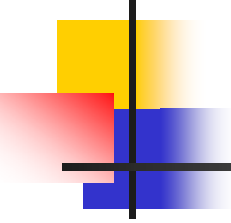


# The Management of Logistics in Large Scale Inventory Systems to Support Weapon System Maintenance



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and  
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# Briefing Overview

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- Problem Definition and Scope
- Background
- Challenges
- Solving the problem





# Problem Definition

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- Classic inventory problems
  - How much to stock?
  - When to order?
  - How much to order?
- Difficult problem without demand data
  - When will the stock location run out of inventory?
- Multiple Consumers, Multiple interrelated maintenance tasks
- No access to planning and production data
- Multiple-criteria optimization problem



# Minimize Inventory Management Cost



- Holding Cost
  - Parts
  - Physical Space
  - Stocking Labor
- Order Cost
  - Inventory Review
  - Shipping
  - Receiving
  - Forward Locating
- Penalty Cost
  - Idle workers
  - Delayed tasks





# Maximize Performance

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- Inventory Bin Fill Rate
- Service Rate
- Inverse Waiting time





# Background

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- Bench stock inventory
- More than 400,000 stock locations
- More than 100,000 inventory items
- Over 1.8 million transactions over three years
- Multiple weapon systems: F-15, F-16, C-130, C-141, C-5, KC-135, B-1B, B-52, B-2, E-3, E-6A, FA-18, P-3, H-60, AV-8, and others.
- Multiple Sites: OCALC, OOALC, WRALC, JXNADEP, NINADEP, CPNADEP





# Challenges

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- Detecting stock-out conditions
- Forecasting demand
- Identifying inventory policy errors
- Compensating for variability of the maintenance environment
- No access to planning and production data





# More Challenges

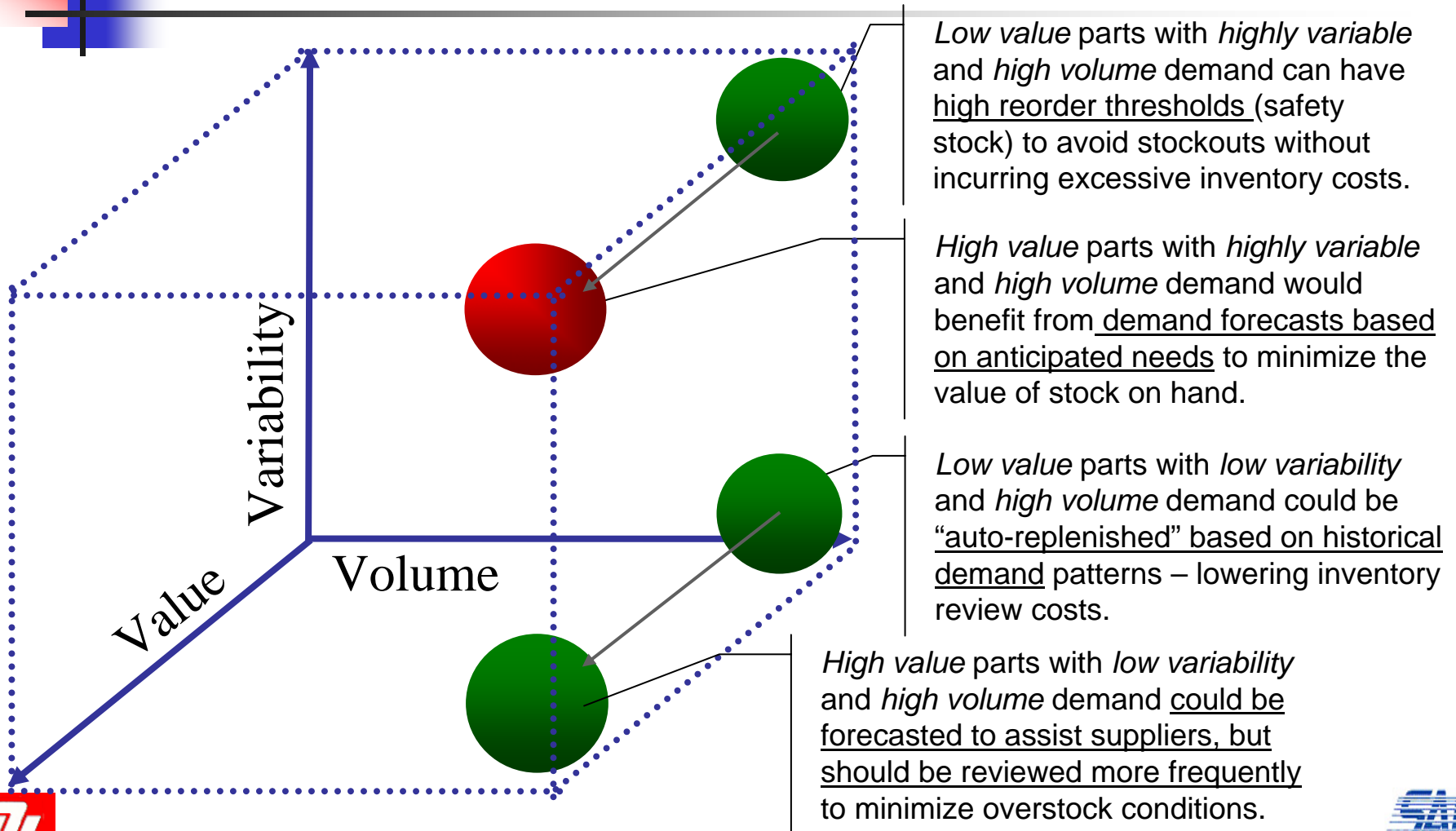
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- Exact item count in inventory location is unknown
- Accurate inventory review is not economically feasible
- Reorder level is an estimate
- Reorder quantity is fixed
- Items removed from the stock locations for direct use

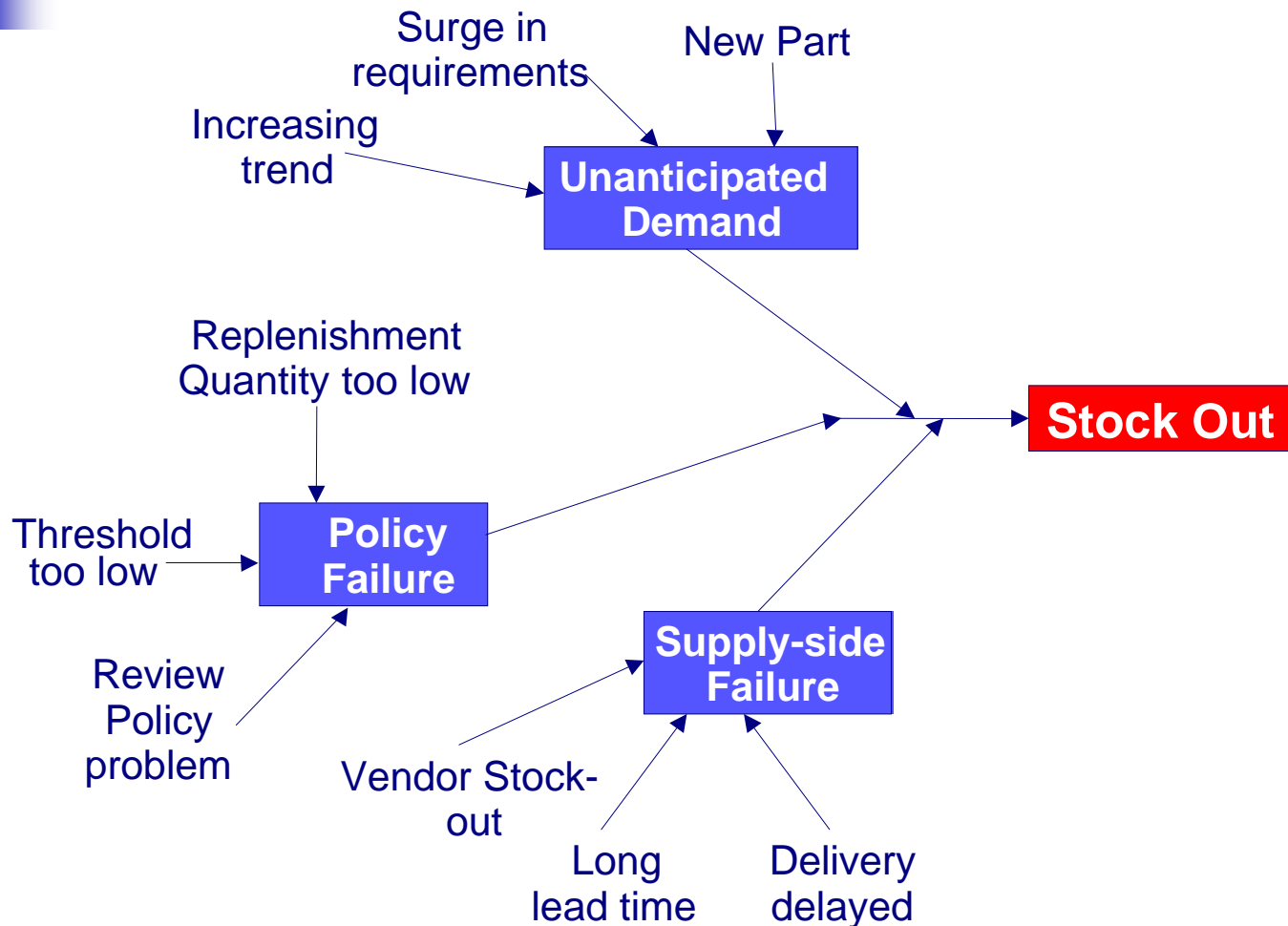




# Insights: Inventory Segmentation



# Stock Out Triggers





# Solving the problem: Daily

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- Unmanned Bench Stock Location
  - Material is placed in a bin and mechanic takes what he needs
  - If a bin is empty, inventory manager is notified and generates an emergency PR to Vendor
  - Conduct physical review of each bench stock location twice per week to create routine replenishment
- Emergency Requirements Management
  - Each emergency requirement is tracked from birth to death
- Stock outage Management
  - Intensive management to ensure parts are in the bin
  - Focuses manager on potential problems
- Web based asset visibility
- EDI Ordering and Invoicing



# Enterprise Supply Chain System: SCOPTIMA™

- Oracle DBMS with custom user and system interfaces
- User-friendly interface for management queries
- Maintains record of supply chain events
  - Bin scan to generate potential order (hand-held device)
  - Order generation based on rule set (automated)
  - EDI order placement to vendor(s)
  - Order receipt and replenishment (physical inspection and confirmation)
  - EDI invoicing
- Supports analysis to identify historical demand patterns and relationships through simulation and data mining



**Item Record Load**

File Personnel Edit Query Administration Mgt Order Analysis Inventory Mgt Item Management Spotbuy Mgt Order Mgt Window Help

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**24 Hr Clock Tracking**

SCOPTIMA Supply Chain Software

RefNo Start Date BSL NSN AQ

53050	07-JAN-2003 11:50:33	514	5962010337979	3
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Comments All Loc/Open Orders Receipt History

Refno	BSL	Bin	UI	Qty Ordered	Order Date	Vendor
53050	514	338B	EA	3		S9E
53050	514	338B	EA	7		S9E

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**Item Record Load**

SCOPTIMA Supply Chain Software

NSN 3120011147043 Contract SP0S0000DBP02

Description BUSHING, SLEEVE Primary SOS S9G

Long Lead  In-Service Date

Unit of Issue EA QUANTITY QUP 1.000 EA

Budget ERRC N

SLC Item Manager Eric R. Curry

DLA Only Supplied  CSI

Create Date 28-SEP-2004

Acquis Advice Code D

Lock Vendor Ranking  Yes  No

Cage Code QA Check  Yes  No

Generic QA issues  Yes  No

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**24 Hr Clock Status**

SCOPTIMA Supply Chain Software

24 Hr Clock Status Screen

RefNo.	Clock Start	Requester
92212	18-AUG-2005 08:58:03	Monn
93750	07-OCT-2005 08:49:42	BEARDSLEE
93751	07-OCT-2005 08:49:42	BEARDSLEE
93752	07-OCT-2005 08:49:43	BEARDSLEE
93753	07-OCT-2005 08:49:43	BEARDSLEE
93755	07-OCT-2005 08:49:43	BEARDSLEE

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**Open Spotbuy Orders**

SAIC Control No	Ordered Qty	UI	RCC	Order Date	Quote Date	Estimated Delivery Date
IPVC0252304576	19	EA		24-AUG-2005	23-AUG-2005	03-NOV-2005
IPVC0252665568	8	EA		05-OCT-2005	30-SEP-2005	21-OCT-2005

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Product At Warehouse Product Inventory Control Vendor Product On Order Open Spotbuy

RefNo.	BSL	Bin	UI	Qty	Order Date	Vendor	Requester	Item	Tracking
530	5320013050143	72CD	0	14				Zero BIN Open Request	Tracking...
530	6145011108895	CEAB	0	879				Zero BIN Open Request	Tracking...

Record: 1/1



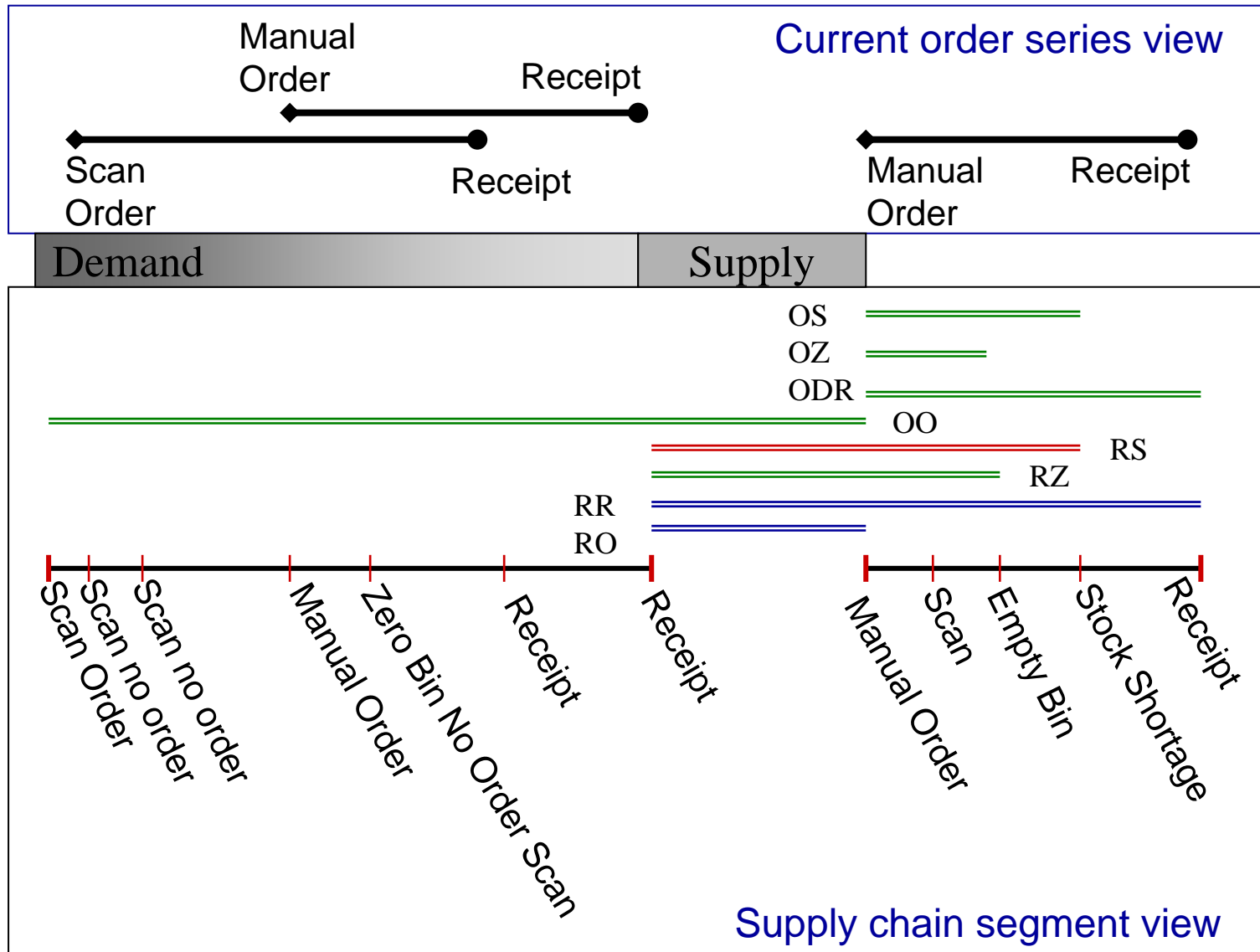
# Applying Technology

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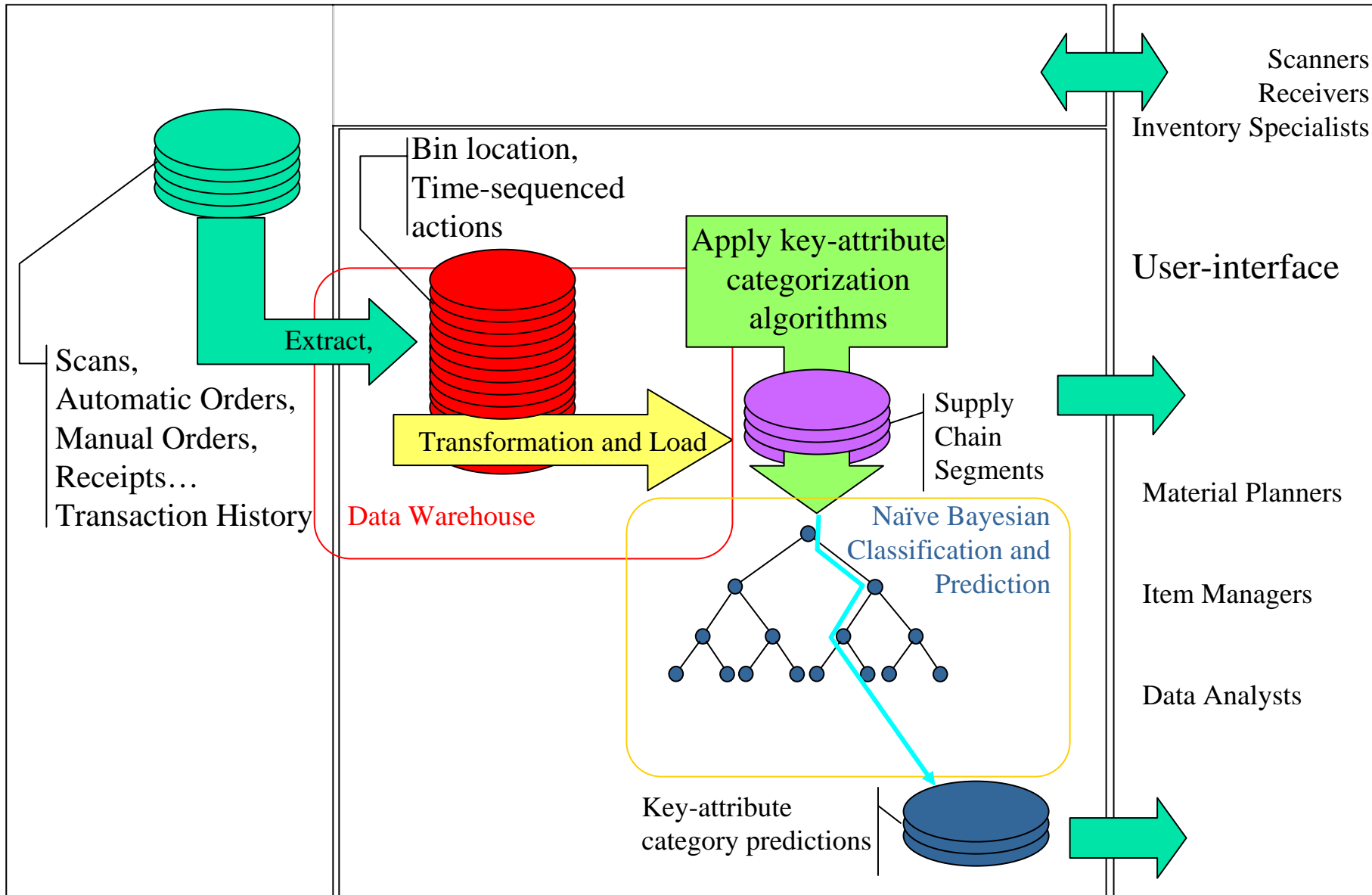
- Data Warehousing
- Data Mining
- Simulation
- Time-series Forecast modeling
- Dynamic data display



# Key Transaction Events



# SCOPTIMA™ Data Mining





# Integration of SLAM and SCOPTIMA™

- Automatically run simulation of Bin Q,r strategy to verify results
- Support SCOPTIMA decision making using simulation
  - Verification of Q,r changes when bin agent determines need for change
- “Agent” based approach
- Automated





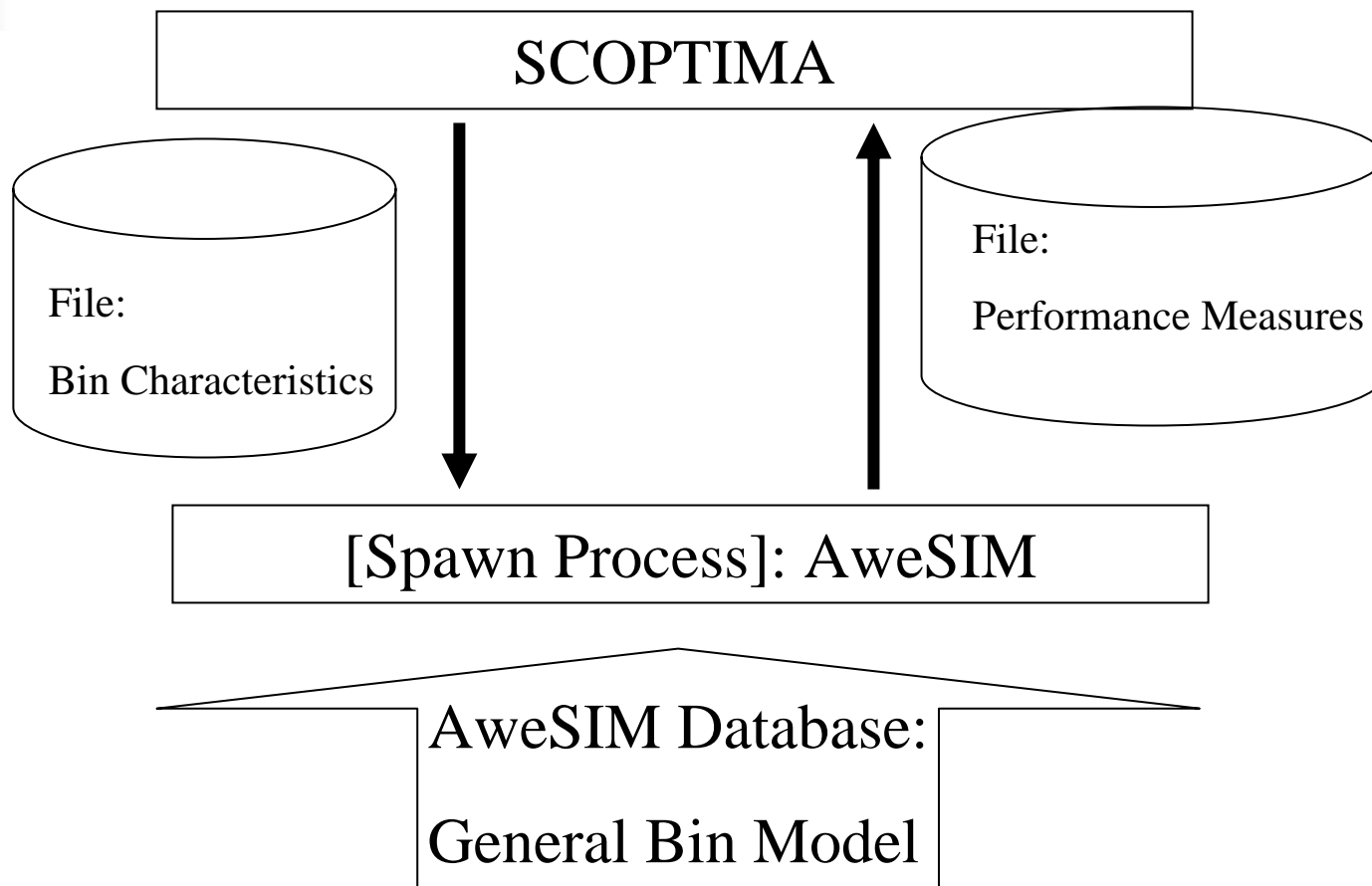
# Integration

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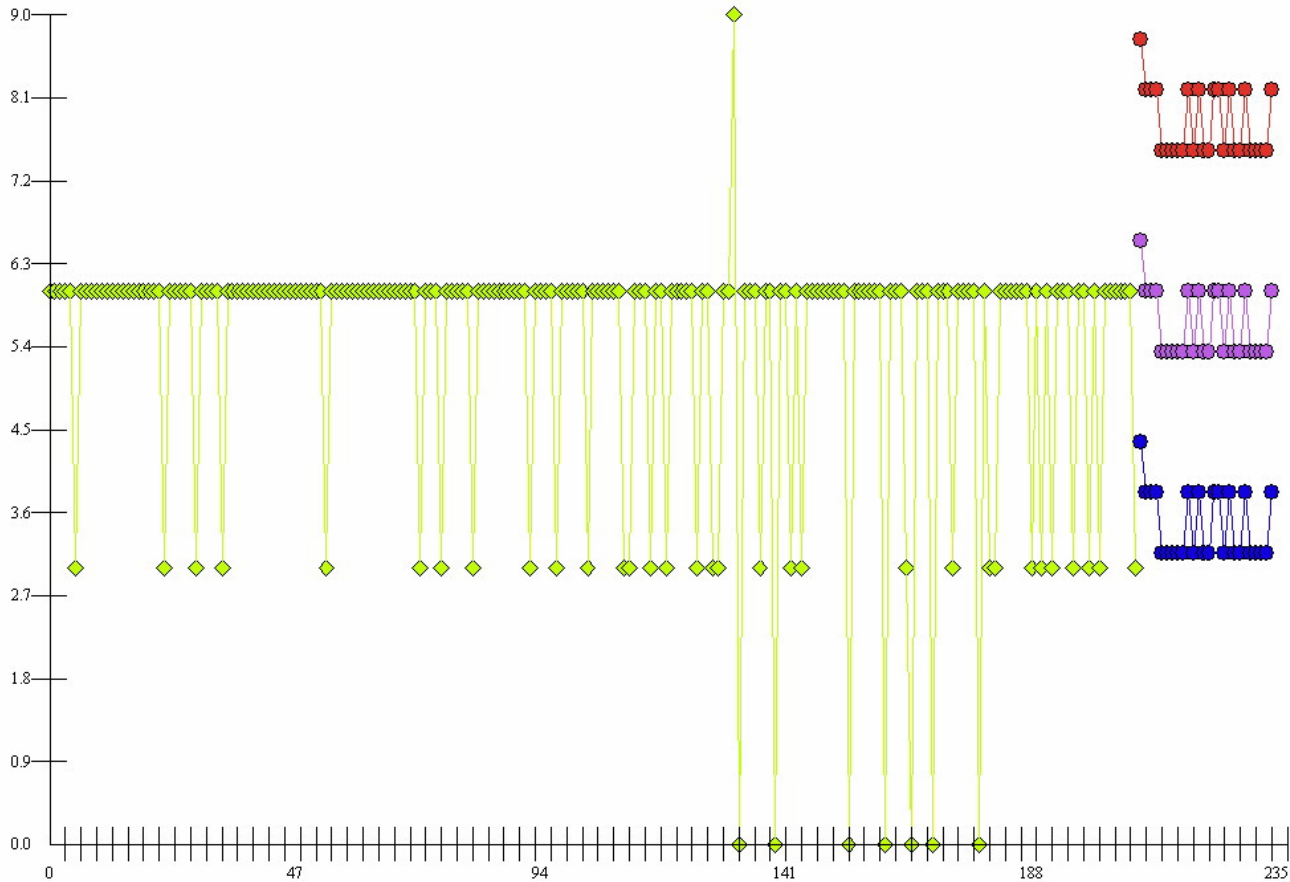
- Spawn process from SCOPTIMA to invoke AweSIM model
- Interface via Data Files or Database
- Results returned to SCOPTIMA via Data Files or Database



# Architecture



21913373



◆ Actual Data      ● Forecast Data  
● Lower Limit      ● Upper Limit

# SCOPTIMA Real-Time Dashboard

LOGIN

Refresh DATA

BSL's

- 310
- 311
- 312
- 313
- 314
- 315
- 316
- 317
- 318
- 319
- 320

NSN's

Display Selector

BSL

BSL+NSN

October 2005						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Service Rate

60.7

Bins

45

Zero Bins

1

Clocks

0

NSN DETAIL DATA

WAIT TIME METRICS - (Days)

CWT

1

BWT

1

Bin Performance

Forecast

View Forecast



# Conclusion

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- Challenging Supply Chain Problems
- Complex inventory model
- Integrated Enterprise System
- Advanced technology solutions





# Dr. Hank Grant

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Dr. Grant joined the faculty at the University of Oklahoma in December of 1993 as Director of the School of Industrial Engineering and Southwestern Bell Professor. He is currently Director of the Center for the Study of Wireless Electromagnetic Compatibility and Dugan Professor of Industrial Engineering. Prior to joining the University of Oklahoma, he was with the National Science Foundation in Washington, DC, where he directed programs in Production Systems, Engineering Design, and Operations Research. Dr. Grant was instrumental in the startup and development of two Industrial Engineering software companies: Pritsker Corporation and FACTROL. Dr. Grant is a Fellow of the Institute of Industrial Engineers and is a member of the following societies: INFORMS, Tau Beta Pi and The Institute of American Entrepreneurs. Dr. Grant received his Ph.D. from Purdue University in Industrial Engineering in 1980.





# Eugene Beardslee

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Eugene Beardslee is the software system architect of the Industrial Prime Vendor (IPV) project's enterprise system: SCOPTIMA Supply Chain Software. For the past five years, Mr. Beardslee has managed and directed the design, development, implementation and maintenance of all aspects of this logistics support software. Recipient of the 2003 SAIC Achievement Award for Excellence in Program Performance: Technology Development and Analysis, he has guided three successful Manufacturing Production and Engineering research projects focused on improved inventory and replenishment process performance. Mr. Beardslee has over 18 years experience in the production of software systems with over 12 years designing Oracle software systems. He is a member of the IEEE Computer Society, the Association for Computing Machinery and the Institute of Industrial Engineers. Mr. Beardslee received his Bachelor of Science degree in Computer Science in 1988, and his Master of Arts in Computer Resources and Information Management in 1997.

