

PCS Sort

Architecture

Revision History

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Table of Contents

Introduction 3

Overview 3

Context 3

Scope 4

Risks 4

Business Activities 5

Inbound: JA Pickup Appointment (Full Trailer) 5

Inbound: JA Pickup Appointment (Partial Trailer or Straight Truck) 6

Inbound: RF Pickup Request (Straight Truck to Full/Partial Transfer Trailer) 7

Outbound: Load Trailer 8

Business Events 9

System Analysis 10

Overview 10

Actors 10

Use Cases 10

Use Case 1 10

Business Rules 10

Key Abstractions 11

States 12

# Introduction

## Overview

Argix Logistics needs to develop a software system to process Bed Bath and Beyond freight. The system needs to support three main considerations: picking up BBB vendor freight, conveyer sorting to Pools 1 – 26, and manual sorting to Pool 27. The problem can be broken down (divide and conquer) along these same considerations, and the solution should answer the following questions being asked by the client and business:

* What is the status of vendor pickups and associated inbound trailers
* How many empty trailers are available for pickups or outbound loading
* What outbound trailers are being loaded and what are the door assignments
* What outbound trailers are ready for line haul
* Which inbound load should be sorted next
* Where is an inbound trailer to sort
* Where is an empty trailer for outbound loading

The system should assume a steady state of the physical world (i.e. yard-trailers-doors). Therefore, inbound and outbound trailers are assumed in the doors from the prior shift (i.e. don’t record moves to accommodate changeover to Tsort processing).

This document details known requirements and a candidate design. It does not address manpower requirements or project scheduling, although these can be determined from this architecture.

How to read this document

Management- Introduction, Analysis (Overview, Business Activities, Actors), Project Planning

Operations- Introduction, Analysis, Project Planning

IT- Introduction, Analysis, Design, Project Planning

## Context

The following diagram provides context for the system under discussion. This is a high level view of the structure of the system. At the center of the drawing is the system under discussion (i.e. Pallet Shipment). Surrounding this system are roles, devices, and other systems that interact with the system. it helps us to understand the people, hardware, and external systems that interact with the system under discussion.



## Scope

Solution Boundary

The solution will provide…

Constraints

1. None

## Risks

1. Time

## Business Activities

The following diagrams show the core business activities for the PCS Sort System. Business activities are modeled using activity diagrams; they show a series of activities, the actor involved, and the information consumed or created during the process. Activity diagrams drive the discovery of Actors, Use Cases, and Key Abstractions.

Inbound: JA Pickup Appointment (Full Trailer)

A Jamesburg pickup appointment is scheduled for an inbound load; this is arrived as a full trailer. The vendor calls or emails a load tender to JA Dispatch. An inbound load is created and dispatched; the vendor receives a confirmation number (i.e. the number of the Dispatch pickup appointment). The inbound load is picked up and arrived in the Jamesburg yard by JA Dispatch. The trailer is parked in the JA yard or an overflow yard (i.e. Hermann’s yards)- the exact location unknown at arrival. The inbound load is eventually pulled to an inbound door and sorted, and the trailer is empty and available for an inbound load (i.e. pickup) or outbound load (i.e. assign to outbound door).

*Strategy*: Partition the yard into separate areas for Tsort and BBB inbound loads.



Inbound: JA Pickup Appointment (Partial Trailer or Straight Truck)

A Jamesburg pickup appointment is scheduled for an inbound load that is less than x pallets or y cartons and is more cost-effective for pickup out of Jamesburg; this is arrived as a partial trailer or on a straight truck. The vendor calls or emails a load tender to JA Dispatch. An inbound load is created and dispatched; the vendor receives a confirmation number (i.e. the number of the Dispatch pickup appointment). The inbound load is picked up and arrived in the Jamesburg yard by JA Dispatch. The inbound load is unloaded to the warehouse floor- the exact location is unknown at arrival. The inbound load is eventually sorted. Notice there is NO notion of a trailer in this process.

*Strategy*: Partition the warehouse into identifiable spaces for each BBB vendor load to make it easier to find loads for sorting.



Inbound: RF Pickup Request (Straight Truck to Full/Partial Transfer Trailer)

A Ridgefield pickup request is scheduled for a vendor load that is less than x pallets or y cartons and is more cost-effective for pickup out of Ridgefield; this is arrived at the local terminal on a straight truck. The vendor calls or emails a load tender to JA Dispatch. An inbound load is created and dispatched; the vendor receives a confirmation number (i.e. the number of the Dispatch pickup request). The inbound load is picked up and received at the Ridgefield warehouse. The load is loaded onto a transfer trailer destined for Jamesburg. The transfer trailer is arrived in the Jamesburg yard by JA Dispatch. A full trailer is parked in the JA yard or an overflow yard (i.e. Hermann’s yards) - the exact location is unknown at arrival; a partial trailer is unloaded to the warehouse floor- the exact location is unknown at arrival. The inbound load is eventually sorted.



Outbound: Load Trailer

An available empty trailer is found and identified for BBB outbound freight. The trailer is moved to the outbound door. The trailer is assigned to the door in the PCS system. The trailer is loaded until full. The trailer is unassigned from the outbound door in the PCS system. The trailer is removed from the door and sealed. The paperwork is sent to Dispatch.

*Strategy*: To simplify the transition between Tsort and PCS shift changes, create a physical token for each outbound door (26 unique tokens) and attach the token to the outbound trailer until it is fully loaded and unassigned from the door. Then attach the token to the next empty pulled to the open door.



## Business Events

The following table lists business events that occur when processing PCS freight. The Action column shows a suggested system activity and the resulting state changes of certain objects.

Inbound Events

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  | **States** | |
| **Actor** | **Event** | **Action** | **Inbound Load** | **Trailer** |
| JA Dispatch | Vendor call or email for pickup | Create Inbound Load | Tendered |  |
| JA Dispatch | Dispatch vendor load | Dispatch Load | Scheduled |  |
| RF Dispatch | Pickup received at RF terminal | Receive Load | Received |  |
| RF Dispatch | Pickup loaded onto transfer trailer | Transfer Load | Transferring |  |
| JA Dispatch | Trailer arrives at JA gate with vendor load(s) | Arrive Load | Arrived | Inbound |
| Driver | Trailer parked in JA or overflow yard |  |  |  |
| Warehouse | Trailer unloaded to JA warehouse |  |  |  |
| Switcher | Trailer pulled to JA warehouse inbound door |  |  |  |
| Switcher | Trailer seal removed |  |  |  |
| Warehouse | First carton unloaded from trailer or floor load | Start Sort | Sorting |  |
| Switcher | Trailer moved from inbound door (shift over) |  |  |  |
| Switcher | Trailer pulled to JA warehouse inbound door |  |  |  |
| Warehouse | Last carton unloaded from trailer or floor load | Stop Sort | Sorted | Empty |
| Switcher | Empty trailer pulled from warehouse inbound door |  |  |  |

Sorting Events

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  | **States** | |
| **Actor** | **Event** | **Action** |  |  |
| Warehouse | Carton placed on conveyer |  |  |  |
| Scanner | Carton scanned, outbound lane requested |  |  |  |
| PCS | Outbound lane returned |  |  |  |
| Warehouse | Carton removed from conveyer |  |  |  |

Outbound Events

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  | **States** | |
| **Actor** | **Event** | **Action** | **Outbound Load** | **Trailer** |
| Warehouse | Outbound door is empty | Create Outbound Load | Empty | Empty |
| Switcher | Empty trailer is moved to an outbound door |  |  |  |
| Warehouse | Trailer is assigned to an outbound door | Assign Trailer | Loading | Outbound |
| Warehouse | First carton is loaded onto trailer |  |  |  |
| Warehouse | Last carton is loaded onto trailer |  |  |  |
| Switcher | Full trailer is moved from an outbound door |  |  |  |
| Warehouse | Trailer is unassigned from outbound door | Un-assign Trailer | Loaded |  |
| Dispatch | Outbound paperwork is complete- BBB notified | Ready Trailer | In Transit | In Transit |

# System Analysis

## Overview

The purpose of defining system behavior is to discover, capture, and analyze the requirements of the system under discussion. This is achieved by describing the requirements (i.e. the conditions or capabilities to which the system must conform) well enough so that an agreement can be reached between the business users and the system developers on what the system should and should not do. It begins by modeling the business processes with a series of activity diagrams. These diagrams drive discovery of the users of the system (i.e. Actors), the system functionality (i.e. Use Cases), and the vocabulary of the system (i.e. Key Abstractions). From these artifacts, an analysis model is created that drives system design and development.

## Actors

An actor specifies a role played by a user or any other system that interacts with the system under discussion. Actors influence UI design and security concerns. The list below provides definitions for the actors surrounding the Pallet Shipment system.

* PCS Sort System- the system under discussion.

## Use Cases

A Use Case is a list of steps, typically defining interactions between a role (i.e. Actor) and a system to achieve a goal. The actor can be a human or an external system. Use Cases describe the functional view of the system under discussion as a set of business transactions. Use Cases influence UI design, domain models, application service interfaces, and define business transactions. The following Use Case diagram shows some, if not all, of the actors and use cases involved.

[use case diagram]

Start Sort

The Warehouse needs to start sorting an inbound load (floor or trailer) or an inbound trailer that contains one or more loads.

* The user chooses to view inbound loads that are arrived at the JA sort terminal and have not begun sorting (Arrived). The view includes information about the vendor freight and the location of the freight in the warehouse or in a trailer in the yard.
* The user selects a load to sort.
* The system sets the load as Sorting.
* The user chooses to view trailers that are arrived at the JA sort terminal (Inbound).
* The user selects a trailer to sort.
* The system sets all loads associated with that trailer to Sorting.

Stop Sort

The Warehouse needs to stop sorting an inbound load (floor only) or an inbound trailer that contains one or more loads.

* The user chooses to view inbound loads that are on the warehouse floor and are sorting (Sorting).
* The user selects a load to stop.
* The system sets the load as Sorted.
* The user chooses to view trailers that are arrived at the JA sort terminal (Inbound).
* The user selects a trailer to sort.
* The system sets all loads associated with that trailer to Sorting.

## Business Rules

1. Pickup requests must be picked up within 48 hours of receipt.
2. Argix trailers are shared between Tsort and PCS processing.

## Key Abstractions

The class diagram below shows the key abstractions involved in Pallet Shipment. Key abstractions are the key concepts and abstractions that the system needs to handle. They are those things that, without which, you could not describe the system. Key abstractions drive design of the database schema and the domain model (if applicable).



* Client- a Tsort client; currently, BBB (client number 142) is the only applicable client.
* Vendor- a Tsort vendor; currently, BBB vendors are only ones supported.
* Terminal- a Tsort local terminal; currently, Ridgefield is the only applicable terminal.
* Sort Center- a Tsort sort center; currently, this is the Jamesburg terminal.
* Vendor BOL- the inbound BOL from a BBB vender load.
* Transfer BOL- the transfer BOL from an Argix local terminal (i.e. RF) to an Argix sort center (i.e. JA).
* Inbound Load- represents the vendor load from receipt thru sort.
* Trailer- the trailer associated with an inbound or an outbound load; not all inbound loads have an associated trailer.
* Outbound Load- represents the outbound load for a BBB pool point.
* Outbound Door- Argix outbound doors appointed for sorting BBB-PCS freight; there are 26 doors that are each associated with a single BBB delivery pool.
* Pickup- a JA pickup appointment (Inbound Schedule) or an RF pickup request (Pickup Log).

## States

The state machine view describes the dynamic behavior of objects over time by modeling the lifecycles of objects of each class. Each object is treated as an isolated entity that communicates with the rest of the world by detecting events and responding to them. Events represent the kinds of changes that an object can detect. Anything that can affect an object can be characterized as an event.

Inbound Load

Inbound Load represents vendor freight inbound to the Jamesburg sort center and sorted into the PCS system. The Inbound Load helps to answer questions concerning the status of vendor loads from pickup request thru sorting until the trailer is empty such as:

* What vendor loads are in the process of being dispatched to the JA sort facility (Tendered, Scheduled, Received, Transferring)
* What vendor loads are in the JA sort facility available for sort or sorting (Arrived, Sorting)
* What vendor loads have been sorted (Sorted)

**Tendered**- the load tender is recorded in the system from an email or a phone call.

**Scheduled**- the load is scheduled in Dispatch with a pickup appointment or pickup request.

**Received**- the load is received by an Argix local terminal.

**Transferring**- the load is assigned to a transfer trailer from an Argix local terminal and destined for the Jamesburg sort center.

**Arrived**- the load is arrived at the Jamesburg sort center; it is in the warehouse (i.e. floor freight) or in the Jamesburg yard or an overflow yard.

**Sorting**- the load is on the warehouse floor or the trailer is pulled up to an inbound door and the first carton has been removed from the load and placed on the conveyer.

**Sorted**- the last carton has been removed from the load and placed on the conveyer; the trailer, if applicable, is now empty and removed from the inbound door.

**Cancelled**-



Outbound Load

An Outbound Load represents the freight sorted to a trailer at a Jamesburg outbound door (an outbound door is associated with a single BBB pool point). The Outbound Load helps to answer questions concerning the status of outbound loads from assigning an empty trailer to a door until the trailer is full and ready for line haul such as:

* What outbound loads are loaded and ready for line haul (Loaded)

**Empty**- the load has an empty trailer assigned, but no door assignment

**Loading**- the load has been assigned to a door

**Loaded**- the load is full and has been unassigned from an outbound door

**Ready**- the paperwork is complete and the load is ready for pickup (line haul)

**Cancelled**-



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Trailer

Trailer represents a physical trailer that is associated with inbound and outbound loads. The Trailer helps to answer questions concerning the status of trailers available for processing PCS freight such as:

* What trailers are in the JA yard with BBB vendor freight (Inbound)
* What trailers are empty and available for pickups or outbound sorted freight (Empty)
* What trailers are currently assigned to the 26 outbound doors (Outbound)

**Inbound**- the trailer is in the JA yard and still contains vendor freight

**Empty**- the trailer is in the JA yard and is empty

**Outbound**- the trailer is in the JA yard, assigned to an outbound door, and being loaded with freight

**InTransit**- the trailer has departed the JA yard as an empty for a pickup or as an outbound full trailer

**OutofService**- the trailer is not available for inbound or outbound



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