

# PERENCANAAN & PENGENDALIAN PRODUKSI

TIN 4113

# Pertemuan 9

- **Outline:**

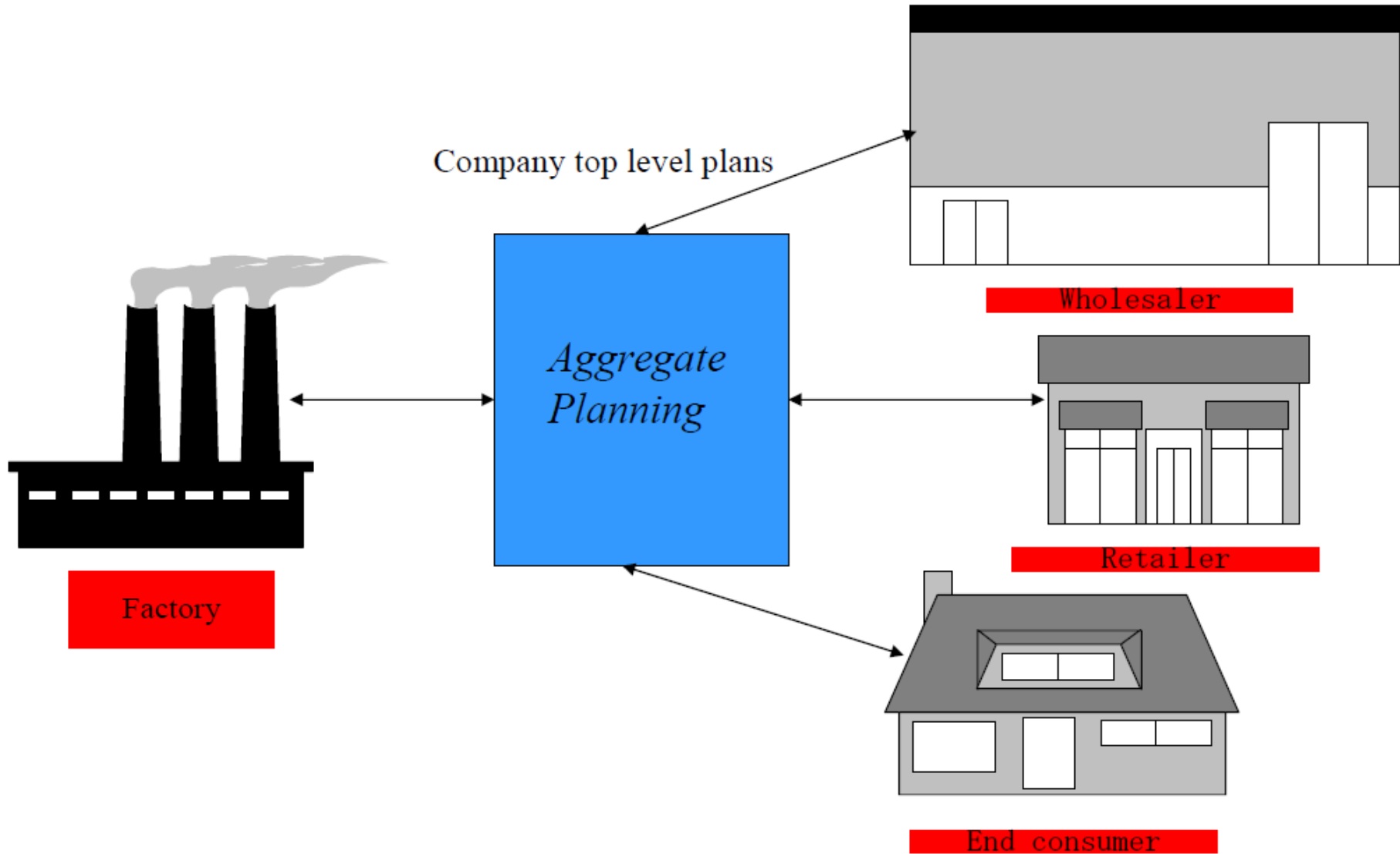
- Master Production Planning / Jadwal Produksi Induk

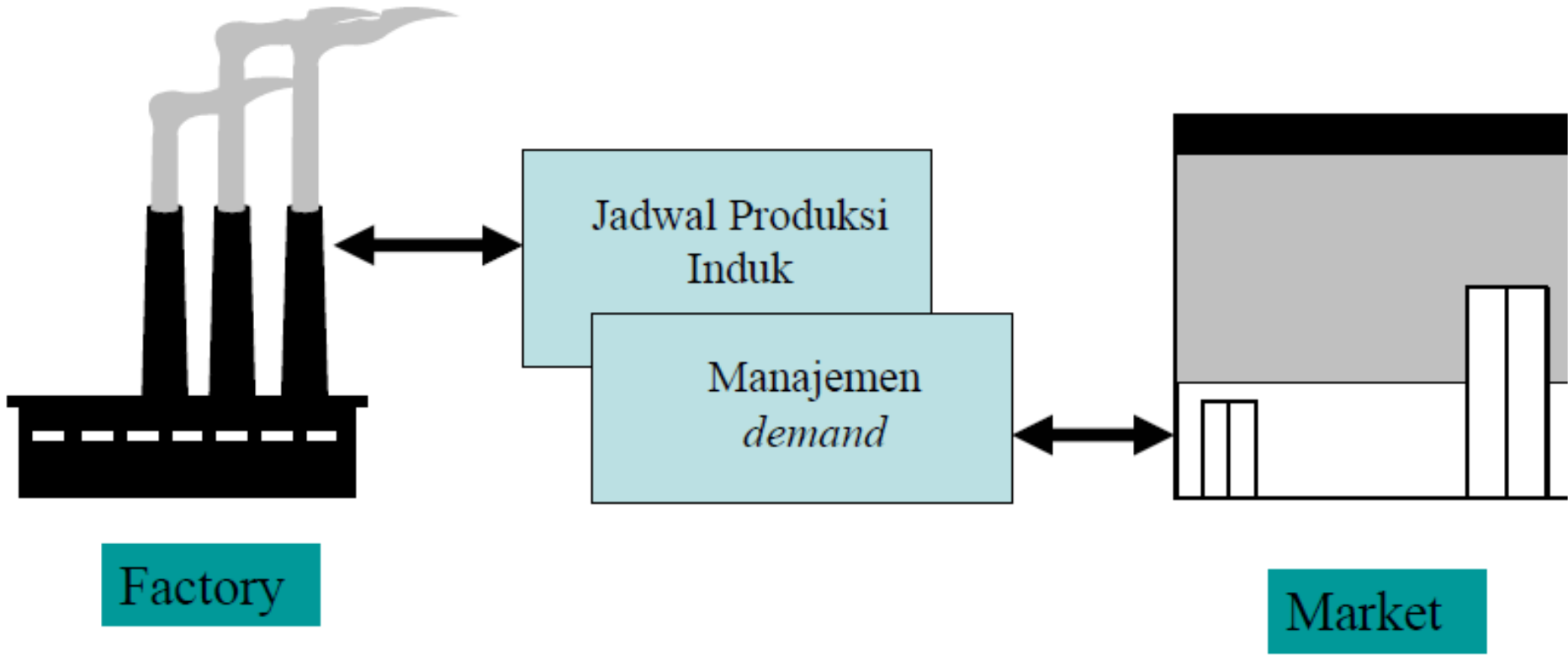
- **Referensi:**

- Smith, Spencer B., *Computer-Based Production and Inventory Control*, Prentice-Hall, 1989.

PRODUCTION PLANNING

# **MASTER PRODUCTION SCHEDULING (JADWAL PRODUKSI INDUK)**





# Master Production Scheduling

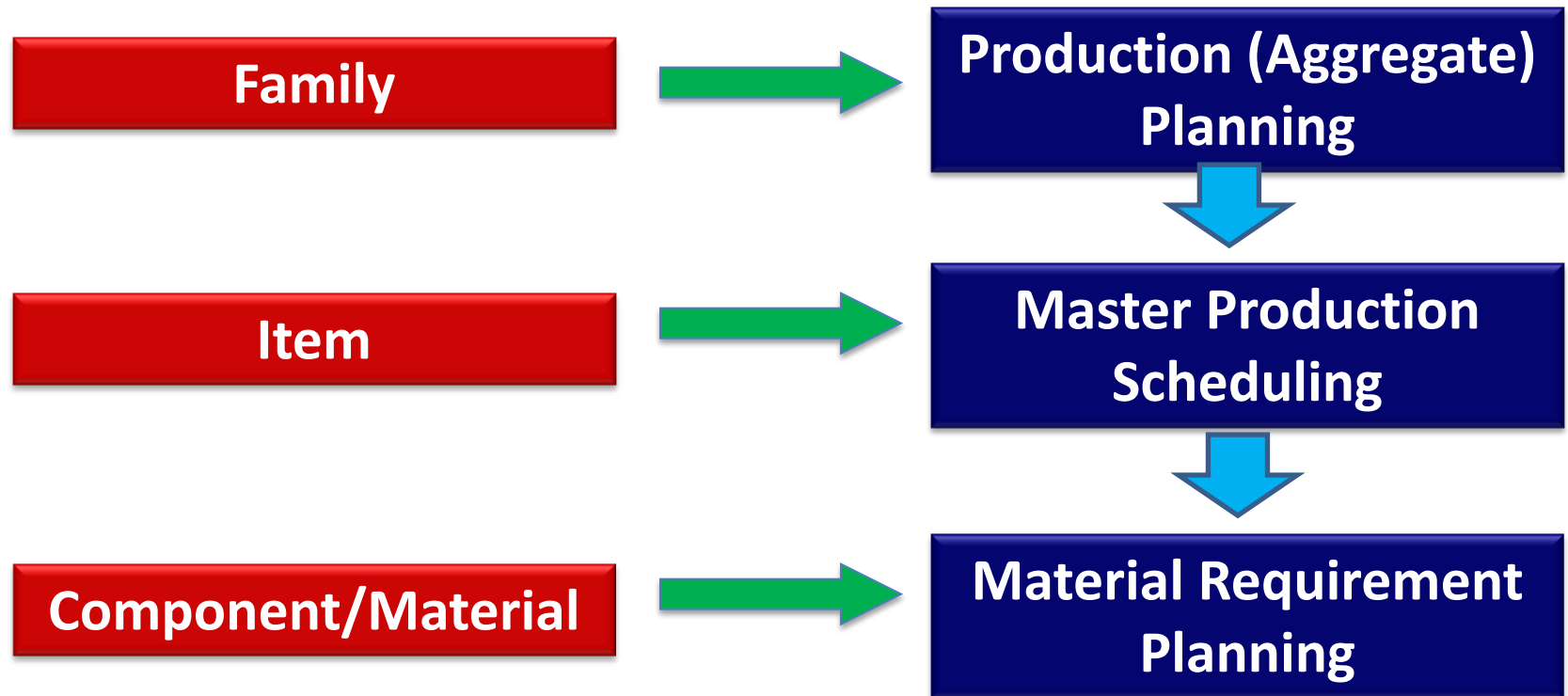
- **Definition:**
  - a statement of **what**, **how much**, and **when** end items are planned to be produced over planning periods. It is a **disaggregation** and implementation of the production plan.

# Master Production Scheduling

- **Functions:**

- It schedules production and purchase orders for MPS items
- It is principal input to MRP system
- It is the basis for determining resource requirements
- It provides the basis for making delivery promises to customers

# Product Level vs Production Planning





# SOP vs. MPS

## PROCESS

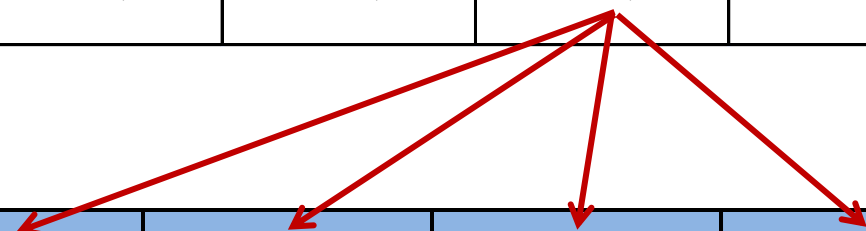
### Sales & Operations Planning

### Master Scheduling

Objective	Supply Rate by Product Family	Anticipated Build Schedule
Item Planned	Product Family	End item or Planning Bill of Materials
Planning Horizon	Longest Lead Time Resource Plant and Equipment	Longest Cumulative Lead Time for End Items
Constraints	Resource Capacity	Critical Workcenters
Time Periods	Monthly	Weekly or Daily
Planning Focus	Product Volume	Product Mix
Process Output	Production Plan	Master Production Schedule

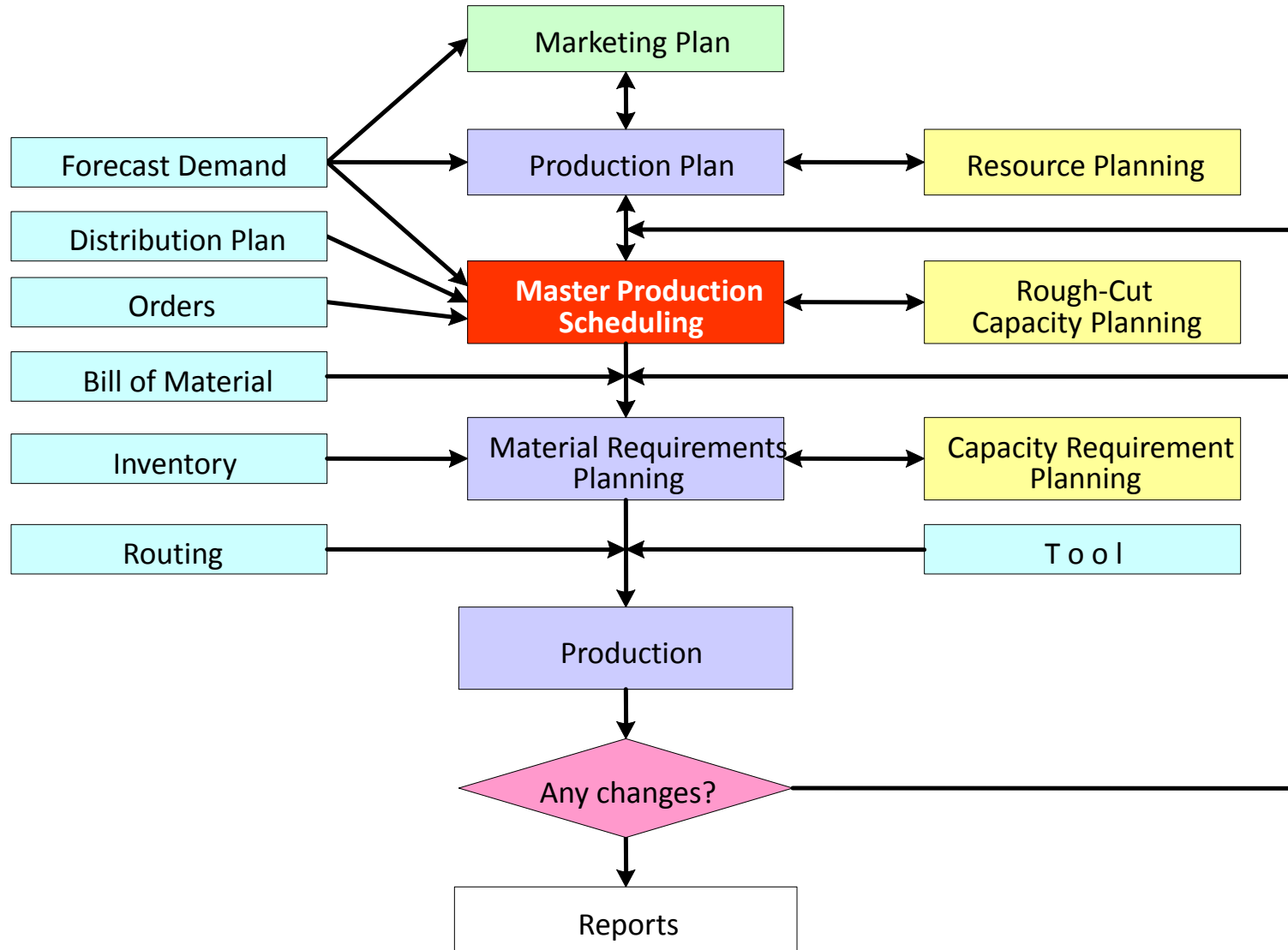
# Production Plan Relationship to MPS

Product Family A	July	August	September	October	November
Working Days/ Month	22	21	23	20	19
Approved Production Plan from S&OP	22,000	21,000	23,000	20,000	19,000



MPS Week	40	41	42	43
Product A1	1,000	1,000	1,000	1,000
Product A2	500	1,000	1,500	2,000
Product A3	1,500	500	500	1,500
Product A4	2,000	2,500	2,000	500
<b>Total</b>	<b>5,000</b>	<b>5,000</b>	<b>5,000</b>	<b>5,000</b>

# The Components of MRP II



# Master Production Scheduling

- **Inputs:**

1. Production Plan

MPS must be reconciled with Production Plan

2. Demand data

- Sales forecast
- Customer orders
- Safety stocks
- Field warehouse requirements

3. Inventory status

4. Ordering policy

# Master Production Scheduling

- **Planning Bills:**
  - BOM yang digunakan untuk memfasilitasi kemudahan dalam melakukan peramalan penjualan, perencanaan MPS, menentukan safety stock dan FAS
  - Jenis-jenis Planning Bills:
    1. Modular Bills
    2. Super Bills

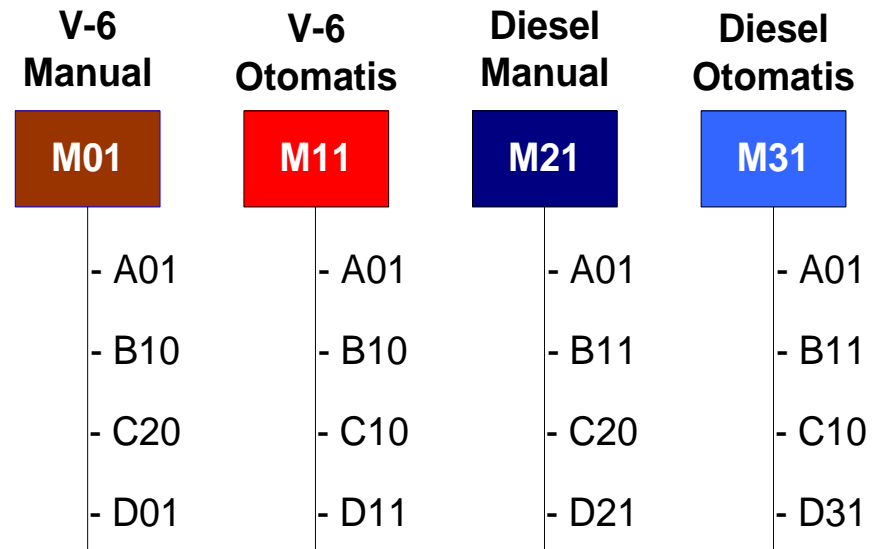
# Master Production Scheduling

- **Modular Bill**

**Contoh:** sebuah mobil dapat dirakit dengan pilihan:

- Transmisi: Manual atau Otomatis (2)
- Mesin: V6 atau diesel (2)

## Single BOM



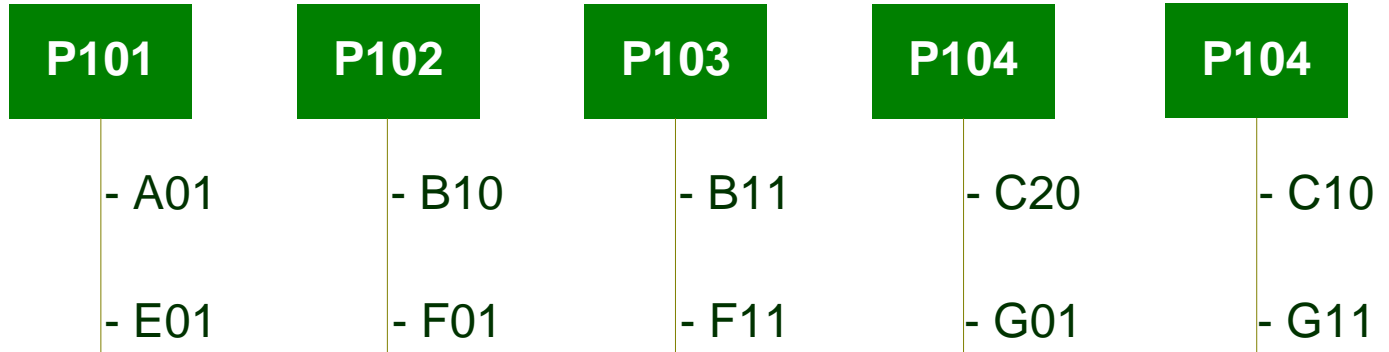
## Modular BOM

Semua Mobil	Mesin V-6	Mesin Diesel	Transmisi Manual	Transmisi Otomatis
A01	B10	B11	C20	C10
E01	F01	F11	G01	G11

# Master Production Scheduling

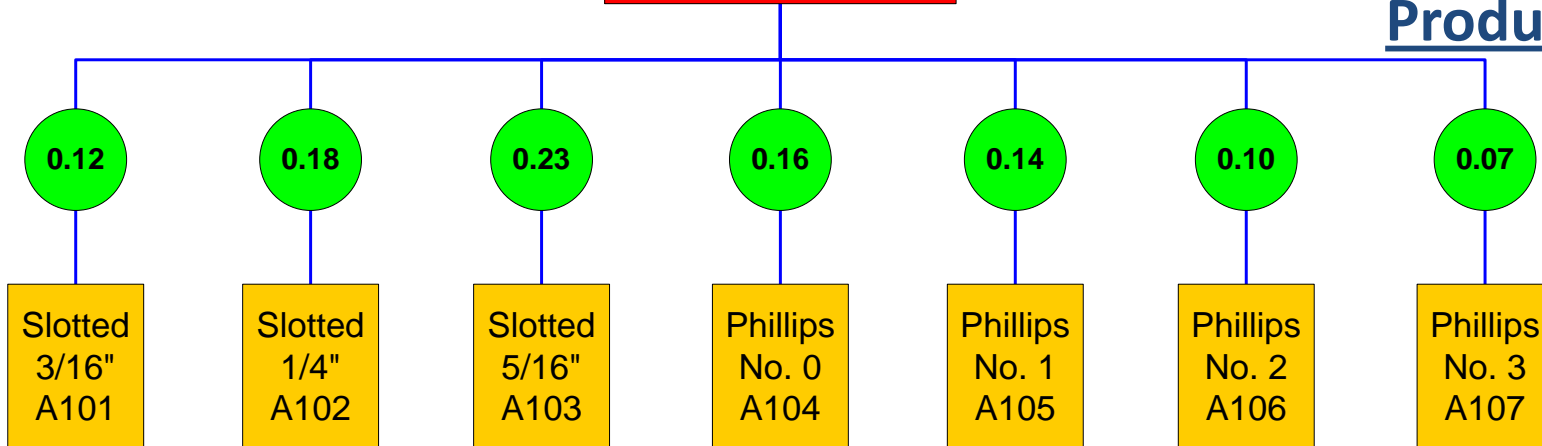
- Super Bill

## Super Bill for BOM Modules



## Screw Drivers A100

## Super Bill for Product Families



# Master Production Scheduling

- **Memilih Item:**

- Menentukan efisien tidaknya pelaksanaan pembuatan MPS

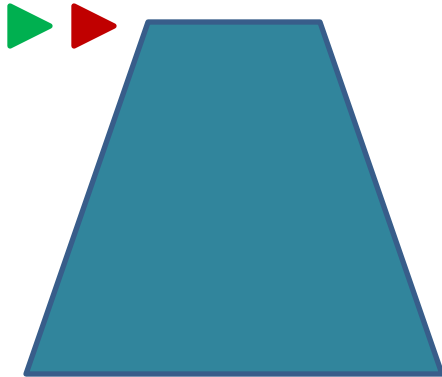
- Pertimbangan:

1. Jumlah item sedikit untuk memudahkan dalam pembuatan dan evaluasi MPS
2. Item harus dapat diramalkan (pada MTS) sehingga karakteristik permintaan item dapat dianalisis
3. Setiap item harus punya BOM sehingga MPS dapat digunakan sebagai dasar pembuatan MRP
4. Kapasitas yang dibutuhkan dari item-item yang akan diproduksi harus dapat dihitung
5. Item dalam MPS harus mudah diterjemahkan sebagai produk yang diminta customer



# BOM Structures and FAS, MPS Level

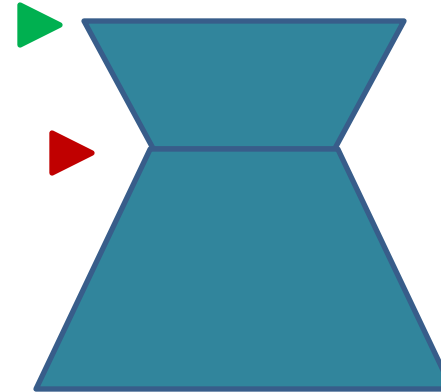
Products



Materials

**Pyramid MTO and MTS**

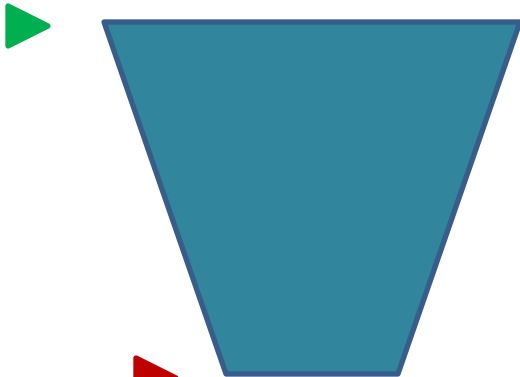
Products



Materials

**Hourglass ATO and MTS**

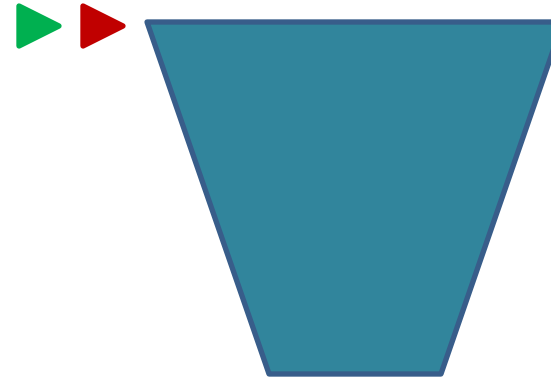
Products



Materials

**Inverted Pyramid MTO**

Products



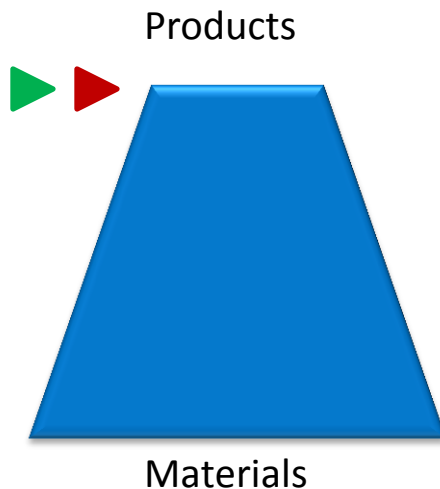
Materials

**Inverted Pyramid MTS**

 **MPS level**

 **FAS level**

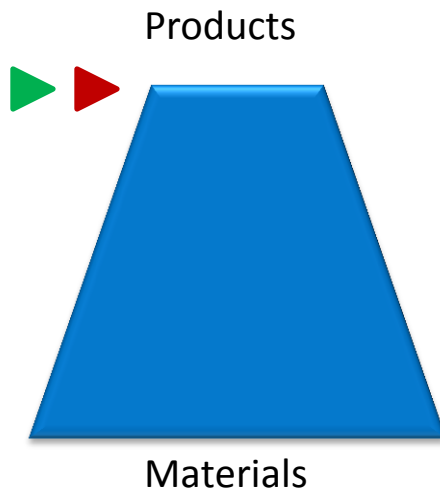
# BOM Structures and FAS, MPS Level



- **Pyramid BOM, Sistem Produksi MTO**

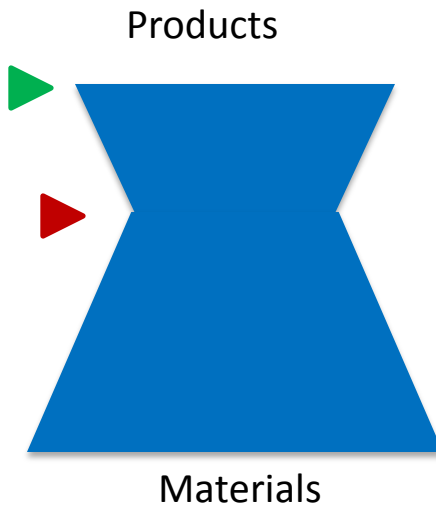
- Produk akhir jenisnya sedikit dan tidak distock karena harganya relatif mahal (mis: pesawat terbang, supercomputer) dimana produk dibuat sesuai spesifikasi yang diinginkan oleh customer
- MPS sama dengan Jadwal Perakitan Akhir (FAS)
- Cumulative Lead Time dapat dipercepat dengan cara melakukan peramalan permintaan dan MPS dibuat jangka waktu yang lebih panjang lagi sehingga pengadaan material dan fabrikasi dapat dilakukan lebih awal
- Pada kasus MPS yang belum sepenuhnya pasti dapat dinyatakan dalam satuan yang cocok seperti jam mesin, jam orang dll

# BOM Structures and FAS, MPS Level



- **Pyramid BOM, Sistem Produksi MTS**
  - Digunakan untuk produk yang standard (TV, Radio, dsb)
  - MPS dan FAS sama
  - Bila variasi produk sedikit maka produk-produk tersebut bisa langsung dijadualkan dalam MPS.
  - Untuk variasi produk banyak, sebaiknya MPS dinyatakan dalam keluarga produk (super bills). MPS dibuat dalam 2-level, pertama adalah tingkat produk family dan kedua adalah produk-produk itu sendiri

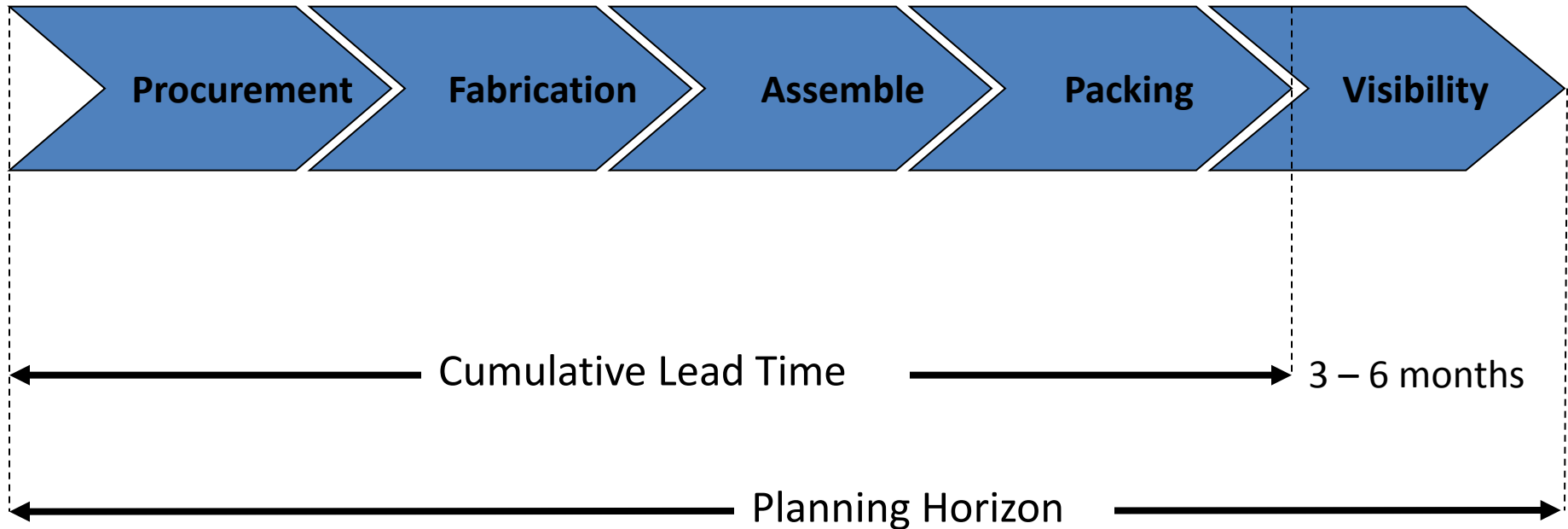
# BOM Structures and FAS, MPS Level



- **Hourglass BOM, Sistem Produksi ETO**
  - Tersedia banyak variasi produk akhir yang dapat diminta kustomer dimana setiap pilihan dirakit dari sejumlah komponen/subassembly (modul) dengan kombinasi yang berbeda-beda (contoh: mobil, PC)
  - MPS dibuat dengan pilihan-pilihan Subassembly level 1, komponen atau modul
  - Bila modul cukup banyak, gunakan super bills dengan MPS Two-level dengan Level-1 adalah produk generik, dan Level-2 adalah modul-modul pilihan.
  - Komponen dan Subassembly tingkat satu pada MPS ini kemudian dirakit menjadi produk jadi yang sebenarnya dengan FAS

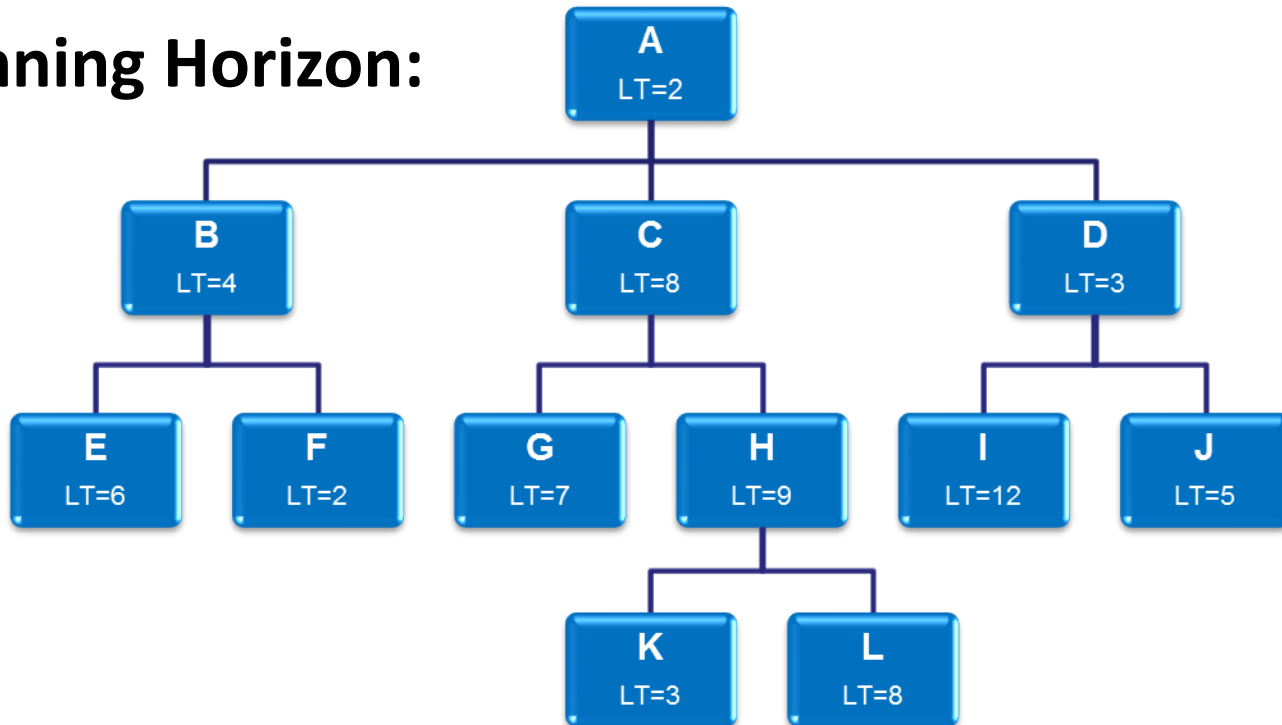
# Master Production Scheduling

- **Planning Horizon:**



# Master Production Scheduling

- **Planning Horizon:**



The length of each path is the sum of the lead times

$$E = E-B-A = 6+4+2 = 12$$

$$F = F-B-A = 2+4+2 = 8$$

$$G = G-C-A = 7+8+2 = 17$$

$$K = K-H-C-A = 3+9+8+2 = 22$$

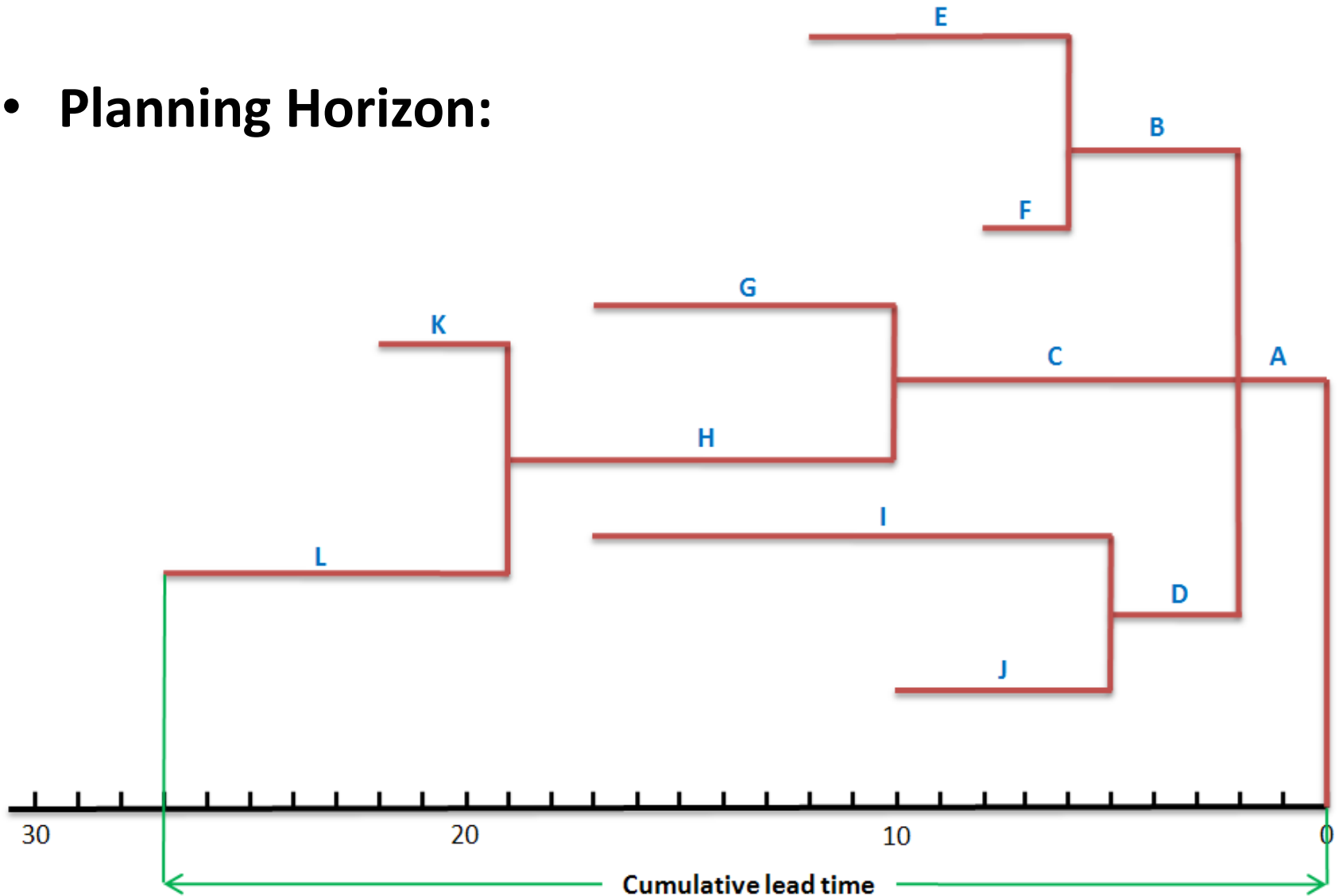
$$L = L-H-C-A = 8+9+8+2 = 27$$

$$I = I-D-A = 12+3+2 = 17$$

$$J = J-D-A = 5+3+2 = 10$$

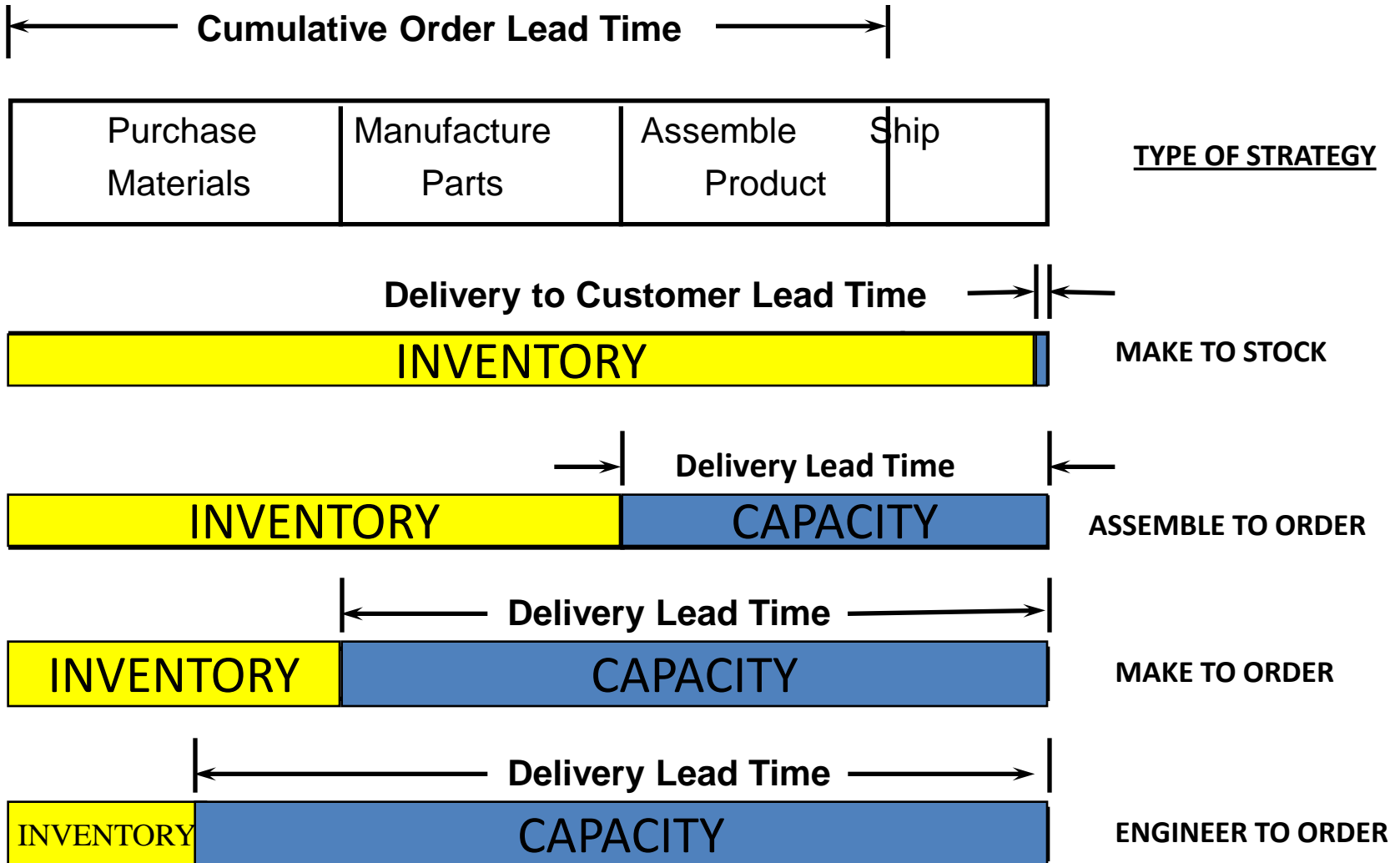
# Master Production Scheduling

- **Planning Horizon:**



# Master Production Scheduling

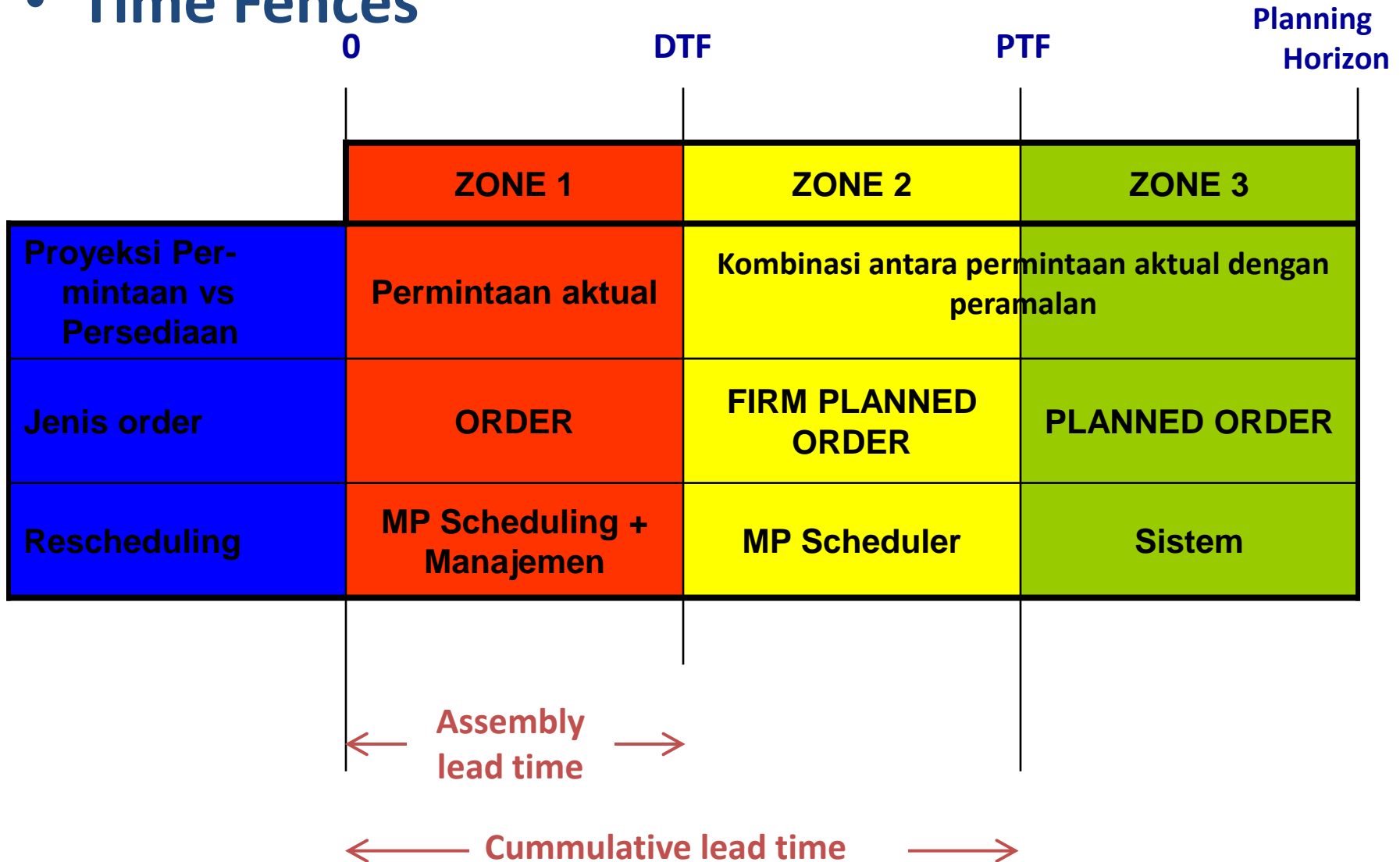
- Manufacturing Strategies





# Master Production Scheduling

- Time Fences



# Master Production Scheduling

- **Planned order**  
Planned order is an order for future execution which is calculated automatically by the system
- **Firm planned order (FPO)**  
FPO is an order authorized by master scheduler but not yet release to manufacturing
- **Order**  
Order is production order that have been release to manufacturing

# Master Production Scheduling

- **Content:**
- Header : Item part number, item description, lead time, safety stock, order quantity policy, DTF and PTF
- Body : information for each time bucket through the planning horizon:
  - Forecast → forecast of independent demand
  - Production forecast → the calculated dependent demand
  - Actual demand → promised customer orders
  - MPS → the scheduled receipts of orders and FPOs
  - Projected available balance → a projection of the on-hand inventory less any allocations or back orders
  - Available to Promise (ATP) → the quantity from the current balance and from each MPS order that has not already been promised to customer and is, therefore, available to promise
  - Planned orders → by period in which they are scheduled to be received

# The Example of MPS

MPS for an **MTS Product** (1)



<b>Item no</b> : X1736		<b>Description</b> : Generator								
<b>Lead time</b> : 3 periods		<b>Safety stock</b> : 3 unit								
<b>Order Quantity</b> : 3 periods net requirements		<b>DTF</b> : 0 period								
		<b>PTF</b> : 5 periods								
		PTF								
Period		1	2	3	4	5	6	7	8	9
Forecast		5	3	8	2	7	5	8	4	10
Production forecast										
<b>Actual demand</b>										
MPS				15						
Projected available balance	14	9	6	13	11	4	-1	-9	-13	-23
<b>Available to promise</b>										
Planned order							16			10

For periods 6, 7, and 8 the net requirements is

$$\begin{aligned}
 &= \text{Demand} + \text{Safety stock} - \text{Starting projected available balance} \\
 &= (5 + 8 + 4) + 3 - 4 \\
 &= 16
 \end{aligned}$$

This will be the planned order to be received in period 6 and to be released in period 3



# The Example of MPS

MPS for an **MTO**



- Tidak akan ada ramalan/proyeksi stok karena produksi hanya dilakukan setelah ada pesanan langsung dari kustomer
- DTF dan PTF jatuh pada waktu yang sama
- Pesanan yang jatuh tempo di luar PTF dialokasikan sebagai Planned Order, sedangkan yang berada pada daerah PTF dialokasikan pada MPS

<b>Item no : Y750</b>		<b>Description : Digital Controller</b>								
<b>Lead time : 5 periods</b>		<b>Safety stock : 0 unit</b>								
<b>Order Quantity : Lot for Lot</b>		<b>DTF/PTF : 6/6 period</b>								
		DTF PTF								
Period		1	2	3	4	5	6	7	8	9
Forecast										
Production forecast										
Actual demand		5	5	7	3	4	2	1		
MPS		5	5	7	3	4	2			
Projected available balance										
Available to promise										
Planned order								1		

# The Example of MPS

MPS for an MTO/MTS Product (1)



- Hybrid system
- Produk akhir terlalu mahal untuk di stok, tetapi harus tersedia sebelum ada permintaan
- MPS berdasarkan forecast, dan permintaan customer dipenuhi sesuai sesuai waktu yang dijanjikan
- Biasanya karakteristik produk hampir standard (*minor customizing*) sehingga MPS bisa dibuat berdasarkan ramalan sebelum pesanan kustomer benar-benar diterima

# The Example of MPS

MPS for an MTO/MTS Product (2)



<b>Item no</b>	<b>: Z438</b>	<b>Description : Electronics microscope</b>									
<b>Lead time</b>	<b>: 3 periods</b>	<b>Safety stock : 0 unit</b>									
<b>Order Quantity</b>	<b>: 4 periods net requirements</b>	<b>DTF : 3 periods</b>									
		<b>PTF : 6 periods</b>									
		<b>DTF</b>			<b>PTF</b>						
Period		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	
Forecast		<b>7</b>	<b>8</b>	<b>3</b>	<b>5</b>	<b>10</b>	<b>11</b>	<b>6</b>	<b>9</b>	<b>15</b>	
Production forecast											
Actual demand		<b>4</b>	<b>6</b>	<b>5</b>	<b>3</b>	<b>2</b>	<b>1</b>				
MPS				<b>18</b>		<b>28</b>					
Projected available balance	<b>11</b>	<b>7</b>	<b>1</b>	<b>14</b>	<b>9</b>	<b>27</b>	<b>16</b>	<b>10</b>	<b>1</b>	<b>-14</b>	
Available to promise		<b>1</b>		<b>10</b>		<b>25</b>					
Planned order										<b>14</b>	

Available to Promise (ATP) = stok awal – total permintaan aktual dan permintaan sebelum MPS

$$\text{ATP (Period 1)} = 11 - 4 - 6 = 1$$

$$\begin{aligned} \text{ATP (Period 3)} &= \text{MPS (Period 3)} - \text{Actual demands (Period 3 and 4)} \\ &= 18 - 5 - 3 = 10 \end{aligned}$$





# Master Production Scheduling

- **Metode Disagregasi:**
  - Metode Heuristic
  - Metode Linear Programming
  - Metode Family Setup

# Pertemuan 10 - Persiapan

- **Materi**
  - Metode Disaggregasi
  - Material Requirement Planning

**SAMPAI JUMPA MINGGU DEPAN**