Production Planning and Execution (PP)

Curriculum: Introduction to S/4HANA using Global Bike

SAP University Alliances

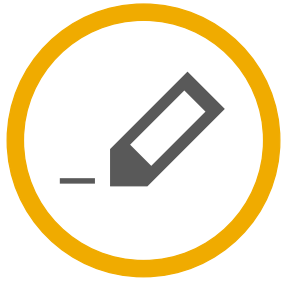
SAP UCC Magdeburg

Teaching material - Information

Teaching material - Version

- GBI 3.3 on S/4HANA 1809 / May 2019
- Software used
  - S/4HANA 1809
  - Fiori 2.0
- Model
  - Global Bike
- Prerequisites
  - No Prerequisites needed

Module Information



Authors

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Target Audience

- Beginner

Module Information

Learning Objectives

- Understand a manufacturing process cycle
- Get familiar with the basics of a production plan

Functionality

- 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

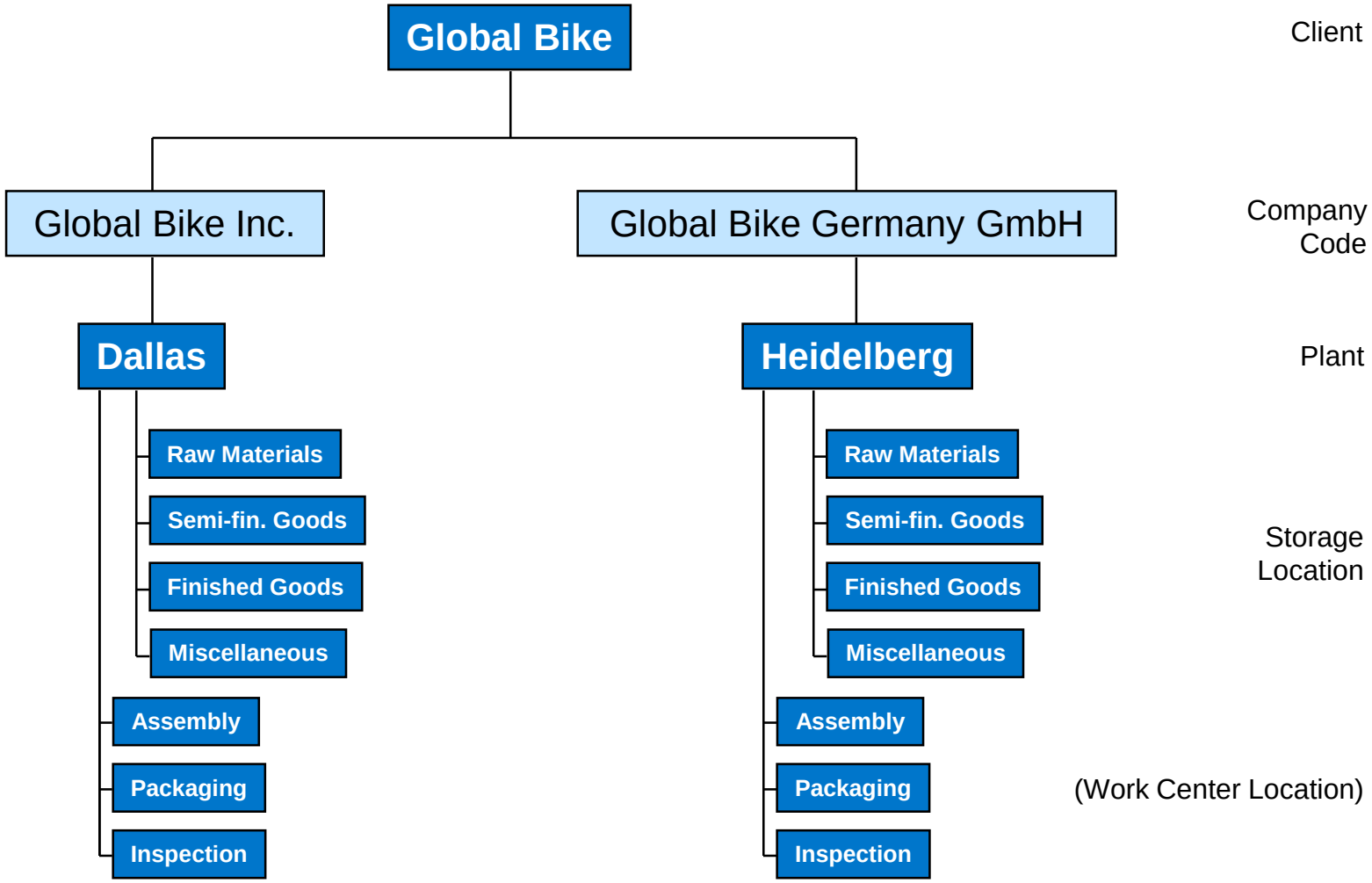
Unit Overview

- PP Organizational Structure
- PP Master Data
- PP Processes
  - Material Planning
  - Production Planning
  - Manufacturing Execution Process
- Innovations in S/4HANA

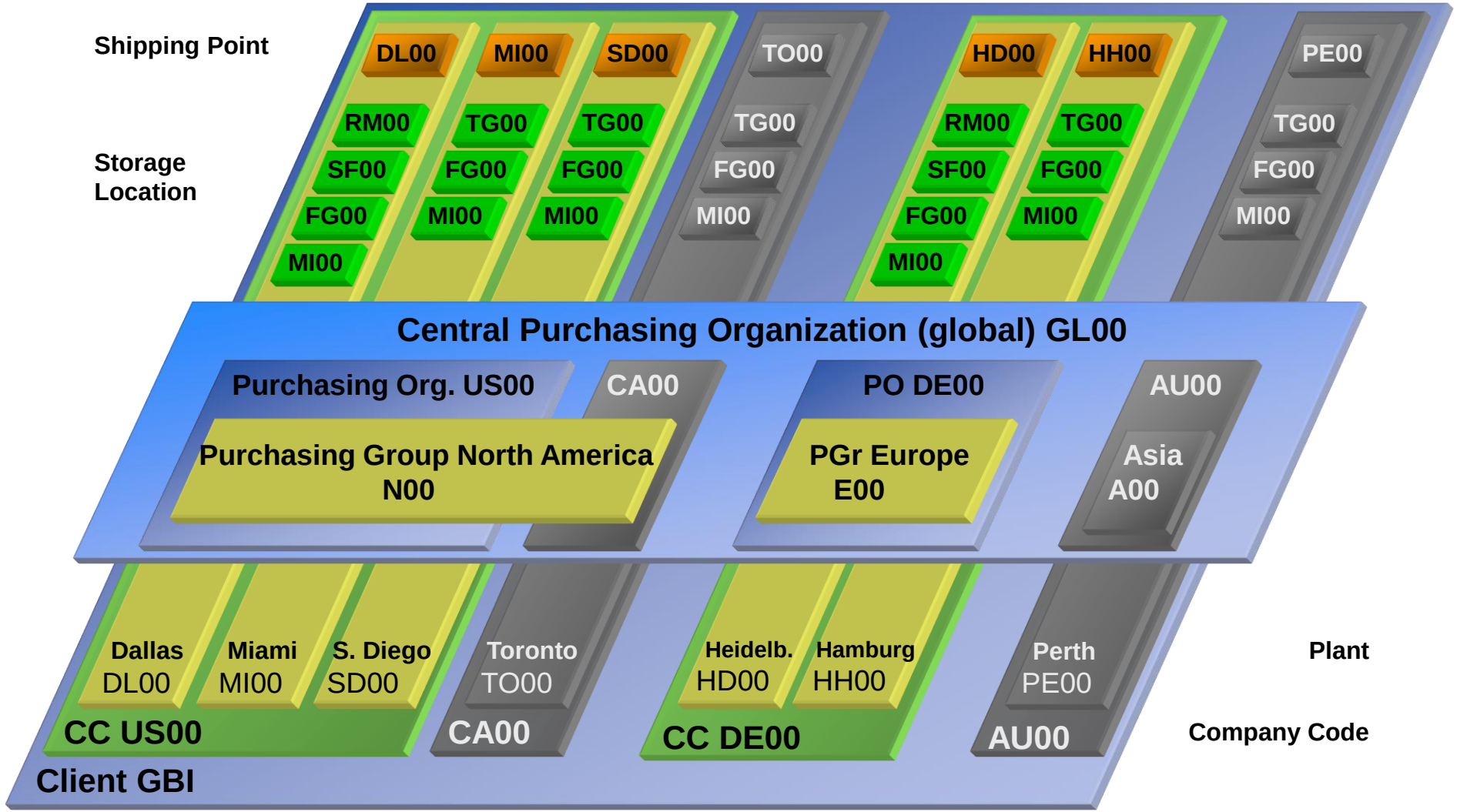
PP Organizational Structure

- 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 tradespeople

Global Bike Structure for Production Planning



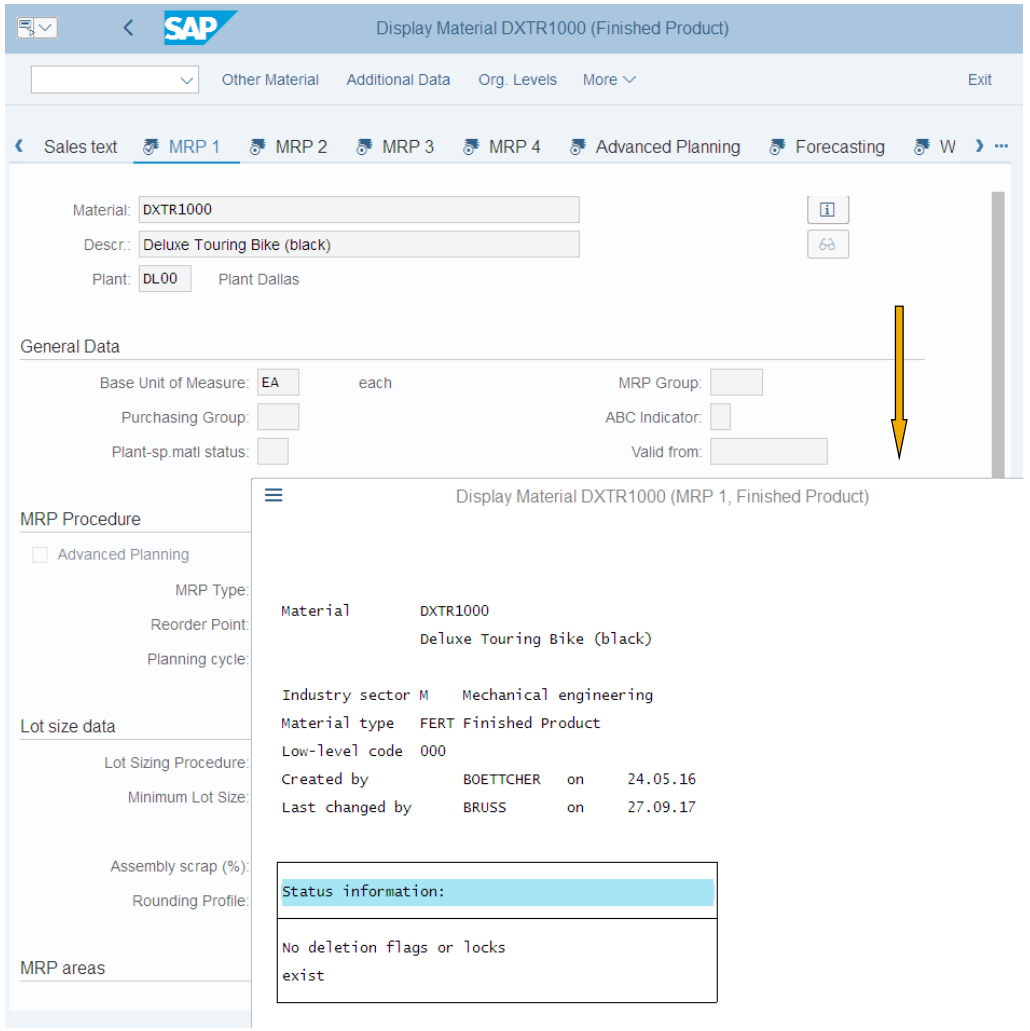
GBI Enterprise Structure in SAP ERP (Logistics)



PP Master Data

- Material
- Bill of Materials (BOM)
- Routing
  - BOM and routine are like a cooking recipe
  - BOM = ingredients and routing = steps in the recipe
- Work Center
- Product Group

Material Master Record



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

Material: ORMN1000 Men's Off Road Bike

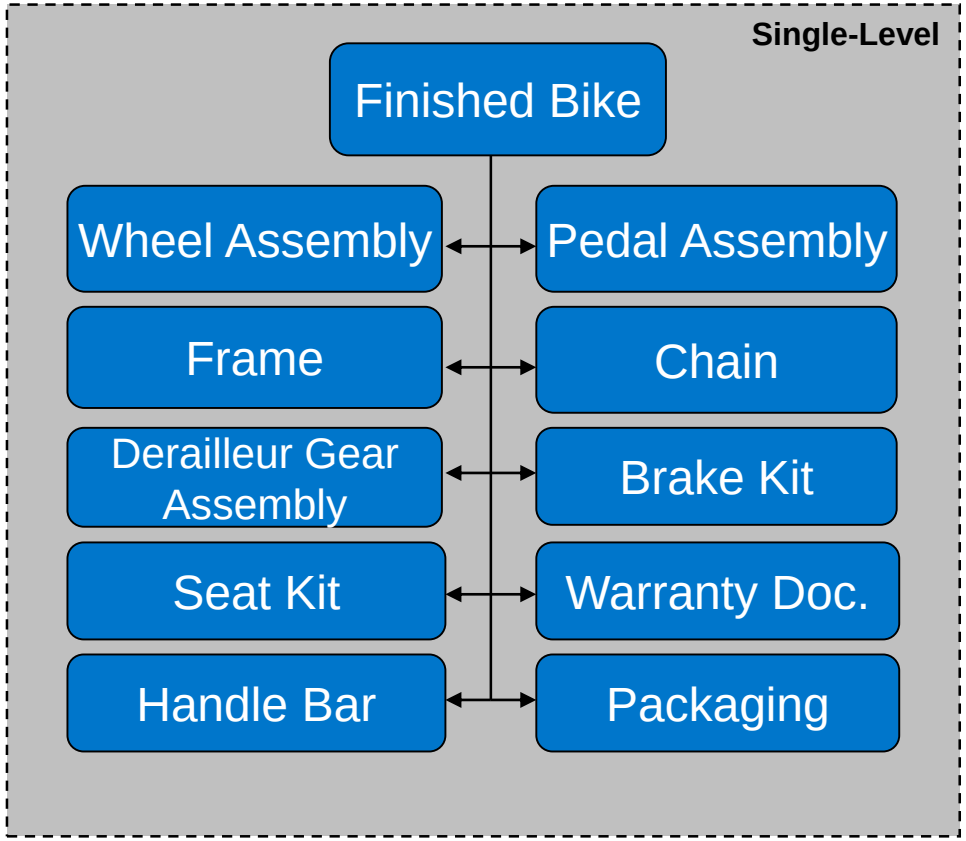
Plant: DL00 Plant Dallas

Alternative BOM: 1

Position | Effectivity Initial Screen

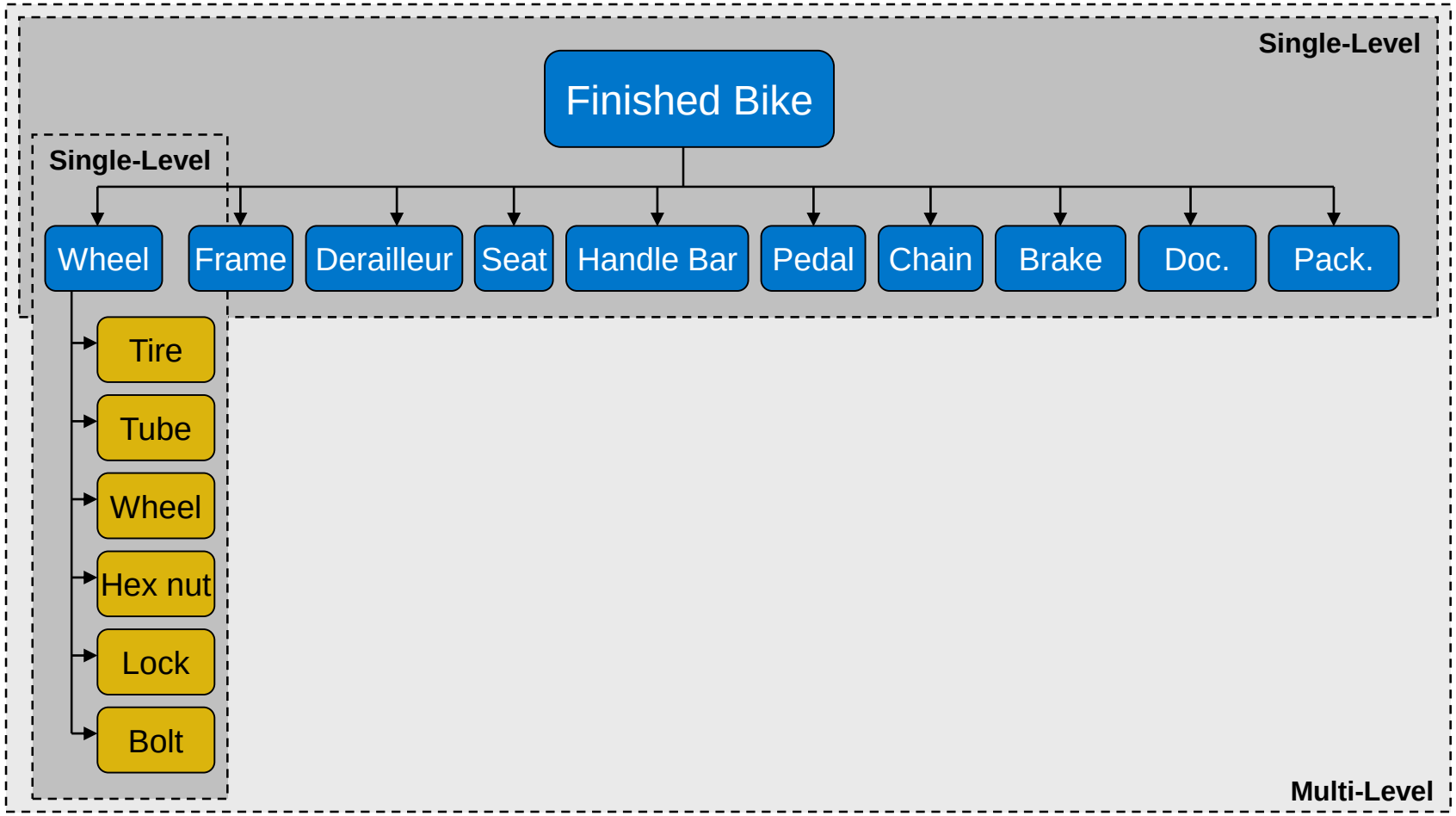
Material | Document | General

Item	ICt	Component	Component description	Quantity	U...
0010	L	ORWA1000	Off Road Aluminum Wheel Assembly	2	EA
0020	L	OFFR1000	Men's Off Road Frame	1	EA
0030	L	DGAM1000	Derailleur Gear Assembly	1	EA
0040	L	ORSK1000	Off Road Seat Kit	1	EA
0050	L	ORHB1000	Off Road Handle Bar	1	EA
0060	L	PEDL1000	Pedal Assembly	1	EA
0070	L	CHAN1000	Chain	1	EA
0080	L	BRKT1000	Brake Kit	1	EA
0090	L	WDOC1000	Warranty Document	1	EA
0100	L	PCKG1000	Packaging	1	EA



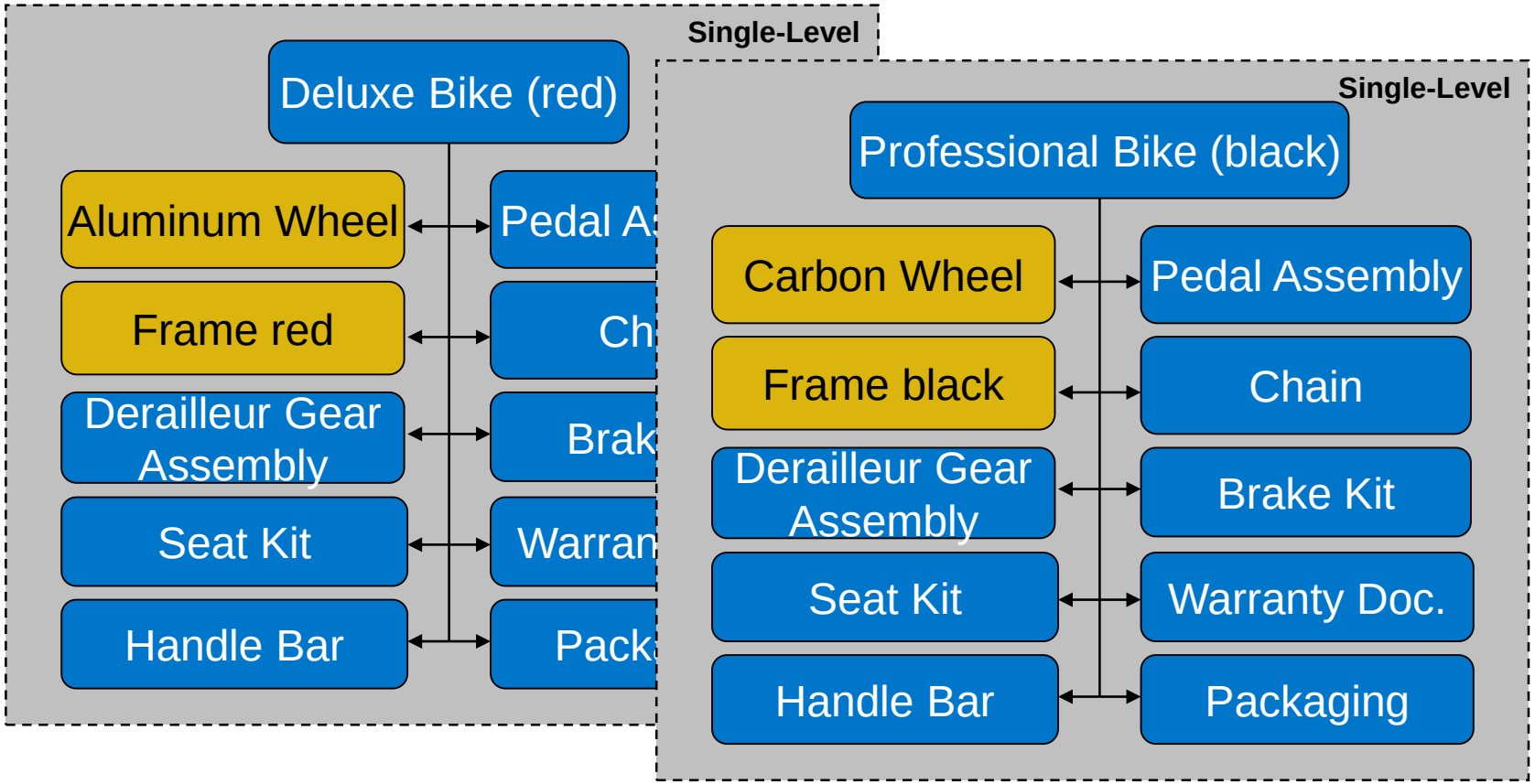
Bill of Materials (BOM)

- Single-Level vs. Multi-Level



Bill of Materials (BOM)

- Variant Bill of Materials (BOM)
  - Several products with a large proportion of identical parts.



BOM – Item Categories

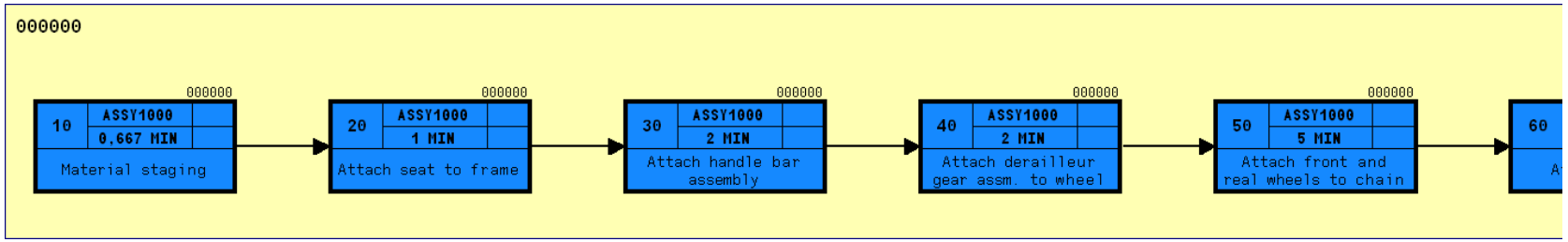
- An object that defines items in a BOM according to criteria, such as the object type of the component, for example, material master record or document info record.

- The item category controls the following:
  - Screen sequence
  - Field selection
  - Default values
  - Material entry
  - Inventory management
  - Subitems

- Item Categories
  - Stock Item
  - Non-stock Item
  - Variable Material – Sheet of steel
  - Document Item
  - Text Item

Routing

- 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

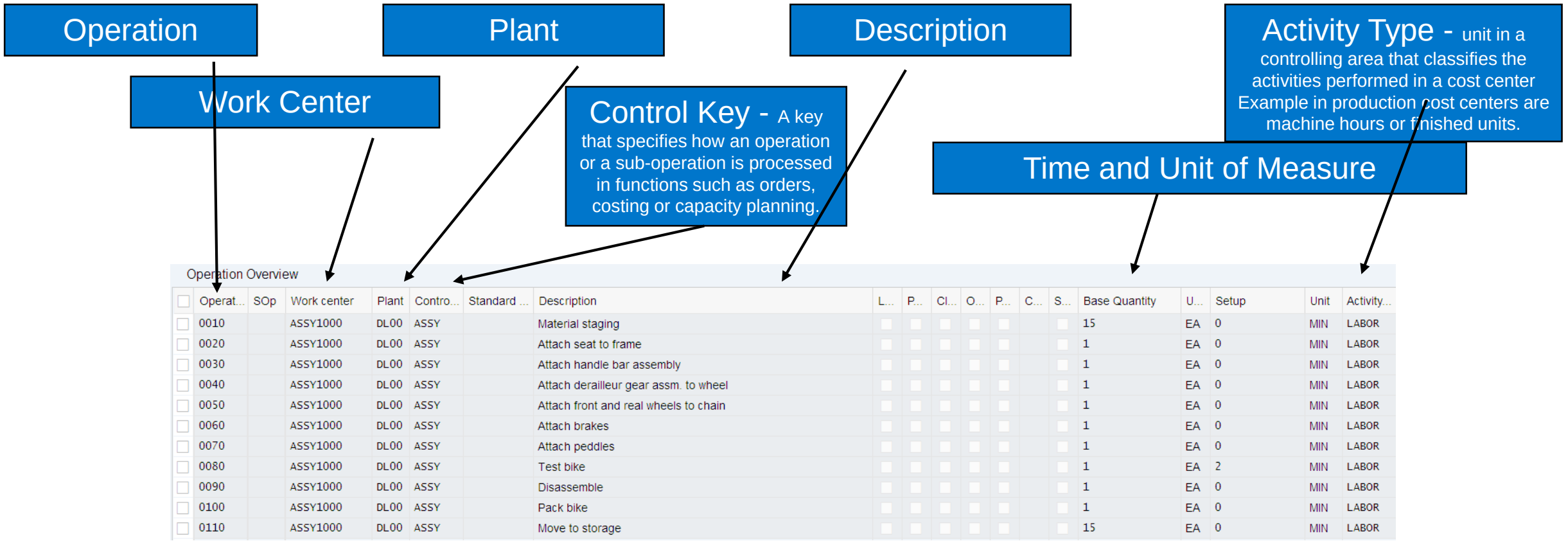


Routing

- Routing – Operation 20
  - Attach seat to frame
- Work Center – ASSY1000
  - Assembly Work Center
- Time
  - 1 minute

Routing

- Routing for Finished Bike



Operation Overview

Operat...	SOp	Work center	Plant	Contro...	Standard ...	Description	L...	P...	Cl...	O...	P...	C...	S...	Base Quantity	U...	Setup	Unit	Activity...
0010		ASSY1000	DL00	ASSY		Material staging								15	EA	0	MIN	LABOR
0020		ASSY1000	DL00	ASSY		Attach seat to frame								1	EA	0	MIN	LABOR
0030		ASSY1000	DL00	ASSY		Attach handle bar assembly								1	EA	0	MIN	LABOR
0040		ASSY1000	DL00	ASSY		Attach derailleur gear assm. to wheel								1	EA	0	MIN	LABOR
0050		ASSY1000	DL00	ASSY		Attach front and real wheels to chain								1	EA	0	MIN	LABOR
0060		ASSY1000	DL00	ASSY		Attach brakes								1	EA	0	MIN	LABOR
0070		ASSY1000	DL00	ASSY		Attach peddles								1	EA	0	MIN	LABOR
0080		ASSY1000	DL00	ASSY		Test bike								1	EA	2	MIN	LABOR
0090		ASSY1000	DL00	ASSY		Disassemble								1	EA	0	MIN	LABOR
0100		ASSY1000	DL00	ASSY		Pack bike								1	EA	0	MIN	LABOR
0110		ASSY1000	DL00	ASSY		Move to storage								15	EA	0	MIN	LABOR

Work Center

- 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 Center

- 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

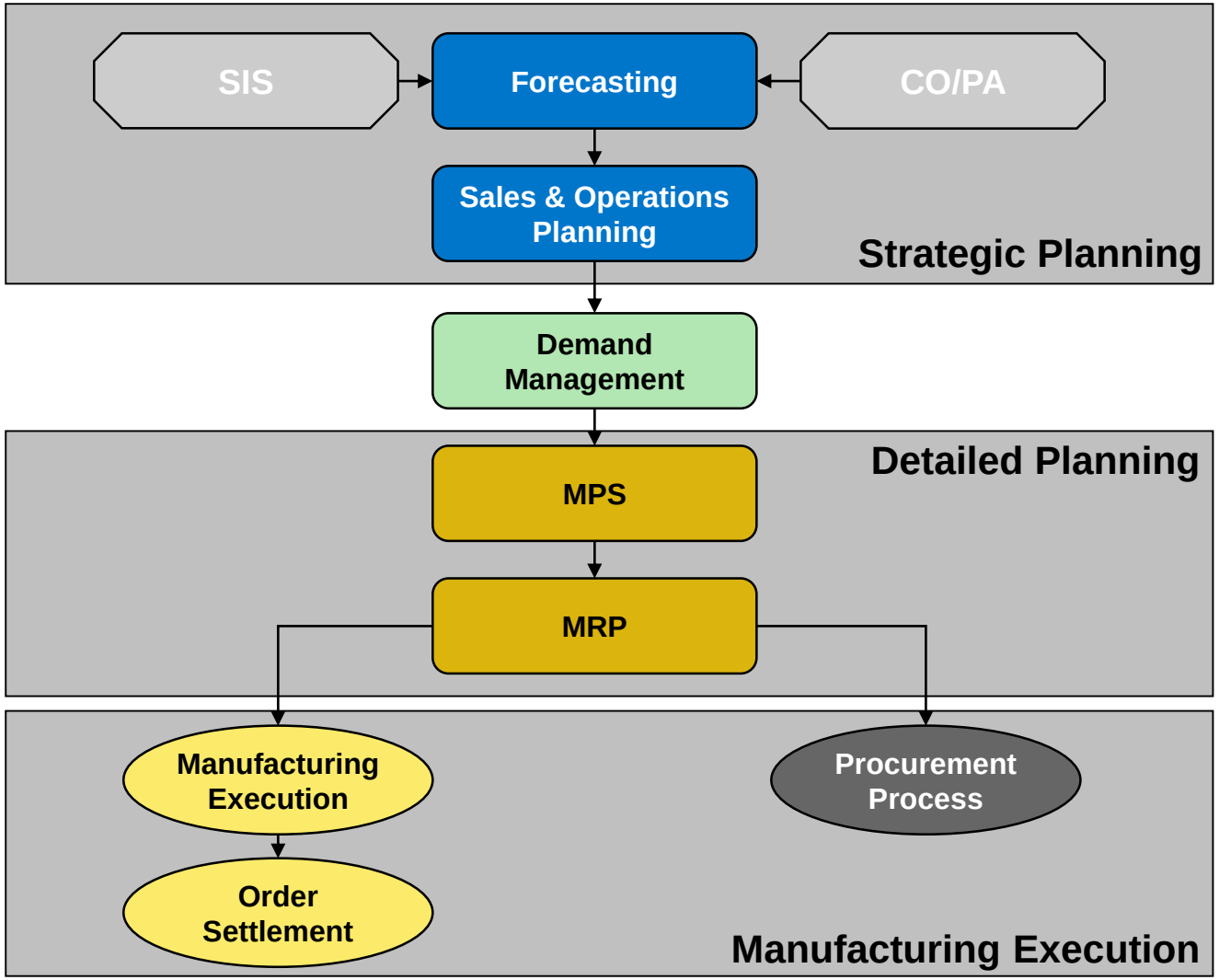
Product Group

- Aggregate planning that groups together materials or other product groups (Product Families)
- Multi- or Single- Level Product Groups
  - The lowest level must always consist of materials

PP Processes

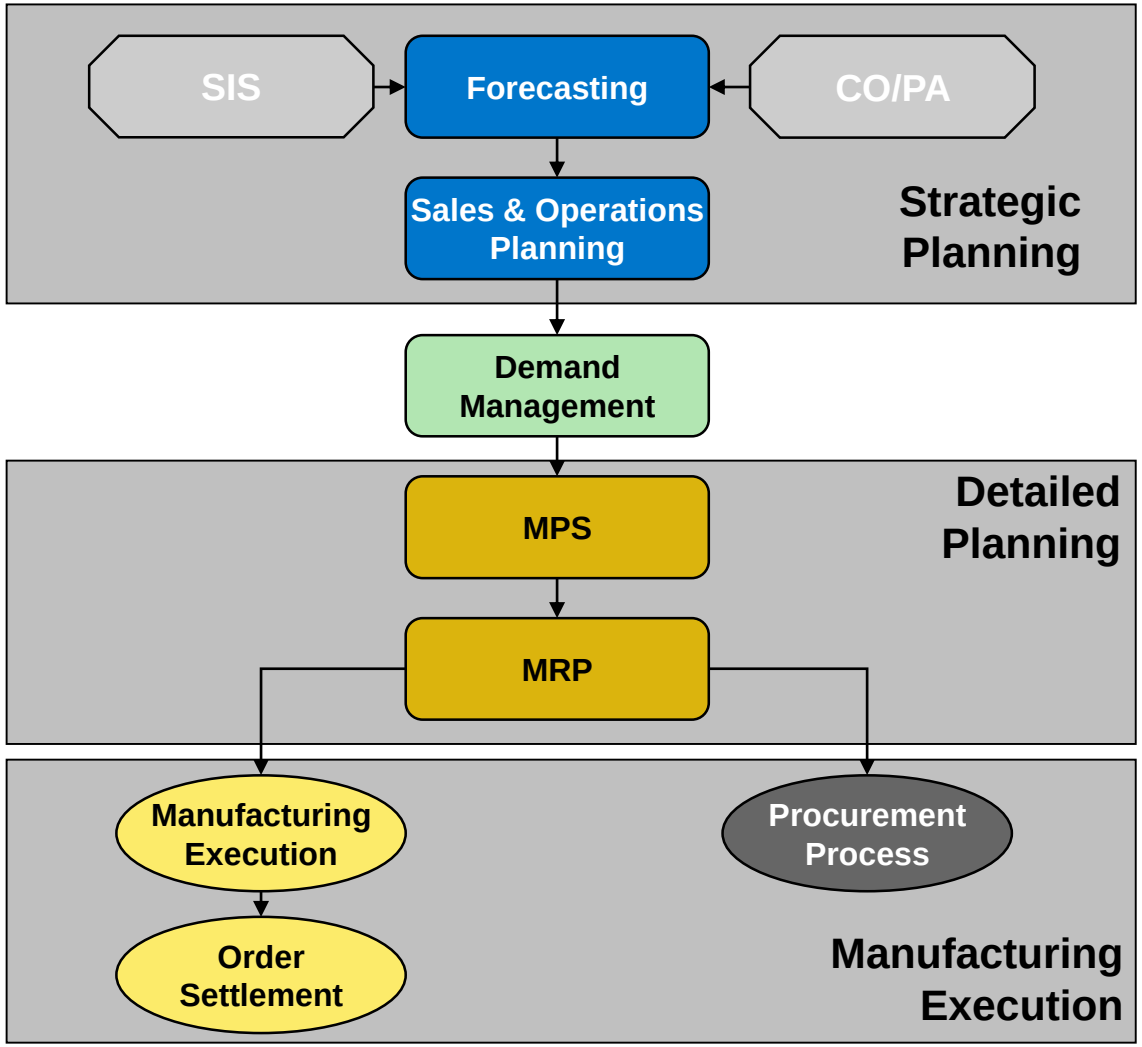
- Production Planning & Execution
  - Forecasting
  - Sales and Operations Planning (SOP)
  - Demand Management
  - Master Production Scheduling (MPS)
  - Material Requirement Planning (MRP)
- Production Order

Production Planning & Execution



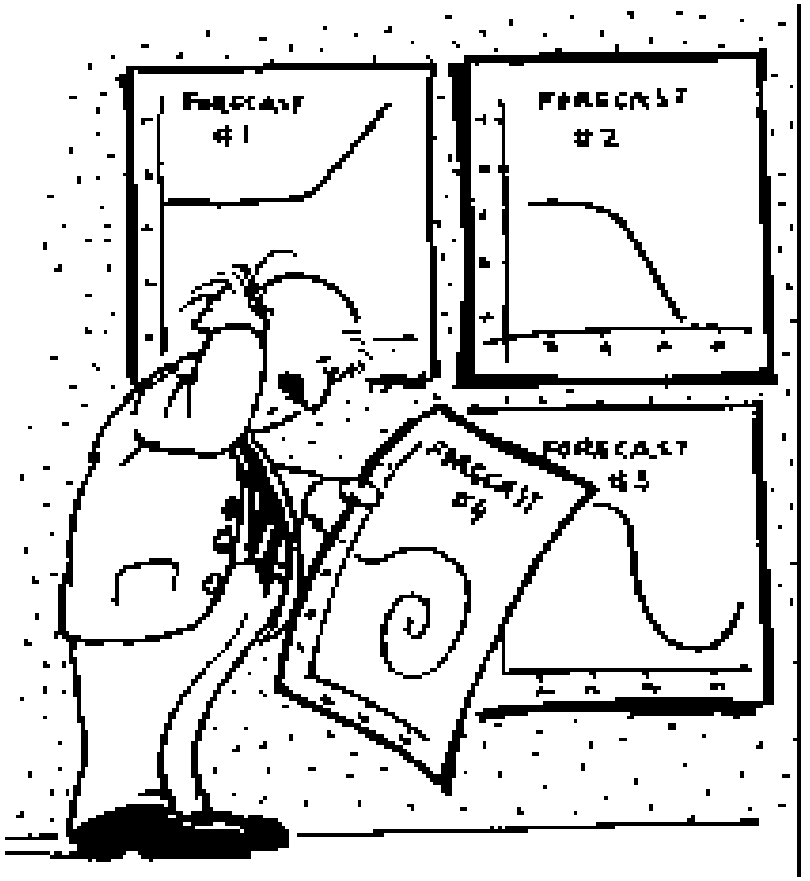
Production Planning & Execution

- 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



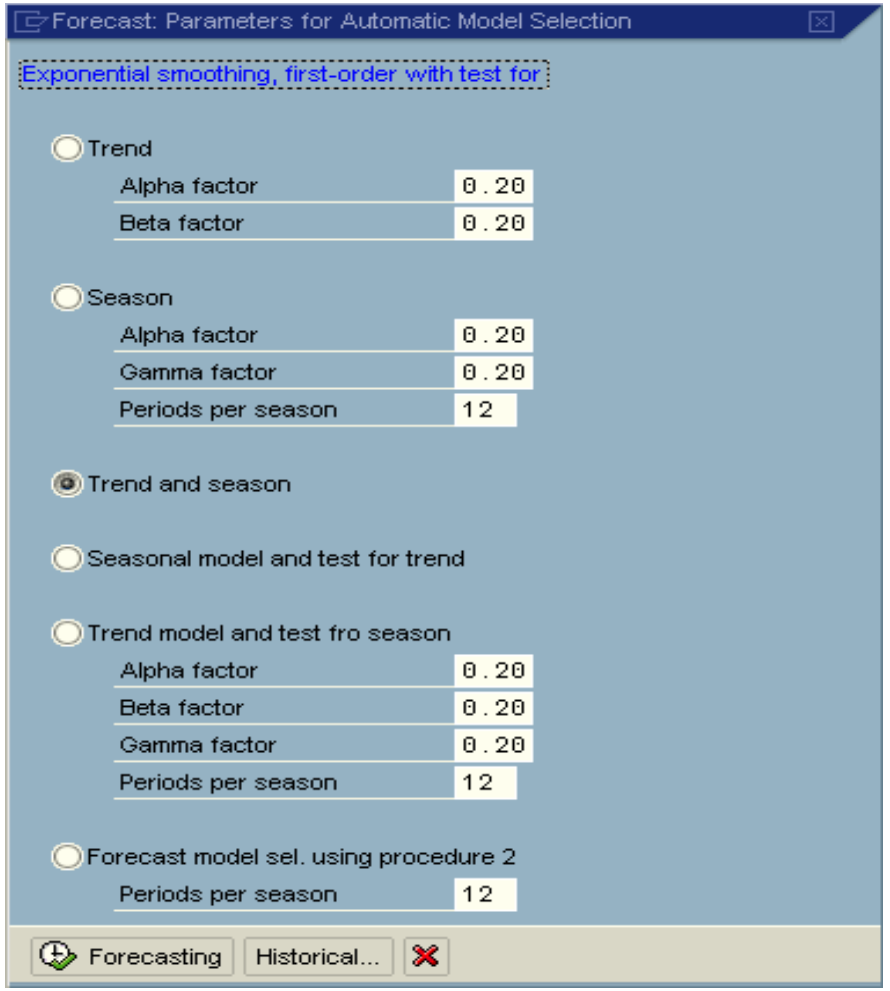
Forecasting

- 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



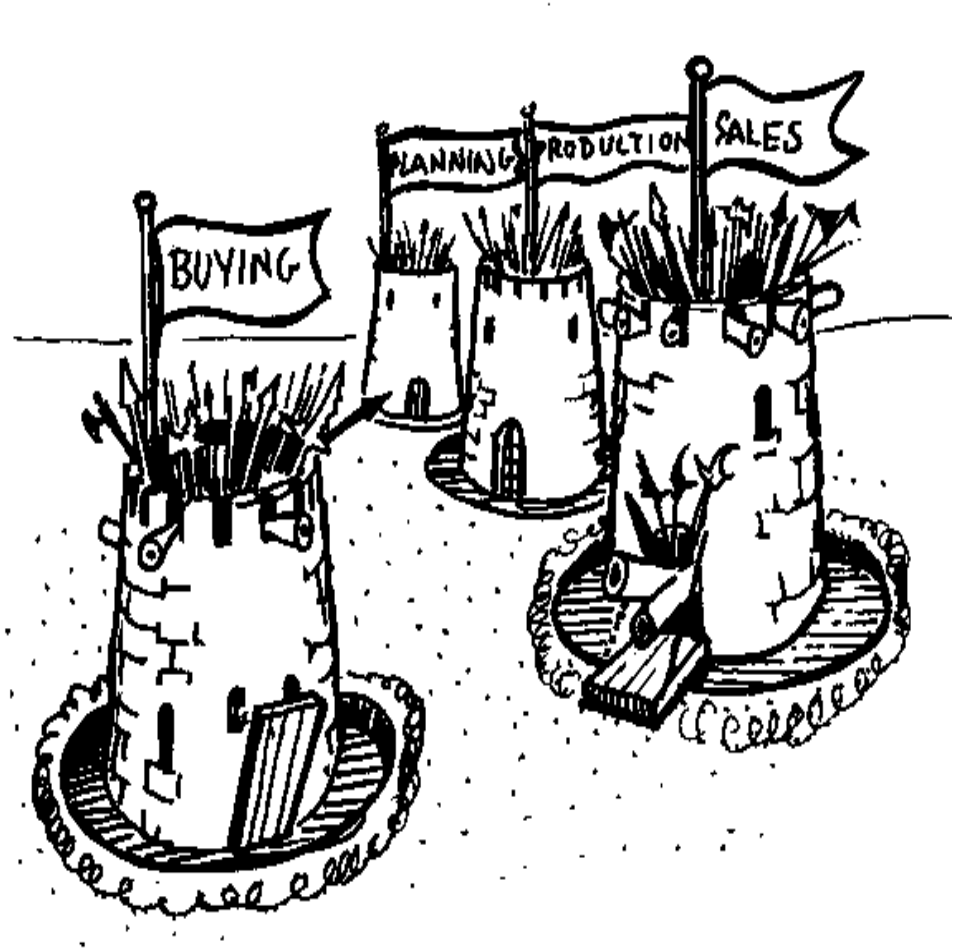
Forecasting

- Forecasting Models
  - Trend
  - Seasonal
  - Trend and Seasonal
  - Constant
- Selecting a Model
  - Automatically
  - Manually



Sales and Operations Planning (SOP)

- Information Origination
  - Sales
  - Marketing
  - Manufacturing
  - Accounting
  - Human Resources
  - Purchasing
- Intra-firm Collaboration
  - Institutional Common Sense



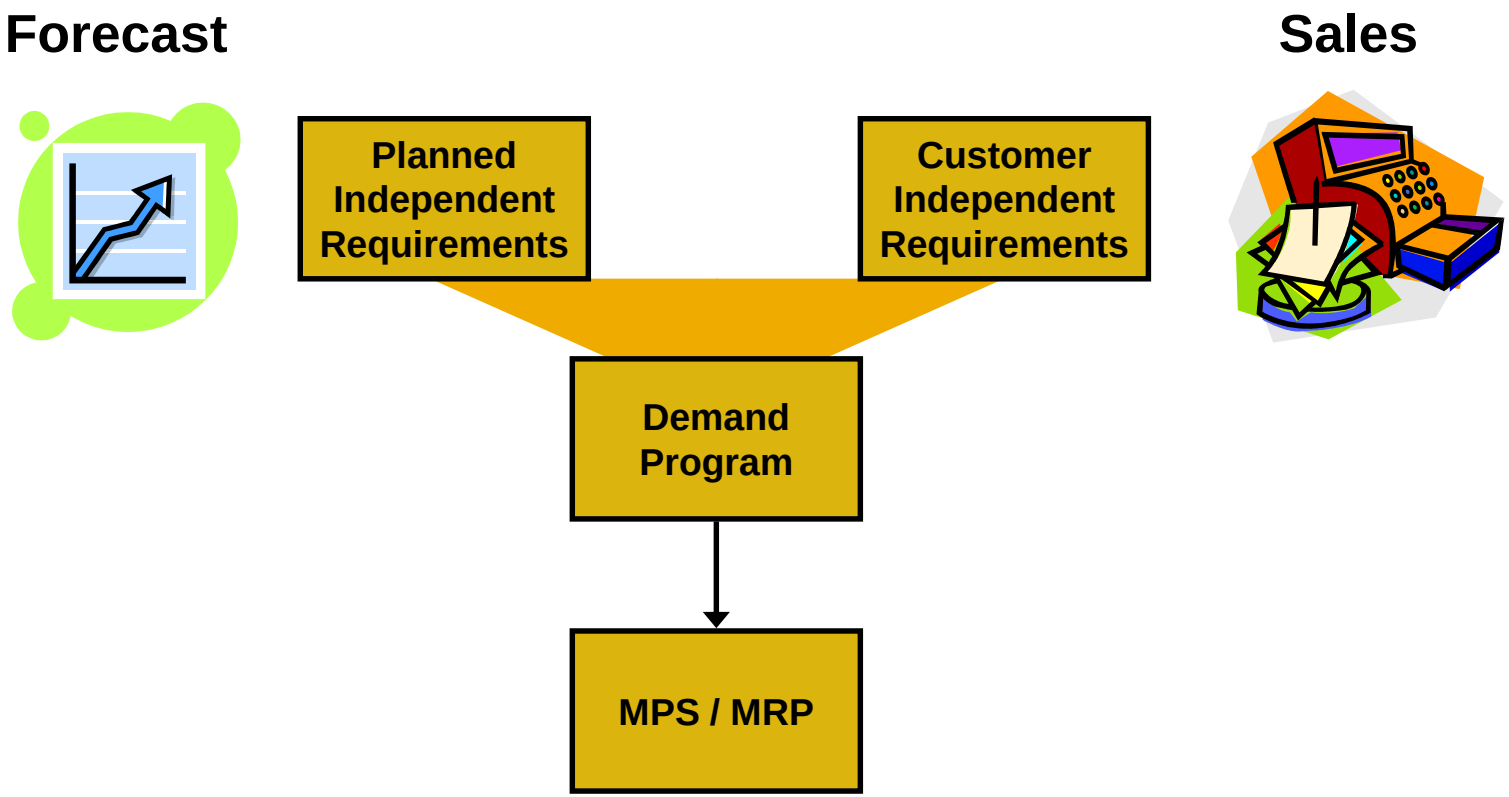
Sales and Operations Planning (SOP)

- 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

- The planning of requirement quantities and requirement dates for finished products and important assemblies, and definition of the strategy for planning and producing or procuring a finished product.
- Link between Strategic Planning (SOP) & Detailed Planning (MPS/MRP)
- Demand management can be done manually or based on previous planning results such as sales planning, SOP, and forecast.
- The results of Demand Management is called the Demand Program, it is generated from our independent requirements - PIR - Planned Independent Requirements and CIR - Customer Independent Requirements

Demand Management



Planning Strategies

- 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 Strategy for Make-to-Stock

- 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

Master Production Scheduling (MPS)

- 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

Material Requirement Planning (MRP)

- 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

Demand-Independent vs. Dependent

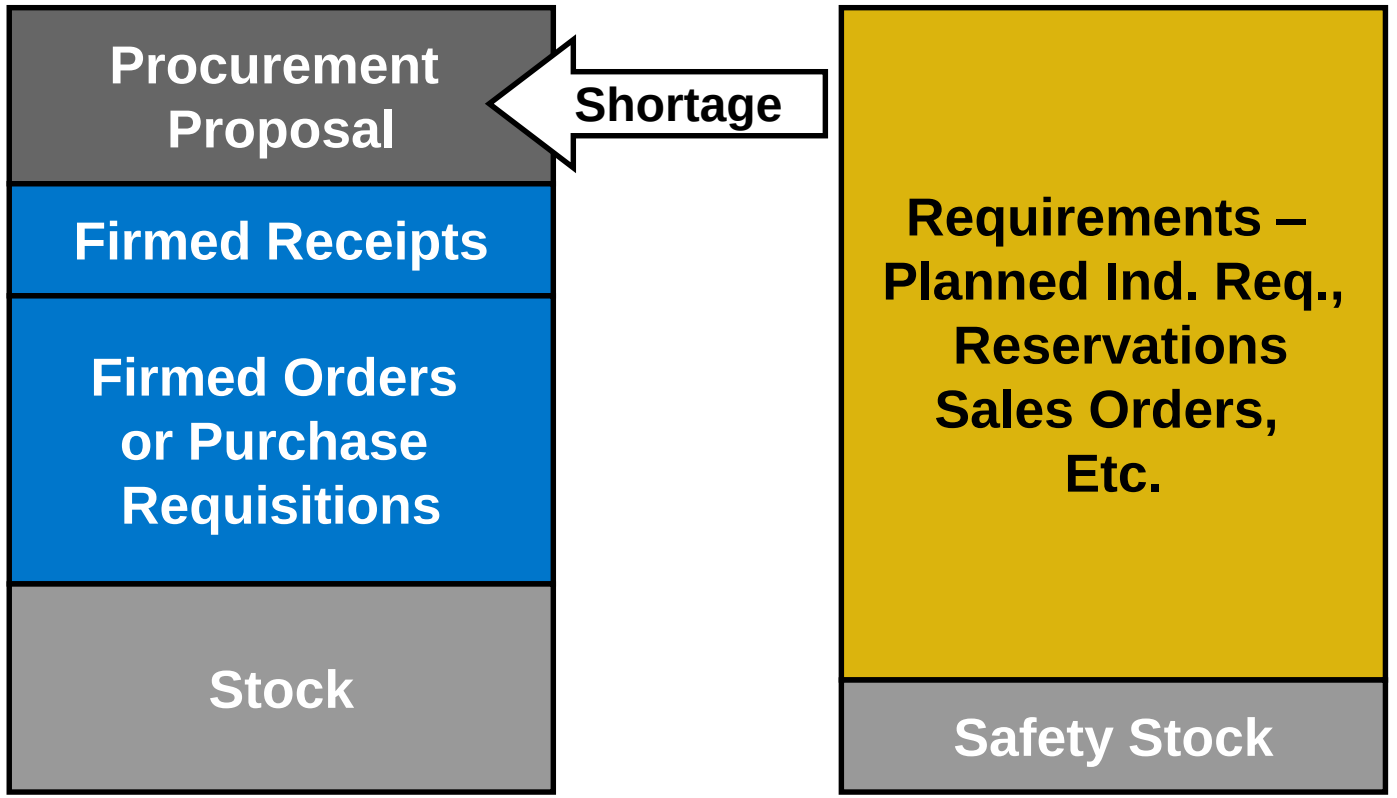
- Independent Demand – Original source of the demand.
  - **Independent demand** is **demand** for a finished product, such as a computer, a bicycle, or a pizza.
- Dependent Demand – Source of demand resides at another level.
  - **Dependent demand**, on the other hand, is demand for component parts or subassemblies. For example, this would be the microchips in the computer, the wheels on the bicycle, or the cheese on the pizza

Material Requirement Planning (MRP)

- 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

Net Requirements



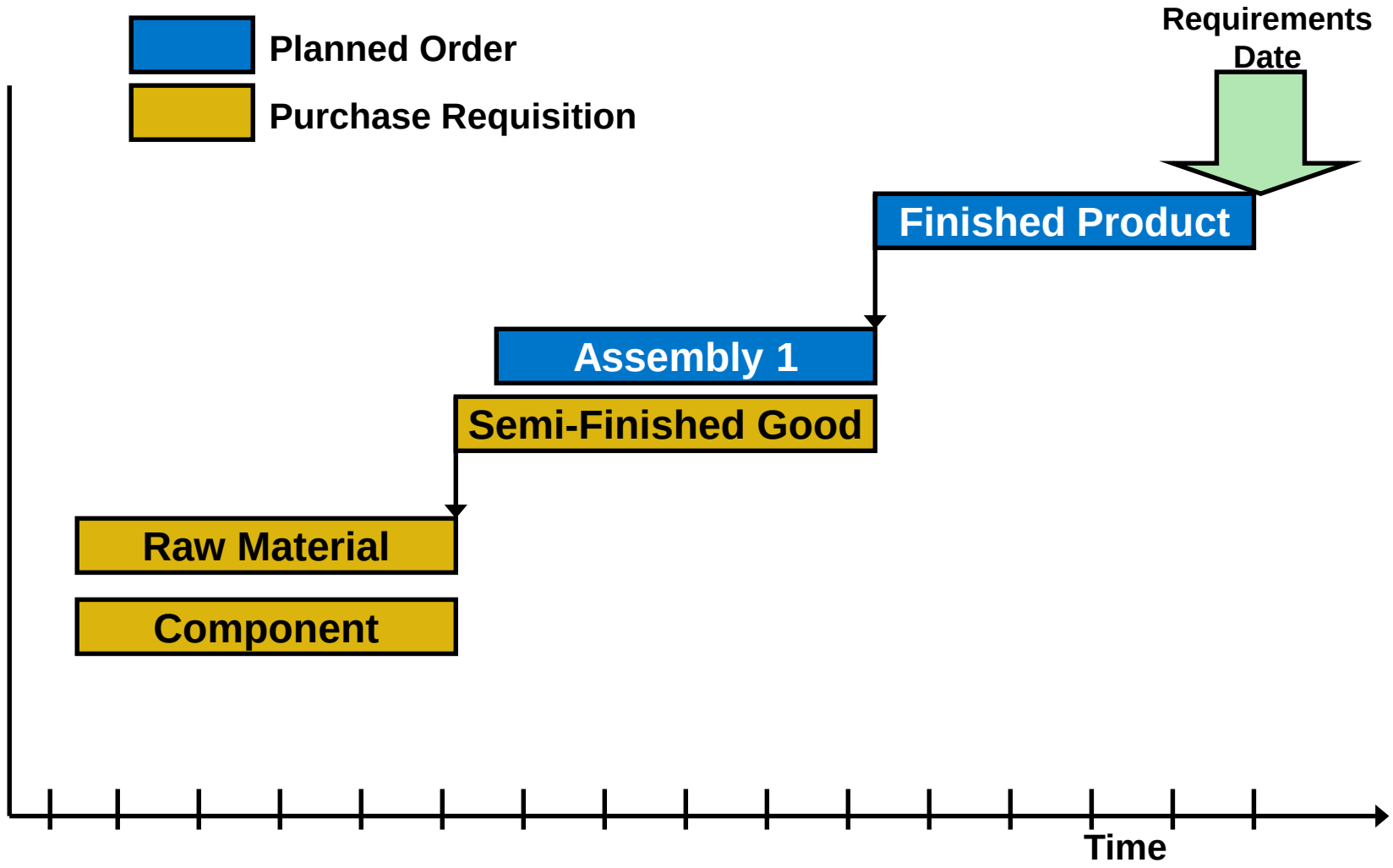
Lot sizing

- Static
  - Based on fixed values in the Material Master
- Periodic
  - Groups net requirements together from multiple periods
- Optimised
  - Calculates the optimum lot size for a several periods of net requirements

Procurement Type

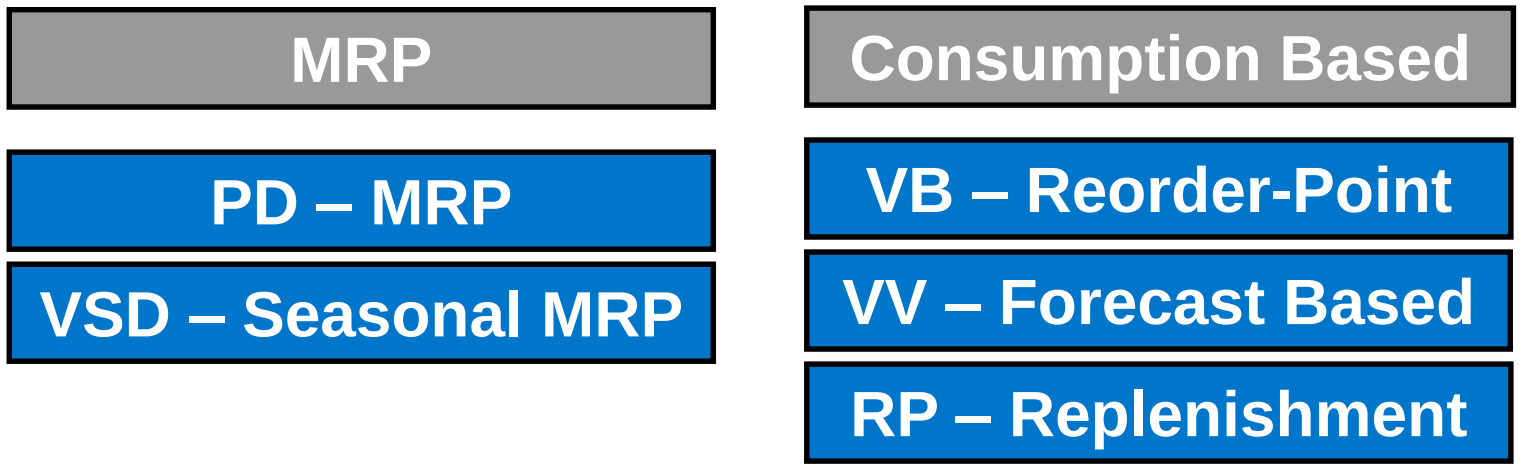
- External Procurement
  - Purchase Requisition
  - Purchase Order
  - Schedule Line
- Internal Procurement
  - Planned Order
  - Production Order
  - Process Order

Multi-Level Scheduling

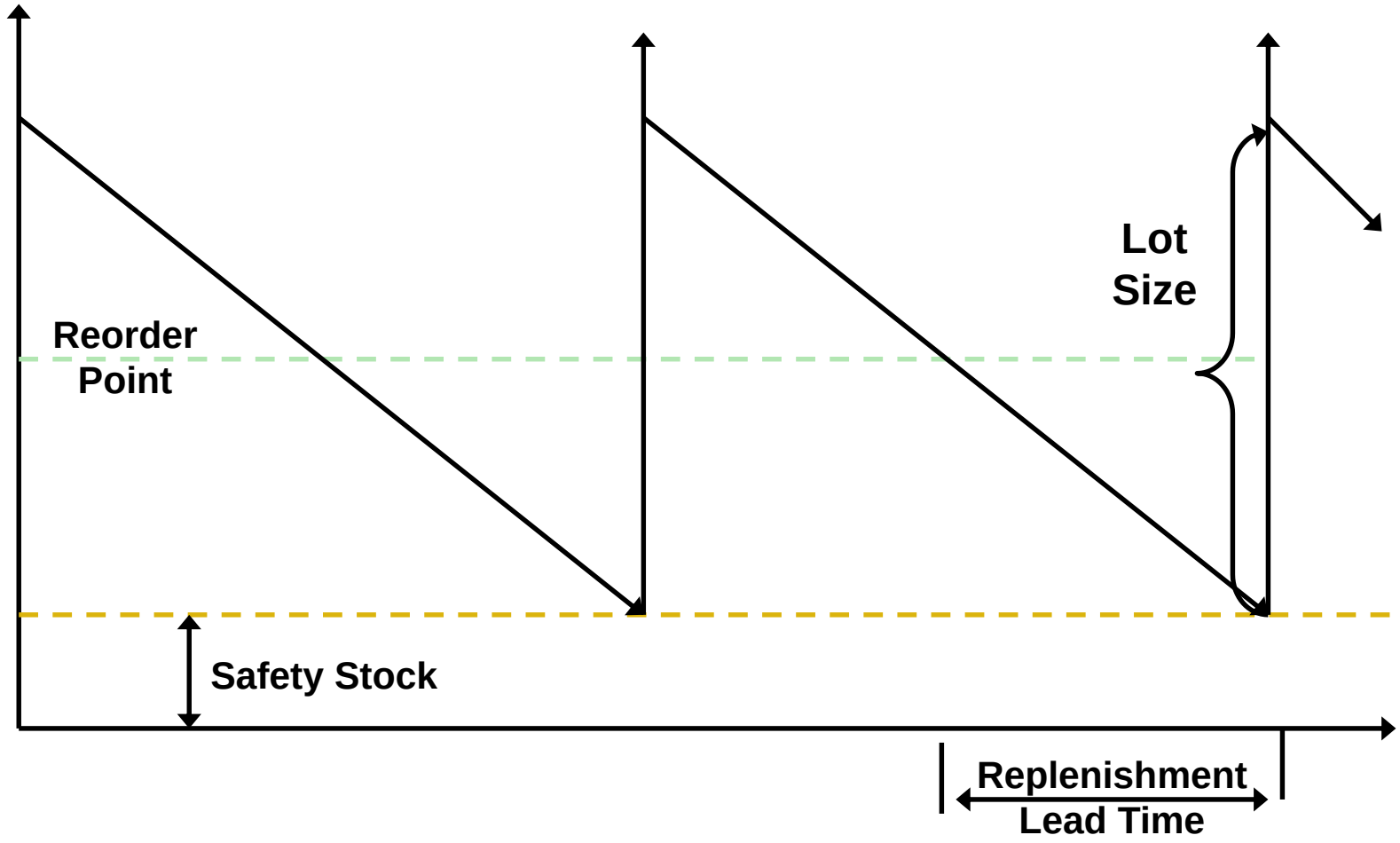


MRP vs. Consumption-Based

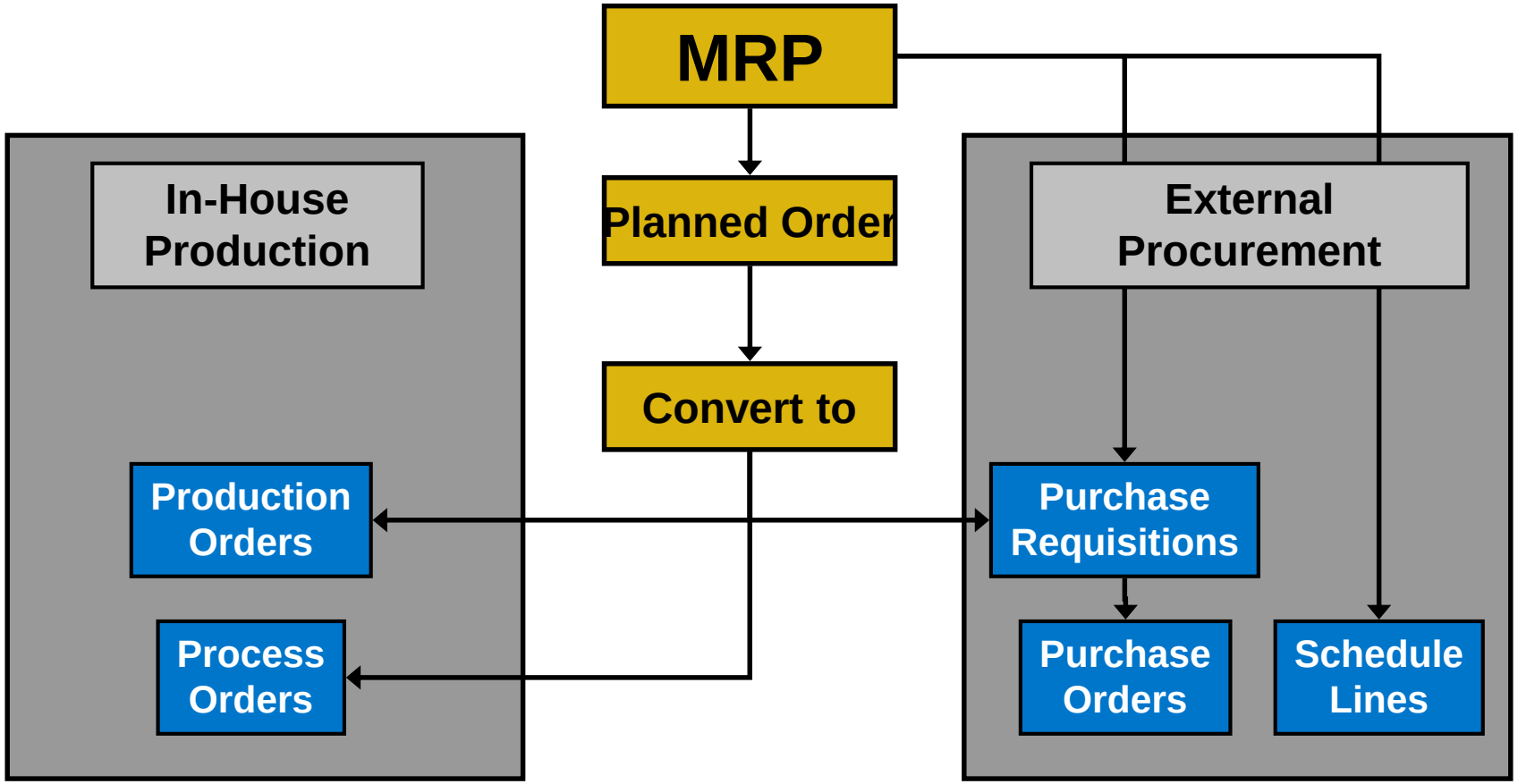
- Whether or not a material is planned using MRP or Consumption Based is determined by the MRP Type on the MRP1 screen of the Material Master



Consumption-Based



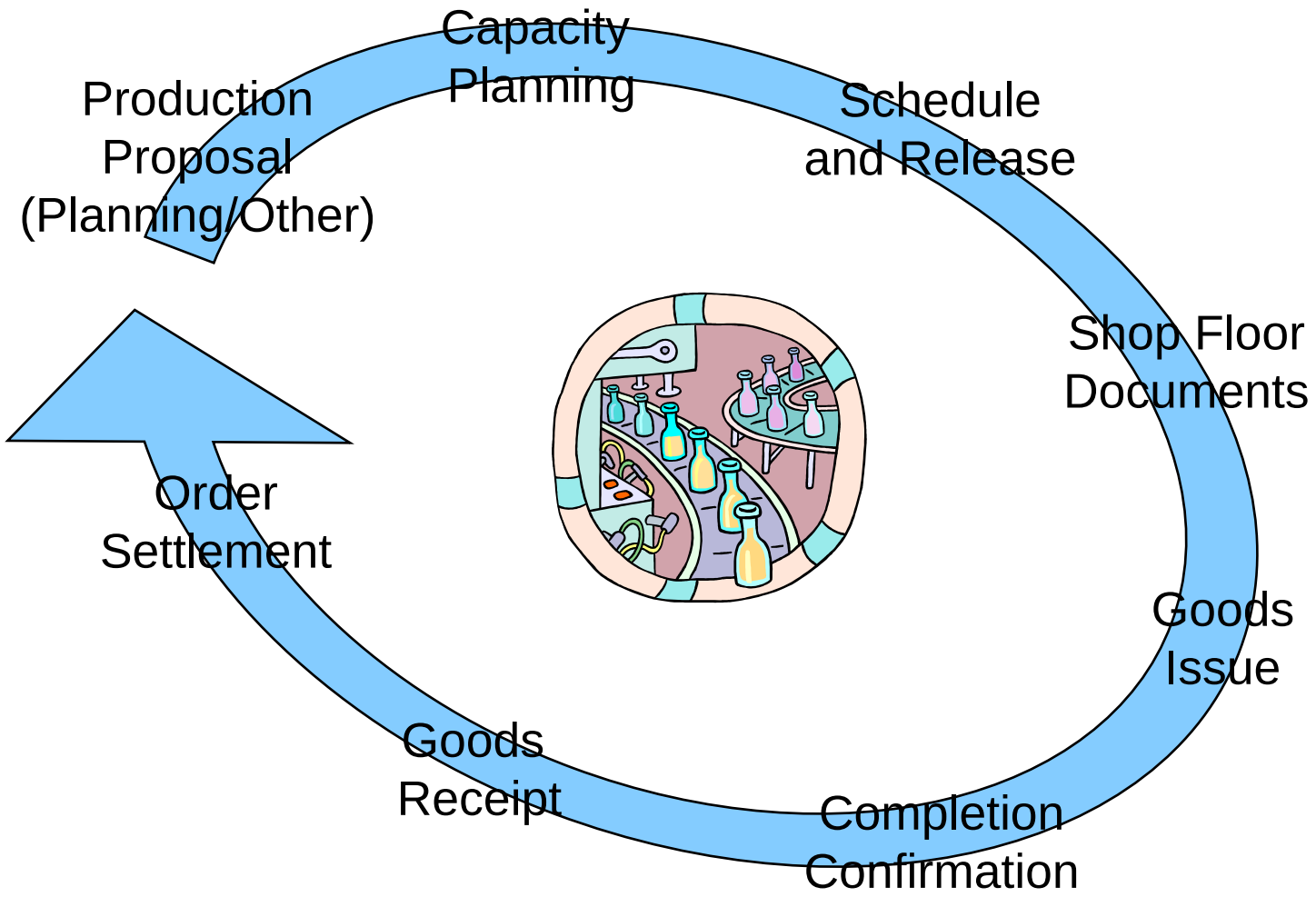
Output of MRP



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

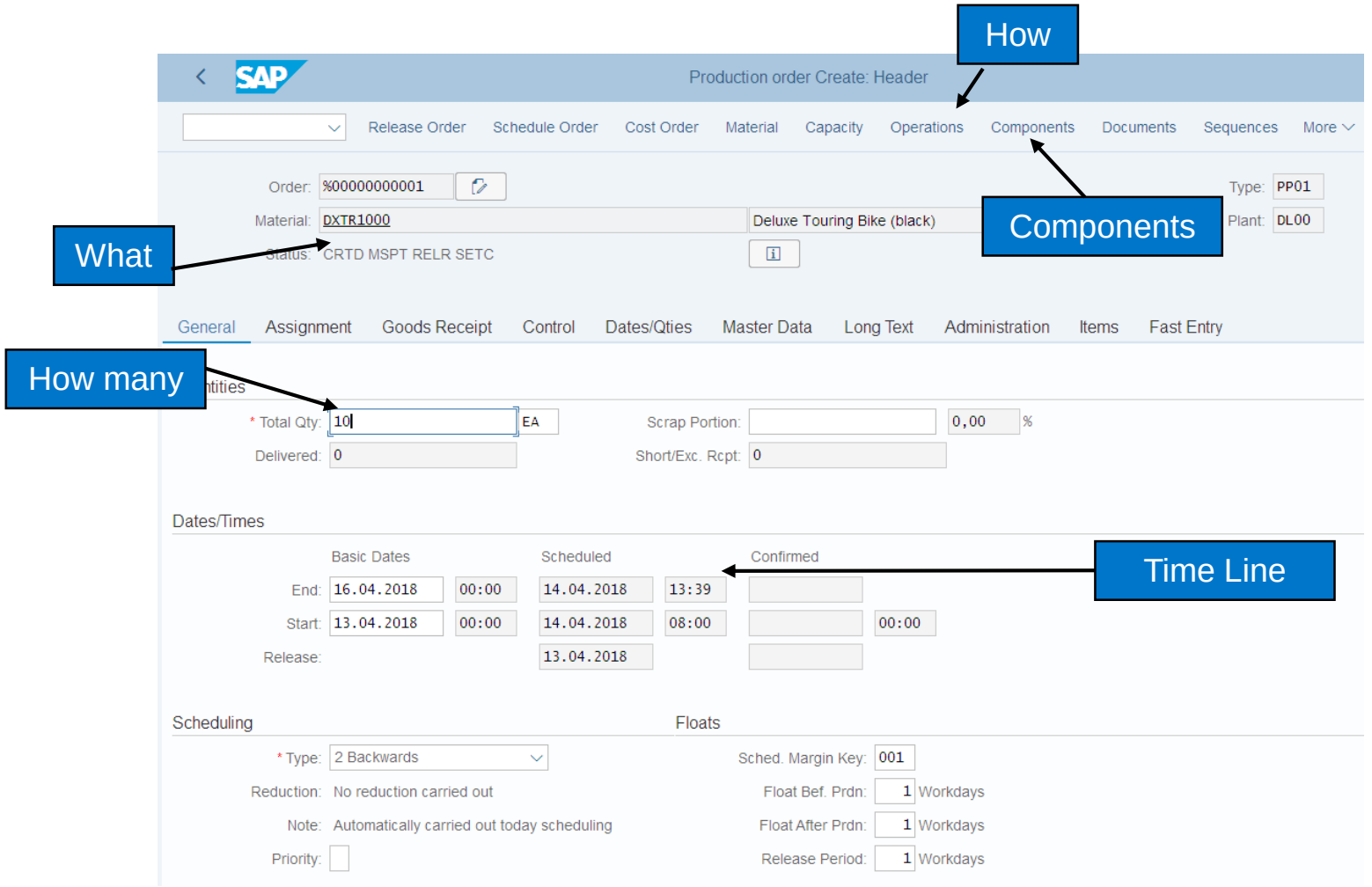
Manufacturing Execution Process



Production Order

- 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



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

Release

- 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 obtains a REL status
- Automatic vs. manual

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

Schedule & Release

- 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

- 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

Material Withdrawal

- 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

- 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

Goods Receipt

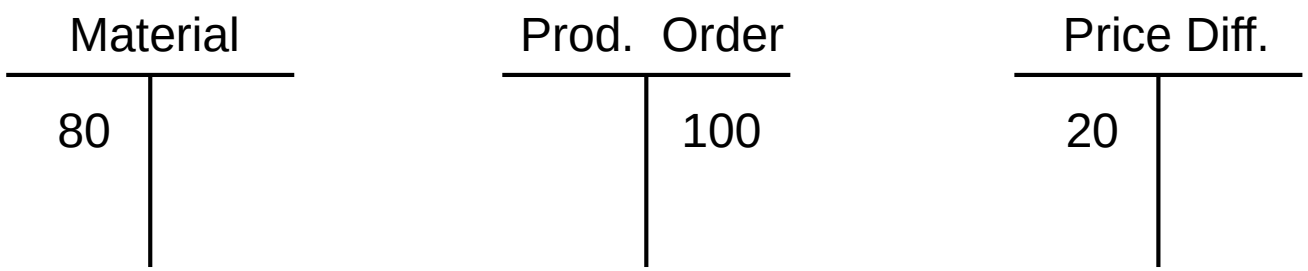
- Acceptance of the confirmed quantity of output from the production order into stock
  - Effects of the Goods Receipt
    - Updates stock quantity
    - Updates stock value
    - Price stored for future valuation changes
    - Production order is updated
  - Three documents are created
    - Material 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

Order Settlement

- Settling a Production Order to Stock
  - Debit 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



* Material Price is determined by the quantity produced times the Standard Price in the Material Master.

Order Settlement

- 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

Innovations in S/4HANA

1) The Functional relationship between Bill of Material (BOM), Routing and Production Version has been changed to streamline future release/revision process .
2) The ERP Engineering Workbench is not the future target architecture. It will not be updated, but will still work at a functional level in the system.
3) MRP has been optimized for the SAP HANA real time database and is called MRP LIve. All MRP relevant data is read directly from the system instead of being stored in a separate table in ERP.
4) Sales & Operations Planning (SOP) is replaced by *Integrated Business Planning (IBP).*
5) Material Number Field length is extended from 18 characters to 40 characters. This will appeal to many different customers

Innovations in S/4HANA

- Innovations in S/4HANA compared to ERP in Production Planning
  - Customizing for date validity is no longer considered for BOM explosion → Instead, only BOMs with valid production version are considered during BOM explosion.
    - For old BOMs you can perform a report
    - For new BOM there are a standard value in the customizing
  - Maintaining product version enables to combine the BOM and Routing entities which helps in streamlining the release/ revision process in future.

- Engineering Workbench is not the target architecture anymore and will not receive any further updates
  - was used in GBI for BOM and Routings
  - required to use alternative UIs, e.g. in Fiori, Web UI or GUI to maintain BOMs and Routings.

Innovations in S/4HANA

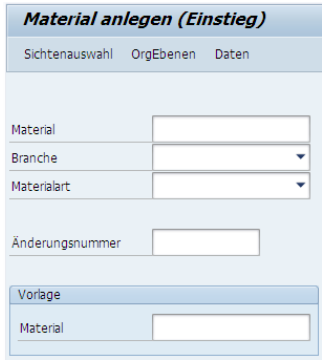
- MRP optimized for SAP HANA
  - reads material receipts and requirements, calculates shortages, and creates planned orders and purchase requisitions all in one database procedure → minimizes the volume of data that has to be copied from database server to application server and back
  - MRP Live reads material receipts and requirements, calculates shortages, and creates planned orders and purchase requisitions all in one database procedure
    - minimizes the volume of data that has to be copied from the database server to the application server and back, which considerably improves performance.
  - MRP Live always creates purchase requisitions if the material is procured externally.
  - Multi-level, make-to-order planning (transaction MD50) and Individual project planning (transaction MD51) is not optimized for HANA

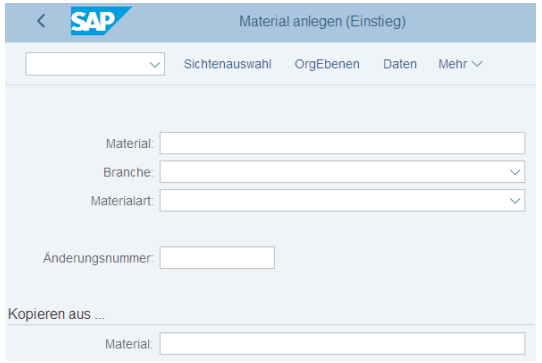
Innovations in S/4HANA

- Sales & Operations Planning (SOP) replaced by *Integrated Business Planning IBP*
  - Sales & Operations Planning (SOP) is a forecasting and planning tool for setting targets for sales and production based on historical, current, or estimated data ➡ used for long-term strategic planning, not short-term tactical planning
  - SOP is often performed on aggregated levels such as product groups and work-center hierarchies.
  - IBP supports all SOP features plus
    - advanced statistical forecasting,
    - multi-level supply planning,
    - Collaboration and optimizing tools,
    - an Excel-based UI, and Web-based Uis
- The key capabilities of SAP IBP for Sales & Operations are as follows:
  - Future production analytics will be based on SAP HANA, core data services (CDS) views aggregating transactional data dynamically, and powerful analytical UIs for multi-dimensional reporting. With this, it will be possible to replace the current logistics information system (LIS).

Innovations in S/4HANA

- Material Number Field Length Extension from 18 to 40 characters





Thank you!