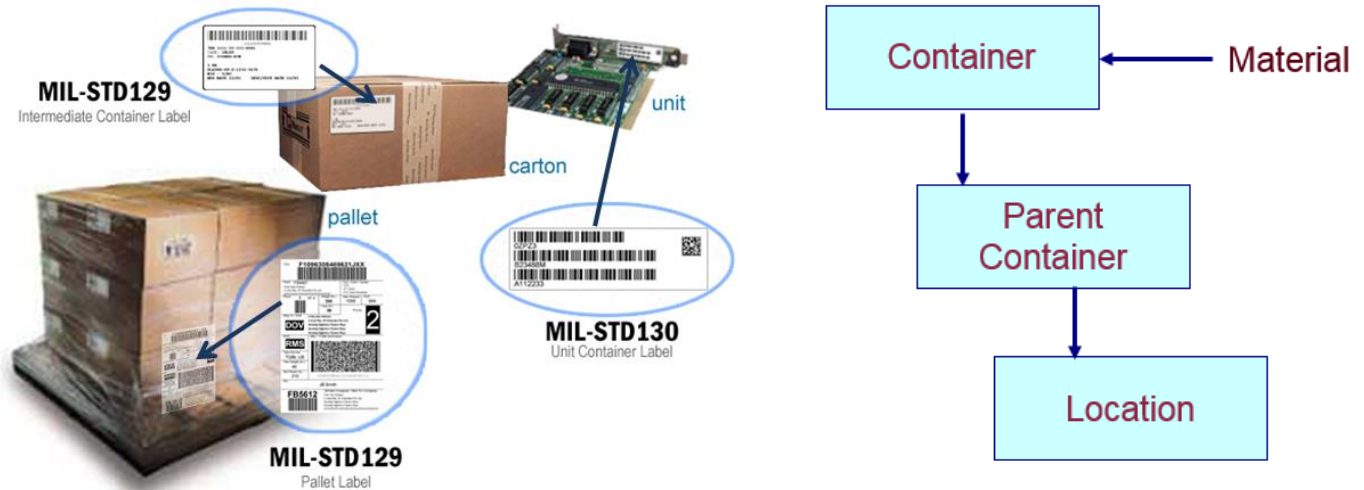## How BellHawk Stores Inventory Data

Concepts

Unlike accounting systems, which track the quantity of material in stock, BellHawk tracks material in containers. At its core it is tracking the quantity of each item in or on each container, such as a box, barrel, or pallet. To compute the inventory of a specific item, BellHawk adds up the quantities of the item in all the containers.

This is also different from ERP (Enterprise Resource Planning) systems, which track the quantity of an item at a location. BellHawk tracks the quantity in a container, which has a location. Each container may move from location to location and, as a result, the inventory at a location changes.

BellHawk has a very fine grained, physical view of locations. To BellHawk, a location is a shelf, a rack, or a floor location. A location can also be a subcontractor or installation site. This is different from many ERP systems, for which locations are typically warehouses or production areas. In BellHawk, warehouses and production areas are referred to as Facilities, which are supersets of its physical locations.

In many cases, with ERP systems, "locations" are used to give properties to the inventory stored there, such as waiting for QC inspection, even though the materials in this "location" may be in many different physical locations.

BellHawk tracks "physical" containers which have a license-plate tracking barcode and "virtual" containers which do not. As a result we can have a set of widgets in a barcoded box at a location or we can have these "loose" in a virtual container at a location. They could be be in a physical box without a tracking barcode, which is still treated as a virtual container.

BellHawk also tracks individually barcoded parts, which have a tracking barcode applied directly to each part. These parts are represented by a container with a quantity count of 1. They also typically have a serial number which is tracked by BellHawk.

BellHawk tracks the lot number and expiration date of the material in each real or virtual container. It can also track the quality control status of this material.

BellHawk can also track nested containers. As a result we can have a parent container, such as a pallet with its own tracking barcode, which has a set of cartons on it, each with their own tracking barcode, with each carton having individually barcoded parts within it. The benefit of this representation is that, when the parent container is recorded as being moved to a new location, then all the contents of the pallet are recorded as being moved to the new location.

This also enables BellHawk to keep track of what is left when a carton is removed from the pallet or a part is removed from a box. The removed cartons and parts can then be tracked individually.

BellHawk distinguishes between a Type 1 single use container that is restricted to containing a single part and lot number at the same time and a Type 2 multi-use container which can contain multiple Type 1 and virtual containers, as well as other Type 2 containers. In physical terms, Type 2 containers are things like pallets and shipping containers, whereas examples of Type 1 containers are boxes of bolts, cans of liquid, and reels of wire.

This fine-grained container and physical location view of the world enables materials managers to track their inventory in real-time and to be aware of its multiple physical locations at all times.

Container Database Records

BellHawk stores its inventory data in a containers table (tblContainers). Some of the important fields in this table include:

1. A global universal identifier – an alphanumeric identifier for the container record that is used when container data is being sent between devices and systems. This is normally a 32 Hexadecimal digit GUID that is generated when the container record is first entered.

2. Real or Virtual flag. A Real container has a tracking barcode and is physically tracked by its barcode. A Virtual container is how we track material without a tracking barcode that exists at a location or as one of a number of different materials in a Real container that has a tracking barcode.

3. A unique tracking barcode – this is how material handlers uniquely identify a physical container. This is required for all Real containers. A pseudo tracking barcode is generated for virtual containers in the form BBBBB>NN where BBBBB is the barcode of the immediate parent container or location and NN is the sequence number of the virtual container within that parent container or location. This is used for selecting virtual containers for transactional purposes.

4. Container type ID –indirect reference to its container type (box, roll, reel etc.,) record which describes whether the container can be used to hold only a single part number or can hold multiple different part numbers.

5. Parent ID – this is the ID of the parent Real-Container. If there is no Parent ID then the material is in a Real or Virtual container at the specified location.

6. Location – this is the physical location of the material.

7. Item Number – this is the part number for the material stored in the Real or Virtual container. This will be absent if the record simply represents a Parent container, such as a pallet that has a number of Real or Virtual containers of different material stacked on it.

8. Quantity – this is the quantity of material in the Real or Virtual container.

9. Lot Number

10. Expiration Date

11. Serial Number

12. Quality Control Status

13. Unit Cost for materials in the container.

14. UDP - which contains user defined parameters for the container, such as length, width and color.

15. IsDeleted - this is normally set to 0. It is set to 1 to indicate that this record is not part of physical inventory.

16. IsWIP - this is set to 0 for "normal" inventory and 1 for Work-in-Progress inventory, which is material in process of being converted to the end product of a work order.

17. IsPending - this is normally set to zero unless this is for a container for which a pre-printed label has been printed or for which an advanced shipment notice has been received but the container has not yet been received in the plant.

BellHawk not only tracks active containers but also tracks containers of material that have been consumed or shipped. It marks these inactive containers with the IsDeleted flag so they do not appear in inventory. But it keeps them in its database so that the data is still available for shipping and similar reports that may refer to them, even if they are not in inventory.

This also enables easier handling of returned material that has a tracking barcode.

Container Types

Each container record, which relates to a physical container, references the container type, through its ID in the container type table (tblContainerTypes). Some of the useful fields in this table, which impact on the way BellHawk tracks its inventory, include:

1. ContainerType - an alphanumeric string, such as Box or Bag, that identifies the container type

2. IsMultiUse - if this is 0 then this container type is a Type 1 (single use) container with its own tracking barcode, or an individually barcoded item (as set on the Item master record), or a virtual container. If this is set to 1 then this is a Type 2 parent container.

3. IsResusable - if this is 0 then the container is assumed to be discarded when empty. If this is set to 1 then the container record is retained when it becomes empty so that it can be reused. For example a box may be considered to be non-reusable whereas a tote would be reusable.

4. Tare weight - assumed weight of empty container of this type.

5. Tare weight UOM - unit of measure nomenclature (such as Kg) for this type of container

Usage Examples

There are several special cases that we use all the time in tracking materials:

1. A Type 1 container. This is a real container with a tracking barcode that contains a quantity of a single part number of a specific material that has a single lot number, quality control status and expiration date. This is most commonly used for tracking raw materials and work-in-process. Here the containers type is set to be single use.

2. A Type 2 container. This is a parent barcoded container that has one or more virtual or real containers with this container as its parent. This is typically used to represent shipping cartons and pallets that hold multiple different part numbers. Here the container type is set to multi-use.

3. An empty container. This is a barcoded container that does not yet have any materials picked or moved into it. It is typically recorded into the system using a Tag Container transaction, ready for picking materials into.

4. An individually barcoded item. This is a part, such as a circuit card or an electric motor that is tracked independent of a physical container. It has its own tracking barcode and always has a quantity of 1 each. This is different from a roll of material, which will also have its own tracking barcode, but will have a weight or length that will vary with the amount of material on the roll.

5. A serialized item is an individually barcoded item that also has a serial number that needs to be recorded when it is entered unto inventory.

6. Loose material at a location. This is where the material is stacked directly on shelves or racks or is stored in Silos. Here there is no container barcode. Instead these materials are tracked in Virtual containers at the location. There may be several materials in Virtual containers at a specific location.

7. Loose material of different types in a parent container. Here we have multiple virtual containers in a Type 2 container. When new materials are added to the Type 2 container a new virtual container is created unless the Item, Lot Number, Expiration date, and UDP parameters match an existing entry in the Type 2 container. In this latter case the quantities in the two virtual containers are added.

8. When new materials are added to a Type 1 container that already has material in it then the material can only be added if the Item, Lot Number, Expiration date, and UDP parameters match, when the quantities are added, otherwise the entry is rejected.

In the illustration, at the beginning of this paper, the printed circuit cards are serialized items with their own individual tracking barcode. They are placed inside a Type 2 container. These Type 2 containers are stacked on a Type 2 pallet. If the items placed in the cartons were not individually barcoded, then they would be placed in Type 1 containers (same part and lot number) which would be placed on the Type 2 pallet.

It should be noted that BellHawk only tracks quality control status, lot numbers, and expiration dates for material in Type 1 containers, for individually barcoded items, and for virtual containers. It does not track these values for Type 2 parent containers.

BellHawk is setup to make it easy to track materials in Type 1 containers or to track individually barcoded items, as these are the most commonly tracked items in manufacturing and other similar industrial operations.

Type 2 containers are also easy to track or ship as an entity by simply scanning the barcode on the outermost parent container. But it requires more data entry to select which of multiple materials or lot numbers you wish to withdraw from a Type 2 parent container or directly from a physical location.

Commentary

The container representation that BellHawk uses is a very powerful and concise way of storing inventory data. It allows for a wide variety of storage configurations from loose material on a shelf to complex nested container representations. It is designed to make it as simple as possible for material handlers to record the receipt, usage, production, picking, packing and shipping of materials.

But this representation can sometimes be confusing, especially when initially setting up a BellHawk system for a specific application. So, please contact us if you have any questions, or simply don't know the best choice for representing some class of your materials. Our experts have implemented many of these systems and can quickly advise you as to the best way to use BellHawk to track your inventory.

BellHawk keeps historical track of every inventory transaction on containers in its tblInventoryTransactions database table. It does not, however, have the ability to readily recall the total inventory of a part on a specific date in the past. If this historical record keeping is required then nightly snapshots of the inventory should be taken using Bell-Connector and these should be transferred to an accounting or ERP system that is setup to provide historical inventory records.