Diamond Advanced Planning System Version 8 Documentation

Release 8

Jim Schmidt

August 01, 2020

CONTENTS

CHAPTER

ONE

OBJECTIVES

1. Maximum buyer productivity
2. Eliminate unnecessary purchases
3. Develop a standardized methodology for buyers that is deterministic, with the same input two buyers should come to the same conclusions.
4. Buyers should be able to test the results of a simulation by, for example adding a secondary manufacturer CofC to a lot and replan the part and get the answer back within a second with a new single screen.
5. All scenarios should be stored with the results.
6. Upon acceptance of a scenario the simulation changes should be reported so that the source systems can be update.
7. Status of simulation changes # Requested # Not possible - stops further recommendations to take this action # Active - Once a download from the source system reflects this change
8. A report of requested modification not yet completed on source systems

CHAPTER

TWO

PURCHASING OPERATIONAL EFFICIENCY

2.1 Purchasing Review Board

Requisitions may be reviewed by the purchasing review board

- Approval
- Disapproval
- Record disapproval reason for requisitions Purchasing review board

can select (or create and select) a reason such as:

- **Review equivalent parts**
  - Is onhand under another part
  - insufficient quotations (other vendors may have lower costs)

2.2 Speed up quotations

- Automatically email vendors request for quotations
- Automated quote response have the vendors provide a CSV, JSON or XML file with the quote to be automatically uploaded to the system.

For example a vendor could create a spreadsheet with the following columns

- item_cd
- quantity
- manufacturer
- price
- available date

by emailing to quotes@yourco.com these quotes can be automatically loaded into the system without changes to the legacy system,

2.3 Buyer information

The buyer should have single screen that shows:

1. Supplies
2. On hand
3. Open Purchase Orders
4. Open Work Orders
5. Demand
6. Forecasted
   (a) Raw
   (b) Consumed
   (c) Unconsumed
7. Safety Stock
8. Reserved Inventory
9. Quarantined
10. Restricted access (JIT programs, Committed Service Level Agreement Plans)
11. All part numbers in the planning group
12. Every part and all equivalents, transitively, that is the equivalents to those equivalents until exhausted.
13. Customer specific substitutions
14. Approved manufacturer matrix Customers down the left, manufacturers across the top
15. Requisitions
16. Supplier on-time historical metrics
17. Supply ineligibility drill-down
18. Vendor Quotes
19. Time phased inventory position, Pipeline (Global, by Facility, by planner)
20. On hand inventory in aggregate with the ability to open details with a single click
21. Sales history for the last three years in multiple dimensions
22. Time Dimensions include annual, quarterly and monthly
23. Ability to see by customer
24. Existing purchase orders
25. Existing facility transfers in process
26. Detailed reason why supplies are not eligible for a demand that is allocated late or short
27. A matrix of approved manufactures and customers
28. See the part and all transitive equivalent parts
29. Late or short demands

In Diamond this is all done locally in the web browser with no network requests so it is virtually instantaneous.

2.4 Recommendations

1. Purchase orders that can be cancelled
2. Get a manufacturer Certificate of Compliance for existing inventory to satisfy a requisition with existing inventory
3. Supply prioritization Use buyback inventory before using our inventory for appropriate customers
4. Allocation based pricing
5. Items with a shelf life have oldest allocated first
6. Less valuable items are allocated first
7. Based on Certifications (dual certified parts have more value)
8. Facility Transfer
9. Supply Pool Transfer
10. Expedite or de-expedite a purchase order

2.5 Alerts

- Obsolete Inventory
- Expiring Inventory
- Purchase Exceeding x% of previous maximum unit price
- Purchase Exceeding x% of previous minimum unit price
- Purchase of specified dollars not yet approved

CHAPTER

THREE

EXTENSIBILITY

Any component must be easily plugged in with an alternative implementation that is compliant with the corresponding interface,

- Demand Priority
- Eligibility Requirements
- Supply Prioritization
  - Lot value determination
- Recommendation Handlers for propagating accepted recommendations to source system

CHAPTER

FOUR

IMPLEMENTATION

- Extract necessary data from legacy systems
- Load into Advanced Planning
- Augment with necessary but unavailable information
- Run a full plan
- Review recommendations
  - Accept recommendation (must define Action Handlers) Reject recommendation (select reason to be persisted across full reloads)

4.1 Questions

1. Inventory Restriction
2. How do you restrict availability of inventory for special purposes such as
   - JIT contracts
   - Committed Service Level Agreements
   - Kitting and Assembly
3. Do you have automated approved manufacturer eligibility?
4. Do you have prioritization for lots with expiry dates?
5. How do you calculate the residual cost of goods for broker buys for the
6. Are you exclusively FIFO or do you consider lots that have lower cost that satisfies the demand (taking into consideration multiple certifications, incremental cost of Quality Assurance testing and destructive tests?), etc.? Quantity that exceeds the customer demand?
7. Quality Assurance Do you have a quality assurance program that supports skip lot testing and pre-approved lots (lots that have already passed the QA requirements for a customer should receive higher priority for that customer and lower priority for others)
8. What supply eligibility rules do you have?
9. How do you pin an allocation to a demand ?
10. Does your system recommend when alternate availability is preferable to a pinned allocation?

4.2 Simple Example

During one of my calls with Peter he told me that he was reviewing purchase orders a simple line such as "Buyers don't buy the correct quantities to get a good price" was extended to:

4.2.1 Compute Optimal Purchase Quantity

Compute a projected per unit cost by solving the equation

unit_cost = (setup_cost / qty) + incremental cost

For two different known qty and prices (vendor quotes) using linear algebra

4.2.2 Graph this relationsihip

Find the "price knee" the first derivative of the function, the slope of the tangent starts to level off (it asymptotically approaches 0, meaning the limit is the unit cost doesn't decrease at all. Depending on setup cost, incremental cost and annual consumption a three year supply may be ten percent more than a one year supply, it may also be three times the acquisition cost and additional carrying costs must be considered.

Vendor quotes should include this range of quantities, purchasing quantities should be in this range, buys can be made and even scheduled so that lower per unit costs can be realized.

4.3 Purchasing Procedures

When a part needs to be replenished

1. Vendor quotes for the price range should be required.
2. Purchase amounts over a defined limit should be reviewed and approved.
3. Requisitions should be created in the new purchase decision application and once approved, be created as purchase orders in the execution system (Dymax and SAP).
4. Checks for any constraints including approved manufacturers should be simulated
5. Existing inventory carried under equivalent part numbers should be considered.

The opportunities for process improvement are best addressed by evaluating your current processes and the issues your experts realize and developing a system to address those issues.

4.4 Constraints

Your new process should:

1. Be external to SAP and Dymax, requiring no modifications to either system. This eliminates risk and complexity.
2. Should include data from both operations for inventory, purchases and demands
3. Incorporate new procedures and policies to reflect best practices
4. Reduce the effort of sales staff and purchasing staff to perform their functions
5. Define metrics to evaluate performance and progress
6. Have an alert system of reports of issues that need to be addressed.

7. Require no hardware or other infrastructure or the installation of any software on any Align computer.

CHAPTER

FIVE

QUESTIONS

What is the current cost of

1. Not buying the correct quantities
2. Not taking into consideration multiple certifications
3. Buying inventory in one operation that is excess inventory in the other operation
4. Time wasted gathering information to create a purchase order

CHAPTER

SIX

CONCLUSION

Align has the expertise in house to participate in the design of a business process and software to optimize the purchasing and sales operations, there is no need to wait for an IT person who has much less experience than your director of purchasing and other operations personnel.

A one hour phone call every two weeks is not going to ever get you a design.

I have no doubt that several times every day a sub-optimal purchase results in a expense greater than the cost of developing a design.

A design is best done by whiteboard meetings, starting with a blank whiteboard. Even with 25 years experience in Aerospace, it would be presumption, and flat out wrong for me to give a Powerpoint presentation and say "This is the universal answer to all problems, it will fit your situation"; this is the approach of someone hawking software.

- Automatically email vendors request for quotations
- Automated quote response have the vendors provide a CSV, JSON or XML file with the quote to be
- automatically uploaded to the system.

For example a vendor could create a spreadsheet with the following columns

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CHAPTER

SEVEN

MODIFICATIONS

- All code is in Java supported by Spring with Hibernate for Object Relation Management, these are widely adoped open source solutions
- Presentation uses the Model, View Controller approach and the model may be exposed as a JavaBean or XML if one prefers to use XSL.
- Diamond dependencies are all vastly popular open source but it extremely unlikely anyone will have any need to modify anyy of the open source code
- I have trained non-programmers to modify Diamond in less than a month.

7.1 Questions

1. Inventory Restriction
2. How do you restrict availability of inventory for special purposes such as
    - JIT contracts
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    - Kitting and Assembly
3. Do you have automated approved manufacturer eligibility?
4. Do you have prioritization for lots with expiry dates?
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8. What supply eligibility rules do you have?
9. How do you pin an allocation to a demand ?
10. Does your system recommend when alternate availability is preferable to a pinned allocation?

CHAPTER

EIGHT

BUSINESS PROCESS IPROVEMENT

Overhaul all client Business Processes associated with Inventory Planning and the operations necessary to effect that overhaul

8.1 Business Process Improvement Description

Managed by Thomas Moreno, who wiil working with each department This describes Business Process Improvement at client

Objectives and Benefits:

- Define standardized procedures and tools to
- Improve employee productivity (facilitate decision makers and reduce clerical work)
- Produce better decisions
- Improve cash utilization
- Optimize inventory
- Produce more consistent results
- Grow sales
- Document procedures
- Audit trails
- Share inventory information across holding company units. Currently US and European operations duplicate work and inventory.
- Reduce inventory by using inventory maintained as equivalent parts.
- Allow these users to use the new system for better and more efficient decision making while offloading legacy system specific clerical work.
- Determinism, with the same input, make similar decisions

This initiative will benefit:

- Inventory Planners
- Buyers
- Sellers
- Customers

- Finance

8.2 Approach

Provide a software tool that

- Design to work as we desired to work
- Exception and priority based
- User interfackkkkke customized to each area of responsibility
- Simplify work
- Improve quality with team review
- Provide better decision support information
- Change procedures to reduce tedious work overheadl
- Allow for simplification
- Allow the system to work in accordance with policy with maximum efficiency for users
- improve inter-company cooperation
- Support proactive activity Additional System Functionality
- Controls
- iiiiiiiiiiiAs policies are developed the new system will enforce these policies with actions flagged for review to be approved or additional research as necessary.i * Describe current and Future State

- – List benefits of future state

8.3 Create tass for future state with

*i Describe what kwill be done in the future * Functional description * Prioritize tasks

*risk / No changes to existing systems

8.4 Document References

https://en.wikipedia.org/wiki/Business_process_re-engineering

CHAPTER

NINE

BUSINESS PROCESS IMPROVEMENT : DIAMOND HISTORY

1. Business Process Improvement
2. Project Description

9.1 Business Process Improvement : Diamond History

Created by James Schmidt, last modified on Dec 21, 2019

9.1.1 History

The User Interface has been rewritten many times since 1995

Oracle Forms 3

Oracle Forms 4.5

Java Servlets

Java JSP

Oracle Apex

Now being written in Angular 8

Layout

9.1.2 Login

9.1.3 Action Reports

9.1.4 Information Reports

9.1.5 Query

9.1.6 Item / Plan Group Listing

Document generated by Confluence on Dec 22, 2019 07:29

Atlassian

CHAPTER

TEN

BUSINESS PROCESS IMPROVEMENT : DIAMOND HISTORY

1. Business Process Improvement
2. Project Description

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10.1.5 Query

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Atlassian

CHAPTER

ELEVEN

INTRODUCTION

The Diamond Advanced Planning System (APS) is the most feature-rich inventory planning system in the market today. There is no other planning engine out there that can match the Diamond APS in terms of speed and versatility.

Diamond was custom designed to address the rigorous specifications of the Aerospace industry, which imposes significantly tighter controls and tracking functionality than a normal distribution environment and has numerous other constraints uniquely solved by Diamond APS.

Diamond Advanced Planning is a module that associates demand for product with inventory that satisfies the demand according to pluggable ("extensible") filters.

Although it was designed explicitly to accomodate the requirements of aerospace subsets of its features will readily support virtually any distribution, MRO or discrete manufacturing environment.

Diamond Advanced Planning was first written in 1983 by the author of this document and served well in planning for Fine China and giftware. Same was employed for a clothing manufacturer and subsequently for Tri-Star Aerospace. In 2001 a total rewrite was effected written in Java accommodating Aerospace requirements in version 10 of Diamond.

11.1 Demand Types

Supports multiple types of Demand. Demand types supported are

- Firm Customer Order
- Work Orders and (Components of Work Orders)
- Safety Stock
- Forecast

11.2 Supply Types

Supports multiple types of Supply:

- On-Hand at Location
- In-Transit from another Location
- Purchase Orders
- Work Orders

11.3 Eligible Supply Rules

Diamond APS is very flexible with respect to filtering supply that is eligible to meet demand.

Many filters are supplied and others may be added by writing a new one that complies with the EligibleSupplyFilter interface. New filters are "wired in" and existing code is not touched.

This allows for customization and rigorous testing of the customization with no risk associated with changes to the base code or precluding update support.

11.4 Supply Partitioning

Physical segregation of Inventory is done using facilities.

Logical Segregation of Inventory within a facility is done using Supply Pools.

Sourcing rules attached to every demand specify which supply to consume and the order in which to consume.

The most commonly used database entities are cached in memory. Cached entities include Facilities, Supply Pools, Sourcing Rules, Certifications, Business Calendar, Equivalent Part Numbers, Customer specific Substitutes, Global Substitutes, Organizations, Forecast Groups, Application Control variables and Purchase Order Equivalents. Caching saves on the expensive operations of database access for the most commonly used entities.

Triggers on cached tables signal the Planning engine to refresh those values.

Part Number, substitutes and equivalents are all planned together.

11.5 Qualifying Inventory

- Ability to specify the revision level required for Sales Order and Work Order, Safety Stock and Forecast. The revision level hierarchy setup in the Parts Master will automatically allocate a higher revision level if the requested revision level is not available.
- Ability to specify certification requirements for Sales Order and Work Order and associate it with the demand.
- Certification requirements for Safety Stock and Forecasts are picked up from the Customer Master.
- Each certification has a weight associated with it. APS uses qualifying lots with the lowest weight to satisfy any demand.
- Ability to specify the manufacturer required at the Demand level or can specify a list of approved manufacturers at the Customer Level. Customer List can be set to Include or Exclude approved manufacturers
- Ability to specify Country of Origin on the Sales Orders.
- Ability to specify "manufactured after" or "must not expire before" date on Sales Orders for parts with a shelf life.
- Automatically excludes expired part numbers
- Kits can be setup in the system to not have mixed manufacturer lots allocated to them for any single kit. APS automatically determines the lot quantity and how many full kits it can satisfy and then switches to the next available lot to satisfy any remaining kits.

11.6 Demand Prioritization

Demand Prioritization module compares every demand for a given set of part numbers and sorts them according to a deterministic process that complies with the EligibleSupplyPrioritizer.

11.7 Preserve Allocations

Once sorted, Demand Prioritization also preserves On-hand allocations to Customer Orders and Work Orders within lead-time. All allocations to Safety Stock are preserved. Preserving existing allocations prevents demands that have been put in later from taking stock away from already existing orders. Safety Stock demand is allocated to Customer Orders and Work Orders within the same forecast groups if there is a shortage. Forecast Demands are reduced by the quantity of open Customer Order demands for the same month for the same forecast group, which stops over stating of demand for a given month.

11.8 Supply Prioritization

Supply prioritization uses the sourcing rules to determine which supplies to use to satisfy a given demand.

Different rules are applied in different scenarios.

11.9 Demand Execution Mode

TODO describe the various modes

Firm customer orders may be allocated to on-hand inventory or to the latest replenishment prior to request date.

Assignment to replenishments is based on vendor on time performance.

Once the qualifying supplies are identified, they are then sorted based on the type of the demand and type of the supply.

An example for this would be to use the oldest lots to satisfy open sales orders while using the newest possible lots to satisfy safety stock demand.

Since safety stock demand is never shipped, it blocks the newer inventory allowing the older lots to ship out before the newer ones. Supply prioritization changes the FIFO order for parts based on the settings in the Parts Master.

Parts with a shelf life can be consumed based on the Manufacture Date or on the Expiration Date of the lots. Supply Prioritization also automatically relaxes all the constraints on the demand when allocating consignment or buyback supply to a demand.

Buyback and consignment supply is stock received from the customer that is shipped back to them when they need it. This stock is always deemed to meet customer requirements.

- Allocations against on-hand supply are classified as Firm or Planned depending on if the on-hand supply is readily available in the primary facility or if the on-hand supply is a planned facility transfer or a processed facility transfer in transit to the primary facility. The primary facility for a demand is identified based on the sourcing rule used to determine the eligible supply for the demand.
- APS automatically creates work orders for kits. Since APS supports multi-level Bills of Material, it creates work orders for sub-kits and re-plans all the items recursively till all the demands for kits have been allocated either to on-hand inventory or to a work order.

- Purchase Orders schedules that are late are automatically padded by a user-defined factor and pushed forward. This enables the system to provide realistic availability dates for the demands which are allocated to those PO schedules.
- Automatically allocates demands to a Purchase Order if the demand is "X" days out in the future and there is a PO Schedule coming available "X" days before the demand is due. The value of "X" is read in from a Control table.
- APS will suggest a optimum reschedule date for the PO Schedules that have allocations against demands that need to be expedited or rescheduled to come in at a date later than the current promise date provided by the vendor
- APS will also suggest cancellation of PO schedules that are not needed to meet any demand that is present in the system.

11.10 Auditing and Traceability

Allocation logic fully traceable. An XML log file may be created created for each item group planned detailing each demand and all supplies, which ones were allocated and which ones were rejected and the reason for rejection.

Ability to bind a given supply to a given demand as long as the supply is qualified for the demand. Allocations once bound are held bound unless unbound by the user.

11.11 APS Output

The Inventory planning process is the most impacted by running Diamond APS. The APS output is fully web-based and provides the Inventory planners with all the information required to make sound buying decisions. Inventory planners have the ability to lookup shortfalls by specifying a whole range of filter conditions. Listed below are the details of the outputs provided by Diamond APS.

11.12 Shortages

Diamond APS classifies shortages into the following categories

Demand Unallocated Late ———— ——— —- Customer Orders Work Orders Forecast Safety Stock

Customer Orders

- Unallocated Customer Orders
- Unallocated Work Orders
- Unallocated Safety Stock
- Unallocated Forecasts
- Customers Orders allocated beyond the requested date
- Work Orders allocated beyond the requested date
- Safety Stock allocated beyond the requested date
- Forecasts allocated beyond the requested date

Users can choose a combination of any of these shortage conditions and then apply the following filters to narrow their search

Part Number Mask (A Wildcard search for a range of Part Numbers)

The Part Category. Normally buyers are responsible for purchasing a certain category or categories of parts. This help narrow the results to only the parts they are responsible for purchasing. Within Lead Time. This restricts the output only to shortages that occur within the lead time for a given Part Outstanding Vendor Quotes less than "X" days. This further narrows the search and ignores the parts that have outstanding vendor quotes that are less than "X" days old. Vendors normally take some time to respond to quotes and this help buyers from seeing the same parts on the list even after they have worked on it. Planning Horizon End Date. This restricts the list of parts being shown to have shortages only within the Date specified here Buyer. This only shows the parts the specified buyer is responsible for buying. Customer Code. This restricts the list of parts only to the shortages for the customer specified. Maximum Part to display. The default is set to 100. The users can specify any number greater than 0.

Once the search criteria is specified, APS will go through its planning results and find all the part numbers that match the specified search criteria. It will then sort them into 4 groups.

A Part will only appear in one of these groups, the group in which the part has the earliest shortage. Each part then links off into a 12-month time-phased view of the Demand and Supply outlook. The time-phased output has columns for past due, current, 12 months starting with the current month and a column for demands and supplies coming in beyond 12 months. This page also provides links to see the following information The Allocation Trace Log. This file contains a complete log of the allocation process for the part and all its substitutes and equivalents. Provides a listing of all the supplies available to allocation and also lists each demand followed by which supplies were allocated to it and which supplies were not and also provides a reason for ineligible supplies for the Demand.

11.13 Workbook

The Work Book create an excel spread sheet with the following information about the Part.

- The On-Hand inventory summary by Lot, Facility and Supply Pool,
- Customer and Vendor Quotes for the Part,
- Open Purchase Orders,
- Open Sales Orders,
- Historical Shipments
- a 12 month forecast by forecast group.
- Customer Quotes Listing
- Vendor Quotes Listing
- Approved Manufacturers by customer

  The work book can then be saved of and helps buyers

maintain a log of the demand/supply scenario at the time they made any purchase. A listing of all available supply and which demands it is allocated to A listing of all demands and what supplies are allocated to it Approved Manufacturers. Provides a cross-tab view of the customers and their approved manufacturers. Helps buyers make a choice of buying from the manufacturer that will satisfy the most number of customers.

Rescheduling information for any PO Schedules in the system Shipment Details. Provides a listing of all the shipment of this part to any customer. Forecast History. Provides a time-phased display of the forecast history by forecast group for the given part. Also lists the forecasts by forecast group. Shipment Summary. Provides a year-month cross-tab of shipment of this part. Shipment Summary by Customer. Provides a year-month cross-tab of shipment by customer of this part. Ability to lookup shortfalls by the following

- Item Certification
- Manufacturer and vendor certification
- Lists shortfalls based on explicit certifications requested on the Demand. A review of these might help the user offer
- Country of Origin
- Approved Manufacturer
- Explicit Manufacturer Requested on the Demand
- Revision Level
- Re-certification opportunities

Ability to lookup Rescheduling Requirements in the following groups

11.13.1 Purchase Orders to be Expedited

Provides a summary by Vendor of the Purchase Orders that need to be expedited to meet current and forecasted demand. Users can then drill down into each Vendor and look at each individual PO Schedules need to be expedited and the system also suggested expedite date taking into account the time required to process the receipt after it arrives.

11.13.2 Purchase Orders to be Rescheduled

Provides a summary by Vendor of the Carrying Cost and the Cancelable Cost for PO Schedules that can either be pushed out for cancelled. Users can then drill down into each Vendor and look at each individual PO Schedule that needs to be rescheduled. For PO schedules that need to be pushed out, the system suggests the new date by which they are required.

11.13.3 Purchase Orders to be Cancelled

Provides a summary by Vendor of the cancelable cost of outstanding PO Schedules. Users can then drill down into each Vendor and see the individual PO Schedules that need to be cancelled.

CHAPTER

TWELVE

APS FEATURES AND BENEFITS

1. Business Process Improvement
2. Project Description
3. Diamond Portal
4. Portal Functionality
5. Data Prerequisites

CHAPTER

THIRTEEN

PURPOSE

This document is intended to introduce Client to Diamond APS and lay out Client objectives and a pathroad to satisfy those objectives.

This is intended to be evergreen, to evolve as requirements are determined and to be fleshed out with technical details.

Personally, I would rather a revisioned, indexed, searchable single document than hundreds of documents. I will assume the responsibility of maintaining this.

CHAPTER

FOURTEEN

CURRENT STATE

CHAPTER

FIFTEEN

FUTURE STATE

Create a central repository of inventory from both systems in a

relational | database accessible through a browser.

Use all open source software whenever possible

AWS
Redhat 8
Postgres 12
Maven 3.2
Java open jdk 12/Spring/Hibernate
Tomcat/Node/Angular

CHAPTER

SIXTEEN

CLIENT OBJECTIVES

16.1 Team

16.2 Migration Plan

CHAPTER

SEVENTEEN

INTRODUCTION

The Diamond Advanced Planning System (APS) is the most feature-rich planning engine out there that can match the Diamond APS in terms of speed and versatility.

Diamond APS is a unique combination of DRP/MRP planning and execution that is aware

of engineered parts and Aerospace constraints.

Diamond distribution was designed to address the supply chain planning and execution requirements of distributors. Diamond was custom designed to address the rigorous specifications of

the Aerospace industry, which imposes significantly tighter controls and tracking functionality than a normal distribution environment.

Features Supports Synchronous and Asynchronous planning queues. Parts

in the synchronous planning queue are planned the instant they are put nto

the queue. The planning engine plans parts in the asynchronous planning

queue when it reaches the top of the queue. The asynchronous planning queue is activated every time a part is inserted into the queue.

17.1 Demand Types

Supports multiple types of Demand. Demand types supported are

- Firm Customer Order
- Work Orders (Components of Work Orders)
- Safety Stock
- Forecast

17.2 Supply Types

Supports multiple types of Supply. Supply Types supported are

- On-Hand at Location
- In-Transit from another Location
- Purchase Orders
- Work Orders

17.3 Supply Partitioning

Physical Segregration
^^^^^^^^^^^^^^^^^^^^

Physical Segregation of Inventory is done using Facilities

Logical Segregation
^^^^^^^^^^^^^^^^^^

Logical of Inventory within a facility is done using *Supply Pools*

Sourcing Rules attached to every demand specify which supply to

consume | and the order in which to consume.

Part Number, substitutes and equivalents are all planned together

17.4 Qualifying Inventory

- Ability to specify the revision level required for Sales Order and Work Order, Safety Stock and Forecast. The revision level hierarchy setup in the Parts Master will automatically allocate a higher revision level if the requested revision level is not available.
- Ability to specify certification requirements for Sales Order and Work Order and associate it with the demand.
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switches to the next available lot to satisfy any remaining kits.

Tests include

17.5 Demand Prioritization

Demand Prioritization module compares every demand for a given set of part numbers and sorts them in the following order

- Sales Orders
- Work Orders
- Safety Stock
- Forecasts

17.6 Preserve Allocations

Once prioritized, Demand Prioritization also preserves On-hand

allocations to | Customer Orders and Work Orders within lead-time. All allocations to | Safety Stock are preserved. Preserving existing allocations prevents | demands that have been put in later from taking stock away from already | existing orders. Safety Stock demand is allocated to Customer Orders and | Work Orders within the same forecast groups if there is a shortage. | Forecast Demands are reduced by the quantity of open Customer Order | demands for the same month for the same forecast group, which stops over | stating of demand for a given month.

17.7 Supply Prioritization

Supply prioritization uses the sourcing rules to determine which supplies to use to satisfy a given demand.

Once the qualifying supplies are identified, they are then sorted

based on the type of the demand and | type of the supply.

An example for this would be to use the oldest lots to satisfy open sales orders while using the newest possible lots to satisfy safety stock demand. Since safety stock demand is never

shipped, | it blocks the newer inventory allowing the older lots to ship out before | the newer ones. Supply prioritization changes the FIFO order for parts | based on the settings in the Parts Master. Parts with a shelf life can | be consumed based on the Manufacture Date or on the Expiration Date of | the lots. Supply Prioritization also automatically relaxes all the | constraints on the demand when allocating consignment or buyback supply | to a demand. Buyback and

consignment supply is stock received from the | customer that is shipped back to them when they need it. This stock is | always deemed to meet customer requirements.

- Allocations against on-hand supply are classified as Firm or

  Planned | depending on if the on-hand supply is readily available in the | primary facility or if the on-hand supply is a planned facility | transfer or a processed facility transfer in transit to the primary | facility. The primary facility for a demand is identified based on | the sourcing rule used to determine the eligible supply for the | demand.

- APS automatically creates work orders for kits. Since APS supports
  multi-level Bills of Material, it creates work orders for sub-kits
  and re-plans all the items recursively till all the demands for

  kits | have been allocated either to on-hand inventory or to a work order.

- Purchase Orders schedules that are late are automatically padded by
  a user-defined factor and pushed forward. This enables the system

  to | provide realistic availability dates for the demands which are | allocated to those PO schedules.

- Automatically allocates demands to a Purchase Order if the demand

  is | "X" days out in the future and there is a PO Schedule coming | available "X" days before the demand is due. The value of "X" is | read in from a Control table.

- APS will suggest a optimum reschedule date for the PO Schedules

  that | have allocations against demands that need to be expedited or | rescheduled to come in at a date later than the current promise date | provided by the vendor

- APS will also suggest cancellation of PO schedules that are not
  needed to meet any demand that is present in the system.

Allocation logic fully traceable. An XML or JSON log file may be

created created | for each item group planned detailing each demand and all supplies, | which ones were allocated and which ones were rejected and the reason | for rejection.

Ability to bind a given supply to a given demand as long as the supply
is qualified for the demand. Allocations once bound are held bound
unless unbound by the user.

17.8 APS Output

The Inventory planning process is the most affect by running Diamond
APS. The APS output is fully web-based and provides the Inventory
planners with all the information required to make sound buying
decisions. Inventory planners have the ability to lookup shortfalls by
specifying a whole range of filter conditions. Listed below are the
details of the outputs provided by Diamond APS.

17.9 Projected Inventory Position

PIP Projected Inventory Position.

Each supply has an *available date*

For on-hand inventory that is the current date or the *effective date*

in case of some | simulations.

For purchase orders that is the *current promise date*.

For work orders that is the *need by date*.

A timeline is created by generating *buckets*, typically calendar months.

Each supply has its own PIP, which is strictly decreasing. Allocations

of demand are bucketed based on *current promise date* | or the associated supply *available date*, whichever is later.

In the aggregate positions can increase and decrease as in a

traditional DRP system. Aggregations can | be at the part, supply pool, facility level or any combination thereof.

If the availability date for a demand is greater than the *current

promise date*, there is a shortage. This shortage | may be actionable

- Expedite the purchase order
- Relieve other supply to satisfy this demand by changing its supply pool
- Create a new requisition

If the earliest demand date for a supply falls in a later bucket than the supply availability this may be actionable:

- Reschedule the Purchase Order or Work Order

Consideration must be made to eliminate *nervouos* adjustments, those

for a short time period or for dollar amounts | such that de-expediting costs exceed the time value of the early receipt

Traditional DRP PIP

.. code-block::
11/2019 12/2019 01/2020 02/2020 03/2020

Onhand 1000 400 250 900 750
Forecast 150 150 150 150 150
Orders 600 30
Replen
Additional Replen 800
Projected 400 250 900 750 600

In traditional DRP the additional replenishment is an Economic Order Quantity *EOQ*

This is not applicable to aerospace due to the unit price sensitivity to order quantity.

You probably know what an *EOQ*, if not a quick refresher is just a *google* or *duckduckgo* search away.

This model also fails to take into consideration a myriad of

constraints which may | make a given supply ineligible for a given demand. This is a model for SKU inventory, | not for engineered parts.

Note that orders and forecast are both demands but are not aggregated,

orders *consume* | *the forecast*.

Optimal Replenishment Quantity

17.10 Shortages

Diamond APS classifies shortages into the following categories

- Unallocated Customer Orders
- Unallocated Work Orders
- Unallocated Safety Stock
- Unallocated Forecasts
- Customers Orders allocated beyond the requested date
- Work Orders allocated beyond the requested date
- Safety Stock allocated beyond the requested date
- Forecasts allocated beyond the requested date

Users can choose a combination of any of these shortage conditions and
then apply the following filters to narrow their search

Part Number Mask (A wildcard search for a range of Part Numbers)

The Part Category. Normally buyers are responsible for purchasing a certain category or categories of parts. This help narrow the results

to | only the parts they are responsible for purchasing.

Within Lead Time. This restricts the output only to shortages that

occur within the lead | time for a given

Part Outstanding Vendor Quotes less than "X" days. This further narrows the search and ignores the parts that have outstanding vendor quotes that are less than "X" days old. Vendors normally take some time to respond to quotes and this help buyers from seeing the

same | parts on the list even after they have worked on it.

Planning Horizon End Date. This restricts the list of parts being

shown to have shortages | only within the Date specified here Buyer. This only shows the parts the | specified buyer is responsible for buying.

Customer Code. This restricts the list of parts only to the shortages

for the customer specified. | Maximum Part to display. The default is set to 100. The users can specify any number greater than 0.

Once the search criteria is specified, APS will go through its

planning | results and find all the part numbers that match the specified search | criteria. It will then sort them into 4 groups.

- Unallocated or Late Customer Orders
- Unallocated or Late Work Orders
- Unallocated or Late Safety Stock
- Unallocated or Late Forecasts

A Part will only appear in one of these groups, the group in which the part has the earliest shortage. Each part then links off into a

12-month | time-phased view of the Demand and Supply outlook. The time-phased | output has columns for past due, current, 12 months starting with the | current month and a column for demands and supplies coming in beyond 12 | months. This page also provides links to see the following information | The Allocation Trace Log. This file contains a complete log of the | allocation process for the part and all its substitutes and equivalents. | Provides a listing of all the supplies available to allocation and also | lists each demand followed by which supplies were allocated to it and | which supplies were not and also provides a reason for ineligible | supplies for the Demand.

Work Book. The Work Book create an excel spread sheet with the

following | information about the Part.

The On-Hand inventory summary by Lot, Facility and Supply Pool,

- Customer Quotes
- Vendor Quotes
- Open Purchase Orders
- Open Sales Orders
- Shipments and a forecast by forecast group.
- Provides a cross-tab view of the customers and their approved manufacturers. Helps buyers make a choice of buying from the manufacturer that will satisfy the most number of customers.

The work book can then be saved of and helps buyers
maintain a log of the demand/supply scenario at the time they made any
purchase. The system takes a snapshot of the full state of planning at

the time | of requisition approval.

A listing of all available supply and which demands it is
allocated to A listing of all demands and what supplies are allocated

to | it Approved Manufacturers.

Rescheduling information for any PO Schedules in the system Shipment
Details. Provides a listing of all the shipment of this part to any
customer. Forecast History. Provides a time-phased display of the
forecast history by forecast group for the given part. Also lists the
forecasts by forecast group. Shipment Summary. Provides a year-month
cross-tab of shipment of this part. Shipment Summary by Customer.
Provides a year-month cross-tab of shipment by customer of this part.
Ability to lookup shortfalls by the following

- Item Certification
- Manufacturer and vendor certification

- Lists shortfalls based on explicit certifications requested on the Demand. A review of these might help the user offer
- Country of Origin
- Approved Manufacturer
- Explicit Manufacturer Requested on the Demand
- Revision Level
- Re-certification opportunities

Ability to lookup Rescheduling Requirements in the following groups

17.10.1 Reports

Purchase Orders to be Expedited

Provides a summary by Vendor of the Purchase Orders that need to be expedited to meet current and forecasted demand. Users can then drill down into each Vendor and look at each individual PO Schedules need to be expedited and the system also suggested expedite date taking into account the time required to process the receipt after it arrives.

17.10.2 Purchase Orders to be Rescheduled

Provides a summary by Vendor of the Carrying Cost and the Cancelable Cost for PO Schedules that can either be pushed out for cancelled.

Users | can then drill down into each Vendor and look at each individual PO | Schedule that needs to be rescheduled. For PO schedules that need to be | pushed out, the system suggests the new date by which they are required.

17.10.3 Purchase Orders to be Cancelled

Provides a summary by Vendor of the Cancelable cost of outstanding PO Schedules. Users can then drill down into each Vendor and see the individual PO Schedules that need to be cancelled.Export Dymax ISAM

files to flat files | Using javautil fixed record mapping utility populate RDBMS tables that map to Dymax records

Write conversion scripts to convert to Diamond Schema.

Supplement with additional data as necessary

Choose the 100 highest value parts as the basis of test suite of data.

Setup Rules

Augment data - setup multiple equivalents, quality assurance valuations, etc.

Run a plan against the parts and review

Document generated by Confluence on Dec 22, 2019 07:29

Atlassian

CHAPTER

EIGHTEEN

ALLOCATION LOGIC

18.1 Modes

Allocation has different behavior based on the allocation mode. The aerospace planning implementation supports four phases each with a different mode.

18.2 Phases

18.2.1 Pick Restore

Existing allocations to onhand inventory from work orders or customer orders that are in pick status are preserved.

This Mode is also used in binding allocations.

An allocation is bound by updating the alloc_type_id to 'R' and requesting the engine to bind the allocation. The alloc_type_id is then set to 'B' for Bound.

18.2.2 First Pass

18.2.3 Customer Prioritized

18.2.4 Overship

The request for Overship is used when variations in the requested ship quantity are supported. For example a customer orders 1000 washers, after the picker picks the order there are only 10 washers left in the box. If the customer allows over shipping then 1010 washers will be picked for his order as it is not worth the time to put 10 washers back in the box and put them away.

The overship phase ensures that the 10 washers are not needed by another demand and changes the

18.3 Restore Onhand Pick Allocations

18.4 Bound Allocations

CHAPTER

NINETEEN

APSFEATURESBOOK

- Describe Boeing Airworthy certificate.

19.1 Challenges

19.2 Certification of Compliance

Many aerospace parts are specified by engineering drawings and may be manufactured by a wide variety of companies. These companies may issue a *Certificate of Compliance* that attests that the parts satisfy the requirements set forth by the drawing issuer.

Examples of drawing issuers are

- AN - Army/Navy
- MS - Millspec
- NAS -

19.2.1 Drawing Issuers

A given physical piece may actually satisfy requirements for many different parts. An example is a cadmium plated steel flat washer for a 3/16 inch screw.

- Material: Steel
- Screw Size: 3/16 / #10
- Outside Diameter: .438 Inches
- Inside Diameter: .203 inches
- Thickness: .063 inches

19.3 Part Names

A part may be known by more names than the drawings specify. Diamond is able to identify the part by any of these naming conventions.

1. Vendors may have their own names

2. Customers may have there own names
3. Your organization may have yet another name
4. Engineered part name

```
NAS1149F0363P
910C331-10
AN960-10
```

- Part Traceability
- Approved Manufacturers by Part
- Approved Manufacturers by Customer
- Lot Level Costing
- Customer Specific Inspection
- Revision Levels

19.4 Part Names

A part may be known by more names than the drawings specify. Diamond is able to store and identify the parts by any of these naming conventions

19.5 Certifications

Complete support for item certifications

19.6 Expiration Date, Cure Date

Support for Cure Date, Expiration Date and

19.7 Simplify

19.8 Supply Pools

Supply pools support logical separation of inventory to facilitate availability to demand Supply Pools are location independent A pool may be consignment or buyback inventory Pools and locations form the basis of "Supply Prioritization"

19.9 Sub Pools

Sub pool types:

- Consignment

- Buyback
- Vendor Stock
- General

19.10 Sourcing Rules

Sourcing Rules are used to determine which supply is given to a given demand and in what order to prioritize the supplies Supplies include On-Hand Inventory, Purchase Orders and Work Orders Each Supply Type for every Supply Pool where it may exists is given a priority within a sourcing rule Can be used to segregate consignment and buyback inventory by including them only in the sourcing rules for customers who are eligible to consume it. Is also used to identify the facility and the supply pool where work orders should be automatically created if needed to satisfy any open demand

19.11 Multiple Certifications

The manufacturer Certificate of Compliance to which a given receiver is qualified is explicitly tracked The part is visible through all parts to which it is certified or equivalent Purchasing supports explication of each part to which the inventory should be certified Inspection validates that purchasing requirements are fulfilled

19.12 Bound Allocations

Allocations may be "bound." This ensures that demand supply prioritizations are not changed Allocations may be bound to incoming facility transfers Allocations may be bound to Purchase Order Schedules which is then transferred over to On-Hand Inventory when it is received

19.13 Introduction

19.14 Features

- Simultaneously supports interactive and batch mode planning
- Generates work orders for kits, assemblies and ???
- Supports Engineered Parts, a single item may simultaneously have multiple part numbers
- Allocation Based Pricing

19.15 Demand Types

19.16 Customer Orders

A customer may be an external organization not within the legal hierarchy of legal entities encompassed by the organization that provides the planning service or be subordinate to the penultimate holding company of the organization

providing planning. These relationships have no bearing on the requirement of the planning organization to fulfill demand in accordance with the contractual rules.

Stated more simply, a customer in the sense of planning is an organization with a specified set of requirements for the fulfillment of inventory.

19.17 Safety Stock

19.18 Forecasted Demand

Diamond provides a statistical forecasting model that forecasts demand based on historical consumption. The planning module is agnostic with respect to the source of the forecast and any forecast system may be used.

19.19 Work Orders

Work orders may take the form of kits, assemblies or rework.

19.20 Supply Types

19.21 On hand inventory

Onhand inventory includes inventory in transit to another warehouse and considers the availability date the time it will take to ship, receive and putaway the inventory.

19.22 Replenishments

A replenishment is additional inventory coming from an external source. This may be the result of a purchase order or anticipated receipt of buyback ??? or consignment inventory.

19.23 Work Orders

A work order is used to designate a part which has components, such as kits, assemblies and parts that require transformation to convert them to another part.

A zinc plated bolt may be converted to a nickel plated bolt by stripping the zinc, copper plating and then nickel plating. Each such operation may have a yield of less than 100

19.24 Planning Group

It is posited that no aerospace planning can be of much value in the absence of planning demand for parts that constitute a planning group, that is all parts which have the same form fit and function are interchangeable and those parts which have been previously been approved by the consumer of said parts as acceptable substitutes for the specified part.

Interchangeability is defined as the parts being equivalent. A single part may comply with multiple engineering diagrams and when produced by a manufacturer of repute acceptable to the consumer and accompanied by a manufacturer Certificate of Compliance with said diagram, these parts are considered equivalent even in the absence of aforesaid Certificate, for often such certification may be purchased from the manufacturer, or waived by the knowing consumer.

19.25 Sourcing Rules

19.26 Eligibility Tests

Generally elibility tests may be considered as filters, that is, the order of the tests is inconsequential and each test may exclude the supply as being applicable for the demand. On occassion two or more tests may exhibit characteristics such that the qualification of either test is sufficient. Consider the case of buyback inventory in which inventory has been purchased from an airframe manufacturer but traceability to the ultimate source is not available. The airframe manufacturer may state that if the inventory was procured from the manufacturer under certain conditions those parts may bypass requirements that would otherwise be in place. It is the responsibility of the kitting or JIT provider to provide traceability back to the airframe manufacturer without any bearing any responsibility for ultimate traceability.

19.27 Certification of Compliance

Many aerospace parts are specified by engineering drawings and may be manufactured by a wide variety of companies. These companies may issue a *Certificate of Compliance* that attests that the parts satisfy the requirements set forth by the drawing issuer.

Examples of drawing issuers are

- AN - Army/Navy
- MS - Millspec
- NAS -

19.28 Attribute Certification

19.29 Approved Manufacturers by Part

19.30 Approved Manufacturers by Customer

19.31 Revision Levels

19.32 Certifications

Complete support for item certifications

19.33 Revision Levels

Complete support for Revision Level Hierarchy

19.34 Expiration Date, Cure Date

Support for Cure Date, Expiration Date and

Cure Date

19.35 Country of Origin

19.36 Revision Levels

Revision Levels may be specified on the demand Supports superceding revision levels, if a higher level revision satisfies lower level revision requirements, the higher level revision is automatically eligible

19.37 Sourcing Rules

Sourcing Rules are used to determine which supply is given to a given demand and in what order to prioritize the supplies Supplies include On-Hand Inventory, Purchase Orders and Work Orders Each Supply Type for every Supply Pool where it may exists is given a priority within a sourcing rule Can be used to segregate consignment and buyback inventory by including them only in the sourcing rules for customers who are eligible to consume it. Is also used to identify the facility and the supply pool where work orders should be automatically created if needed to satisfy any open demand

19.38 Multiple Certifications

The manufacturer Certificate of Compliance to which a given receiver is qualified is explicitly tracked The part is visible through all parts to which it is certified or equivalent Purchasing supports explication of each part to which the inventory should be certified Inspection validates that purchasing requirements are fulfilled

19.39 Revision Levels

Revision Levels may be specified on the demand Supports superceding revision levels, if a higher level revision satisfies lower level revision requirements, the higher level revision is automatically eligible

19.40 Eligible Supply

Approved Sources Equivalent Parts Buyback and Consigned Inventory Inventory Pooling Manufacturer Certificate of Compliance Customer Substitutes Global Substitutes Geographic Inventory Locations Revision Levels

19.41 Eligibility Tests

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19.42 Approved Manufacturer

A customer may define a *white list* or *black list* of manufacturers by part.

19.43 Buyback

Buyback inventory is purchased by a distributor from a customer and may be sold back to that customer even in the absence of complete traceability in the hands of the distributor.

19.44 Certifications

Certifications can assume arbitrary meanings.

Examples of Certifications include for example only

- Manufacturer Certificate of Compliance
- ??? list additional
- Manufacturer Certificate of Compliance

19.45 Consignment Inventory

Consignment inventory

19.46 Contract Aerospace

19.47 Country of Origin

A demand may specify that the supply must be from a specified country. A filter exists to enforce this requirement.

19.48 Equivalency

Equivalency is defined as a part number that complies with the engineering specification for another part. Although an equivalent part will not be automatically allocated by the planning engine, suggestions may be made that a Certificate of Compliance for the lot in question.

19.49 Expiry Date

A demand may explicate the latest date of expiry for the supply. This filter ensures that the supply complies with the demand minimum expiration date.

19.50 Manufacturer

19.50.1 Explicit Manufacturer

A given demand may specify that a part must be made by one manufacturer.

19.50.2 Approved Manufacturer

Customers may be set up with rules for approved manufacturers inclusively or exclusively.

19.51 Lot Date

A demand may have an associated maximum date of manufacture.

19.52 Revision Level

Complete support for Revision Level Hierarchy

19.53 Substitutes

19.54 Sourcing Rule

Sourcing rules

19.55 Approved Manufacturer

A customer may define a *white list* or *black list* of manufacturers by part.

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Consignment inventory

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19.63.1 Explicit Manufacturer

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Customers may be set up with rules for approved manufacturers inclusively or exclusively.

19.64 Lot Date

A demand may have an associated maximum date of manufacture.

19.65 Revision Level

19.66 Substitutes

19.67 Sourcing Rule

Sourcing rules

19.68 Planning Groups

19.69 Aerospace Features

- Show which items could obtain certification rather than procure
- Generate Warehouse Transfers
- Generate Work Orders
- Overship Capability

19.70 Planning Mode

19.71 Execution Planning Mode

In this mode demand the supply prioritizer gives higher precedence to the supply associated with delivery most prior to ???

19.72 Inventory Planning Mode

Inventory Planning Mode attempts to allocate demand such that on hand inventory is exhausted, deferring allocation to purchase orders or work orders to the first available by date. The result of this is that a reschedule date can be derived from the first requirement date.

19.73 Bound Allocations

A demand may be bound to a supply. These allocations are restored foremost in the first pass of allocation. Bound states include

- R Request
- B Bound

19.74 Logging

All of the decision paths for a planning group are incorporated into a single logging entity reflecting each of the decisions and prioritization. This data is persisted in XML, generally in a relational database.

19.75 Certifications

```
8130/MCC BOEING 8130 OR MCC
AIRLREL  AIRLINE RELEASE CERTIFICATE
AIRWORT  AIRWORTHINESS CERTIFICATE
ANODRIVT ANODIZED BOEING RIVETS
CERTBAC  CERTIFIED BY BOEING CORP
CHEMTEST CHEMICAL TEST REPORTS
CLASS3IN CLASS3 INSPECTION REQUIRED
CPT      Certificate Of Proof Test
D590BAC  D590 Parts
DFARS    Material Compliance With Military Requirements (DFARS)
DSQAR    Delegated Supplier QA Representative
LINKCERT LINKED ALL CERTIFICATES
MATRCERT RAW MATERIAL TEST REPORTS
MFGCOFC  Manufacturer Certificate Of Conformance
MFR-FAI  Manufacturer's FAI
MILSPEC  MIL SPEC DOCUMENTATION
MISSTEST missing performance test
PHYTEST  PHYSICAL TEST REPORTS
PLATCERT PLATING CERTIFICATE
PPAPCERT PPAP CERTIFICATION
PROCESS  PROCESS CERT FOR PATCH
REPAIRPN Item that is repaired
ROHS     RoHs Compliant
VENDCERT VENDOR CERTIFICATE
```

19.76 Kitting

CHAPTER

TWENTY

APS TECHNICAL

try using aps inventoryForecasting

20.1 Requests for Planning

20.1.1 Synchronous Requests

Synchronous requests are from the warehousing, work order, customer order and purchasing systems.

20.1.2 Asynchronous Requests

Asynchronous requests are for a fully regenerative plan or after forecasting and forecasting adjustments

20.2 Components

20.2.1 Planning Machine

20.2.2 Planning Engine

A thread that performs the actual planning.

It calls the dispatcher to get the items to be planned, invokes the persistence service to get the data and then calls the persistence service to store the results.

A Planning Engine generates allocations, which are associations of demand and supply

Get Items to Plan

May be in a planning group, but retrieving items that are not is also a lot faster.

Populate Planning Data

Retrieve Data from Database

Index the data

20.3 Preserve Allocations

Allocations that are in pick may not be updated.

Bound allocations must be preserved.

20.4 First Pass

```
public void allocate() {
        clear();
        isDemandsByCustomerValid = false;
        demandsByCustomer.clear();
        setPreviousAllocations();
        restoreOnhandPickAllocations();
        restoreBoundAllocations();
        firstPass();

        computeCustomerSupply();
        demandS.setCustomerEligibleSupplies();
        customerPrioritized();
        if (requestToOverShip()) {
            overship();
        }

    }
```

20.5 Prioritize Demands

20.6 Filter Supply

20.7 Prioritize Supply

TODO

20.7.1 Execution Mode

Supply will be allocated to the latest anticipated receipt prior to customer request date if the supplier performance warrants it. This leaves onhand supply available for customers with earlier request dates.

20.7.2 Schedule Optimization Mode

Onhand Supply is prioritized over replenishments in order to evaluate the potential to “push out” replenishments.

20.8 Generate Work Orders

20.9 Generate Reschedules

Reschedules are based on the earliest demand date for a non onhand supply.

If cross facility or cross pool allocations are made, logical or physical inventory transfer suggestions are made.

20.10 Update Data

20.11 Notes

Safety Stock must be allocated

Forecast must be consumed.

Consideration must be given to the fact that work orders may have customer demand and priority given to allocation to them.

Support for overshipping

Generates Reschedules

Generate log trace xml

Demands within a customer must be prioritized

20.11.1 Work Order Generator

20.11.2 Dispatcher

The dispatcher provides the items to be planned in a planning group

20.11.3 Data Services

Data services retrieve and update the planning database

20.12 Properties and Command Line Arguments

20.13 Equivalent Items

Two items are equivalent if they have the same form, fit and function and can be certified to the other.

This is in the case of engineered parts.

20.14 Customer Substitutes

Customer substitutes are used when one part may be used in place of another.

The parts may have identical specifications or just be satisfactory.

For example a police department may need “D” Cell batteries for their flashlights.

In lieu of customer substitutes a pseudo part can be created.

20.15 Global Substitutes

iimes - (IcItemMastEquivS) cache.get(IcItemMastEquivS.class.getName()); iicss - (ApsCustItemSubstS) cache.get(ApsCustItemSubstS.class.getName()); aigs - (ApsItemGlobalSubstS) cache.get(ApsItemGlobalSubstS.class .getName());

CHAPTER

TWENTYONE

APSTECHNICALREFERENCEBOOK

try using aps inventoryForecasting

21.1 Database Privileges

21.2 Synchronous Requests

21.3 Asynchronous Requests

21.4 Properties and Command Line Arguments

21.4.1 leadTimePaddingFactor

Double lp - PropertyHelper.getMandatoryDoubleSystemProperty("leadTimePaddingFactor"); double totalLeadTime - lp * this.itemMaster.getLeadTmDy().floatValue(); endLeadTime - DateHelper.toSqlDate(DateHelper.addDays(today, java.lang.Math.round((float)totalLeadTime))); comp - this.getNeedByDate().compareTo(endLeadTime);

21.5 Cache Manager

21.6 DBMS_PIPE

grant execute on dbms_pipe to diamond;

21.7 Planning Group

21.8 Equivalent Items

Two items are equivalent if they have the same form, fit and function and can be certified to the other.

This is in the case of engineered parts.

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CHAPTER

TWENTYTWO

COMPONENTS AND SERVICES

22.1 Planning Machine

The **Planning Machine** is the high level component that creates and manages all other components.

22.1.1 Populate Planning Data

Populates the request queue for all parts with supply or demand.

May invoke *_ComponentsAndServices_PlanningGrouper*

22.2 Planning Grouper

The **Planning Grouper** creates planning groups, items that must be planned simultaneously due to the fact that these parts are

- **equivalent** If one part can be certified to be another part, they are equivalent, but this is not necessarily bi-directional. That is part-a may be certifiable to be a part-b but part-b may not necessarily be certifiable to be a part-a
- **substitutes**
  - customer substitutes
  - global substitutes
-

22.3 Dispatcher

The **dispatcher** returns a list of items that comprise a planning group. The dispatcher may create a planning engine or be invoked from a planning engine.

22.4 Planning Engine

A Planning Engine generates allocations, which are associations of demand and supply

22.4.1 Get Items to Plan

May be in a planning group, but retrieving items that are not is also a lot faster.

22.4.2 Plan Phases

Preserve Allocations

Allocations that are in pick may not be updated.

Bound allocations must be preserved.

First Pass

Plan Demands within Lead Time

```
public void allocate() {
        clear();
        isDemandsByCustomerValid = false;
        demandsByCustomer.clear();
        setPreviousAllocations();
        restoreOnhandPickAllocations();
        restoreBoundAllocations();
        firstPass();

        computeCustomerSupply();
        demandS.setCustomerEligibleSupplies();
        customerPrioritized();
        if (requestToOverShip()) {
            overship();
        }

    }
```

22.5 Prioritize Demands

22.6 Filter Supply

22.7 Prioritize Supply

22.8 Generate Work Orders

22.9 Generate Reschedules

22.10 Update Data

22.11 Notes

Safety Stock must be allocated

Forecast must be consumed.

Consideration must be given to the fact that work orders may have customer demand and priority given to allocation to them.

Support for overshipping

Generates Reschedules

Generate log trace xml

Demands within a customer must be prioritized

CHAPTER

TWENTYTHREE

ELIGIBILITY TESTS

Generally elibility tests may be considered as filters, that is, the order of the tests is inconsequential and each test may exclude the supply as being applicable for the demand. On occassion two or more tests may exhibit characteristics such that the qualification of either test is sufficient. Consider the case of buyback inventory in which inventory has been purchased from an airframe manufacturer but traceability to the ultimate source is not available. The airframe manufacturer may state that if the inventory was procured from the manufacturer under certain conditions those parts may bypass requirements that would otherwise be in place. It is the responsibility of the kitting or JIT provider to provide traceability back to the airframe manufacturer without any bearing any responsibility for ultimate traceability.

23.1 Approved Manufacturer

A customer may define a *white list* or *black list* of manufacturers by part.

23.2 Buyback

Buyback inventory is purchased by a distributor from a customer and may be sold back to that customer even in the absence of complete traceability in the hands of the distributor.

23.3 Certifications

Certifications can assume arbitrary meanings.

Examples of Certifications include for example only

- Manufacturer Certificate of Compliance
- ??? list additional
- Manufacturer Certificate of Compliance

23.4 Consignment Inventory

Consignment inventory

23.5 Contract Aerospace

23.6 Country of Origin

A demand may specify that the supply must be from a specified country. A filter exists to enforce this requirement.

23.7 Equivalency

Equivalency is defined as a part number that complies with the engineering specification for another part. Although an equivalent part will not be automatically allocated by the planning engine, suggestions may be made that a Certificate of Compliance for the lot in question.

23.8 Expiry Date

A demand may explicate the latest date of expiry for the supply. This filter ensures that the supply complies with the demand minimum expiration date.

23.9 Manufacturer

23.9.1 Explicit Manufacturer

A given demand may specify that a part must be made by one manufacturer.

23.9.2 Approved Manufacturer

Customers may be set up with rules for approved manufacturers inclusively or exclusively.

23.10 Lot Date

A demand may have an associated maximum date of manufacture.

23.11 Revision Level

Complete support for Revision Level Hierarchy

23.12 Substitutes

23.13 Sourcing Rule

Sourcing rules

23.14 Approved Manufacturer

A customer may define a *white list* or *black list* of manufacturers by part.

23.15 Buyback

Buyback inventory is purchased by a distributor from a customer and may be sold back to that customer even in the absence of complete traceability in the hands of the distributor.

23.16 Certifications

Certifications can assume arbitrary meanings.

Examples of Certifications include for example only

- Manufacturer Certificate of Compliance
- ??? list additional
- Manufacturer Certificate of Compliance

23.17 Consignment Inventory

Consignment inventory

23.18 Contract Aerospace

23.19 Country of Origin

A demand may specify that the supply must be from a specified country. A filter exists to enforce this requirement.

23.20 Equivalency

Equivalency is defined as a part number that complies with the engineering specification for another part. Although an equivalent part will not be automatically allocated by the planning engine, suggestions may be made that a Certificate of Compliance for the lot in question.

23.21 Expiry Date

A demand may explicate the latest date of expiry for the supply. This filter ensures that the supply complies with the demand minimum expiration date.

23.22 Manufacturer

23.22.1 Explicit Manufacturer

A given demand may specify that a part must be made by one manufacturer.

23.22.2 Approved Manufacturer

Customers may be set up with rules for approved manufacturers inclusively or exclusively.

23.23 Lot Date

A demand may have an associated maximum date of manufacture.

23.24 Revision Level

23.25 Substitutes

CHAPTER

TWENTYFOUR

BUSINESS PROCESS IMPROVEMENT : EQUIVALENT PARTS

1. Business Process Improvement
2. Project Description
3. Diamond Portal
4. Portal Functionality
5. Purchasing

24.1 Business Process Improvement : Equivalent Parts

Created by James Schmidt on Dec 21, 2019

Document generated by Confluence on Dec 22, 2019 07:29

Atlassian

CHAPTER

TWENTYFIVE

FUNCTIONAL

25.1 Introduction

Diamond Advanced Planning is a module that associates demand for product with inventory that satisfies the demand according to pluggable ("extensible") filters and

Although it was designed explicitly to accomodate the requirements of aerospace subsets of its features will readily support virtually any distribution, MRO or discrete manufacturing environment.

Diamond Advanced Planning was first written in 1983 by the author of this document and served well in planning for Fine China and giftware. Same was employed for a clothing manufacturer and subsequently for Tri-Star Aerospace. In 2001 a total rewrite was effected written in Java accommodating Aerospace requirements in version 10 of Diamond Distribution.

25.2 Features

- Simultaneously supports interactive and batch mode planning
- Generates work orders for kits, assemblies and ???
- Supports Engineered Parts, a single item may simultaneously have multiple part numbers
- Allocation Based Pricing
- Complex MRO Kitting TODO link

25.3 Demand Types

25.3.1 Customer Orders

A customer may be an external organization not within the legal hierarchy of legal entities encompassed by the organization that provides the planning service or be subordinate to the penultimate holding company of the organization providing planning. These relationships have no bearing on the requirement of the planning organization to fulfill demand in accordance with the contractual rules.

Stated more simply, a customer in the sense of planning is an organization with a specified set of requirements for the fulfillment of inventory.

25.3.2 Safety Stock

25.3.3 Forecasted Demand

Diamond provides a statistical forecasting model that forecasts demand based on historical consumption. The planning module is agnostic with respect to the source of the forecast and any forecast system may be used.

25.3.4 Work Orders

Work orders may take the form of kits, assemblies or rework.

25.4 Supply Types

25.4.1 On hand inventory

Onhand inventory includes inventory in transit to another warehouse and considers the availability date the time it will take to ship, receive and putaway the inventory.

25.4.2 Replenishments

A replenishment is additional inventory coming from an external source. This may be the result of a purchase order or anticipated receipt of buyback ??? or consignment inventory.

25.4.3 Work Orders

A work order is used to designate a part which has components, such as kits, assemblies and parts that require transformation to convert them to another part.

A zinc plated bolt may be converted to a nickel plated bolt by stripping the zinc, copper plating and then nickel plating. Each such operation may have a yield of less than 100

25.5 Rules

25.5.1 Configuration Data

Customer Item Substitutes

Global Substitutes

Replenishment Policies

Supply Pool

Inventory may be logically separated by supply pool.

Supply pools may transcend facilities.

Supply Sub Pool

A sub-pool is subordinate to a supply pool.

Sourcing Rules

A sourcing rule is associated with a supply sub-pool and a facility.

It describes:

- facility
- sub-pool
- supply type
- sourcing priority

Examples

Just In Time

Kitting MRO

Buy Back

Customeer Item Manufacturer

25.6 Planning Group

It is posited that no aerospace planning can be of much value in the absence of planning demand for parts that constitute a planning group, that is all parts which have the same form fit and function are interchangeable and those parts which have been previously been approved by the consumer of said parts as acceptable substitutes for the specified part.

Interchangeability is defined as the parts being equivalent. A single part may comply with multiple engineering diagrams and when produced by a manufacturer of repute acceptable to the consumer and accompanied by a manufacturer Certificate of Compliance with said diagram, these parts are considered equivalent even in the absence of aforesaid Certificate, for often such certification may be purchased from the manufacturer, or waived by the knowing consumer.

25.7 Sourcing Rules

25.8 Eligibility Tests

Generally elibility tests may be considered as filters, that is, the order of the tests is inconsequential and each test may exclude the supply as being applicable for the demand. On occassion two or more tests may exhibit characteristics such that the qualification of either test is sufficient. Consider the case of buyback inventory in which inventory has been purchased from an airframe manufacturer but traceability to the ultimate source is not available. The airframe manufacturer may state that if the inventory was procured from the manufacturer under certain conditions those parts may bypass requirements that would otherwise be in place. It is the responsibility of the kitting or JIT provider to provide traceability back to the airframe manufacturer without any bearing any responsibility for ultimate traceability.

25.9 Sourcing Rule

Sourcing rules

25.10 Planning Groups

25.11 Aerospace Features

- Show which items could obtain certification rather than procure
- Generate Warehouse Transfers
- Generate Work Orders
- Overship Capability

25.12 Planning Mode

25.13 Execution Planning Mode

In this mode demand the supply prioritizer gives higher precedence to the supply associated with delivery most prior to ???

25.14 Inventory Planning Mode

Inventory Planning Mode attempts to allocate demand such that on hand inventory is exhausted, deferring allocation to purchase orders or work orders to the first available by date. The result of this is that a reschedule date can be derived from the first requirement date.

25.15 Bound Allocations

A demand may be bound to a supply. These allocations are restored foremost in the first pass of allocation. Bound states include

- R Request
- B Bound

25.16 Logging

All of the decision paths for a planning group are incorporated into a single logging entity reflecting each of the decisions and prioritization. This data is persisted in XML, generally in a relational database.

CHAPTER

TWENTYSIX

GLOSSARY

26.1 Allocation

26.2 Allocation Based Pricing

It is a common practice in the aerospace industry for a distributor to provide Just-In-Time fulfillment of products under contractual arrangements. Often the distributor will purchase an airframe supplier's inventory and sell it back for cost plus a service fee although other arrangements are certainly not rare. After the inventory that was purchased is exhausted additional demand is satisfied by inventory of the distributor. It is not known at the time the order is placed the source of the inventory that will be used to satisfy the demand. Allocation based pricing updates the order line with the appropriate price and creates sublines if necessary in the case of mixed supply at different prices.

26.3 Approved Manufacturer

Customers may either "whitelist" or "blacklist" manufacturers.

26.4 Bound Allocation

An allocation which

26.5 Certificate of Compliance

See Manufacturer Certificate of Compliance

26.6 Country of Origin

26.7 Dispatch Group

A set of items that are planned concurrently.

26.7.1 Planning Set

A planning set is a set of items that must be planned simultaneously

It includes, transitively,

- Equivalent Parts
- Customer Substitutes
- Global Substitutes

26.7.2 Dispatch Set

A set of items that are retrieved concurrently from the underlying datastore for the purpose of improving performance of the persistent data store.

26.8 Eligible Supply

For each demand any supply that passes all filters is considered eligible supply.

26.9 Engineered Parts

An engineered part is an item produced in compliance with an engineering drawing. Most everyone is familiar with Stock Keeping Unit or SKU, usually identified by a UPC (Universal Product Code) or an EAN (European ???).

An engineered part may be produced by a wide variety of manufacturers.

26.10 Equivalent Part

Two parts are equivalent if they could be cross certified.

For example AN960-10 and NAS1149 are very common flat washers and the former diagrams where drawn by the Army Navy coalition and the latter by ???

These parts are identical, the only difference being whether the manufacturer has provided a *Manufacturer Certificate of Compliance*.

One of the byproducts of APS is the ability to query for lots which may be made suitable for the demand by simply buying a *Manufacturer Certificate of Compliance*, another query will show unsatisified demand that could be satisfied by changing the requested part to be the equivalent part which frequently is readily accommodated by the party that gave rise to the demand.

26.11 Forecast Consumption

The process of decreasing Forecasted Demand by the amount of firm orders.

This is necessary to eliminate “double dipping” requirements for supply.

26.12 Forecasting Granularity

Bucketed by week in TMP_APS_DMD_FC_PRD

26.13 Forecast Group

26.14 Hard Alloc Fc Within Lead Time

APS_DMD_FC

26.15 In Pick

26.16 Manufacturer Certificate of Compliance

A physical or electronic document issued by the manufacturer of an engineered part specifying a specific lot or set of lots with assurances backed solely by the credibility of the manufacturer that the items in the lot comply with the specifications set forth on the engineering diagrams for the part.

26.17 Manufacturer Lot Code

A designator assigned by the manufacturer for items produced, generally on the same machines after setup and demarcated by policies set forth by the manufacturer which may include quantity produced and machine setup, internal quality tests and so forth.

26.18 Multicerted Item

26.19 Pre-approved Lot

A lot which has been pre-approved by the organization ordering.

This may be the result of quality assurance tests or buyback inventory.

26.20 Planning Data

Planning Data is the domain of all information necessary to generate a planning result for a [PlanningGroup] planning group. [PlanningGroup]

26.21 Planning Group

A planning group consists of all related items whether by equivalence, or substitution to arbitrary depths until such relationships are exhausted. This is performed procedurally in memory as all attempts to effect this declaratively have resulted in quantitative run times three or four orders of magnitude greater than object traversal.

26.22 Quality Assurance Tests

Lowest cost to incrementally pass quality.

26.23 Receiver Number

A receiver number is created by Diamond Distribution for each unique manufacturer lot on a shipping manifest.

Therefor it is quite possible that

26.24 Safety Stock Consumption

26.25 Substitute Part

A customer may agree for a substitute for a part when form, fit and function are satisfied irrespective of whether the part is an engineered part.

For example 'D' batteries from Everready and Ray-O-Vac with the same number of ampere hours.

26.26 UPC

26.27 Quality Assurance Tests

CHAPTER

TWENTYSEVEN

GOALS

Identify the business benefits sought

TODO examples

Determine how success can be measured

Determine

CHAPTER

TWENTYEIGHT

INTEGRATION

28.1 Data Loading

Diamond APS provides IDL (Interface Data Load) tables

These tables provide a consistent source of data from which the planning tables are populated for batch processing.

Interfaces are available execution mode, not addressed in this document.

28.1.1 Scrubbing

After the tables are loaded the javautil.org ConditionIdentifications tests are run to identify whether the data is fit to load.

There are no referential constraints and few data checks in the IDL tables to allow unsatisfactory data to be loaded and analyzed as the rigorous data requirements of planning might make it impossible to load.

28.1.2 Rules

Your Diamond Consultant will assist you in defining and loading the rules.

These rule data is generally programatically generated and a few passes of planning are made in order to explain the ramifications.

28.2 Consulting

28.3 Rules Data

Customer Substitutes

Global Substitutes

Replenishment Policies

Planning Groups

Supply Pools

Supply Sub Pools

Sourcing Rules

Customer Item Manufacturer Rules

28.4 Logic Review

Goals

CHAPTER

TWENTYNINE

PLANNINGCOMPONENTSPAPER

29.1 Planning Machine

29.2 Planning Engine

A Planning Engine generates allocations, which are associations of demand and supply

29.3 Get Items to Plan

May be in a planning group, but retrieving items that are not is also a lot faster.

29.4 Populate Planning Data

29.4.1 Retrieve Data from Database

29.4.2 Index the data

29.5 Preserve Allocations

Allocations that are in pick may not be updated.

Bound allocations must be preserved.

29.6 First Pass

29.6.1 Plan Demands within Lead Time

```
public void allocate() {
            clear();
            isDemandsByCustomerValid - false;
            demandsByCustomer.clear();
            setPreviousAllocations();
            restoreOnhandPickAllocations();
```

```
            restoreBoundAllocations();
            firstPass();

            computeCustomerSupply();
            demandS.setCustomerEligibleSupplies();
            customerPrioritized();
            if (requestToOverShip()) {
                    overship();
            }

    }
```

29.7 Prioritize Demands

29.8 Filter Supply

29.9 Prioritize Supply

29.10 Generate Work Orders

29.11 Generate Reschedules

29.12 Update Data

29.13 Notes

Safety Stock must be allocated

Forecast must be consumed.

Consideration must be given to the fact that work orders may have customer demand and priority given to allocation to them.

Support for overshipping

Generates Reschedules

Generate log trace xml

Demands within a customer must be prioritized

29.14 Planning Dispatcher

29.15 Planning Grouper

The planning grouper computes all of the items which need to be planned concurrently taking into consideration

- Customer Substitutes

- Global Substititutes
- Part Equivalencies

CHAPTER

THIRTY

PLANNING DISPATCHER

30.1 Fully Regenerative

30.2 Synchronous

CHAPTER

THIRTYONE

PLANNING ENGINE

A planning engine is a thread that plans and item group.

All of the input and output of planning is contained in PlanningData.

Planning data can be populated and persisted in various ways.

CHAPTER

THIRTYTWO

PLANNING GROUPER

CHAPTER

THIRTYTHREE

PLANNING MACHINE

CHAPTER

THIRTYFOUR

RULES

Sourcing Rules

Eligibility Rules

CHAPTER

THIRTYFIVE

TABLES

35.1 ALL_SUPPLY and APS_SUPPLY

Name Type ————— ———— SPLY_IDENTIFIER VARCHAR2(61) AVAIL_TYPE_CD CHAR(1) LOT_NBR NUMBER ITEM_NBR NUMBER(9) FACILITY VARCHAR2(16) APS_SPLY_SUB_POOL NUMBER(9) _NBR ORG_NBR_MFR NUMBER ORG_NBR_VND NUMBER AVAIL_DT DATE GROSS_AVAIL_QTY NUMBER LOT_UM VARCHAR2(3) REV_LVL VARCHAR2(5) PK_SUPPLY NUMBER(9) LOT_COST NUMBER CNTRY_CD_ORIGIN VARCHAR2(3) MFR_DATE DATE EXPIRE_DT DATE RCPT_DT DATE APS_AVAIL_DT DATE WO_ITEM_NBR NUMBER AVAIL_DT_ID VARCHAR2(1) - DECODE(iil.avail_dt, NULL, 'F', 'P') avail_dt_id

PO_LINE_HDR_NBR NUMBER

SELECT sply_identifier, 'O', lot_nbr, item_nbr, facility, aps_sply_sub_pool_nbr, org_nbr_mfr, org_nbr_vnd, avail_dt, gross_avail_qty, lot_um, rev_lvl, pk_supply, lot_cost, cntry_cd_origin, mfr_date, expire_dt, rcpt_dt, avail_dt, TO_NUMBER(NULL) wo_item_nbr, avail_dt_id, to_number(null) po_line_hdr_nbr

FROM aps_avail_onhand

UNION ALL SELECT tar.sply_identifier,

'R', TO_NUMBER(NULL), tar.item_nbr, tar.facility, tar.aps_sply_sub_pool_nbr, tar.org_nbr_mfr, tar.org_nbr_vnd, tar.avail_dt, tar.gross_avail_qty, tar.replen_um, tar.rev_lvl, tar.po_line_dtl_nbr, tar.unit_cost_stk_um, tar.cntry_cd_origin, tar.lot_manufacture_after_dt, tar.lot_not_expire_before_dt, TO_DATE(NULL), tar.aps_avail_dt, TO_NUMBER(NULL) wo_item_nbr, NULL avail_dt_id, tar.po_line_Hdr_Nbr

FROM aps_avail_replen tar

UNION ALL SELECT /*+ use_nl(iii woh) index (woh) */

TO_CHAR(woh.wo_hdr_nbr) sply_identifier, 'W', TO_NUMBER(NULL), woh.item_nbr_rqst, woh.facility, woh.aps_sply_sub_pool_nbr, TO_NUMBER(NULL), TO_NUMBER(NULL), woh.need_by_dt avail_dt, woh.rqst_qty - NVL(woh.fill_qty,0) gross_avail_qty, woh.wo_um, TO_CHAR(NULL) rev_lvl, woh.wo_hdr_nbr, TO_NUMBER(NULL), TO_CHAR(NULL), TO_DATE(NULL), TO_DATE(NULL), TO_DATE(NULL), woh.need_by_dt, woh.item_nbr_rqst wo_item_nbr, NULL avail_dt_id, to_number(null)

FROM wo_hdr woh

WHERE woh.wo_stat_id = 'O'

CHAPTER

THIRTYSIX

TECHNICAL

36.1 Queue Populator

The queue populator inserts items to be planned into the request queue.

The only implementation at this time is a stored procedure *APS_RQST_QUEUE_POPULATOR*

36.2 Queue Manager

The queue manager is responsible for managing the queue of items for which planning has been requested.

The request queue is fully read and Planning Groups are established. The priority for dispatching is established.

A call to

```
int[] getPlanningItems()
```

Will return all of the items in a planning group.

36.3 Planning Engine

The planning engine obtains the identifiers for a set of items to be planned, either through a pull from the engine to the Queue Manager or through a push by an invocation of

```
public void planItems(int[] itemIds)
```

36.3.1 Populate Data

All of the data necessary to plan an item are populated in PlanningData and inter object references are resolved. Various dimension objects are populated from the Cache Manager [CacheManager] There are two implementation of Persistence interface, one which is based on generated and hand tweaked JDBC and one which is backed by Hibernate, using a few tweaks to optimize performance.

36.3.2 Planning

CHAPTER

THIRTYSEVEN

ARCHITECTURE

37.1 Language

Most of the logic in APS is expressed in Java.

37.2 Inversion of Control

37.3 Interface

```
package com.dbexperts.diamond.planning;

public interface PlanningOperation {
        public void process(PlanningData planningData);
}
```

Some may object to exposing all of the data available for arbitrary operations but and

37.4 Persistence

APS employs the DAO paradigm with default implementation for persistence using Hibernate for Object Relational Mapping.

37.5 Planning Data and Related Interfaces

37.6 Planning Modes

37.6.1 Batch

Batch planning is equivalent to fully regenerative MRP.

When no more items are in the request queue the program terminates.

37.6.2 Interactive

37.7 Queue Manager

The queue manager is responsible for monitoring all of the items in the request queue and creating a queue of groups of planning items to be dispatched.

See

37.8 CommandLineExecution

java com.dbexperts.diamond.cli dataSourceName

TODO should create a big fat jar

in /common/home/jjs/workspace/Diamond11 ./run_planning

note document EJB3PlanningDataPersistence

CHAPTER

THIRTYEIGHT

DIAMOND ADVANCED PLANNING

- *genindex*

38.1 Introduction

38.2 Concepts

38.3 Introduction

Goals

38.4 Components

PlanningMachine PlanningEngine PlanningDispatcher Supply Equivalent-Parts

AllocationLogic APS-Features-and-Benefits ApsFeatures ApsTechnicalReferenceBook ApsTechnical ComponentsAndServices Functional Glossary Goals Integration PlanningComponentsPaper RulesData Technical todo workspaces Integration ComponentsAndServices AllocationLogic ApsFeaturesBook EligibilityTests Supply Functional Glossary ApsTechnicalReferenceBook PlanningComponentsPaper ApsFeatures

CHAPTER

THIRTYNINE

TODO

Order Loads

Pre-approved Lots:

Planning Phases

Properties

Describe Kitting

Describe where best used

CHAPTER

FORTY

BUSINESS PROCESS REEINGENEERING

40.1 Objectives

1. Maximum buyer productivity
2. Eliminate unnecessary purchases
3. Develop a standardized methodology for buyers that is deterministic, with the same input two buyers should come to the same conclusions.
4. Buyers should be able to test the results of a simulation by, for example adding a secondary manufacturer CofC to a lot and replan the part and get the answer back within a second with a new single screen.
5. All scenarios should be stored with the results.
6. Upon acceptance of a scenario the simulation changes should be reported so that the source systems can be update.
7. Status of simulation changes # Requested # Not possible - stops further recommendations to take this action # Active - Once a download from the source system reflects this change
8. A report of requested modification not yet completed on source systems

40.2 Purchasing Operational Efficiency

40.2.1 Purchasing Review Board

Requisitions may be reviewd by the purchasing review board * Approval

* Disapproval | * Record disapproval reason for requisitions Purchasing review board can select (or create and select) a reason such as | * Review equivalent parts * Is onhand under another part * insufficient quotations (other vendors may have lower costs)

40.2.2 Speed up quotations

- Automatically email vendors request for quotations
- Automated quote response have the vendors provide a CSV, JSON or XML file with the quote to be

- automatically uploaded to the system.

For example a vendor could create a spreadsheet with the following columns

- item_cd
- quantity
- manufacturer
- price
- available date

by emailing to quotes@yourco.com these quotes can be automatically loaded into the system without changes to the legacy system,

40.2.3 Buyer information

The buyer should have single screen that shows:

1. Supplies
2. On hand
3. Open Purchase Orders
4. Open Work Orders
5. Demand
6. Forecasted
   (a) Raw
   (b) Consumed
   (c) Unconsumed
7. Safety Stock
8. Reserved Inventory
9. Quarantined
10. Restricted access (JIT programs, Committed Service Level Agreement Plans)
11. All part numbers in the planning group
12. Every part and all equivalents, transitively, that is the equivalents to those equivalents until exhausted.
13. Customer specific substitutions
14. Approved manufacturer matrix Customers down the left, manufacturers across the top
15. Requisitions
16. Supplier on-time historical metrics
17. Supply ineligibility drill-down
18. Vendor Quotes
19. Time phased inventory position, Pipeline (Global, by Facility, by planner)
20. On hand inventory in aggregate with the ability to open details with a single click
21. Sales history for the last three years in multiple dimensions

22. Time Dimensions include annual, quarterly and monthly
23. Ability to see by customer
24. Existing purchase orders
25. Existing facility transfers in process
26. Detailed reason why supplies are not eligible for a demand that is allocated late or short
27. A matrix of approved manufactures and customers
28. See the part and all transitive equivalent parts
29. Late or short demands

In Diamond this is all done locally in the web browser with no network requests so it is virtually instaneous.

40.2.4 Recommendations

1. Purchase orders that can be cancelled
2. Get a manufacturer Certificate of Compliance for existing inventory to satisfy a requisition with existing inventory
3. Supply prioritization Use buyback inventory before using our inventory for appropriate customers
4. Allocation based pricing
5. Items with a shelf life have oldest allocated first
6. Less valuable items are allocated first
7. Based on Certifications (dual certed parts have more value)
8. Facility Transfer
9. Supply Pool Transfer
10. Expedite or de-expedite a purchase order

40.2.5 Alerts

- Obsolete Inventory
- Expiring Inventory
- Purchase Exceeding x% of previous maximum unit price
- Purchase Exceeding x% of previous minimum unit price
- Purchase of specified dollars not yet approved

40.3 Computing based on Setup

“Aerospace distribution can be very profitable if the buying is correct”.

- Buy the right parts
- Buy the optimal quantity

40.4 Introduction

Define a process to

1. Improve purchasing efficiency
2. Provide decision support for better purchasing decisions
3. Monitor performance
4. Create and enforce policies
5. Improve detailed and summary information
6. Leverage inter company inventory

40.5 Objectives

Lower unit cost

We will introduce:

- Multiple Certifications
- Supply Prioritization
- Eligible Supply

40.6 Traditional DRP

40.6.1 Forecast

- History is aggregated by month
- Various forecast models are applied to the history simulating forecasts into historical periods
- Forecast performance is evaluated over lead time
- Best performing model is chosen
- Forecast is made
- Safety stock is calculated based on service level and forecast statistics
- Economic Order Quantity is computed

40.6.2 Projections

Buckets are created, usually monthly

Starting with onhand inventory

Forecast demand is decrease by firm demand during the corresponinding bucket

For each sucessive bucket the preceeeding position is incremented by replensishments and decremented by unconsumed forecast and actual demand.

Additional Replenishment Orders are created based on the EOQ and incremental purchase quantities.

40.6.3 SKUs

In traditional DRP a Stock Keeping Unit is the basis of planning.

Say there are four different *D Cell batteries*, 888888-333333 F-R-Eddy Alkaline and 666666-22222 Deer-a-Bull and 33333-55555 BRAND-X 77777-22222 BRAND-Z.

These batteries would be planned independently.

Now consider an engineer for a major flashlight compant specifies that specifies a battery based on dimensions, chemical composition and electrical properties, voltage and ampere hours and a voltage discharge curve and calls this *BATT-D-ALK*.

F-R-Eddy, Deer-a-Bull and Brand-X all issue a *Certificate of Compliance* stating that their batteries meet all of the engineering requirement of *BATT-D-ALK*

Let"s assume

1,000 888888-333333

2,000 666666-222222

500 333333-555555

300 777777-222222

How many *BATT-D-ALKS* do you have?

Answer: You have 3,500

40.7 Scenario

Now assume you get a customer order for 1,000 *BATT-D-ALK* for next month.

What is your projected position for each of the parts at the end of next month?

That depends on whether the 888888-333333, the 66666-222222 or the 333333-555555 parts are used.

Perhaps:

40.7.1 Supply Prioritization

This section introduces the concept of supply prioritization, determinining which eligible supply to to use to satisfy demand.

- 88888-33333 Parts cost more so you fill with the cheaper part
- You use some of each because they have a shelf life and you want to get rid of those near the expiry date.
- Another customer will only accept from Deer-A-Bull so you fulfill with F-R-Ready to reserve your Deer-A-Bull inventory as it is more widely accepted.

Perhaps: The customer only approves

40.8 Buy Quantity

Simple part, no equivalent parts.

Average monthly consumption is 200 units

Vendor quote unit price 1,000 3.02 2,500 1.647

So you buy a years supply and move onto the next part.

STOP!

Let"s assume unit_cost = setup_cost/nbr_units + incremental cost

substituting in *unit_cost* and *nbr_units* in the equation twice leaves us two equations with two unknowns. Using linear algebra we solve for the setup cost and incremental_cost and plot this.

We see ...

Now we can quote lower prices and hopefully get a higher quote conversion while simultaneously getting a higher profit margin.

???

40.8.1 Prioritization

Sourcing Rule

Purchase Orders

Availability Date

Late

Vendor On Time Performance

Attribute Weight values

Other Demand for

FIFO

CHAPTER

FORTYONE

DATA REQUIREMENTS

Onhand Inventory Purchase Orders Work Orders

Forecast Customer Orders Work Orders

Item Master

History Vendor Quotes Customer Quotes Approved Manufacturers

CHAPTER

FORTYTWO

LEGACY SYSTEM

No changes to the legacy system will be required

Diamond APS can support

Vendor Quotes Customer Quotes Requisitions

42.1 Legacy System

Purchasing interaction with Dymax and SAP can be reduced to a data entry function, all decisions can be made in Diamond.

42.2 Risk

There is zero risk, no existing systems are modified. No execution processes are affected.

CHAPTER

FORTYTHREE

CONCEPTS

43.1 Supply Pools

Supply pools are logical collections of inventory and may be used to

1. Ensure that the pool is only available to the appropriate customers
2. Distinguish between regular, buyback and consigment inventory
3. Used in prioritization of supply for demand

43.2 Forecast Groups

Demand for a customer or a collection of customers may be aggregated in history and an aggregate forecast created. Forecast groups may have their own eligibility constraints.

43.3 Eligible Inventory

Aerospace parts are not fungible, more than a specified part number is necessary to satify customer demand.

43.4 Demand Prioritization

Demand prioritization is the set of rules that determines which demands get fulfilled and in what order.

43.5 Supply Prioritization

Supply prioritization is the set of rules that determines which inventory is consumed for a given demand.

43.6 Forecast Consumption

CHAPTER

FORTYFOUR

PROCEDURES

44.1 Requisitions

44.2 Review

44.3 Approval

44.4 Purchasing Approval

44.5 Portal

CHAPTER

FORTYFIVE

BENEFITS

CHAPTER

FORTYSIX

QUESTIONS

1. How long does it take to get

Sales History Vendor Quotes Customer Quotes Approved Manufacturers Item Equivalencies Forecasted Demand Purchase Orders Requisitions

For a part and all of its equivalents in both the United States and France?

1. How do you compute a buy quantity?

46.1 Extensibility

Any component must be easily plugged in with an alternative implementation that is compliant with the corresponding interface,

- Demand Priority
- Eligibility Requirements
- Supply Prioritization
  - Lot value determination
- Recommendation Handlers for propagating accepted recommendations to source system

CHAPTER

FORTYSEVEN

IMPLEMENTATION

- Extract necessary data from legacy systems
- Load into Advanced Planning
- Augment with necessary but unavailable information
- Run a full plan
- Review recommendations
  - Accept recommendation (must define Action Handlers) Reject recommendation (select reason to be persisted across full reloads)

47.1 Questions

1. Inventory Restriction
2. How do you restrict availability of inventory for special purposes such as
   - JIT contracts
   - Committed Service Level Agreements
   - Kitting and Assembly
3. Do you have automated approved manufacturer eligibility?
4. Do you have prioritization for lots with expiry dates?
5. How do you calculate the residual cost of goods for broker buys for the
6. Are you exclusively FIFO or do you consider lots that have lower cost that satisfies the demand (taking into consideration multiple certifications, incremental cost of Quality Assurance testing and destructive tests?), etc.? quantity that exceeds the customer demand?
7. Quality Assurance Do you have a quality assurance program that supports skip lot testing and pre-approved lots (lots that have already passed the QA requirements for a customer should receive higher priority for that customer and lower priority for others)
8. What supply eligibility rules do you have?
9. How do you pin an allocation to a demand ?
10. Does your system recommend when alternate availability is preferable to a pinned allocation?

CHAPTER

FORTYEIGHT

SAP ON THE WEB

- https://www.brightworkresearch.com/sap/2017/11/best-understand-saps-negative-innovation/
- https://boards.straightdope.com/sdmb/archive/index.php/t-509111.html
- https://www.linkedin.com/pulse/who-knew-sap-could-so-complicated-heather-peyton/
- "We are nowhere near best-in-class, but we are making progress," says Steve Rogers, UK managing director of SAP to an audience of his customers at the German applications firm's annual user gathering at the end of last year. It's not the kind of comment that you expect from a senior executive at a leading software firm.
- https://www.thirdstage-consulting.com/lessons-from-an-sap-failure-at-lidl/
- https://www.360cloudsolutions.com/top-six-erp-implementation-failures/
- https://www.brightworkresearch.com/saphana/2017/06/22/hana-big-data-equals-big-failure/

There is a huge amount that can be done but a specification has not been articulated.

Concepts must be articulated.

48.1 Simple Example

During one of my calls with Peter he told me that he was reviewing purchase orders a simple line such as "Buyers don't buy the correct quantities to get a good price" was extended to:

48.1.1 Compute Optimal Purchase Quantity

Compute a projected per unit cost by solving the equation

unit_cost = (setup_cost / qty) + incremental cost

For two different known qty and prices (vendor quotes) using linear algebra

48.1.2 Graph this relationsihip

Find the "price knee" the first derivative of the function, the slope of the tangent starts to level off (it asymptotically approaches 0, meaning the limit is the unit cost doesn't decrease at all. Depending on setup cost, incremental cost and annual consumption a three year supply may be ten percent more than a one year supply, it may also be three times the acquisition cost and additional carrying costs must be considered.

Vendor quotes should include this range of quantities, purchasing quantities should be in this range, buys can be made and even scheduled so that lower per unit costs can be realized.

48.2 Purchasing Procedures

When a part needs to be replenished

1. Vendor quotes for the price range should be required.
2. Purchase amounts over a defined limit should be reviewed and approved.
3. Requisitions should be created in the new purchase decision application and once approved, be created as purchase orders in the execution system (Dymax and SAP).
4. Checks for any constraints including approved manufacturers should be simulated
5. Existing inventory carried under equivalent part numbers should be considered.

The opportunities for process improvement are best addressed by evaluating your current processes and the issues your experts realize and developing a system to address those issues.

48.3 Constraints

Your new process should:

1. Be external to SAP and Dymax, requiring no modifications to either system. This eliminates risk and complexity.
2. Should include data from both operations for inventory, purchases and demands
3. Incorporate new procedures and policies to reflect best practices
4. Reduce the effort of sales staff and purchasing staff to perform their functions
5. Define metrics to evaluate performance and progress
6. Have an alert system of reports of issues that need to be addressed.
7. Require no hardware or other infrastructure or the installation of any software on any client computer.

CHAPTER

FORTYNINE

QUESTIONS

What is the current cost of

1. Not buying the correct quantities
2. Not taking into consideration multiple certifications
3. Buying inventory in one operation that is excess inventory in the other operation
4. Time wasted gathering information to create a purchase order

CHAPTER

FIFTY

CONCLUSION

Client has the expertise in house to participate in the design of a business process and software to optimize the purchasing and sales operations, there is no need to wait for an IT person who has much less experience than your director of purchasing and other operations personnel.

A one hour phone call every two weeks is not going to ever get you a design.

I have no doubt that several times every day a sub-optimal purchase results in a expense greater than the cost of developing a design.

A design is best done by whiteboard meetings, starting with a blank whiteboard. Even with 25 years experience in Aerospace, it would be presumptious, and flat out wrong for me to give a powerpoint presentation and say “This is the universal answer to all problems, it will fit your situation”; this is the approach of someone hawking software.

CHAPTER

FIFTYONE

PLANNING REQUIREMENTS

51.1 Objectives

1. Maximum buyer productivity
2. Eliminate unnecessary purchases
3. Develop a standardized methodology for buyers that is deterministic, with the same input two buyers should come to the same conclusions.
4. Buyers should be able to test the results of a simulation by, for example adding a secondary manufacturer CofC to a lot and replan the part and get the answer back within a second with a new single screen.
5. All scenarios should be stored with the results.
6. Upon acceptance of a scenario the simulation changes should be reported so that the source systems can be update.
7. Status of simulation changes # Requested # Not possible - stops further recommendations to take this action # Active - Once a download from the source system reflects this change
8. A report of requested modification not yet completed on source systems

51.2 Purchasing Operational Efficiency

51.2.1 Purchasing Review Board

Requisitions may be reviewd by the purchasing review board * Approval

* Disapproval | * Record disapproval reason for requisitions Purchasing review board can select (or create and select) a reason such as | * Review equivalent parts * Is onhand under another part * insufficient quotations (other vendors may have lower costs)

51.2.2 Speed up quotations

- Automatically email vendors request for quotations
- Automated quote response have the vendors provide a CSV, JSON or XML file with the quote to be
- automatically uploaded to the system.

For example a vendor could create a spreadsheet with the following columns

- item_cd
- quantity
- manufacturer
- price
- available date

by emailing to quotes@yourco.com these quotes can be automatically loaded into the system without changes to the legacy system,

51.2.3 Buyer information

The buyer should have single screen that shows:

1. Supplies
2. On hand
3. Open Purchase Orders
4. Open Work Orders
5. Demand
6. Forecasted
   (a) Raw
   (b) Consumed
   (c) Unconsumed
7. Safety Stock
8. Work Orders
9. Reserved Inventory
10. Quarantined
11. Restricted access (JIT programs, Committed Service Level Agreement Plans)
12. All part numbers in the planning group
13. Every part and all equivalents, transitively, that is the equivalents to those equivalents until exhausted.
14. Customer specific substitutions
15. Approved manufacturer matrix Customers down the left, manufacturers across the top
16. Requisitions
17. Supplier on-time historical metrics
18. Supply ineligibility drill-down
19. Vendor Quotes
20. Time phased inventory position, Pipeline (Global, by Facility, by planner)
21. On hand inventory in aggregate with the ability to open details with a single click
22. Sales history for the last three years in multiple dimensions

23. Time Dimensions include annual, quarterly and monthly
24. Ability to see by customer
25. Existing purchase orders
26. Existing facility transfers in process
27. Detailed reason why supplies are not eligible for a demand that is allocated late or short
28. A matrix of approved manufactures and customers
29. See the part and all transitive equivalent parts
30. Late or short demands

In Diamond this is all done locally in the web browser with no network requests so it is virtually instaneous.

51.2.4 Recommendations

1. Purchase orders that can be cancelled
2. Get a manufacturer Certificate of Compliance for existing inventory to satisfy a requisition with existing inventory
3. Supply prioritization Use buyback inventory before using our inventory for appropriate customers
4. Allocation based pricing
5. Items with a shelf life have oldest allocated first
6. Less valuable items are allocated first
7. Based on Certifications (dual certed parts have more value)
8. Facility Transfer
9. Supply Pool Transfer
10. Expedite or de-expedite a purchase order

51.2.5 Alerts

- Obsolete Inventory
- Expiring Inventory
- Purchase Exceeding x% of previous maximum unit price
- Purchase Exceeding x% of previous minimum unit price
- Purchase of specified dollars not yet approved

51.3 Extensibility

Any component must be easily plugged in with an alternative implementation that is compliant with the corresponding interface,

- Demand Priority
- Eligibility Requirements
- Supply Prioritization

  - Lot value determination

- Recommendation Handlers for propagating accepted recommendations to source system

CHAPTER

FIFTYTWO

IMPLEMENTATION

- Extract necessary data from legacy systems
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  - Accept recommendation (must define Action Handlers) Reject recommendation (select reason to be persisted across full reloads)

CHAPTER

FIFTYTHREE

MODIFICATIONS

- All code is in Java supported by Spring with Hibernate for Object Relation Management, these are widely adoped open source solutions
- Presentation uses the Model, View Controller approach and the model may be exposed as a JavaBean or XML if one prefers to use XSL.
- Diamond dependencies are all vastly popular open source but it extremely unlikely anyone will have any need to modify anyy of the open source code
- I have trained non-programmers to modify Diamond in less than a month.

53.1 Questions

1. Inventory Restriction
2. How do you restrict availability of inventory for special purposes such as
    - JIT contracts
    - Committed Service Level Agreements
    - Kitting and Assembly
3. Do you have automated approved manufacturer eligibility?
4. Do you have prioritization for lots with expiry dates?
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8. What supply eligibility rules do you have?
9. How do you pin an allocation to a demand ?
10. Does your system recommend when alternate availability is preferable to a pinned allocation?

CHAPTER

FIFTYFOUR

DIFFERENCE FROM SAP

1. Diamond client interface is natively HTML5 and all functionality is available in a simple browser, whereas SAP has a cludgy interface, the native interface is client-server, a technology that is embarassingly old fashioned and the implementation is poor, at best https://help.sap.com/doc/saphelp_nw70ehp1/7.01.16/en-US/4d/aeae42cd7fb611e10000000a155106/content.htm?no_cache=true
2. There are no exposed transaction codes in Diamond, everything is menu driven, reducing training time and simplifying operation efficiency.
3. SAP has a proprietary database, HANA
4. Diamond is not complicated it uses International Standards for everything, and the most widely adopted technologies, there is no dependency on anything proprietary unless the oracle database is used.

CHAPTER

FIFTYFIVE

SAP ON THE WEB

- https://www.brightworkresearch.com/sap/2017/11/best-understand-saps-negative-innovation/
- https://boards.straightdope.com/sdmb/archive/index.php/t-509111.html
- https://www.linkedin.com/pulse/who-knew-sap-could-so-complicated-heather-peyton/
- "We are nowhere near best-in-class, but we are making progress," says Steve Rogers, UK managing director of SAP to an audience of his customers at the German applications firm's annual user gathering at the end of last year. It's not the kind of comment that you expect from a senior executive at a leading software firm.
- https://www.thirdstage-consulting.com/lessons-from-an-sap-failure-at-lidl/
- https://www.360cloudsolutions.com/top-six-erp-implementation-failures/
- https://www.brightworkresearch.com/saphana/2017/06/22/hana-big-data-equals-big-failure/

CHAPTER

FIFTYSIX

QUESTIONS

1. How many buyers are there?
2. How many purchase orders are created per year?
3. How much time does it take to create a purchase order?
4. Gather the information
    - Onhand Inventory
    - Sales History
    - Sales Forecast
    - Forecast Consumption
    - Approved Manufacturers
    - Vendor Quotes
    - Existing Purchase Orders

    (a) Vendor Quotes
    - Get quotes for the parts
    - Compute Optimal Replenishment Quantity (Not Economic Order Quantity)
    - Create a requisition
5. What are the requisition review requirements?
    - When is a requisition subject to review?
    - What are the needs additional work conditions?
        - Need more vendor quotes
        - Need work on equivalent parts
        - Incorrect buy quantity
        - Get existing inventory certified.

56.1 Out of Scope

Lead times can vary drastically based on

- vendor

- material shortages
- new product introduction
- product recall MRO (Maintenance, Repair and Overhaul)Definition

The elapsed time, usually measured in weeks between when a product is ordered and receivied.

Usually not considered

- Recieving time
- Inspection Time
- Intra-facility transfer time
- These are consider *availability times*

Typically in DRP Planning

- There is only one lead time
- This lead time is fairly consistent
- Costs due not vary based on lead time.

56.2 In aerospace

56.3 Source of Lead Time

56.3.1 vendor quotes

Take the lead time from the maximum quote expiration date

56.3.2 Summarized Lead Times should include

- Vendor Code
- Vendor type (Manufacturer, Distibutor, intra-company
- Vendor quote beginning and ending effective date
- Date of request for quote

56.3.3 Lead time details should include:

- Historical lead times

56.3.4 Lead time projections

Factors that can effect lead time, Lead times can vary drastically based on

- vendor
- Some vendors will stock
- Some manufacturers will build to stock

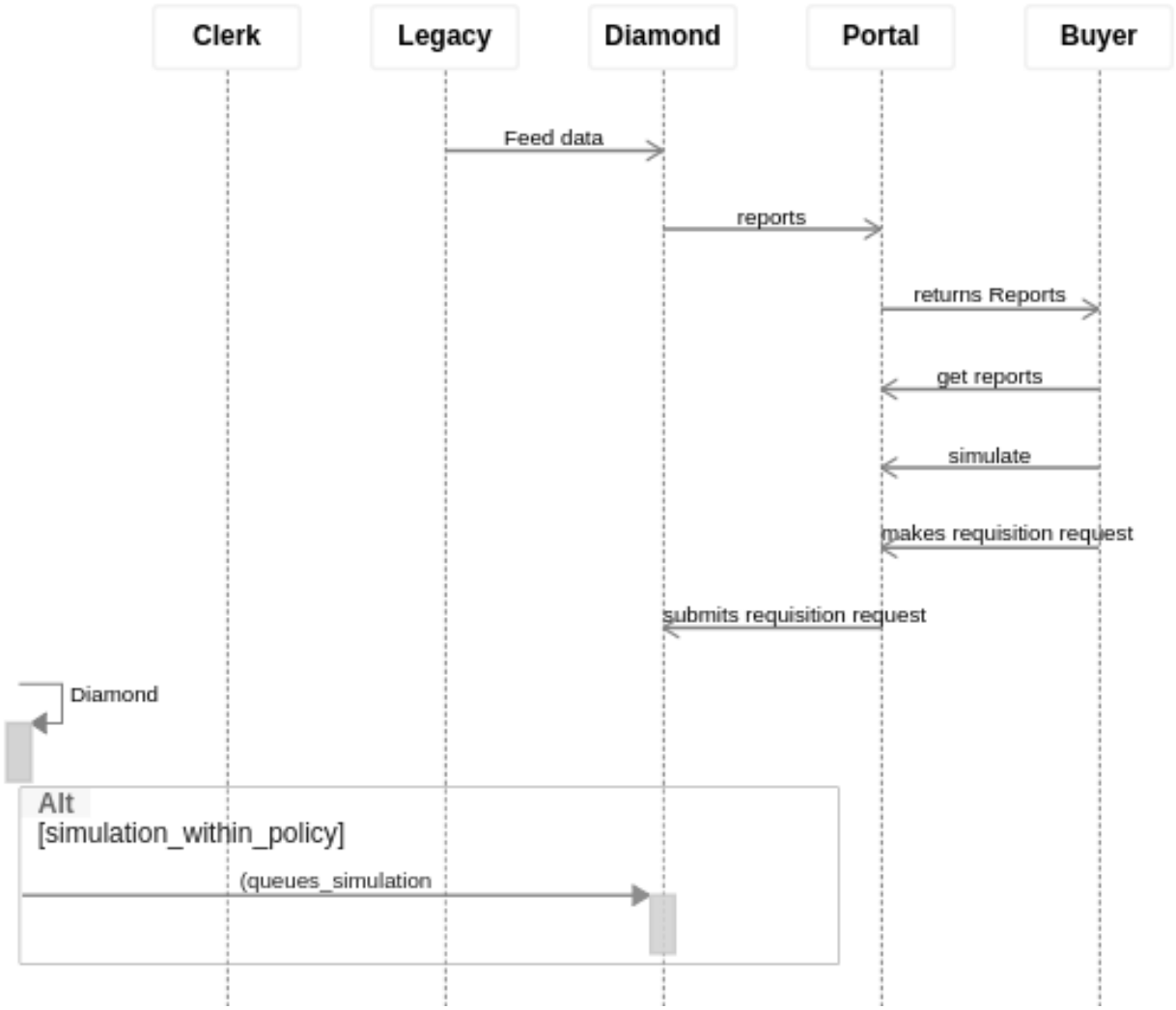
- Some manufactureres will build only on demand, see Cost per Unit
- material shortages
- new product introduction
- product recall MRO (Maintenance, Repair and Overhaul)

56.4 Instructions

1. Look at the report section of the portal
2. Review the information
3. Fill out the checklist
4. Create the requisition

56.4.1 Requisition Checklist

56.5 Sequence Diagram



56.5.1 Intrinsic Information

56.5.2 Extrinsic Information

Gather all information, it should all be available in the portal

56.6 Related articles

CHAPTER

FIFTYSEVEN

SERVICE LEVEL AGREEMENTS

CHAPTER

FIFTYEIGHT

DEFINITIONS

Definitions:

```
ABC_SLS_PCT_DLR

    Top 20 of previous 12 month contribution to sales dollars
    Does not adequately support new product introduction

ABC_CUST_QTE

SVC_LVL

    Contractual service levels

ABC_SLS_PCT ABC Sales Percent
```

CHAPTER

FIFTYNINE

ABC - PARETO

59.1 Purpose

Concentrate inventory and dollars on

- high volume,
- high profit item
- highest service level
- core products
- JIT / SLA / KITS

Metric

59.2 Assumptions

Users wish to quickly summarize the characteristics of an item

59.3 Item Statistics

59.4 Overview

This demonstrates computing a number of potentially useful statistics

59.5 Definition

This is also known as Pareto or 80/20 rule

https://en.wikipedia.org/wiki/Pareto_principle

- Top 20 percent of sales items are rated A
- Next 60 percent rated B
- Bottom 20 Rated C

This has the following problems, an item may be at 21% but is indistinguishable from a 79

59.6 Approach

- Create a table to hold statistics
- Create a script to populate statistics by item
- Create a service to obtain the data model for the web page
- create an angular 8 controller *label-name*
- Modify the filter screen to allow query filters on the statistics
- Modify the web pages to show the statistics information

59.7 Purpose

Concentrate inventory and dollars on

- high volume,
- high profit item
- highest service level for **important** products, those with high margins, not just hhigh

markups , complementery sales, Service Level Agreements, Just in Time Contracts and Kits.

- core products
- **What should the service level be? An item with a 5% markup that turns 12 times a year may be

more profitable than an item with a 30% markup and 1 annual turn**

Certainly a B item at 21% contriibution to profit margin is more valuable than a B item at 79%.

package com.pacificdataservices.diamond.apsweb;

import java.io.IOException; import java.sql.Connection; import java.sql.SQLException;

import javax.sql.DataSource;

import org.javautil.core.json.JsonSerializer; import org.javautil.core.json.JsonSerializerGson; import org.javautil.core.sql.Binds; import org.javautil.core.sql.SqlStatement; import org.javautil.util.NameValue; import org.slf4j.Logger; import org.slf4j.LoggerFactory; import org.springframework.beans.factory.annotation.Autowired; import org.springframework.web.bind.annotation.RequestMapping; import org.springframework.web.bind.annotation.RequestParam; import org.springframework.web.bind.annotation.RestController;

@RestController public class IcItemStatController {

private Logger logger = LoggerFactory.getLogger(getClass()); @Autowired private DataSource datasource;

@RequestMapping("/icItemStat") public String planData(@RequestParam(value="itemNbr") String itemNbr) throws SQLException, IOException { logger.info("invoked with itemNumber {}",itemNbr); Connection conn = datasource.getConnection(); SqlStatement ss = new SqlStatement(conn, "select * from ic_item_stat where item_nbr = :item_nbr"); Binds binds = new Binds(); binds.put("item_nbr", itemNbr); NameValue nameValue = ss.getNameValue(binds,true); JsonSerializer serializer = new JsonSerializerGson(); String json = serializer.toJsonPretty(nameValue); return json; }

'https://www.briantracy.com/blog/personal-success/how-to-use-the-80-20-rule-pareto-principle/
<https://www.briantracy.com/blog/personal-success/how-to-use-the-80-20-rule-pareto-principle/> }

59.7.1 Create a node service

59.8 Modify web page template

https://en.wikipedia.org/wiki/Pareto_principle

https://www.briantracy.com/blog/personal-success/how-to-use-the-80-20-rule-pareto-principle/

59.9 Item Statistics

59.10 Item Statistics Fields

Name

Code

Description

Benefit

Disadvantage

Compare to

While we are at it we may as well get

- Number of customers
- Number of approved manufacturers
- Annual Turns
- Sales Conversion Percentile from quotes

ABC

ABC_SLS

Top 20 of previous12 month contribution to sales dollars

Does not adequately support new product introduction

ABCUSTQUOTE

Top 20 percent of CUST OPEN Quotes

Similar to ABC

59.11 Approach

- Create a table to hold statistics
- Create a script to populate statistics by item
- Create a service to obtain the data model for the web pages
- Modify the filter screen to allow query filters on the statistics
- Modify the web pages to show the statistics information

CHAPTER

SIXTY

OPTIMAL REPLENISHMENT QUANTITY

60.1 Objectives

- Highest Profit
- Highest Customer Satisfaction
- JITS / KITS / SLA

CHAPTER

SIXTYONE

UNIT COST

During one of my calls with Peter he told me that he was reviewing purchase orders a simple line such as "Buyers don't buy the correct quantities to get a good price" was extended to:

61.1 Compute Optimal Purchase Quantity

61.2 Cost Types

Compute a projected per unit cost by solving the equation

unit_cost = (setup_cost / qty) + incremental cost

For two different known qty and prices (vendor quotes) using linear algebra

61.3 Graph this relationship

Find the "price knee" the first derivative of the function, the slope of the tangent starts to level off (it asymptotically approaches 0, meaning the limit is the unit cost doesn't decrease at all. Depending on setup cost, incremental cost and annual consumption a three year supply may be ten percent more than a one year supply, it may also be three times the acquisition cost and additional carrying costs must be considered.

Vendor quotes should include this range of quantities, purchasing quantities should be in this range, buys can be made and even scheduled so that lower per unit costs can be realized.

During one of my calls with Peter he told me that he was reviewing purchase orders a simple line such as "Buyers don't buy the correct quantities to get a good price" was extended to:

61.4 Compute Optimal Purchase Quantity

Compute a projected per unit cost by solving the equation

unit_cost = (setup_cost / qty) + incremental cost

For two different known qty and prices (vendor quotes) using linear algebra

61.5 Graph this relationsihip

Find the “price knee” the first derivative of the function, the slope of the tangent starts to level off (it asymptotically approaches 0, meaning the limit is the unit cost doesn’‘t decrease at all. Depending on setup cost, incremental cost and annual consumption a three year supply may be ten percent more than a one year supply, it may also be three times the acquisition cost and additional carrying costs must be considered. by vendor Vendor quotes should include this range of quantities, purchasing quantities should be in this range, buys can be made and even scheduled so that lower per unit costs can be realized. by vendor

CHAPTER

SIXTYTWO

MULTIPLE LEAD TIMES

62.1 Overview

Vendors may have drastically different lead times.

62.2 Acquiring

Data for lead times should be derived from the latest vendor quotes that is the longest lead tie from the maximum effective date for a vendor quote.

Note that item_nbr, the item surrogate key is not used, allowing you to get vendor quotes for items that have not been set up;

```
create view ic_item_vnd_lead_time as
select  item_cd_qte,
    vq_qte_dt,
    vq_qte_eff_dt,
    max(vq_qte_exp_dt) max_qte_exp_dt,
    (max(vq_qte_exp_dt) - vq_qte_eff_dt) / 7 lead_tm_wks
from vq_qte_vw
group by org_nbr_vnd,
    item_cd_qte,
    vq_qte_eff_dt,
    vq_qte_dt;
```

62.3 YAML

```
ic_item_vnd_lead_tm:
    sql: >
          create view ic_item_vnd_lead_time as
          select item_cd_qte,
               vq_qte_dt,
               vq_qte_eff_dt,
               max(vq_qte_exp_dt) max_qte_exp_dt,
               (max(vq_qte_exp_dt) - vq_qte_eff_dt) / 7 lead_tm_wks
           from vq_qte_vw
           group by org_nbr_vnd,
              item_cd_qte,
              vq_qte_eff_dt,
```

```
         vq_qte_dt;
description: Create ic_item_vnd_lead_tm
narrative: >
   TODO describe consequence of using the quote expiration date, vq_qte_exp_dt
   rather than the quote of quotation or the effective date of quotation.
```

62.4 Assumptions

The most recent vendor quote for lead times will be used.

If multiple vendor quotes exist for the same quote date, the maximum lead time will be used.

Full historical vendor quotes are useful to see trends in cost and lead time.

62.5 Issues

Vendor on-time performance.

CHAPTER

SIXTYTHREE

LEAD TIME BY VENDOR

63.1 Overview

Vendors may have drastically different lead times.

63.2 Acquiring

Data for lead times should be derived from the latest vendor quotes that is:

Note that item_nbr, the item surrogate key is not used, allowing you to get vendor quotes for items that have not been set up;

```
create view ic_item_vnd_lead_time as
select  item_cd_qte,
    vq_qte_dt,
    vq_qte_eff_dt,
    max(vq_qte_exp_dt) max_qte_exp_dt,
    (max(vq_qte_exp_dt) - vq_qte_eff_dt) / 7 lead_tm_wks
from vq_qte_vw
group by org_nbr_vnd,
    item_cd_qte,
    vq_qte_eff_dt,
    vq_qte_dt;
```

63.3 YAML

ic_item_vnd_lead_tm:

sql: >

create view ic_item_vnd_lead_time as select item_cd_qte,

vq_qte_dt, vq_qte_eff_dt, max(vq_qte_exp_dt) max_qte_exp_dt, (max(vq_qte_exp_dt) - vq_qte_eff_dt) / 7 lead_tm_wks

from vq_qte_vw group by org_nbr_vnd,

item_cd_qte, vq_qte_eff_dt, vq_qte_dt;

description: Create ic_item_vnd_lead_tm narrative: >

TODO describe consequence of using the quote expiration date, vq_qte_exp_dt rather than the quote of quotation or the effectivedate of quotation.

63.4 Assumptions

The most recent vendor quote for lead times will be used.

If multiple vendor quotes exist for the same quote date, the maximum lead time will be used.

Full historical vendor quotes are useful to see trends in cost and lead time.

63.5 Issues

Vendor on-time performance.

TODO flesh out

CHAPTER

SIXTYFOUR

BUSINESS PROCESS IMPROVEMENT : CREATE REQUISITION

1. Business Process Improvement
2. Project Description
3. Diamond Portal
4. Portal Functionality
5. Purchasing

64.1 Business Process Improvement : Create Requisition

Created by James Schmidt, last modified on Dec 21, 2019

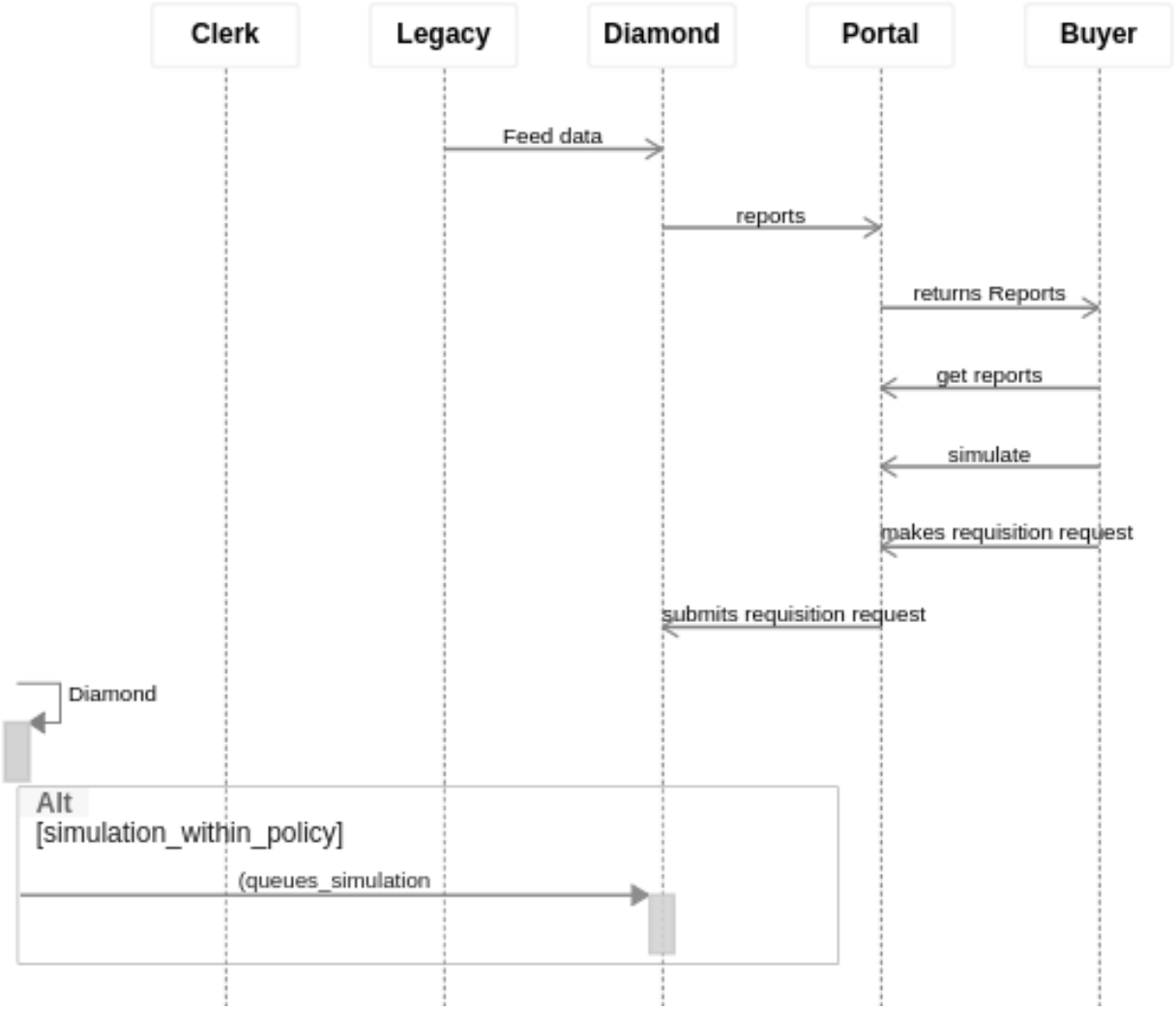
]How and why to create a requisition

64.1.1 Instructions

1. Look at the report section of the portal
2. Review the information
3. Fill out the checkist
4. Create the requistitio

Requisition Checklist

64.1.2 Sequence Diagram



Intrinsic Information

Extrinsic Information

Gather all information, it should all be available in the portal

64.1.3 Related articles

CHAPTER

SIXTYFIVE

REQUISITION

]How and why to create a requisition

65.1 Instructions

1. Look at the report section of the portal
2. Review the information
3. Fill out the checkist
4. Simulate
5. Create the requisititioni
6. Proper quantity for ABC?

65.2 Gather Information

- Lead Times
- Unit Costs
- Optimal Replenishment Quantities
- Approved Manufacturers

65.2.1 Requisition Checklist

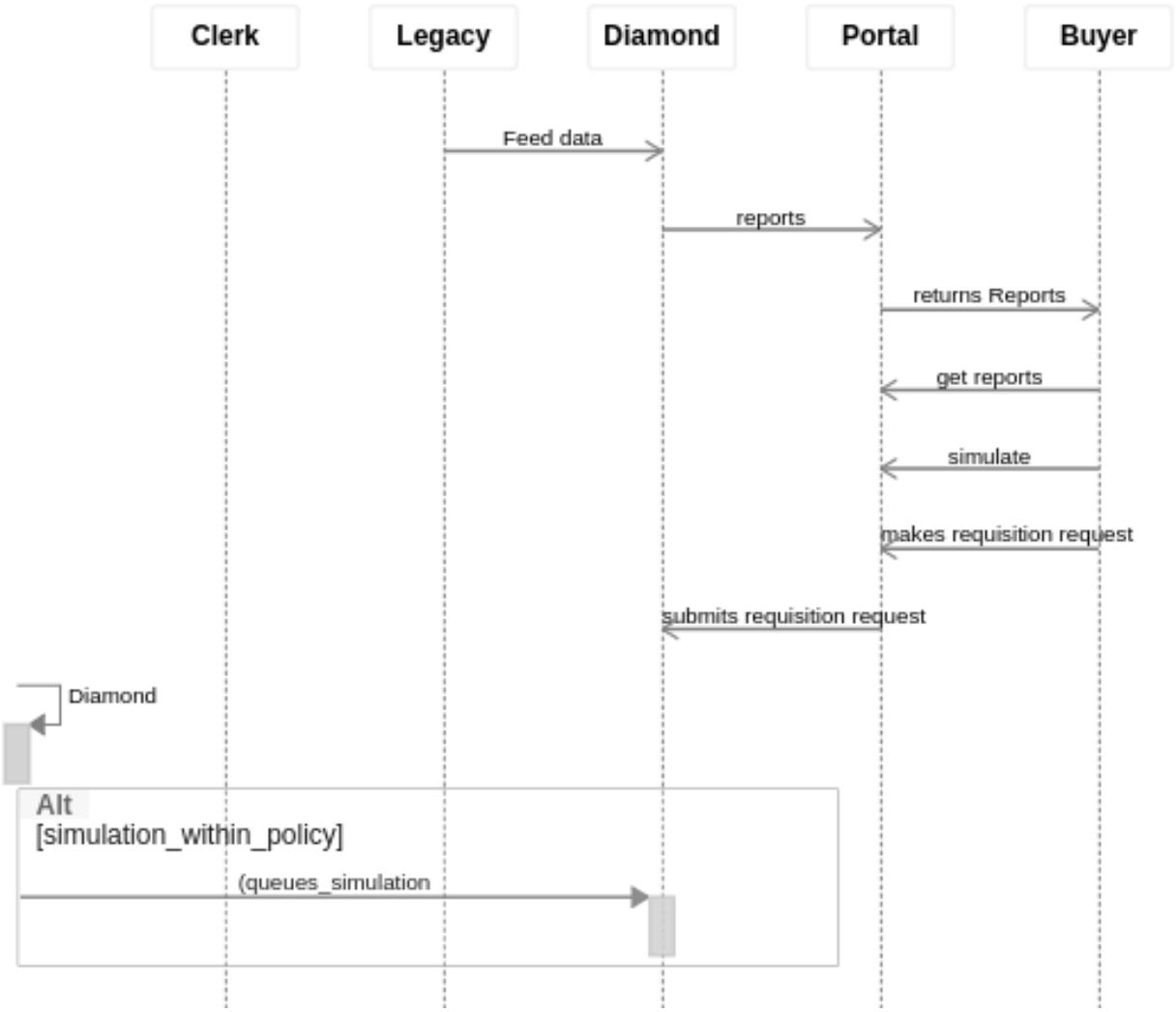
65.2.2 Intrinsic Information

65.2.3 Extrinsic Information

65.2.4 Simulate

DOCTHIS

65.2.5 Sequence Diagram



1. What are the requisition review requirements?
    - When is a requisition subject to review?
    - What are the needs additional work conditions?
        - Need more vendor quotes
        - Need work on equivalent parts
        - Incorrect buy quantity
        - Get existing inventory certified.

65.3 Out of Scope

Lead times can vary drastically based on

- vendor

- material shortages
- new product introduction
- product recall MRO (Maintenance, Repair and Overhaul)Definition

The elapsed time, usually measured in weeks between when a product is ordered and receivied.

Usually not considered

- Recieving time
- Inspection Time
- Intra-facility transfer time
- These are consider *availability times*

Typically in DRP Planning

- There is only one lead time
- This lead time is fairly consistent
- Costs due not vary based on lead time.

65.4 In aerospace

65.5 Source of Lead Time

65.5.1 vendor quotes

Take the lead time from the maximum quote expiration date

65.5.2 Summarized Lead Times should include

- Vendor Code
- Vendor type (Manufacturer, Distibutor, intra-company
- Vendor quote beginning and ending effective date
- Date of request for quote

65.5.3 Lead time details should include:

- Historical lead times

65.5.4 Lead time projections

Factors that can effect lead time, Lead times can vary drastically based on

- vendor
- Some vendors will stock
- Some manufacturers will build to stock

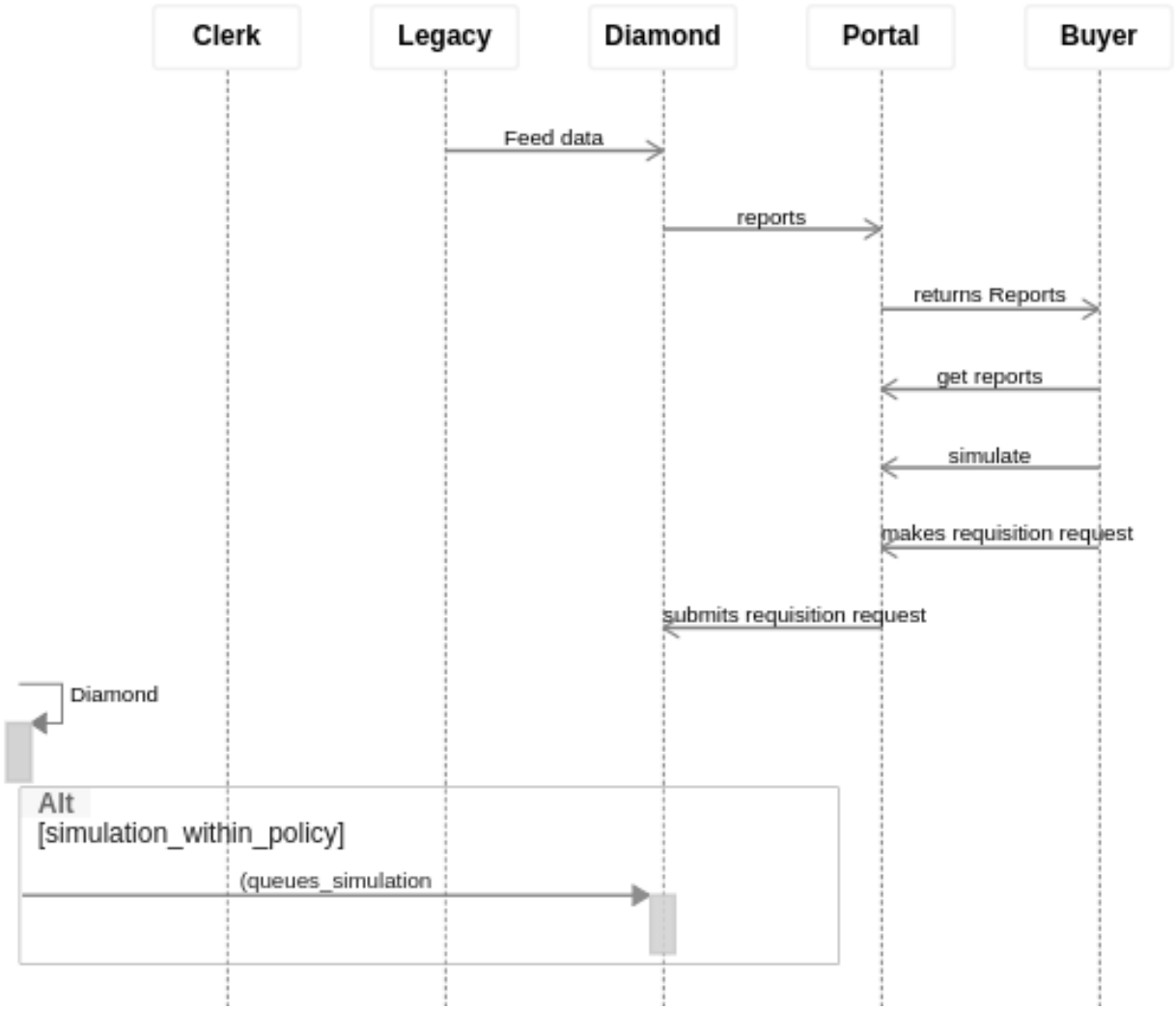
- Some manufactureres will build only on demand, see Cost per Unit
- material shortages
- new product introduction
- product recall MRO (Maintenance, Repair and Overhaul)

65.6 Instructions

1. Look at the report section of the portal
2. Review the information
3. Fill out the checklist
4. Create the requisition

65.6.1 Requisition Checklist

65.7 Sequence Diagram



65.7.1 Intrinsic Information

65.7.2 Extrinsic Information

Gather all information, it should all be available in the portal

65.8 Related articles

CHAPTER

SIXTYSIX

AIRFRAME SCENARIO 737 MAX

As Boeing grounds planes and stops manufacturing 737 Max,

lead times from and costs from distributors are presumably dropping, but client would carry until ramp up resumes. Can they be bought at manufacturer costs now and sat on until production resumes? Lower acquisition cost, higher carrying costs and intermediate turns will be non existent but risk of obsolescence decreases. We can only plug in the variables and run various simulations or a Monte Carlo simulation.

All intrinsic system information for my formulas is worthless in this scenario.

Buy a bunch of parts at lower cost now and take delivery now from distributors or buy for delivery in 30 weeks? When will production resume? These are judgment calls based communication with the manufacturer. The distributors are probably offering for less, the lead times should be shorter, the costs less, but the will sit idle for six to eighteen months.

We can only plug in these assumptions and come up with buys based on those assumptions, historical data in the system has significantly less value. We can only come up with investment cost and carrying cost based on this extrinsic information and the formulas I have developed but not yet published.

..image:: Portal/images/ActionReport.png

CHAPTER

SIXTYSEVEN

INDICES AND TABLES

- *genindex*
- *modindex*
- *search*