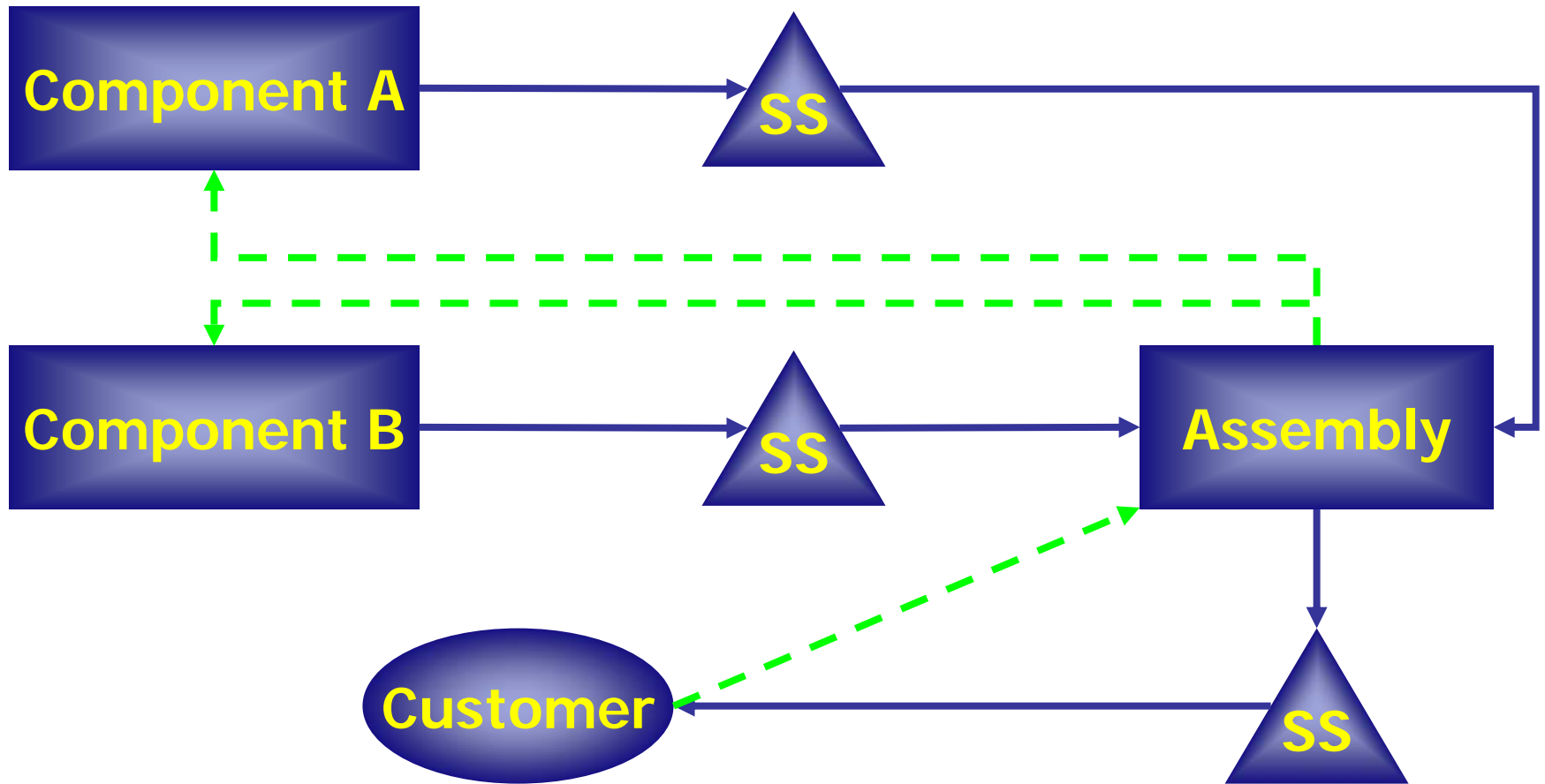




MRP

From Materials Requirement
To Manufacturing Resource
Planning

Traditional Replenishment Systems

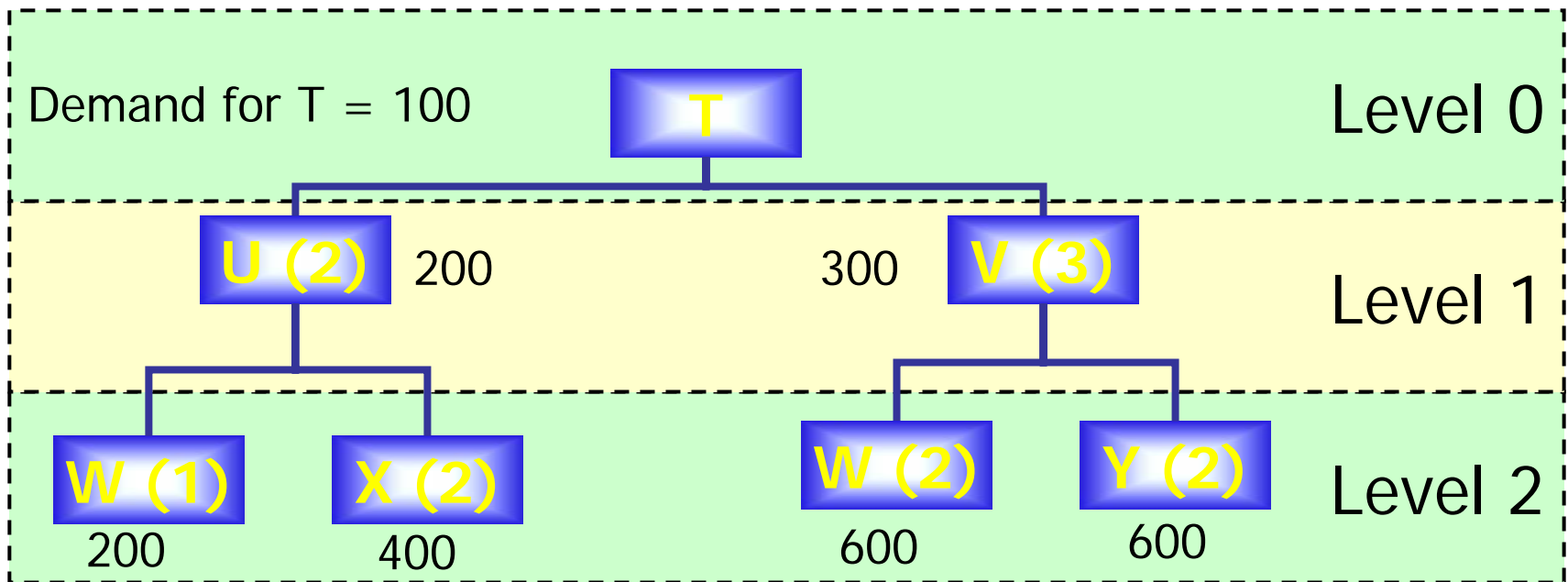




Problems with Traditional Replenishment Systems

- Demand is Dependent, not Stochastic
- Demand not Smooth (Batching)
- Geared Towards Instantaneous Replenishment
- Inventories for Assembly are treated in Isolation

Bill of Materials



Overview of MRP

			WEEKS						
	LT		1	2	3	4	5	6	7
T	1	Req.							100
		Ord.						100	←
U	2	Req.						200	
		Ord.				200	←		
V	2	Req.						300	
		Ord.				300	←		
W	3	Req.				800			
		Ord.	800	←					
X	1	Req.				400			
		Ord.			400	←			
Y	1	Req.				600			
		Ord.			600	←			



MRP Inputs & Outputs

Inputs

- Master Schedule
 - Forecasts
 - Orders
- Inventory
- BOM
- Lead Times
- Yields



Outputs

- Production Plan
- Purchasing Plan
 - What ?
 - When ?
 - How Much ?



MRP Nervousness

- Information Updates
 - ⇒ Rescheduling Actions
- Dampening Methods
 - MPS Freeze
 - Order Freeze
 - Safety Stock
 - Safety Time
 - Safety Capacity
 - Expediting



Uncertainty & Safety Cushions

- Safety Stock
 - Items with direct external Demand
 - Items with highly variable Yield
 - Items produced at a Bottleneck
 - Items with a myriad of different Parents
- Safety Time
 - Primarily Raw Materials



CRP Capacity Requirements Planning

- Product Load Profile
 - Capacity Requirements of End Items
- While Schedule not feasible
 1. MRP
 2. Capacity Loading
 3. Capacity Reconciliation
- If no feasible Solution
 - Modify Master Schedule



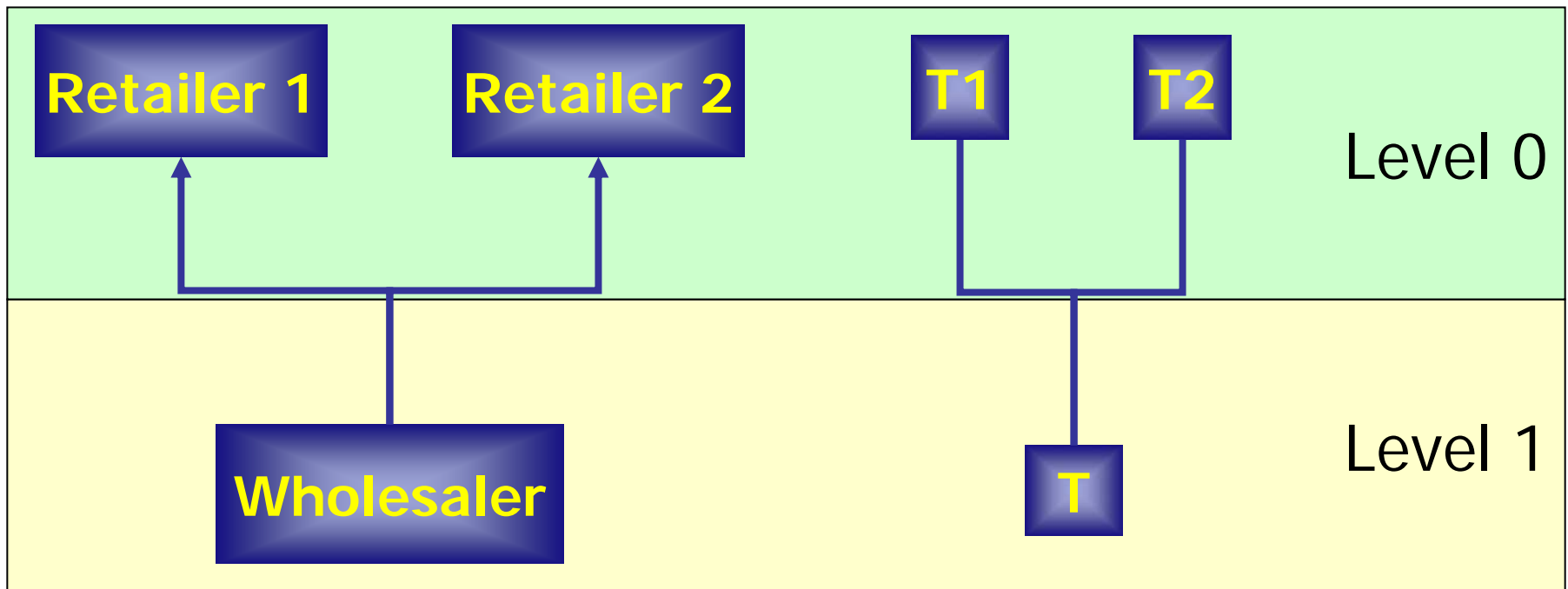
Capacity Reconciliation

- Sub Contract
 - End Parts
 - Components
- Transfer Capacity
 - Machines
 - Personnel
- Use alternate Routings

DRP: Distribution Requirements Planning

Supply Chain

BOM





MRP Shortcomings...

- Lead Times
 - $LT = f(\text{Part}), f(\text{shop})$ or $f(\text{schedule})$?
 - Inflate LT ?
- Lot Sizes
 - Optimization difficult
 - EOQ, LFL, Heuristics?
- Safety Stocks
 - In isolation?



...MRP Shortcomings...

- Improvement Incentives
 - Significant Effort to Gather and Input Data
 - Reluctance to Change Inputs
 - Initialization with Inflated Values
 - Keep Inflated Values to avoid Problems
 - Excessive Trust in Computer Data



Application Traps

- Continuous Processes
 - Simple BOMs
 - “Factory like one Machine”
 - Setup Costs drive Schedule
- Job Shops
 - $LT \neq f(\text{part})$
 - Simple BOMs
 - Shifting BNs



ERP

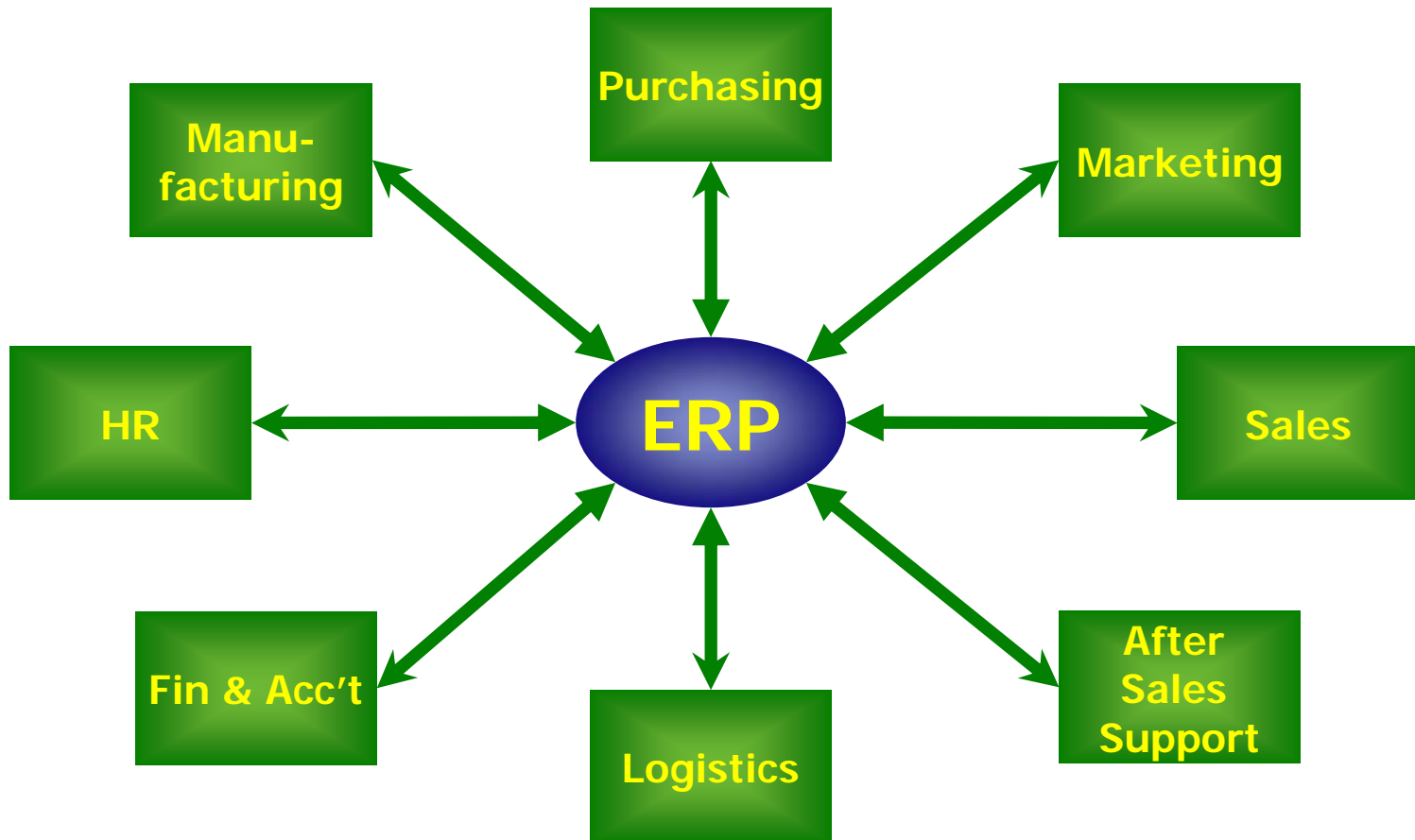
Enterprise Resource Planning An Overview



What is ERP?

- Client Server Software
- Integrates Majority of Business Processes
- Processes Majority of Transactions
- Enterprise wide Database
 - Each data point is stored once
- Real Time Data Access

ERP Modules





Stake Holders

- ERP Vendors
- Consultants
- Hardware Providers
- Databases
- Operating Systems
- Complementary Tool Providers



BOPSE

- Baan ~5%
- Oracle ~ 10%
- People Soft ~5%
- SAP ~30%
- J.D. Edwards ~7%

- Others (30%)



ERP Factoids

- >60% of Multinationals use SAP's R/3
- SAP's revenue:
 - 1995: 90% from large companies
 - 1997: 70% from large companies
- Average Implementation Costs:
 - \$15 M, or ~\$53K per user



ERP Factoids

- Market Growth
 - 1993: \$ 319 M
 - 2000: \$ 2400 M
- ERP Investments during 90s: ~\$ 300B
- META Group Study of 63 companies:
 - Average quantifiable net gain:
Negative \$ 1.5M



Wrap Up

- Clean Sheet vs. Technology Enabled
- Big Bang vs. Phased Introduction
- Best of Breed vs. Single Vendor
- Managing Complex Procedures vs. Procedure Petrification



Wrap Up

- Best Practices vs. Continuous Improvement
- Operations as Strategy?
- Importance of “Buy-In”
- The Role of Consultants