

# **PROJECT REPORT**

**ON**

**IBM MAXIMO 7.6.0**

**BACHELORS OF TECHNOLOGY**

**IN**

**ELECTRONICS AND COMMUNICATION**

By

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SOLAN**

# DECLARATION

I hereby declare that the project work entitled **IBM MAXIMO 7.6.0** submitted to the Department of Electronics and Communication, Jaypee University of Information Technology, Solan is a record of an original work done by me. This project work is submitted as a part of partial fulfillment for the award of the degree of Bachelor of Technology under Jaypee University of Information Technology.

Name and Signature of the student

.....

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# CERTIFICATE

This is to certify that the work titled **IBM MAXIMO 7.6.0** submitted by **Krittika Tewari** in partial fulfillment for the award of degree of Bachelor of Technology in Electronics and Communication Engineering of Jaypee University of Information Technology, Solan has been carried out under my supervision.

Signature of Supervisor

Name of Supervisor - Mr. Sheetal Gadale

Designation - Architect

## **ACKNOWLEDGEMENT**

I take this opportunity to express our gratitude to our supervisor Mr. Sheetal Gadale for his insightful advice, motivating suggestions, invaluable guidance, help and support in successful completion of this project and also for his constant encouragement and advice throughout my internship programme.

The in-house facilities provided by the company throughout the internship programme are also equally acknowledgeable. I would like to convey our thanks to the colleagues for invaluable help and support.

Krittika Tewari

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## **ABSTRACT**

With time, the human population has increased, and human life has become very complex. The advent of digital computers and growth in the field of computing and communication, human life has helped in easing out the complexity and reducing the world to a global village. The growth of population has led to increased demand of items that are produced and it needs to be marketed at any place in the world at the right time. The demand and supply chain therefore are not that easy to be handled by the human being. Technology has come to the rescue of providing right information at the right time, which is greatly helpful in decision making, planning and control. It provides real-time information to guide the future investment plan. In this project, one Enterprise Asset Management (EAM) software has been studied and handled. The author thanks Wipro Limited, Pune for providing the opportunity to expose her to IBM Maximo during the internship period, an Asset Management software which has been integrated with Enterprise Resource Planning (ERP) software.

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# CHAPTER 1

## INTRODUCTION

IBM Maximo is an **Enterprise Asset Management (EAM)** product that provides the capability to maintain, repair and operate (MRO) of any asset type throughout its life cycle. Maximo incorporates the organization maintenance strategy and planning into the product. This includes a number of applications, grouped into modules to facilitate a maintenance strategy.

- **ASSET MANAGEMENT:** Enables the organization to effectively track the asset throughout its lifecycle. This includes the location of the asset, safety related information, meter and meter readings, which are used in predictive and preventive maintenance of the asset.
- **WORK MANAGEMENT:** Enables the organization to manage both planned as well as unplanned work activities, such as emergency maintenance. It enables the planner to identify the labor, material, services and tools required to complete the work as well as check for the availability of those items. When a planner views item availability, they can ascertain quickly the quantities of item available in each storeroom, or checks which alternative item can be brought to use, if not available, view any outstanding purchases of the item and determine which work order has reservations for the item.
- **INVENTORY MANAGEMENT:** This enables the organization to ascertain the details of asset related inventory and its usage. This includes available balances, any issues and transfers, economic order quantities, vendor details, including vendor analysis. Maximo can automatically generate purchase records when the available inventory balance reaches the reorder point and initiate the procurement process for the organization.
- **PURCHASE MANAGEMENT:** From vendor management to item management to generating records such as purchase request, request for quote, Maximo provides



receiving, return and inspection capabilities to ensure that the items received from the vendor meet the requirements and are not damaged. As these items are received, the inventory balances in the storerooms are automatically adjusted, or in some cases, directly issued to the work order.

- **CONTRACT MANAGEMENT:** Maximo provides a number of contract types by the vendor. These contract types include purchase, lease, rental, warranty, labor rate and user-defined contracts. For example, by setting warranty contracts, the organizations reduces the chances that it will perform unnecessary work on assets that are still covered under warranty.
- **SERVICE AND CUSTOMER MANAGEMENT:** Enables optimization to define service offerings, and proactively monitor service level delivery, and implement escalation procedures, to reduce service level breeches that impact customer management. It can bill the customer for all the services provided. The service provider can create response plans to ensure that the service is delivered in the prescribed manner.

Maximo can be extended to better meet the specific needs of the industry.

- IBM Maximo for Transportation
- IBM Maximo for Life Sciences
- IBM Maximo for Oil and Sea
- IBM Maximo for Utilities
- IBM Maximo for Nuclear Energy

Some add on solutions can also be added to Maximo to enhance product functionality. Maximo can also be used on mobile devices such as Maximo Anywhere, or Maximo Everyplace and hence supports smarter infrastructure.

## **1.1 PRODUCT OVERVIEW:**

- ❖ **PLAN:** Many organizations make use of maintenance strategies like Total Productive Maintenance (TPM) and Reliability Centered Maintenance (RCM) that drives how the asset is acquired and sustained throughout the life cycle.

TPM incorporates reliability and maintainability characteristics in the design of the product to be acquired or built.

- ❖ **ACQUIRE:** Vendor management from authorizing use of vendor, obtaining competitive bids from vendors, obtaining internal approvals for spending and accomplishing inspection of materials and services.
- ❖ **COMMISSION:** Location of assets, maintenance of job plans, various predictive maintenance schedules and identifying the user, custodian and owner of the commissioned asset.
- ❖ **MAINTAIN:** Once the asset is operational, a host of maintenance work may be needed to be performed. Maximo can automatically generate Preventive Maintenance (PM) schedule. Work may also be needed to be performed on corrective or emergency basis, where some assets may be sent to repair facilities. As the work is performed, it will consume some parts and may need to be reconditioned. This impacts the inventory balances of spare and consumable inventory items and there may fall a need to replenish these items in the storeroom.
- ❖ **DECOMMISSIONING:** At some point, the asset is going to reach the end of its life. One way of tracking assets that have reached the end of their life is to create a location that represents the vendor and the type of disposition.

When Maximo is first installed, the media is extracted on a physical or virtual machine known as Administrator Workstation. Administrator Workstation contains the file structure for Maximo, that is, the necessary files that are deployed to Application Servers so that users can access Maximo. It is used for any updates to the product and hence, it should not be destroyed. Maximo is a J2EE compliant file and is deployed to the application server.

IBM Maximo is an integrated productivity tool and database that helps you achieve maximum efficiency by managing all kinds of assets on a single software platform.

Built on a service-oriented architecture (SOA), Maximo Asset Management delivers a comprehensive view of all asset types, their locations and the work

processes that support them to provide optimal planning, control, audit and compliance policy.

Maximo Asset Management is composed of six modules that in turn contain applications or sub-applications. Six of key management modules are:

1. Assets
2. Work
3. Service
4. Contracts
5. Materials
6. Procurement Management

Based on Java platform Enterprise Edition, Maximo lays a significant focus on configured tooling-such as Application Designer for modifying the user interface, Database Configuration for adding new tables and columns, Maximo Asset Management tailors the software according to the needs and requirements of the customer.

## **SOFTWARE REQUIREMENT:**

1. **Toad for Oracle:** Toad for Oracle keeps on being the standard instrument for database improvement and organization. Toad for Oracle gives an instinctive and proficient route for database experts of all ability and experience levels to play out their employments with a general improvement in work process viability and efficiency.

### **With Toad for Oracle you can:**

- Overseeing Database Connections
- Channel information

- Alter information
- Export information
- Execute contents
- Write and execute queries

2. **OA12 Adapter:** You should design the connector in Maximo Asset Management to send value-based information between Maximo Asset Management and Oracle E-Business Suite. After you complete the adapter setup, Maximo Asset Management can change information from its organization to a format that is reconcilable with OracleBusiness Suite and the other way around.

## Chapter 2

### ASSETS

#### 2.1 Introduction

Assets application is used to create and store asset numbers as well as to associate information such as location, vendor, parent, status as well as maintenance cost for the asset. Asset hierarchy enables Maximo users to roll up vendor costs so that one can check accumulated costs at any level.

Assets application is primarily put to use for the following purposes:

- Search for asset records.
- View, modify, add, or delete the main record for an asset.
- Create the asset order and view the subassemblies.
- Understanding, transform, add, or delete safety records for an asset.
- View or add meter information for an asset.
- Specify or view the conditions for an asset as recorded in the Classifications application.

There are two types of assets managed with the help of Maximo:

- **ROTATING ASSETS:** Rotating assets have both a distinctive asset number and an inventory item number. The item number lets the users trace assets as a group as they are moved in and out of inventory and other types of locations, while the asset number is useful to trace individual instances of the asset as it is moved from one location to another and from one site to another.

- **NON-ROTATING ASSETS:** Non-rotating assets do not move in and out of storerooms. A non-rotating asset has a unique asset number, but does not have an item number as it is not tracked in inventory.

System uses priority to indicate priority for work orders, assets and locations. The calculated priority can determine the overall priority of work orders among work orders that pertain to similar assets or locations.

Assets can be moved from one inventory location to another inventory location. It can also be moved from one site to another site within the same organization or to a site in a different organization. In order to create new assets for an organization, following steps should be done:

1. Go to Assets Application from Maximo Start Center.
2. Click the New Asset icon from the toolbar.
3. If the asset is Rotating, specify its value in the rotating
4. If this asset has a parent, type a value in the **Parent** field. If the parent asset is associated with a location, the location value is copied to the **Location** field. Merely assets that are in non-inventory locations can be assigned as parents. You cannot build an order when assets are in a stockroom.
5. Save the asset.

An asset user can be associated to the asset as a user or a custodian.

- **User:** A user is a person who uses the asset
- **Custodian:** A person who is responsible to take care of the asset.

A status can be assigned to an asset, to define its current state of operation. It is used to indicate the whether the asset is operational.

- **Not Ready:** It is also the default status assigned to an asset. Preventive maintenance records are generated when the asset is commissioned or it is

in operating status. This status is used to designate the installation of the asset.

- **Decommissioned:** This indicates that the asset is out of service permanently or no longer put to use.
- **Operating:** The asset has been commissioned and is in working condition.
- Inactive
- Missing
- Sealed
- Active
- Limited use

Assets can also be assigned to a general ledger account.

Spare parts can also be added to the asset template. Having the right spare part at the right time is useful for maintaining the asset. Managing the spare parts inventory of an asset is important for the maintenance of the assets of any organization.

## 2.2 Item Assembly Structure

Item Assembly Structure (IAS) includes spare parts, sub-assemblies or both. It is a list of parts that are required in order to build an item or define the requirements of a location. IAS can be copied and used for the existing items. This helps Maximo users in saving time. IAS can only be applied to an asset or an operating location.

Rules for defining an IAS:

- If the parent is a rotating item, add either rotating or non-rotating item to the Item Assembly Structure.
- If the parent item is a non-rotating item, add only non-rotating item to the IAS.
- Rotating items cannot be added to the IAS if the parent is a non-rotating item.
- If a non-rotating item is added to the IAS, its child rotating item also becomes a part of parent rotating item and do not have their own inventory balance.

If the parent has 'Maintain Hierarchy' flag checked, then we can make asset-related changes only at the top level, that is, at the parent level.

## 2.3 Moving assets

A location is defined as a place where the assets are operated, stored or repaired. Locations for an asset can be defined as the following types:

- **Operating location:** Location where the asset operates. For example: Work orders, tickets
- **Asset type:** Vendor, salvage and repair. The users can track the asset as they move from one location to another.
- **Inventory locations:** They are classified as labor and courier. They can maintain a balance of rotating items that are issued from a storeroom. Non-rotating items can be moved to organizations with different item sets. When moving rotating items to a different organization, the receiving organization must have the same item sets.

Return item operation should be used, when an item has been expended by a GL entity, but for one reason or the other, the item was not necessary, and it had to be returned back to the storeroom at full-issue value.

Assets can be moved from one current site to another site within an organization or to a site in a different organization.

Related assets can be bundled by accessing first record in hierarchy and selecting the **Maintain Hierarchy** check box.

Every asset within a site must have a unique asset number by means of which, it can be identified. If the site the users want to move an asset to have a same asset number as the one the user is moving, then one must assign a different asset number to the asset being moved.

Maximo decommissions asset number in the previous site, keeping its previous history and builds a new history for the asset at the new site.

Swapping assets involves replacing one asset with another one. Swapping is done between two non-storeroom locations.

**Moved** checkbox is selected in order to indicate that the asset has been moved.



## 2.4 Modifying assets

GL Accounts can be assigned to location records, asset records, or both.

There are three types of associations with an asset or a location.

1. **Primary:** By default, the first person that you associate with an asset or a location is designated as a primary contact for that location. The primary has the ultimate responsibility for an asset as well as a location. The first person to be associated with an asset must be its owner. If other people are associated with an asset, then the primary ownership can be moved to another person.
2. **Users:** A user is a person from the vendor site who makes use of the asset. A user has a direct access to as well as the usage authorities for the given asset.
3. **Custodian:** A custodian is a person who is responsible for maintaining the condition of the asset, using condition monitoring. Custodians might work directly with the user of an asset, but does not directly access the asset.

Assigning users and custodians to an asset makes it easier to find and repair assets as and when needed in self-service applications.

Asset templates can be made use of to specify common asset information, which can be applied to multiple assets of the same kind. Spare parts, meters, and data sheets can be associated with the templates. Specifications and preventive maintenance can be mentioned for an asset template as well. Attributes can be added to select subset of the asset, by going to Specifications tab of the Asset window. Records to which the attributes need to be selected by using select records checkbox.

Downtime for an asset is used to refer to time periods when the system is unavailable. It is a period of time when the system fails to provide information or perform its primary function. To report Asset Downtime, following steps are undertaken:

- Expand **More Actions** menu.

- Choose **Report Downtime** option from the menu.

Downtime can either be reported using Assets application, or using work order.

## 2.5 Failure Codes

Failure codes are linked in parent-child relationships, to form a failure hierarchy. A failure hierarchy is a set of data on the problems, the causes, and remedies for asset-based failure as well as location-based failures. A failure hierarchy is identified by a failure class.

Each failure code can have one or more child failure codes. By identifying the failure class with an asset, or a location, we can conduct failure analysis. It helps the user build an accurate history of problems that lead to asset location and failures.

In Maximo, a failure hierarchy consists of:

- Problems
- Causes
- Remedies

Here, Causes window is paired with the Problems window. Remedies window is paired with the Causes window.

The user can make use of **Quick Reporting** application or the **Work Order Tracking** application to record asset or location failures on work orders.

Failure class is specified for a work order even if the asset or location does not specify one. It helps on reducing the number of duplicate work orders in the system.

## 2.6 Meter Types in Maximo

There are three basic kinds of meters that can be associated with an asset:

- **Continuous:** They are cumulative and are used for measuring consumption or accumulation. They are useful for tracking things such as miles, hours, pieces produced or the fuel consumption.

- **Gauge:** These meters are used for performing condition monitoring based on assets as well as locations. They are useful for tracking a range of values such as temperature, pressure, oil level, etc.
- **Characteristic:** They are observational and have a list of derived values. They are useful for tracking characteristics of a substance, such as, its color, clarity or texture.

Meters can not only be associated with assets, but also with asset templates. The user may modify the pre-defined meter definitions by making use of meter applications. Meters are defined to track the location and performance of the assets/locations.

An asset or a location can have multiple meters associated to it. Meter groups represent a collection of meters that are used together multiple times. By making use of a meter group, multiple meters can be added to the assets at the same time.

Meters must be defined in meters application first, before they can be used in meter groups or any other applications.

## CHAPTER 3

# PREVENTIVE MAINTENANCE

### 3.1 Introduction

IEEE characterizes reliability as the capacity of the framework or a segment to play out its required capacities appropriately, under expressed conditions, for a particular

- ❖ Equipment: It alludes to the substantial things.
- ❖ Assets: Refers to a particular physical thing, for example, gear, segments, apparatus, infrastructure
- ❖ System: Refers to a progression of hardware that work together as a solitary unit, for example, a generation line or a ventilation framework. It is a client characterized gathering of parts or offices that help an operational requirement.
- ❖ Functions: These allude to an activity or a necessity that a part or a framework must achieve, now and then, characterized in terms of its execution capacities.

Reliability Centered Maintenance (RCM) is a logical procedure, used to decide the ideal maintenance technique for physical resources. It is a propelled maintenance technique, for expanding resource accessibility, by limiting downtime brought about by failure and expanding generally speaking gear viability.

The clear aim of RCM is to improve resource dependability and enhance the adequacy of the support program.

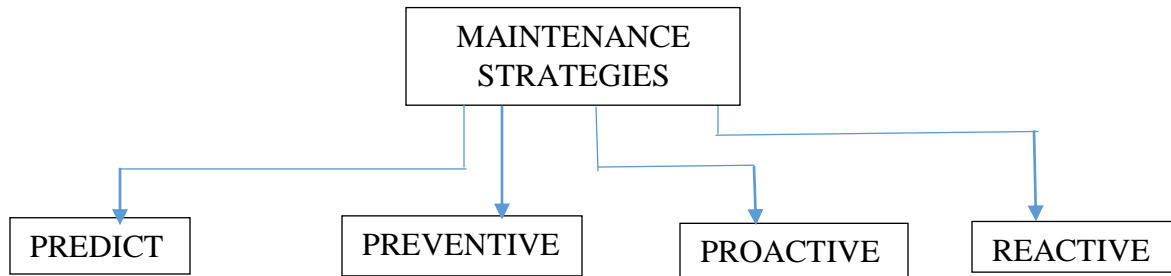


Fig 3.1 Various types of Maintenance Strategies adopted by EAM applications.

**Predictive:** Maintenance tasks are performed to detect impending failures by using non-intrusive techniques such as visual inspection. Maintenance is performed only when certain indicators show signs of decreased performance and fall below certain established acceptable limits.

**Preventive:** Process of performing the maintenance tasks to minimize the probability and severity of lost or degraded functions. These tasks on a recurring basis related to calendar time, equipment age, without regarding the condition of the equipment.

**Proactive:** Failure finding tasks are performed on a regular basis to detect hidden failures or failures that can be avoided without giving evidence of impending failure.

**Reactive:**

Preventive Maintenance is a maintenance program with activities that are initiated at pre-determined intervals and intended to reduce the probability of failure or the degradation of functioning of the system.

A route is a list of related assets, or locations or both. The assets and locations are considered as stops along the route.

In Maximo, the users create a PM, assign a route to a PM, and generate work orders from a PM. PM hierarchies are used to generate an organized group of work orders from an asset or location hierarchy.

Preventive Maintenance is basically divided into:

- Planned work
- Condition-based work

Condition monitoring is used to keep track regularly of the state or degree of change in specific measurable parameters to indicate a developing or impending failure.

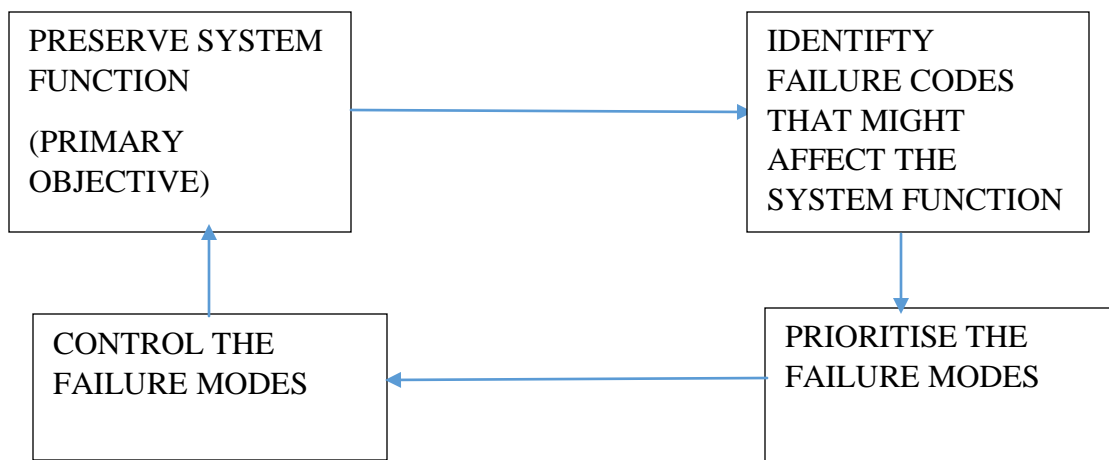


Fig 3.2 Four principles critical to any PM

Preventive maintenance is planned maintenance of facilities and equipment that is designated to improve the equipment life and avoid any unplanned maintenance activity. It is a proactive maintenance program which includes painting, lubrication, and cleaning, adjusting as well as minor component replacement to extend the life of equipment as well as facilities. This work is either periodic, i.e., based on time intervals, counter readings or events, or directed based on conditions, determined from diagnosis tests, inspections and other kinds of monitoring.

Preventive maintenance module in Maximo contains Master PM and Preventive Maintenance Applications, that are used in creation and management of preventive maintenance records. They are written against a specific asset, location or a route. One can create a PM record for either an asset or a location, but not both.

A service interval is defined for each and every PM record. It refers to the frequency with which maintenance related work is performed. PM work orders are generated based on elapsed time, meter readings, or both. The user can also specify the active days, dates, seasons in which the work order can be generated.

The user can also establish parent-child relationships between similar PMs to build a PM hierarchy, which enables the user to generate hierarchy of related work orders.

### **3.2 MASTER PM**

Master PMs act on organizational as well as site level. However, master PMs cannot generate work orders. They serve as templates that are set up to govern certain aspects of other PM records, identified as associated PMs. Aspects include information related to frequency, work detail, lead times, active season and job plans.

Master PMs are used to control and update associated PMs. They are defined for an item, while PM is mainly defined for an asset. Associated PMs are records created from a master PM or contain a reference to a master PM. Some of the aspects that are defined for a PM are:

- **Lead Time:** Number of days in advance of the next due date when Maximo generates work orders from a PM. Lead time is useful for generating alert messages before the work orders can be generated.
- **Counter:** Number of work orders generated by a PM since the first start date. Counter value is set to zero when one creates a new PM record.

Work orders are generated from a PM automatically by setting up and enabling alert notifications, based on the status of the work order.

In order to create a new PM record, following steps have to be performed:

1. In the Preventive Maintenance application, we select **New PM** from the toolbar.

2. Specify a value for the PM Field as well as enter a description for a PM in **Long Description**.
3. Specify the value for the Location, Asset, or GL Account fields. The asset or location is the entity for which the Maximo user intends to schedule work orders.
4. **Route** field is optional.
5. Select the **Use this PM to Trigger PM Hierarchy** if the user wants to generate work orders for the entire hierarchy when this PM becomes due. If the user does not want to generate work orders for other PMs in the hierarchy, this check-box can be ignored.
6. Go to Frequency Tab. Frequency for automatic generation of work orders can be based on the basis of:
  - **Using Last Work Order's Start Date to Calculate Next Due Date:** It uses the start date for the previous work order to generate due date for the next work order.
  - **Based on meter readings (Do Not Estimate):** We use this option if the user wants the work orders to be generated automatically when a defined meter reading has reached.
  - **Generate work order when a meter reading has reached:** This checkbox needs to be selected when we want work orders for a PM to be generated automatically when the meter frequency has been reached or entered.
7. If the PM is a seasonal one, define the active days/days in which the Maximo user wants the PM to be active.
8. If the PM is a parent record, define Child PMs in the **PM Hierarchy tab**.
9. Associate Job Plans for the PM. A job plan is a detailed description of the work that is performed by a work order. Job Plan generally includes tasks and information about estimated labor, materials required and labor hours. Save the PM.

In Preventive Maintenance Applications, only continuous type meters meters can be associated to a PM record. For a floating schedule, the system uses the completion date for the previous work order to calculate the estimate due date for the next work order. While working with a floating schedule, the user cannot generate work orders until the current one is complete.



With PM job plan sequencing, one can assign weekly, monthly, quarterly and annual job plans on an asset or a location. By assigning a sequence number to each job plan, the user specifies which job plan Maximo selects each time a work order is generated. Maximo also makes use of Nested Job Plans.

The user might force or set the counter to a specific value, thereby making the PM generate the next work order using a specific job plan. PM Counter might be modified by the user for one of the following reasons:

- The PM or job plans can be entered in the middle of asset's or location's maintenance cycle.
- Counter might have reset due to one reason or another.
- Next sequenced job plan might need to be urgently performed.

### **3.3 PM Hierarchy**

There are several conditions that need to be fulfilled for PM hierarchy.

- ✓ At the highest level, there is only one parent PM.
- ✓ The top level PM can have one or more child PMs.
- ✓ Each child PM can have one or more child PMs.
- ✓ A child PM can have only one parent PM.
- ✓ Sequence numbers are copied from PM to the work orders.
- ✓ The user cannot delete a PM that is already a part of hierarchy.
- ✓ If any PM in the hierarchy is due, then that PM will generate the work orders for the entire hierarchy.

#### **PM Hierarchy Processing Rules**

- Maximo first evaluates the top-level PM, and if that PM is due, then the PM triggers PM Hierarchy to generate work order hierarchy.
- If the top level PM is not due, then the system evaluates each child PM in that hierarchy. If a child PM is due, it checks whether "Use This PM to Trigger PM

Hierarchy” checkbox is not selected. Then the current child PM will generate Work Order hierarchy.

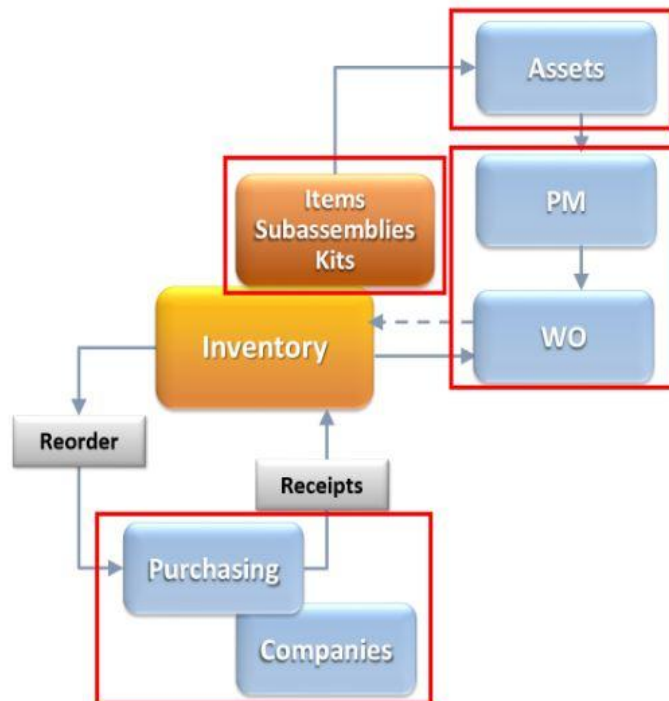
- System generates Work Order at each level where the PM generated it.
- If one PM cannot generate work order in that hierarchy, then work orders are not generated for any PMs in the hierarchy.

## CHAPTER 4

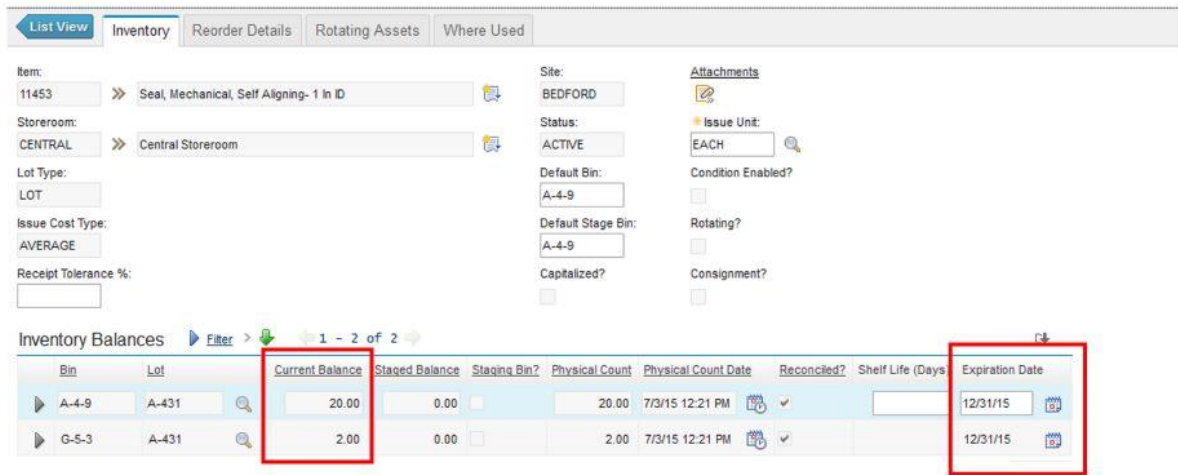
# INVENTORY MANAGEMENT

### 4.1 INTRODUCTION

The Maximo users can make use of inventory application to enter, display and update information related to a specific item at a specific storeroom location. We can view balance summaries, set reorder quantities, manage reservations, and adjust the balances and costs of an item. The users can also check the availability of all storeroom locations that stock the item.



**Fig 4.1** Process Cycle adopted by Maximo modules



**Fig 4.2** Options that can be used while creating a new inventory in Maximo

**View Item Availability** action enables the user to access information such as quantities within each storeroom, work orders currently reserving the quantity of an item.

**View Inventory Transaction** option uses a tool to view inventory transaction for an item such as receipts and transfers, issues and returns and adjustments. On receiving the orders, we can specify and sort the items into various bins.

When an item is set to **LOT**, an expiration date can be established for items when received into the storeroom. When the stock expires, the expired quantity is deducted from the current balance to determine the quantity available balance. The default value for all the items is **NOLOT**.

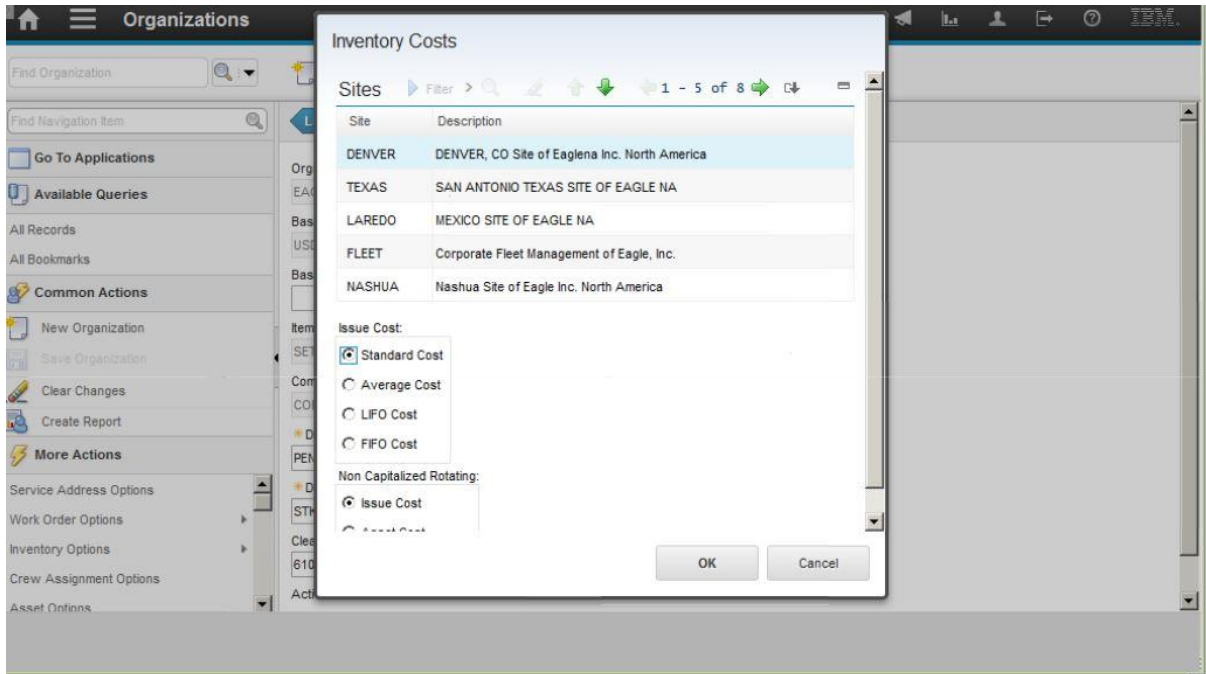
Inventory management aims at improving the item availability in the storeroom by reducing cost.

There are many costing methods using which the users might control the cost of inventory items:

- **Standard:** Estimated cost of labour, material, overheads, and other costs are given in a given accounting period.
- **Average:** This kind of costing method is used when a lot of items in the inventory are similar to one another and the cost becomes intertwined and it gets cumbersome to get specific costs of various units of items. It is computed by dividing the cost of goods in inventory by the number of items in the inventory.
- **LIFO:** Last In First Out method is a method which makes use of the assumption that the items that are bought first are also sold first. This costing method makes use of the receipt cost of items that were most recently purchased and are newest in the storeroom.
- **FIFO:** The FIFO method, the oldest cost will be removed first and will be reported as a part of income statement.

When the Maximo user changes from Standard to LIFO/FIFO costing, Maximo creates a new **INVLIFOFIFOCOST** record.

When a Maximo user changes the item from LIFO/FIFO to Standard Costing, the application takes the total unit cost from INVLIFOFIFOCOST records, and divides the total by the total quantity.



**Fig 4.3** Setting up Inventory Costs from More Actions Menu of Organizations Application

Inventory management also incorporates the use of various kinds of reservations. Reservations are created in Maximo in order to ensure that various items are restocked so that they can never run out of stock and can be used by the client as and when required.

- **Hard Reservation:** A hard reservation implies that the inventory items needed are time-sensitive and are required on an immediate basis. The needs of the item are defined by a specified time-frame.
- **Soft Reservation:** These kind of reservations are not time-sensitive. Its demand is not critical to task completion.
- **Automatic Reservation:** Automatic Reservation uses the following equation:  

$$\text{Required Date} \leq \text{System Date} + \text{Inventory Lead Time}$$
 If the equation is evaluated to be as true, then the system will automatically set the reservation type to **APHARD**, otherwise **APSOFT**.

Reconcile option is used to adjust the current balance of the item equal to amount recorded during the inventory physical count.

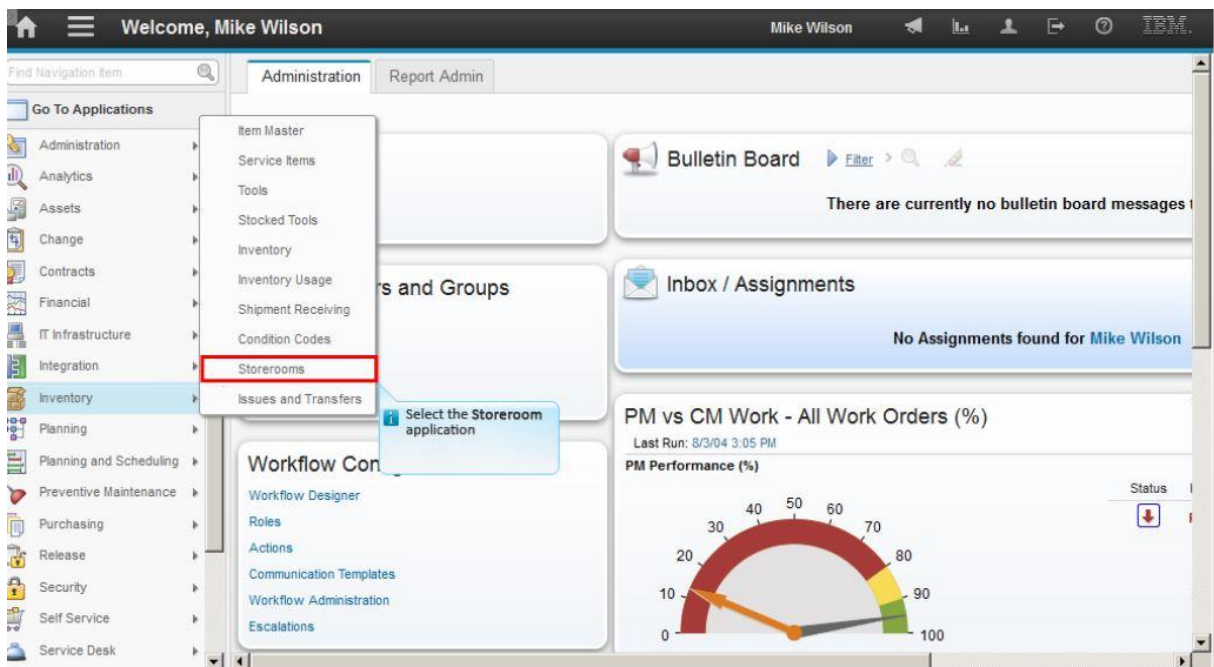
Maximo users also have an advantage to reorder inventory items as they are needed. Reordering can be done by:

- Manually via Reorder Actions
- By scheduling in ReorderCronTask

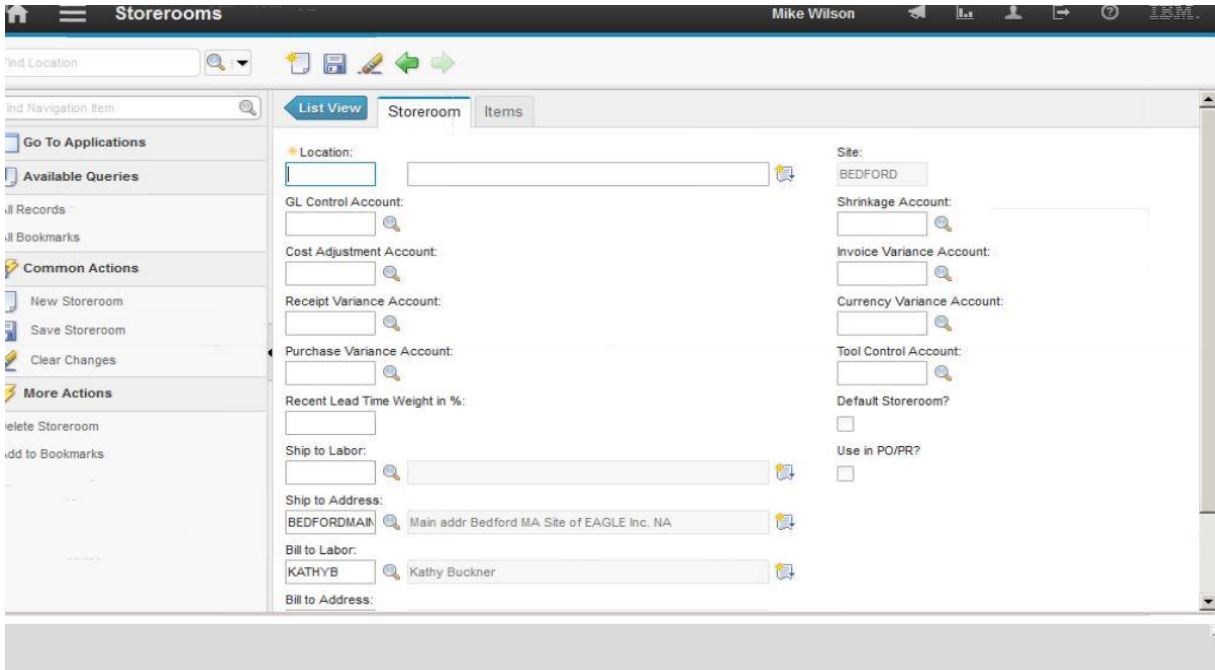
## 4.2 Inventory Locations

Inventory locations are defined:

- ❖ To issue items and tools
- ❖ For transferring items and tools
- ❖ Stock Control



**Fig 4.4**How to create a new storeroom for items in the Inventory application of Maximo



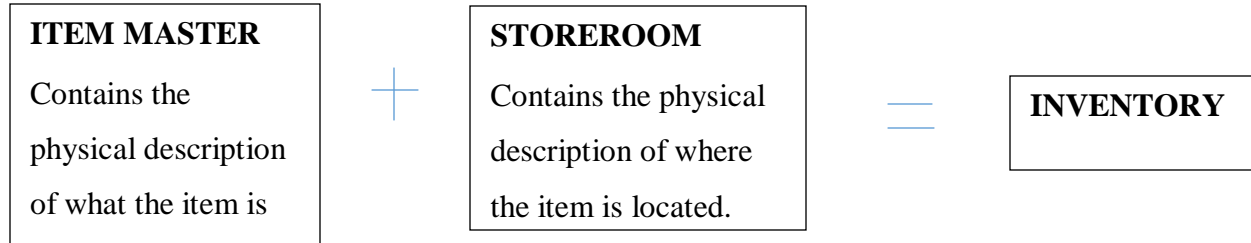
**Fig 4.5** Various types of accounts and their set-ups in Storeroom application

There are various types of inventory locations such as:

- 1) **Storeroom:** Each of the storerooms can further be broken down into various bins. These bins represent a specific location within a storeroom and the bins can further be broken down into: row, rack and shelf. It is a place to recognize stock levels held in specific locations.
- 2) **Courier:** It is an inventory location which is useful for transmitting items from one storeroom to another. It allows tracking of items throughout its life.
- 3) **Holding:** It is used to indicate that the item has received, but it cannot go to its final location until it has been inspected and serialized into an asset. It is set up automatically when a new site is created from Organizations application. Only one holding location per site is allowed. An item in the holding location will be transferred to its final destination, be it a storeroom or to a vendor, if found faulty.
- 4) **Vendor:** Such locations are used when items are sent off-site for repair. This is also used for total life tracking and accumulating repair costs.



- 5) **Labor:**It is used to record an internal issue of specialized tools or Personal Protective Equipment(PPE).



**Fig 4.6** Mathematics of inventory

Some other kinds of accounts linked with items in inventory are:

- **General Ledger Account:** This account controls attributes related to issue, return, receipts, transfers and adjustments of items.
- **Cost Adjustment Account:** This type of account is used when the standard price or an average price of an inventory item varies. It is used for adjusting the cost of items.
- **Invoice Adjustment Account:** This kind of account is used for tracking the difference between receipt price cost and invoice price cost.
- **Receipt Variance Account:** This account records the price difference between invoice exchange and PO.

Storerooms are locations, and locations are defined at site-level. We can have multiple locations for the same site.

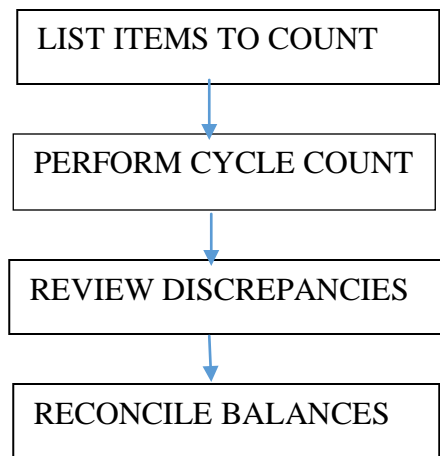
### 4.3 STOCKED TOOLS

**Table 4.1: Differences between tools and Stocked Tools**

<b>TOOLS</b>	<b>STOCKED TOOLS</b>
Tools are non-consumable.	They can be reserved, especially when they are limited in number.
Each tool may have a qualification assigned to it.	They reside in a storeroom, until they are needed.
Tools are defined in the item master.	They are returned to the storeroom at the end of the job. Stocked tools are defined in the inventory.

### 4.4 INVENTORY CYCLE COUNTS

Inventory Cycle Count is a methodology which allows our clients to have an adequate stock on hand, at all times. It is a process for validating the accuracy of our inventory by regularly counting the portion of our inventory, on daily basis or weekly basis.



**Fig 4.7** Inventory Cycle Counting Principle

#### **4.4.1 ABC CONCEPT**

Inventory items are classified on the basis of annual consumption or on the basis of costing. Inventory counting a.k.a cycle counting is the process of continually validating the accuracy of the inventory in the client system, by regularly counting a portion of the inventory in your system on a scheduled basis.

It has turned into a vital part of a business and the ABC analysis is broadly utilized for unfinished goods, manufactured items, additional parts, segments, finished items and assembly items. This analysis ensures that the crucial inventory does not fall below minimum levels, and helps to keep current balances and figures reconciled with the actual count.

This strategy of the management quickly lets the Maximo user identify the inventory items that bring the greatest monetary investment in terms of turnover, and isolates the items into three classifications A, B and C; where A is the most significant thing and C the least profitable.

A	<ul style="list-style-type: none"> <li>• &gt; 5 per annum</li> <li>• Count every 30 days</li> </ul>
B	<ul style="list-style-type: none"> <li>• &gt;3 &lt;5 per annum</li> <li>• Count every 60 days</li> </ul>
C	<ul style="list-style-type: none"> <li>• &lt;3 per annum</li> <li>• Count every 90 days</li> </ul>
N	<ul style="list-style-type: none"> <li>• Do not count</li> <li>• Normally “insurance” spares or high value/unique items</li> </ul>

**Fig 4.8** ABC Counts defined

**Item A:**

In the ABC model of stock control, items classified under A are products that register the most elevated value in terms of annual utilization. It is intriguing to take note of that the top 70 to 80 percent of the yearly utilization estimation of the organization originates from just around 10 to 20 percent of the total inventory items. Thus, it is significant to organize these items. They are tightly controlled, high-cost complex parts used by the client and require the most attention from the management.

**Item B:**

These are items that have a medium utilization value. These sum to around 30 percent of the total stock in an organization which represents around 15 to 20 percent of yearly utilization value. These items are less-tightly controlled, medium cost as well as medium complexity.

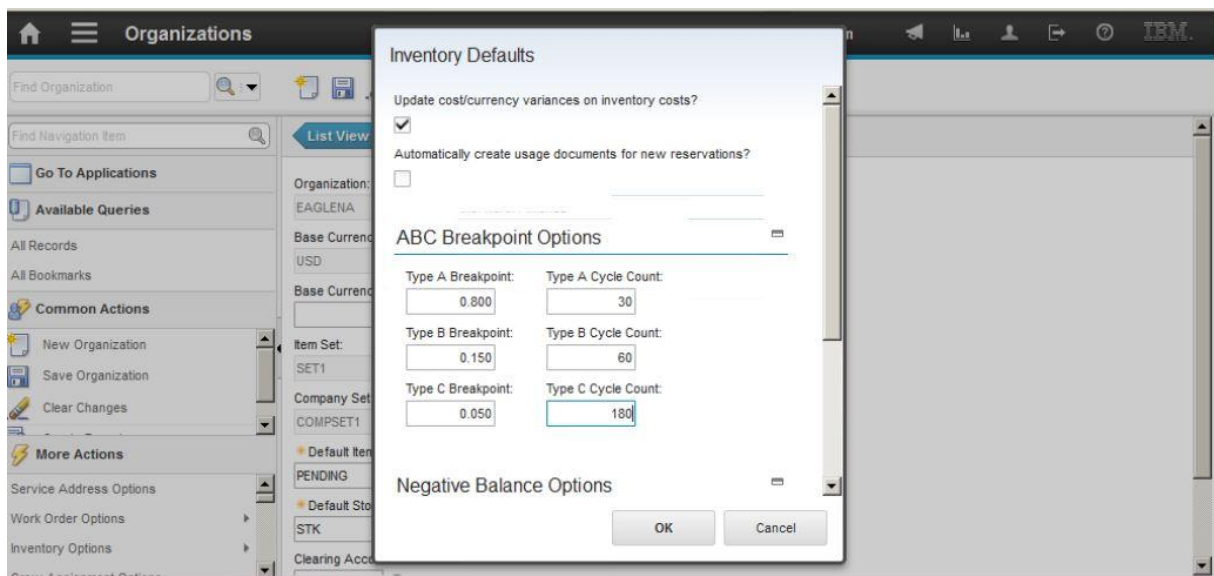
## Item C:

The items put in this class have the least utilization value and record for under 5 percent of the yearly utilization esteem that originates from around 50 percent of the total inventory items. They are low cost and also marginally important.

Note: The yearly utilization value is determined by the formula:

$$\text{(Yearly interest)} \times \text{(item cost per unit)}$$

This ensures that we are counting items at a reasonable frequency and also helps the client ensure that all the items are counted. It also helps in spreading the load throughout the year.



**Fig 4.9** ABC Breakpoints are defined in the Inventory Defaults option in Organizations Application.

Inventory applications also includes an option to reconcile the balances. Reconciliation is the process of taking into account, the stock movement from the day the physical count was performed to the day the user performed actual reconciliation in Maximo

Maximo users can set ABC breakpoints at inventory defaults option.

## 4.5 INVENTORY TRANSACTIONS

There are three major categories of inventory transactions:

- ❖ **Receipts and transfers:** Recording purchase and shipment receipts
- ❖ **Issues and returns:** Issue as well as returns from the storeroom
- ❖ **Adjustments:** Adding new items to the storeroom as well as entering a physical count value

### IMPACTS OF THESE TRANSACTIONS ON THE STORE:

- An issue will help in decreasing the value of the store
- A return will help in increasing the value of the store.
- A receipt also increases the value of the store.
- A transfer decreases the value of the store.

Types of adjustments that can be performed in Maximo:

- **INSERTITEM:** Used when the item is created
- **PCOUNTADJ:** When the item is counted as a part of the stock table.
- **CURBALADJ:** Manual adjustment of the balance in the store is performed.
- **RECBALADJ:** It is a result of performing reconciliation of the physical count.

## **4.6 INVENTORY LABOR LOCATIONS**

A labour inventory location is a special type of location that acts like a storeroom. These kind of locations can be created from the labour application. Labour locations have certain kinds of accounts that are associated to them.

- GL accounts are associated with transactions that occur on the debit side of the ledger.
- Control account is on the credit side of the ledger.
- Shrinkage account is where the money is accumulated.

It acts like a pseudo-storeroom, that is, the list of issues/transfers can be viewed from the Inventory Application only.

## **4.7 INVENTORY RESERVATIONS**

Clients using Maximo can create reservations for inventory items and tools to ensure that they are replenished in the inventory stocks in time.

Reservations are classified on the basis of the importance of inventory reservation

<b>HARD RESERVATION</b>	<b>SOFT RESERVATION</b>
User set via Inventory Application of Maximo	User set via Inventory Application of Maximo
Requirement for an item or material is subject to a specific time frame.	Requirement for an item or material is not subject to a specific time frame.

In order to incorporate various reservation types in Maximo:

- ✓ From the **System Configuration** module, we will select the **Update Reservation Cron Task**
- ✓ System makes use of a field known as **Promised Lead Time** to determine the reservation type
- ✓ The reservation type is checked in the **Work Order Tracking Application**.
- ✓ Provided that the CronTask has been activated and the item reservation type is set to **AUTOMATIC**, the system will determine and change the reservation type according to the required date field.
- ✓ If the required date value of the item is greater than the lead time in days for the item, and the reservation type is automatic, the reservation type is automatically changed to APSOFT, otherwise it is changed to APHARD.



## 4.8 INVENTORY USAGE:

Inventory usage is one of the main applications that allows one to create usage records, track the issues, transfers and returns of the inventory items within as well as across organizations. Inventory items or tools can be assigned to a work order, an asset or to an operating location or to a general ledger account. Items can be issued to a same site, or to a different site within an organization. By using **Transfer Options**, we can transfer inventory items or tools between storerooms within an organization by creating shipment records.

Inventory usage types categorize the intended purpose of intended usage records.

- **Issue:** Contains items for issue and return only.
- **Mixed:** All usage lines contain a combination of lines for issues, transfers as well as returns.
- **Transfer:** All usage lines contain records for transfers only.

Status of inventory usage:

- ❖ **Entered:** Default status for an inventory usage record when created.
- ❖ **Staged:** It indicates that the inventory items are ready and waiting to be issued or transferred.
- ❖ **Shipped:** This status indicates that the item has been moved from the inventory storeroom and is in transit to the final destination.
- ❖ **Complete:** This indicates that the issue/transfer/return is complete.

## **CONCLUSION & FUTURE SCOPE**

In the 21<sup>st</sup> century lot many new concepts and tools are available to ease the life of human being. Using Machine Learning concepts and available tools for analyzing any size of data (Big Data), predictive and prescriptive analytics can be combined to analyze when and whether an asset should be repaired, replaced or phased out with no replacement. Today, one has moved beyond Internet to Internet of Things (IoT) and Industrial Internet of Things (IIoT) which, with the help of sensor networks, can easily provide the right information at the right time so that one can quickly take the right decision and necessary action to prevent any problem. Industrial Internet of Things (IIoT) is the next generation hot topic that is leading IoT in manufacturing area. Further, because of the growth of Cloud Computing, the growth in the market is being driven by cloud adoption, growth in small and medium businesses and IoT deployments.

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