SAP ERP

Course Overview

- Introduction to SAP
- Navigation
- Introduction to GBI
- Sales & Distribution
- Materials Management
- Production Planning
- Financial Accounting
- Controlling
- Human Capital Management
- Warehouse Management
- Project System
SAP divides production into multiple processes
- Production Planning
- Manufacturing Execution
  - Discrete Manufacturing
  - Repetitive Manufacturing
  - KANBAN
- Production – Process Industries
  - Integrated planning tool for batch-orientated process manufacturing
  - Design primarily for chemical, pharmaceutical, food and beverage industries along with batch-oriented electronics
SAP ERP
Unit Overview

- PP Organizational Structure
- PP Master Data
- PP Processes
  - Material Planning
  - Production Planning
  - Manufacturing Execution Process
PP Organizational Structure

- **Client**
  - An independent environment in the system

- **Company Code**
  - Smallest org unit for which you can maintain a legal set of books

- **Plant**
  - Operating area or branch within a company
    - Manufacturing, distribution, purchasing or maintenance facility

- **Storage Location**
  - An organizational unit allowing differentiation between the various stocks of a material in a plant

- **Work Center Locations** (in SAP system → master data)
  - An organizational unit that defines where and when an operation is performed
  - Has an available capacity
  - Activities performed are valuated by charge rates, which are determined by cost centers and activity types.
  - Can be machines, people, production lines or groups of craftsmen
SAP ERP
PP Master Data

- Material
- Bill of Materials (BOM)
- Routing
- Work Center
- Product Group
### Display Material DXTR1000 (Finished Product)

<table>
<thead>
<tr>
<th>Material</th>
<th>DXTR1000</th>
<th>Deluxe Touring Bike (black)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant</td>
<td>DL00</td>
<td>Dallas</td>
</tr>
</tbody>
</table>

#### General Data
- **Base Unit of Measure**: EA
- **MRP group**: Each
- **Purchasing Group**: N/A
- **Plant site status**: N/A
- **Valid from**: N/A

#### MRP Procedure
- **MRP Type**: MT, MP
- **Reorder Point**: 0
- **Planning cycle**: N/A

#### Lot Size Data
- **Lot size**: EX, Lot ID
- **Minimum Lot Size**: 0

#### Status Information:
- **No deletion flags or locks exist**
SAP ERP  Bill of Materials (BOM)

- List of components that make up a product or assembly

- Wheel Assembly
  - Tire
  - Tube
  - Wheel
  - Hex nut
  - Lock Washer
  - Socket Head Bolt

- Frame

- Derailleur Gear Assembly

  - Seat Kit
  - Handle Bar
  - Pedal Assembly
  - Chain
  - Brake Kit
  - Warranty Document
  - Packaging
Bill of Materials (BOM)

- Single-Level

<table>
<thead>
<tr>
<th>Material Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0010 L ORWA1000</td>
<td>Off Road Aluminum Wheel</td>
</tr>
<tr>
<td>0020 L OFFR1000</td>
<td>Men's Off Road Frame</td>
</tr>
<tr>
<td>0030 L DGM1000</td>
<td>Derailleur Gear Assembly</td>
</tr>
<tr>
<td>0040 L TRSK1000</td>
<td>Touring Seat Kit</td>
</tr>
<tr>
<td>0050 L TRHB1000</td>
<td>Touring Handle Bar</td>
</tr>
<tr>
<td>0060 L PEDL1000</td>
<td>Pedal Assembly</td>
</tr>
<tr>
<td>0070 L CHAN1000</td>
<td>Chain</td>
</tr>
<tr>
<td>0080 L BRKT1000</td>
<td>Brake Kit</td>
</tr>
<tr>
<td>0090 L WDOC1000</td>
<td>Warranty Document</td>
</tr>
<tr>
<td>0100 L PCKG1000</td>
<td>Packaging</td>
</tr>
</tbody>
</table>

Finished Bike
- Wheel Assembly
- Pedal Assembly
- Frame
- Chain
- Derailleur Gear Assembly
- Brake Kit
- Seat Kit
- Warranty Doc.
- Handle Bar
- Packaging
Single-Level vs. Multi-Level

- **Single-Level**
  - Finished Bike
    - Wheel
    - Frame
    - Derailleur
    - Seat
    - Handle Bar
    - Pedal
    - Chain
    - Brake
    - Doc.
    - Pack.

- **Multi-Level**
  - Tire
  - Tube
  - Wheel
  - Hex nut
  - Lock
  - Bolt
Variant Bill of Materials (BOM)
- Several products with a large proportion of identical parts.
Item Categories
- Stock Item
- Non-stock Item
- Variable Material – Sheet of steel
- Intra Item – Phantom material – process industry
- Class Item – place holder
- Document Item
- Text Item
Routings enable you to plan the production of materials (products).

Routings are used as a template for production orders and run schedules.

Routing are also used as a basis for product costing.

Series of sequential steps (operations) that must be carried out to produce a given product.

Routings contain:
- What, Where, When, How
- Routing – Operation 20
  - Attach seat to frame
- Work Center – ASSY1000
  - Assembly Work Center
- Time
  - 1 minute
### Routing for Finished Bike

<table>
<thead>
<tr>
<th>Operation</th>
<th>Plant</th>
<th>Description</th>
<th>Activity Type</th>
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<tbody>
<tr>
<td>0019</td>
<td>ASSY1000</td>
<td>DL00 ASSY</td>
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<tr>
<td>0029</td>
<td>ASSY1000</td>
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<td></td>
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<tr>
<td>0039</td>
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<td>DL00 ASSY</td>
<td></td>
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<tr>
<td>0049</td>
<td>ASSY1000</td>
<td>DL00 ASSY</td>
<td></td>
</tr>
<tr>
<td>0059</td>
<td>ASSY1000</td>
<td>DL00 ASSY</td>
<td></td>
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<tr>
<td>0069</td>
<td>ASSY1000</td>
<td>DL00 ASSY</td>
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<td></td>
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<tr>
<td>0089</td>
<td>INSP1000</td>
<td>DL00 ASSY</td>
<td></td>
</tr>
<tr>
<td>0099</td>
<td>PACK1000</td>
<td>DL00 ASSY</td>
<td></td>
</tr>
<tr>
<td>0109</td>
<td>PACK1000</td>
<td>DL00 ASSY</td>
<td></td>
</tr>
<tr>
<td>0119</td>
<td>PACK1000</td>
<td>DL00 ASSY</td>
<td></td>
</tr>
</tbody>
</table>

- **Operation**: The sequence of tasks.
- **Plant**: The location where the tasks are performed.
- **Description**: The nature of the task.
- **Activity Type**: The type of activity associated with the task.
A location within a plant where value-added work (operations or activities) are performed
- Work Centers can represent
  • People or Groups of People
  • Machines or Groups of Machines
  • Assembly Lines

Work center used to define capacities
- Labor
- Machine
- Output
- Emissions

 Capacities used in
- Capacity requirements planning (CRP)
- Detailed scheduling
- Costing
Work centers capture and use the following Resource Related data:

- **Basic Data**
  - Person Responsible, Location of Work Center

- **Scheduling Information**
  - Queues and Move Times (interoperation), Formula Keys

- **Costing Data**
  - Cost Center, Activity Types

- **Personnel Data**
  - People, Positions, Qualifications

- **Capacity Planning**
  - Available Capacity, Formulas, Operating Time

- **Default Data**
  - Control Key, Standard Text Key
Aggregate planning that group together materials or other product groups (Product Families)

Multi- or Single-Level Product Groups
- The lowest level must always consist of materials
SOP provides a method for Sales Planning, Production Planning, Feasibility

Sales, Production, Inventory

- Sales
- Production
- Inventory

<table>
<thead>
<tr>
<th>Month</th>
<th>Unit</th>
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<tbody>
<tr>
<td>January</td>
<td>500,000</td>
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<tr>
<td>February</td>
<td>1,000,000</td>
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<tr>
<td>March</td>
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<tr>
<td>April</td>
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<td>May</td>
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<td>June</td>
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<td>July</td>
<td>3,500,000</td>
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<td>August</td>
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<td>September</td>
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<td>October</td>
<td>5,000,000</td>
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<tr>
<td>November</td>
<td>5,500,000</td>
</tr>
<tr>
<td>December</td>
<td>6,000,000</td>
</tr>
</tbody>
</table>
- **Players in the Game**
  - *Strategic Planning*
    *CEO, COO, CIO, CFO, Controller, Marketing Director*
  - *Detailed Planning*
    *Line Managers, Production Scheduler, MRP Controller, Capacity Planners*
  - *Execution*
    *Line Workers, Shop Floor Supervisors*
Forecasting is the foundation of a reliable SOP.

Accurate forecasts are essential in the manufacturing sector.

Overstocked & understocked warehouses result in the same thing: a loss in profits.

Forecasts are ALWAYS WRONG.
Forecasting Models
- Trend
- Seasonal
- Trend and Seasonal
- Constant

Selecting a Model
- Automatically
- Manually
Information Origination
- Sales
- Marketing
- Manufacturing
- Accounting
- Human Resources
- Purchasing

Intra-firm Collaboration
- Institutional Common Sense
SAP ERP Sales and Operations Planning (SOP)

- Flexible forecasting and planning tool
- Usually consists of three steps:
  - Sales Plan
  - Production Plan
  - Rough Cut Capacity Plan
- Planned at an aggregate level in time buckets
Demand Management

- Link between Strategic Planning (SOP) & Detailed Planning (MPS/MRP)
- The results of Demand Mgmt is called the Demand Program, it is generated from our independent requirements - PIR and CIR
SAP ERP

Demand Management

Forecast

Planned Independent Requirements

Demand Program

Customer Independent Requirements

MPS / MRP

Sales
Planning strategies represent the business procedures for
- The planning of production quantities
- Dates

Wide range of strategies

Multiple types of planning strategies based upon environment
- Make-To-Stock (MTS)
- Make-To-order (MTO)
  • Driven by sales orders
- Configurable materials
  • Mass customization of one
- Assembly orders
Planning takes place using Independent Requirements
Sales are covered by make-to-stock inventory

Strategies
- 10 – Net Requirements Planning
- 11 – Gross Requirements Planning
- 30 – Production by Lot Size
- 40 – Planning with Final Assembly
Planning Strategy for Make-to-Order

- Planning takes place using Customer Orders
- Sales are covered by make-to-order production

Strategies
- 20 – Make to Order Production
- 50 – Planning without Final Assembly
- 60 – Planning with Planning Material
MPS allows a company to distinguish planning methods between materials that have a strong influence on profit or use critical resources and those that do not.
In MRP, the system calculates the net requirements while considering available warehouse stock and scheduled receipts from purchasing and production.

During MRP, all levels of the bill of material are planned.

The output of MRP is a detailed production and/or purchasing plan.

Detailed planning level:
- Primary Functions
- Monitor inventory stocks
- Determine material needs
  - Quantity
  - Timing
- Generate purchase or production orders
Independent Demand – Original source of the demand.
Dependent Demand – Source of demand resides at another level.
MRP is used to ensure the availability of materials based on the need generated by MPS or the Demand Program

- 5 Logical Steps
  - Net Requirements Calculation
  - Lot Size Calculation
  - Procurement Type
  - Scheduling
  - BOM Explosion
SAP ERP
Net Requirements

Procurement Proposal

Firmed Receipts

Firmed Orders or Purchase Requisitions

Requirements – Planned Ind. Req., Reservations, Sales Orders, Etc.

Stock

Safety Stock

Shortage
Lot sizing

- **Static**
  - Based on fixed values in the Material Master

- **Periodic**
  - Groups net requirements together from multiple periods

- **Optimum**
  - Calculates the optimum lot size for a several periods of net requirements
SAP ERP

Procurement Type

- External Procurement
  - Purchase Requisition
  - Purchase Order
  - Schedule Line

- Internal Procurement
  - Planned Order
  - Production Order
  - Process Order
Whether or not a material is planned using MRP or Consumption Based is determined by the MRP Type on the MRP1 screen of the Material Master.
SAP ERP

Output of MRP

- In-House Production
  - Production Orders
  - Process Orders
- External Procurement
  - Purchase Requisitions
  - Purchase Orders
  - Schedule Lines
- MRP
  - Planned Order
  - Convert to
    - Production Orders
    - Process Orders
Orders, orders, orders

- **Planned Order (planning)**
  - A request created in the planning run for a material in the future (converts to either a production or purchase order)

- **Production Order (execution)**
  - A request or instruction internally to produce a specific product at a specific time

- **Purchase Order (execution)**
  - A request or instruction to a vendor for a material or service at a specific time
SAP ERP
Manufacturing Execution Process

Capacity Planning

Production Proposal (Planning/Other)

Schedule and Release

Shop Floor Documents

Order Settlement

Goods Issue

Goods Receipt

Completion Confirmation

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Production orders are used to control production operations and associated costs

- Production Orders define the following
  - Material produced
  - Quantity
  - Location
  - Time line
  - Work involved
  - Resources used
  - How to costs are settled
### Production Order Create: Header

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
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<tbody>
<tr>
<td>Order</td>
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<tr>
<td>Material</td>
<td>DXTR1000 Deluxe Touring Bike (black)</td>
</tr>
<tr>
<td>Status</td>
<td>REL MACM SETC</td>
</tr>
<tr>
<td>Total Qty</td>
<td>10</td>
</tr>
<tr>
<td>Delivered</td>
<td>0</td>
</tr>
<tr>
<td>Basic Dates</td>
<td>Start: 05/26/2010, Finish: 05/28/2010</td>
</tr>
<tr>
<td>Confirmed Dates</td>
<td>Start: 05/13/2010</td>
</tr>
<tr>
<td>Time</td>
<td>2 Backwards</td>
</tr>
<tr>
<td>Reduction</td>
<td>No reduction carried out</td>
</tr>
<tr>
<td>Note</td>
<td>No scheduling note</td>
</tr>
<tr>
<td>Priority</td>
<td></td>
</tr>
</tbody>
</table>

### Components

- **Material**: DXTR1000 Deluxe Touring Bike (black)
- **Status**: REL MACM SETC
- **Total Qty**: 10
- **Delivered**: 0
- **Basic Dates**
  - Start: 05/26/2010, Finish: 05/28/2010
- **Scheduled Dates**
  - Start: 05/27/2010, Finish: 05/27/2010
- **Confirmed Dates**: Start: 05/13/2010
- **Time**: 2 Backwards
- **Reduction**: No reduction carried out
- **Note**: No scheduling note
- **Priority**: 

### Time Line

- **Start**: 05/26/2010, 05/27/2010
- **Finish**: 05/28/2010
- **Release**: 05/26/2010

### How many

- **Total Qty**: 10
- **Delivered**: 0
SAP ERP Schedule

- Calculates the production dates and capacity requirements for all operations within an order
  - Determines a Routing
    - Operation specific time lines
    - Material Consumption Points
  - Material Master
    - Scheduling Margin Key (Floats)
  - Work Center
    - Formulas
    - Standard Inter-operation Times
Two release processes

- Header Level
  - Entire order and all operations are released for processing, order is given a REL status

- Operation Level
  - Individual operations within an order are released
  - Order is given a PREL status
  - Not until the last operation is released does the order obtain a REL status

Automatic vs. manual
SAP ERP

Availability Check

- Automatic check to determine whether the component, production resource tools, or capacities in an order are available
  - Can be automatic or manually executed
  - Determines availability on the required date

- Generates an availability log
  - Displays results of the check
  - Missing parts list
  - Reservations that could not be verified
• The time between scheduling and releasing an order is used for company checks and any preparation needed for the processing of the order

• Once an order has been released it is ready for execution, we can at this time
  - Print shop floor documents
  - Execute goods movements
  - Accept confirmations against the order
Shop Floor Documents are printed upon release of the Production Order, examples would be:
- Operation-based Lists
  - Time Tickets, Confirmation Slips
- Component-based Lists
  - Material Withdrawal Slips, Pull List (consumption list)
- PRT Lists
  - Overview of PRT's used and in which operations
- Multi-Purpose Lists
  - Operation Control Ticket, Object Overview
When a production order is created it references a BOM to determine the necessary components to produce the material.

It then places a reservation on each of the components.

Upon release of the order (or operation) you can withdraw the reserved materials from inventory

- Reservation is updated
- Inventory is updated
- Costs are assigned to the order as actual costs
Confirmations are used to monitor and track the progression of an order through its production cycle
- Confirmation can be done at the operation or order level

Exact confirmation shortly after completion of an operation is essential for realistic production planning and control

Data that needs confirmation include
- Quantities – yield, scrap, rework
- Activity data – setup time, machine time
- Dates – setup, processing, teardown started or finished
- Personnel data – employee who carried out the operation, number of employee involved in the operation
- Work center
- Goods movements – planned and unplanned
- Variance reasons
- PRT usage
Acceptance of the confirmed quantity of output from the production order into stock

- Effects of the Goods Receipt
  - Updates stock quantity
  - Updates stock value
  - Price stored for future valuation changes
  - Production order is updated

- Three documents are created
  - Material document
  - Accounting document
  - Controlling document
Order Settlement

- Consists of settling the actual costs incurred in the order to one or more receiver cost objects
  - Receivers could include: a material, a cost center, an internal order, a sales order, a project, a network, a fixed asset

- Parameters for Order Settlement
  - Settlement Profile
    - Specifics the receivers, distributions rules and method
  - Settlement Structure
    - Determines how the debit cost elements are assigned to the settlement cost elements

- Settlement Rule
  - Automatically assigned on creation of order, the parameters are used to define this rule
    - Has one or more distribution rules assigned to it
    - Distribution rules defines: cost receiver, settlement share, settlement type
Settling a Production Order to Stock
- Debt posting is made to the Production Order with the value of the material
- Difference between the debt posting and credit posting is posted to a price difference account

<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>100</td>
<td>20</td>
</tr>
</tbody>
</table>

* Material Price is determined by the quantity produced times the Standard Price in the Material Master.
Costs analyzed
- Primary
  - Materials
  - External Processing
- Secondary
  - Production, Material, and Administrative Overhead
  - Labor

Cost Analysis Reporting
- Calculate and analyze planned costs, target costs, and actual costs of the production order.
- Calculate and analyze variances