

供應鏈管理簡介

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Agenda

- § Basic Concept of SCM
- § Supply Chain Modeling
- § ERP & APS
- § SCM Workflow
- § Demand Planning
- § Allocation Planning
- § Master Planning
- § Order Promising
- § Factory Planning

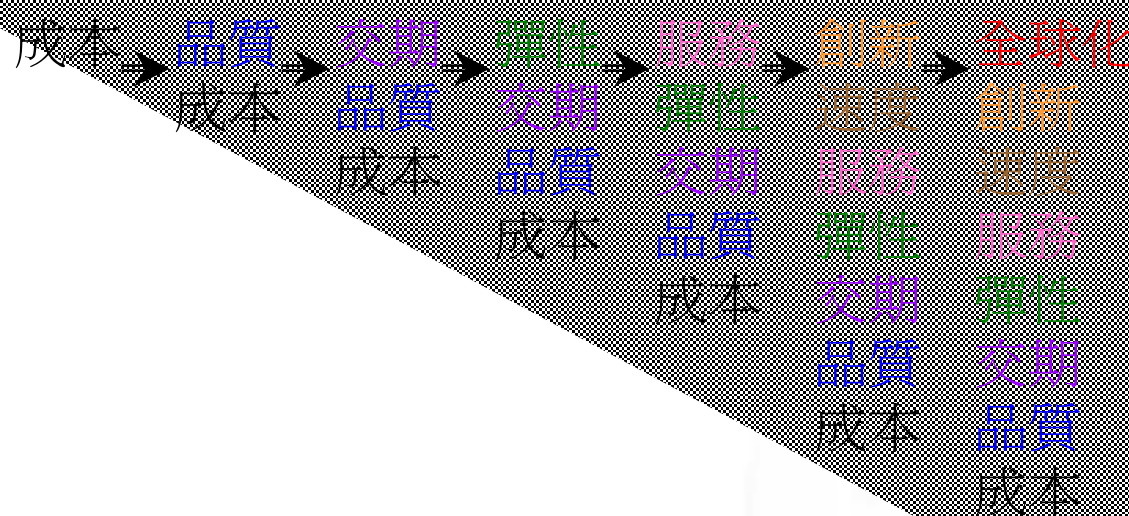


Evolution of Strategy

- § Vertical Integration (垂直整合)
- § Focusing on "core business" (垂直分工)
- § Supply Chain Management: Integration & Coordination(分工整合)



Changing Objectives



結果

顧客迫使製造商／
供應商生產／供應
多樣、大量且低成
本的一般化商品
(Commodity)

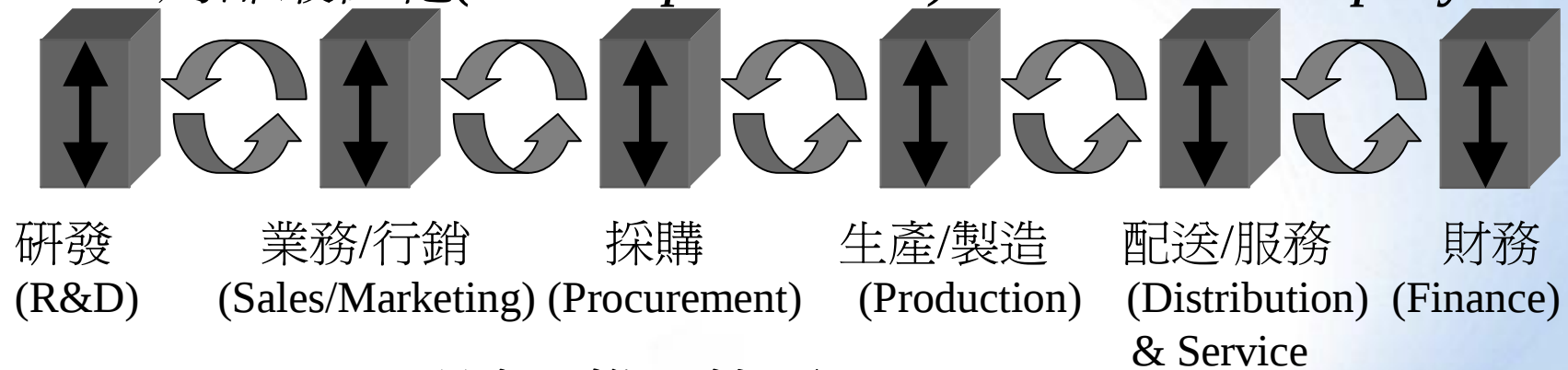


Changing Sales/Production Model



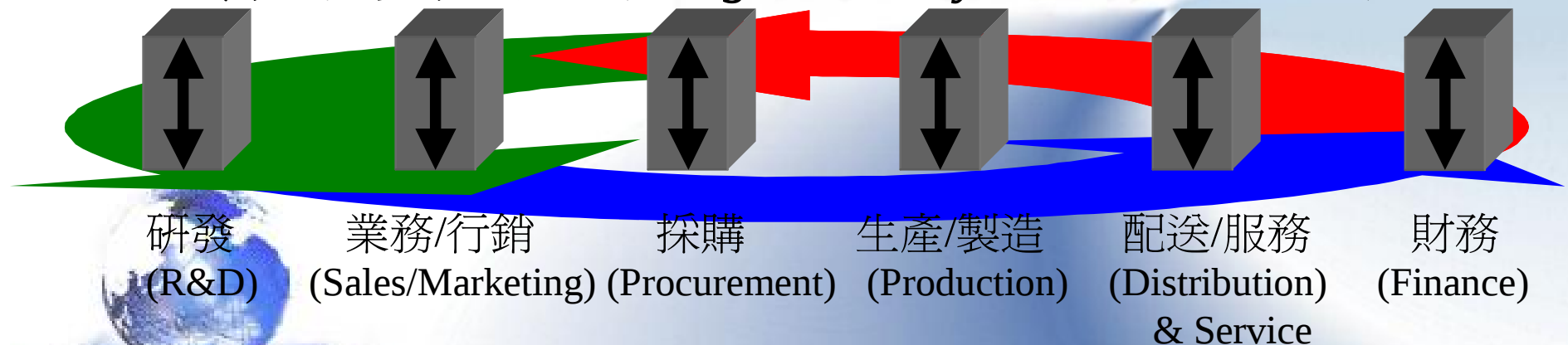
過去 (推 / Push)

局部最佳化(Local Optimization) Misleads A Company



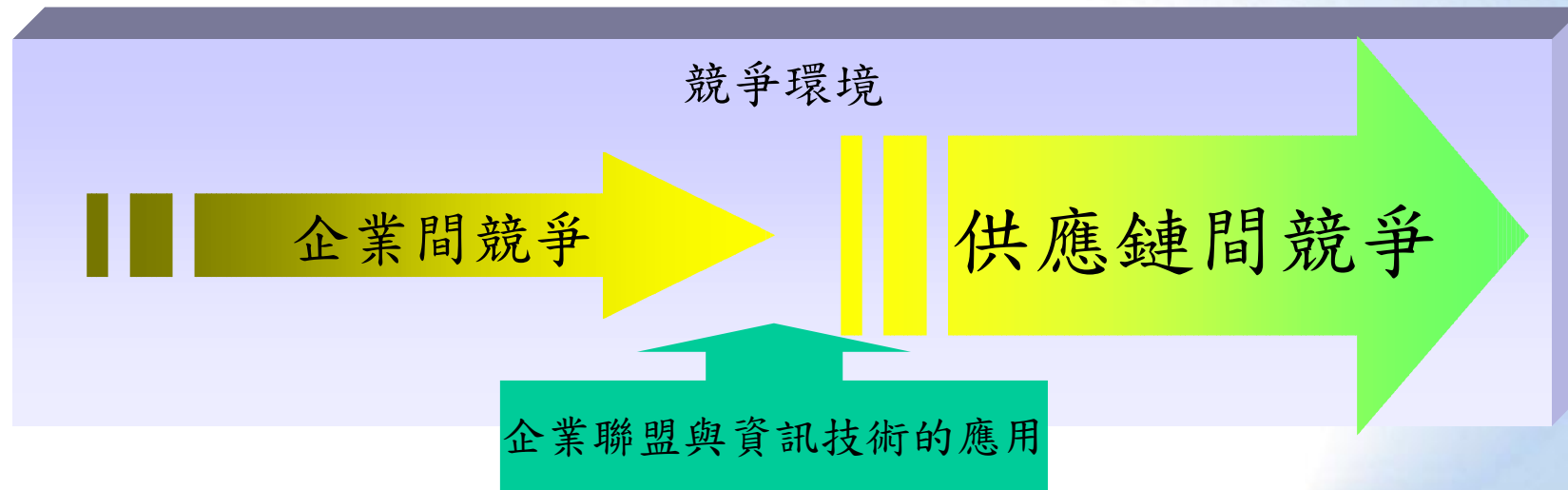
現在 (推 & 拉 / Push & Pull)

整合且同步化的鏈 (Integrated & Synchronized Chain)

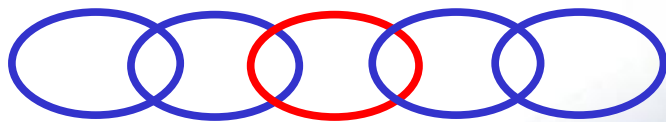


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Changing Competition Environment



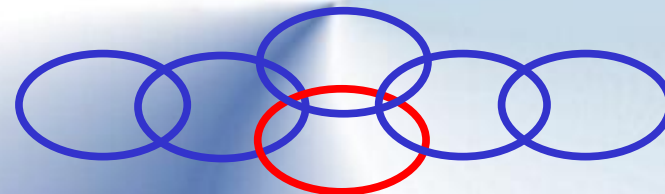
3 提昇企業競爭力



3 企業內資訊的傳遞與整合應用

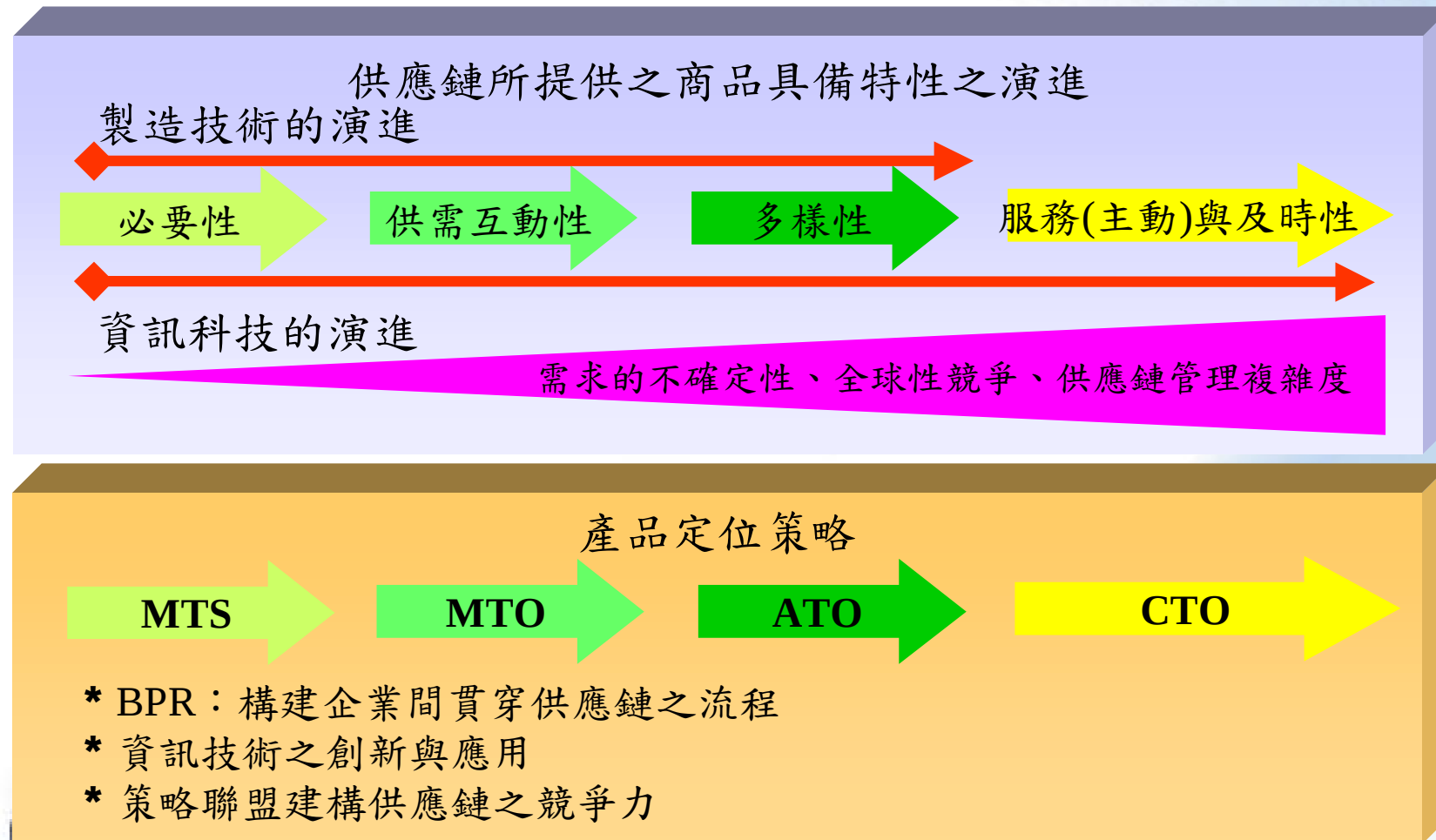


3 提昇供應鏈競爭力



3 企業間資訊的快速傳遞與整合應用

Evolution for Supply Chain Requirements



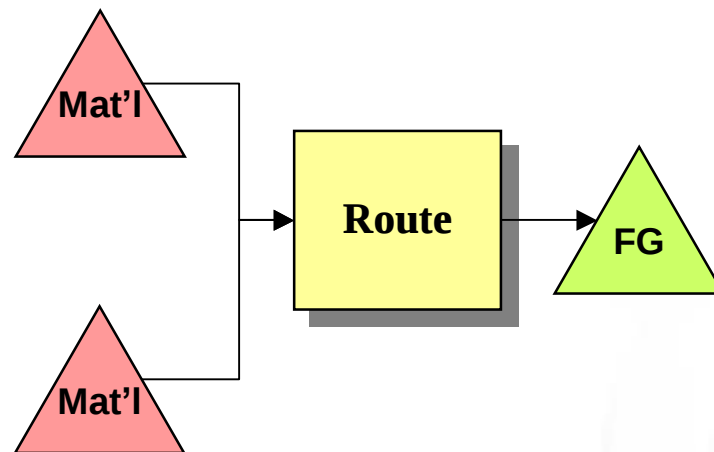
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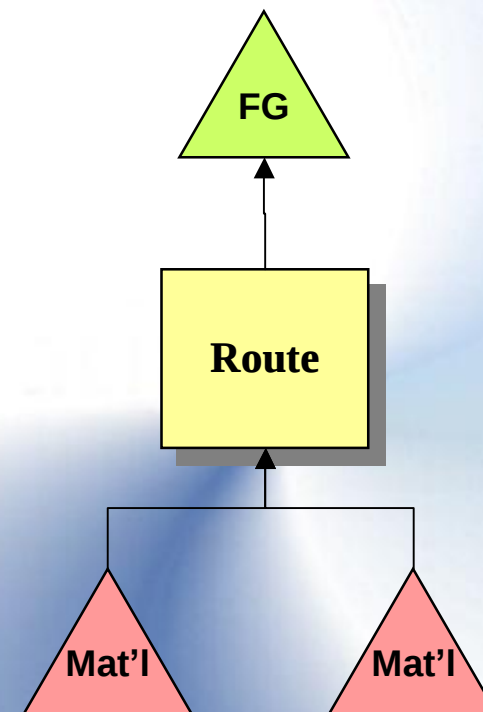


Modeling: a basic form

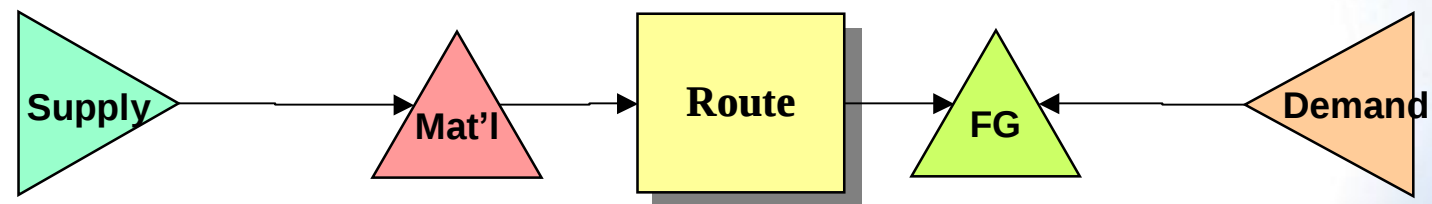
Supply Chain Network View



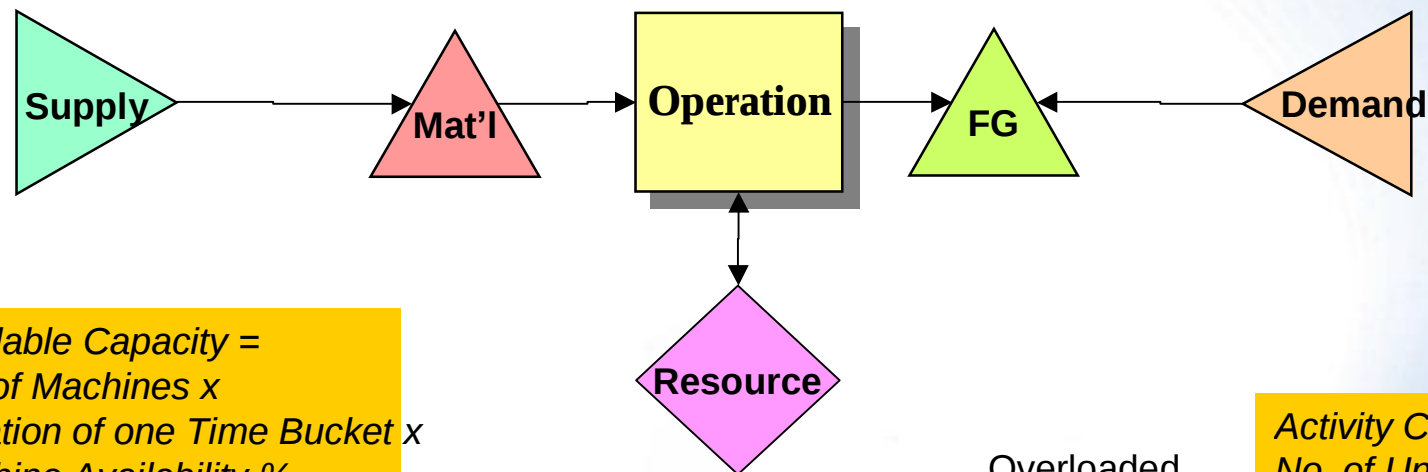
BOM View



Modeling the Dynamics

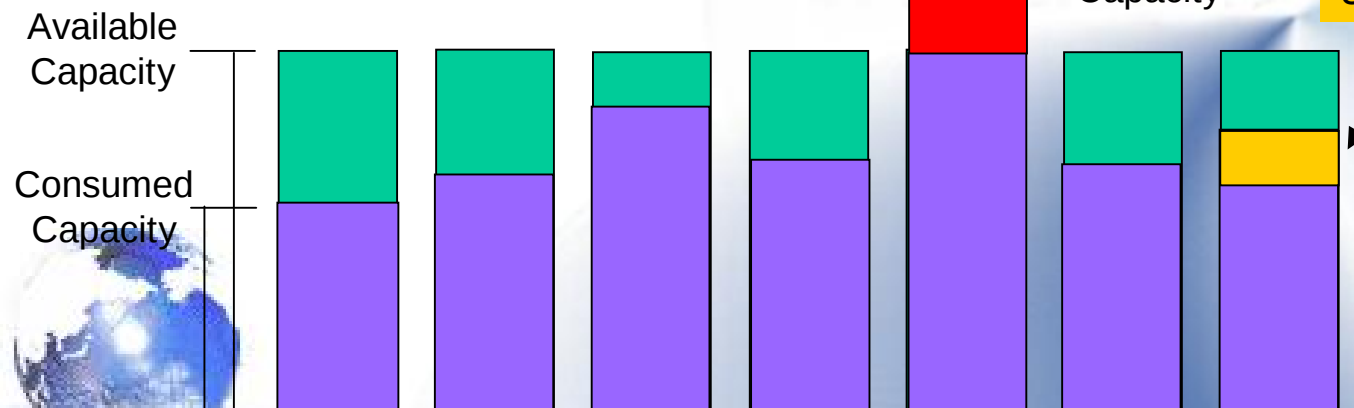


Modeling the Capacity

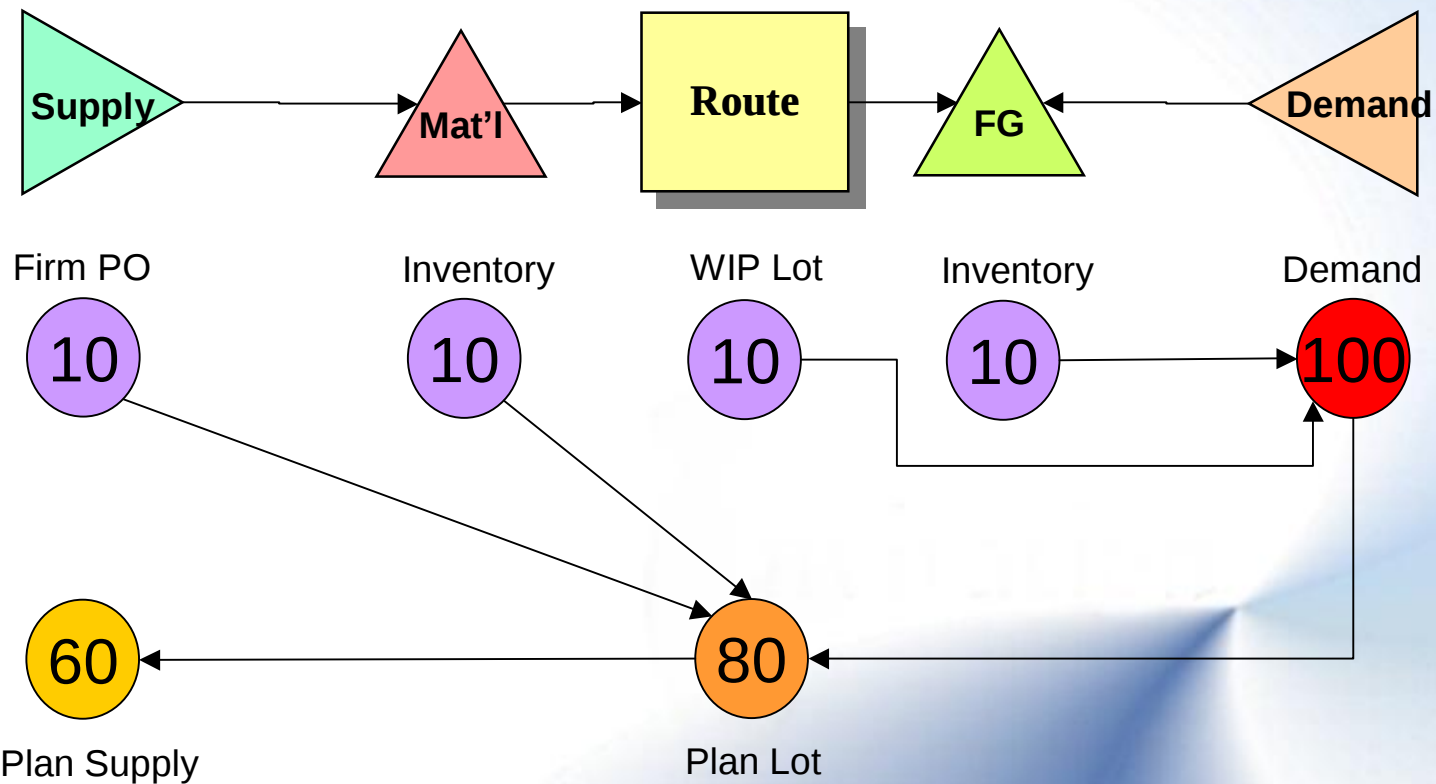


*Available Capacity =
No. of Machines x
Duration of one Time Bucket x
Machine Availability %*

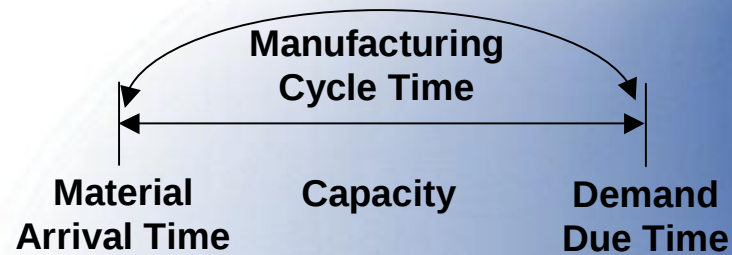
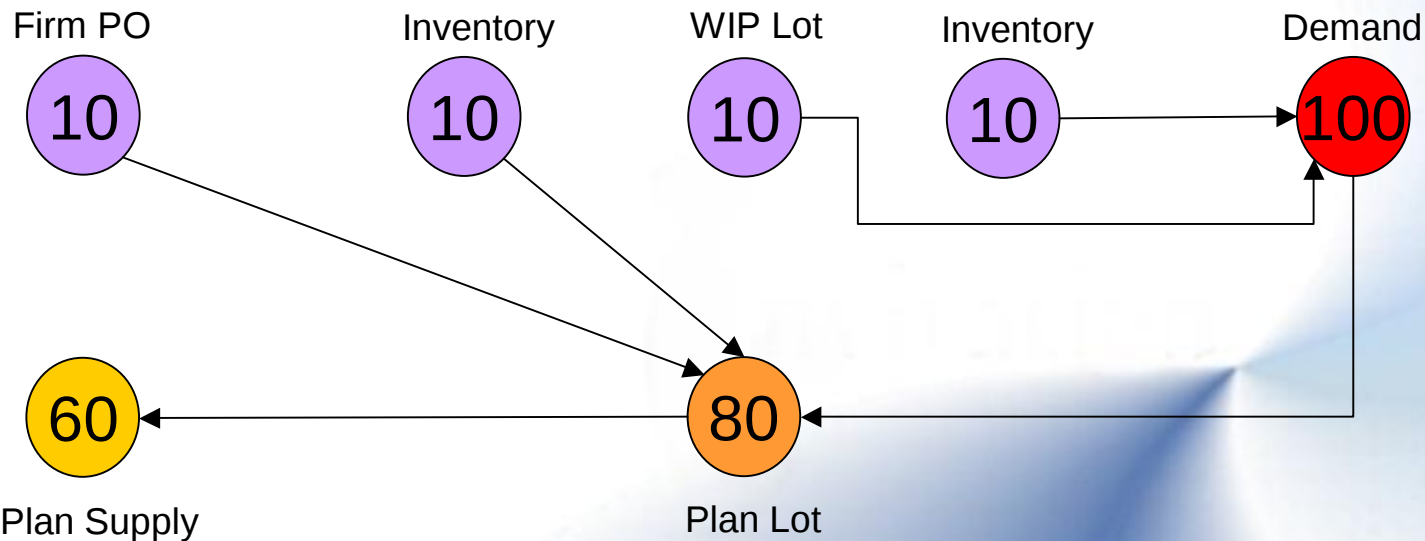
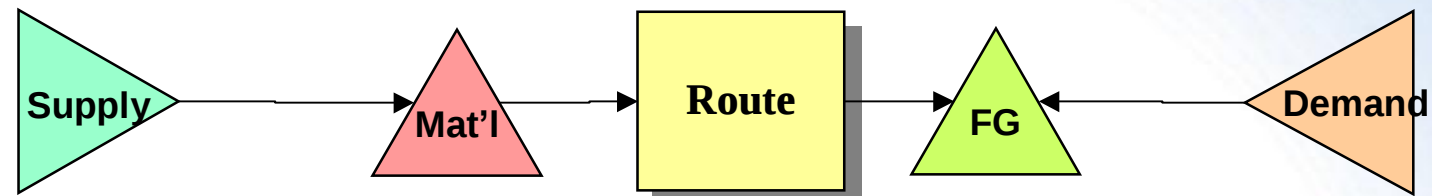
*Activity Consumed Capacity =
No. of Units x
Unit Operation Process Time*



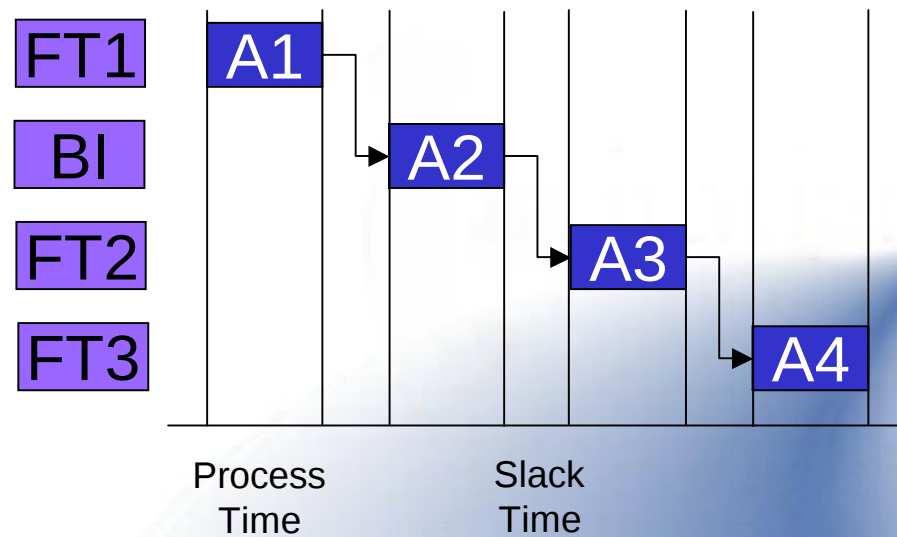
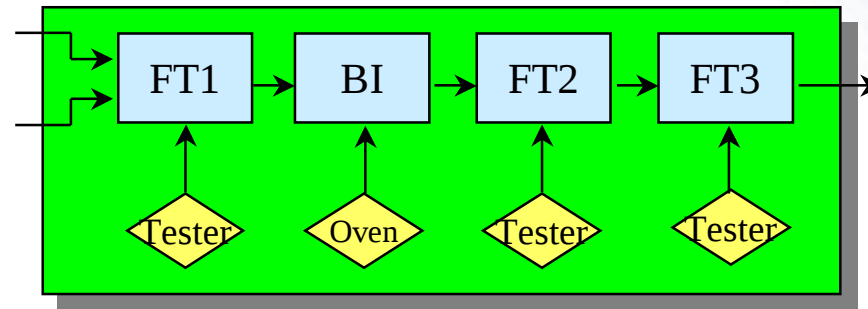
Balancing Algorithm



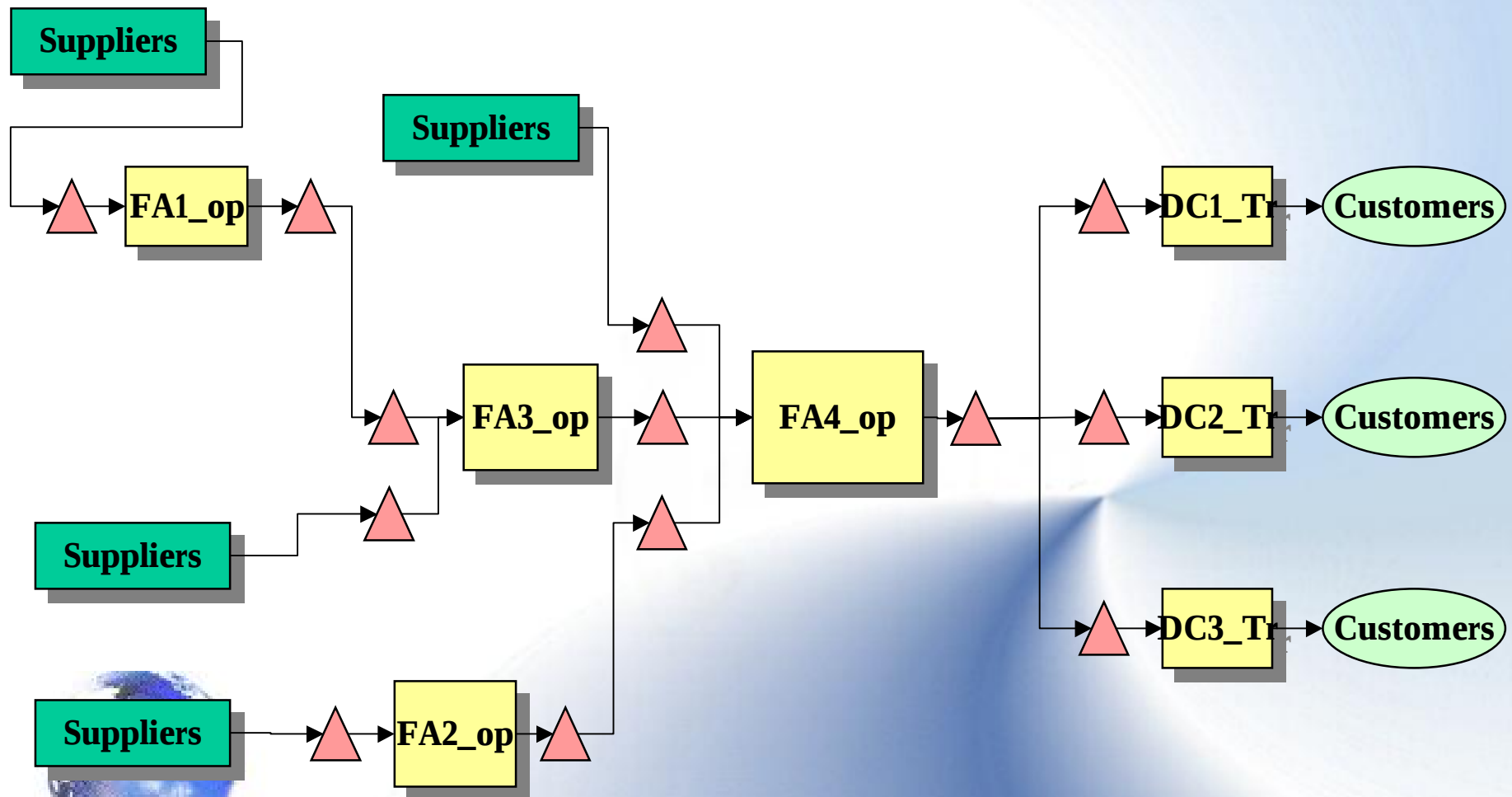
Scheduling Constraints



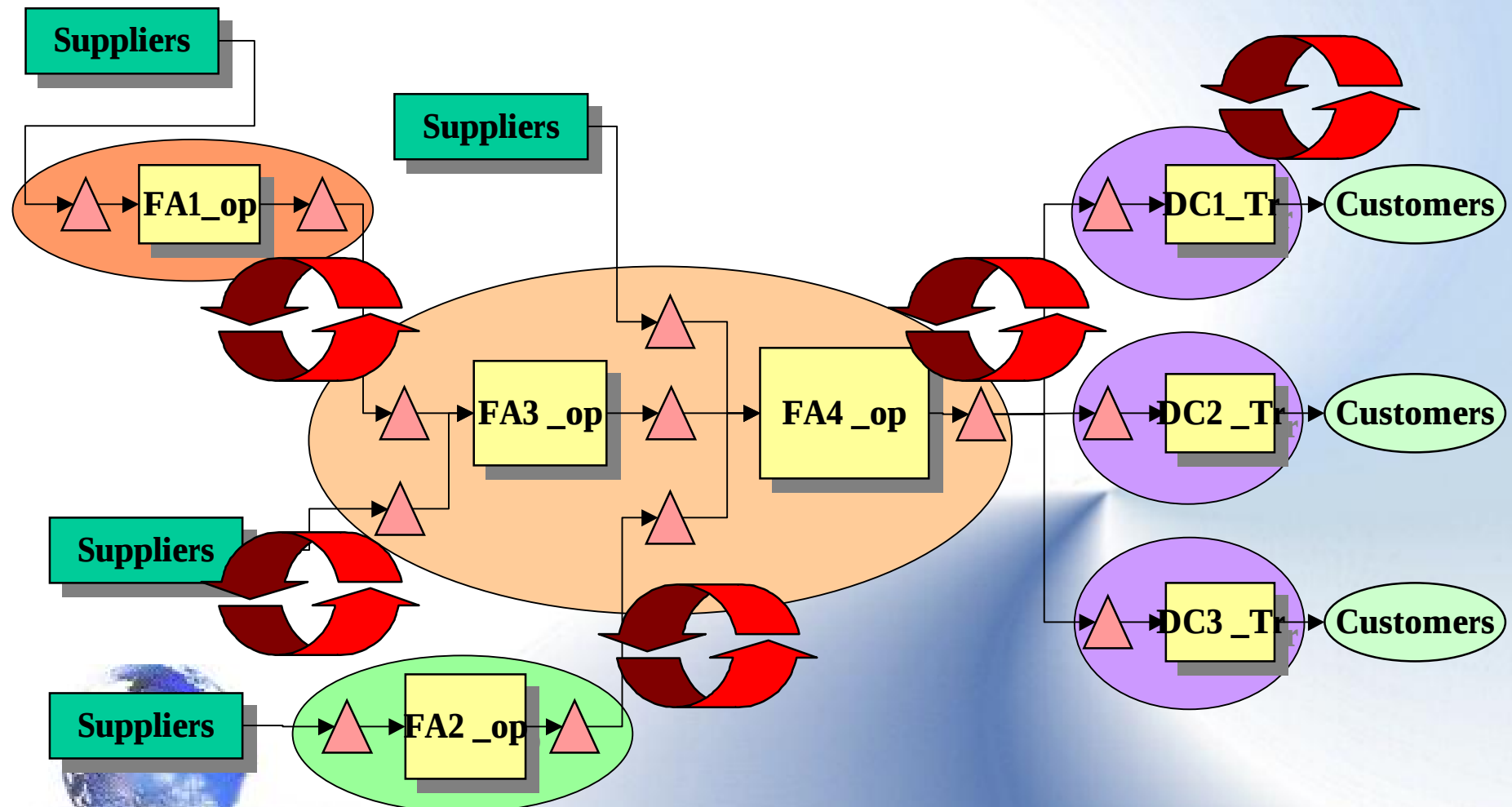
Scheduling Activities



Supply Chain Network



Request Reply Collaboration



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ERP Basic Function

銷退貨與存貨管理連結
銷退貨與應收帳款連結
銷貨與生產計劃連結
銷貨與製造現場連結

庫存進耗(銷)存管理
庫存交易查詢
庫存金額即時查詢
盤點作業
ABC分析
生產發料管理
製造成本管理
生產排程作業
在製品即時查詢

銷貨收款循環

採購付款循環

生產存貨循環

人事薪工循環

固定資產循環

財務會計系統

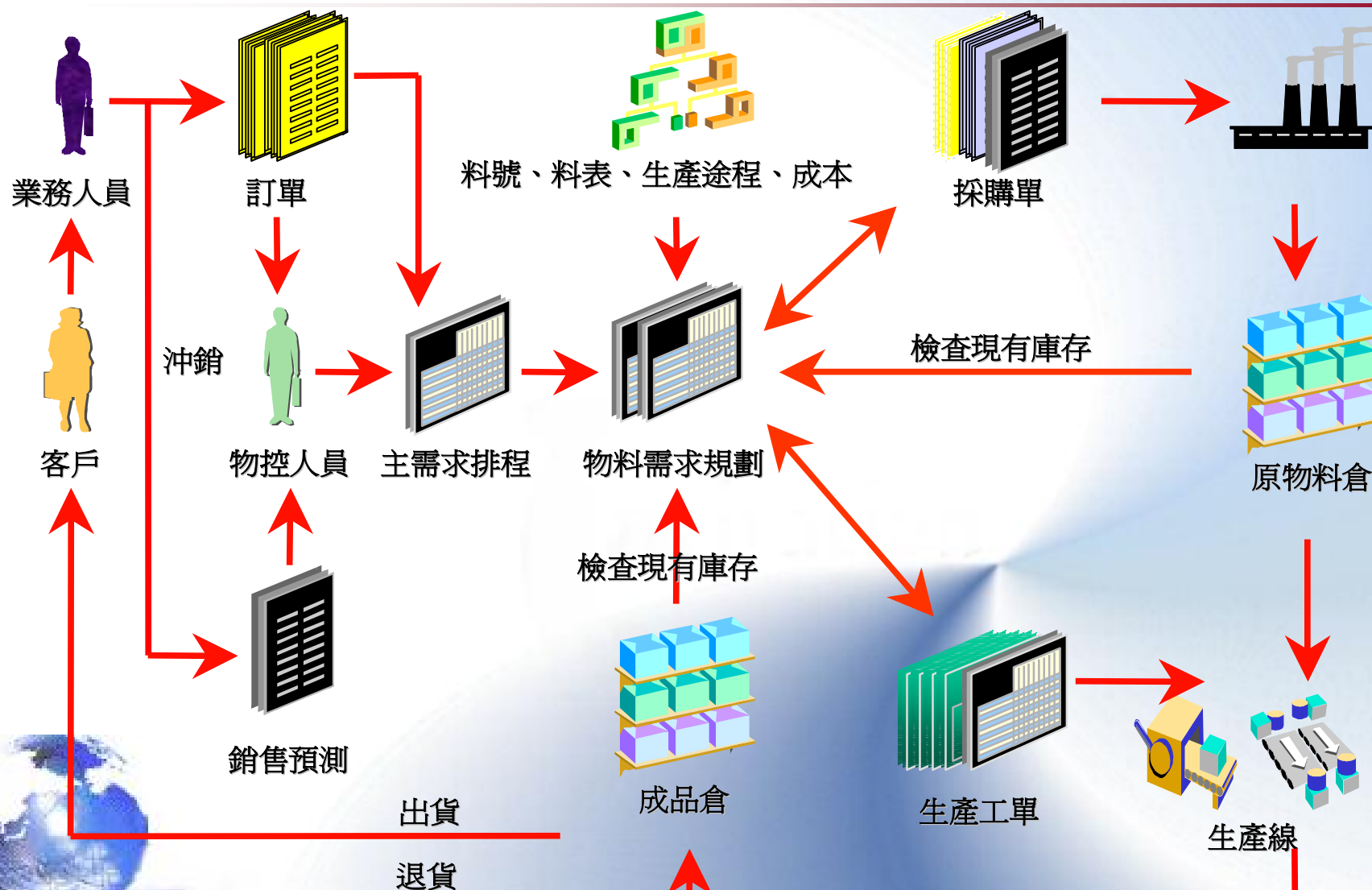
請購與採購流程連結
採購與收料入庫連結
採購與應付帳款連結
採購與生產計劃連結
採購與製造現場連結

人員考勤
直接人工薪資計算
間接人工薪資計算
生產效率計算

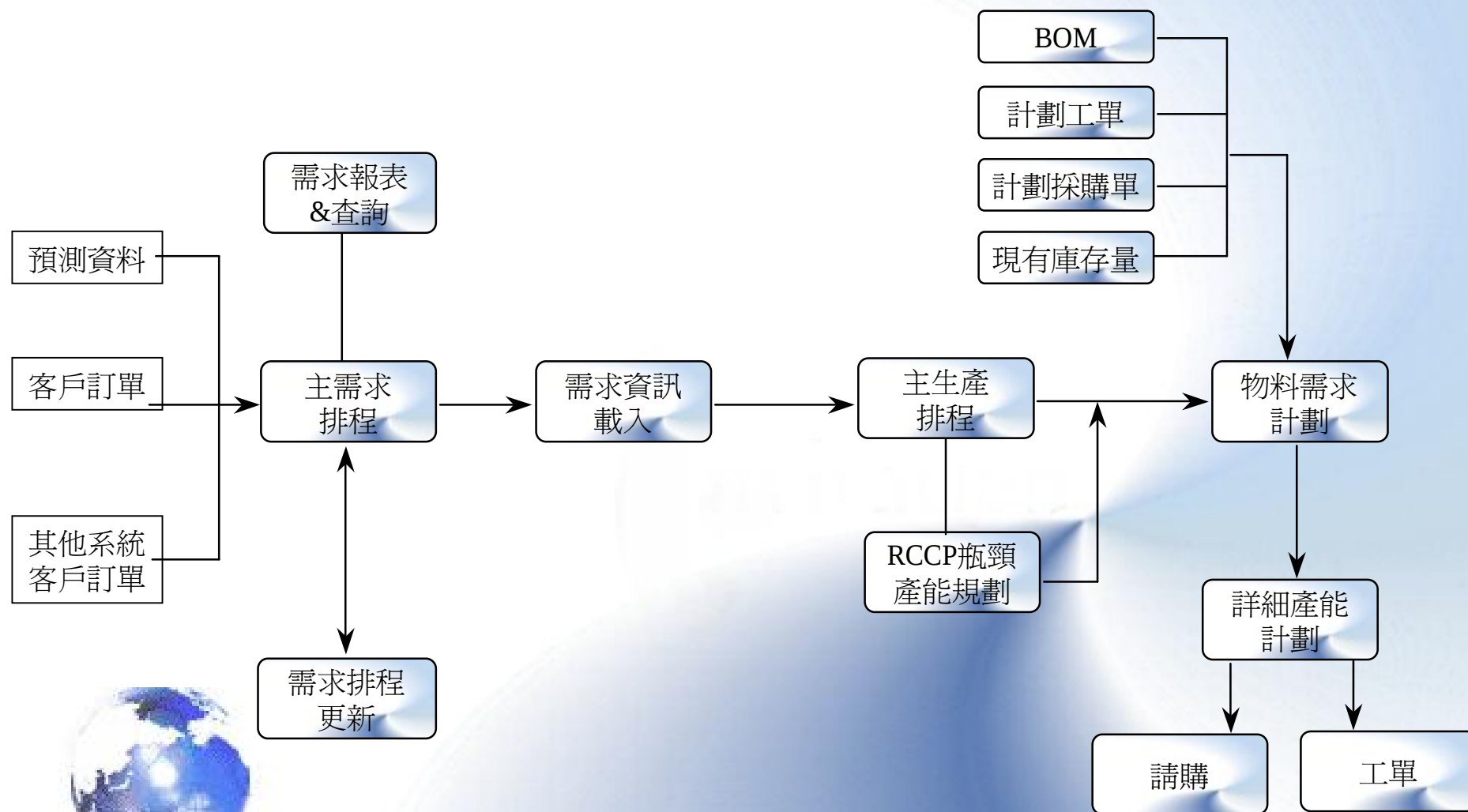
固定資產取得
固定資產總冊
固定資產折舊
累計折舊提列

多幣別帳本、跨公司合併報表
報表產生機制、分錄自動拋轉
預算控管、

Typical Manufacturing Process



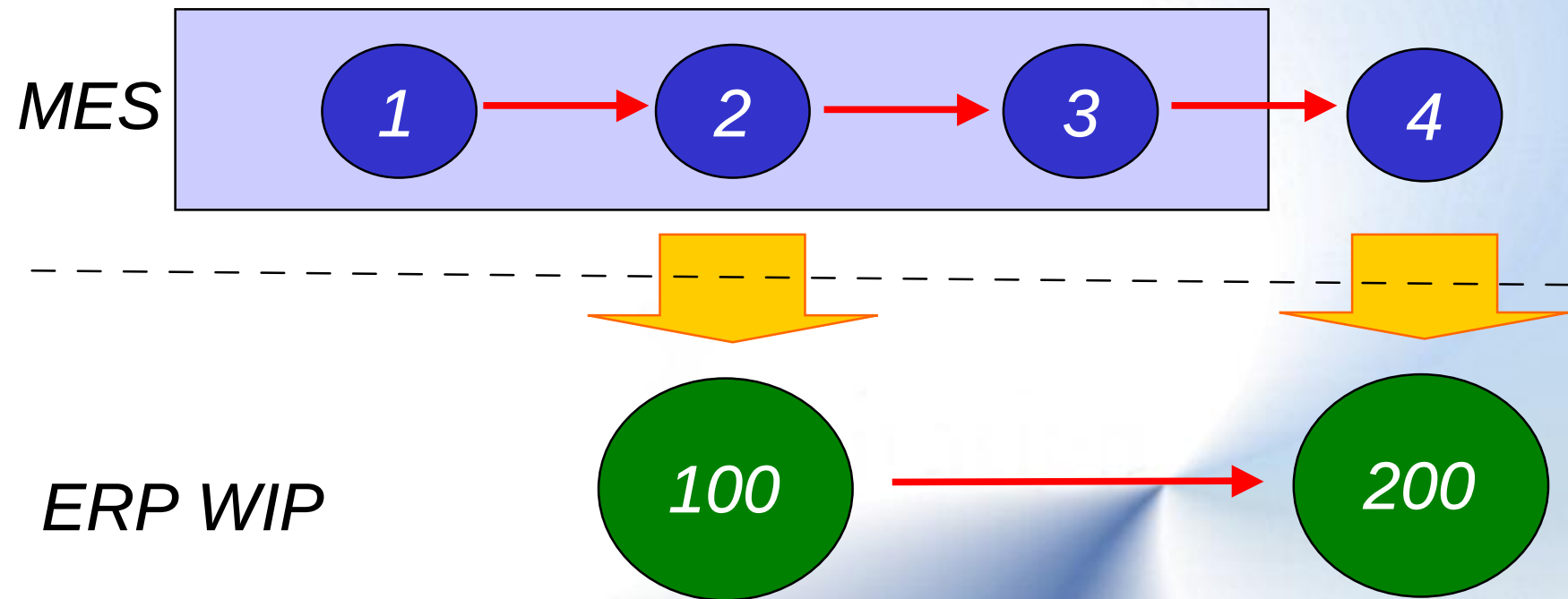
MPS/MRP Planning



- § ERP製造模組不是取代所有的製造系統
 - ERP負責收集成本，MES則否
 - 製造作業的產業特性差異大
- § ERP製造模組與製造執行系統(MES)的整合
 - 資料的對應
 - 料號
 - 用料表
 - 途程
 - 流程卡(工單)
 - 拋轉的頻率
 - 客製化
 - 有利於ERP中成本收集



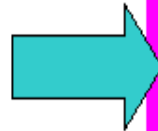
ERP & MES



ERP & MES



MES Transaction



LOT_Number/工單號碼

研發/量產識別

Product 產品型號

產品 Grade

起始站別

目的站別

站別狀態

移動數量

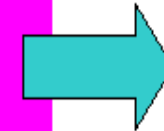
報廢數量

單位

交易類型

交易日期/時間

ERP WIP Transaction



MES Transactions Transfer

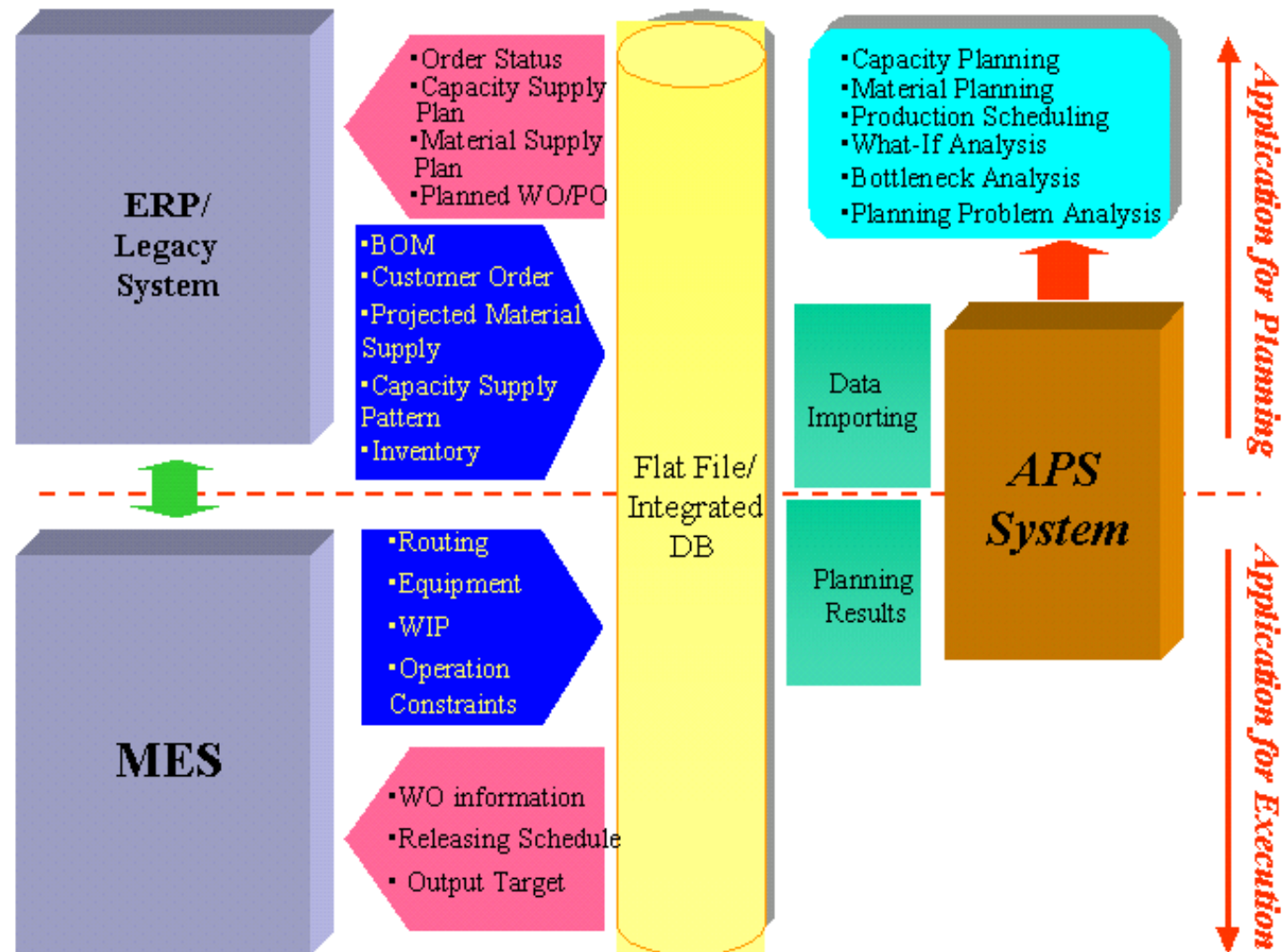
ERP Manufacturing Module & APS Planning

§ ERP製造模組與供應鏈規劃的整合

- 有限產能
- 多工廠
 - 供應體系
- ERP MRP是基本物料規劃
 - 替代料
 - 產能
 - 機台配對
- 資料的對應
- 拋轉的頻率



Dataflow between MES, ERP, and APS



Difference between APS & Traditional Planning

§ 傳統規劃方式

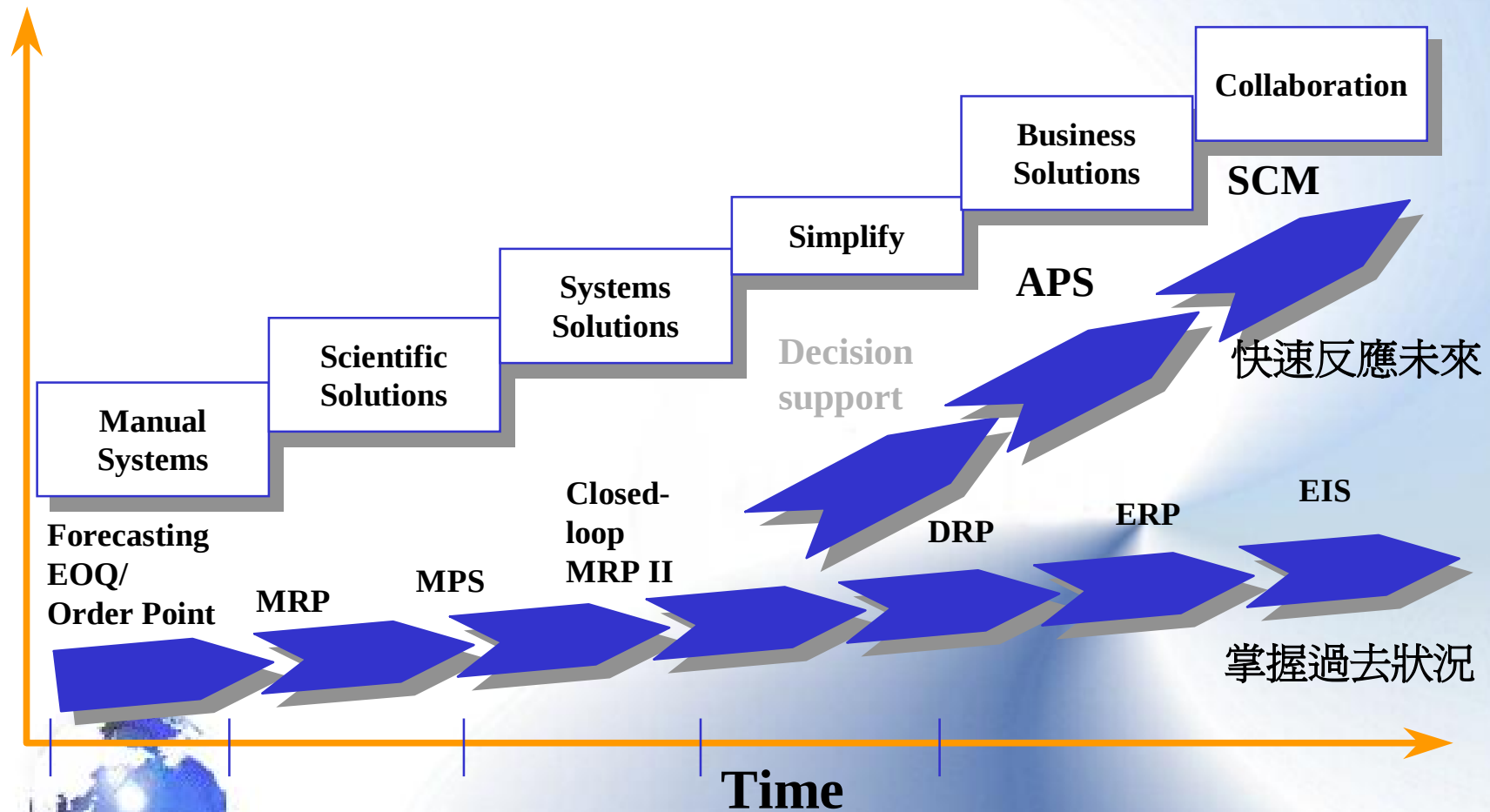
- 固定的前置時間
- MRP假設無限產能
- CRP假設無限材料
- 排程時只管單獨之生產批量
- 各階段需求循序規劃
- 局部最佳解
- 適用企業：以產出為競爭方式的企業

§ 先進排程規劃系統 (APS)

- 動態前置時間
- 有限物料規劃
- 有限產能規劃
- 排程時會牽動上下游相關生產批量
- 同步規劃
- 整體最佳解
- 適用企業：以客戶服務滿意度為競爭方式的企業



Planning Solution Trend



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Furniture Manufacturing Company – Situation



- § Small family owned business in Dallas
- § Orders and Shipments are restricted to the city limits
- § Makes chairs as per order
- § Procures wood as raw material from the vendor and other consumables as required



Furniture Manufacturing Company – Typical Process Flow (1)



- § A customer places an order for a chair in the showroom
- § The sales representative promises the customer that the chair will be delivered in 2 weeks
- § The sales representative generates a requirement document showing details of the customer and the configuration of the chair



Furniture Manufacturing Company – Typical Process Flow (2)



- § At the end of each day, the sales representative sends a copy of their sales to the manager of the store
- § The manager of the store looks at the raw material inventory and determines how much wood he will need to buy
- § The store manager creates PO's for additional requirements based on the orders received



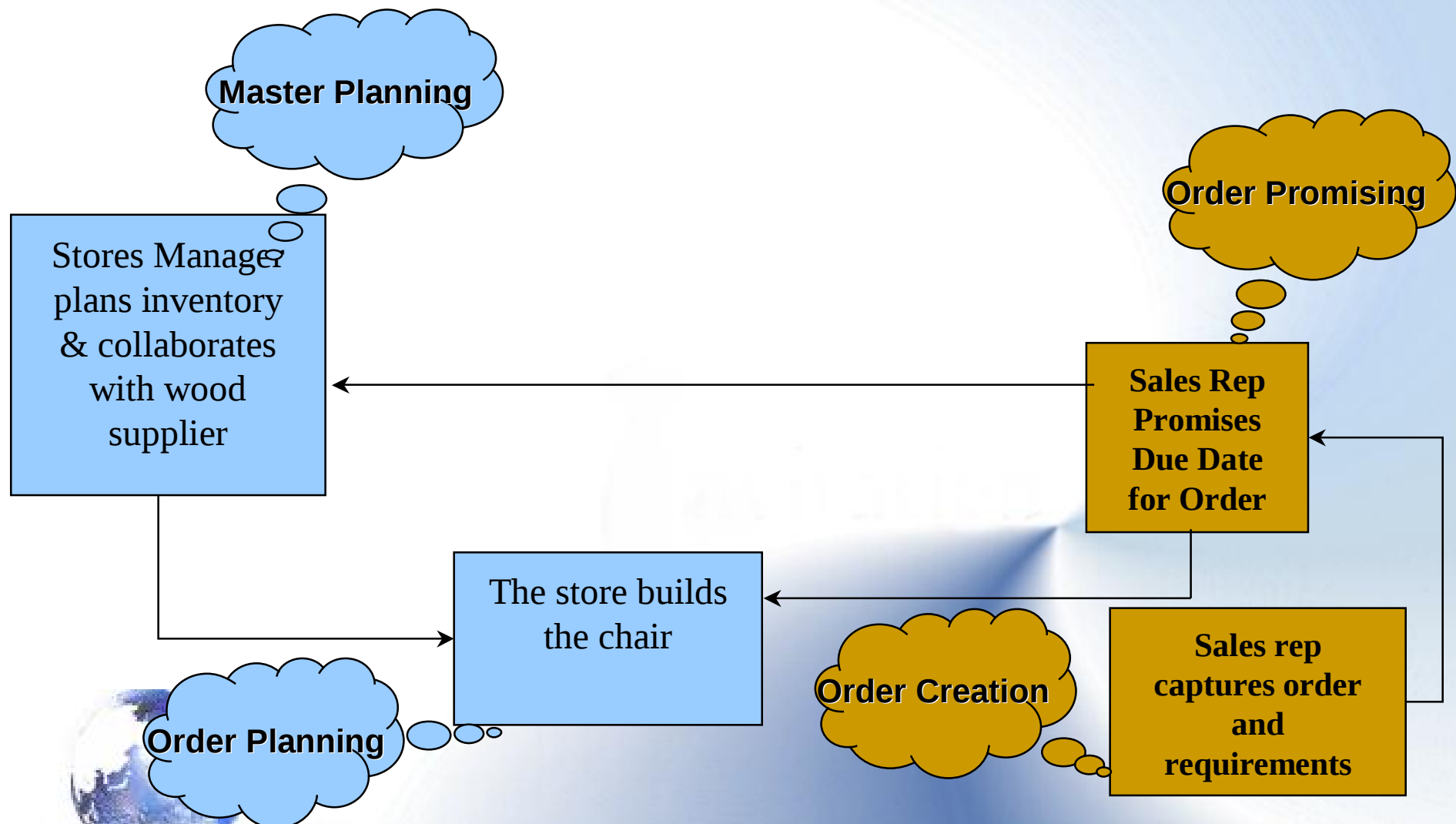
Furniture Manufacturing Company – Typical Process Flow (3)



- § The manager talks to the wood supplier and communicates the raw wood requirements, and ensures that he will receive the supply
- § He directs his store people to start making the chairs based on current set of orders and available material. He schedules his labor and assembly machines based on due dates of the current orders



Furniture Manufacturing Company – What's the workflow here?



International Furniture Company – Situation



- § Large corporation manufacturing and delivering chairs in all parts of USA
- § Forecasts the demand and manufactures to meet the forecasts
- § Procures raw material from different suppliers and manufactures chairs in two central facilities in USA
- § All chairs are of a fixed configuration



International Furniture Company – Typical Process Flow (1)



- § Market regions forecast their regional sales
- § Head office collects all the sales figures and aggregates the forecasts based on consensus/historical estimates
- § Forecasts are planned for generating long term material and capacity requirements at the manufacturing facility
- § Factories are instructed on what to build, when to build and how much to build based on the forecast
- § Factories communicates build position to the head office



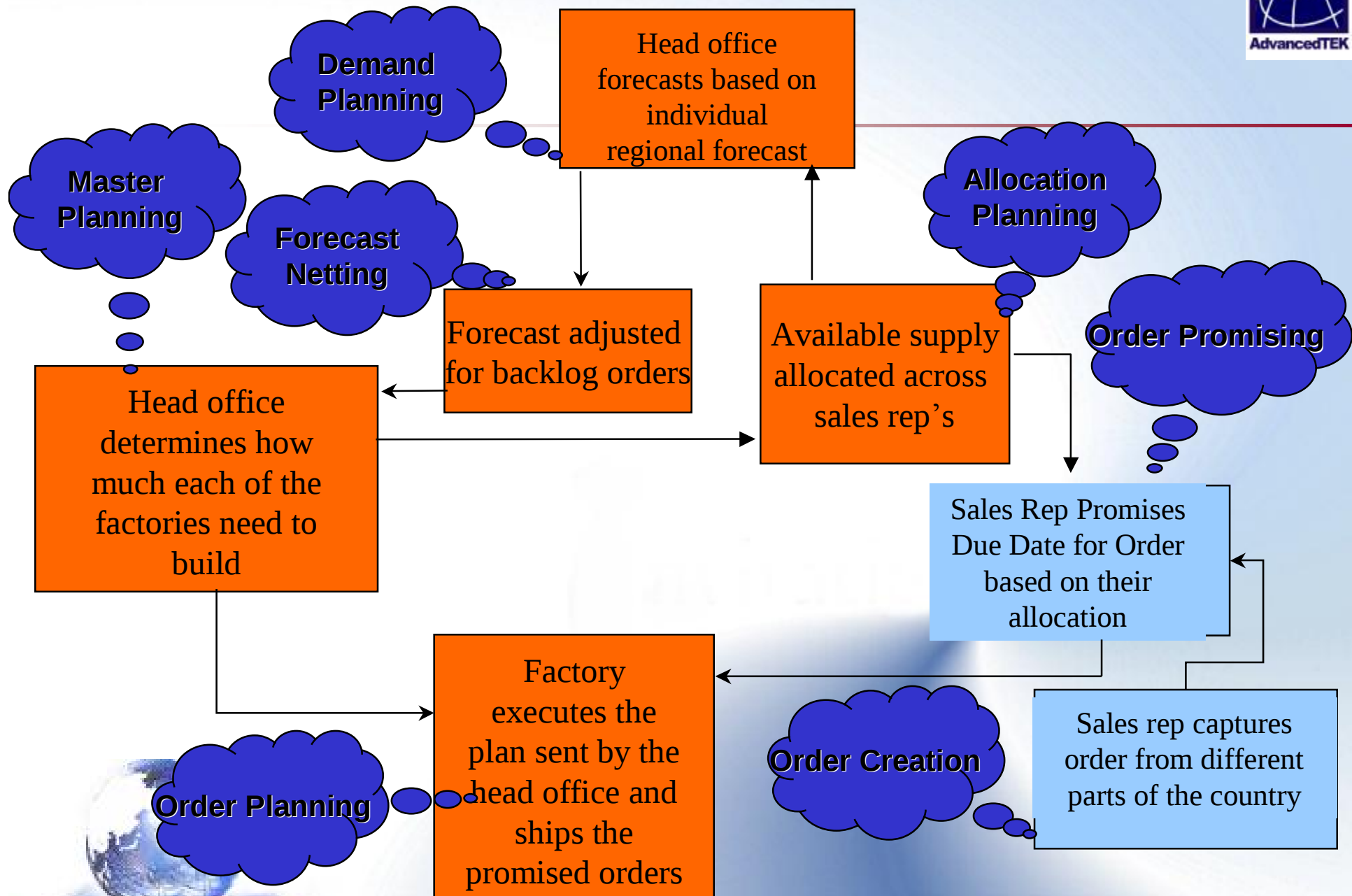
International Furniture Company – Typical Process Flow (2)



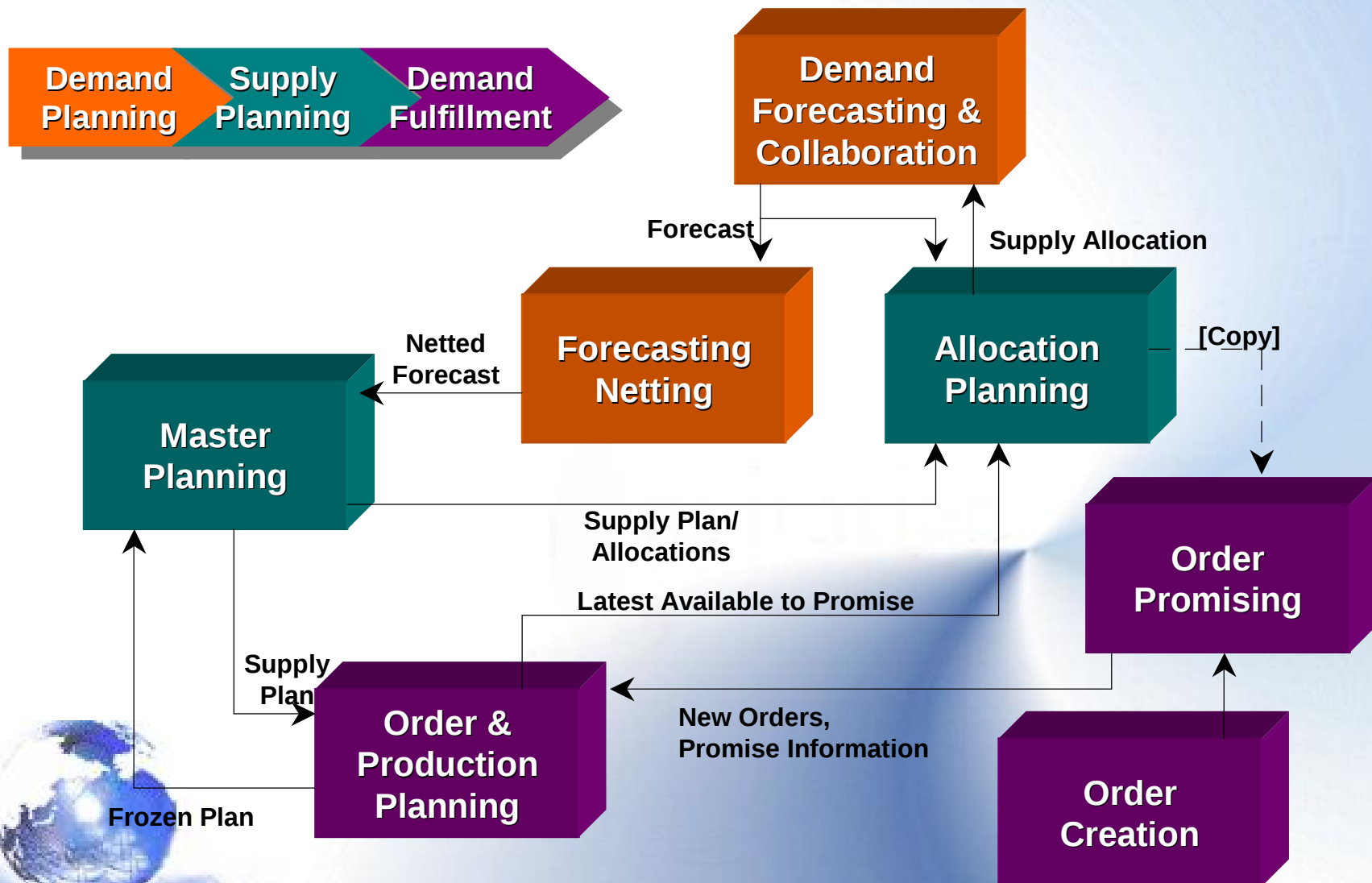
- § The head office allocates the available and projected supply to the sales representatives
- § Orders are taken through the order entry system at different levels
- § Orders are quoted by the sales representatives for a due date based on the supply allocated to them
- § The factories supply assembled chairs from stock based on the orders (pick, pack and ship)
- § Allocations are stored for forecasting in the next cycle



What is the workflow here?



SCM Workflow



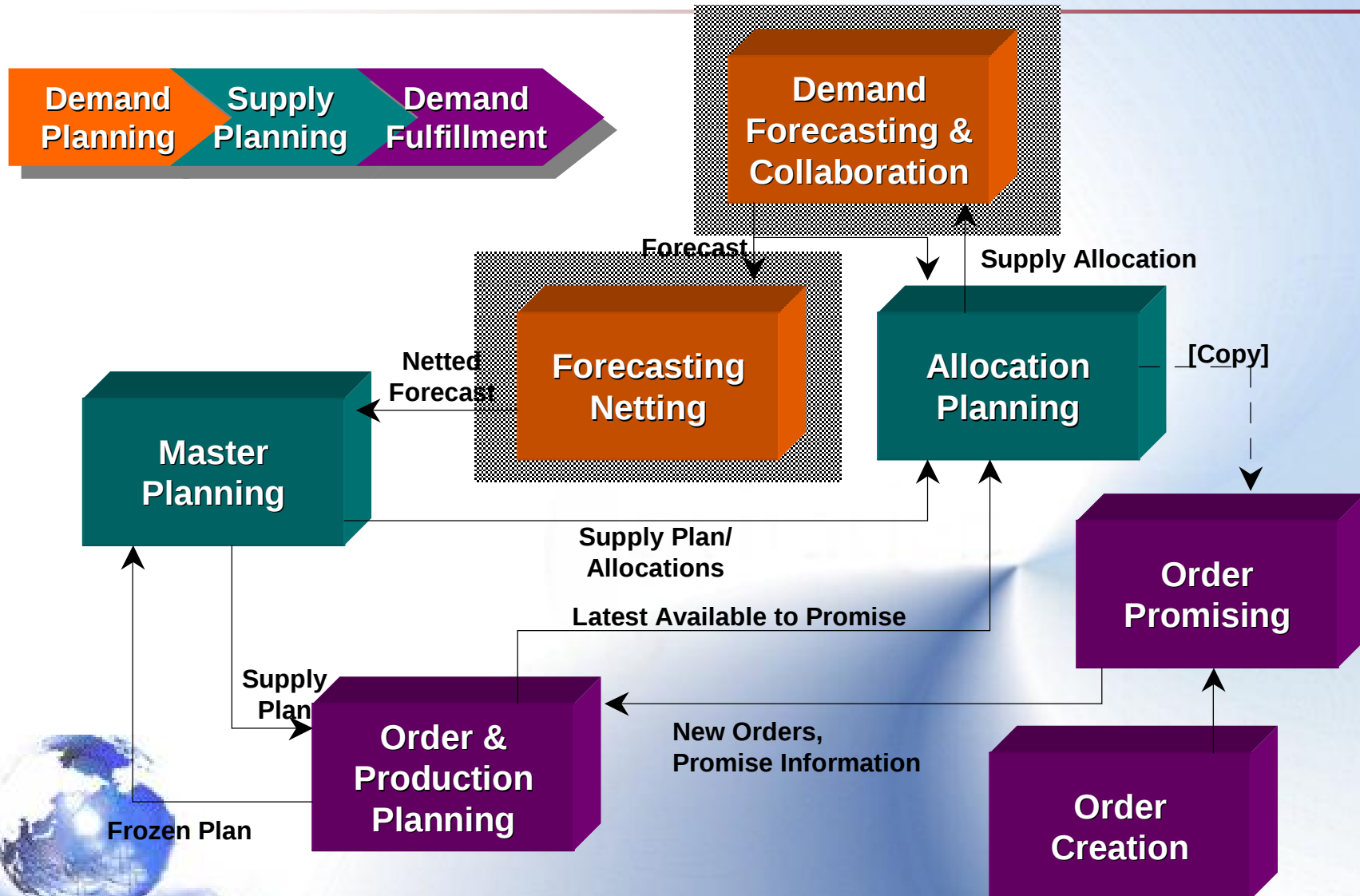
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SCM Workflow



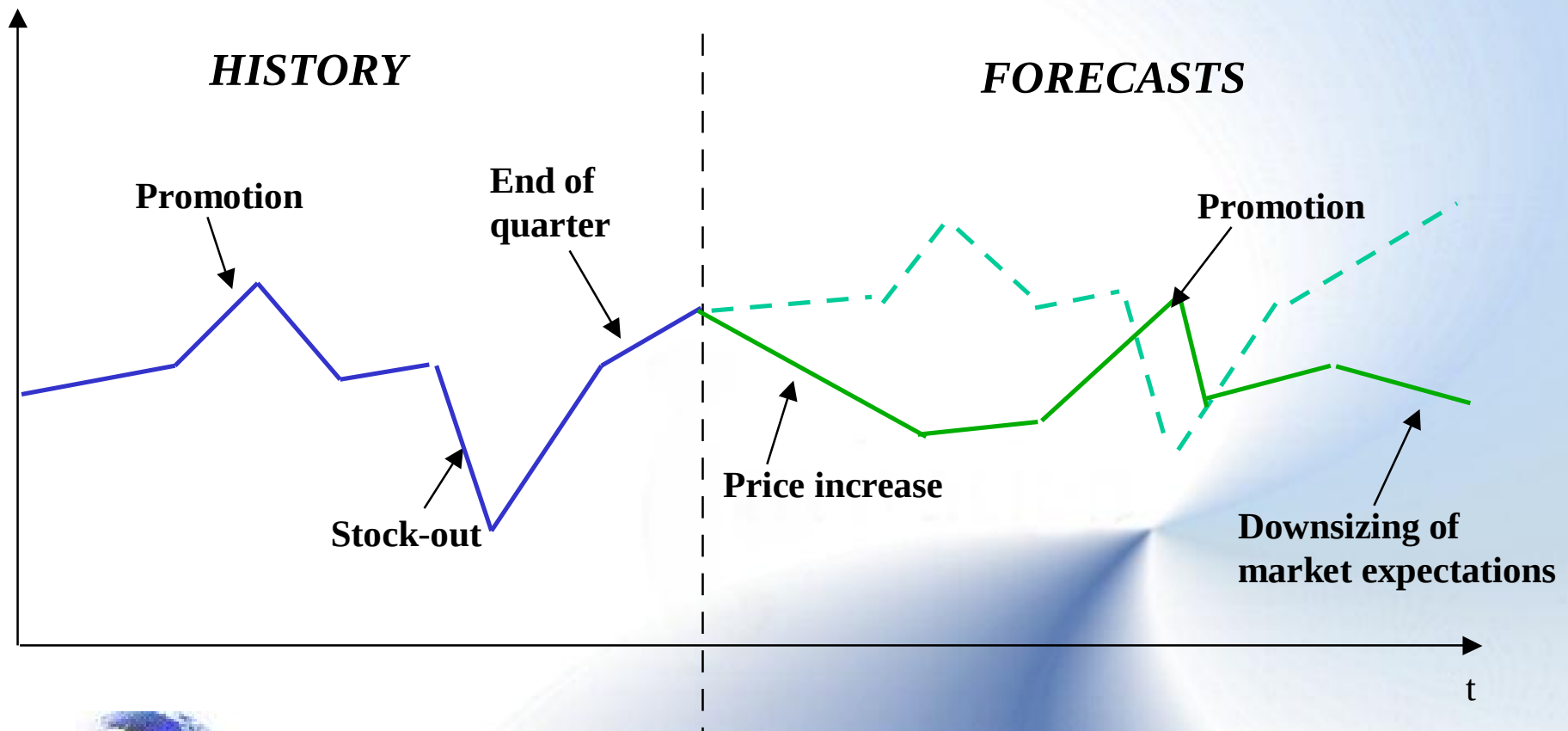
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Demand Planning

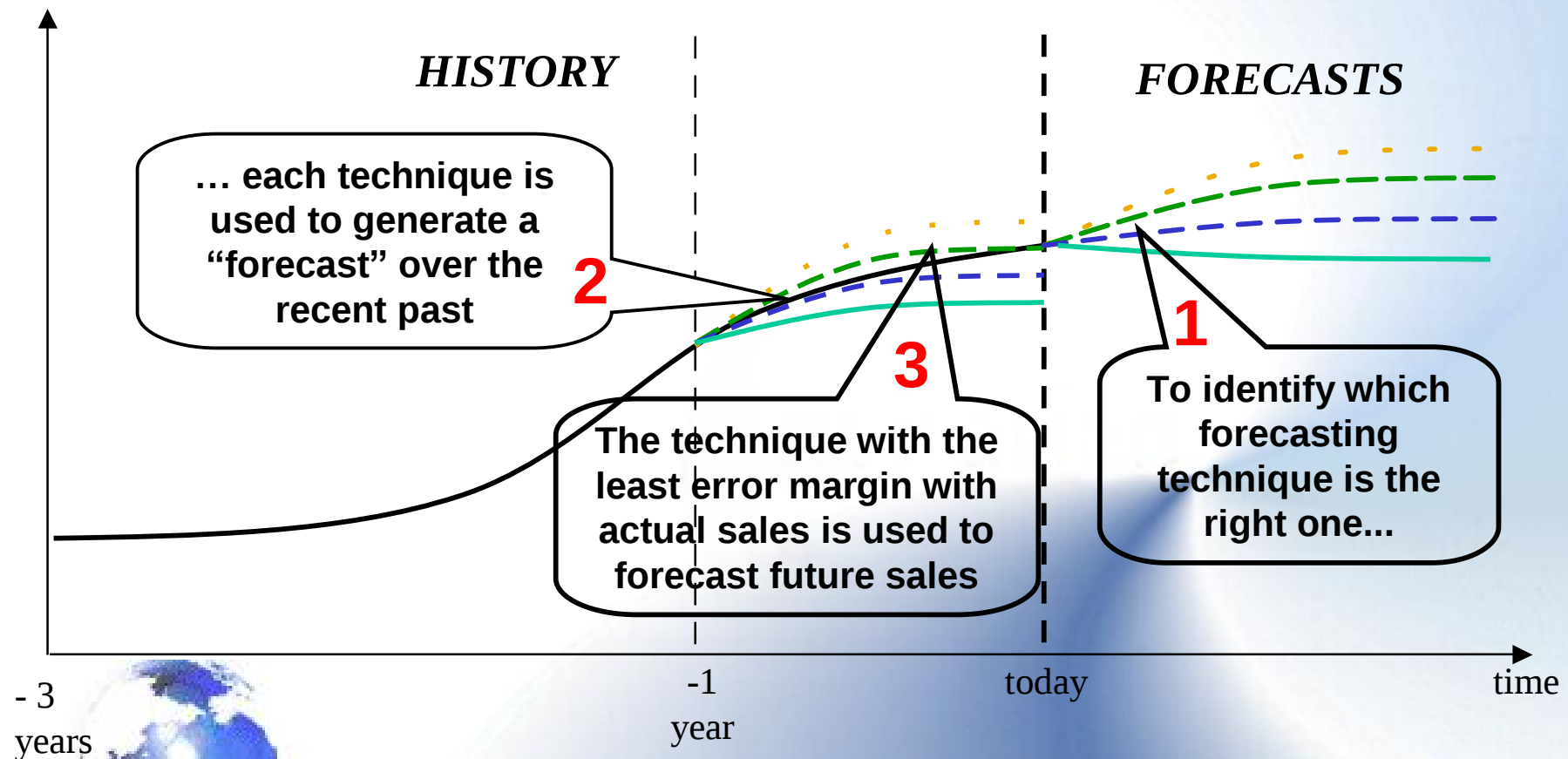
- § The process of developing
 - an accurate, and reliable view
 - of market demand and its drivers
 - by identifying market trends and predicting changes
 - in customer needs
- § To create, understand, respond to, and effectively manage a comprehensive view of demand in real time for a product-intensive business



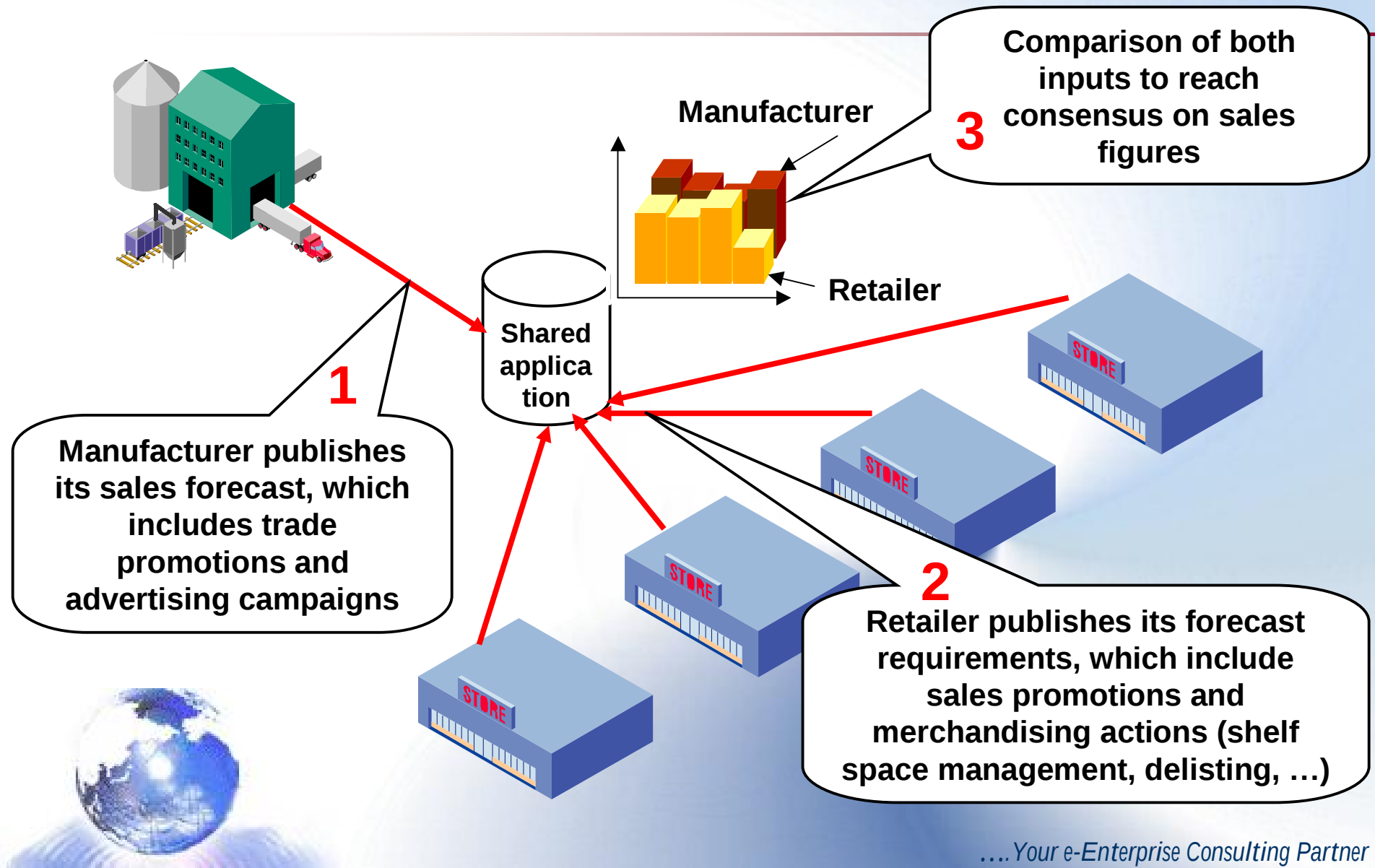
'Sales Forecast are Always Inaccurate



Selection of the Right Forecasting Technique Through the 'Focused Forecasting' Logic



Demand Planning – Collaboration with Customers

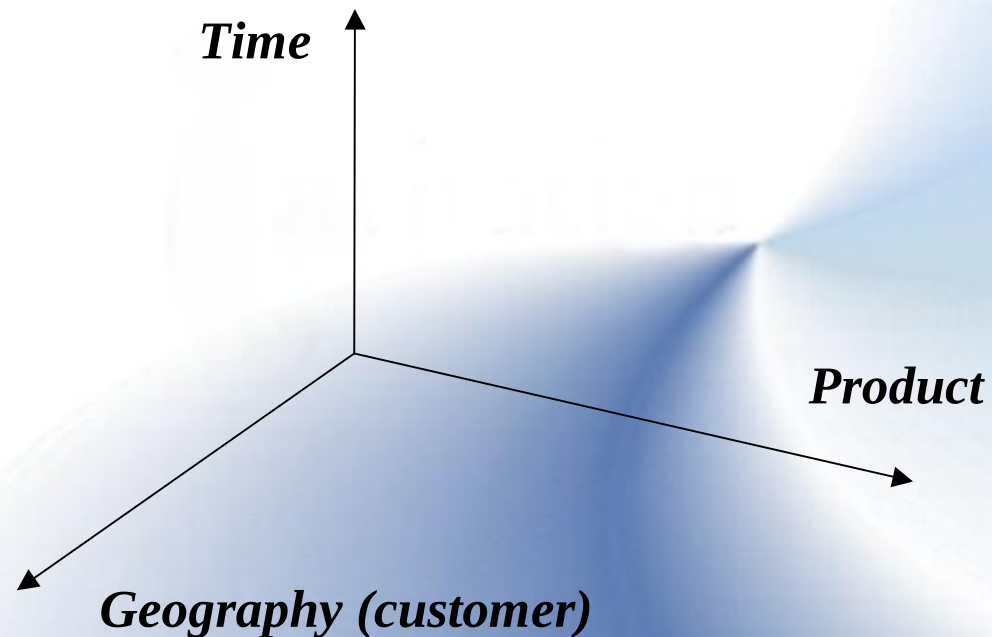


Demand Planning – Multidimensional Demand

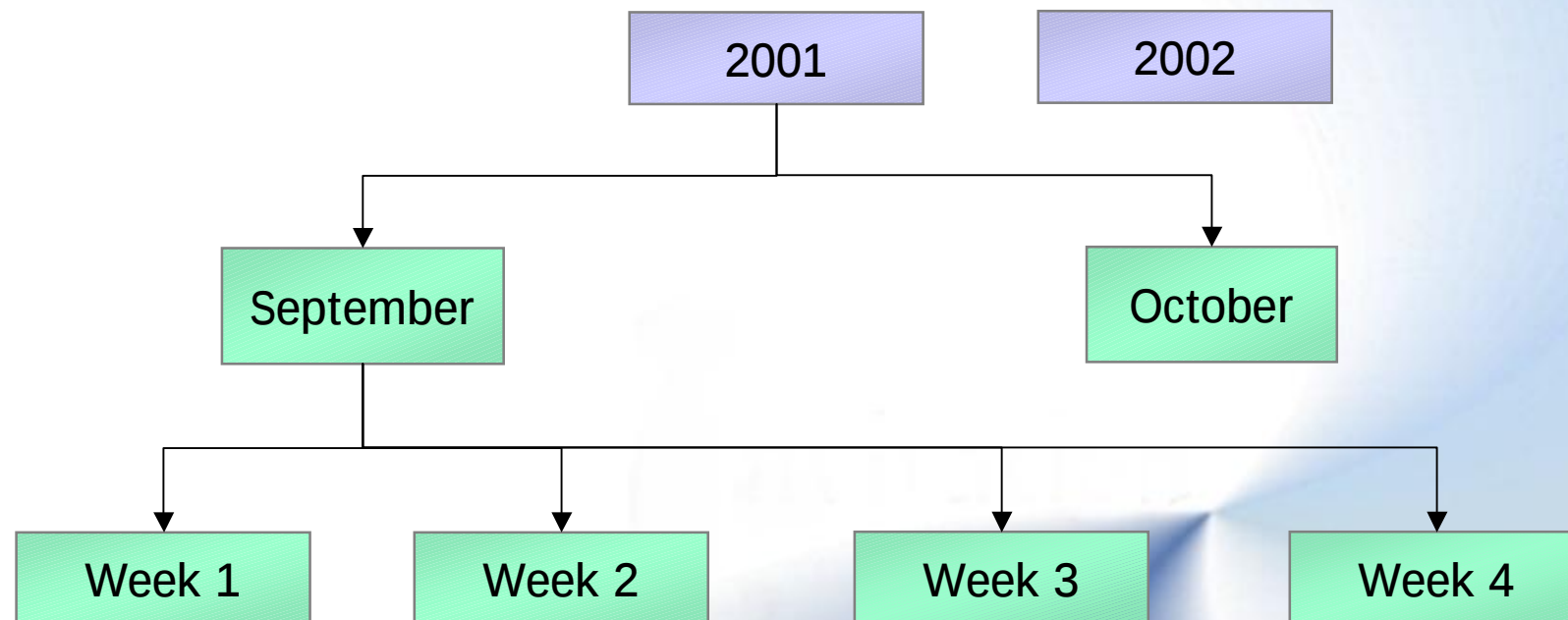


§ Each functional area views demand from the perspective of three primary dimensions:

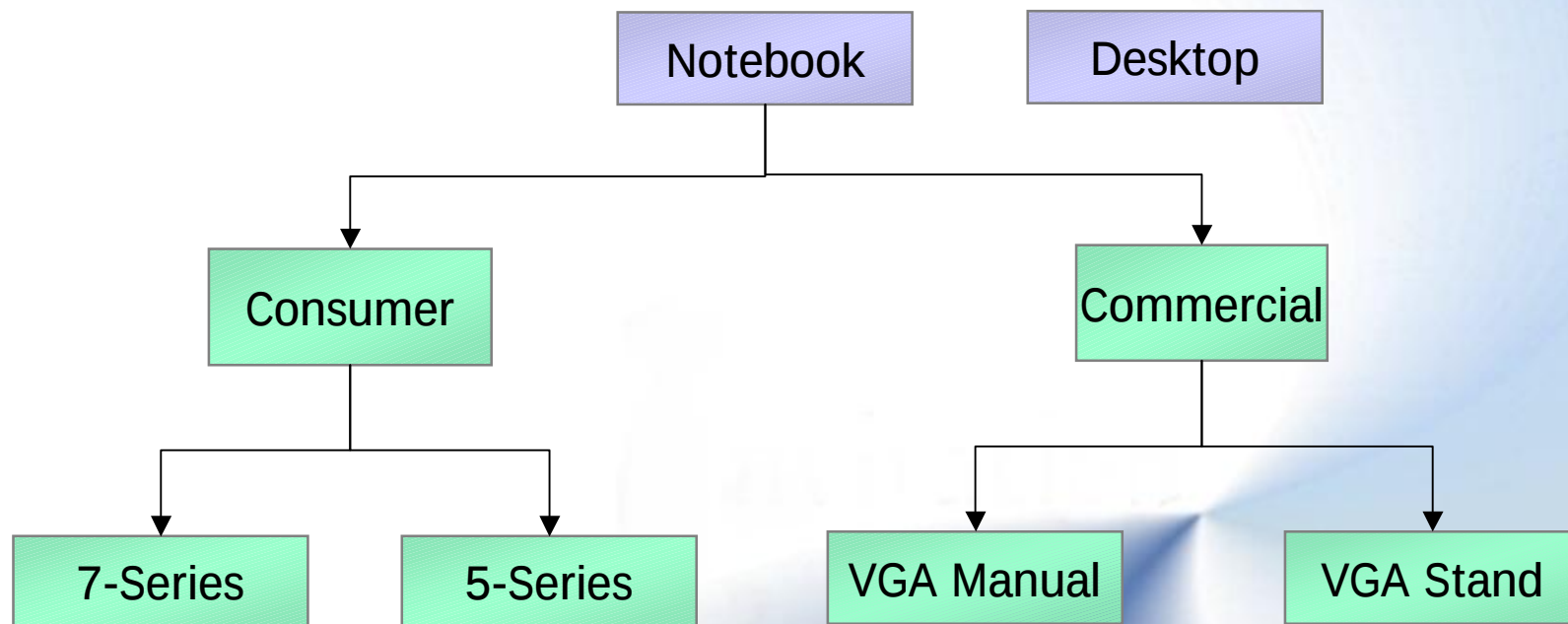
- Product
- Geography (customer)
- Time



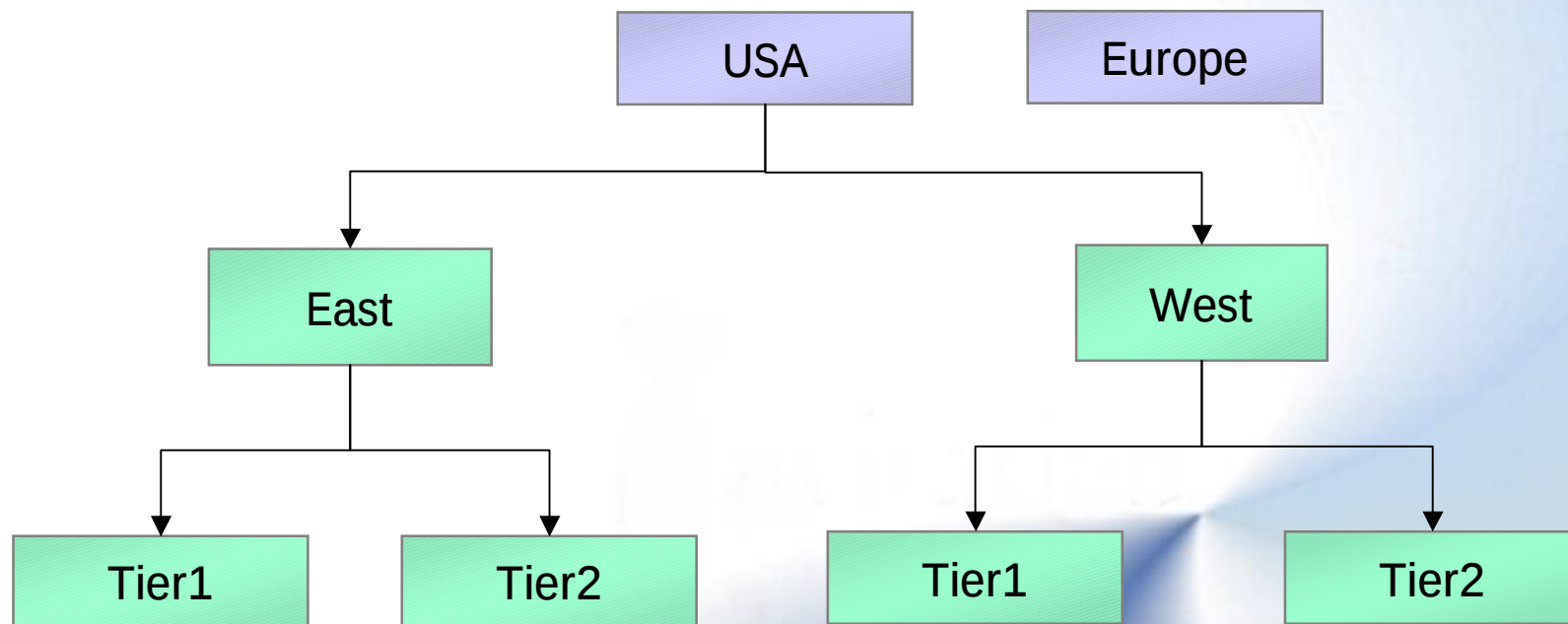
Demand Planning – Time Dimension



Demand Planning – Product Dimension



Demand Planning – Customer Dimension



Demand Planning – Major Challenges



- § Clean up of historical data
- § Selection of the right forecasting technique
- § Capture all intelligence influencing future demand
 - promotions / pricing modifications
 - phase-in/phase-out
- § Compare inputs coming from different players using different languages
 - Sales manager: sales by region
 - Marketing manager: sales by product family
 - Sales rep: sales by clients
 - Finance/management: global sales
 - Statistical forecast: sales by SKU
- § Agree on a consensus forecast



Forecast Netting

- § Process of accounting for promised orders
 - against forecasts
 - to form demand signals
 - for the Master Planning process
 - in a subsequent planning cycle
- § Demand must be prioritized for Master Planning process
 - to allow limited material and/or capacity to be reserved
 - to meet demand with high priority (actual demand) rather than assigned to demand with low priority (forecast demand)
- § Open orders (promised but not fulfilled orders) will take precedence during Master Planning over forecasted demand
- § Consumption of forecast against the actual orders is called "Forecast Netting" in SCM



Forecast Netting – Inputs / Outputs



§ Inputs

- Total forecast from Demand Planning – this represents unconstrained market demand
- Promised orders from OMS (order management system)
 - Includes both open orders and shipped orders

§ Outputs

- Netted forecast to be sent to Master Planning



Forecast Netting – Decisions Making



§ Profiling

- Selection of appropriate buckets to profile forecast into
- How to distribute forecast into profiled buckets
- Profiled buckets match planning buckets used in Master Planning

§ Forecast Netting

- How to net promised orders from total forecast for each profiled bucket



Forecast Netting – Profiling Scenarios

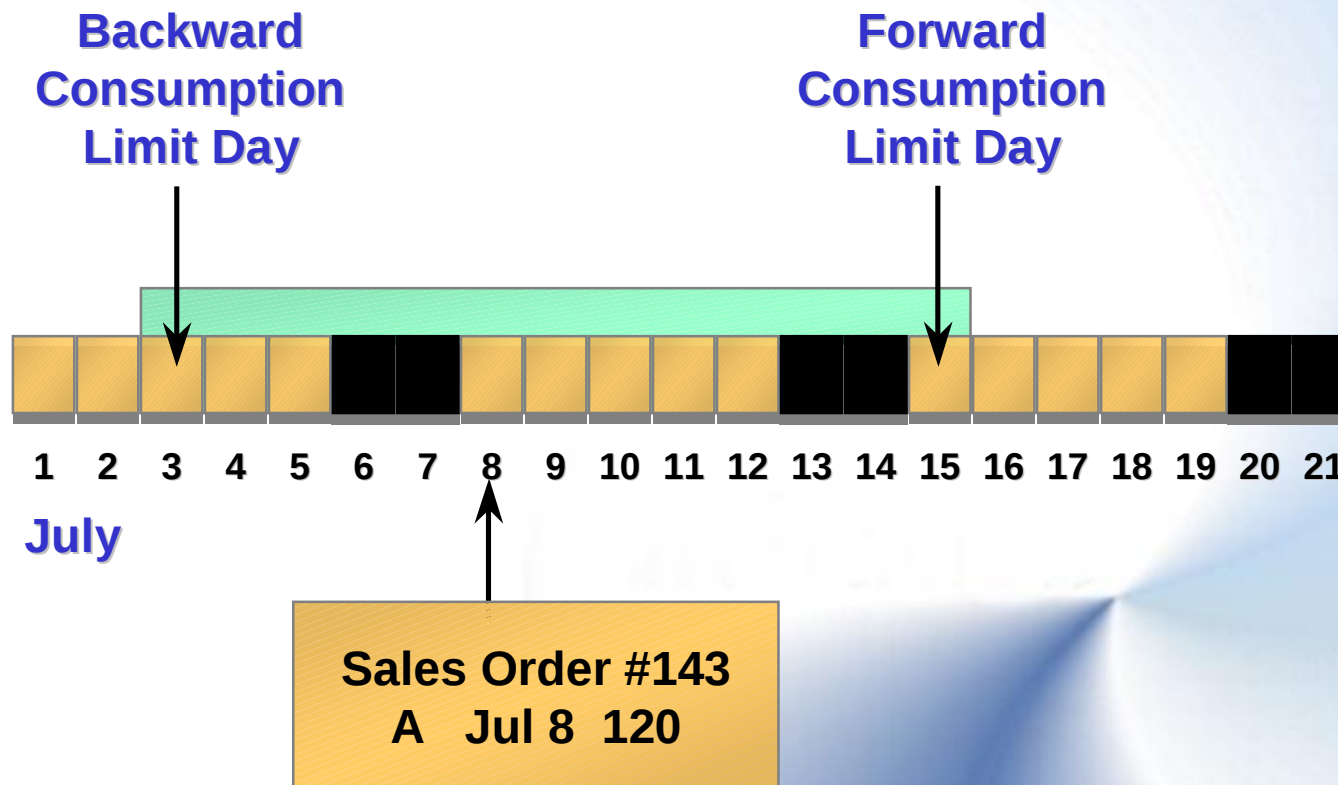


- § Determine how to disaggregate monthly forecast into weekly buckets within each forecast bucket
- § Consider how to profile 1000 forecast for the month with calendar below

Mon	Tue	Wed	Thu	Fri	Sat	Sun
29	30	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2



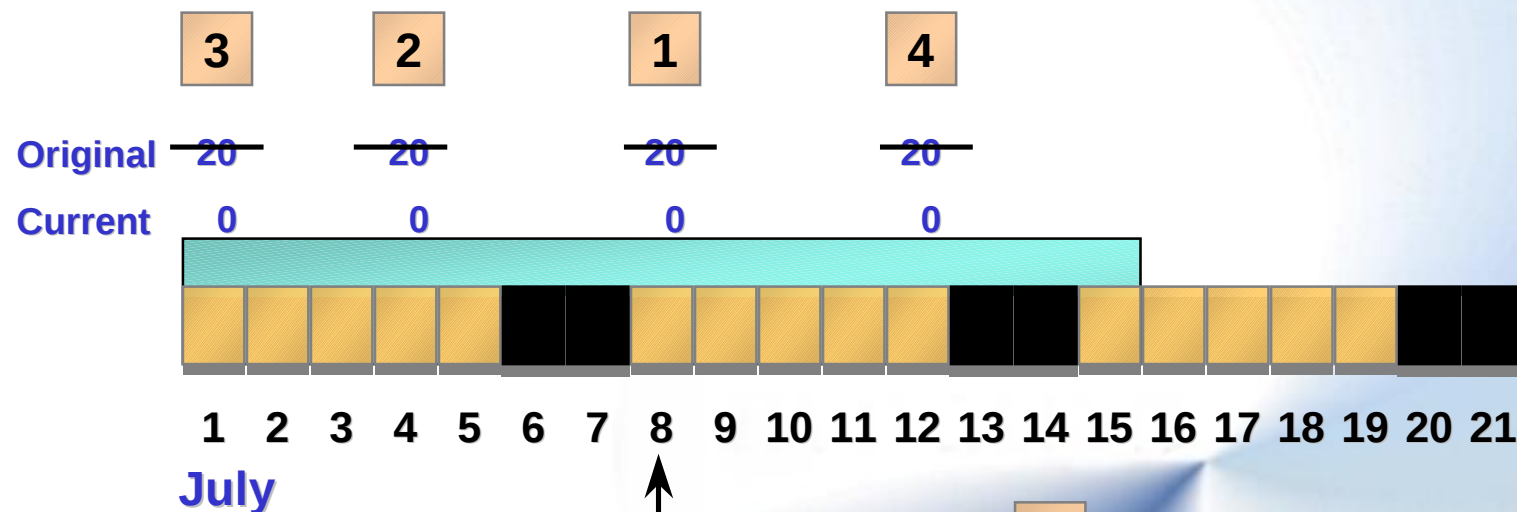
Forecast Netting – Scenario



Forecast Netting – Consumption: Days

Backward Consumption Days = 5 from Day 8 (Days 5, 4, 3, 2, 1)

Forward Consumption Days = 5 from Day 8 (Days 9, 10, 11, 12, 15)



Sales Order #143
A Jul 8 120

5

Over-consumption Entry
In forecast set
On July 8
For quantity - 40

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Allocation Planning

- § Process of reserving product supply for individual sales channels or arbitrary groups of sales channels
- § Objective is to provide high customer service to priority customers and/or strategic product line under constrained supply
- § Backlog Management
 - Backlog = (open orders, not necessarily late orders)
 - The set of orders a business has already committed to fulfill
 - They are given priority while allocating product supply among different products/sellers



Allocation Planning – Inputs / Outputs



§ Inputs

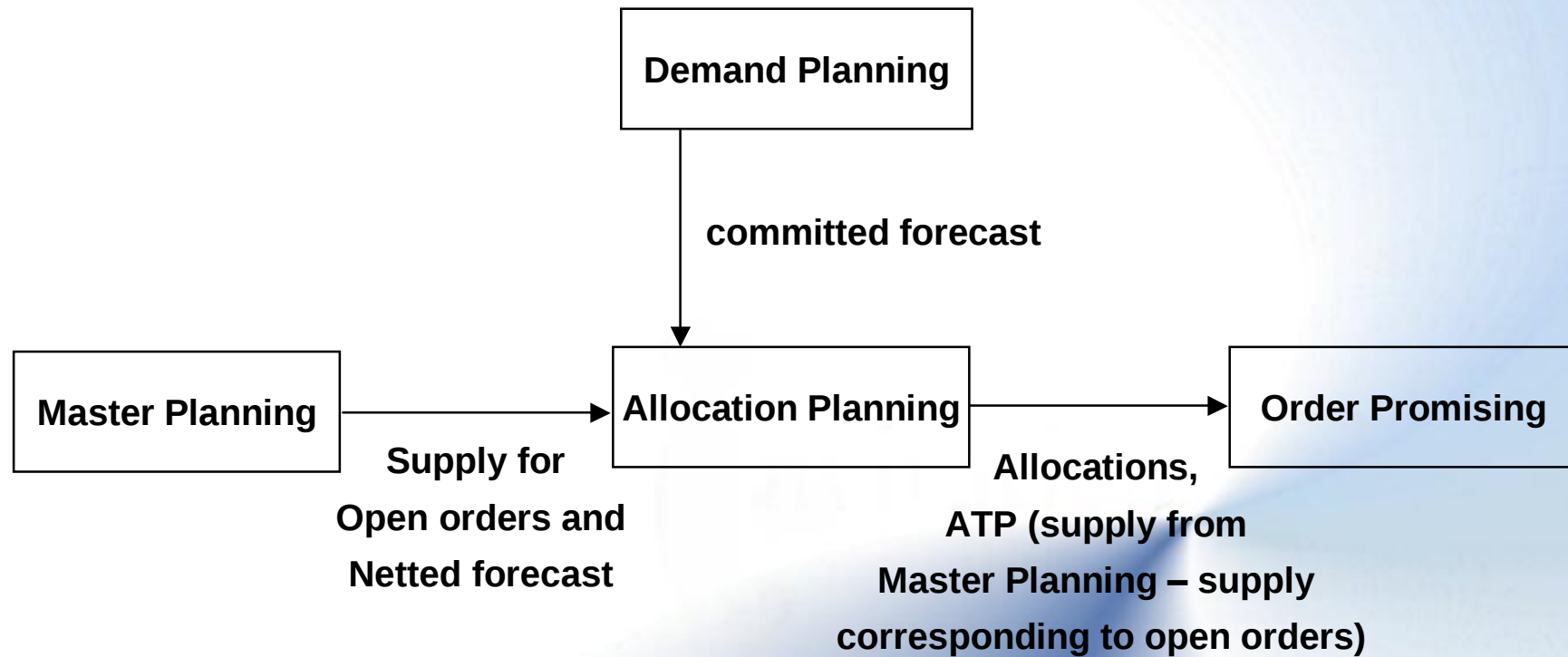
- Forecast – total forecast from Demand Planning or netted forecast from Forecast Netting
- Promised orders from OMS (both shipped and open orders)
- Supply Plan

§ Outputs

- Allocations for each seller
- New promise and schedule dates for open orders (with pegging information)



Allocation Planning – Workflows



Allocation Planning – Scenario (1)



§ Consider the following case

- 3 regional sellers, APAC, EMEA, NA
- Committed forecast for a specific month
 - APAC – 500
 - EMEA – 500
 - NA – 1000
- Total supply available from Master Planning is 1000

§ How would you allocate the insufficient supply to each seller?



Allocation Planning – Scenario (2)



§ Option1

- Allocate according to the committed forecast
 - APAC – committed 500 – Allocated 250
 - EMEA – committed 500 – Allocated 250
 - NA - committed 1000 – Allocated 500

§ Option2

- In case there is a priority ranking among sellers, allocate to higher priority seller first
- Let's assume NA has a higher priority than other sellers
 - APAC – Allocated 0
 - EMEA – Allocated 0
 - NA – Allocated 1000



Allocation Planning – Scenario (3)



§ Option3

- Allocate according to a predefined split percentage
- Assume the following split percentages
 - APAC – 30%
 - EMEA – 30%
 - NA – 40%
- Allocation
 - APAC – Allocated 300
 - EMEA – Allocated 300
 - NA – Allocated 400

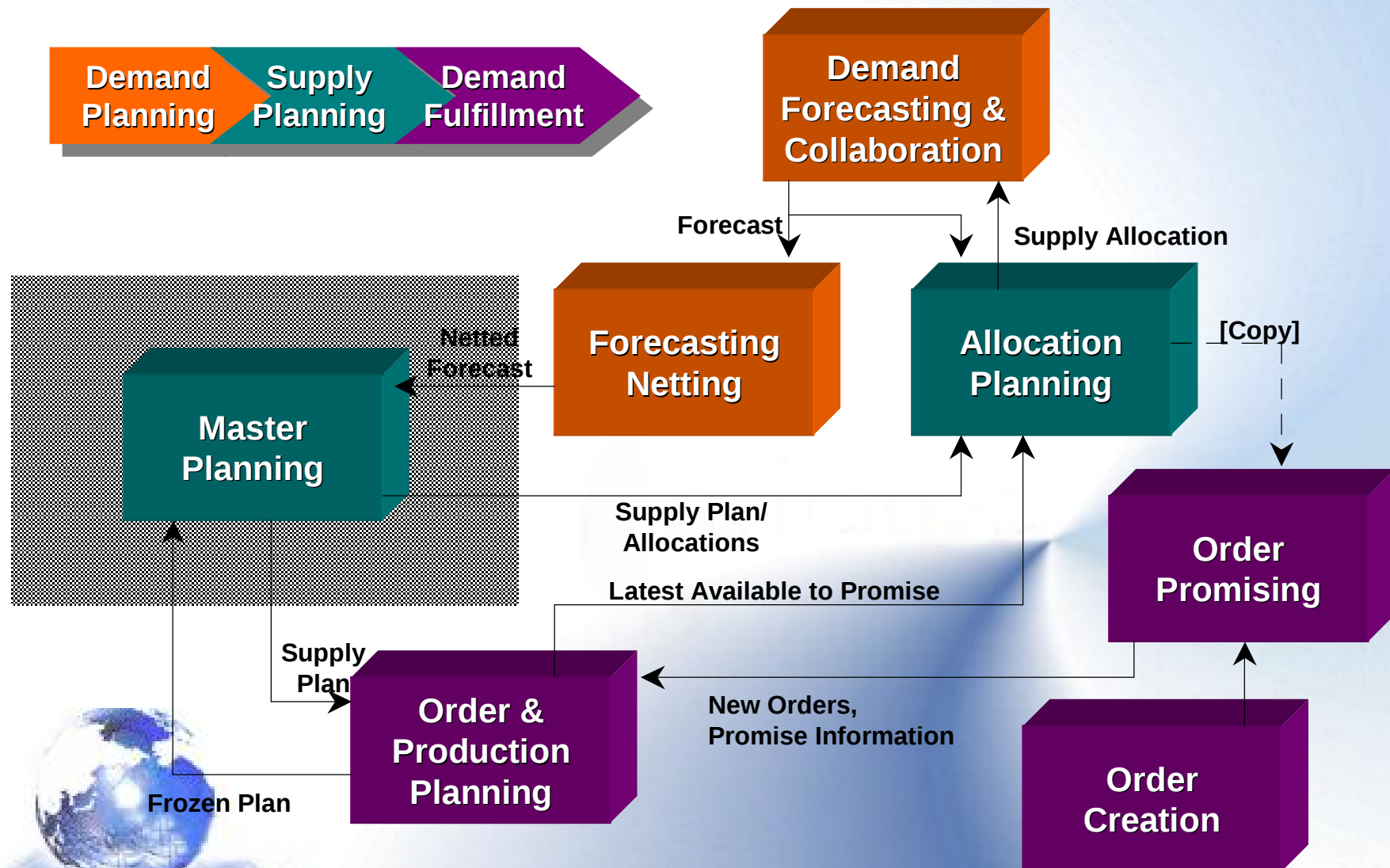


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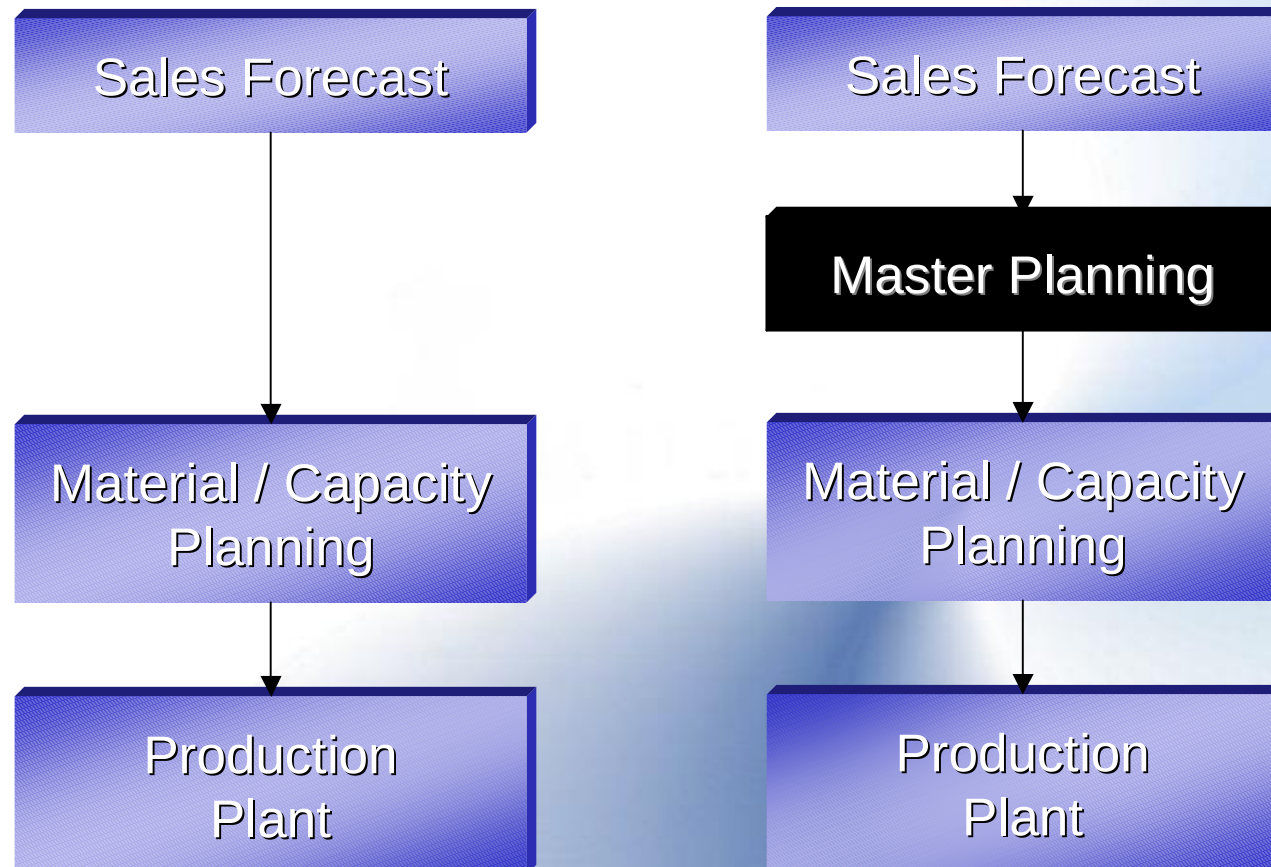


SCM Workflow



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Master Planning as Buffer Between Sales Forecast and Production



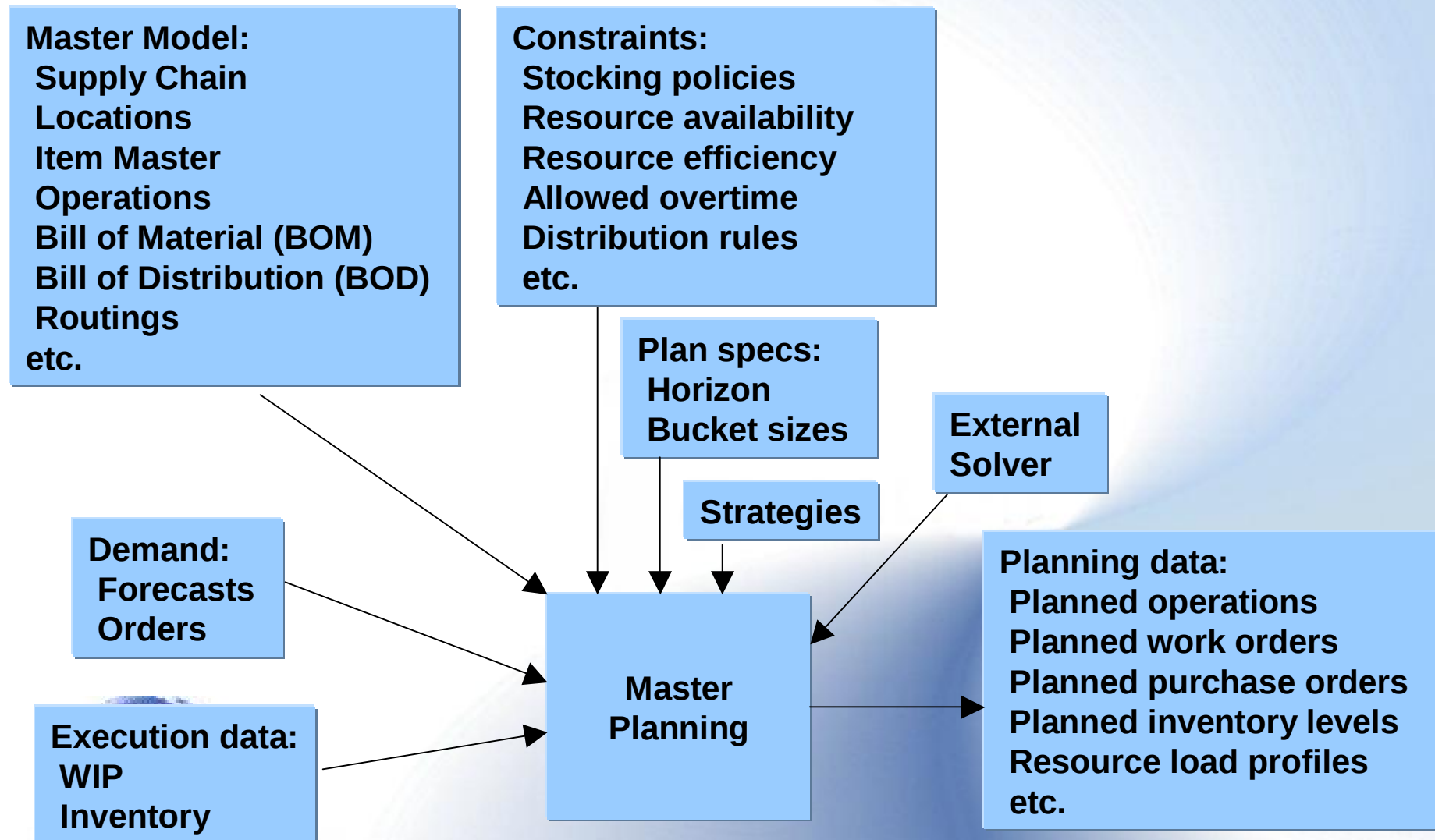
Master Planning – Goals



- § To balance supply and demand priorities
- § To develop practical solutions to supply constraints
- § To prioritize and allocate supply to customer demands
- § To establish a strategy to avoid overloaded schedules and unbalanced conditions
- § To create a schedule with attainable completion dates that satisfy customer needs
- § To make the best use of material, labor and equipment.
- § To maintain inventory investment at the required levels.



Master Planning – Inputs / Outputs



Master Planning – Outputs



- § Master production schedule
- § Projected inventory levels
- § Projected backlog levels
- § Product availability information
- § Order promising information



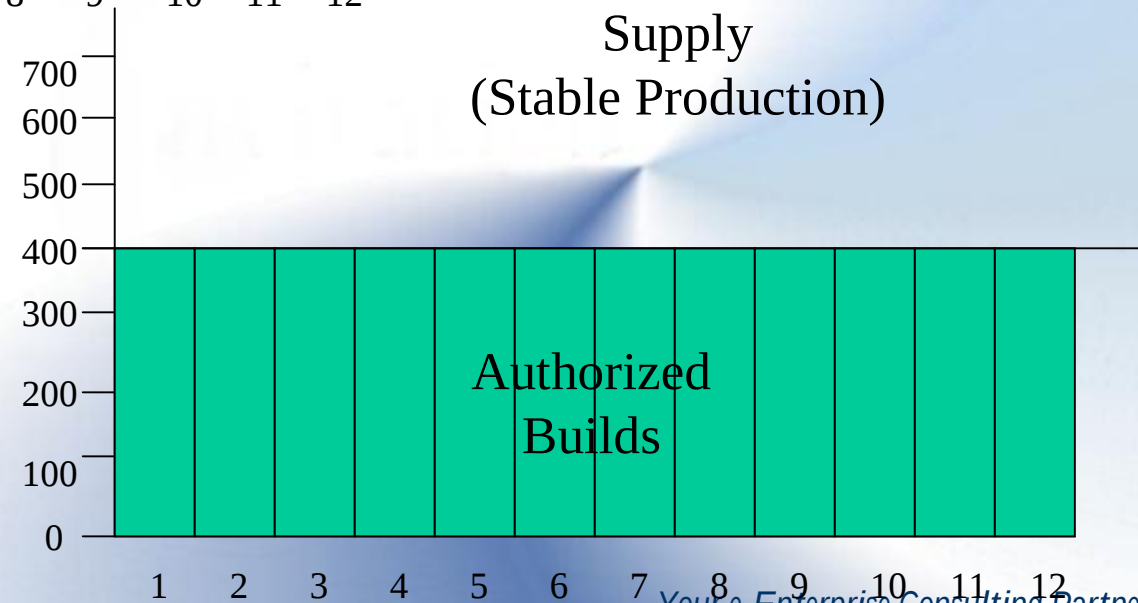
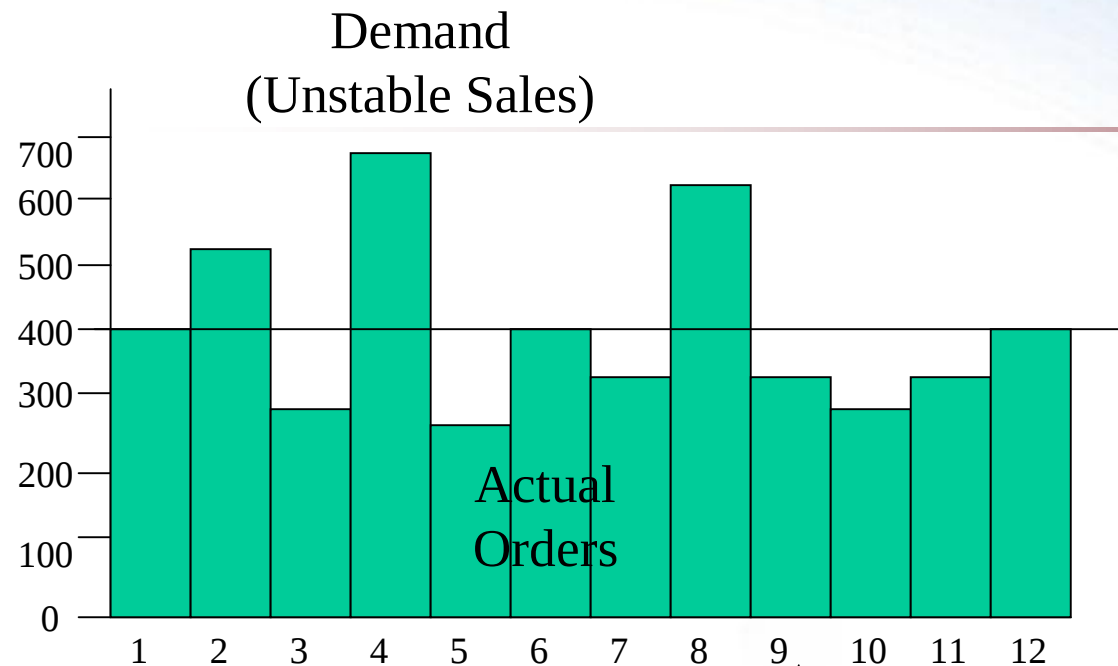
Production Plan to MPS

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

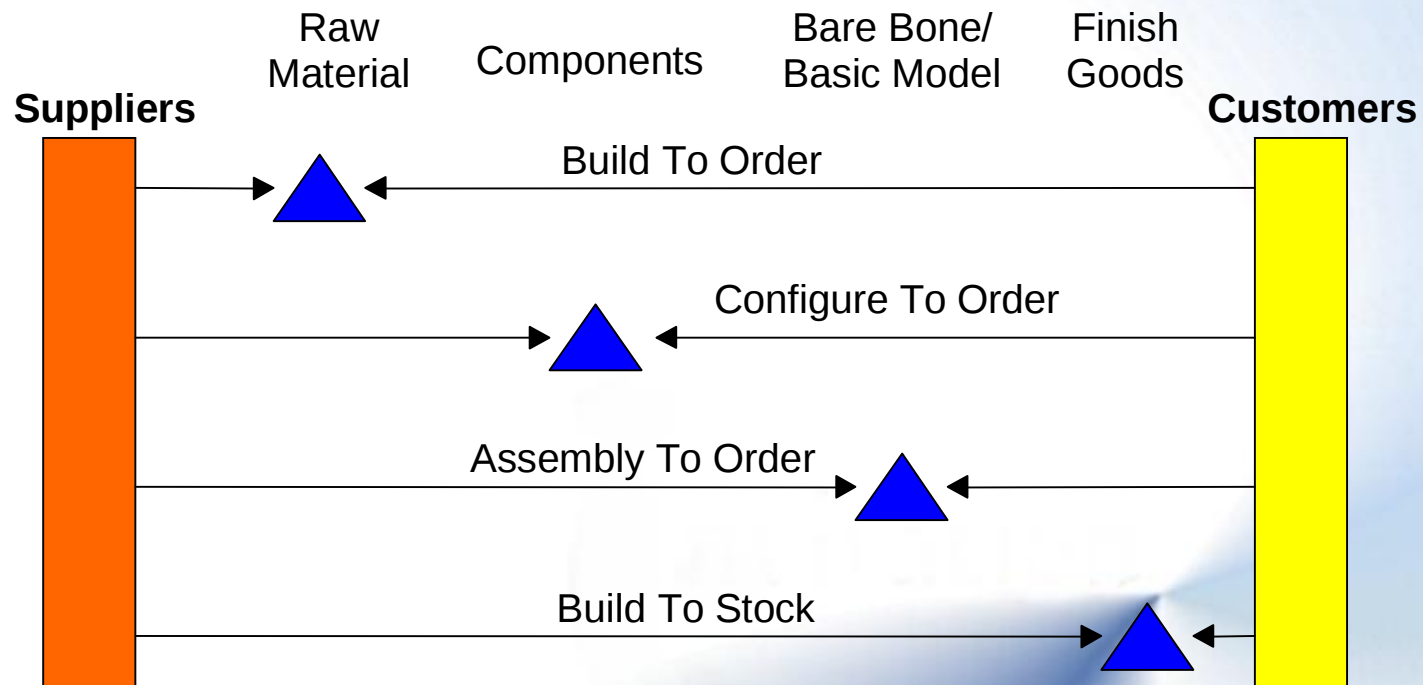


MPS Week	40	41	42	43
Product A1	1,000	1,000	1,000	1,000
Product A2	500	1,000	1,500	2,000
Product A3	1,500	500	500	1,500
Product A4	2,000	2,500	2,000	500
Total	5,000	5,000	5,000	5,000

Varying Demand v.s. Desired Supply



Manufacturing Model



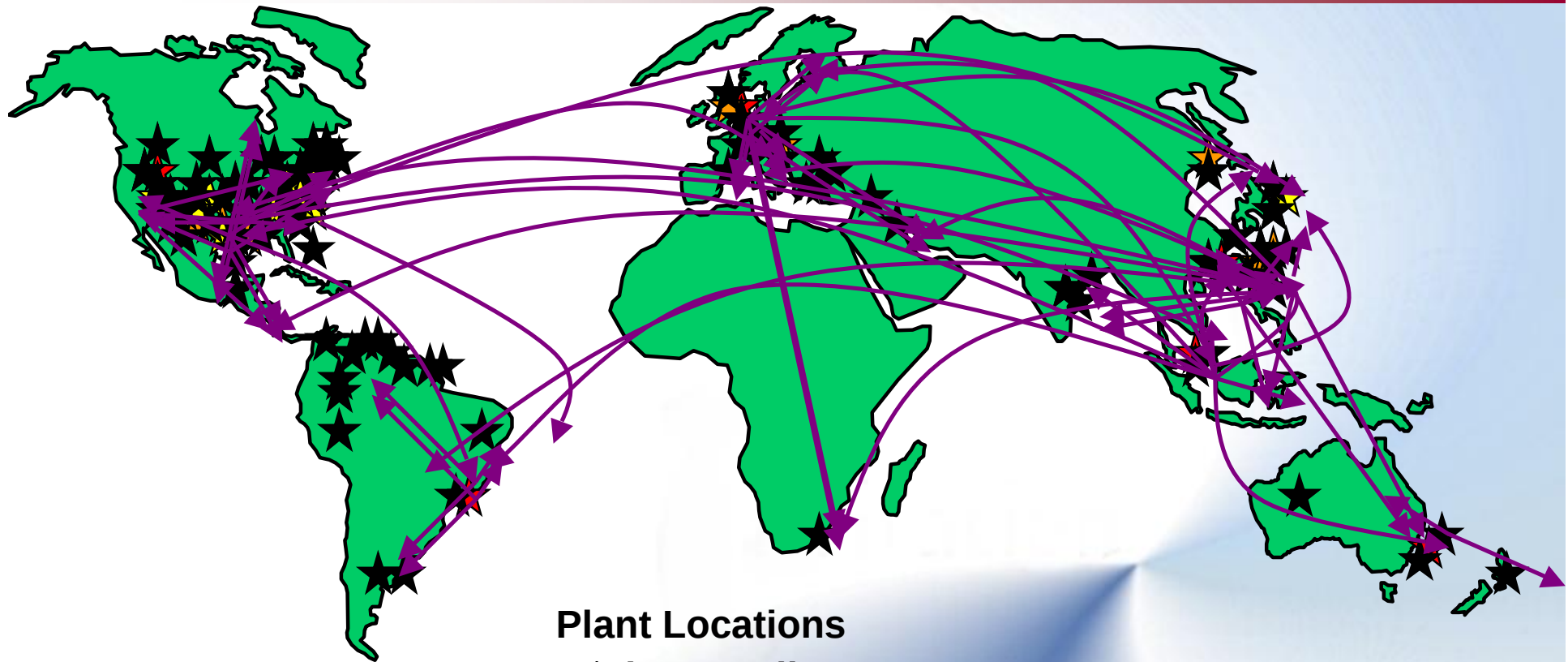
- Production based on forecast
- ← Production based on orders
- ▲ Customer orderedecouplingpoint

Environment Characteristics



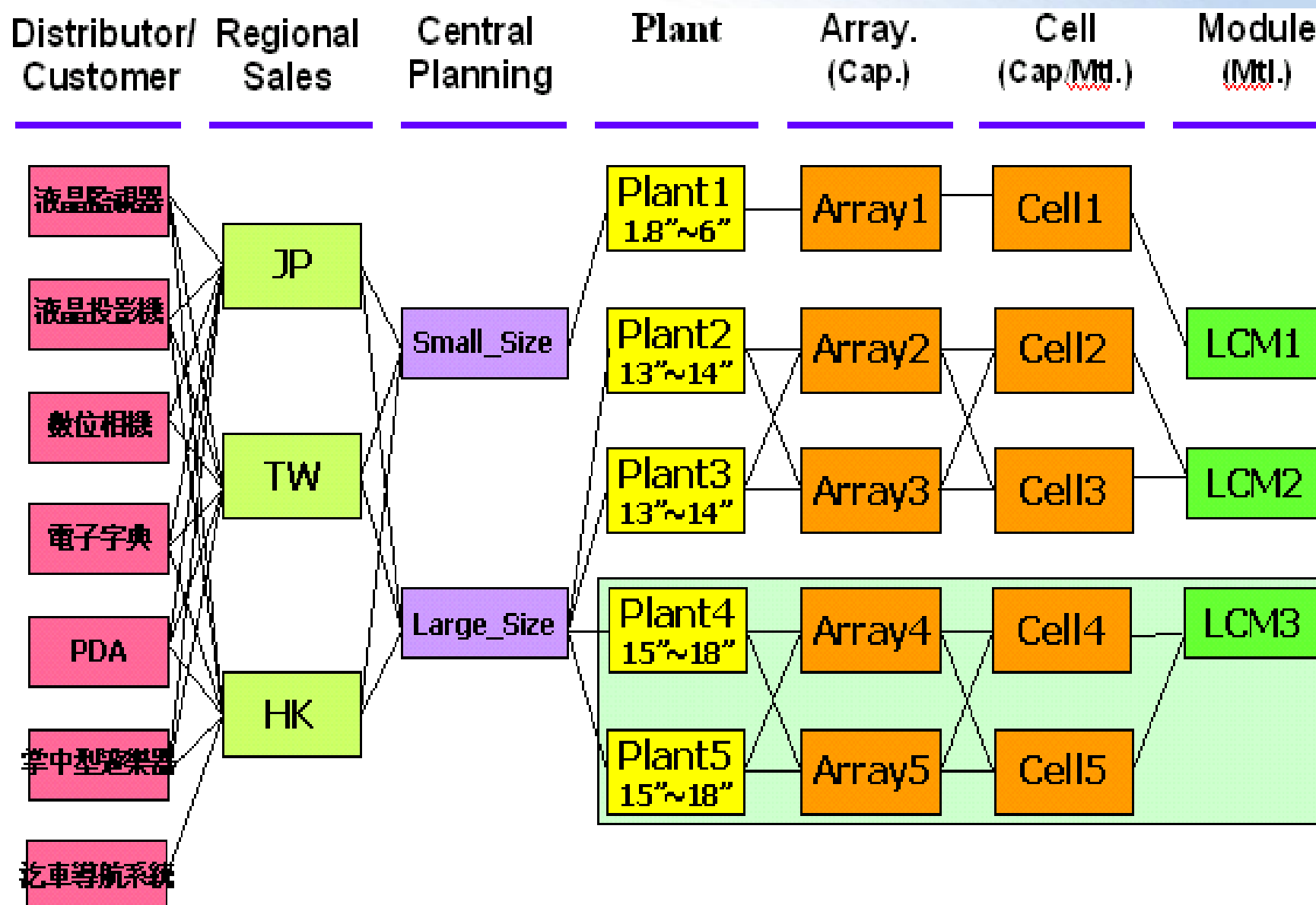
<i>Characteristic</i>	<i>Make-to-Stock</i>	<i>Assemble-to-order</i>	<i>Make-to-order</i>	Engineer-to-Order
Interface between production and customer	Low	Medium	High	High
Customer delivery time	Short	Medium	Long	Long
Production volume of each unit	High	Medium	Low	Low
Production range (Number of products in the line)	Narrow	Medium	Broad	Broad
Basis for production planning, and scheduling	Forecast	Forecast and Backlog	Backlog	Backlog
Seasonality (likelihood)	High	Medium	Low	None
Order promising	Based on availability of finished goods	Based on availability of subassemblies and components	Based on availability of raw material, capacity and some engineering	Based on availability of raw material, capacity and engineering
Handling of demand uncertainty	Safety stock	Over-planning of components and subassemblies	Little uncertainty exists after receipt of order	Very little uncertainty exists after receipt of order
Final assembly schedule	Identical to the MPS (Not Applicable)	Determined by customer orders	Used for most assembly operations	Determined by customer orders
Bill of material	Standard BOM for each product	Planning BOM	BOM unique for each other	BOM unique for each other

The Links of Global Supply Chain

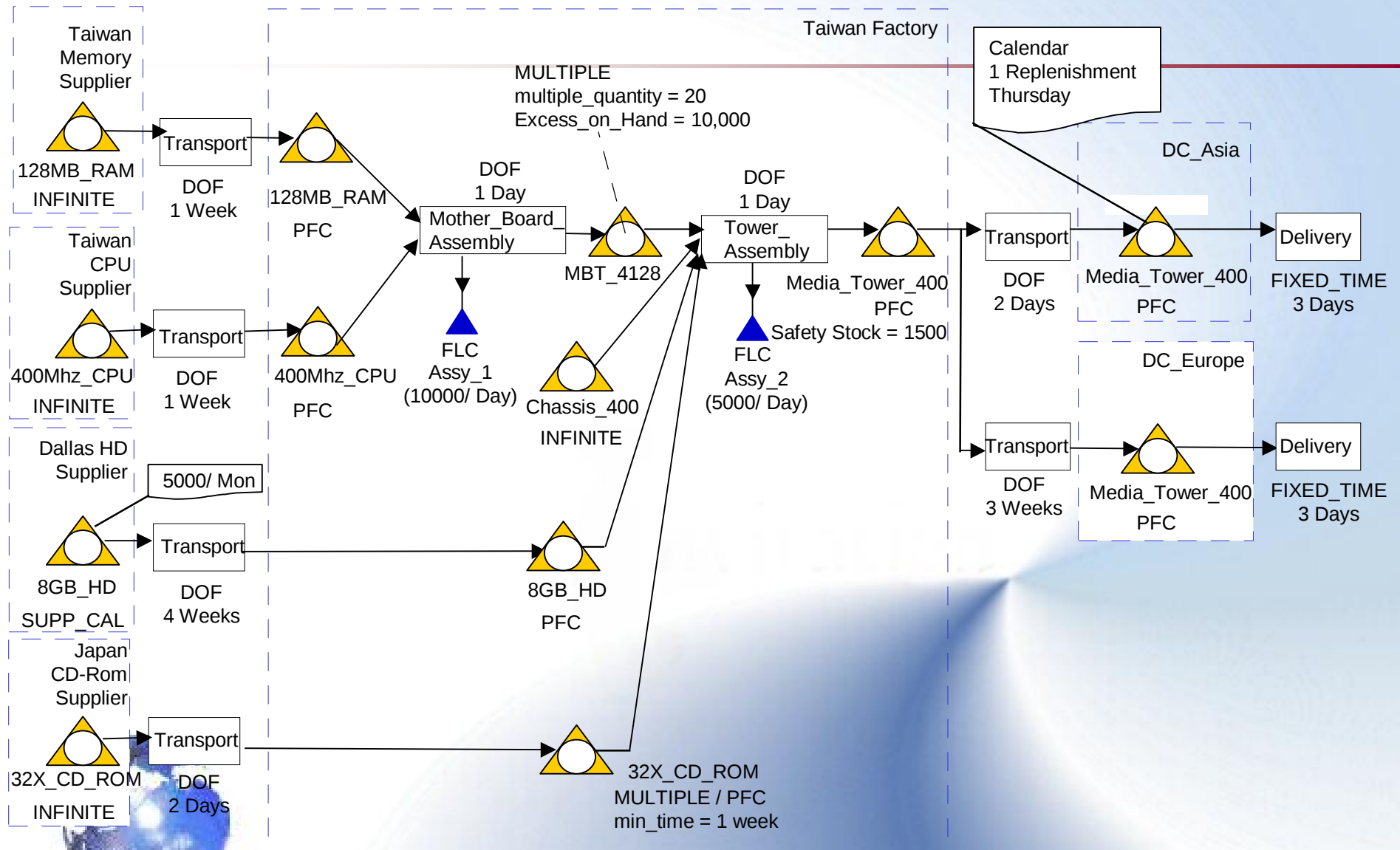


Plant Locations
1st tier suppliers
Hub and warehouses
Customers
Routing & Shipping Lanes

LCD SCM Flow



Conceptual Model Example

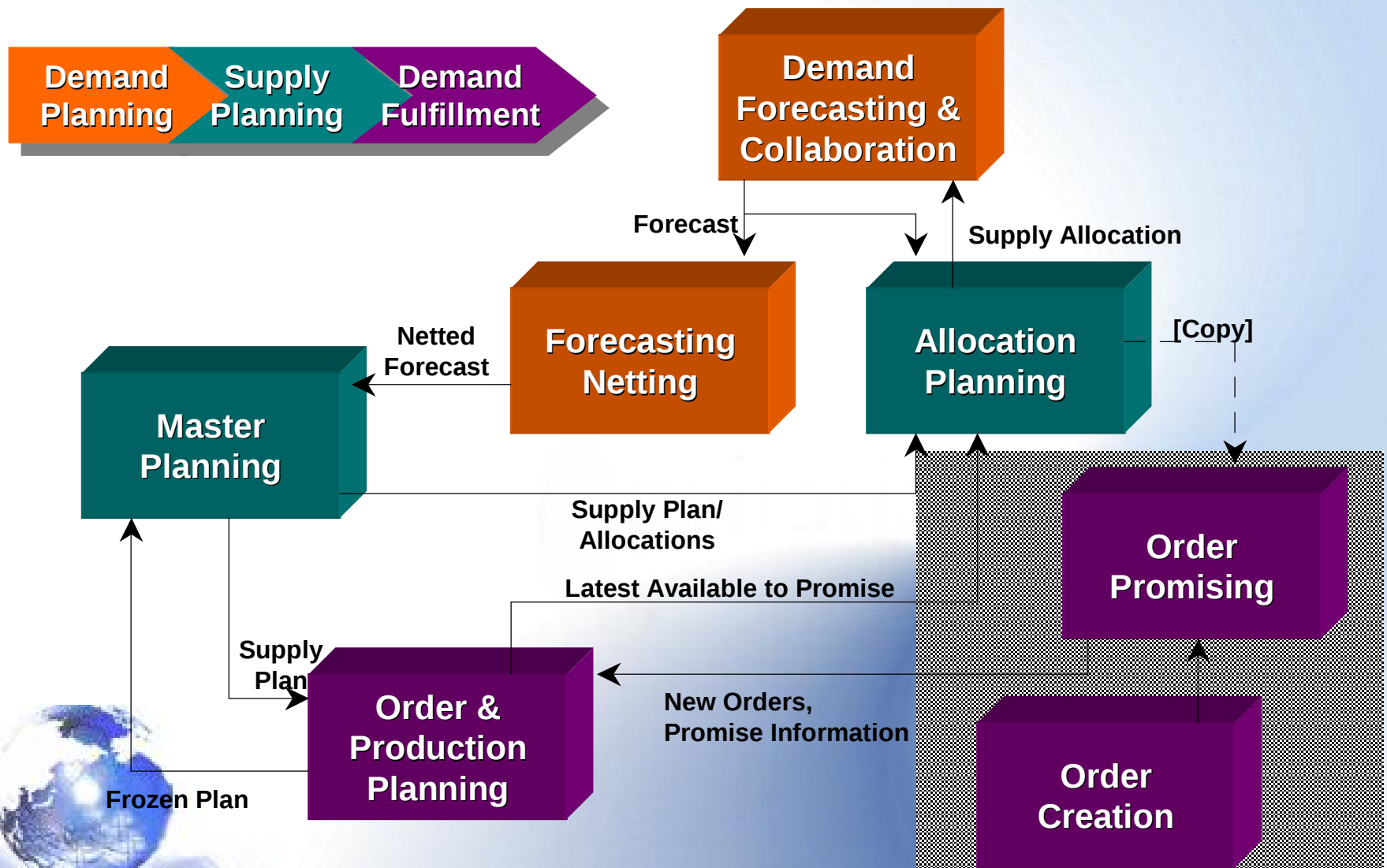


Agenda

- § Basic Concept of SCM
- § Supply Chain Modeling
- § ERP & APS
- § SCM Workflow
- § Demand Planning
- § Allocation Planning
- § Master Planning
- § Order Promising
- § Factory Planning



SCM Workflow



§ Process Focuses on Two Simple Objectives

- Make reliable and optimal delivery promises to customers
- Respect those promises

§ Two sets of numbers are considered when determining promised date

- ATP – available to promise
- AATP – allocated available to promise



Order Promising – ATP



- § Supports order promising
- § Uncommitted portion of
 - § Inventory
 - § Planned supply
- § Calculation method depends on demand fulfillment approach
 - § Non-cumulative
 - § Cumulative
 - § Look-ahead (Backward ATP)



Order Promising – ATP & AATP



§ ATP

- Total supply that is available to promise for the entire seller hierarchy (or under the seller where product is rooted)

§ AATP

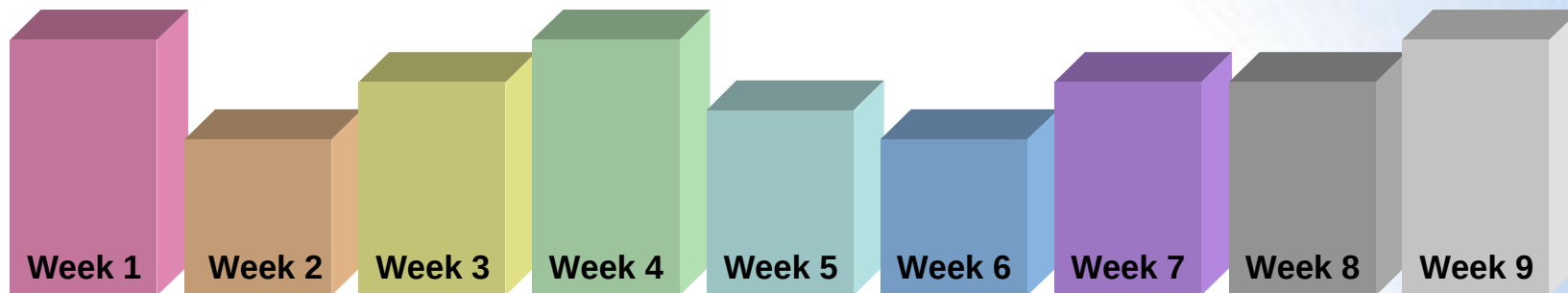
- Allocation specific to each seller in each forecast bucket
- Provides mechanism to reserve supply for particular sellers

§ ATP bucket size is finer or equal to AATP bucket size

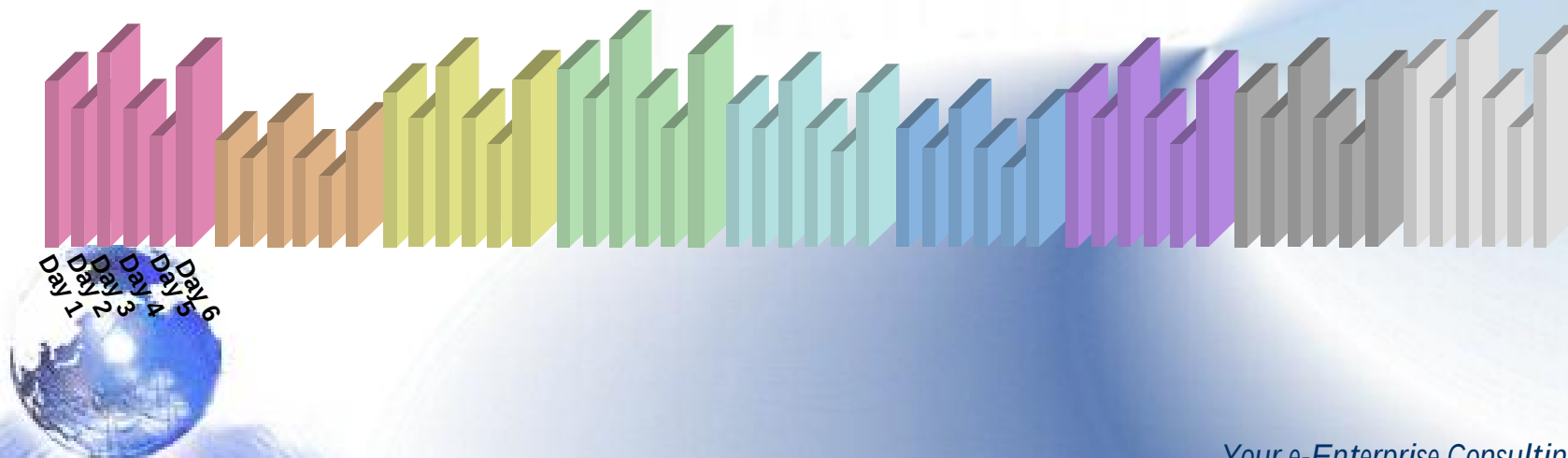


Example of ATP and AATP Bucket Sizes

§ Forecast_Horizon: WEEKS



§ ATP_Horizon : DAYS



Order Promising – Inputs / Outputs



§ Inputs

- Residual ATP and allocations
- Fresh orders

§ Outputs

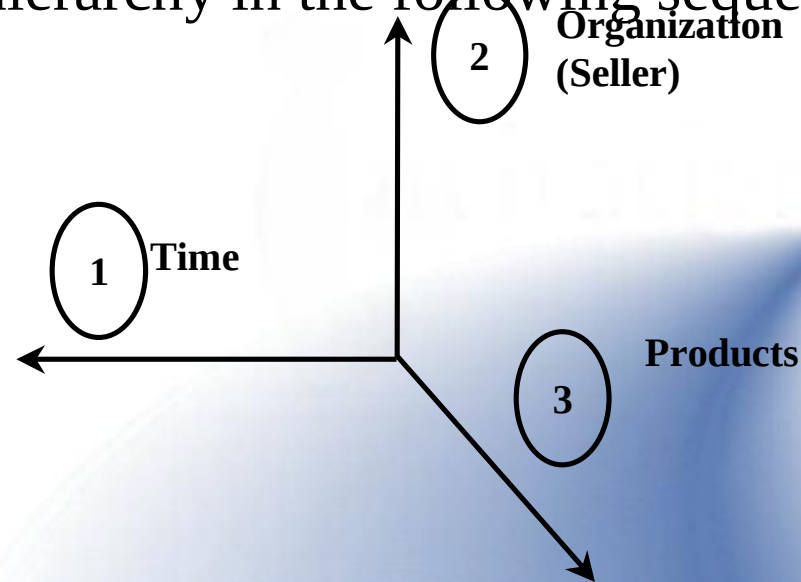
- Promise information for each fresh order



Order Promising – AATP in 3 Dimensions



- § AATP is specified for each seller/product/time combination
- § AATP consumption along the 3 dimensions is determined by considering time, seller hierarchy, product hierarchy in the following sequence



Order Promising – Time Dimension



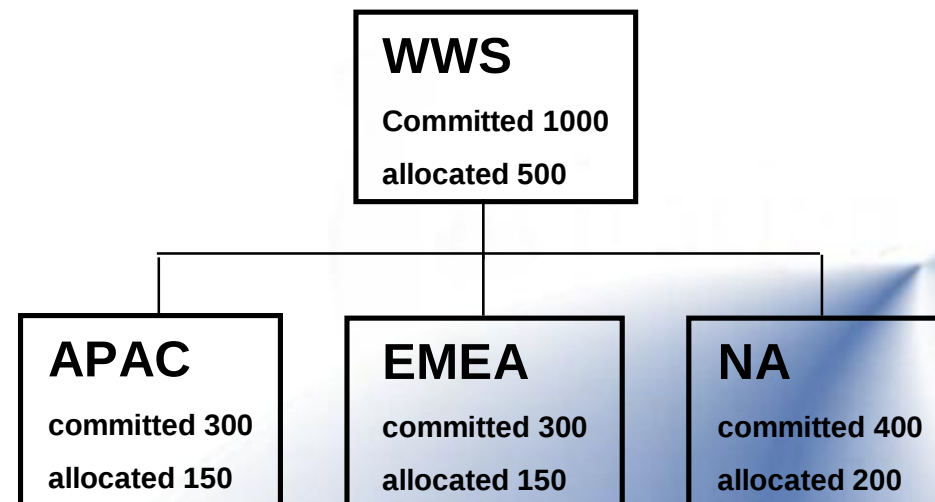
- § Both ATP and AATP are specified for specific time buckets
- If the forecast horizon is monthly, AATP (or allocation) is given for each month
 - If ATP horizon is daily, ATP is given for each day



Order Promising – Seller Dimension



§ Forecasts and allocations are aggregated/disaggregated along the seller hierarchy



Order Promising – Product Dimension



§ Alternate products

- When product_A is not available, use product_B to promise orders asking for product_A
- Example - Down binning
 - 900 MHz CPU can function as 800 MHz CPU
 - 800 MHz can not perform as 900 MHz CPU
 - 900 MHz can be set as an alternate product of 800 MHz CPU
 - Not the other way



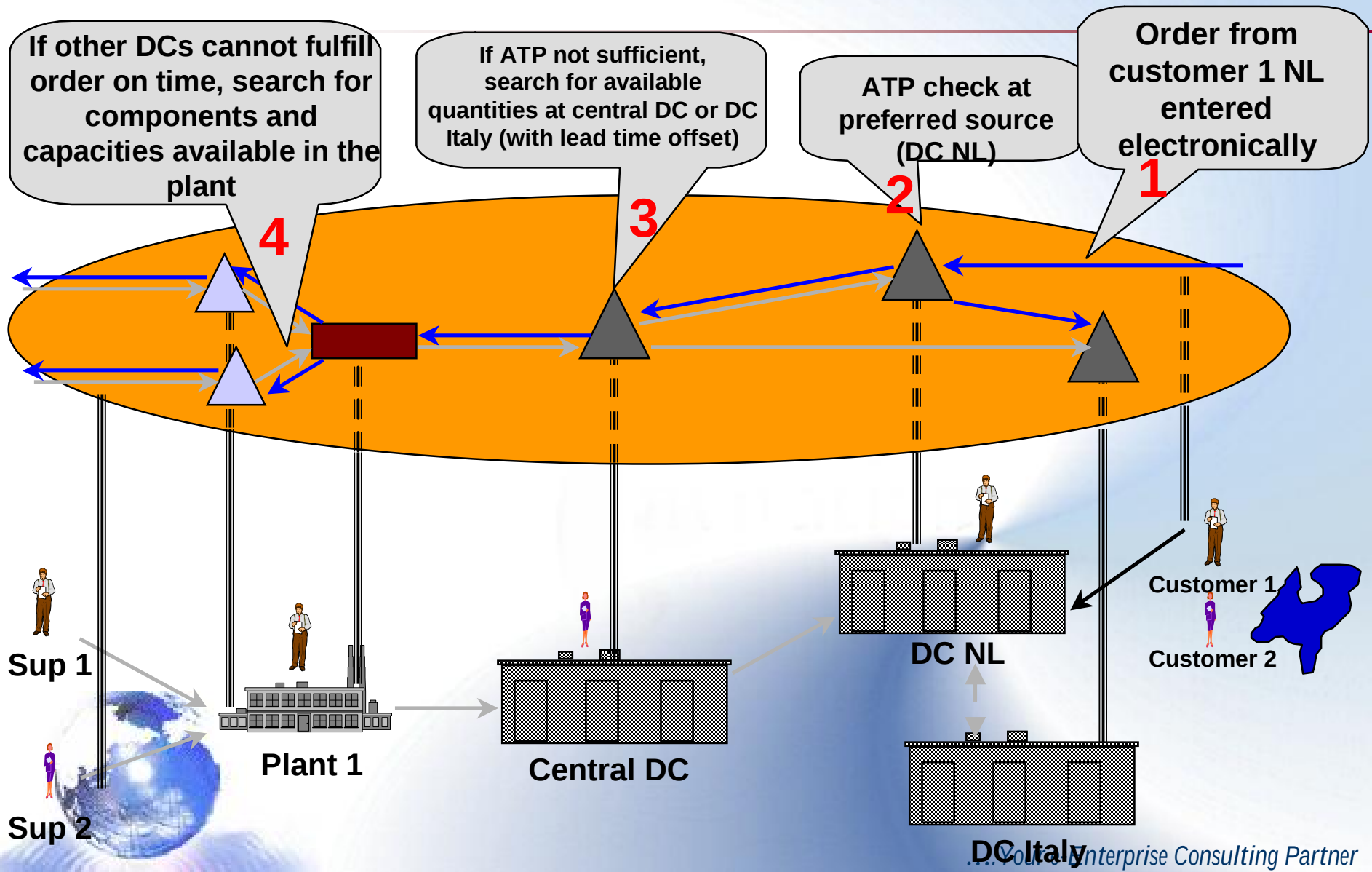
Traditional Order Promising Based on ATP Records in an ERP System

Period	1	2	3	4	5
Unconsumed Forecast	2	4	7	8	10
Customer orders	13	12	3	2	0
Total demand	15	16	10	10	10
Projected on hand	10	5	4	9	-1
ATP	7	3	10		15
Cumulative ATP	7	10	20	20	35
MPS/ MDS	10	15	15		15

Customer : 'Can you supply me 30 units in period 3?'

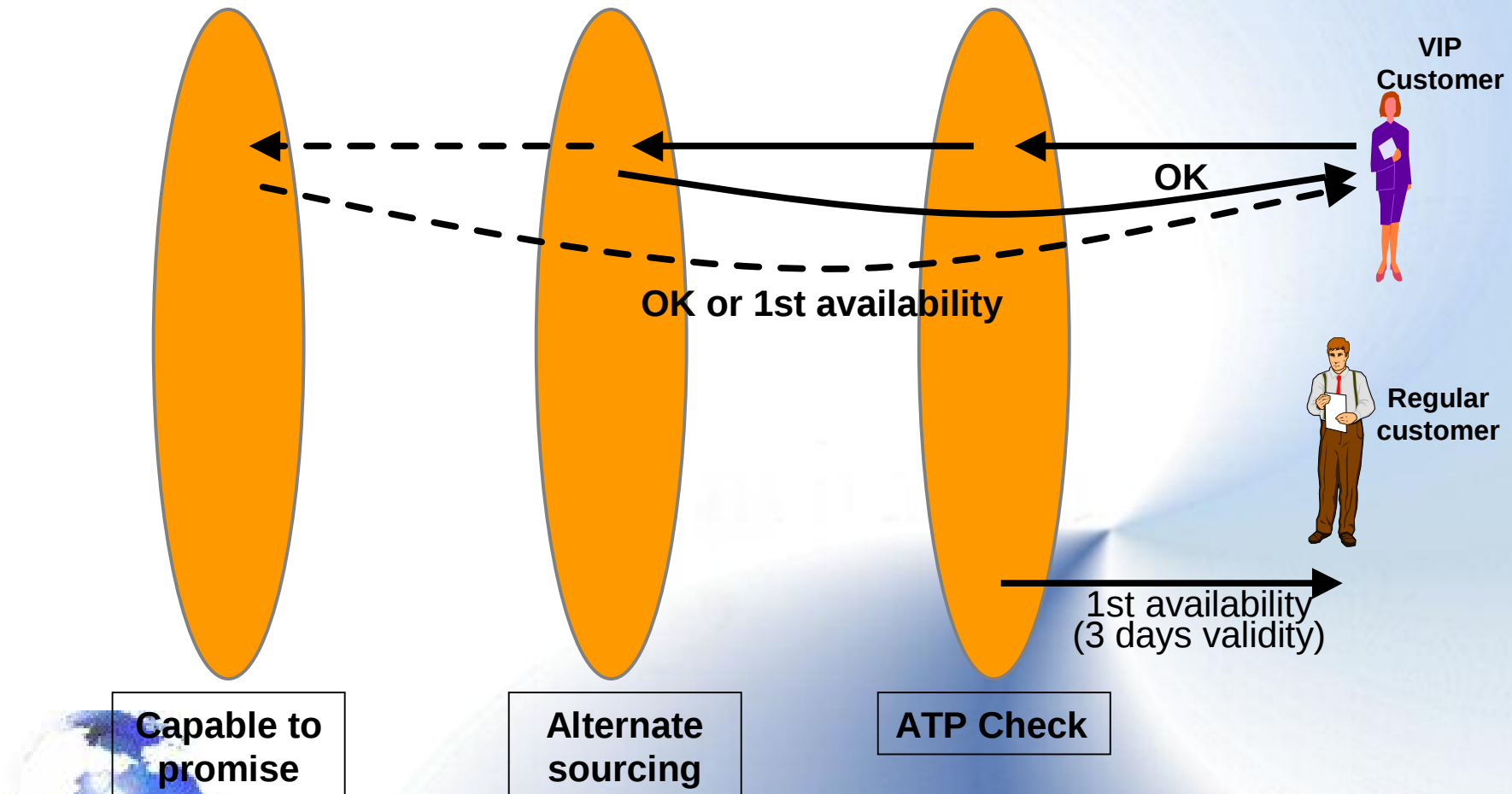
Company : 'We can supply you 20 units in period 3 and the remaining quantity in period 5.'

Capable-To-Promise Process (Dynamic, Multi-Level ATP)



Differentiated Workflows to Support the Order Fulfillment Process

Example: How should the Supply Chain react when no ATP is available at a requested date?



Balancing customer responsiveness with supply awareness based on customer importance

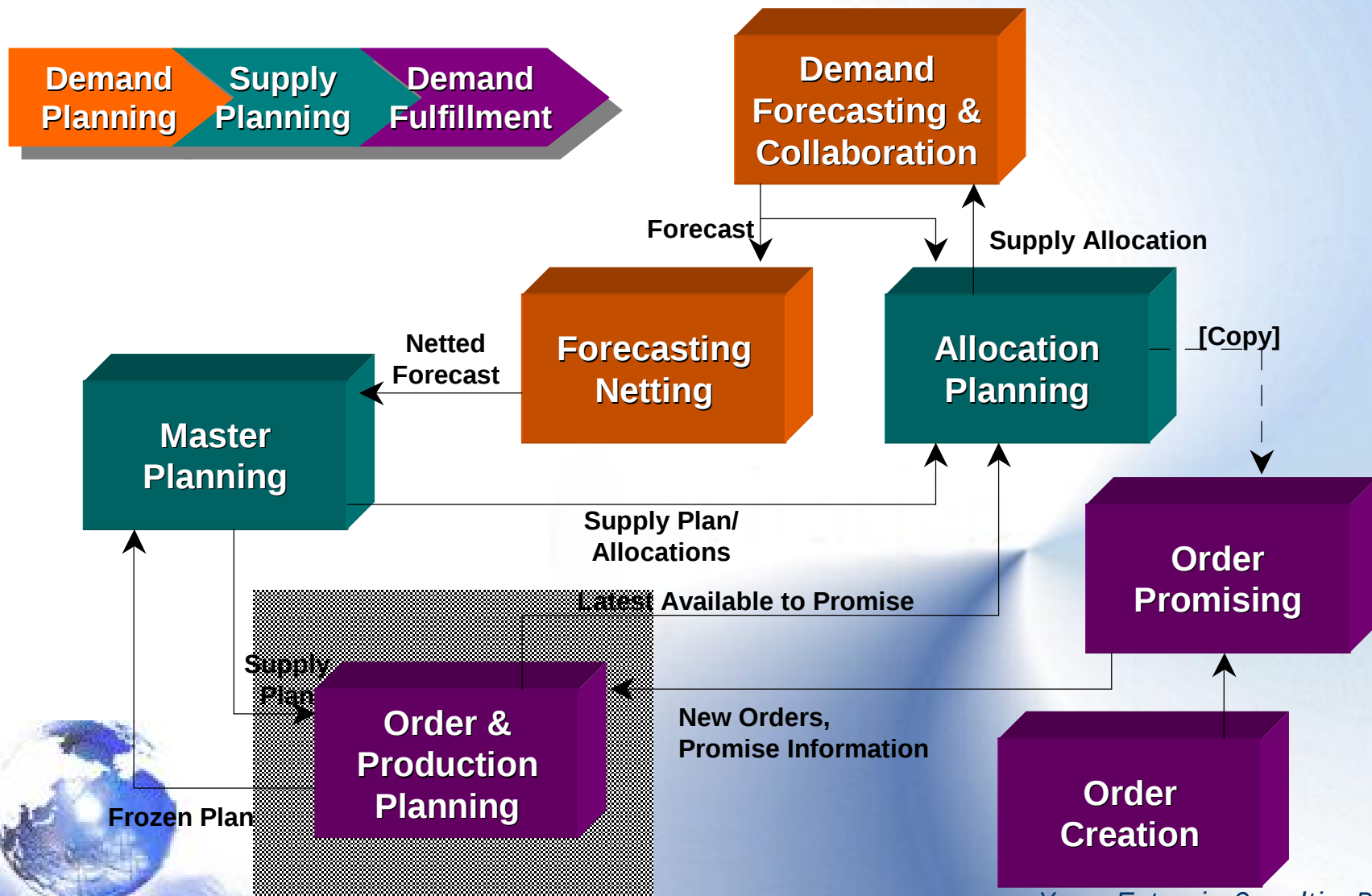
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Agenda

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SCM Workflow



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Factory Planning

§ For delivering the right products and service to the right place and at the right time, factory needs to know:

- What needs to do?
- When needs to do?
- And use which resources to do?

§ The goal of Factory Planning is to produce and maintain a feasible plan.

- Meet orders due date
- Delivery required quantity
- Required material and resources are available



Factory Planning – Activities



§ Material Planning (Infinite Capacity Planning)

- Inventory Assignments
- Procurement Planning

§ Capacity Planning (Finite Capacity Planning)

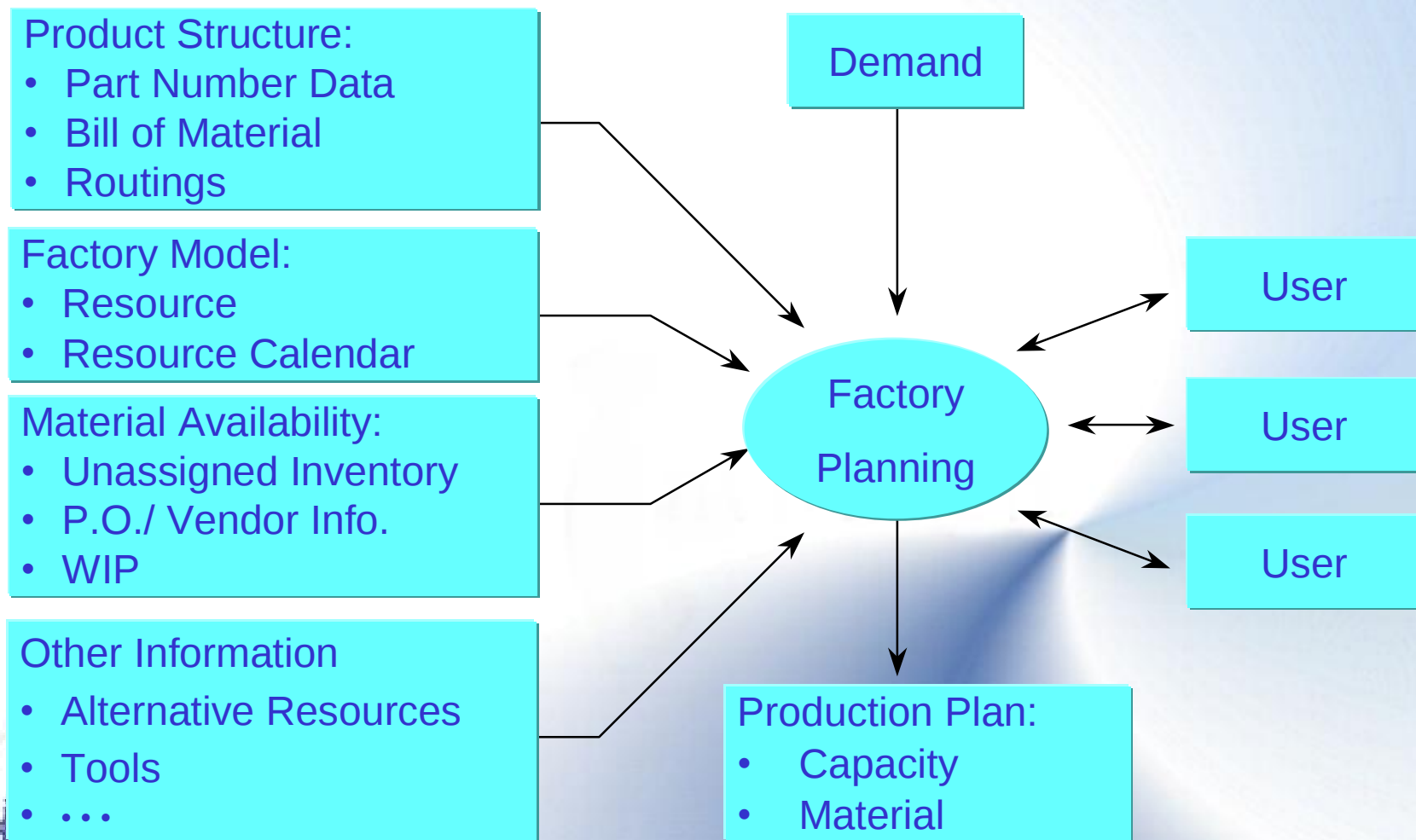
- Bottleneck Identify
- Capacity Balancing

§ Detail Scheduling

- Sequencing
- Dispatching



Factory Planning – Objects



Factory Planning – Decision Points (1)



- § **Managing Orders** involves the decisions of how to prioritize the demand orders and what planning options to apply to minimize their lateness.
- § **Inventory Assignments** involve decisions of which supplies will be assigned to which demands.
- § **Resolving Capacity Issues** involves the decisions of how to re-allocate the planned work loads on resources to balance the capacity.



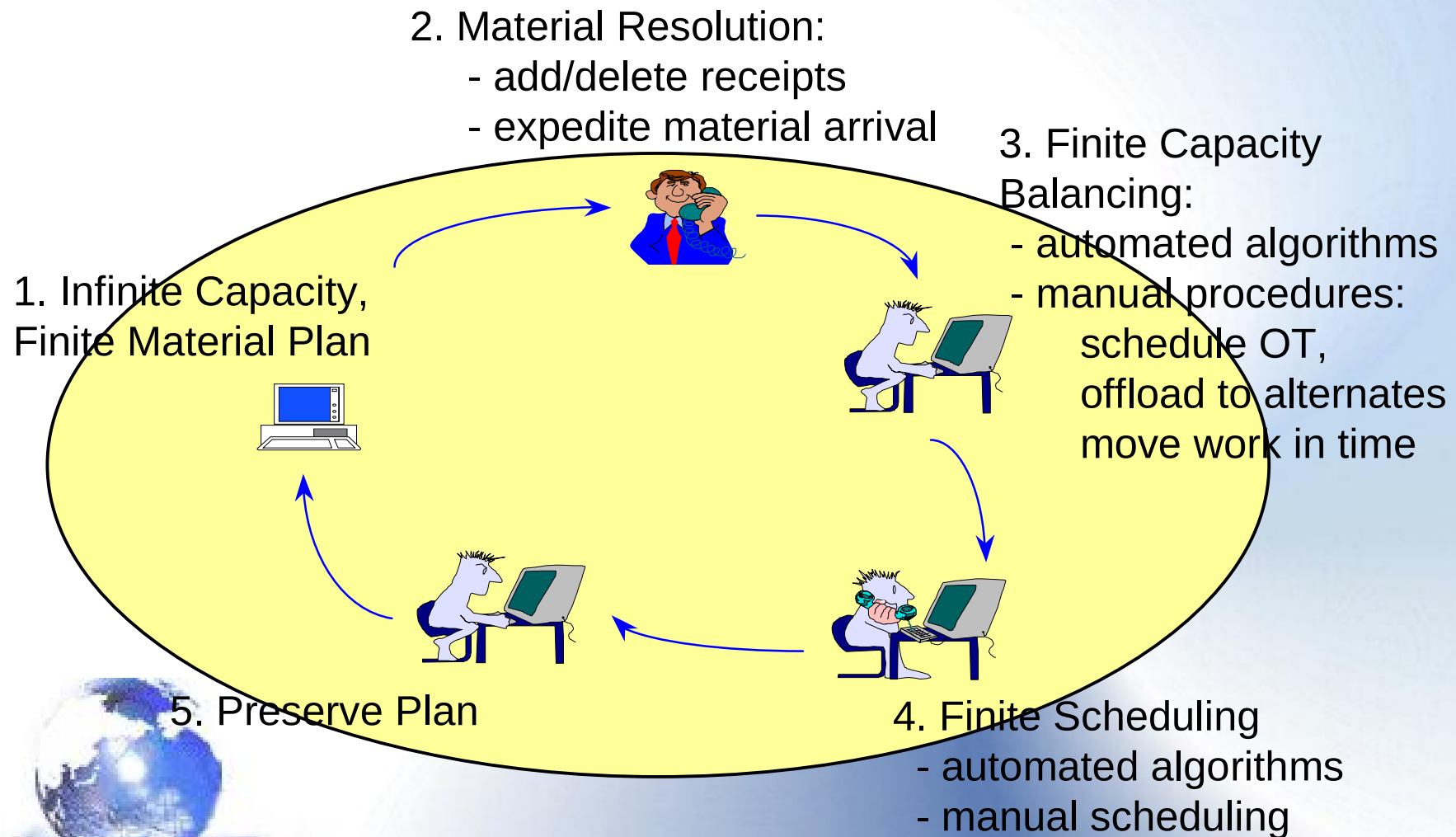
Factory Planning – Decision Points (2)



- § **Managing Resources** involves the decisions of when the resources will be available to perform tasks.
- § **Resource Assignments** involve the decision of which and how many resources should be assigned to mfg tasks.
- § **Scheduling Resources** involves decisions of what should be a sequence of scheduled tasks on resources.
- § **Planned Start Times (PST)** involve the decision of when mfg tasks will begin.



Factory Planning – Planning Cycle



Factory Planning – Balancing Supply and Demand



§ Demand

- orders (customer)
- forecasts
- safety stock targets
- dependent demand

§ Supply

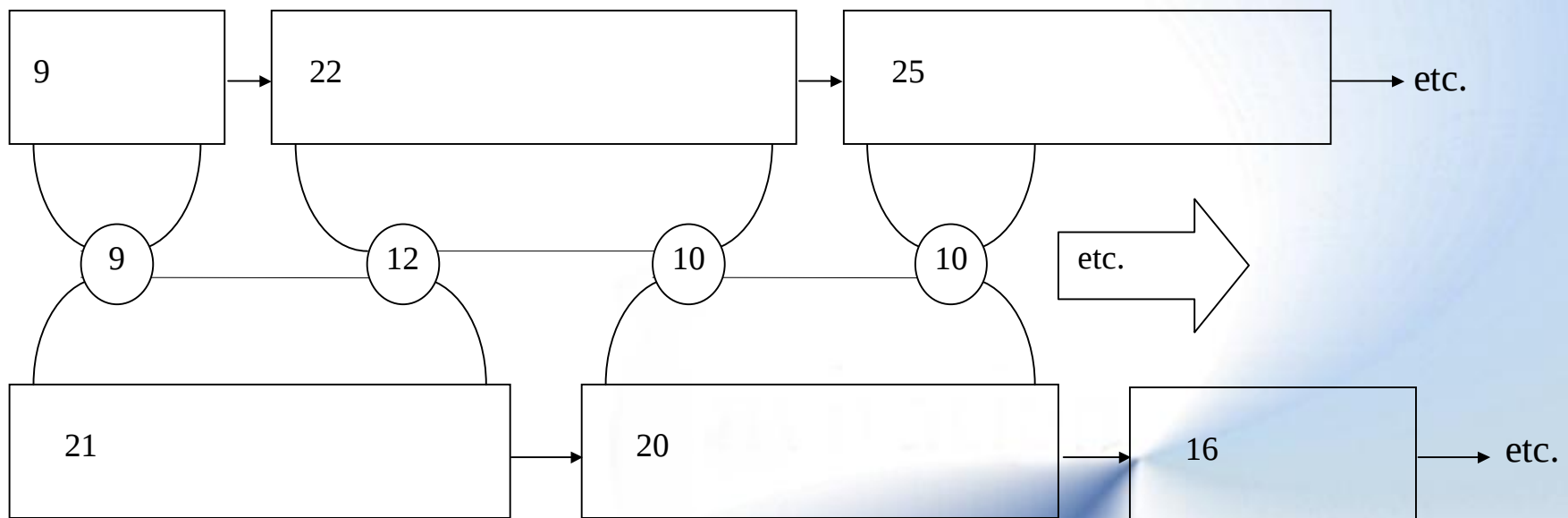
- WIP lots
- planned manufacturing lots
- inventory
- planned purchased supply
- firm purchased supply



Factory Planning – Supply and Demand Pegging



Demand



Supply



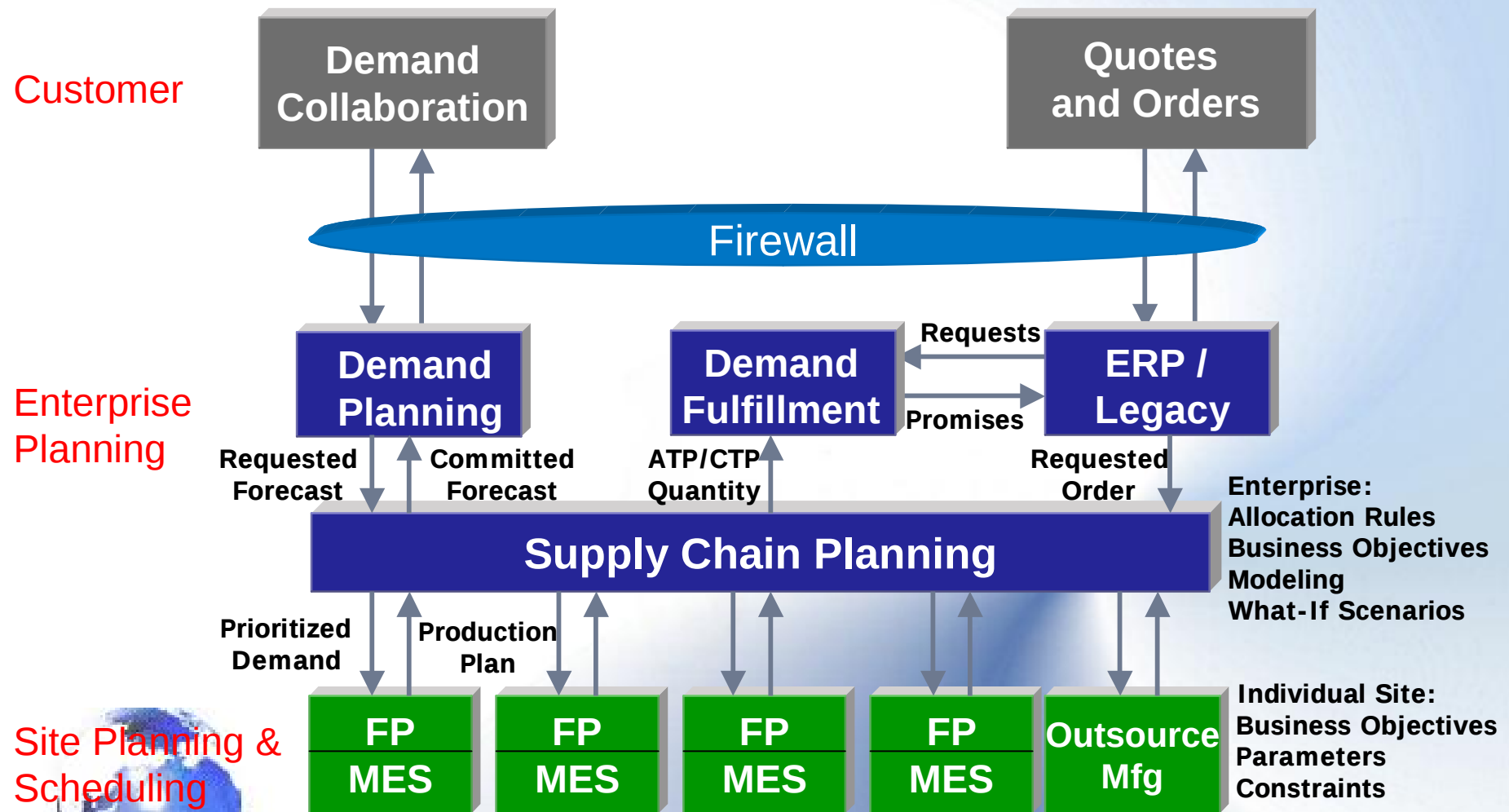
Factory Planning – Common Planning Approach



- § Constructive
 - Order by Order planning
 - Problem oriented planning
- § Repair, Heuristic searching
- § Linear programming



High-Level Solution Architecture of i2



Q & A



Thank You!



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