A Short Range Scheduling Model For Blockbuster’s Order Processing Operation
2006-2007

Daniel H. Wagner Prize for Excellence in Operations Research Practice

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Blockbuster: Entertainment Industry

**Rental and Retail of Movies and Games**
- DVD/VHS/Games/Accessories
- 2008
  - 20+ B Industry
- Blockbuster
  - 5.9 B Worldwide
  - 3.9 B US

**Competition**
- Rental
  - Hollywood Video
  - Netflix
  - Redbox
  - PPV and Video-On-Demand
- Retail
  - Wal*Mart
  - Target
- Piracy
Nature of Product & Challenges

~ 35 new titles/wk
~ some no theatrical release
~ Demand ~4 :1 peak/average
~ 52 seasons /yr
~ No correlation between titles
~ Weak correlation – calendar seasons
~ Forecasting based on “like titles”
~ Varied volume decay paths

Release on DVD

~ Rapid Revenue Erosion
~ Compressed Lifecycle
~ Intermittent Overcapacity

Decline at box office

Decline on DVD

Blockbuster Model

Movie production

Time

Revenue

Theatrical release

24-36 months

6-8 weeks

4-6 weeks

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Product Lifecycle

Life Cycle by Product Type

New Release

Catalog Inventory

High

Seasonal or complimentary

Exiting catalog Inventory – dead titles

Relative Catalog Inventory

Poor performer, regional or short lived event

Low

New Release Title

Activity
Blockbuster Supply Chain

- Studios
- Games
- Accessories

800,000 sq.ft.
5.4 miles of conveyor
40,000 pick locations
18,000 pallet locations
1100-3000 people
24/6 – 2 shifts-12hrs each
60% Value Added Services
IN ~ 5400 pallets/wk
VA ~ 2.4 M units/wk
OUT ~ 600,000 cartons/wk

40 pool points
2-7 days

38 regional centers

LTL

4800 US Stores

TL

2-7 days

1-5 days

Kiosk

38 regional centers

IN ~ 5400 pallets/wk
VA ~ 2.4 M units/wk
OUT ~ 600,000 cartons/wk

4800 US Stores

TL

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Kiosk
The brand name “Blockbuster” means having the right movie or game in the right store at the right time every time. Our Goal is to “Make every night a Blockbuster night” and through timely and accurate supply chain delivery be the complete source of “At home Entertainment” for millions of customers.

~The Cost of handling a box at the pool point is the same irrespective of the size - CONSOLIDATION
Process Flow at the Distribution Center

- P1: 10 cpm
- P2: 25 cpm
- P3: 20 cpm
- M1: 120 cpm
- M2: 40 cpm
- S1: 80 cpm
- S2: 120 cpm
- M3: 35 cpm
- P4: 64 cpm
- M4: 40 cpm
- P5: 64 cpm
- M5: 64 cpm
- P6: 64 cpm
- M6: 64 cpm
- P7: 64 cpm
- P8: 40 cpm
- M7: 60 cpm
- P9: 45 cpm
- P10: 40 cpm
- P11: 7 cpm
- P12: 64 cpm

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Carton Consolidation: Merge Point M3

Purpose of Consolidation: Exploiting the **fixed cost** of transportation
Sortation Point S1: Outbound flow
System Bypass

- Bypass can occur at merge points M1, M2, M3 and sortation points S1, S2.
- Necessitated by excess in-flow
- Expensive
Blockbuster’s Challenges

- Lack of “short range planning process” to address the intermittent over capacity
  - It was art and not science
  - Planning tools available
    - Long range model 3-18 month (budgeting)
    - Intermediate range 1-3 month (capacity)
    - Short range 1 week (capacity and labor planning)
- Poor system utilization with an “accordionian effect-exaggerated peaks and valleys”
  - M3 was a bottleneck and was not recognized in planning.
  - The jobs were not always assigned to the most effective processing department
- Excess safety labor capacity was used as a shock absorber for wide fluctuations in peak volumes at M3 – planning for peak volumes
- Undesirable “system bypass” resulting in increased transportation cost at pool points

System Utilization  
Transportation Cost  
Labor Cost
Why minimize fluctuation at M3?

P1-P12: 10 units/hr

M3: 3.5 units/hr

S1: 10 units/hr

~ 3.5 units

System Utilization

By Pass Event

Labor Cost
Problem: What is needed?

- Develop a working model
  - Short range planning solution which schedules discrete jobs to departments
  - Parallel picking / processing department environment
  - Preferred departments based on processing costs
  - Competition for shared constraints that have finite capacity

- Implement the model in a live environment
- Ensure it drives the right behavior across the end to end supply chain
**Input Data: Sample**

- Primary processing department and (potential) secondary departments for each job. Number of cartons, Processing times, Costs, etc.

<table>
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<tr>
<th>Job</th>
<th>Due Date</th>
<th>Job Name</th>
<th># Pieces</th>
<th># Cartons</th>
<th>Primary Dept</th>
<th>Process Time (hrs)</th>
<th>Process Rate (pcs/hr)</th>
<th>Process Cost ($/pc)</th>
<th>Secondary Dept</th>
<th>Process Time (hrs)</th>
<th>Process Rate (pcs/hr)</th>
<th>Process Cost ($/pc)</th>
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<td>18,500</td>
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</tbody>
</table>
The Model

■ Objectives
  ■ Minimize total cost of processing and transportation
  ■ Balance the workload throughout the planning horizon

■ Constraints
  ■ All jobs shipped over a 4-shift horizon.
  ■ Capacity bounds for each shift.
  ■ Flow balance over each shift.
  ■ Smoothing of flow through each department.

■ Implementation Considerations
  ■ Assign special jobs to specific departments
  ■ Intentional system bypasses for rush jobs
  ■ Constrain piece volumes in addition to carton volumes
  ■ Reserve capacity in departments/shifts for important/expected work
  ■ End user friendly
Modeling Complexity

- Mixed Integer Program solved by CPLEX
- Scheduling complexity
  - Over 400 jobs per week
  - 12 processing departments
  - Jobs may have 1 to 5 potential processing departments
  - Multiple processing departments may have different costs to process
  - 24 / 6 Operation
  - Consolidation
- Model Complexity for a 4 shift model
  - ~25000 constraints, ~15000 variables, ~250 binary variables
Impact – M3 Reduced Peak Carton Volume

Merge M3 Volume

21.8% decrease in peak volumes

Smoothed fluctuations and improved capacity utilization
Stabilized staffing levels and reduced labor costs
Reduction of 8,216 employee-shifts, => 98,592 labor hours @ $14.00/hr.
Annual savings: about $1.38 million.
Impact – M3 Reduced By Pass Events

- 2006 - 12 bypass events in 52 weeks, incurring a total cost of $322,200.
- 2007 - No bypass events

Savings
2007: $1.38M + $322,200 = $ 1.7 M

Conservative Estimates (accounting for reduced volumes)
2008: $1.31 M
2009: $1.16 M

Total Savings: $ 4.17
Lessons Learnt: Modeling Best Practices

- Look ahead 2 steps, monitor 1 step
- Use the model to drive complexity and cost out of the system
  - Do not use the model to manage the complexity
- Local improvement, but global impact
  - Squeeze the cost out instead of shifting the cost
- Drive Continuous Improvement
- Design for X

**Design for Consolidation**

Is it happening by accident or is it planned?