



Traceability of a Breakthrough Food Science Technology



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Advisor: Bruce Arntzen
Sponsor Company: Apeel Sciences

The Team



Russ Miller

Before MIT, Russ was a **Process Engineer** in biotech. He has experience with **FDA regulations**, as well as a deep Good Manufacturing Practices (GMP) knowledge in the pharmaceutical industry.



Hilary Taylor

Before MIT, Hilary was a **supply chain systems** project lead for a Canadian retailer. She has experience in **business process engineering**, change management and **technology implementation**.

Agenda

Introduction

- Apeel's Supply Chain
- Recommendations
- Q&A



Sponsor Company - Apeel Sciences

- 45% of produce is wasted due to spoilage - \$750B annually
- Food science **start-up**
- Founded in **Santa Barbara, California** in **2012**



Company Mission

Apeel uses **natural plant-based technologies** to protect crops and harvested produce, helping to **eliminate food spoilage** and **reduce reliance on chemicals**

Company Purpose

This means we will **waste less food**, water and energy, **helping to preserve our natural ecosystems** while creating economic opportunities for the 500 million small family farms worldwide

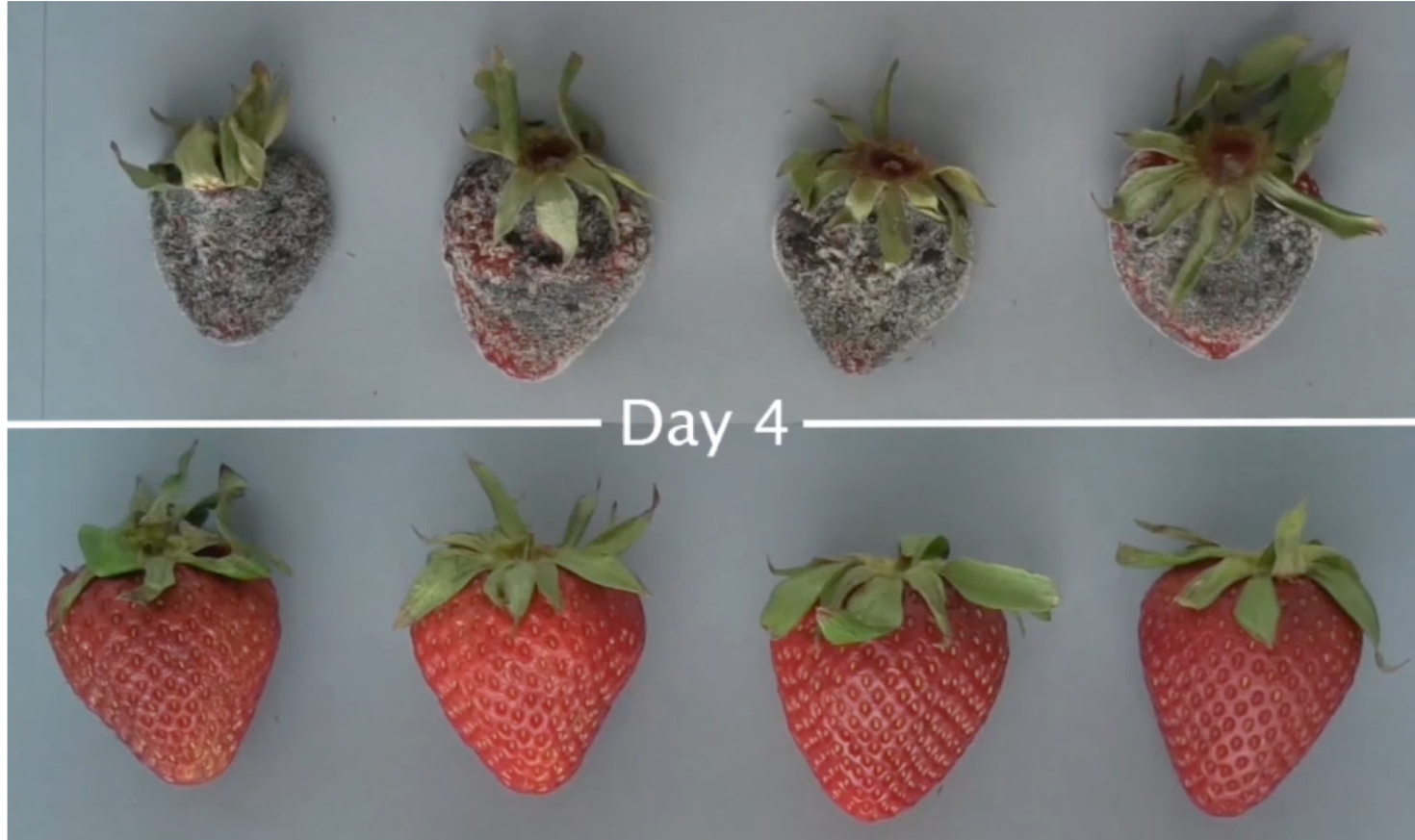
Company Vision

In the future, less food will be wasted, we will use smarter, more natural methods for growing and protecting crops, and there will be an **abundance of fresh food for everyone**



Introducing... Edipeel™

UNTREATED

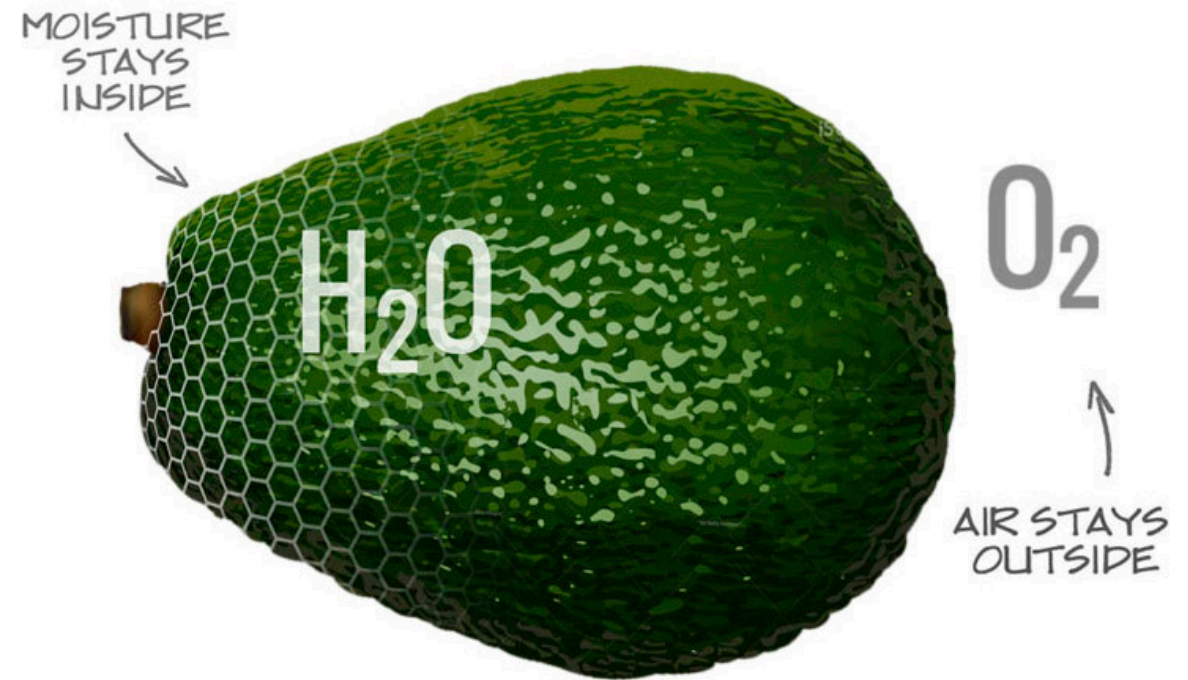


TREATED with Edipeel



Edipeel™

- Edible, natural, odorless, flavorless
- Produced as a powder and **reconstituted** with water
- Mimics the protection of the plant's natural peel
- **DOUBLES** the viable shelf-life of harvested produce



Project Purpose – Lot Traceability of Edipeel

- Ensure Apeel's lot traceability program is **compliant** from a **regulatory standpoint** and **scalable**
- Apeel must identify the origin & location of all Edipeel inventory - **current and historic** - upon request
- **Critical data points** from production to applying Edipeel are **logged & linked**
- **Avocados** are the current commercial Edipeel product
- **Lack of standardization** for collecting and communicating data along the supply chain



EDIPEEL AVOCADO



Regulatory Environment

Code of Federal Regulations

- Establish a **recall plan**
- Packaging requirements – include: lot #, commodity name, date/time, operator signature, supervisor review

Food & Drug Amendments Act of 2007

- **Built** upon one up / one down
- **Reportable Food Registry (RFR)**

Bioterrorism Preparedness & Response Act 2002

- Companies must maintain a record of: “immediate previous sources and the immediate subsequent recipients of food”
- **One up / one down** traceability

Food Safety Modernization Act (FSMA) of 2011

- Shifts focus from reactive to preventative
- Written recall plan, **respond within 4 hours**
- Initiated Tracking & Tracing Pilots



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Apeel's Supply Chain

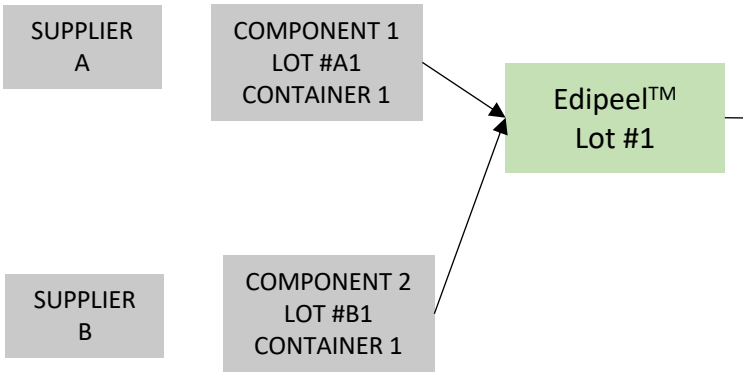
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Edipeel Supply Chain

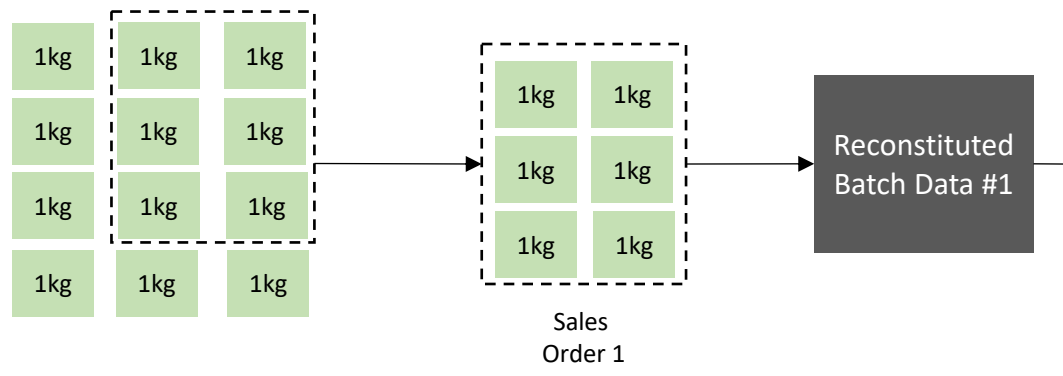
RAW MATERIALS & MANUFACTURING

SUPPLY RECEIVING MANUFACTURING



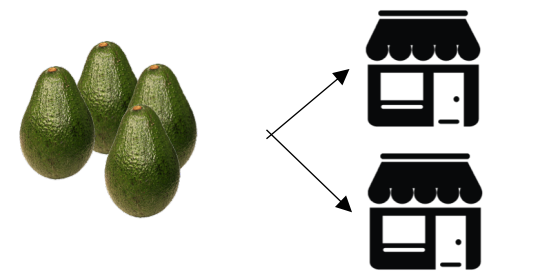
EDIPEEL™ FINISHED GOODS INVENTORY MANAGEMENT

INVENTORY (APEEL) INVENTORY (CUSTOMER) RECONSTITUTION



RECONSTITUTION & APPLICATION

APPLICATION SHIP TO RETAILER



Edipeel Supply Chain

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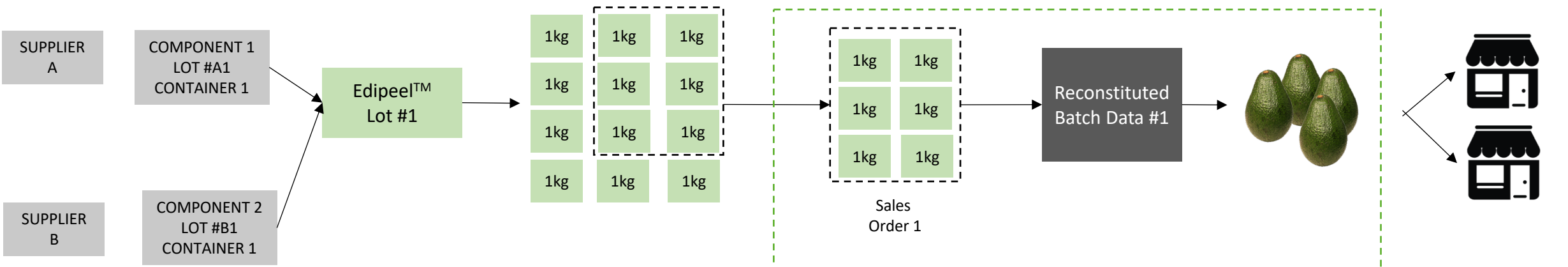
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Apeel's Service Model:

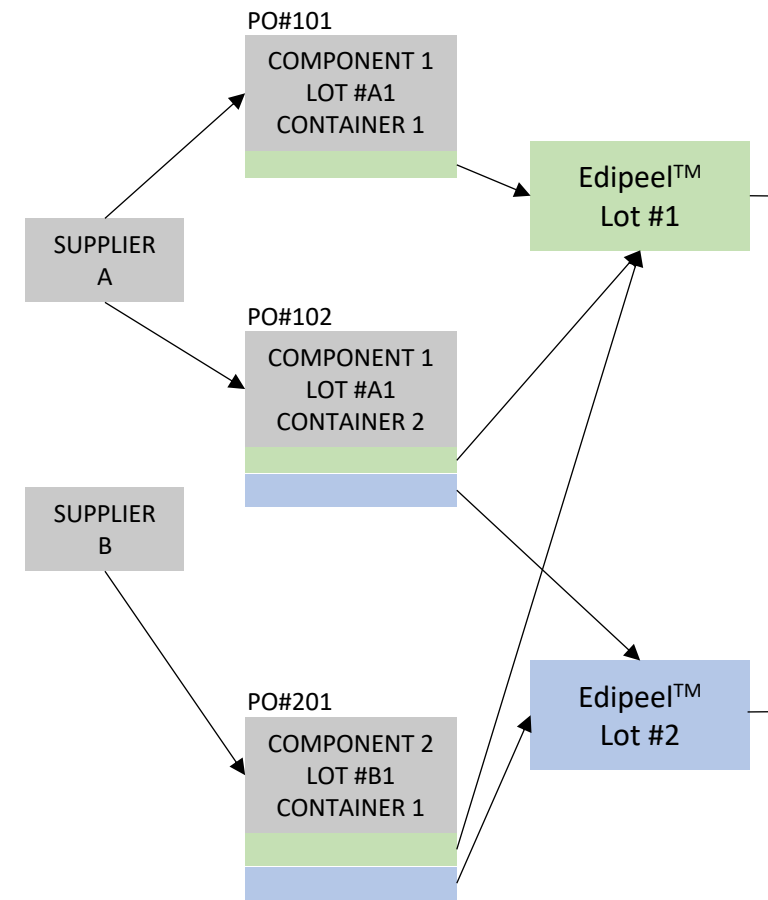
- Integrate into customer **packing house**
- Own inventory on customer's site
- Manage reconstitution and application
- Inventory **title transfer** upon application



Edipeel Supply Chain – Scenario Review

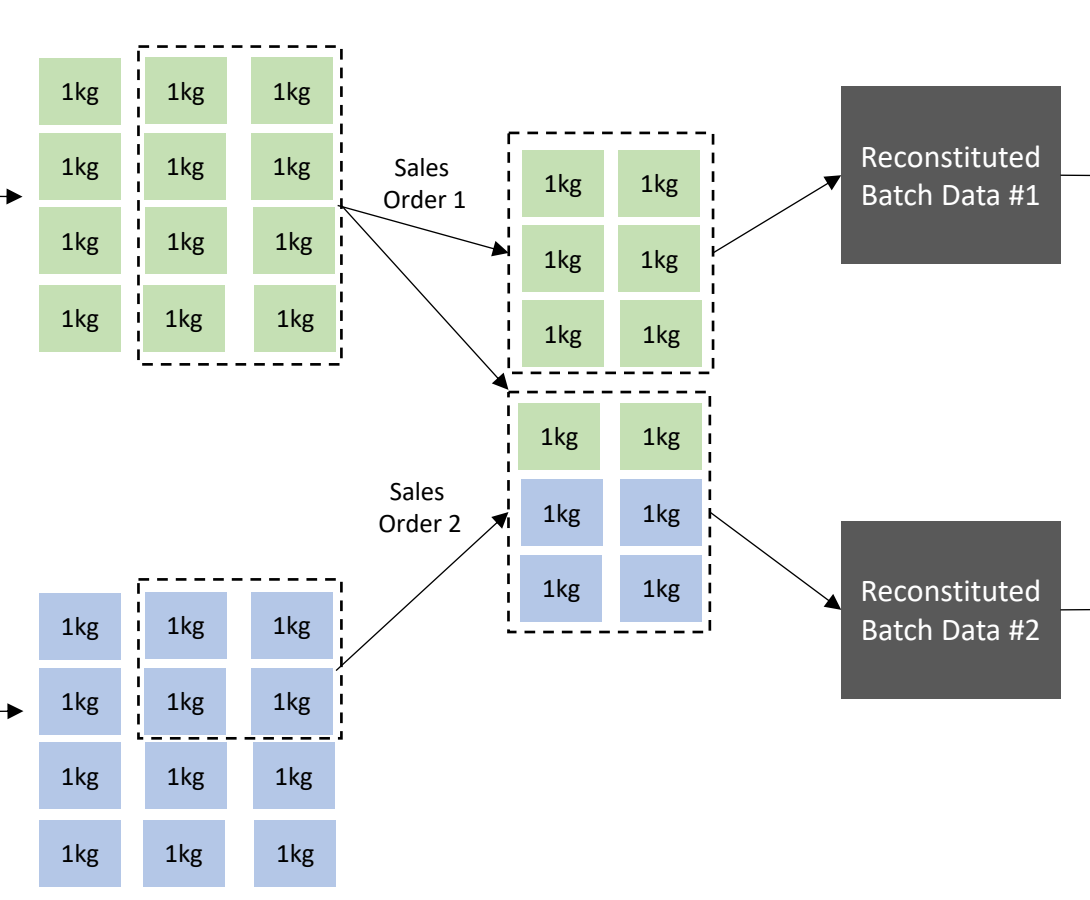
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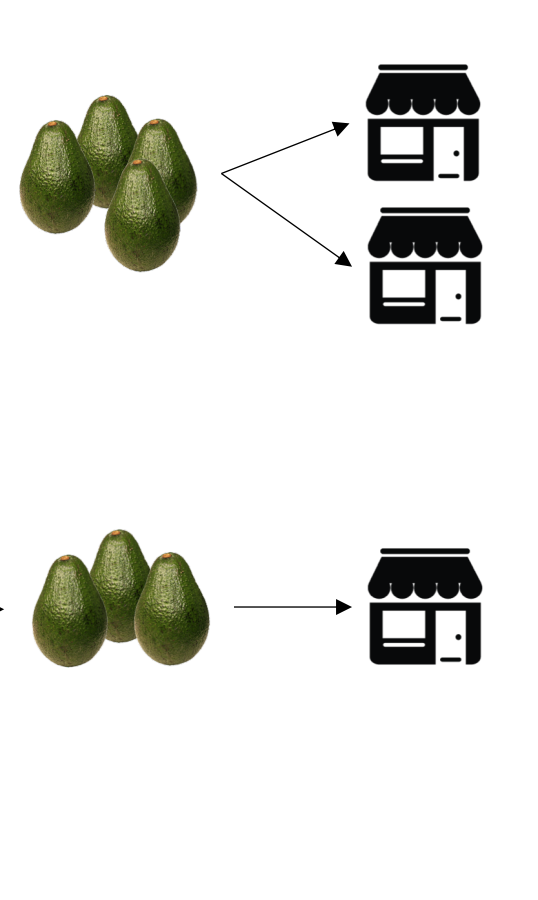
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Key Data Elements

Raw Material Inventory

Upon Receipt:

- Raw Material
- Supplier
- Supplier Lot #
- Date
- Quality Inspected

= Container ID-01/02/2018

Edipeel Inventory

- Container ID-01/02/2018
- Work Order #
- Production Date
- Quantity
- Expiry Date

= Lot # CCO3-AVOCAD-001

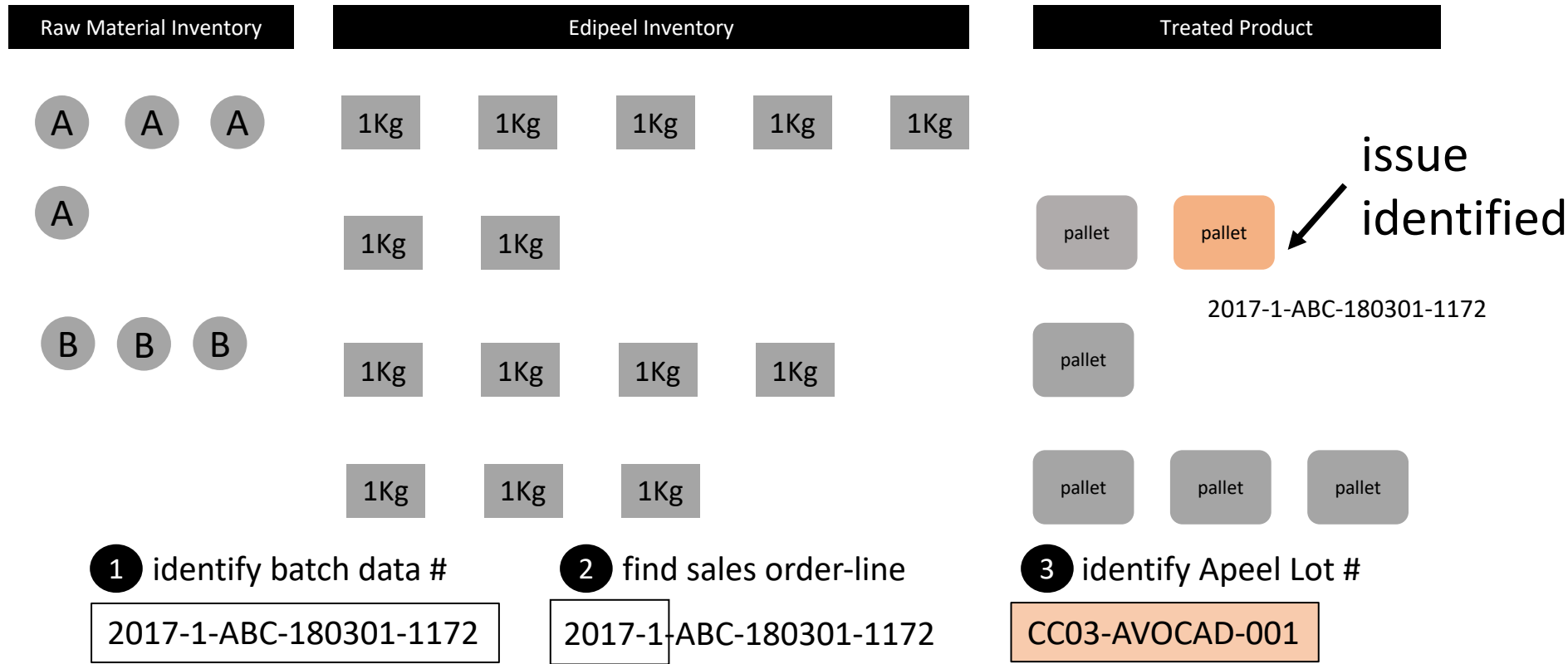
Treated Product

- Lot # CCO3-AVOCAD-001
- Sales order #
- Reconstitution date
- Quantity

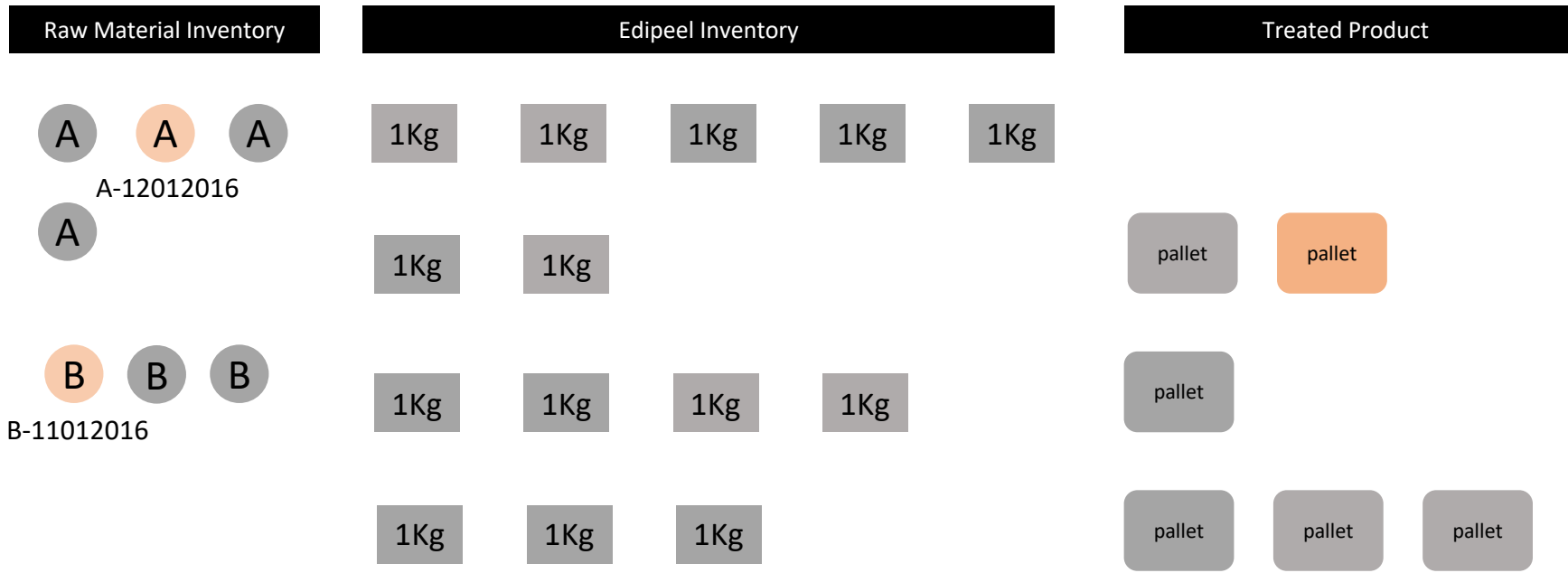
= 2017-1-ABC-180301-1172



Recall Traceback – example



Recall Traceback – example



4 identify raw material container IDs used to create CC03-AVOCAD-001

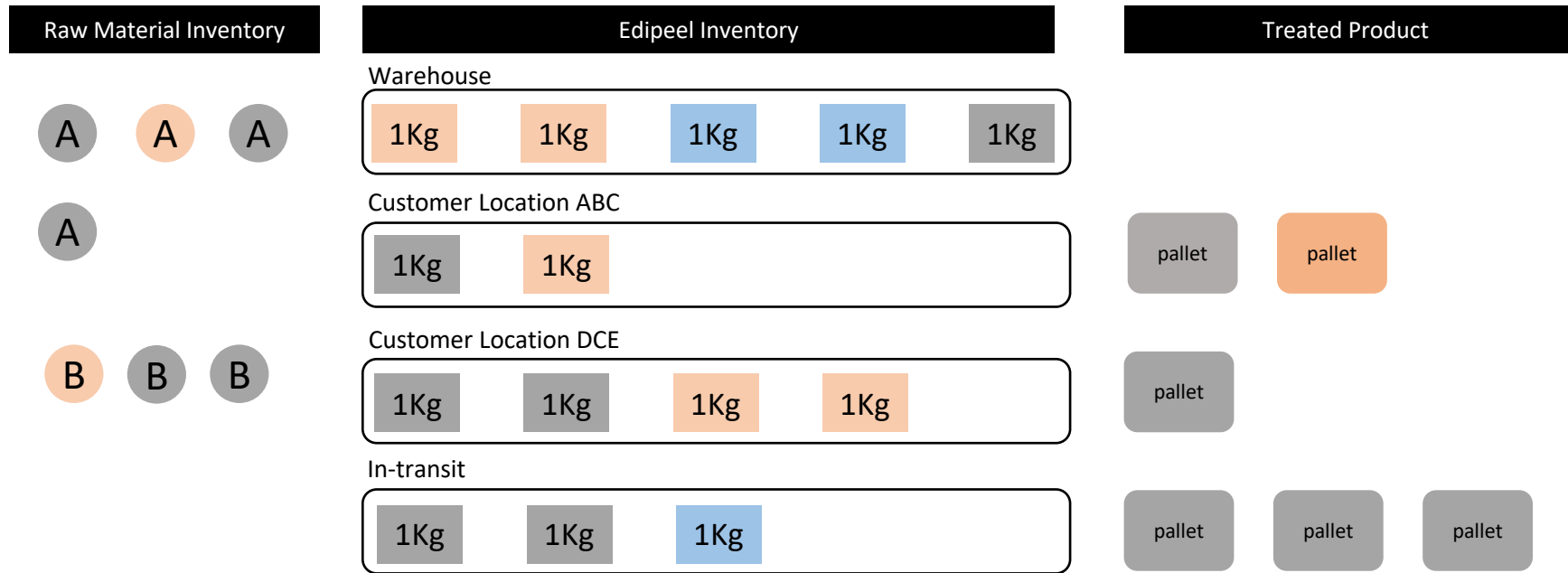
A-12012016 B-11012016

5 identify all Apeel lot #'s using A-12012016 & B-11012016

CC03-AVOCAD-001 CB01-AVOCAD-001



Recall Traceback – example

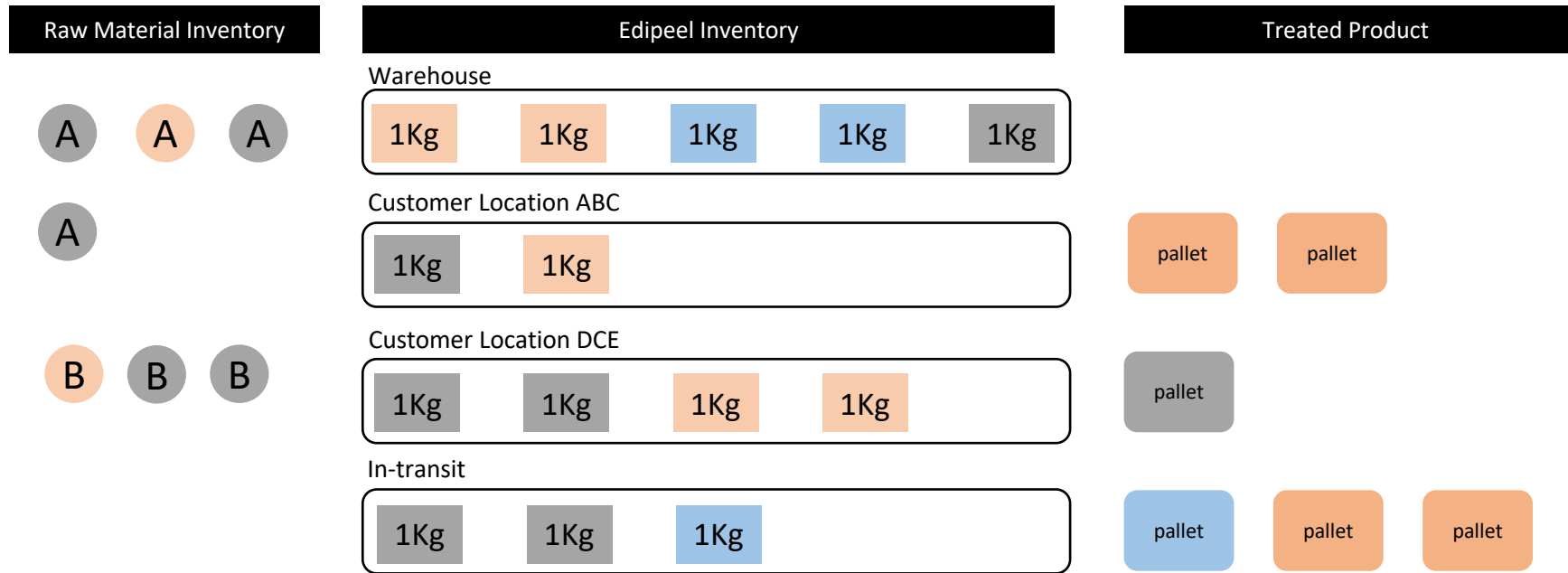


- 6 identify all finished goods inventory of the identified lots:
- Warehouse
 - In-Transit
 - At Customer

CC03-AVOCAD-001 CB01-AVOCAD-001



Recall Traceback – example



7 identify any additional processed batches of the identified lots:

- 2017-1-ABC-180301-1172
- 2024-1-DCE-180228-1012
- 2024-1-DCE-180228-1011



Reporting Requirements

Given:		Identify:
Treatment Batch ID	—————>	Any Additional Treatment Batch IDs
	—————>	All relevant Apeel Lot #s
Apeel Lot #	—————>	All relevant Raw Material Container IDs
	—————>	All relevant Treatment Batch IDs
Raw Material Container ID	—————>	All relevant Apeel Lot #s



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Recommendations and Considerations

Recommendations

- Reporting requirements – 5 reports
- Minimize manually generating batch data number when applying Edipeel
- Automate inventory reconciliation after Edipeel is applied
- Address limitations of current ERP system

Considerations for Operating at Scale

- Vertical integration – consider raw material lot tracking
- Future customers – different inventory tracking processes must integrate with Apeel tracking
- Future products – may require different steps
- Cost of Apeel Engineer applying Edipeel





Questions?

