pallet based on different parameters, such as item ID, mark for address, unit of measure
 - Which containers can be used
 - Whether the container requires shipment container marking based on parcel and less-than truckload/truckload shipments
 - The level at which shipment container markings are applied based on parcel and less-than truckload/truckload shipments
- Container specific constraints include:
 - The Buyer on the shipment line
 - The shipment line item's containerization category
 - The volume of the container that can be used
 - The maximum weight the container can hold
 - The quantity of a particular item the container can hold, based on item classification

In addition to the standard industry constraints, the Sterling Warehouse Management System ensures that a container does not contain multiple shipments, task types, items requiring different value-added services, and container categories.

The Sterling Warehouse Management System provides the initial containerization estimate to determine the pick strategy, which is recalculated during wave release in accordance with PLA.

A warehouse can also choose manual post-pick containerization. In this case a packer provides details about the shipment container chosen, and the items in the container. For example, warehouses that handle soft items defy regular area, volume calculations, like clothes that have a 'squish' ratio or warehouses that do not have standard packs defined or are in the process of establishing the same.

During containerization, the system creates Pallet labels if the item has an alternate UOM with LPN type = Pallet and containerization quantity matches the alternate UOM quantity. But for Parcel shipments, the creation of Pallet labels can be prevented by setting the property `yfs.prevent.palletlabel.for.parcelshipment.tasktypelist` to a list of task types separated by commas. If this property is not set or if the task is not among the task types mentioned in the property value list, the system will retain the default behavior.

For more information about containerization, see the *Sterling Warehouse Management System: Configuration Guide*.

Batching

Activities or processes in a warehouse are carried out on equipment that has their own size or quantity restrictions. The different activities in a warehouse include picking, retrieval for replenishment. The tasks are grouped into 'batches' of activities based on the equipment used to complete these tasks.

Batch pick is defined as picking of multiple tasks across shipments in one trip. A batch is picked either using equipment like carts or flatbeds or totes. Equipment constraints limit the number of units that is picked in one trip due to slots being defined in carts or physical limitations.

The different methods of batch pick include:

- Pick—This process involves picking of multiple shipments into a single tote. The picked quantity is deposited at a pack station where packing slips or Radio Frequency (RF) Mobile Terminal scanners are used to pack the individual shipments.
- Sort while pick—This process involves picking of quantity into specific totes determined by the system. Each tote represents either a shipment or carton in a shipment. The picked quantity can now be dropped off at a pack station at a tote level.
- Sort and pack while pick—This process involves picking of quantity into specific cartons placed in specific slots in a cart or flat bed. Each carton indicates the item and quantity that needs to be packed in it as well as the size of carton. The picked cartons can now be individually dropped at packing station where packing slip is applied and carton is closed.

The locations assigned for pick are also considered when building the optimal batch. The optimal batch is determined by calculating cost of picking using criteria including number of trips, number of locations visited and the number of aisles to be visited, to determine the batch that takes the least time.

Shipping Specific Serials

When a customer requests for shipments with serial numbers, the Sterling Warehouse Management System creates Move Requests for such shipments and releases to the pack station.

Building a Cart Manually

The manual cart build functionality provides the ability to build a picking cart by associating a cart location to a set of totes, cartons or shipments.

Cart build also provides the ability to capture the productivity of a user.

Printing Documents for a Wave

The operation of a warehouse requires numerous documents, be it labels or reports, to be printed daily. The printing of the documents is either initiated by the occurrence of specific events or requested ad hoc by a user. The Sterling Warehouse Management System provides necessary documentation to complete the outbound processes. Documents are printed either individually or in a set or group. A document set consists of multiple documents that relate to individual activity that is performed. The Sterling Warehouse Management System supports printing of standard documents for waves.

Printing Carrier Labels

The Sterling Warehouse Management System provides the ability to print carrier carton labels during wave release or at the time of manifest. To print labels during wave release, the Sterling Warehouse Management System may generate a tracking number and print the labels for cartons that are manifested later.

Visibility

The Sterling Warehouse Management System provides comprehensive visibility to shipments and waves through consoles. The combinations of the attributes are better illustrated through the following use cases or examples:

- View waves status for priority UPS Shipments
Criteria used include ship node, enterprise, status range and shipment group id representing priority UPS shipments
- View waves that are scheduled to release for tomorrow
Criteria used include ship node, enterprise, status range and release no earlier than date and time
- View all shipments for a buyer that are included in wave expected to ship by tomorrow
Criteria used include ship node, enterprise, buyer, select 'Shipment In Wave', select 'Enter Shipment Dates' to enter requested ship dates
- View all shipments that are on a specific trailer
Criteria used include ship node, enterprise and trailer number.
- View all shipments that are picked or packed for a specific item that requires additional inspection
Criteria used include ship node, enterprise, item and status.
- View all pick lists that have been created today for a specific carrier
Criteria used include ship node, carrier and pick list date range
- View all loose cases that belong to a specific shipment that are awaiting pick
Criteria used include ship node, container type, select 'Loose Quantity', shipment number and status range

Chapter 13. Outbound Execution

Outbound Execution

Outbound Execution covers the process from the point when pick tasks are released for an outbound shipment up to the point when the packages are loaded into trailers.

The seamless and flawless execution is an integral part of how reduced order turnaround time and inventory accuracy is achieved. The ability of a system to mirror the routing of inventory in order to comply with the customer and item requirements are the key to reduced turnaround time. The following figure illustrates the relationship between Order Pipeline, Shipment Pipeline, and Container Pipeline.

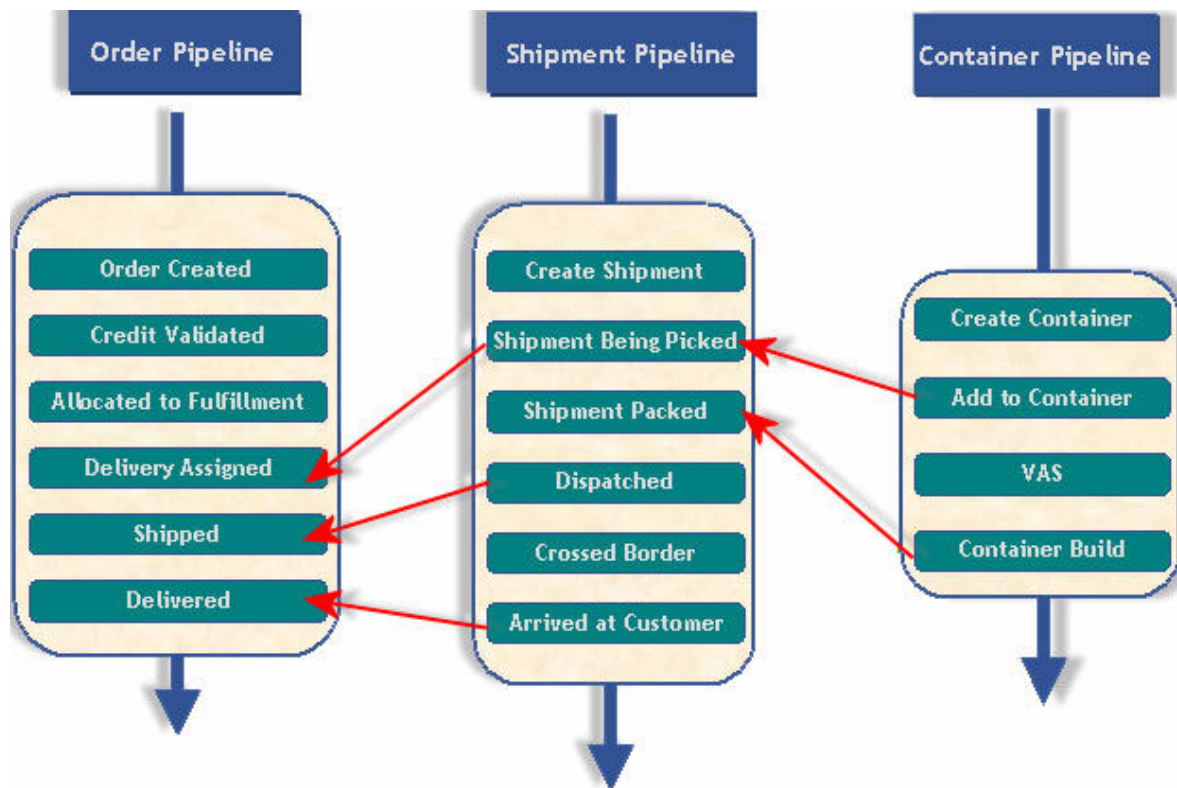


Figure 27. Order Shipment Container

Shipment specific attributes further define the process to be followed during picking and packing. For example, shipments are loaded in stop-off fashion demanding that the picking and packing process be done in a certain sequence. LTL and TL require pallets to be built from individual containers. Parcel shipments are shipped at an individual carton or container level.

Shipments requiring additional VAS activity are routed through the appropriate departments. Items that require assembly referred to as 'physical kits' are also routed through the VAS department. VAS activities, such as customer specific labeling, monogramming, price ticketing and gift-wrapping deferred till the last

minute are part of "postponement" strategies employed. The diverse nature of the VAS requirements enforces the need to track each individual process.

The complex and shipment specific nature of the processes enforces the need to have visibility to a shipment at a granular level.

Outbound execution in the Sterling Warehouse Management System is a result of the strategies employed during the release of shipments. The flow of activity in a warehouse is modeled through business process configuration at a shipment attribute level in a warehouse.

An activity in a warehouse is modeled through a task type. Additional constraints are defined at a task type level to control the execution. Task Management manages and monitors all tasks. Shipment selectors that are defined allow a warehouse to group shipments by attributes including 'Pack & Hold' or 'VAS.'

A task is completed through Radio Frequency (RF) Mobile Terminal, batch sheet or interfacing with appropriate MHE. The Sterling Warehouse Management System allows the deployment of different pick strategies including "sort while pick," "pick and sort," "pick and pass" in a warehouse. Also, a warehouse can choose to have batch picking in the shelves, RF Mobile Terminal picking in bulk and put to light systems in active zones.

Picking, packing and shipping procedures also adhere to the compliance requirements at a customer, carrier level. Customs compliance is also enforced for international shipments. The requirements include appropriate labeling and documentation. The generation and printing of these documents is modeled through events in the business process configuration against a transaction. The Event Management then dispatches these prints through the application's print infrastructure.

The Sterling Warehouse Management System business process configuration at both a shipment and container level allows quality control processes to be enforced. This improves the inventory accuracy of shipments, thereby improving customer satisfaction.

Parcel shipments are processed through a manifesting console. The Parcel Carrier Adapters (Carrier Adapter) provides integration to carrier-specific services, including FedEx Ship Manager, and other external carrier servers.

LTL and TL shipments require creation of BOL. The Sterling Warehouse Management System provides the VICS standard BOL. Trailer manifests or Master BOL is also provided to carriers, if necessary.

The Sterling Warehouse Management System provides complete control over the execution process at a granular level. A shipment can be monitored, managed and processed through consoles. The Sterling Warehouse Management System provides complete control over modifications done at a shipment line level.

Picking

Picking tasks are carried out by RF Mobile Terminal, batch sheet or by interfacing with a MHE.

During the pick process, appropriate instructions for pick and pack are provided to the user. Additional attributes such as serial numbers can be captured during the

picking process. Pick strategy determines the method of pick for a SKU on the shipment. Pick strategies including "pick and sort", "sort while pick", "order pick", "pick and pass" and "zone based pick" are supported. For small products that are not received in standard cases, the Sterling Warehouse Management System allows over-picking if the excess quantity picked does not exceed preset over-ship limits.

Users are assigned to specific task types and equipment associated with their skill set. The controls provided to a supervisor allow a shipment to be restricted to specific users and to the number of users who can work on the task. This allows a warehouse to leverage assets appropriately. For example, a warehouse where TL shipments are restricted to one or two users provides batch pick to a larger group of users.

The Sterling Warehouse Management System always attempts to consolidate outbound pick tasks before suggesting to the user.

Ability is provided to a picker to record exceptions such as short picks at a location.

The Sterling Warehouse Management System lets you pick, pack and ship more than the shipment line quantity, as long as the quantity picked is within the set tolerance limit.

Thus you can pick and pack more than the shipment line quantity. Over picking is allowed as long as the quantity picked (sum of the shipment line quantity and the over ship quantity) is within the set tolerance limit.

At the end of the picking process, the inventory is moved through drop-off locations to the next point in the route. After all pick tasks are completed for a wave, the wave status is appropriately updated.

Task management automatically assigns the next task to the picker based on business process configuration and priorities at a task type level. In the event, that a specific shipment requires to be moved to a higher priority, a supervisor uses the console to modify the priority manually. A user is assigned the task based on the priority. This reduces the need for a supervisor to call out or walk up to a user to indicate which shipment or task they need to work on.

Outbound Value-Added Services

The Sterling Warehouse Management System enables a warehouse to configure different VAS operations as part of outbound shipment.

Inventory picked for shipments that require VAS processing is putaway to the VAS department. VAS processes are diverse based on the type of item being processed. For example:

- Gift-wrapping each individual package with a personalized card.
- Monogramming on garments.
- Grinding coffee seeds to the required grind level.
- Assembly of a mobile phone with the appropriate front panel.
- Frequency programming

VAS operations may also apply only to a single carton in the shipment. This type of VAS operation is customer based and not based on the item picked in the shipment. Examples include, inserting marketing materials, return labels or packets, or inserting packing list.

All VAS processes are recorded through a VAS Station. A station is associated with activities that can be performed. A work order is associated with multiple activities that may be confirmed individually.

The completion of the VAS activities automatically initiates the next step in the route. Visibility is provided at a shipment level for the VAS work order.

Packing Cartons and Pallets

Packing operations or confirmation is performed on completion of the picking and/or VAS operations at a SKU level.

Certain pick strategies including "sort while pick" and "pick and pass" combine packing activity along with the pick. The pack process in this scenario is closing of the carton after insertion of appropriate material.

The pack process in other pick strategies including "pick and sort" is performed at the completion of pick of the entire wave or shipment.

The packing process captures additional information like serial numbers, ship by date and weight. Serial number is captured during the pack process only if the warehouse does not capture serial number as an inventory attribute. The Sterling Warehouse Management System automatically determines the weight of a container using the attributes at an item level and the corrugation weight. However, it is necessary for some warehouses to capture actual weight at a carton level.

The packing process ensures customer compliance. Packing is done into a container. The Sterling Warehouse Management System supports the ability to assign a unique license plate number or a SCM label to a container. In addition, a container may go through further VAS operations to meet additional customer requirements. Instructions to the customer or carrier compliance requirements like pallet height restrictions and stacking restrictions are provided.

Documentation is provided during the packing step based on the customer compliance or as per business process configuration. For example, customer compliance requirements to have packing list for each carton or only for the last carton.

The packing process for a Sterling Warehouse Management System-containerized carton directs the user to pack contents of the cartons. Visibility is provided to a user to the expected contents of a carton. A warehouse that choose to manually pack cartons after the pick operation is referred to as 'post-pick containerization', which records the license plate number and contents being packed at stations. A packer is informed of completion of the container packing or of an exception immediately. In the manual packing process, a packer informs the system of completion.

The Sterling Warehouse Management System also supports the feature of packing at a shipment level. A shipment is sorted into multiple pallets or cartons and unique license plate numbers or SCM labels are applied. The shipment is

considered as packed upon user confirmation of the labels associated with it. However, the contents of each individual carton are not known.

A single item broken into multiple physical containers is also supported in this manner. For example, a table where the legs and individual table are physical shipped as two or more containers. The Sterling Warehouse Management System ensures that the number of containers associated with the item is packed.

Freight charges for parcel shipments are placed at an individual container level. LTL and TL shipments are typically charged for their weight. Individual standard cases are placed along with other items into a larger carton or multiple cartons are shrink-wrapped together to optimize on the total charge for parcel shipments. This is referred to as "over-pack".

Quality processes to ensure picking and packing accuracy and customer compliance are enforced through business process configuration or through ad-hoc processes. The QC operator marks a container if the check fails.

The Sterling Warehouse Management System provides procedures for directed building of pallets by associating an outbound pallet to the shipment. A packer indicates when a pallet is complete and associates a new pallet with the shipment. A packer is instructed to place a container for a shipment into the appropriate pallet.

The license plate or the SCM label associated to the pallet allows subsequent movements on the scan of the label, into the trailer or to the appropriate shipping lane.

A shipment container or pallet is passed through a manifesting station in the case of pallet shipments or to a shipping lane awaiting trailer loading.

Documentation required in the inside of a container or on the outside of a pallet or container is automated through the raising of appropriate events to the application's print infrastructure.

Pack and Hold

The Sterling Warehouse Management System allows a warehouse to pick and pack shipments that are marked as 'Pack and Hold.' These pallets or cartons are putaway to appropriate locations for later retrieval.

Tasks are automatically created for a container based on the ship date attribute of a shipment.

The Sterling Warehouse Management System also supports last minute modifications to indicate that a shipment must be put on 'Pack and Hold.' It also provides complete location level visibility to all containers of a shipment.

Outbound Sorting

The Sterling Warehouse Management System enables a warehouse to sort outbound shipment containers into a location. Once a shipment container is sorted at a particular location, the system suggests the same location for other containers of the shipment until the user manually overrides the location.

Shipping

Shipping in the Sterling Warehouse Management System can be either LTL, TL, or Parcel shipments.

Dock Scheduling

The Dock Scheduling functionality of the Sterling Warehouse Management System enables you to manage all dock locations in a warehouse for receiving inbound shipments and shipping outbound shipments. The dock scheduling rules enables the user to specify number of days in advance to take a dock appointment.

The Sterling Warehouse Management System enables you to associate a dock schedule with a shipment or load. If scheduling is done for a shipment, the Sterling Warehouse Management System provides complete visibility into the shipment volume, weight, number of cartons available, and pallet information. Based on the Productivity Metrics (SAM definition), the duration of the appointment is also suggested.

Dock scheduling is based on the warehouse calendar associated with a dock and considers all working days and holidays, and shifts that are valid for receiving or shipping operations. Each dock can have its own calendar and shifts specified when they are available. You may also exclude certain docks from the scheduling process. For example, a warehouse may allocate one dock for UPS fluid loading, which may require one full day. In this case, dock appointment is not required for UPS fluid loading.

Each appointment is assigned a unique reference number. The time slot assigned for each appointment may vary based on the shipment size. For example, the duration for one appointment could be for 30 minutes and another appointment could vary between 45 minutes to 1 hour. Appointments can be changed to a future date in case the delivery fails. The Sterling Warehouse Management System creates alerts for such missed deliveries or pickups to ensure that new appointments are created. The Sterling Warehouse Management System also enables the cancellation of appointments that are already taken.

Due to additional resource constraints, a warehouse may not want to take more than a certain number of appointments at a given time. For example, if 20 docks are available for taking appointments, a warehouse may not want to schedule all 20 docks from 10:00 AM to 11:00 AM, as it may not be possible for a warehouse to unload all 20 trucks at the same time.

Appointments can be taken only for the number of days specified in advance.

Less-Than-Truckload or Truckload Shipments

Typically, LTL and TL shipments are physically sorted into pallets at a carrier level.

For LTL carriers, the Sterling Warehouse Management System can automatically generate PRO numbers.

The Sterling Warehouse Management System provides a VICS-compliant BOL for each shipment. Additional documentation for customs including commercial invoices and NAFTA ship by date documents can also be printed.

A shipment is marked as 'Shipped' upon confirmation at a BOL level or at a trailer level.

Trailer Loading

A load consists of a single shipment or multiple shipments. In TL and LTL shipments, it is critical to ensure that all pallets and containers are loaded into the correct trailer to ensure shipment accuracy and customer satisfaction.

A trailer manifest or Master BOL is printed for the load, if necessary.

Visibility is provided at a load, shipment and container level for a trailer indicating which containers have been loaded.

Manifesting

The Sterling Warehouse Management System supports both LTL and Parcel Manifests. The following sections provides a brief description about both manifests.

Parcel Manifest

Parcel shipment containers are processed through the manifest station. Each container is associated with the appropriate carrier's manifest at the station. For parcel shipments, the Sterling Warehouse Management System is capable of creating loads and load containers that can be manifested.

The Sterling Warehouse Management System supports parcel manifest procedures for parcel carriers including UPS, FedEx, USPS, and Purolator. Carrier-specific requirements are automatically provided at the station. For example, FedEx requires that each container being added to the manifest to obtain a tracking number from its Ship Manager Server.

The Sterling Warehouse Management System supports multiple billing options such as prepaid, collect and third party billing that are provided by the parcel carriers. International and domestic shipments are also supported. Special services for a carrier are also provided, which can be added or removed as needed.

The Sterling Warehouse Management System is configured appropriately at a carrier or SCAC level, to pre-generate tracking numbers and labels.

A manifest station processes containers belonging to multiple carriers. However, physical requirements or printer type compliance forces a warehouse to have a dedicated station for specific carriers. The Sterling Warehouse Management System also supports building of pallets for shipments to allow movements of containers at the pallet license plate level to the manifest station.

Integration is provided for in-line weighing scales, such as Mettler Toledo. The Sterling Warehouse Management System allows a warehouse to integrate with weighing scales connected to the MHE devices. In such situations, weight of the package is recorded as and when the container is diverted through MHE. Manual entry of weight is also allowed.

A unique manifest number is assigned by the Sterling Warehouse Management System or provided by the user. Parcel carriers provide tracking at both manifest

level and individual container level. The Sterling Warehouse Management System provides the capability to capture the return tracking number for carriers that support return services.

Typically, containers are fluid-loaded into the parcel truck. Confirmation of a manifest as an end-of-day process confirms the individual cartons as 'Shipped.'

Shipments that are added to a manifest gets shipped on closing the manifest. The Sterling Warehouse Management System supports Synchronous and Asynchronous closure of manifests, with the default being Synchronous closure. When manifests are closed synchronously, errors, if any are reported to the user on submitting the closure request. However, when closed Asynchronously, the user would need to check for alerts/errors in the Alert Console. The manifest status "Closure Failed" indicates occurrence of errors while closing the manifest.

LTL Manifest

Similar to parcel manifesting, all parent containers in LTL shipments and loads can be manifested. The Sterling Warehouse Management System provides the ability to include the entire load into a manifest, instead of manifesting individual containers. Upon confirming an LTL manifest, apart from LTL BOLs, a Trailer Manifest for all loads included in the manifest gets printed.

Exceptions in Outbound Execution

The activities during pick, pack, VAS and ship are dependent on the inventory available at each step. Typically, exceptions that occur in a warehouse include short picks, customer requests for cancellation of entire order or part of order. Modifications of carrier assigned, rebuild of pallets or re-containerization at a shipment level are also allowed.

In the case of a short pick, the picker requests for an alternate location. The Sterling Warehouse Management System automatically records a discrepancy against the location. If inventory is not found, the carton is marked as short pick and the shipment requires resolution after interaction with the customer.

A customer requests to modify an order or place an order on credit hold. The shipment corresponding on the order requires to be stopped. If necessary, the shipment needs to be cancelled. The Sterling Warehouse Management System facilitates this process by allowing moving of this carton into a problem area for resolution. Depending on the activities that have been completed on this carton, the picking and packing are undone. Inventory is created in the problem resolution that is putaway based on the algorithm.

The Sterling Warehouse Management System allows a problem container or pallet to be removed from the appropriate trailer or manifest before closing the manifest. At a shipment level carrier modification, re-containerization and re-building of pallets are allowed.

Cancellation of a wave automatically cancels the corresponding batches and tasks for all shipments.

Manual move request for putaway or retrieval is provided for ad-hoc moves of inventory into locations that have shortage.

The Sterling Warehouse Management System enables you to move products that are already allocated. After moving the allocated products into the location, the system automatically cancels the corresponding putaway task for these products.

The Sterling Warehouse Management System provides comprehensive visibility to shipment status. Audits are also provided at each step of the process to monitor user productivity and quick resolution.

Visibility

The Sterling Warehouse Management System provides comprehensive visibility to shipments, containers, waves through consoles. The combinations of the attributes are better illustrated through the following use cases or examples:

- View all shipments packed for a carrier
Criteria used include ship node, enterprise, carrier and status.
- View all shipments for which there is a shipping delay due to bad weather
Criteria used include ship node, enterprise, select 'Enter Shipment Dates' to enter today's date and status range.
- View all shipments that are part of a specific load
Criteria used include ship node, enterprise and load number.
- View shipments for a LTL or TL shipments using attributes
Criteria used include ship node, enterprise, shipment mode and BOL or PRO#, Trailer#.
- View shipments that are waiting for pickup
Criteria used include ship node, enterprise, delivery method and status range.
- View all containers that are packed and not manifested for a specific carrier
Criteria used include ship node, select 'Un-manifested Containers Only' and status range

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