



Replenishment Business Processes

Fundamentals, with Focus on Forecast-Based Replenishment

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Topics

- ▶ Part 1 - Fundamentals
 - ▶ Business Processes and Technology Options
 - ▶ Definition of "Replenishment"
 - ▶ Determining what to order
 - ▶ More definitions
 - ▶ Why do forecasting?
 - ▶ Generating requirements
- ▶ Part 2 - Forecast types and Data Requirements
 - ▶ Forecast types and Forecast-based replenishment scenarios
 - ▶ Typical back-end processing, BMI and SMI/VMI
 - ▶ Consumption-based Replenishment
 - ▶ Forecast contents

Topics

- ▶ Part 3 – Overview of Advanced Concepts
 - ▶ Constrained vs. Unconstrained Demand
 - ▶ Closed-Loop MRP
 - ▶ Collaboration
 - ▶ Decision Support Systems
 - ▶ Just-In-Time Inventory Methodology

Background/Reference

Available to public

- ▶ EIDX Business Models: Order Models and Replenishment Scenarios
 - ▶ http://www.eidx.org/publications/business_models/fcmodl/fcmodl.html
 - ▶ http://www.eidx.org/publications/business_models/replmodl/replmodl.html

- ▶ EDIFICE Business Models
 - ▶ <http://www.edifice.org/REP/fimbim.pdf>

- ▶ EIDX classes at <http://www.eidx.org/publications/eidxClasses.html>
 - ▶ “The Business in eBusiness”
 - ▶ “Fundamentals of Purchase Order Processes”

Background/Reference continued

Available to public

- ▶ EIDX Glossary
 - ▶ <http://www.eidx.org/publications/gloss/>
- ▶ EIDX Collection of Acronyms and Abbreviations
 - ▶ <http://www.eidx.org/publications/abbrev/>

Available to Task Group Members – will be incorporated into the class when task group has finalized the content

- ▶ EIDX working document: “Forecast Business Process Analysis”

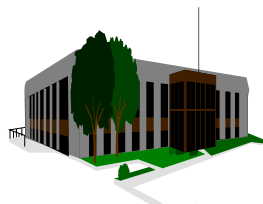


Replenishment Business Processes Part 1: Fundamentals

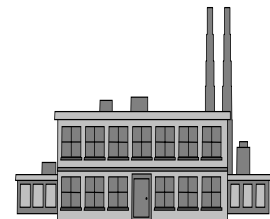
Terminology and Scope
Generating Requirements

Macro-level "business process"

- ▶ At the most basic, technology-independent level, A buyer plans for replenishment of goods or services by sending a forecast, the seller may send a response if needed; forecast is regenerated periodically.

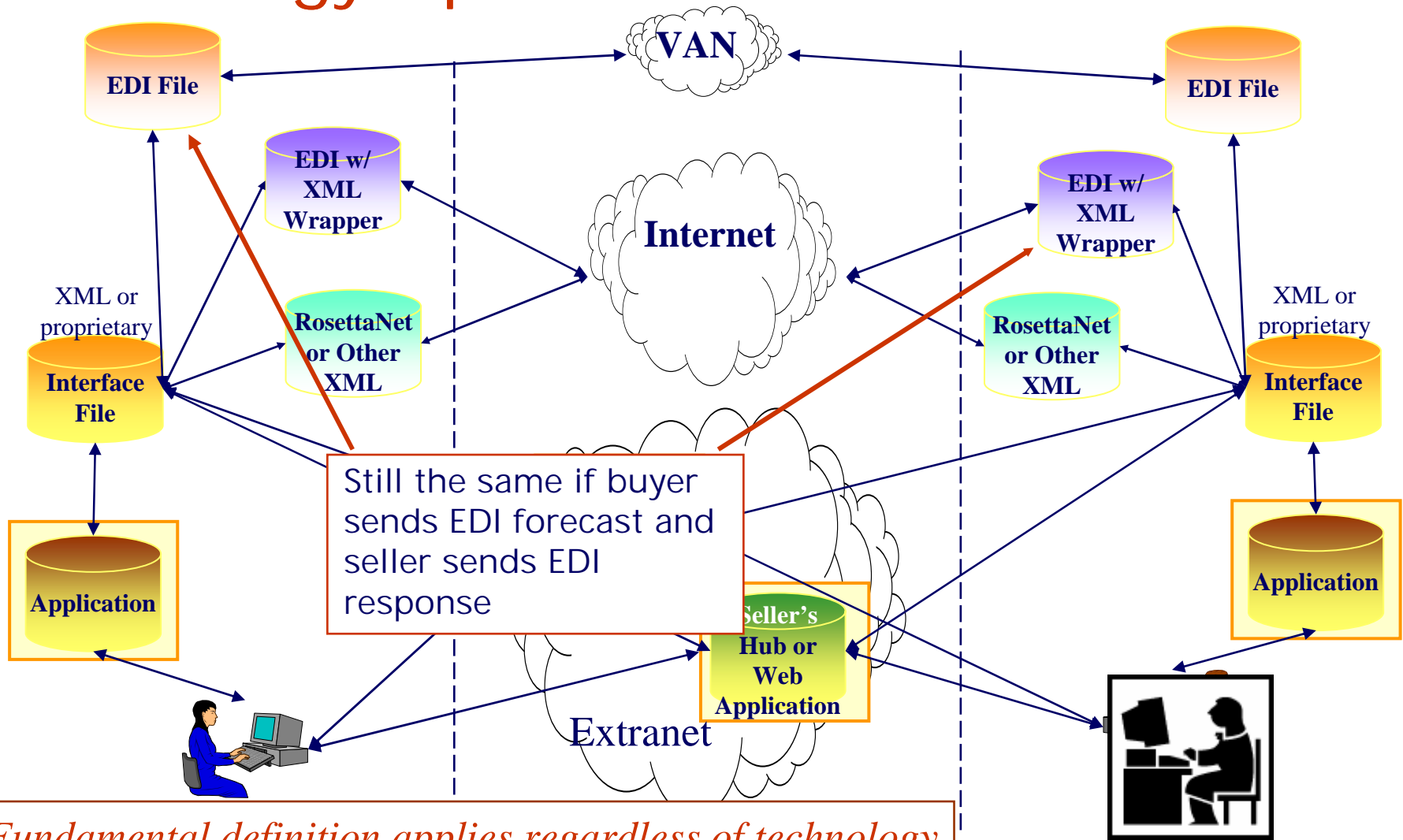


BUYER



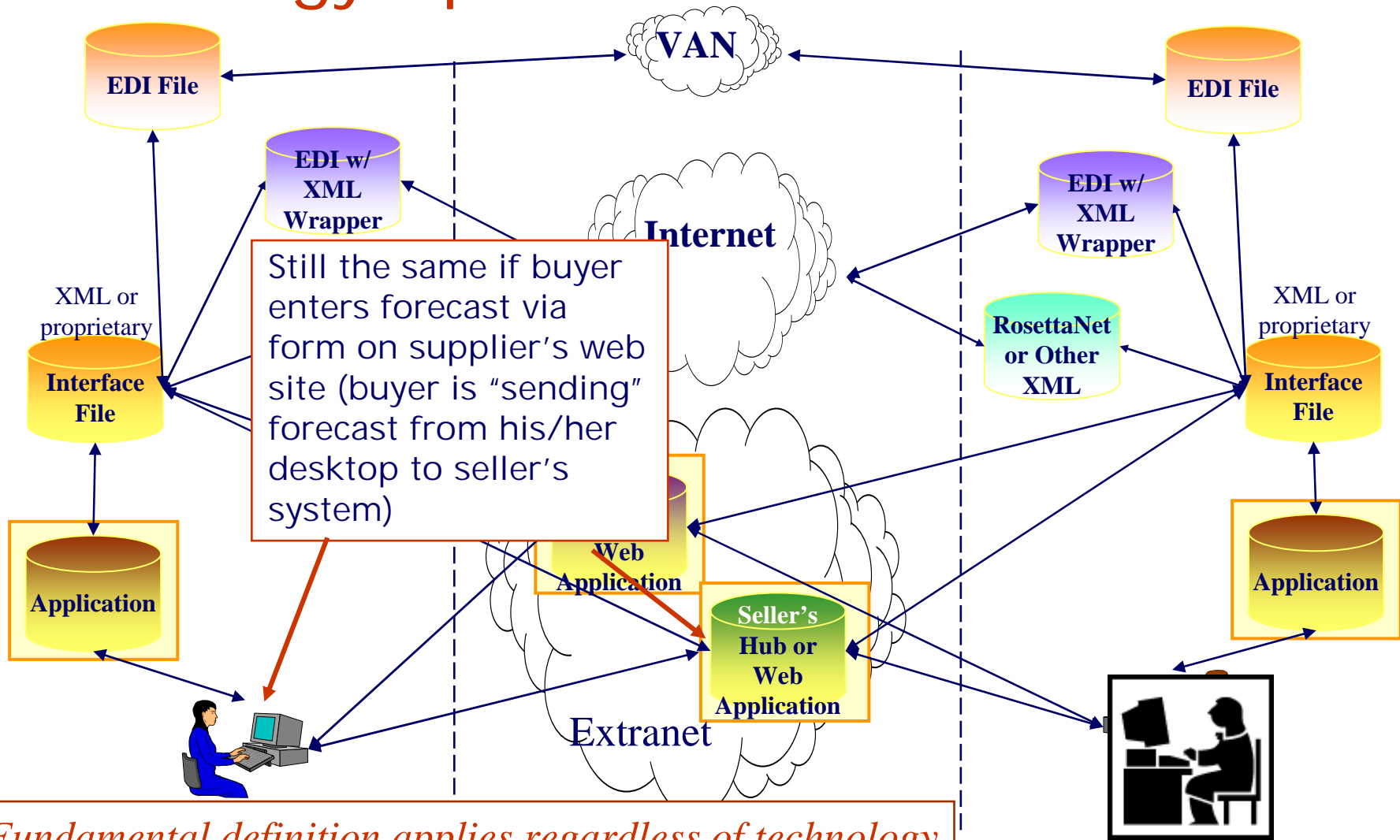
SELLER

Technology Options - EDI



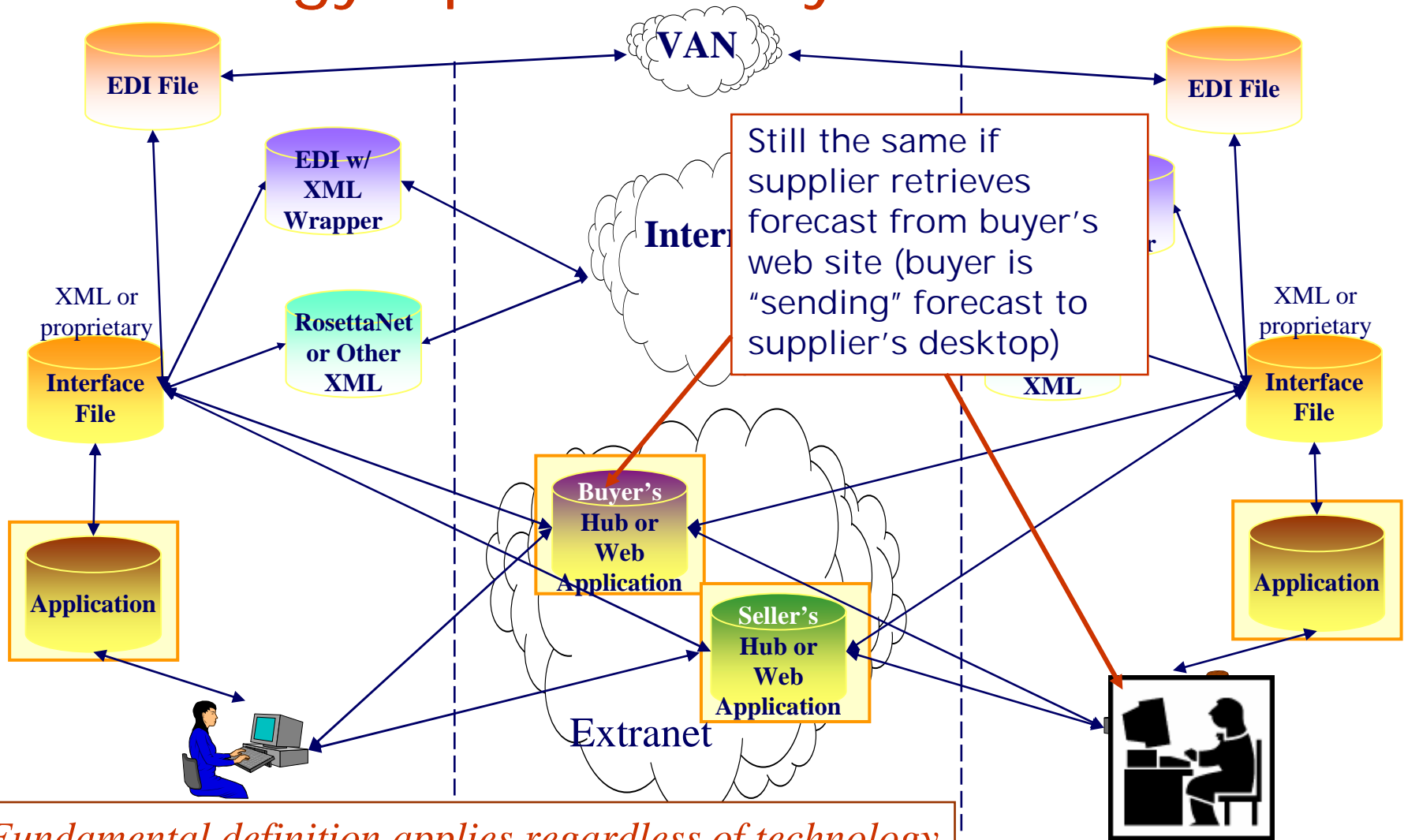
Fundamental definition applies regardless of technology

Technology Options – Seller's Web Site



Fundamental definition applies regardless of technology

Technology Options – Buyer's Web Site



Fundamental definition applies regardless of technology

What do we mean by “replenishment?”

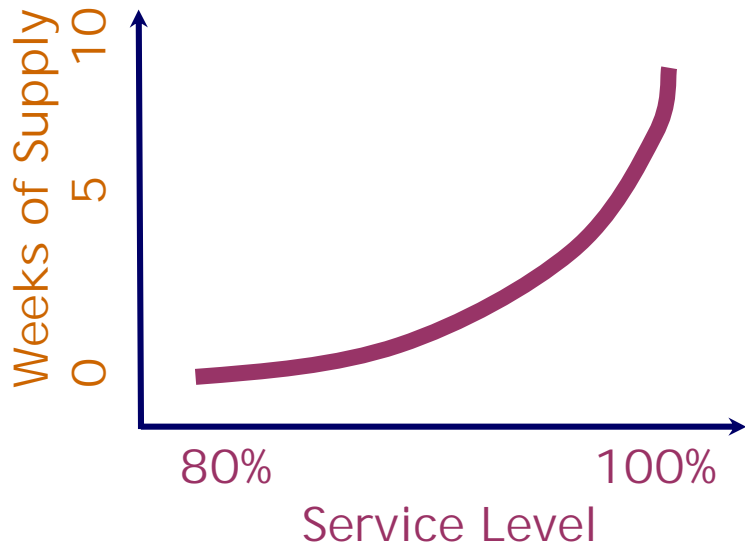
- ▶ The process of filling up or “making complete again” by supplying what has been used up.
 - ▶ Repeat buy items (not one-time buys)
 - ▶ Activity of one link reverberates throughout the supply chain – all directions
 - ▶ *More about supply chain on later slide*
 - ▶ May be based on forecasted demand, firm demand, past demand (history of consumption) or some combination of these



The goal is ...

- ▶ Maintain as little inventory as possible ...
- ▶ While maximizing ability to meet customer demand ...
- ▶ With the lowest lead time ...
- ▶ And the highest quality ...
- ▶ At the lowest cost ...
- ▶ And the most competitive price ...
- ▶ Yielding the highest profit ...

Historical Conundrum: Service Level vs. Inventory Level



Maximize service level:

- Carry **more inventory** so you are more likely to have what the customer wants when they want it
- Carry inventory at **several locations** so that you can get it to the customer quickly
- **Costs a lot** of money to store the inventory and manage it

Minimize Inventory level:

- Carry **less inventory** to keep costs down
- **Don't stock** repair parts
- Could **lose sales** if you don't have what the customers want when they want it

Determining what to Order

Replenishment requirements may be based on ...

- ▶ A request (a requisition)
- ▶ Past consumption (historical demand)
 - ▶ May replenish exactly what was used
 - ▶ May base replenishment quantity on usage trends
- ▶ **Forecast** of future demand
- ▶ Events such as product promotions or product discontinuation or seasonal demand fluctuations
- ▶ Anticipated demand for repairs, replacements and spare parts
 - ▶ *This is one of the most overlooked sources of demand*
- ▶ Unplanned demand

What do we mean by "Forecast?"

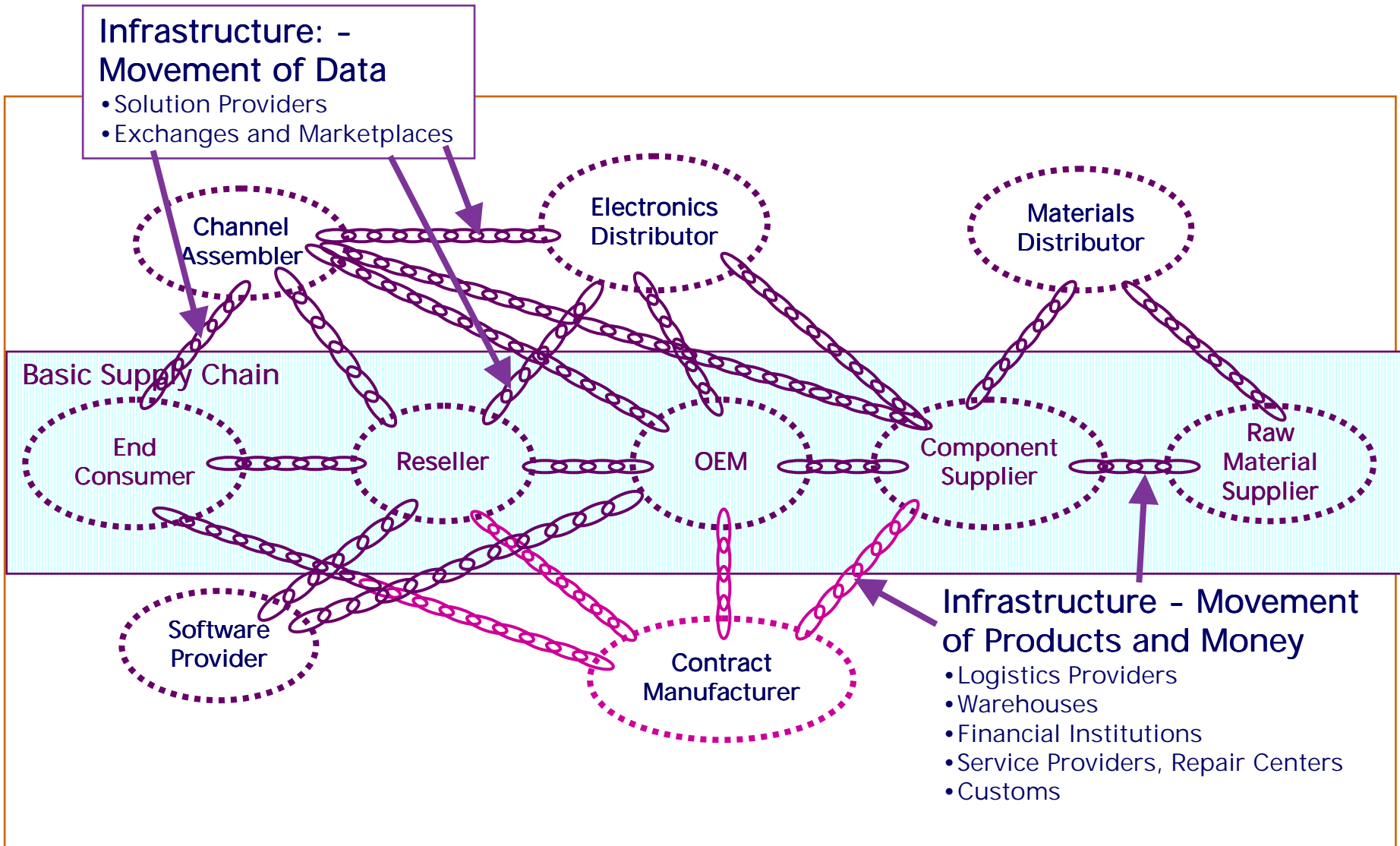
- ▶ An estimate of future demand.
 - ▶ Forecast-based replenishment is the replenishment of goods based on estimated future demand.
 - ▶ Forecast models are best understood in the context of Replenishment Scenarios

What do we mean by “Supply Chain?”

- ▶ The **enterprises** and **activities** involved in supplying products, from the ordering and receipt of raw materials through the manufacturing of products through the distribution and delivery to end customers.
 - ▶ **Order** acquisition and management
 - ▶ Logistics (physical distribution)
 - ▶ Managing transportation resources
 - ▶ Scheduling, what-if impact assessment
 - ▶ Inventory management and purchasing
 - ▶ Manufacturing and shop floor control
 - ▶ Contract Manufacturing



Partners in the Supply Chain





Where's the Beef?

The Supply Chain for that Filet on Your Dinner Plate

*Self-study slide -
you may study the
details on your own.*

- ▶ The **cowboy** or **range hand** who looks after the cattle
- ▶ The **banker** who finances land, herd, equipment
- ▶ The **oil refiner** who provides fuel to power ranch machinery
- ▶ The **steelmaker** who provides materials for fencing, branding irons, filing cabinets, etc.
- ▶ The **brewer, sugar refiner, cotton ginner and flour miller** who furnish by-products used to make livestock feeds
- ▶ The **veterinarian** who maintains the health of the cattle
- ▶ The **blacksmith** who shoes cattle drive horses and repairs ranch machinery
- ▶ The **airplane pilot** who sprays ranges with pesticides
- ▶ The **lumberjack** who provides materials for corrals, barns and pens
- ▶ The **wind miller** who makes machinery that keeps ranch water holes working
- ▶ The **feeder** who fattens up the cattle for market
- ▶ The **truck drivers and railroaders** who haul cattle to market
- ▶ The **stockyard workers** who provide temporary board for the cattle
- ▶ The **agent** who arranges the sale of cattle on commission
- ▶ The **butcher** who prepares divides cattle into beef products
- ▶ The **meat packer** who processes and distributes the beef
- ▶ The **distributor** who sells beef to restaurants
- ▶ The **retailer** who sells beef to consumers

A 1000-lb. steer produces 465 pounds of retail cuts.

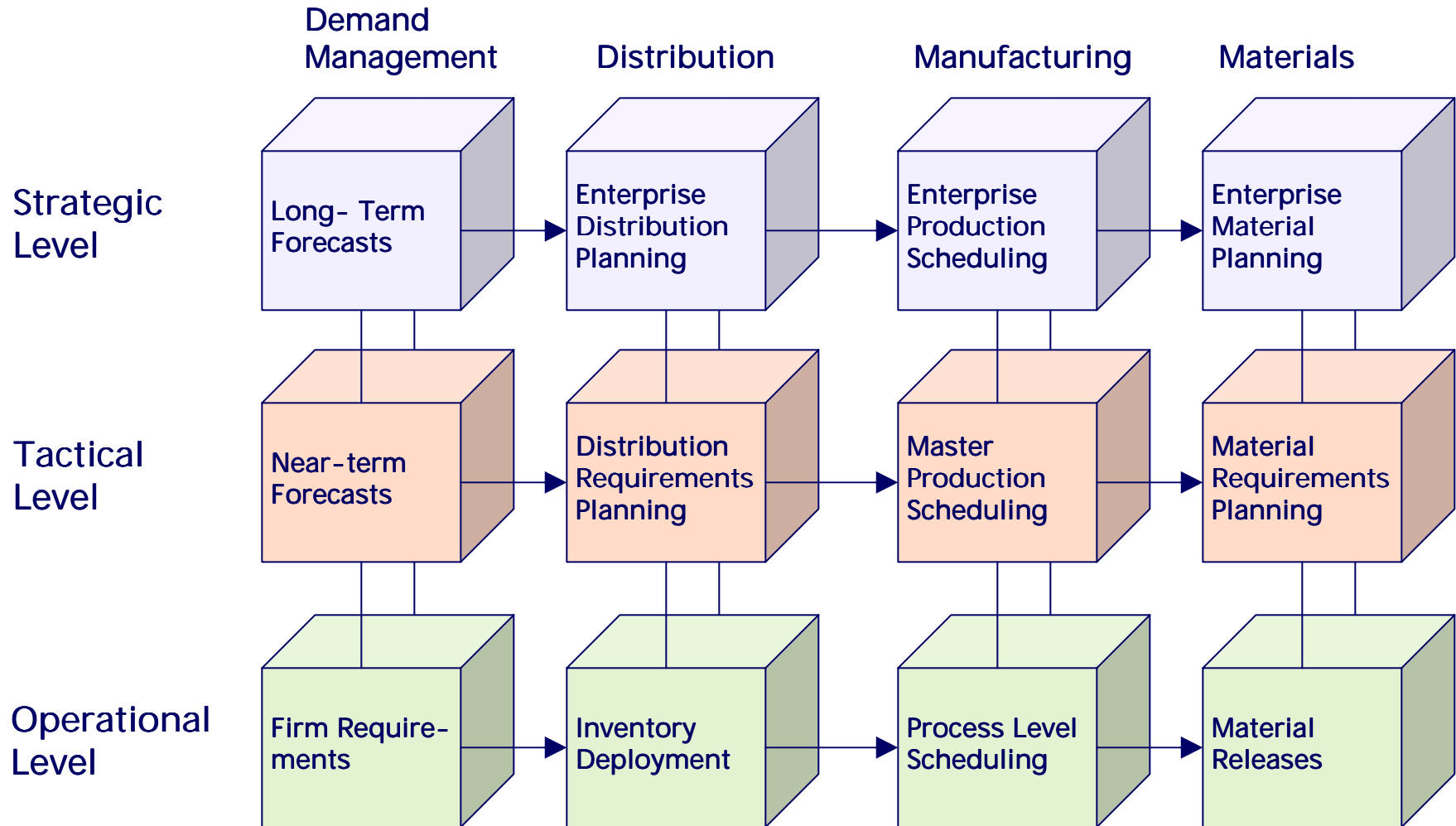
What do we mean by Collaborative?

- ▶ The act of **working together**
 - ▶ Opposite of working “independently”
 - ▶ Term getting overused; technically, all business activities involving a trading partner are collaborative

“Collaborative” is taking on more specific meanings today. Hold on to those thoughts and questions. More about collaboration later in the class.

Supply Chain Management Functions

Self-study slide - you may study the details on your own.



* Adapted from: "The Integrated Supply Chain Management System," University of Toronto, 1993

EIDX Scope

- ▶ EIDX deals with methods of exchanging the numbers or collaborating on the numbers – operational focus
- ▶ High-level descriptions of and basic education about back-end processing – enough to aid understanding of what can enable and constrain B2B processes.

EIDX Scope

- ▶ EIDX does not make recommendations on what forecast analysis methods companies should use. EIDX doesn't talk about:
 - ▶ Time series decomposition
 - ▶ Exponential smoothing
 - ▶ Single, multiple or dynamic regression
 - ▶ Intervention analysis
 - ▶ Testing statistical significance
 - ▶ Simulation methods
 - ▶ Econometric models – deterministic, stochastic and hybrid
 - ▶ Company strategies
 - ▶ Company proprietary and private information
 - ▶ How good or bad the numbers are

Why do Forecasting?

Forecasts can be used to ...

- ▶ Reduce Lead Times by allowing the supplier to anticipate orders
- ▶ Increase assurance of supply
- ▶ Reduce total inventory in the supply chain pipeline
- ▶ Optimize allocation of manufacturing capacity
- ▶ Facilitate faster reaction to fluctuations in demand

Replenishment Roles

- ▶ In any replenishment transaction, the buyer is not necessarily the end user and the seller is not necessarily the manufacturer.

- ▶ **Buyer may be**

- ▶ Prime Contractor (PC, a/k/a Original Equipment Manufacturer (OEM))
- ▶ Contract Manufacturer (CM)
- ▶ Distributor (DS)
- ▶ Component Supplier (CS)
- ▶ Value-Added Reseller (VAR)
- ▶ Third-party Purchasing Agent
- ▶ etc.

- ▶ **Seller may be:**

- ▶ Prime Contractor (PC, a/k/a Original Equipment Manufacturer (OEM))
- ▶ Contract Manufacturer (CM)
- ▶ Distributor (DS)
- ▶ Component Supplier (CS)
- ▶ Value-Added Reseller (VAR)
- ▶ Sales Representative (Third-party Sales Agent)
- ▶ etc.

The roles may affect what is required in a forecast.

Things to Consider

- ▶ Source of the forecast
- ▶ Reliability of the forecast
- ▶ Stability of the forecast
- ▶ Buyer-managed vs. supplier-managed inventory
- ▶ Use of Third parties
- ▶ Product mix and volume
- ▶ What the customer wants
- ▶ Impact on seller of other customers
- ▶ Systems capabilities and limitations
- ▶ External factors (Transportation, Customs, etc.)

Self-study slide - you may study the details on your own.



Factors That Affect Sales

Things that Impact Forecast Accuracy and Stability

Self-study slide - you may study the details on your own.

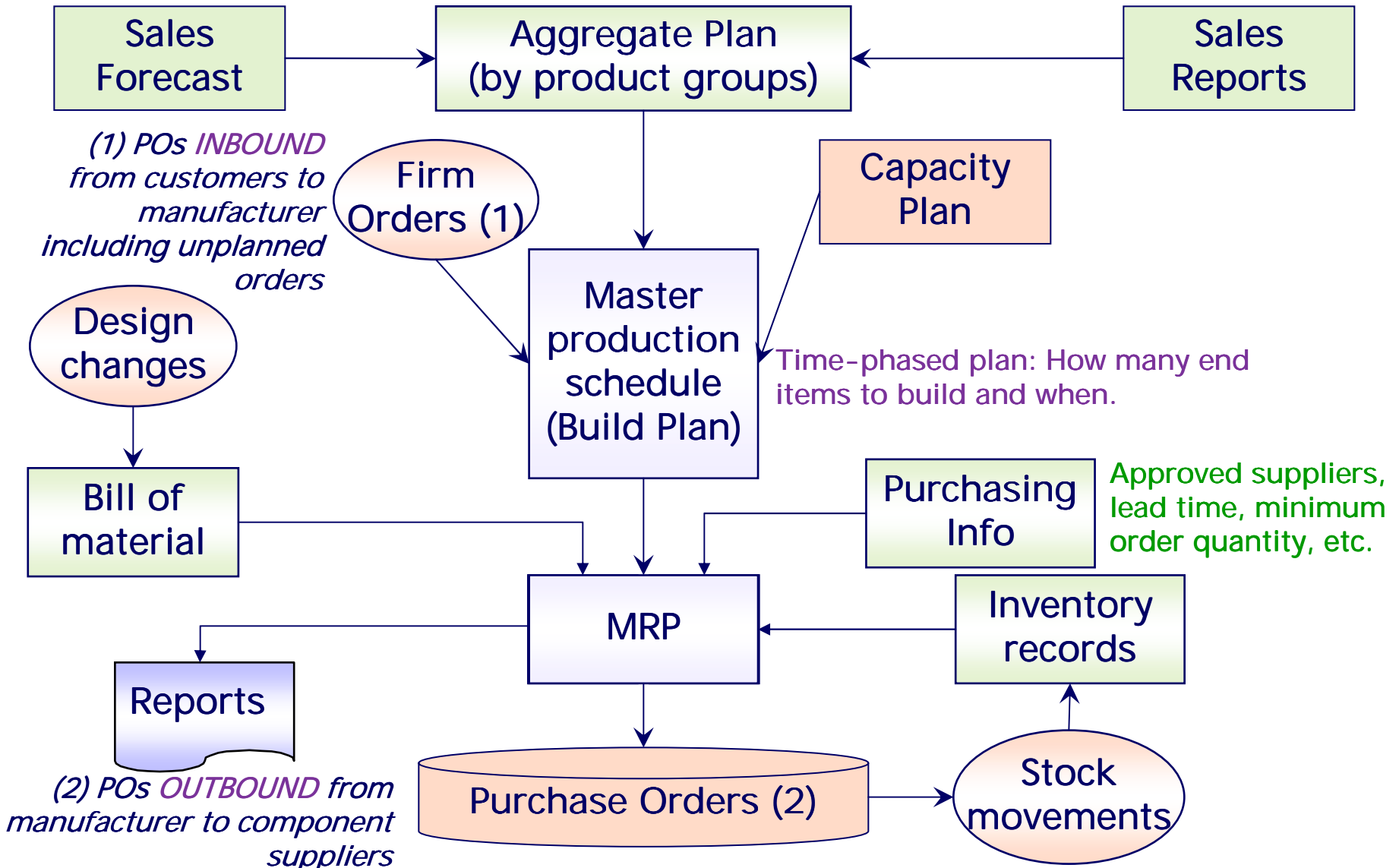
▶ External

- ▶ Seasons
- ▶ Holidays
- ▶ Special Events
- ▶ Big Deals
- ▶ Competition, direct
- ▶ Competition, indirect
- ▶ External labor events
- ▶ Productivity changes
- ▶ Fashions or styles
- ▶ Population changes
- ▶ Consumer earnings
- ▶ Political events
- ▶ Weather
- ▶ Returns
- ▶ Spikes in returns

▶ Internal

- ▶ Product changes, style, quality
- ▶ Service changes, type, quality
- ▶ Shortages, production capability
- ▶ Promotional effort changes
- ▶ Sales Motivation plans
- ▶ Price changes
- ▶ Shortages, inventory
- ▶ Shortages/working capital
- ▶ Overages (excess inventory)
- ▶ Distribution methods used
- ▶ Credit policy changes
- ▶ Labor Problems

Generating Requirements



MRP vs. ERP vs. ...

- ▶ **Material Requirements Planning (MRP)**
 - ▶ Methods and systems designed to determine what materials will be needed over a specified time horizon, and when they will be needed.
 - ▶ Focus on materials acquisition and inventory management functions

- ▶ **Enterprise Resource Planning (ERP) –**
 - ▶ Successor to MRP
 - ▶ Brings into play all the business functions of an enterprise.

- ▶ Next generation after ERP is the Virtual Enterprise.
 - ▶ Link buyers, sellers, and others together as if they are one

Lead Times

Self-study slide - you may study the details on your own.

- ▶ **Information LT** - how long it takes to get the information needed to get the ordering started
- ▶ **Negotiation lead time** - how long it takes to establish pricing and terms for a single order (see also 'contracting lead time' on later slide)
- ▶ **Order lead time (LT)** - how long it takes to order it
 - ▶ Includes how long it takes to get the order from buyer to seller
- ▶ **Admin LT** - how long the document preparation and signature gathering takes
- ▶ **Manufacturing LT** - how long it takes to build it
- ▶ **Transit time** - how long it takes to transport ordered item
- ▶ **Material Handling LT** - how long it takes to get from the truck at the back door to the product line on the floor
- ▶ **Testing/quality assurance LT** - how long it takes seller to inspect outgoing material and how long it takes the buyer to inspect incoming material

To simply MRP examples used here, we are using an aggregate lead time.



Product Structure

Level 0



A, Powwow Costume
Lead Time (LT) = 1 week

Level 1

B, Basic Costume (1 each)
Lead Time = 1 week



H, Headdress 1
25%
LT = 3 weeks



I, Headdress 2
25%
LT = 1 week



J, Headdress 3
50%
LT = 4 weeks

Level 2

C, Dress Buckskin Top
1 each
LT = 2 weeks



F, Buckskin Pant
1 each
LT = 1 week



G, Dress Boots
2 pair each
LT = 2 weeks

Level 3

D, Shirt
2 each
LT = 1 week



E, Beaded Shield
1 each
LT = 3 weeks

Master Production Schedule (Build Plan) and Bill of Materials

Self-study slide - you may study the details on your own.

Item	Week							
	1	2	3	4	5	6	7	8
Ceremonial Staff	20	0	20	0	20	0	30	0
Powwow Costume	60	110	150	170	150	130	145	150
Kettledrum	25	0	17	20	17	40	0	30
Hand Drum	125	125	125	125	125	125	125	125

LEVEL	ITEM	Unit of Measure	Quantity	Leadtime
0 - - - -	A - Powwow Costume	Ea	1	1 week
- 1 - - -	B - Basic Costume	Ea	1	1 week
- - 2 - -	C - Dress Buckskin Top	Ea	1	2 weeks
- - - 3 -	D - Shirt	Ea	2	1 week
- - - 3 -	E - Beaded Shield	Ea	1	3 weeks
- - 2 - -	F - Buckskin Pant	Ea	1	1 week
- - 2 - -	G - Dress Boots	Pr	2	2 weeks
- 1 - - -	H - Headdress 1	Ea	.25	3 weeks
- 1 - - -	I - Headdress 2	Ea	.25	1 week
- 1 - - -	J - Headdress 3	Ea	.50	4 weeks

Part Master – Purchasing Information

Self-study slide - you may study the details on your own.

Item	Powwow Costume	Lead time	1
Item no.	A	Annual demand	4600
Item type	Manuf.	Holding cost/week	60
ABC Code	A	Ordering/setup cost	200
Unit price/cost	5200.00	Safety stock	100
Phantom code	N	Minimum order qty	60
Multiple order qty	20	Maximum order qty	-

Item	Headdress 3	Lead time	4
Item no.	J	Annual demand	1500
Item type	Manuf.	Holding cost/week	25
ABC Code	A	Ordering/setup cost	50
Unit price/cost	820.00	Safety stock	50
Phantom code	N	Minimum order qty	120
Multiple order qty	20	Maximum order qty	-

Material Requirements Planning – Consumption Schedule

Self-study slide - you may study the details on your own.

Week:		-9	-8	-7	-6	-5	-4	-3	-2	-1	1
A	Required										60
	Order Placement									60	
B	Required									60	
	Order Placement								60		

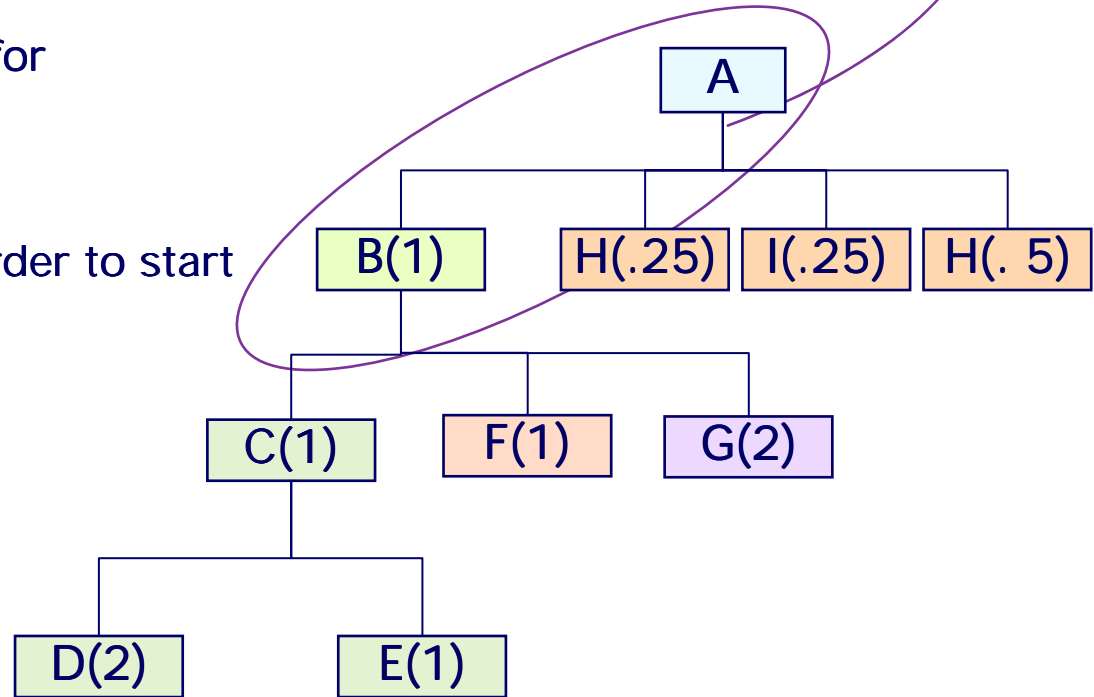
10 A's needed week 10.

- 1 week lead time = order A for (Week 1 -1)

1 B needed in each A

- Need 10 of B in week 9 in order to start build of A

- 1 week LT = order B for (Week 1 -2)



Material Requirements Planning – Consumption Schedule

Self-study slide - you may study the details on your own.

Week:		-9	-8	-7	-6	-5	-4	-3	-2	-1	1
A	Required										60
LT=1	Order Placement									60	
B	Required									60	
LT=1	Order Placement								60		
C	Required								60		
LT=2	Order Placement						60				
D	Required						120				
LT=1	Order Placement				120						
E	Required						60		120		
LT=3	Order Placement			60							
F	Required								60		
LT=1	Order Placement							60			
G	Required							120			
LT=2	Order Placement					120					
H	Required									15	
LT=4	Order Placement							50			
I	Required									15	
LT=1	Order Placement								60		
J	Required									30	
LT=2	Order Placement					120					

Minimum order quantity

Netting Requirements

Self-study slide - you may study the details on your own.

Projections before new orders are suggested.

Safety Stock Level =		50					
Delivery Week	Anticipated On Hand	Quantity in Transit	Planned Usage (Demand)	Planned Receipt (Order)	Planned Ending On Hand	On Hand - Safety Stock	Suggested Order
1	70	20	60	30	60	10	
2	60		110	50	0	-50	
3	0		150		-150	-200	
4	-150		170		-320	-370	
5	-320		150		-470	-520	
6	-470		130		-600	-650	
7	-600		145		-745	-795	

Projections with suggested new orders.

Safety Stock Level =		50					
Delivery Week	Anticipated On Hand	Quantity in Transit	Planned Usage (Demand)	Planned Receipt (Order)	Planned Ending On Hand	On Hand - Safety Stock	Suggested Order
1	70	20	60	30	60	10	0
2	60		110		-50	-100	100
3	50		150		-100	-150	160
4	60		170		-110	-160	180
5	70		150		-80	-130	140
6	60		130		-70	-120	120
7	50		145		-95	-145	160

Netting Requirements

Self-study slide - you may study the details on your own.

Demand Change in Week 6

Safety Stock Level =		50					
Delivery Week	Anticipated On Hand	Quantity in Transit	Planned Usage (Demand)	Planned Receipt (Order)	Planned Ending On Hand	On Hand - Safety Stock	Suggested Order
2	60	0	110	100	50	0	
3	50		150	160	60	10	
4	60		170	180	70	20	
5	70		150	140	60	10	
6	60		50	120	130	80	-60
7	70		145	160	85	35	
8	85		120		-35	-85	100

Suggested change order

Suggested new order

Depending on how much it costs to hold excess inventory vs. how much it costs to process a change order, the planner may decide whether or not to act on suggested changes.



Questions? Comments?

Feedback is welcome!

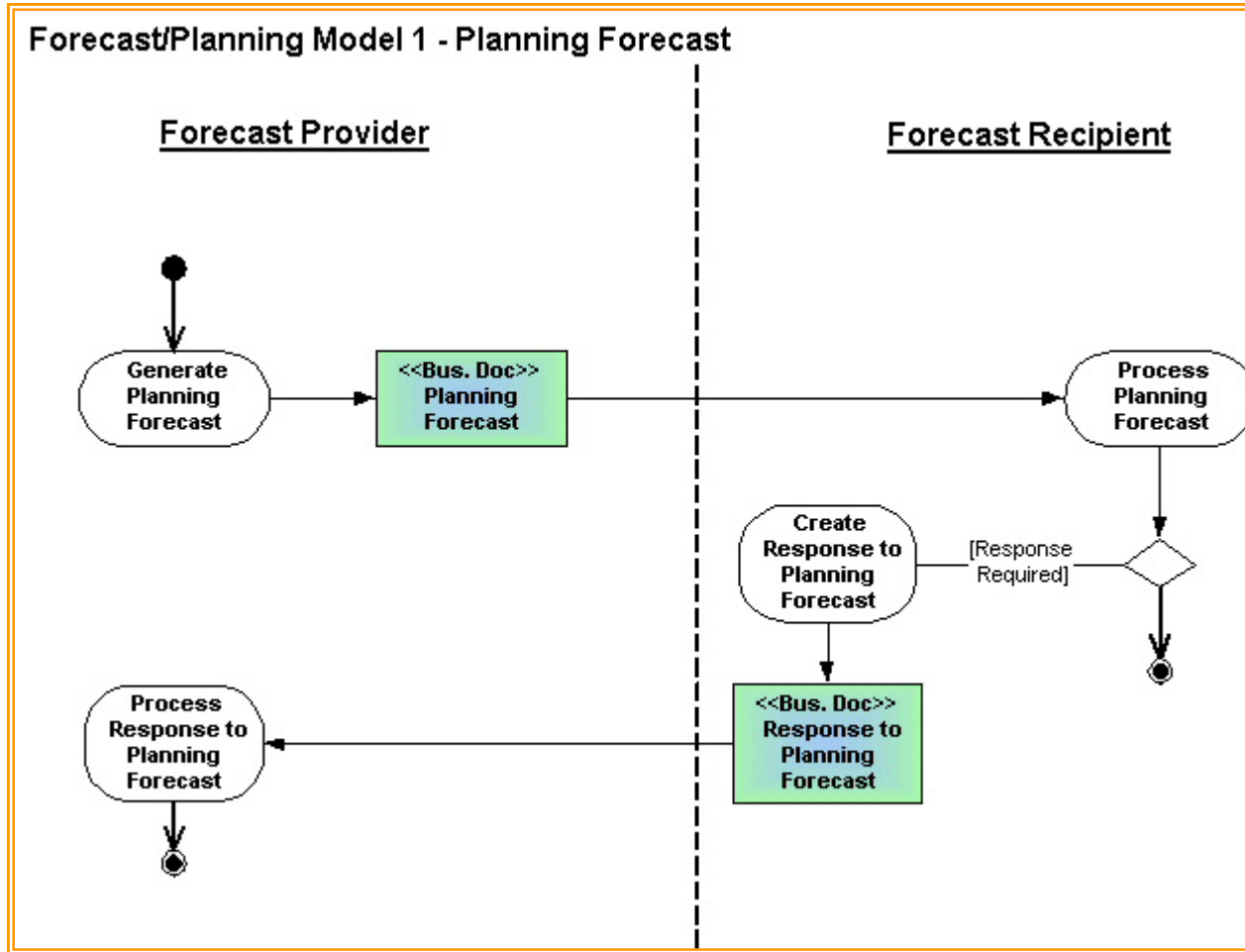


Replenishment Business Processes Part 2: Forecast Types and Data Requirements

Forecast contents

Forecast types and Forecast-based
Replenishment Scenarios

Forecast Processes



At a fundamental level, every forecast the process could be described as "if needed, send response to forecast".

This same fundamental process holds for all forecast types.

Types of Forecasts

Self-study slide - you may study the details on your own.



Some of these are synonyms, some are just variations ...

- | | | |
|--|------------------------------------|--|
| 1. Planning Forecast | 13. Consolidated Forecast | 24. Requirements Planning |
| 2. Simple Forecast | 14. Demand forecast | 25. Material Requirements Planning (MRP) |
| 3. Material Release Schedule | 15. Supply forecast | 26. Enterprise Requirements Planning (ERP) |
| 4. Consumption Schedule (supplier-managed inventory) | 16. Unconstrained Demand | 27. Distribution Requirements Planning (DRP) |
| 5. Strategic forecast | 17. Constrained Demand | 28. Sales and Operations Planning (SOP) |
| 6. Collaborative forecast | 18. Planned demand/demand planning | 29. Rough Cut Planning |
| 7. Collaborative planning | 19. Shipment Demand Forecast | 30. Economic Demand |
| 8. Order forecast | 20. Build Plan | 31. Master Planning |
| 9. Sales forecast | 21. Delivery Forecast | 32. Closed Loop MRP |
| 10. Product/item forecast | 22. Rolling forecast | |
| 11. Product Family Forecast | 23. Capacity Planning | |

Continued ...

Types of Forecasts

Self-study slide - you may study the details on your own.



Some of these are synonyms, some are just variations

- | | | |
|------------------------------------|--|--|
| 33. Master Product Schedule (MPS) | 43. What-if planning | 53. Demand/forecast smoothing |
| 34. Final Assembly Schedule (FAS) | 44. Worst-case/best-case scenario planning | 54. Budgeting forecast |
| 35. Mixed Model Scheduling | 45. Statistical forecasting | 55. Revenue forecast |
| 36. Resource Planning | 46. Top down or bottom up allocation | 56. Market potential forecast |
| 37. Availability Forecast | 47. JIT planning | 57. Sales potential forecast |
| 38. Promotional Plan | 48. Long-term forecast | 58. Derived demand |
| 39. Logistics Planning | 49. Production planning | 59. Consumption-based Planning |
| 40. Multi-level forecasting | 50. New Product Introduction Forecast | 60. Inventory planning |
| 41. Product life cycle forecasting | 51. Attribute-based planning | 61. Advanced Planning and Scheduling (APS) |
| 42. Batch forecasting | 52. Commitment Forecast | 62. Tactical Forecast |

Replenishment Scenarios

EIDX has already done a lot of analysis of forecasts used for **component replenishment**.

EIDX Replenishment Models – General – Microsoft Internet Explorer

Address: http://www.eidx.org/publications/business_models/replenishment/replmod.html

Links: [Rosie's Eatlink](#) [Hotmail](#) [EIDX](#) [EIDXModels](#) [CTIAMail](#) [Google](#) [OneLook](#) [Dictionaries](#) [Webopedia](#) [Rosie's Bookmarks](#)

	Buyer (Customer) Managed Replenishment					Supplier (Vendor) Managed Replenishment	
	Replenishment, Non-Forecast Environment	Material Release, Non-Forecast Environment	Replenishment with Forecast, Buyer-Managed	Material Release, Forecast Environment, Discrete Releases	Material Release, Forecast Environment, Embedded Release	Consumption-Based Supplier-Managed Inventory	Forecast-based Supplier Managed Inventory
Click here for Consignment Scenarios							
Replenishment Scenarios – Non-Consignment	Use ORD1	REPL5 (incomplete)	REPL1	REPL2	REPL3	REPL6	REPL4
Replenishment Scenarios – Consignment	tbd	tbd	tbd	tbd	tbd	tbd	tbd
Pre-Order Component	QT1 Traditional Quote	QT2 Blanket Order/Contract	QT1 Traditional Quote	QT2 Blanket Order/Contract	QT2 Blanket Order/Contract	QT2 Blanket Order/Contract	QT2 Blanket Order/Contract
Order Component	ORD1 Standalone Purchase Order	ORD2 Blanket Purchase Order	ORD1 Standalone Purchase Order	ORD2 Blanket Purchase Order	ORD2 Blanket Purchase Order	ORD2 Blanket Purchase Order	ORD2 Blanket Purchase Order
Forecast Component	Not Applicable	Not Applicable	EC1 Planning Forecast (Net)	EC1 Planning Forecast (Net)	EC2 Replenishment Plan (Net)	Not Applicable	EC3 Consumption (Planned Usage) Forecast
Release Component	Not Applicable – release already included in ORD1 PO document.	ORD3A Release Against BFO, Buyer-Managed	ORD1 Standalone Purchase Order	ORD3A Release Against BFO, Buyer-Managed	Use EC2 – Releases embedded in Replenishment Plan	ORD3B Release Against BFO, Supplier-Managed	ORD3B Release Against BFO, Supplier-Managed
Shipment Plan or Order Status	tbd	tbd	tbd	tbd	tbd	tbd	tbd

Done

Start | Internet | 3:54 PM

*Self Study: Complete table is on EIDX web site - [Replenishment Scenarios](http://www.eidx.org/publications/business_models/replmod/replmod.html) **

* http://www.eidx.org/publications/business_models/replmod/replmod.html

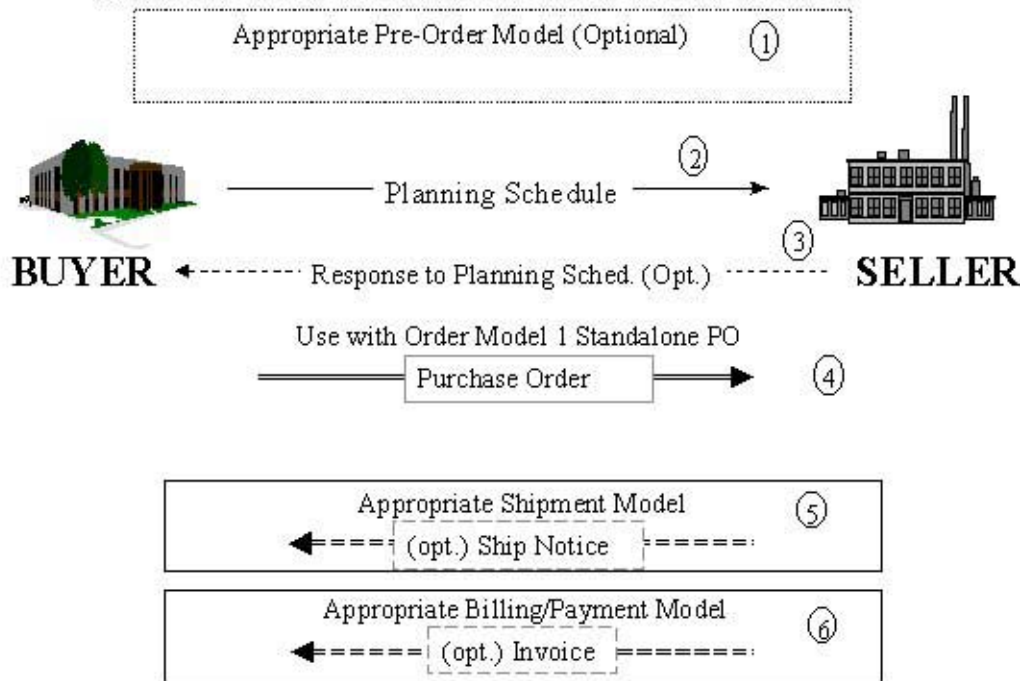
Planning Forecast (Simple Forecast)

- ▶ “Planning Forecast” is used as a synonym for “simple” forecast.
 - ▶ Forecast file containing only **planned requirements** (no firm requirements), **net of inventory**. There are no replenishment triggers included with the data.
 - ▶ In one replenishment scenario, replenishment triggers are sent as **discrete purchase orders**
 - ▶ This is sometimes referred to as the “**standard**” replenishment process
 - ▶ In another replenishment scenario, replenishment triggers are sent as **discrete releases** against a blanket PO.
 - ▶ This is referred to as the “**Classic Material Release**” replenishment process

Overview – Replenishment Model 1

EIDX Business Models

Replenishment Model 1 Planning Forecast with Discrete Purchase Order

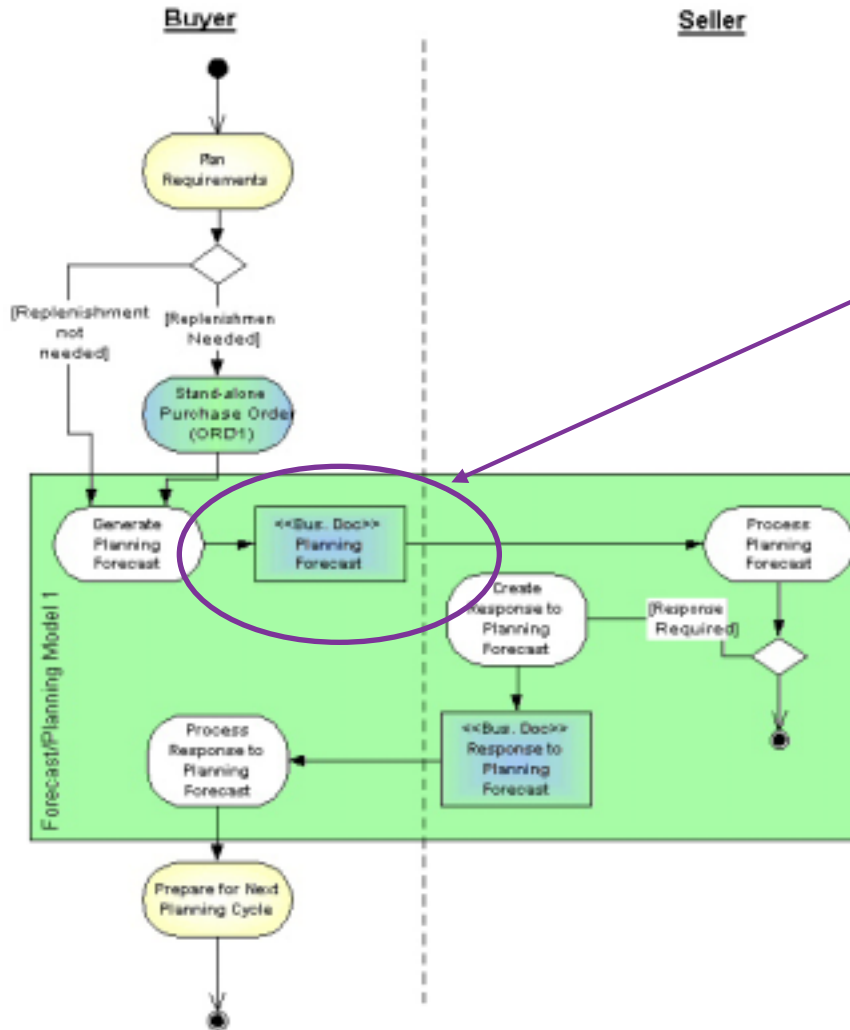


This traditional representation used for electronic exchanges is a user-friendly type of "use case" diagram.

It's a summary of interactions with "the system". In the case of the planning forecast portion, the interactions take the form of a three messages that are exchanged (middle of the diagram).

Self Study: Business model is on EIDX web site - [Replenishment Scenario 1*](#)

Replenishment Model 1 - Planning Forecast with Discrete Purchase Order



Replenishment Scenario 1

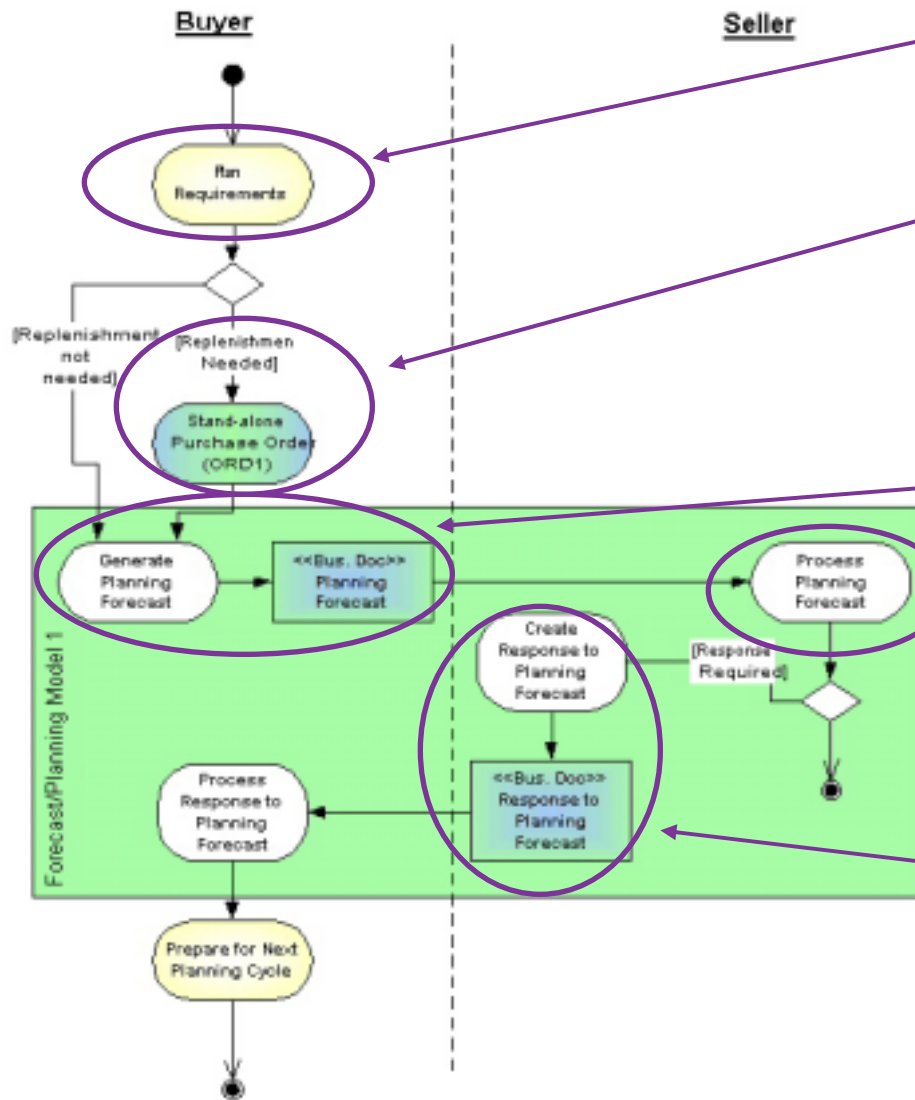
Forecasts are best understood in the context of replenishment scenarios.

In this scenario, the replenishment trigger *is* the order, and so all the overhead associated with an order applies.

The supplier uses the forecast as a planning tool. The buyer is not liable for any material unless liability terms are stated in a contract.

* http://www.eidx.org/publications/business_models/replmod1/replmod1_activity.html

Replenishment Model 1 - Planning Forecast with Discrete Purchase Order

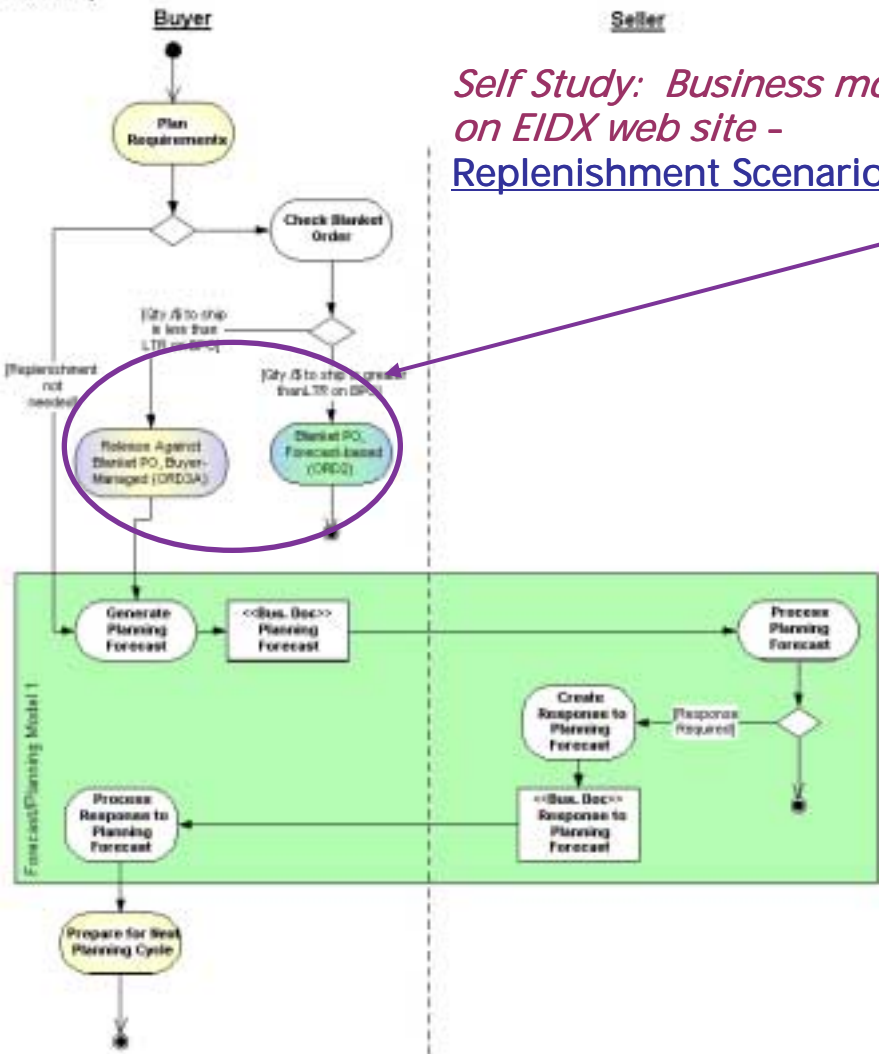


Replenishment Scenario 1

1. The buyer plans requirements.
2. If replenishment is needed, the buyer generates a discrete purchase order.
3. The buyer generates and sends a planning forecast.
4. The seller processes the forecast.
5. If a response is required, either by contract or because exception conditions exist, the seller sends a response to the forecast.



Replenishment Model 2 - Planning Forecast with Release Against Blanket PO (Classic Material Release)



*Self Study: Business model is on EIDX web site - Replenishment Scenario 2 **

Replenishment Scenario 2

In this scenario, the replenishment trigger *is* a separate signal than the order order. By using a BPO, most of the overhead has occurred up front, so release signals require very little processing. Before anything released against the BPO, it needs to be checked to see if it is still valid.

Lead time depends on contractual arrangements for liability, and with a good contract, lead time can be reduced essential to transit-time (Slide 40).

* http://www.eidx.org/publications/business_models/replmodl/replmodl2_activity.html

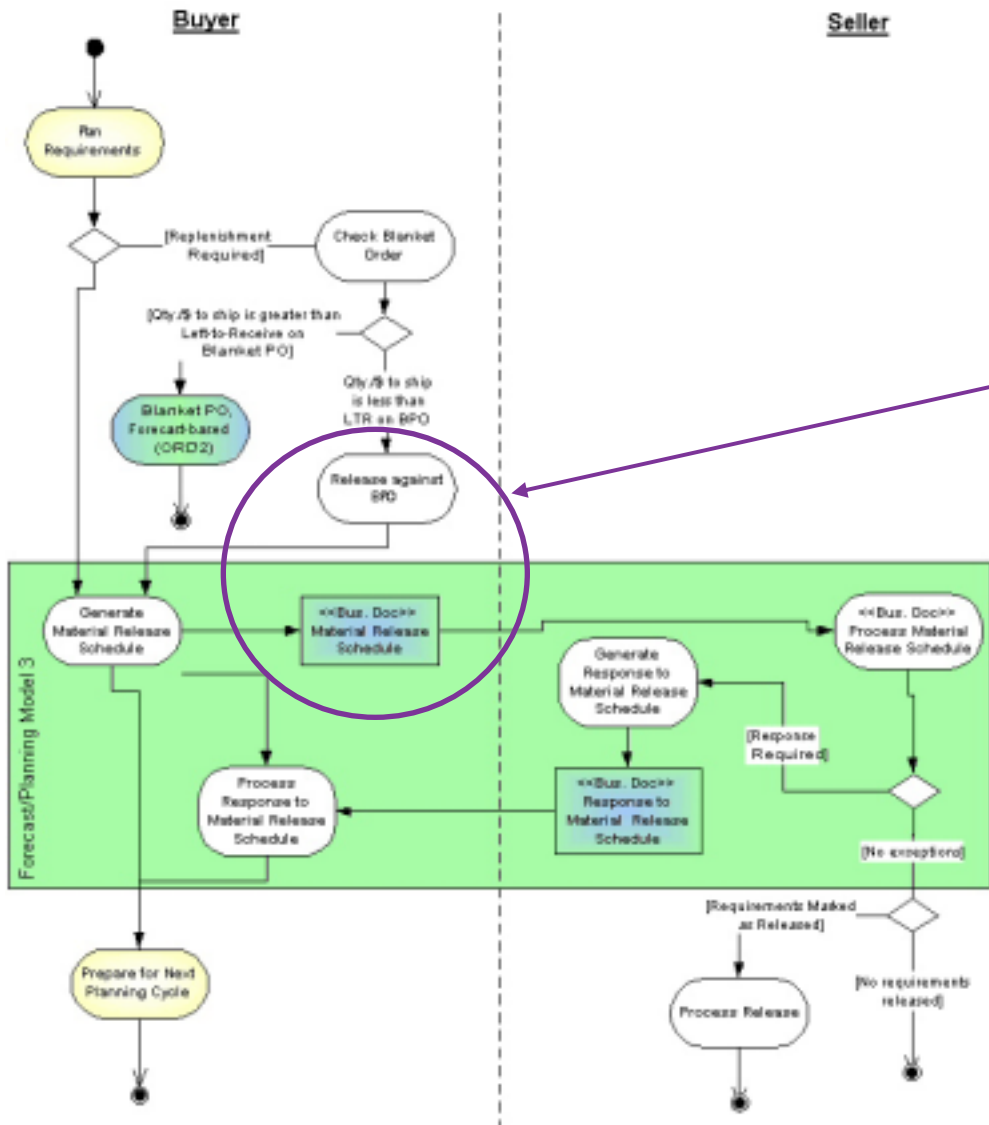
Material Release Schedule

A “**Material Release Schedule**” is forecast file containing both planned requirements *and* replenishment triggers for firm requirements.

- ▶ The replenishment triggers represent releases against a Blanket Purchase Order. However, no separate replenishment trigger is sent.
 - ▶ This is referred to as the “**Embedded Release**” replenishment process



Replenishment Model 3 - Embedded Release



Replenishment Scenario 3

This scenario is very similar to Replenishment Scenario 2, except that here, the replenishment trigger *is* a embedded in forecast file, so some steps in the model for the buyer-managed release are here in the scenario model instead. But ... it's still a release against an established BPO.

Self Study: Business model is on EIDX web site - [Replenishment Scenario 3](#)

Typical Back-end Processing – Buyer

Buyer-Managed Inventory Processes – Forecast-based

- ▶ The **build plan** is loaded
- ▶ Using bills of materials (BOMs), demand for product is “**exploded**” into demand for component materials – the consumption plan (planned usage)
- ▶ **Evaluate** new forecast to see what has changed from previous forecast
 - ▶ Are **changes in control** or out of control?
 - ▶ Should the forecast be acted upon?

Continued next page ...



Typical Back-end Processing – Buyer

Buyer-Managed Inventory Processes – Forecast-based

Continued ... if the forecast is in control ...

- ▶ The MRP system compares the component demand to inventory on-hand and on-order, nets current and projected inventory from the demand and generates **suggested orders** as needed
 - ▶ A forecast file is generated from the netted demand (without suggested orders) and transmitted to the supplier
 - ▶ Suggested orders may automatically generate purchase orders, or a buyer may have to explicitly release the suggested order to the procurement application
- ▶ The MRP system also **suggests changes** or **cancellations** to orders already placed
 - ▶ The buyer determines which suggested changes to heed; may not be cost-effective to make all the suggested changes



Typical Back-end Processing – Supplier Buyer-Managed Inventory Processes – Forecast-based

- ▶ **Evaluate** new forecast to see what has changed from previous forecast
- ▶ Are **changes in control** or out of control?
 - ▶ If applicable, are changes within contracted terms for upside and downside flexibility?
 - ▶ How do demand patterns compare to historical usage patterns?
- ▶ Evaluate **capacity requirements** vs. available capacity
- ▶ Generate **changes** to build and ship schedule
- ▶ Send **response** to forecast if required
 - ▶ Response to all forecasts
 - ▶ Response only where exceptions exist – forecast changes are out of control, capacity not sufficient to meet buyer demand, etc.

Forecast Comparison Evaluating Against Contracted Terms

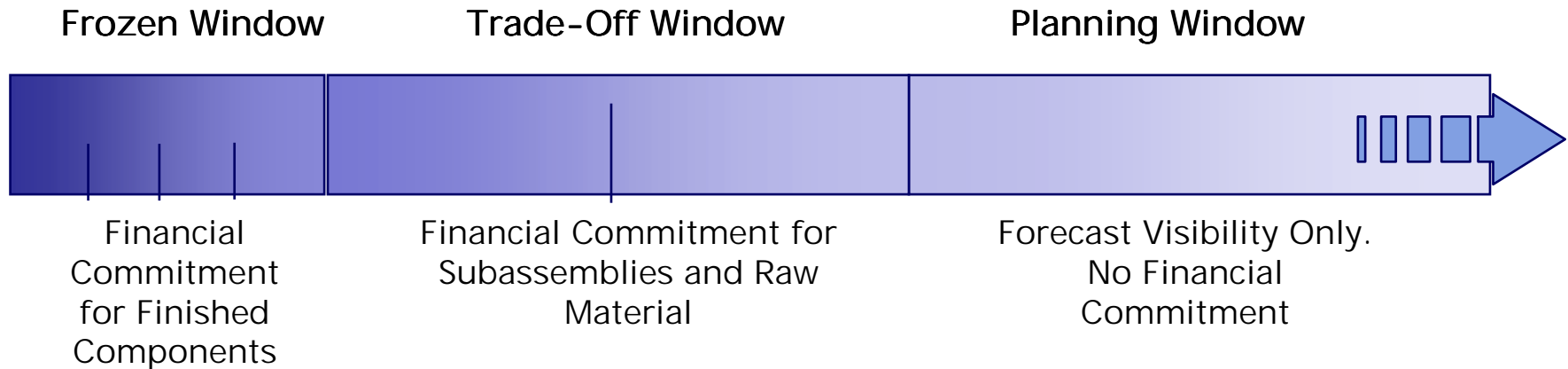
Self-study slide - you may study the details on your own.

Contracted
Percent of Upside
Flexibility

Delivery Week	Previous Forecast Amount	Current Forecast Amount	Difference	Percent of Change	Contract Percent	Deviation from Contract Percent
02/23/02	300.00					
03/02/02	400.00	410.00	10.00	2.50	10.00	-7.50
04/06/02	450.00	500.00	50.00	11.11	10.00	1.11
04/20/02	400.00	450.00	50.00	12.50	10.00	2.50
05/18/02	375.00	400.00	25.00	6.67	10.00	-3.33
05/25/02	300.00	325.00	25.00	8.33	10.00	-1.67
06/06/02	400.00	425.00	25.00	6.25	10.00	-3.75

The buyer may have been quoted a special lead time for forecasted parts. There are 2 "peak" weeks (forecast for current 2nd and 3rd delivery weeks) where deviation is outside contract percent; if the contract only supports one peak week, the supplier may negotiate "normal" lead time for the amount over contract percent.

Contract for Schedule Flexibility and Shared Liability



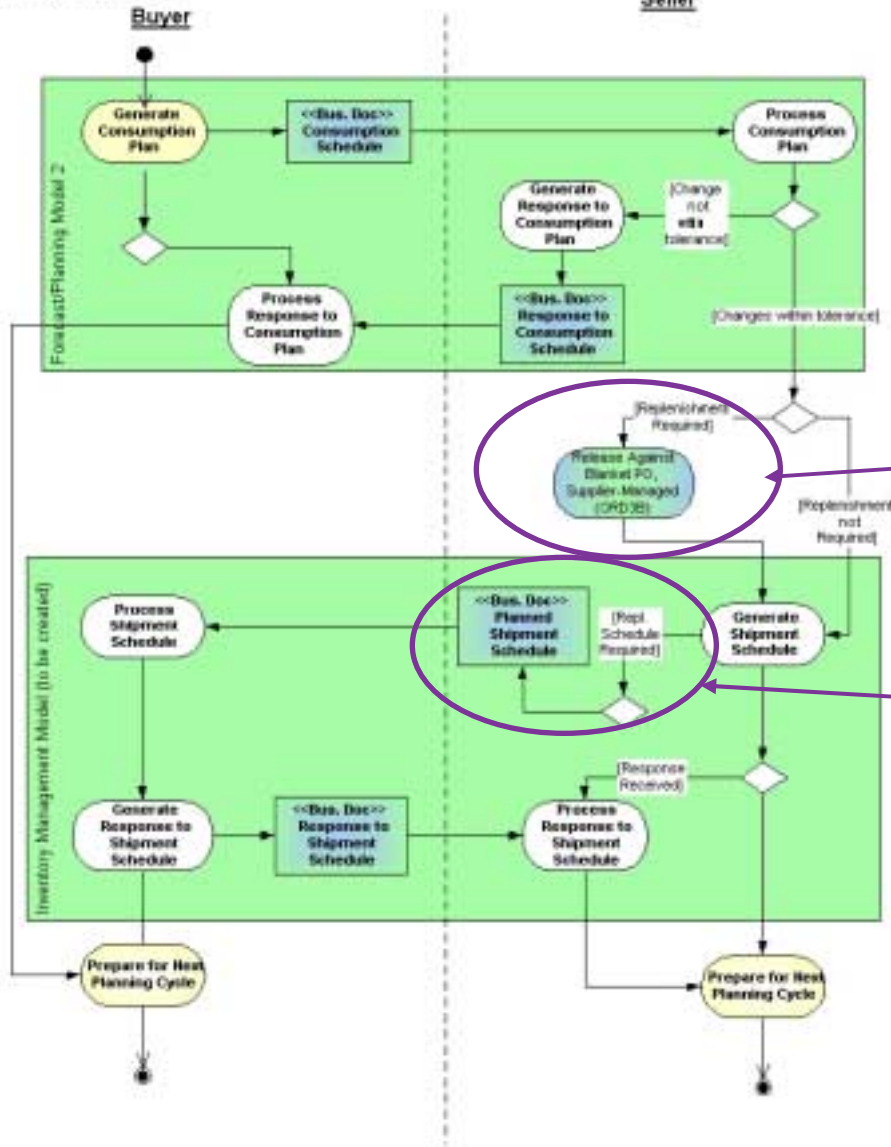
- Length of each window may vary by commodity
 - Frozen window may be equal to transit time for off-the-shelf parts if buyer's volume is comparatively small
 - Frozen window may be several weeks for custom parts or if buyer has exceptionally high volumes
- Default windows may be negotiated with overrides/exceptions by part number and/or order

Contracts can also cover allowable demand fluctuation.

Consumption Schedule (for SMI/VMI)

- ▶ A “**Consumption Schedule**” is a forecast file containing the buyer's gross planned requirements. The Consumption Schedule represents what the buyer plans to use, sell or transfer out on the specified date or in the specified period.
 - ▶ Additional information is included that allow the supplier to perform the requirements netting and determine when the buyer's inventory should be replenished: buyer's available inventory, receipt and/or in-transit data, and the buyer's inventory thresholds for minimum and maximum on-hand quantities.
 - ▶ This is referred to as the “**Forecast-based Supplier-Managed Inventory**” replenishment process

Replenishment Model 4 - Forecast-Based Supplier-Managed Inventory



Replenishment Scenario 4

This is the supplier-managed inventory scenario, where the supplier determines what to release

If the supplier generates a release, it's *still* a release against the buyer's BPO.

The seller may send the shipment plan to the buyer for review.

Self Study: Business model is on EIDX web site - [Replenishment Scenario 4](#)

Order Model 3B - Release Against Blanket Order,
Forecast-Based Supplier-Managed Inventory

Buyer

Seller



Order Model 3B

When a seller makes a release against the buyer's BPO, the processing is similar to buyer-managed release, with a couple of exceptions.

1. The seller checks the buyer's BPO to see if it covers replenishment requirement or needs to be renewed.
2. The seller issues and processes a release in their system just as if the buyer had issued the release.

Self Study: Business model is on EIDX web site - Order Model 3B

Typical Back-end Processing – Buyer Supplier-Managed Inventory Processes – Forecast-based

- ▶ The **build plan** is loaded

- ▶ Using bills of materials (BOMs), demand for product is “**exploded**” into demand for component materials – the consumption plan (planned usage)

- ▶ **Evaluate** new forecast to see what has changed from previous forecast
 - ▶ Are **changes in control** or out of control?
 - ▶ Should the forecast be acted upon?

Continued next page ...



Typical Back-end Processing – Buyer Supplier-Managed Inventory Processes – Forecast-based

Continued ... if the forecast is in control ...

- ▶ A forecast file is generated from the **planned consumption** (not net of current and projected inventory), and **transmitted** to the supplier along with **inventory data**:
 - ▶ Current on-hand
 - ▶ In transit, or receipt data so the supplier can calculate in-transit
 - ▶ **Targeted minimum and maximum** inventory levels, either as discrete numbers or expressed as days-of-supply or weeks-of-supply (or this may be specified in the contract and not sent as part of the data – the supplier calculates inventory targets based on average demand)
 - ▶ Any demand on the available inventory that is not reflected in the forecasted demand (demand from a past week that the buyer still plans to fulfill)



Typical Back-end Processing – Supplier Supplier-Managed Inventory Processes – Forecast-based

- ▶ **Evaluate** new forecast to see what has changed from previous forecast
- ▶ Are **changes in control** or out of control?
 - ▶ If applicable, are changes within contracted terms for upside and downside flexibility?
 - ▶ How do demand patterns compare to historical usage patterns?
- ▶ Net current and projected inventory from the demand and generate **suggested shipments** to keep the buyer's inventory within the target minimum and maximum levels
 - ▶ The supplier may turn these into orders within its system, just as if the buyer sent orders, but the system knows that the orders were generated internally and should not generate purchase order responses to be sent to the buyer

Continued next page ...



Typical Back-end Processing – Supplier Buyer-Managed Inventory Processes – Forecast-based

Continued ... if the forecast is in control ...

- ▶ The system also **suggests changes** or **cancellations** to orders already placed
 - ▶ The supplier determines which suggested changes to heed; may not be cost-effective to make all the suggested changes
 - ▶ The system knows that the order changes were generated internally and should not generate purchase order responses to be sent to the buyer
- ▶ The buyer may request that the supplier generate and transmit a shipment plan
 - ▶ Particularly for suppliers new to SMI, allows buyer to monitor plan against inventory targets and alert the supplier of potential inventory shortages or overages

Consumption-based Replenishment

- ▶ The back-end processes are similar to forecast-based planning, except for how demand is calculated
 - ▶ Replenishment is based on historical usage (consumption/sales) rather than forward-looking forecasted demand
 - ▶ Applicable to items that can't easily be forecasted based on projected product builds, such as office supplies, chemicals and gases, nuts and bolts, repair parts, etc.; particularly useful for items where consumption patterns are consistent with only a few fluctuations
 - ▶ Consumption data and knowledge about events that cause demand spikes, such as sales promotions, used to create a forward-looking projection
 - ▶ More common in retail environments than in Computing and Electronics industry

Forecast Contents

- ▶ This list of forecast contents on the following slide is the result of the analysis done by the task team and is **standards-neutral**.
- ▶ Different standards may require elements that are not on the list
- ▶ Cardinality (mandatory vs. optional) in the standards may vary
- ▶ We merely want to say what information needs to be in a purchase order.
 - ▶ No EIDX stand taken on data architecture (which things should be expressed as name-value pairs (qualifier + data) and which should be expressed as standalone data elements and which as attributes of an element).

Forecast Contents – Common Elements

INCLUDED IN All component replenishment forecast types

- ▶ Forecast ID Number (Document Number, whatever) - **mandatory**
- ▶ Date forecast generated - **mandatory**
- ▶ Date forecast submitted - **optional**
- ▶ Date forecast horizon start - **optional**
- ▶ Date forecast horizon end - **optional**
- ▶ Document purpose code - **mandatory**
- ▶ Forecast Type - **mandatory**
- ▶ Buyer identification - **mandatory**
- ▶ Seller identification - **mandatory**
- ▶ Contact names - *optional*
- ▶ Ship-To - **optional**
- ▶ Bill-To - **optional**
- ▶ Item Identification (Part Number) – **mandatory**
 - ▶ May include revision or other data to make the identification complete
- ▶ Item Number (line number) - **optional**
- ▶ Line item Quantity – **optional**
- ▶ Quantity Unit of Measure – **mandatory**
- ▶ Contract number – *optional*

Self-study slide - you may study the details on your own.

* If needed, should be pre-established as part of account setup



Forecast Contents –Elements by Type

Self-study slide - you may study the details on your own.

Planning Forecast –

Common Elements Plus:

- ▶ Planned requirements – **1 or more required**
 - ▶ Planned schedule quantity – **mandatory**
 - ▶ Quantity interval type (discrete, weekly bucket, etc.) – **mandatory**
 - ▶ Schedule date – **mandatory**
 - ▶ Date type indicator (ship date or delivery date) – **mandatory**
 - ▶ Other line or schedule level reference, such as PO number or release number – **optional**

Material Release Schedule

(Embedded Release) – Common Elements Plus:

- ▶ Planned requirements and/or released requirements – **At least one of either required**
 - ▶ Planned or released schedule quantity – **mandatory**
 - ▶ Quantity interval type (discrete, weekly bucket, etc.) – **mandatory**
 - ▶ Schedule date – **mandatory**
 - ▶ Date type indicator (ship date or delivery date) – **mandatory**
 - ▶ Blanket Purchase Order Number – **mandatory**
 - ▶ Released requirements only: Release number – **optional**

Consumption Schedule (SMI

Forecast) – Common Elements Plus:

- ▶ Planned usage schedules – **At least one required**
 - ▶ Planned consumption quantity – **mandatory**
 - ▶ Quantity interval type (discrete, weekly bucket, etc.) – **mandatory**
 - ▶ Planned consumption date – **mandatory**
 - ▶ Blanket Purchase Order Number – **mandatory**
- ▶ Inventory quantities
 - ▶ Quantity on Hand – **mandatory**
 - ▶ Minimum and minimum inventory quantities or factors – **optional***
- ▶ Receipts – **Optional**
 - ▶ Date received
 - ▶ Quantity received
 - ▶ Reference ID

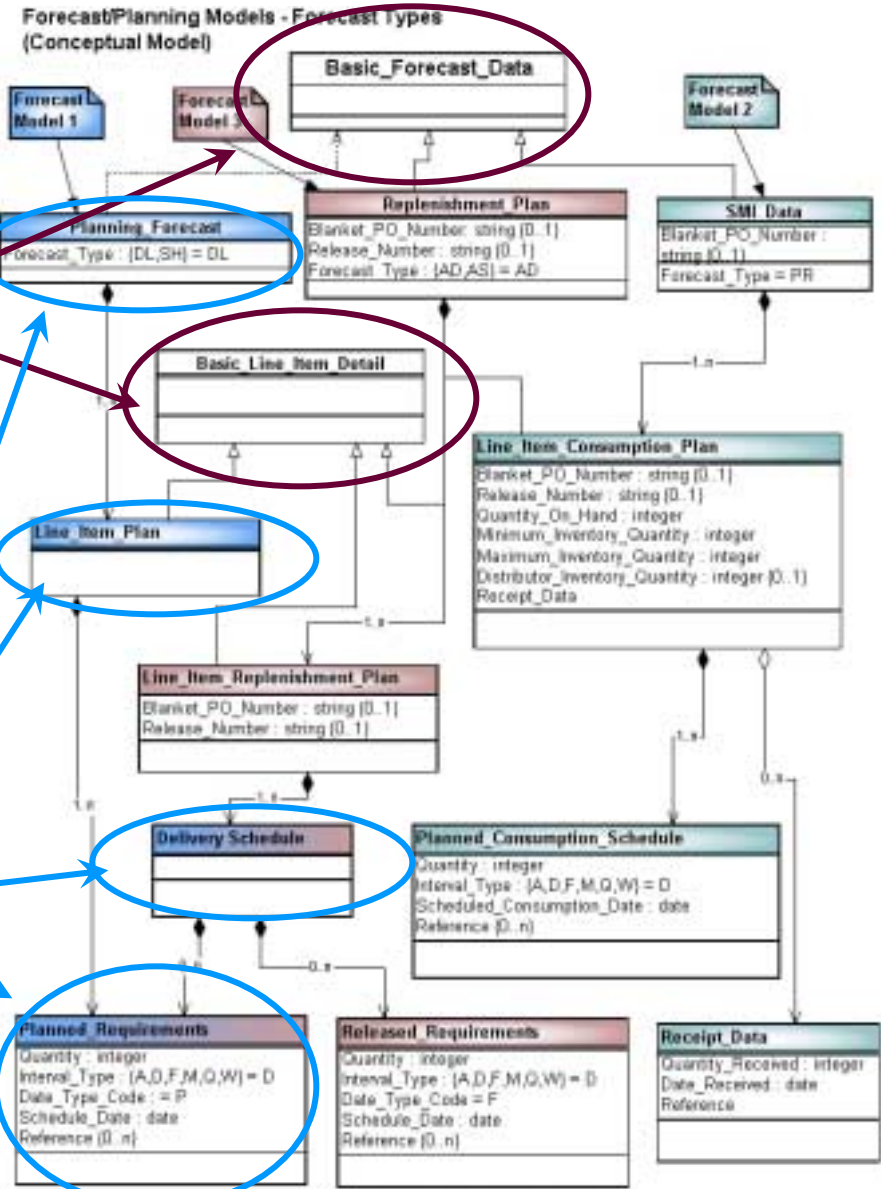
* Parameters may be explicitly called out in forecast file or established by contract

"Core" vs. "Standard"

- ▶ "Standard" document type and "core components" for a document type are not the same thing, although there is often a pretty big overlap.
 - ▶ Core = basic, center, nucleus; essential parts around which other parts are grouped. Core components are re-usable across transactions/messages
 - ▶ A nucleus by itself does not make a cell complete - forecast core elements by themselves do not make up a complete, valid forecast file definition; the forecast common elements are forecast "core components".
 - ▶ The elements by type can be thought of as extensions, a/k/a "specializations". The forecast core plus an extension = a complete, valid forecast file definition.

Forecast – Core plus Extensions

- ▶ Core components
- ▶ All other data blocks are extensions (specializations)
 - ▶ Extensions for Planning Forecast



Self-study slide - you may study the details on your own.



Questions? Comments?

Feedback is welcome!



Replenishment Business Processes Part 3: Overviews of Advanced Concepts

Or ... you mean we weren't really been collaborating before?

Constrained vs. Unconstrained Demand

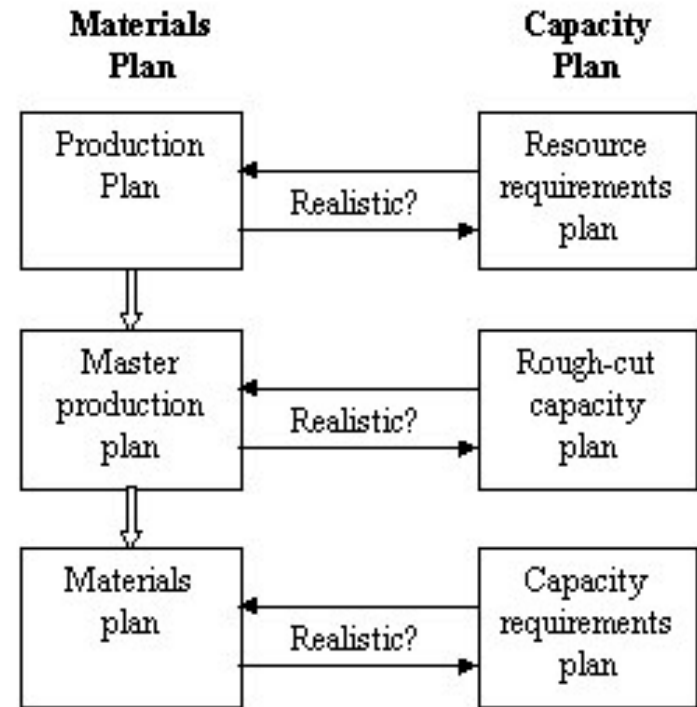
- ▶ **Unconstrained demand** is a forecast of demand with no limits applied.
- ▶ **Constrained demand** is a forecast that reflects limitations such as projected availability of manufacturing capacity, projected availability of product components and raw materials, legal constraints, financial constraints, etc.

Constrained vs. Unconstrained Demand

- ▶ Historically, suppliers have not always had visibility of unconstrained demand
- ▶ In general, the options for dealing with mismatch between unconstrained demand and what is possible is to **increase capacity** or **adjust the master schedule**
 - ▶ Strategic, collaborative forecast processes like CPFR (www.cpfr.org) and **closed loop MRP** allow both buyer and supplier visibility what they need to continually compare constrained production plan with unconstrained demand forecast and work toward the ability to support unconstrained demand

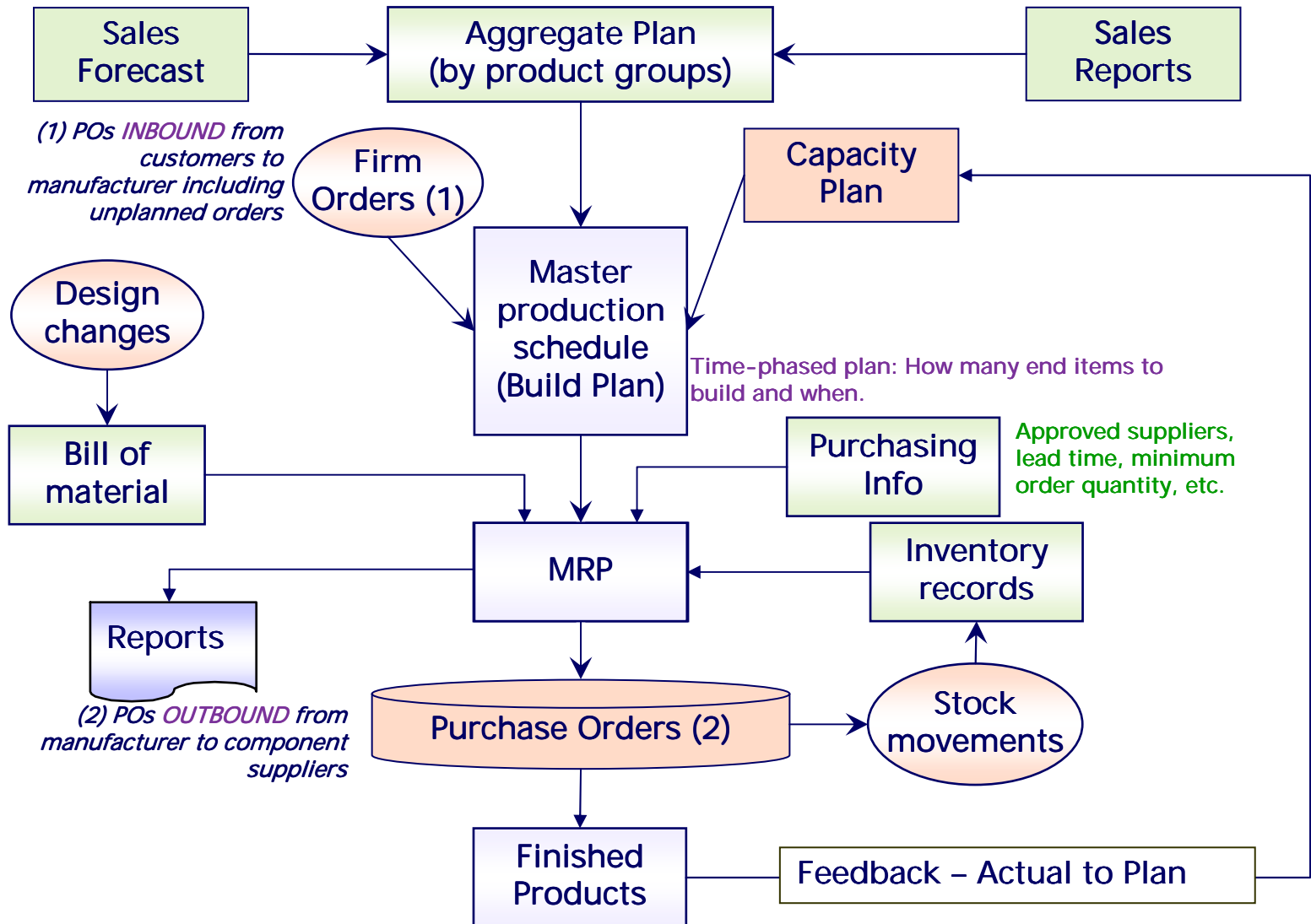
Closed-Loop MRP

- ▶ Method for putting a reality check into planning, to determine if the plan is realistic. It involves continually checking actual production against plan (“Has the plan been achieved so far?”) and against available resources (“Can the plan be achieved?”).
 - ▶ Actual vs. plan, becomes “feedback” used to constrain (or further constrain) demand



Closed-Loop MRP

Self-study slide - you may study the details on your own.



What do we mean by Collaboration?

- ▶ General definition: The act of **working together**
- ▶ Term taking on more specific meanings in eBusiness:
 - ▶ Trading partners working together via **on-line discussion** groups/e-mail exchanges
 - ▶ Trading partners working together on a **shared document** in a **shared application**
 - ▶ **Information sharing** – giving trading partners access to **shared data** - often data that used to be treated as private by one party or the other - in order to manipulate the data jointly or analyze information jointly to **arrive at a shared decision or solution for mutual benefit**
- ▶ Term as used today implies “**real time**” information sharing.



Enabling "True" Collaboration

Things Partners Must Do

- ▶ Base relationships on **trust**
 - ▶ Give each other visibility of all relevant information, e.g. unconstrained demand as well as constrained, actual firm demand as well as forecasted demand
- ▶ **Share risks**
- ▶ Establish **metrics** for evaluating the success (or failure) of collaborative processes
- ▶ Establish/implement **standards** instead of proprietary solutions
- ▶ **Automate** where it makes sense; make constant **improvements/upgrades** to systems
- ▶ Invest in robust **exception management** and **notification** capabilities
 - ▶ Includes ability to trace source every change – robust **audit** trail – and ability to roll data back to a previous state

What do we mean by Decision Support?

- ▶ **Decision Support System (DSS)** - Software designed to aid in decision making; the architecture generally relies on one or more data bases that feed into a specialized data warehouse that captures information that will be queried and analyzed.
 - ▶ For DSS purposes, "real time" is a myth
 - ▶ To achieve proper synchronization between event and state data, file creation must occur when the system is stable, and preferably at rest
 - ▶ That usually means nightly backup time
 - ▶ Which happens in 24 different global time zones
 - ▶ Which means you are doing well to produce a global, synchronized portrait of the supply chain every 24 hours

Nevertheless ...

Decision Support and Supply Chain

- ▶ Decision Support Systems are still powerful despite the “gotchas”
 - ▶ Capture data needed to do “what-if” analyses in order to optimize supply chain capacity when constraints have to be applied to demand
 - ▶ Data for analyzing demand and the strategic level and for negotiating with partners to reserve capacity
 - ▶ Identifying optimum location and state (from raw material to fully configured system) of inventory throughout the supply chain, and optimized use of logistics resources for moving the inventory
 - ▶ Analyses for optimizing tradeoff between service levels and inventory levels
 - ▶ And more ...

What do we mean by Just-In-Time?

- ▶ An inventory management methodology where goods are delivered just before they are needed for manufacturing, eliminating the necessity to store inventory at the manufacturing location.
 - ▶ A JIT strategy should involve all relevant parts of the supply chain; if the supplier of the inventory is not utilizing a JIT methodology, JIT may only serve to shift the cost of carrying inventory to another point in the supply chain.
 - ▶ A successful JIT strategy is aided by use of collaborative methods, decision support systems, and closed-loop MRP.



Questions? Comments?

Feedback is welcome!