

Supply chain tactical planning and OM research

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Intent and Overview

- What do I mean by tactical planning for supply chains?
- How is this done in practice?
- Where has OM research provided some value?
- What's required to have some impact?
- Where else might OM research provide some value?

Supply Chain Tactical Planning

- Tactical planning entails:
 - Countermeasures for variability and uncertainty
 - Tactics for managing economies of scale in supply, production and distribution
- For given design decisions and accounting for system constraints and inflexibilities
- Often synonymous with mid-term planning

Examples of tactical decisions

- Strategic safety stock placement
- Review intervals & replenishment frequencies
- Demand management, e.g., customer service times, order acceptance,
- Master production scheduling, e.g., smoothing
- Planned lead times
- Capacity buffers & dynamic capacity planning

Observations on practice

- MRP framework remains pervasive because of software and the inherent appeal of the underlying model
- The MRP model assumes a deterministic world, driven by a demand forecast
- The MRP model relies on MPS function and on planned lead times to simplify and decompose the planning problem

Observations on practice

- Limited accommodations for uncertainty:
 - Re-planning, with time fences and frozen schedules
 - Safety stocks – primarily for FGs and RMs
 - Inflated planned lead times → create a hidden safety stock in form of WIP

Observations on practice

- Advent of APSs has provided capability to incorporate constraints and optimize economies of scale – largely at MPS level.
- APS also provide useful input to demand management issues, e.g., order acceptance, delivery date quotation, etc.

Where has OM research provided some value?

- Limited impact on architecture of APSs and on the engines for APS modules
 - Hierarchical planning (Hax Meal, 1975)
 - OR algorithms for large-scale MIPs
 - Proprietary heuristics for bottleneck identification and scheduling

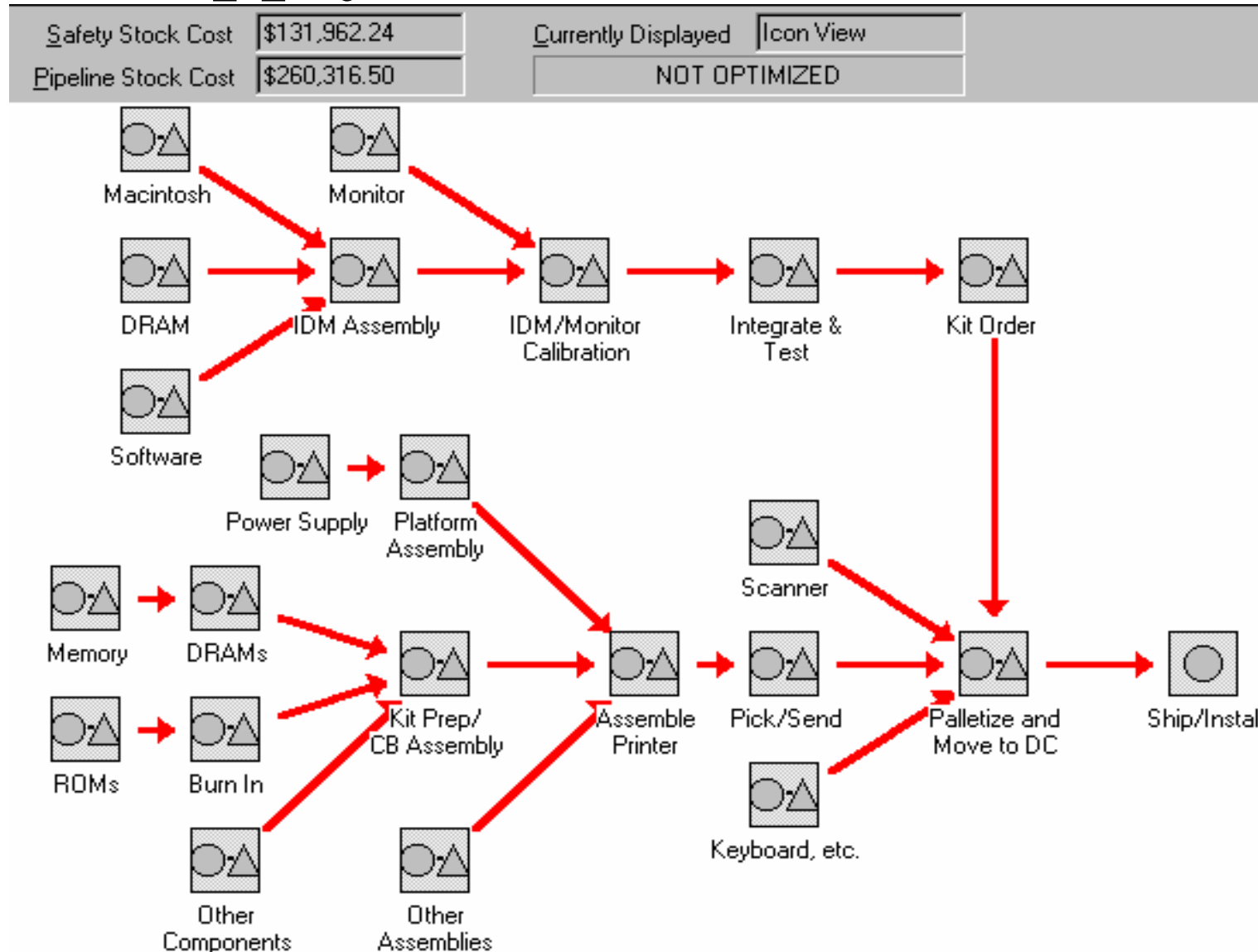
Where has OM research provided some value?

- Much more impact on setting safety stocks across supply chain
- Published research-based applications
 - Deere, Caterpillar
 - HP, Kodak
 - Philips
 - IBM
- Commercialization of research into software by Optiant, SmartOps, LogicTools

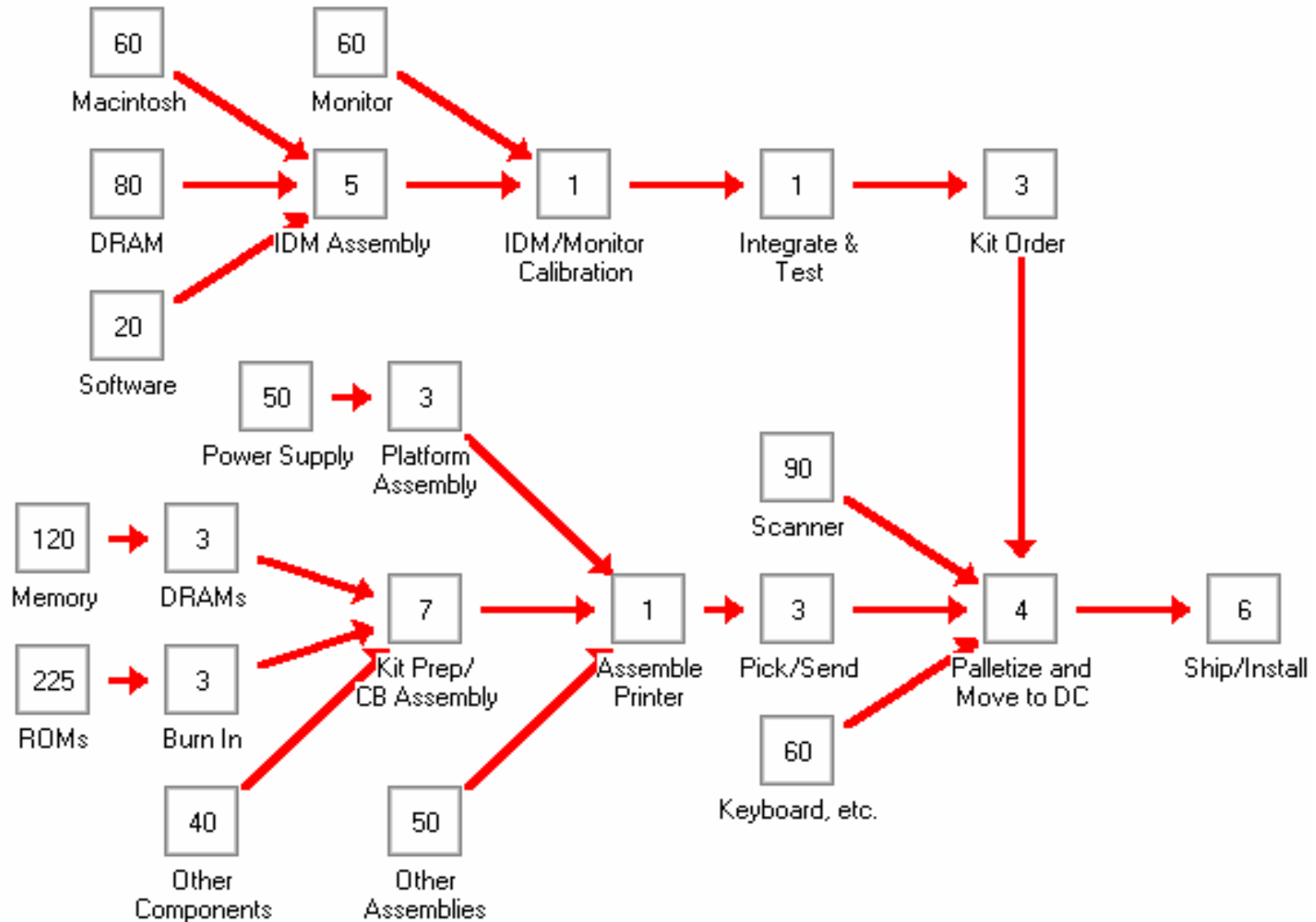
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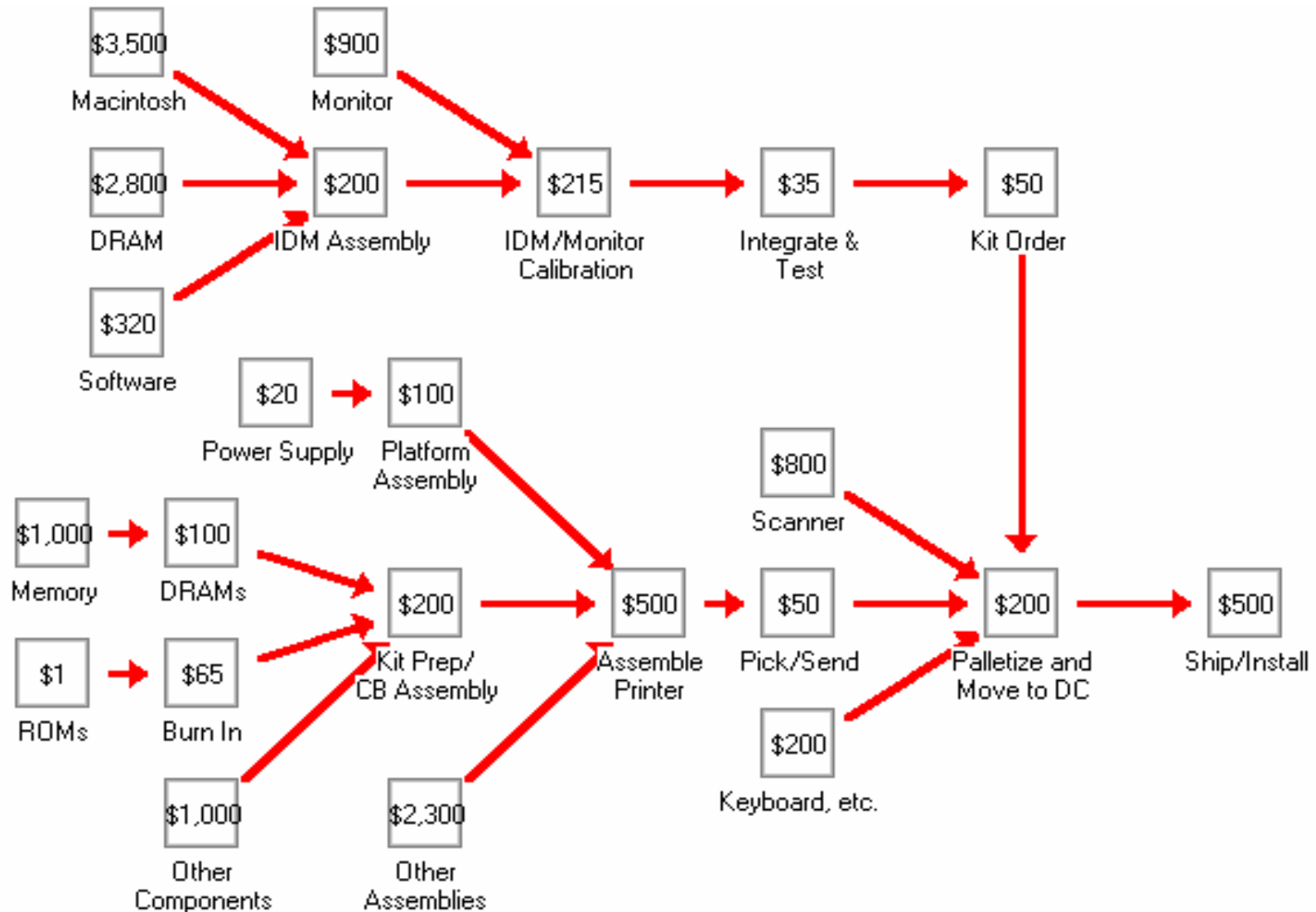
Supply Chain: Before



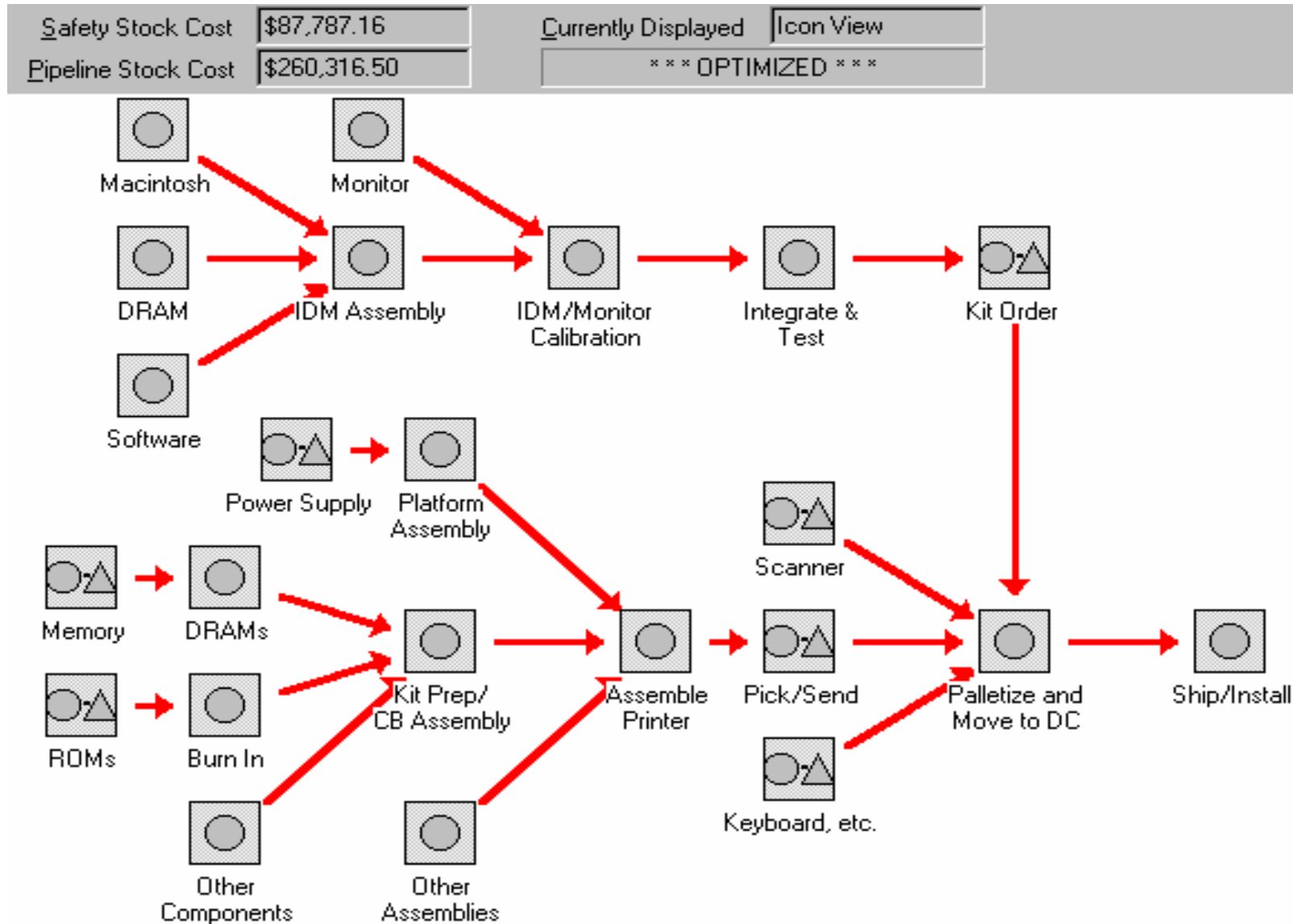
Supply Chain: Lead Times



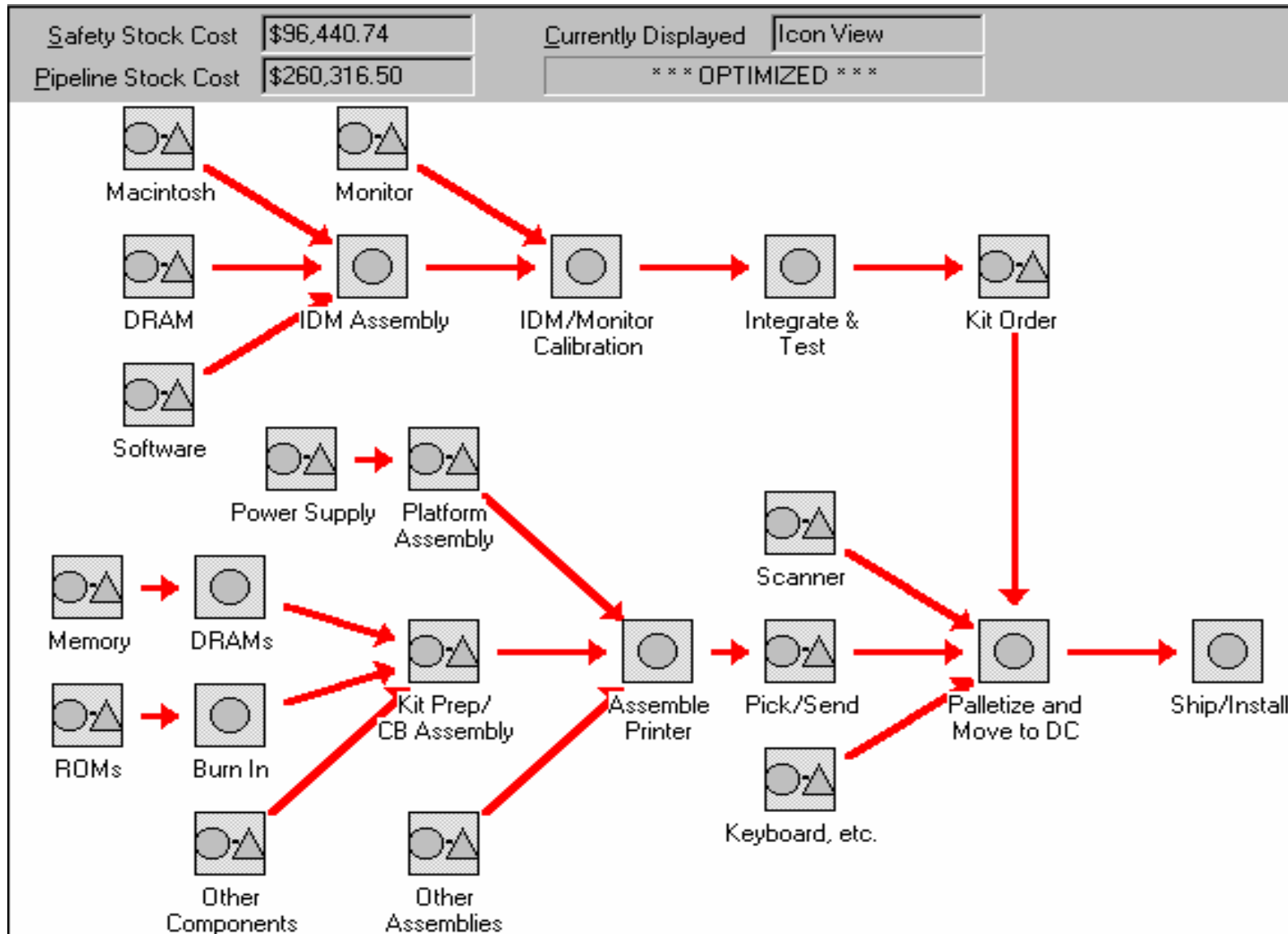
Supply Chain: Costs



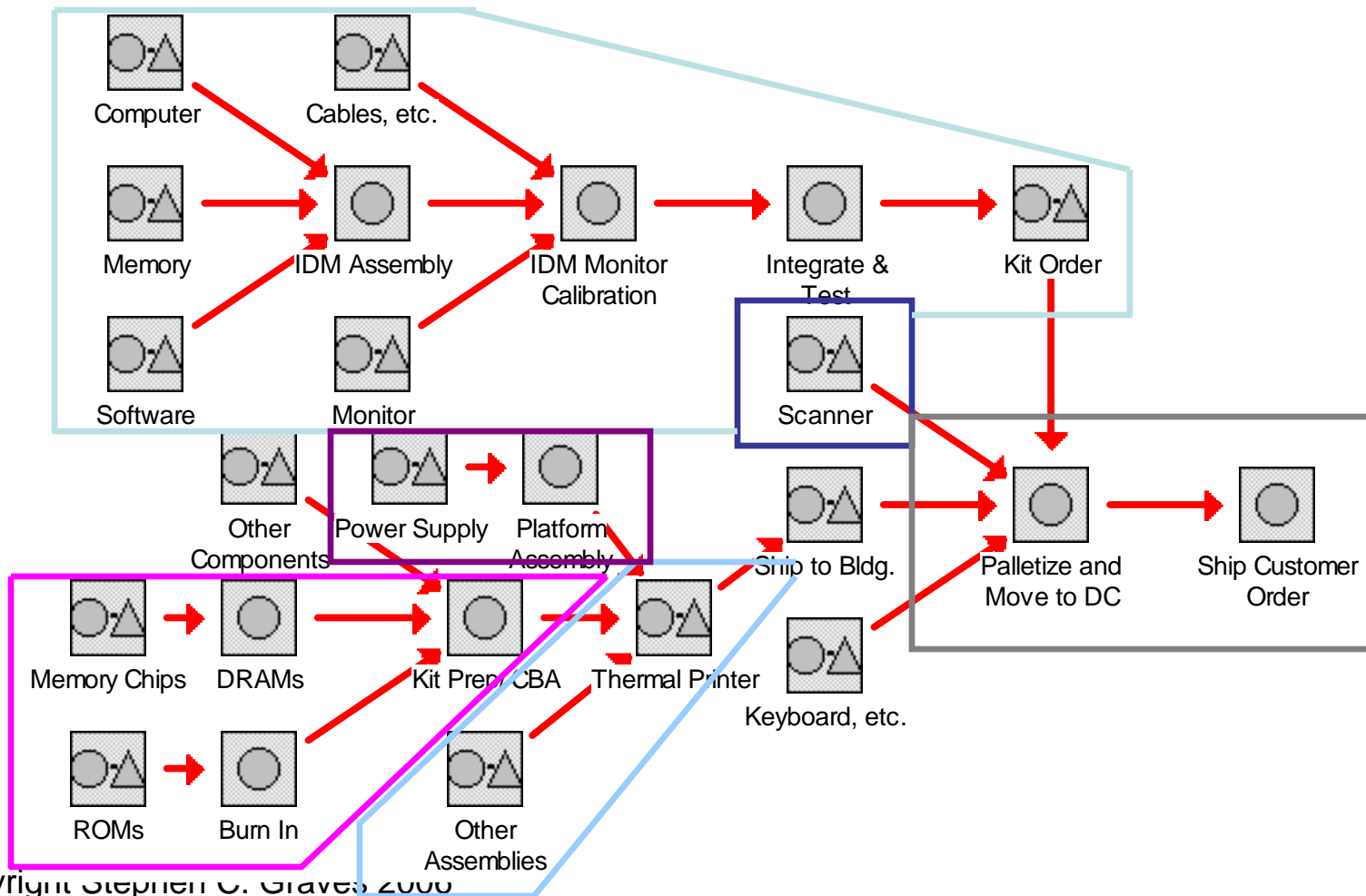
Supply Chain: Optimized



Supply Chain: Implemented



Supply-Chain



History of Effort

- 1994 – 1996
 - Problem definition stage; summers on-site at Kodak
 - Development of model and software for solving assembly and distribution networks
 - Produce a master's thesis
 - Transfer model to Kodak for testing

History of Effort

- 1997 – 1999
 - LFM interns apply model at HP, Kodak, ALCOA
 - CTS project with Lucent
 - Continued knowledge transfer with Kodak
 - Develop version 2.0 of model and software; solve spanning tree networks; implemented on PC
 - Model and software used in supply chain electives
 - PhD thesis on supply chain configuration

History of Effort

- 2000 – present -- commercialization
 - HP San Diego interested in “industrial strength” version
 - Ruark and Willems enter MIT \$50K and co-found Optiant
 - Continual enhancements to both UI and algorithms to meet industry needs
 - HP and Optiant participate in 2003 Edelman competition.

History of Effort

- 2000 – present -- academic
 - Publication of core model – MSOM, 2000
 - Research on extensions & enhancements
 - General networks (Humair, Willems)
 - Non stationary demand (Graves Willems)
 - General review periods (Bossert Willems)
 - Configuration decisions (Graves Willems)
 - Ongoing work to incorporate forecast evolution model; contracting considerations; capacity

Learnings from Experience

- Value from simple, applicable tools that satisfy a need and support tactical decisions
- Importance of software platform to deliver the model
- Virtuous cycle between industry application, research and education
- Research requires investment and patience, as well as significant in-kind contribution from partner companies
- Collaboration informs teaching and research

Challenges from Applied Research

- Managing expectations and risks – what can be delivered and in what time frame?
- Pick partners carefully; e.g., find company innovators who can navigate through the bumps and set-backs in the implementation and testing processes
- Meeting traditional academic requirements for outputs
- Need to combine OR with computer implementation expertise

Where else might OM research provide some value?

- Decision support for “other” tactics
 - How to set planned lead times?
 - Where to locate and how to size capacity buffers?
 - How to plan capacity for demand upside, e.g., capacity reservations and options, dual sourcing, etc?
 - How to manage order backlog and smooth MPS

Where else might OM research provide some value?

- Decision support for contracting with supply partners
 - How to coordinate tactics between manufacturer and supplier – e.g., safety stocks, capacity buffers, time fences?
 - How to assure consistency and alignment across supply contracts?
 - How to determine amount of visibility to provide to supply base?

Wrap Up:

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