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FastMRP™ Integration with ERP and the Supply Chain

ChuckMorris@FastMRP.com

FastMRP™ Integration with ERP and the Supply Chain

Agenda

- Lean FastMRP versus Traditional ERP
- Brief Overview of FastMRP™
- Discuss two key inputs
  - The Production String
  - Generic Engineering Bill of Materials
- Integration with ERP systems
- Summary

Brief History of MRP for Mass Customization

ERP Enterprise Resource Planning bundled everything you can think of (MRP, MPS, CRP, DRP, HR, PP, MM, etc.) and focused on a large integrated databases.

MRPII came about because MRP was too slow. MRP typically took a weekend to run.

MRPII Manufacturing Resource Planning – added a Master Production Schedule which order parts based on Marketing & Sales best guess at what customers want. This led manufacturers to **push** products to customers. MPS sent data to MRP. Capacity requirements Planning, CRP, checked for constraints. But does not reschedule. Distribution requirements Planning (DRP) is used to help update the Master Schedule.

APS
Advanced Planning & Scheduling Dynamically synchronizes customer demand to produce valid schedules. Capacity and supply constraints define freeze points for option changes.

MRP Material Requirements Planning – used backward scheduling to automatically generate orders when material dropped below a fixed, minimum value. The inventory quantity would be taken to the maximum quantity defined.

FastMRP Fast Material Requirements Planning - generates material requirement based on dynamic schedules of real customer orders. Using new rule base methods and memory resident matrix calculations. Plans in Hourly buckets –vs.- days.

Backward Scheduling used a Bill of Material and real customer orders. Material Purchase Orders were created manually.

FastMRP tools and methods deliver operational improvements over traditional MRP

- Elimination of inbound warehouses
- FastMRP runs on lower cost CPUs and can be easily distributed to remote locations to save on band-width.
- Complete regeneration of bills of material with each new plan
  - Engineering Changes included
  - Schedule Changes included
- Hourly planning buckets instead of daily
  - Internal and external pull signals are generated at the same time
  - Low variable inventory levels based on actual demand
- CPU run-time in minutes –versus- hours
  - Demand driven requirements can be regenerated every hour
  - Provides constant monitoring and alert notification of part shortages

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Elimination of In-bound warehouses

- In-bound warehouses for production parts are not lean.
  - Expensive to build
  - Expensive to operate
  - Add no value to product, just cost
- Traditionally, in-bound warehouses are needed for:
  - Buffer
    - Supplier orders and deliveries are done daily
    - Product line deliveries are done using KANBAN or a pull list
- FastMRP eliminates need for buffer
  - Internal and external pull signals are generated at the same time using actual customer demand
  - Multiple deliveries per day can be scheduled directly from the supplier
  - With hourly MRP each inbound truck has a mix of parts that meets the upcoming production demand

Summary of Lean FastMRP versus Traditional ERP

Lean FastMRP

- BOMs exploded on demand locally
- Simple calculation for internal and external pull signals
- Forecast based on actual customer demand
- Schedule is flexible and can change if needed

- No inbound warehouse
- Hourly MRP
- Leanest plants in the world

Traditional MRP

- BOMs exploded using legacy applications on mainframe CPU
- Multiple applications required for different delivery methods
- MPS Forecasting estimates required
- Schedule is fixed because BOMs can not be changed but once per night
- Inbound warehouse required
- Daily MRP
- Typical OEM assembly plant

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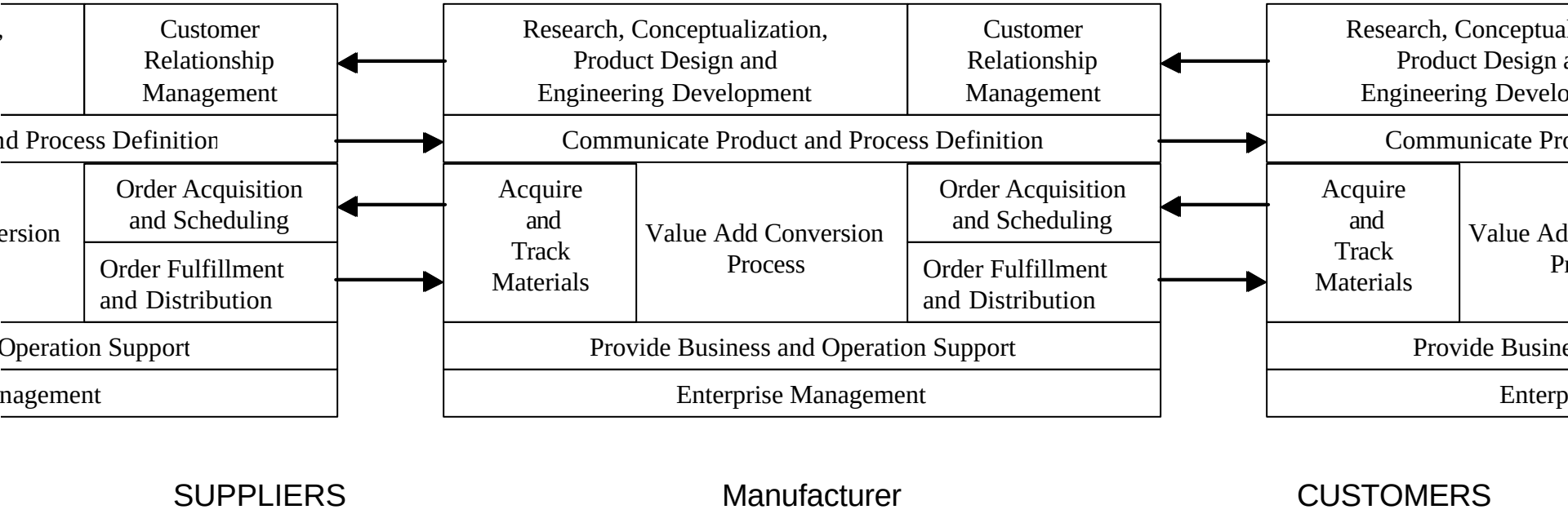
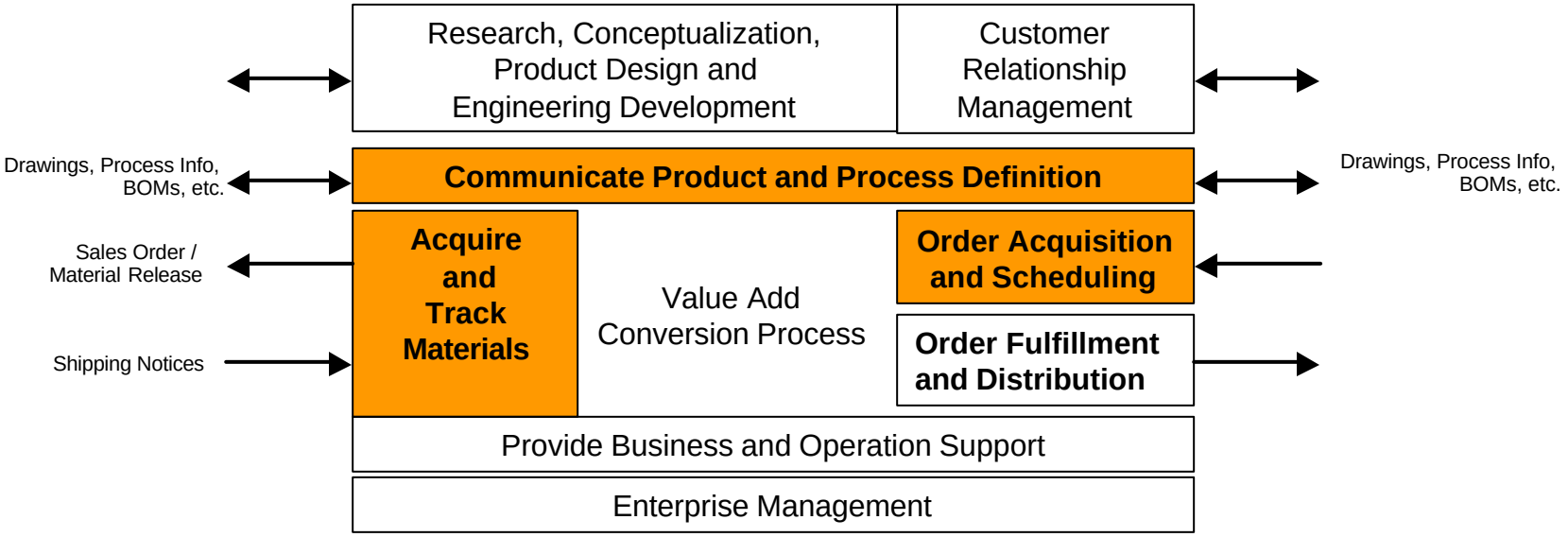
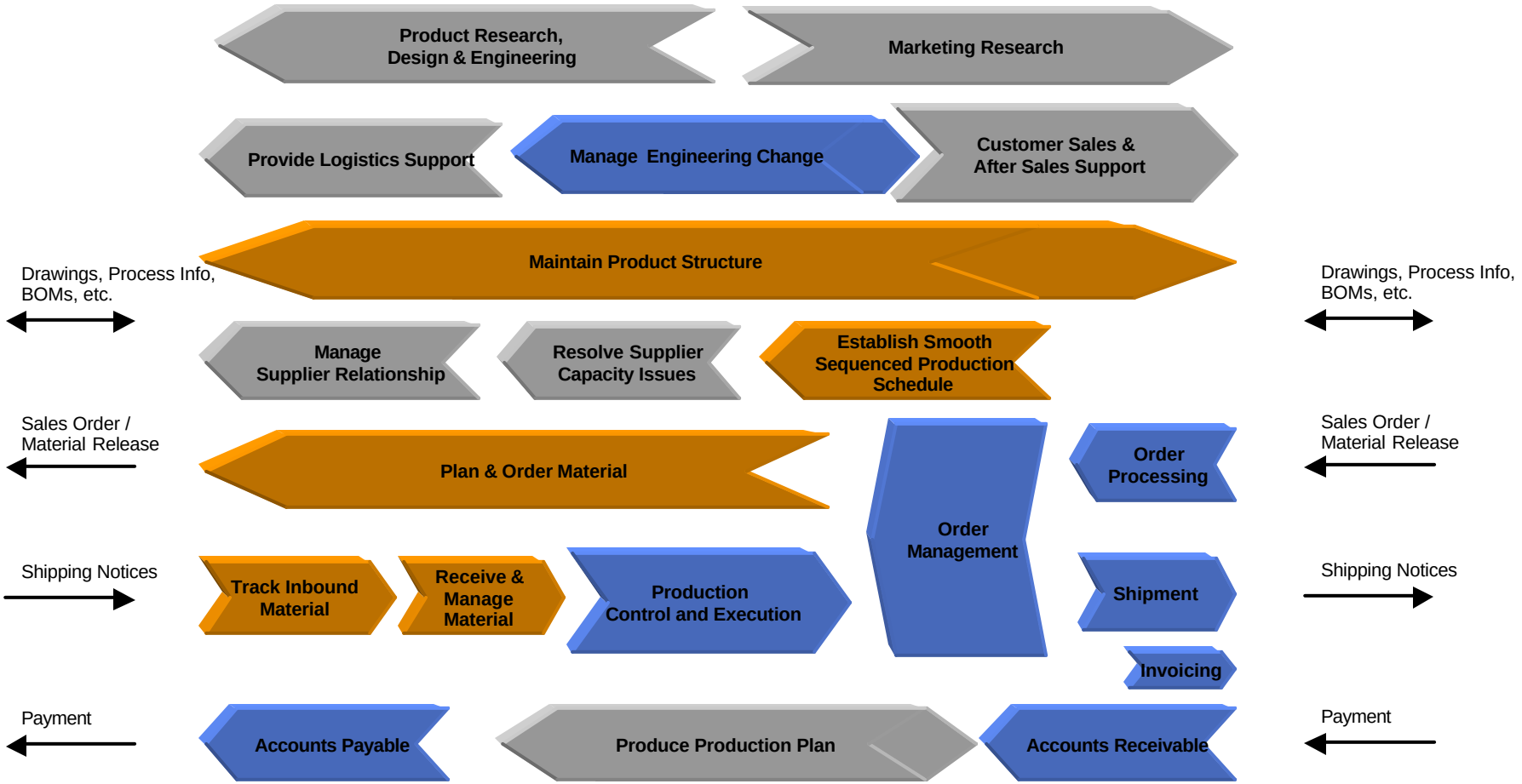
The Key Supply Chain Business Processes link and integrate organizations together.



FastMRP™ supports Critical Logistics Business Processes



Supply Chain Business Process Decomposition



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If material arrives just-in-time, inbound warehouses can be eliminated.

Inputs

- Production String
- Generic BOM
- Part Control Parameters
- Inventory On-Hand

FastMRP™ calculates material requirements in planning periods equal to the tact time of the production line.

Outputs

Material Release to Suppliers

- Netted requirements
- Date, time, and quantity
- Unique Item Pull Signal

Using **ASN's** the inbound material is modeled as a **warehouse in motion**. Deliveries are timed to the point of application (POA).

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When FastMRP™ calculates material requirements a complete MRP Run is executed in a few minutes.

1. Explode a new bill of material for every order in the “Production String”.
2. Adjust the demand to the point of application based on the defined linefeed for every item in the “Production Generic Bill of Material”.
3. Accumulate the demand into hourly buckets.
4. Calculate recommended inventory levels based on defined “Float” with an accuracy equal to the tact time. Float can be specified in fractions of an hour (I.e. 1.1, 1.2, … hours)
5. Calculate new requirements netted and lotted based on “Order Multiples”.
6. Adjust new requirements based on “Delivery Patterns”.
7. New requirements and “Pull Signals” are now available for delivery to internal/external suppliers via a material release or a supplier portal.

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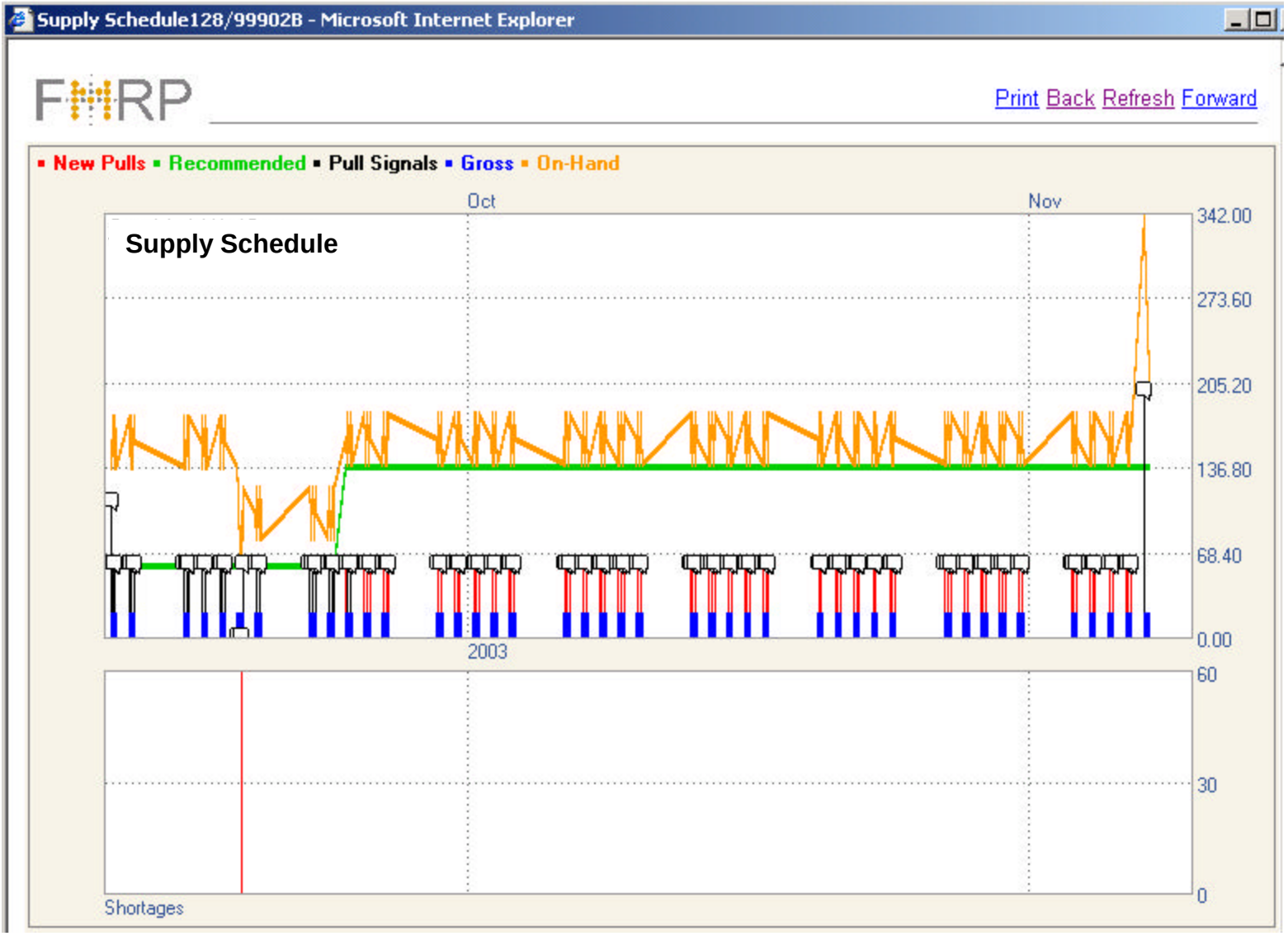
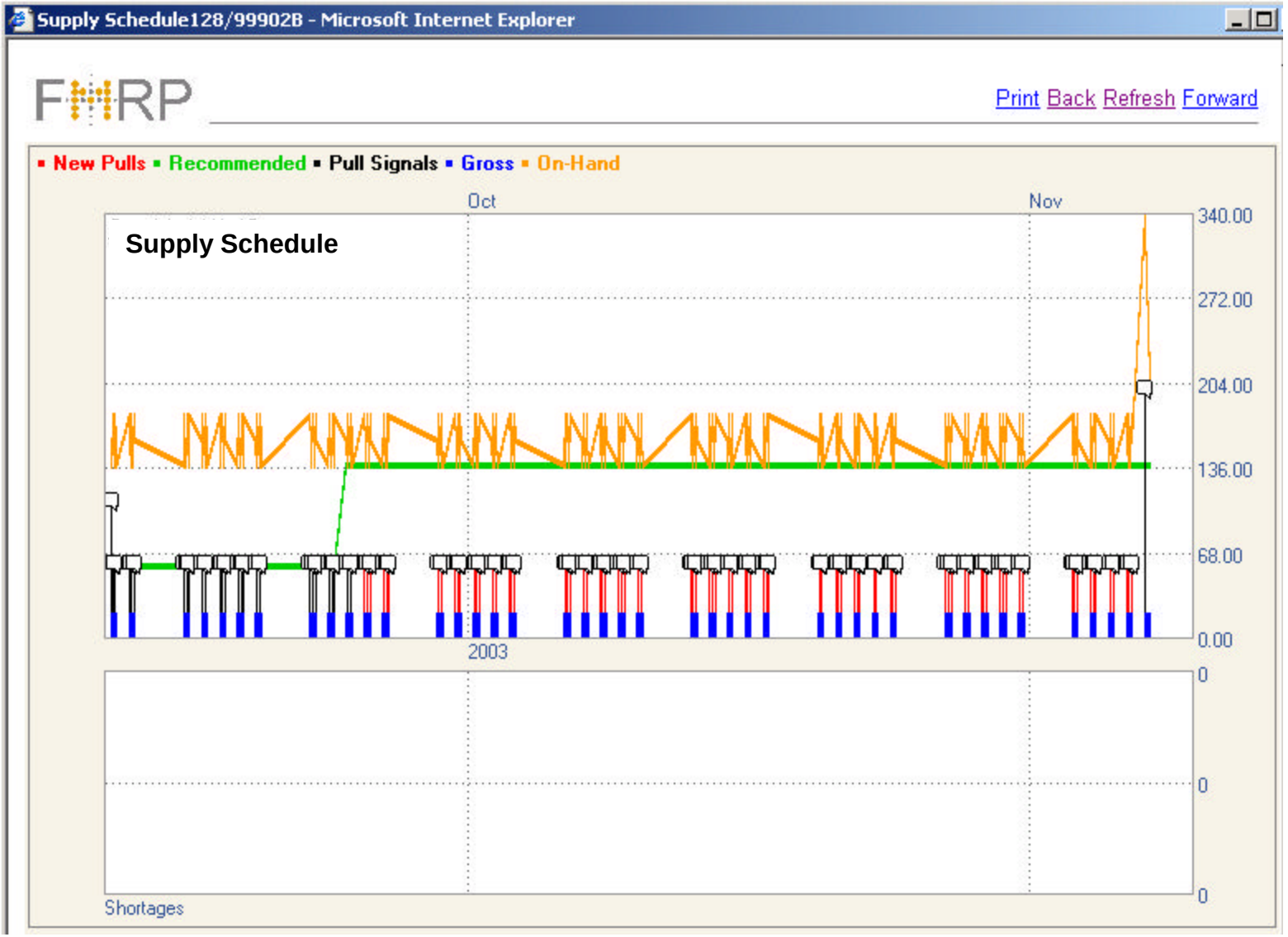
How fast is Fast ?

FastMRP Performance Chart				
Inputs				
Sales Orders per day	160	320	960	1,200
Total Orders in Production String	32,000	64,000	96,000	120,000
Generic Bill of Material Size	24,642	24,642	24,642	24,642
Production Schedule	4/2 to 8/25/2003	4/2 to 8/25/2003	4/2 to 8/25/2003	4/2 to 8/25/2003
Function Performed				
Delete Existing Forecast Orders	Step 0	Step 0	Step 0	Step 0
Explode Custom BOM for every Order	Step 1	Step 1	Step 1	Step 1
Adjust Demand to Linefeed	Step 2	Step 2	Step 2	Step 2
Calculate Recommended Inventory based on Float	Step 3	Step 3	Step 3	Step 3
Calculate New Requirements based on Order Multiples	Step 4	Step 4	Step 4	Step 4
Adjust Times based on Delivery Pattern	Step 5	Step 5	Step 5	Step 5
Results				
Number Forecast Orders Created	209,550	356,235	471,731	589,664
Time to generate Material Orders (sec)	214	574	782	992
Time to generate Material Orders (minutes)	3.6	9.6	13.0	16.5
Number of Material Orders per week	6,000	12,000	36,000	45,000
Time to create Material Orders (seconds)	23	46	138	172
Time to create Material Orders (minutes)	0.4	0.8	2.3	2.9
Total MRP Run Time (Minutes)	**3.9**	**10.3**	**15.3**	**19.4**
Note: Results based on tests performed on RS6000, 450Mhz, 1GB memory, Retail cost ~$20,000				
Actual tests done for 160 and 1200 orders. Worst case results used to extrapolate results for 320 & 960 orders				
Worst case MRP Generation	784	per second		
Worst case Material Orders Creation	261	per second		

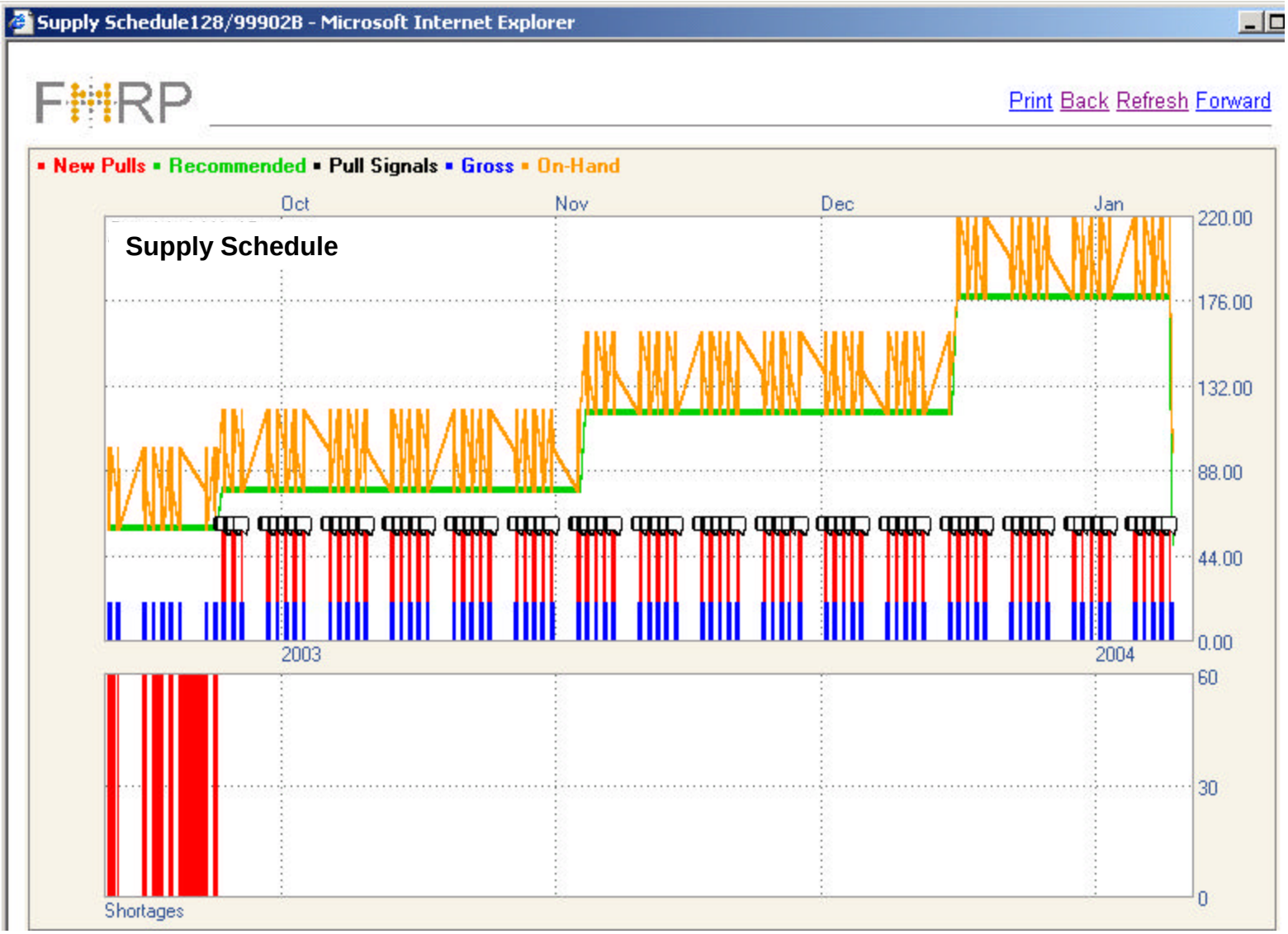
Sample Supply Schedule with Shortage



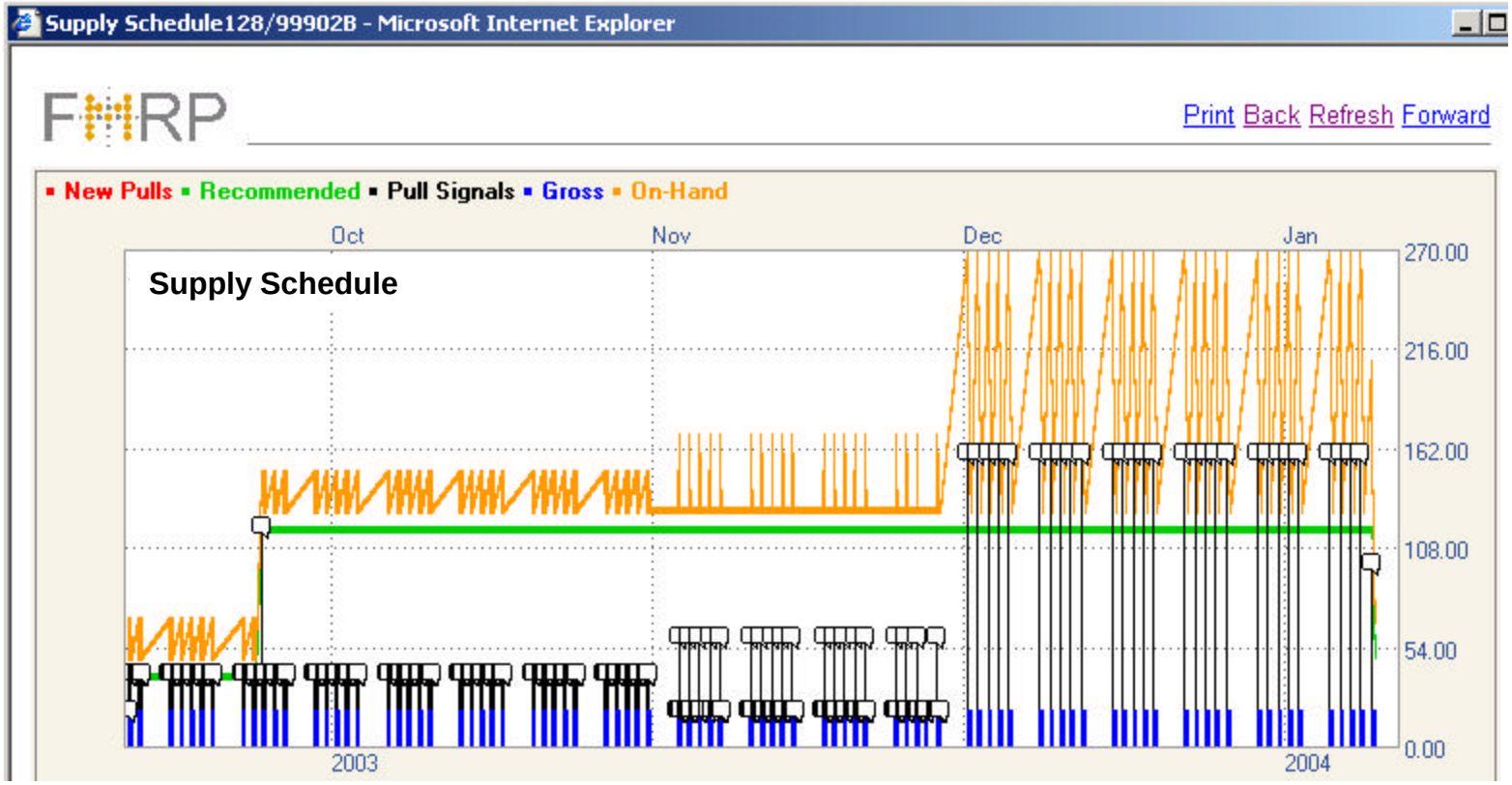
Sample Supply Schedule with no Shortages



Sample Supply Schedule with Date Driven Float

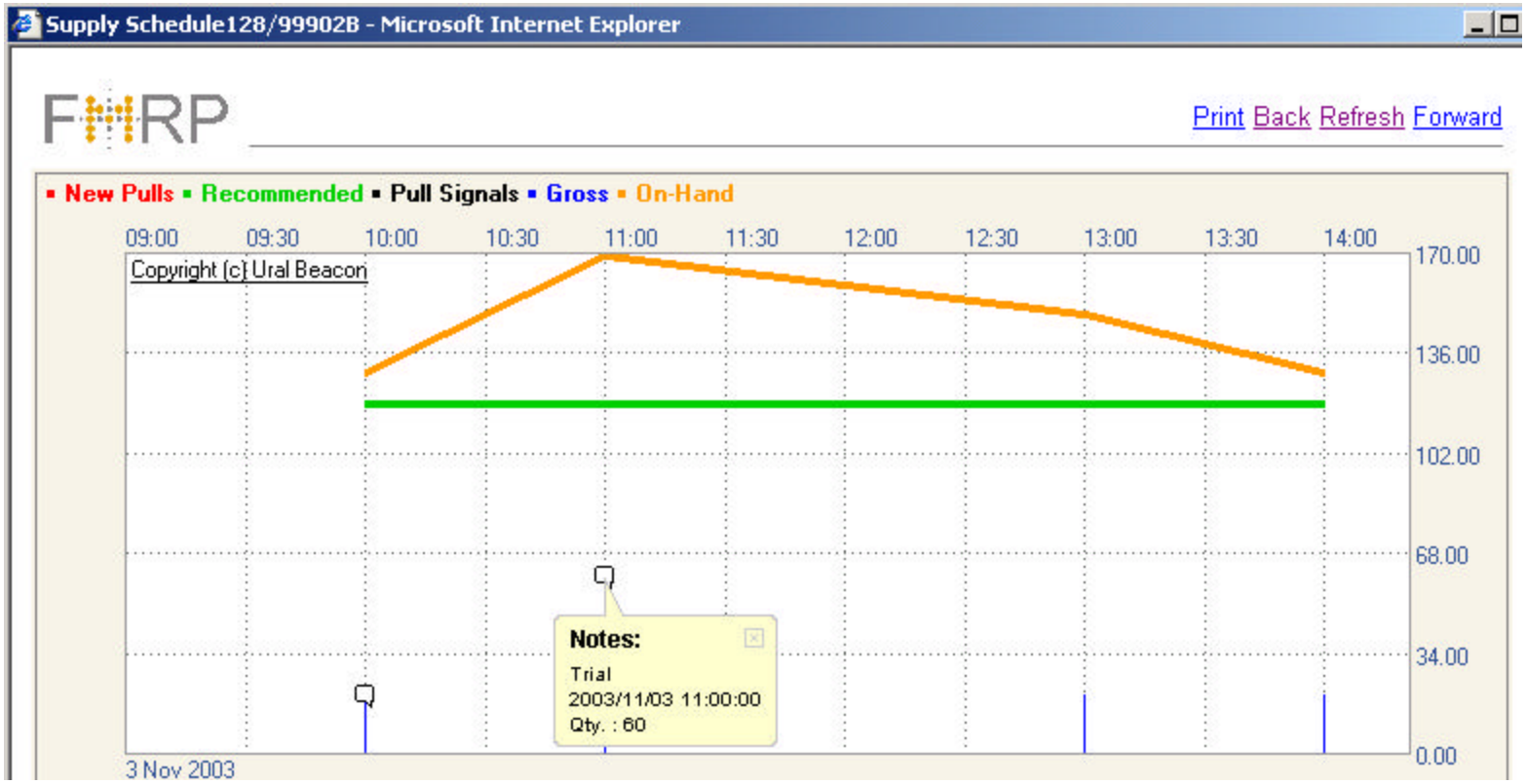


Sample Supply Schedule with Date Driven Delivery Patterns.



8 per day 4 per day 1 per day

Graphic Supply Schedule Allows Interactive Viewing and zooming down to hours.



Each generated “Pull Signal” is tracked from creation to receipt.

Display Item Pull Signals	
Pull Number	E1J3000039
Pull Status	In-Transit
Pull Status Date	09/11/2003
Pull Status Time	19:36:06
Item	128/99902B - CHASSIS
Supplier	9999999999 - Test Supplier
Pull Type	Emergency
Nettable	Yes
MRP Area	MRP1 - Main MRP Area
Timing	
Required Date	09/11/2003
Required Time	08:00:00
ASN ETA Date	08/11/2003
ASN ETA Time	09:00:00
In-Transit Date	
In-Transit Time	00:00:00
Export Date	
Export Time	00:00:00
Import Date	
Import Time	00:00:00
In-Yard Date	
In-Yard Time	00:00:00
Closed Date	
Closed Time	00:00:00
Pull Gen. Date	09/11/2003
Pull Gen. Time	19:27:51
Quanties	
Pull Quantity	20
Pull UOM	EA - INDIVIDUAL PIECES
ASN Quantity	20

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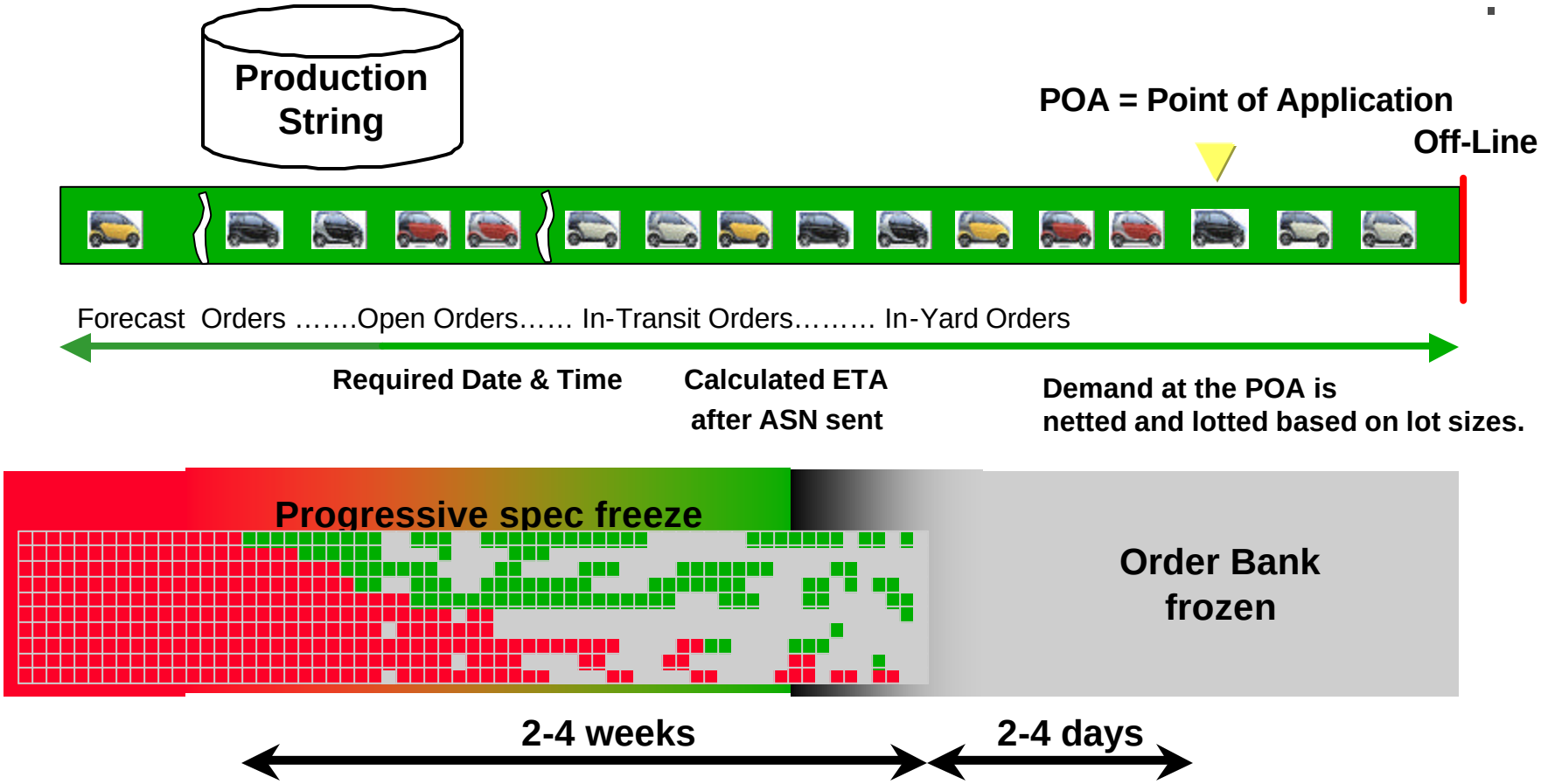
Calculated material demand is based on actual sales orders that have been scheduled and sequenced.



Shortage Reports look for exceptions. If coverage drops below the minimum float in the frozen period, shortages are identified.

A Generic Bill of Material is used to create a customized Bill of Material for every order.

MODEL	1st level	2nd level	n-th level	VARIANT	ITEM	DESCRIPTION	QTY	PART CLASS	ADOPT	ABOL	RULES
C248962	121210	100	50	1	A123456	V6 ENG	1	purchased	10/1/1998		V6
C248962	121210	100	50	2	B124444	V8 ENG	1	purchased	10/1/1998	11/1/1998	V8
C248962	121210	100	50	2	C124243	V8 ENG	1	purchased	11/1/1998		V8
C248967	101214	200	100	1	D121241	DOOR ASSY	1	purchased	4/1/1996		ALL
C248967	101214	300	100	1	E124242	DOOR INNER	1	purchased	4/1/1996		ALL
C248967	101214	400	100	1	F124222	BRACE	2	component	4/1/1996		ALL
C248967	101214	500	100	1	A123456	NUT	4	purchased	4/1/1996		ALL
C248973	104234	100	100	1	H235222	S/WHEEL	1	purchased	11/15/1997		ALL
C248973	104234	100	100	2	I652222	S/WHEEL	1	purchased	11/15/1997		LEATHER
C248973	104234	100	100	3	J123456	S/WHEEL	1	purchased	11/15/1997		WOOD

- Defines all items that go into a product using code rules
- Organized by model and structure levels which can define unique positions.
- For each position, each possible item is considered to be a variant
- Includes past, present and future data
- Contains purchased items, assembled items and reference information (components, drawing #, etc.)

Multiple plants can can produce the same products by defining local information.

E-GBOM - Engineering Generic Bill of Material

Plant #N

MODEL	1st level	2nd level	n-th level	VARIANT	ITEM	DESCRIPTION	QTY	Work Center	Work Station	Process Sheet	Broadcast Data	Delivery Method
C248962	121210	100	50	1	A123456	V6 ENG	1					
C248962	121210	100	50	2	B124444	V8 ENG	1					
C248962	121210	100	50	2	C124243	V8 ENG	1					

Plant #2

MODEL	1st level	2nd level	n-th level	VARIANT	ITEM	DESCRIPTION	QTY	Work Center	Work Station	Process Sheet	Broadcast Data	Delivery Method
C248962	121210	100	50	1	A123456	V6 ENG	1					
C248962	121210	100	50	2	B124444	V8 ENG	1					
C248962	121210	100	50	2	C124243	V8 ENG	1					

Plant #1

MODEL	1st level	2nd level	n-th level	VARIANT	ITEM	DESCRIPTION	QTY	Work Center	Work Station	Process Sheet	Broadcast Data	Delivery Method
C248962	121210	100	50	1	A123456	V6 ENG	1					
C248962	121210	100	50	2	B124444	V8 ENG	1					
C248962	121210	100	50	2	C124243	V8 ENG	1					
C248967	101214	200	100	1	D121241	DOOR ASSY	1					
C248967	101214	300	100	1	E124242	DOOR INNER	1					
C248967	101214	400	100	1	F124222	BRACE	2					
C248967	101214	500	100	1	A123456	NUT	4					
C248973	104234	100	100	1	H235222	S/WHEEL	1					
C248973	104234	100	100	1	I652222	S/WHEEL	1					
C248973	104234	100	100	1	J	S/WHEEL	1					
C248978	121210	100	100	1	K	FRAME	1					
C248978	121210	100	100	1	L	FRAME	1					
C248978	121210	100	100	2	M	FRAME	1					

- POA –> Point of Application
- Process Sheet –> How to Build
- Broadcast –> What to use
- Delivery Method

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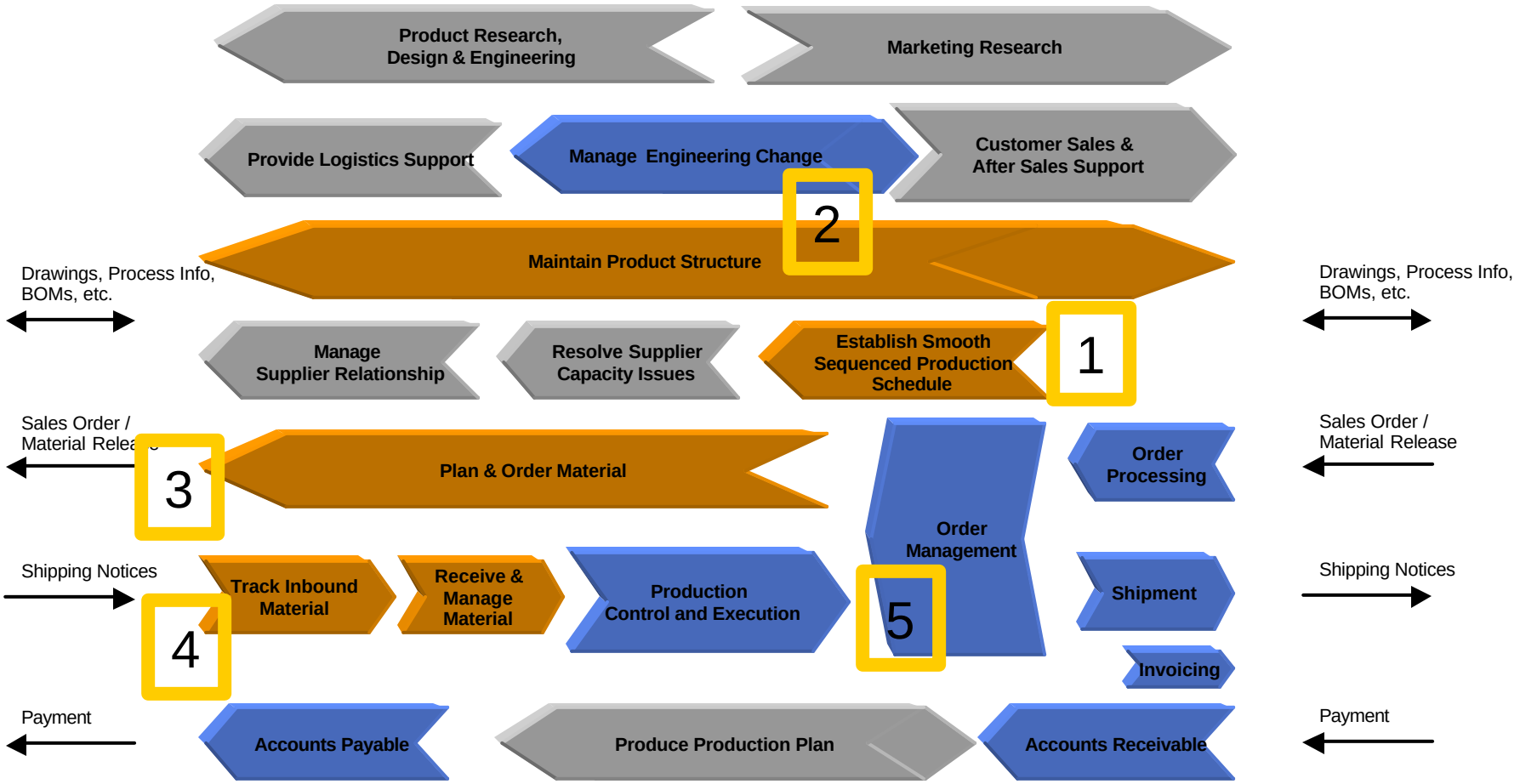
Supply Chain Business Process Flow Chart with 5 integration points to ERP systems.



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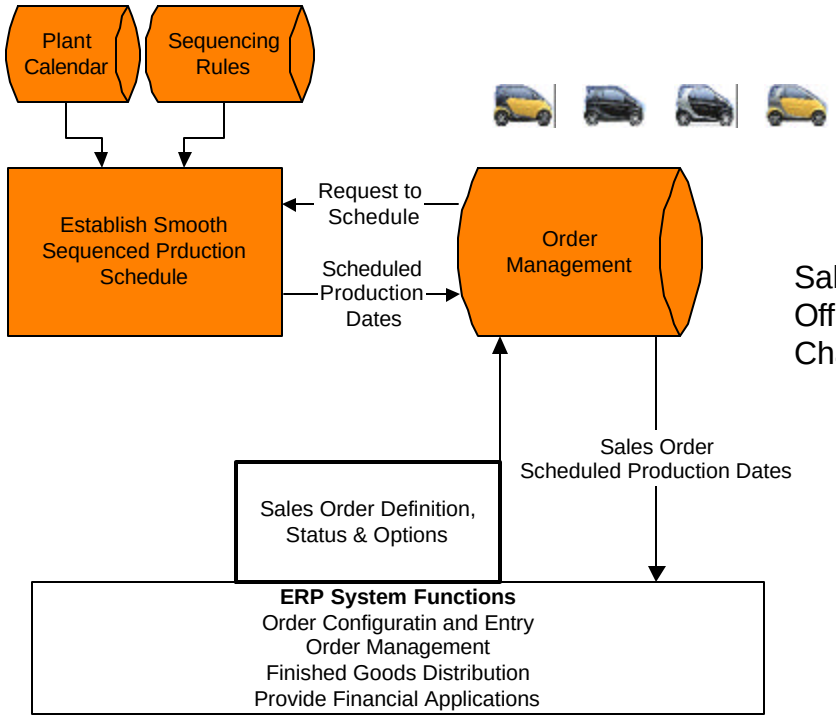
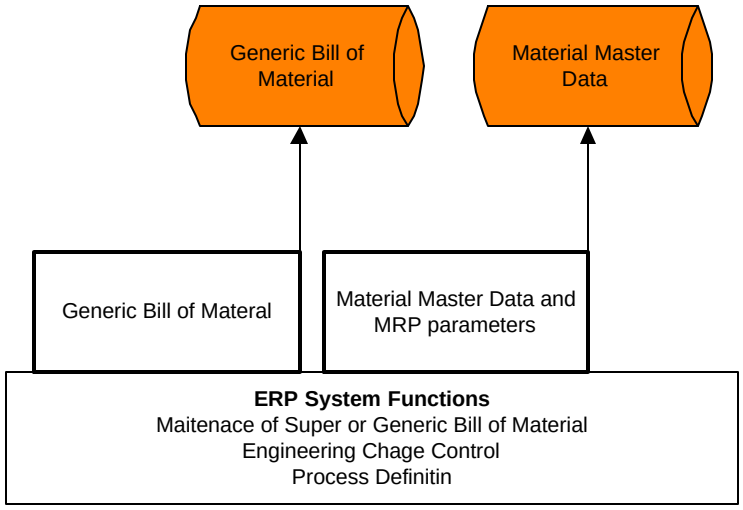
Sales Order Management Process
Integration Requirements

1 Sales Order Definition with optional Scheduling and Sequencing



Maintain Product Structure Process Integration Requirements

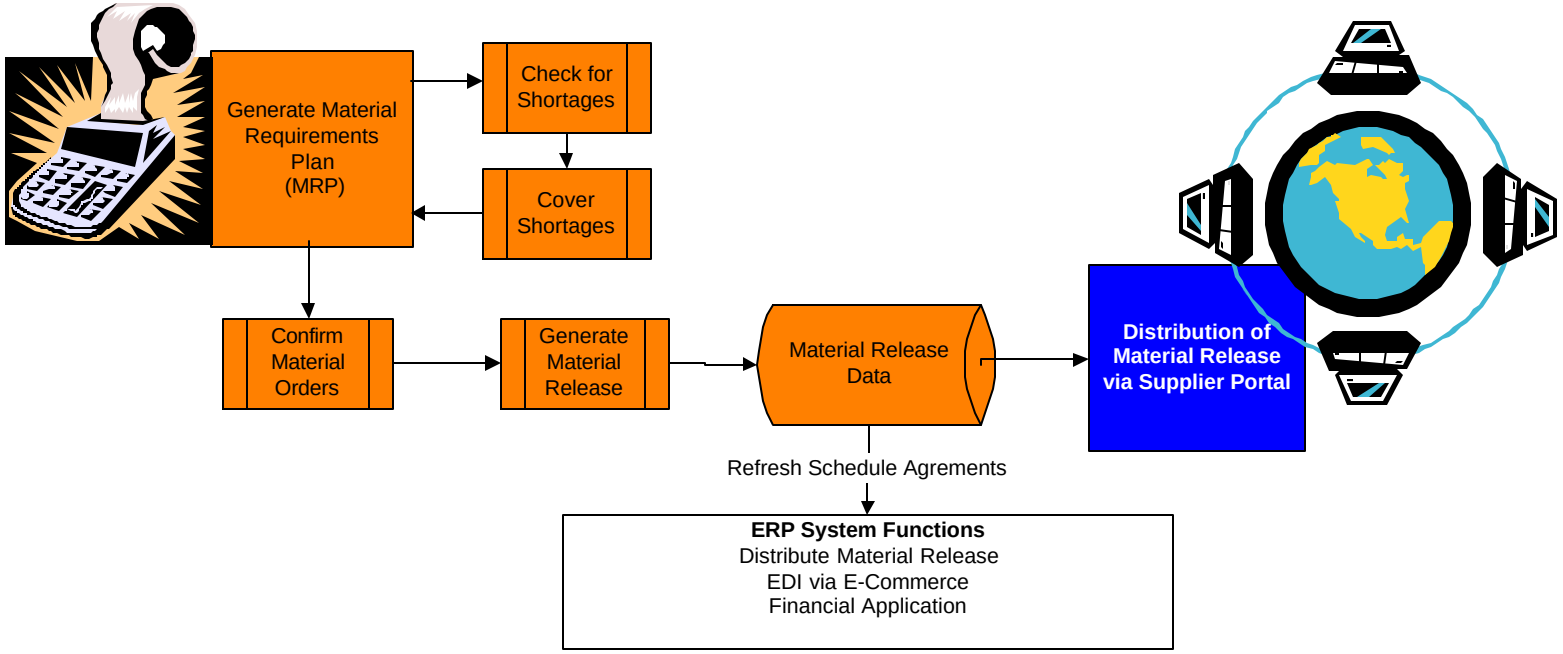
2 Generic Bill of Material transfer and MRP Parameters



- List of Complete BOM & Rule Link
- List of Rules with Link
- List of Characteristic & Values
- Master Material Data
  - Description
  - BOM UoM
  - MRP Parameters

Plan & Order Material Process
Integration Requirements

3 Output file to refresh schedule agreements and distribute material requirements by supplier portal



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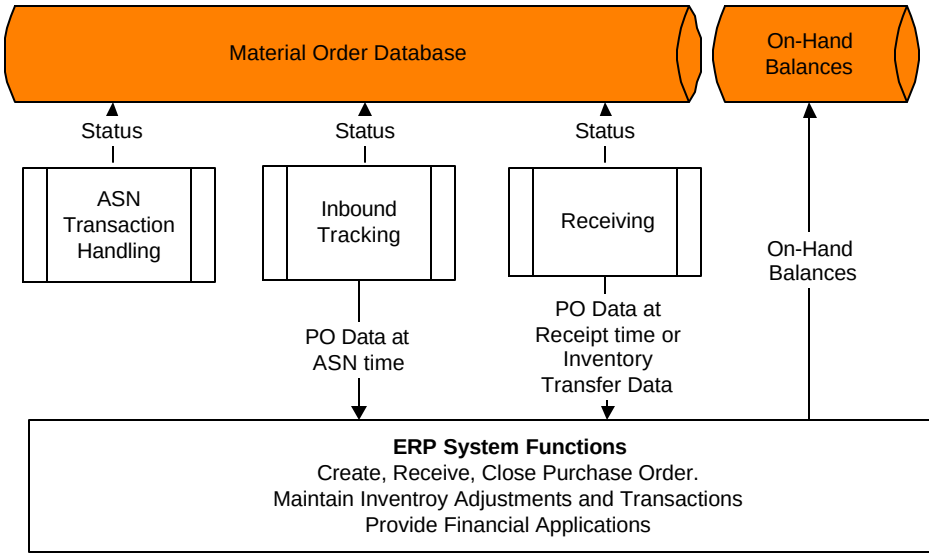
Track Inbound, Receive and Manage Material Process Integration Requirements

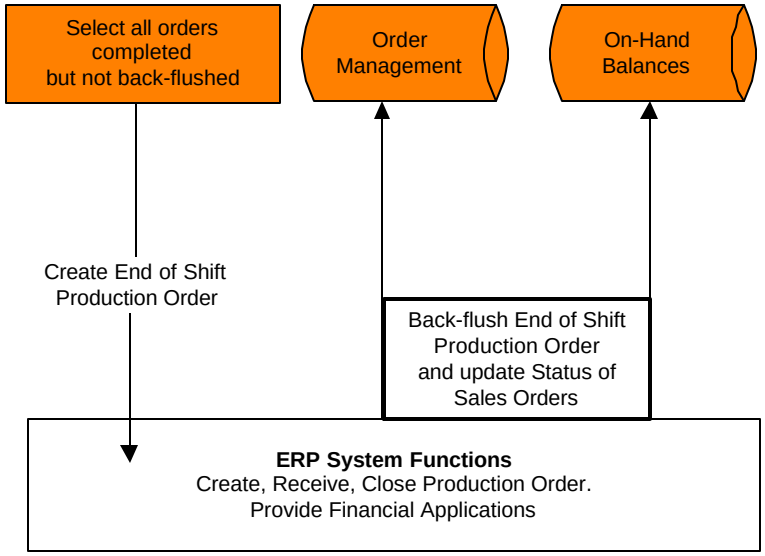
4 On-Hand Balance and Material Order status updates



- Material Tracking ID
- Shipment Date & Time
- Shipment Quantity
- Route Checkpoint Date & Time
- Arrival Date & Time
- On-Hand Balances
  - Material Number
  - MRP Area
  - Quantity
  - Inventory UoM

Production Control and Manage Inventory Process Integration Requirements

5 Production Order creation for back-flushing



- Sales Order List
- Aggregated Bill of Material List
- Order Status Updates
- On-Hand Balances
  - Material Number
  - MRP Area
  - Quantity
  - Inventory UoM

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FastMRP is a Lean solution and saves money!
Est. savings for an OEM assembly plant over 10 years

Elimination of Inbound Warehouses	Cost to build ~ $15,000,000 Cost to operate ~ $3,000,000 /year
Lower cost and distributed CPUs	CPU Cost Savings ~ $750,000 CPU Maintenance ~ $60,000 /year One T1 line ~ $10,000/year
Hourly MRP eliminates need for multiple applications. This leads to simple lean processes that are easy to understand.	Standard MRP ~ $1,000,000 /plant Standard Implementation Cost ~ $3,000,000 over 3 years FastMRP ~ $200,000 / plant FastMRP Implementation Cost ~ $600,000 over 1 year
10 year estimated savings	45 + 0.75 + 6 + 0.01 + 0.8 + 2.4 = **~$49,650,000 Savings**

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