Retail Insights Framework

January 2024

Prepared by
KC Rakam and Kundan Sarkar

Reviewed by
Vish Ganapathy, Keerthi Chidambaram, C.J. Gunn, Baseer Siddiqui

Retail Insights Framework

Data insights framework to accelerate the development of consistent and interoperable retail applications

Why Retail Insights Framework?

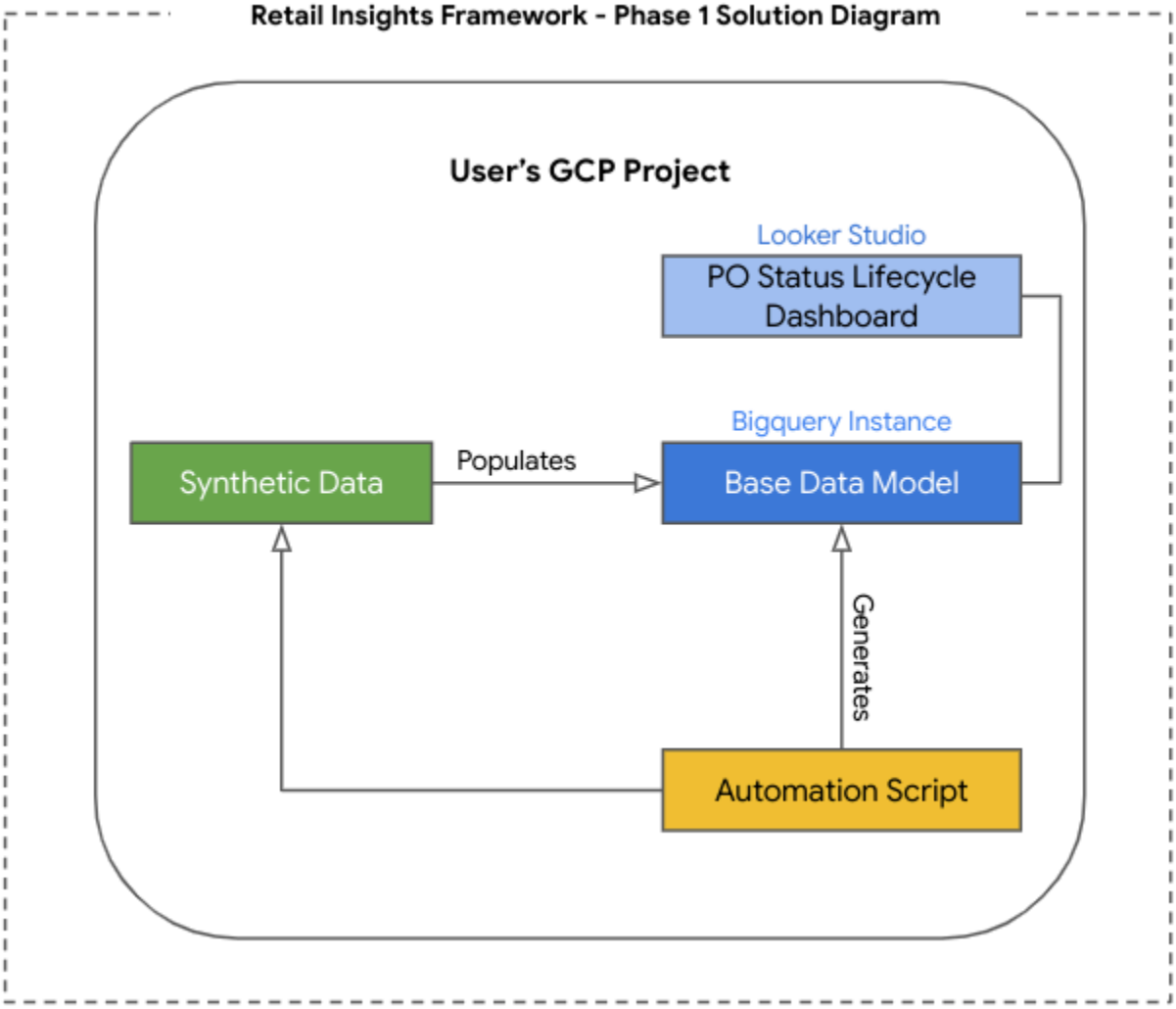
The need for a retail insights framework is driven by the increasing complexity of retail businesses. As retailers expand their product offerings, open new stores, and enter new markets, they need to be able to manage and analyze large amounts of data in order to make informed business decisions. A framework to derive these insights can help retailers to consolidate and standardize their data, making it easier to access and analyze.
An insight framework can also help to improve the efficiency of retail operations. By providing a common understanding of the data, the framework can help to break down data silos and improve communication between different departments within a retail business. This can lead to improved decision-making, reduced costs, and increased profits.

Solution Approach

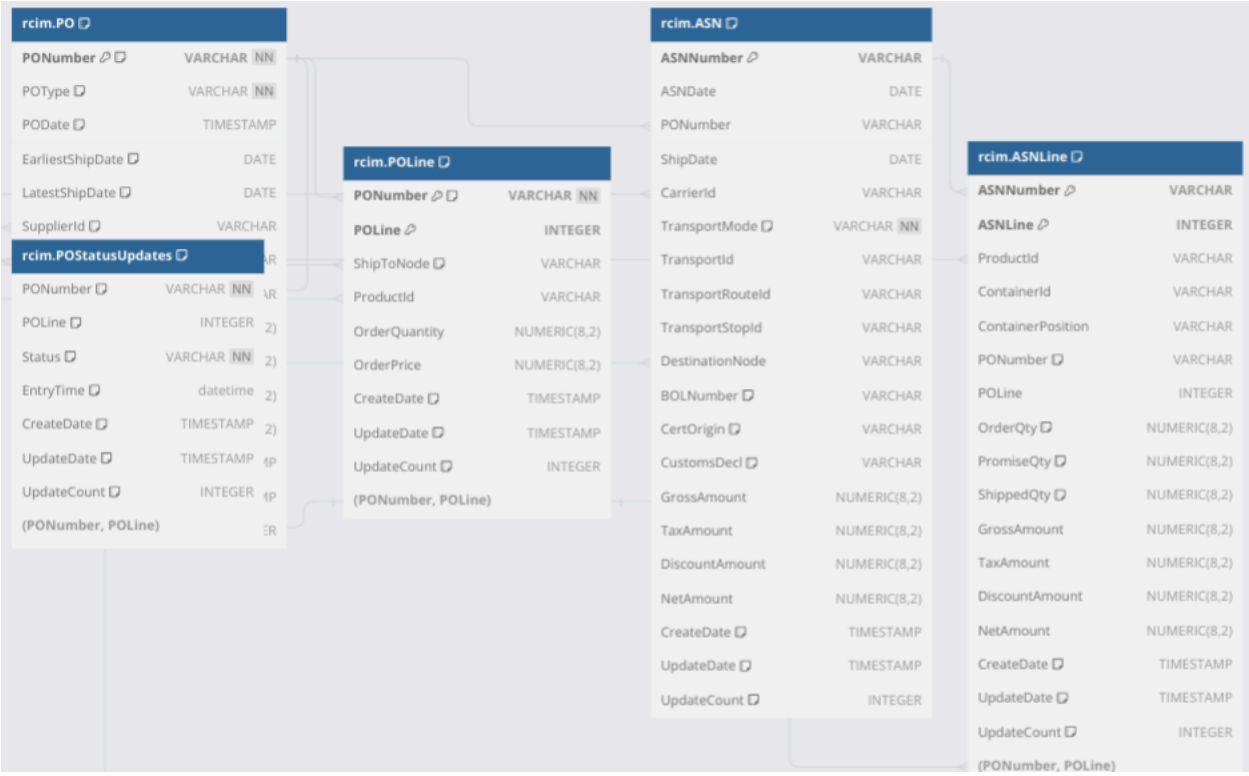
As our Retail and CPG customers are going through their digital supply chain transformation journeys, they are asking us how they can leverage Google's scale and AI/ML expertise to build an intelligent supply chain. Asks are primarily around how they can improve upon their visibility use cases and develop their predictive and prescriptive capabilities along their journey. Although we have a few data models already existing (e.g. Twin data model, Cortex data model, Data model for our productized solutions), there is a need for an insight framework that provides retail specific understandings and enables analytics over and above the company's master data and transaction data. To meet that requirement, the Retail/CPG team has defined a retail insights framework that combines master data dimensions with facts from transaction data and enhances it with aggregation views to be used to resolve analytic use cases and generate business insights.
The framework will initially focus on the PO visibility based on PO status updates. The goal is to position the framework as as an accelerator with the following components:

- Reference architecture and data model
- Pre-built automation scripts to create the data model and populate it with synthetic data. This script can be easily deployed by customers or partners in a Google Cloud project
- Looker Studio dashboards focusing on common use cases

Solution diagram



Retail Insight Framework (ERD View for Phase 1)



For phase 1, this framework will support the PO Visibility dashboard. The dashboard will be based on views to be generated from the following reference and transaction tables:

Reference Tables

- RefNode
- RefTradePartner
- RefProduct

Transaction Tables

- PO
- POLine
- ASN
- ASNLine
- POStatusUpdates

Please refer to this github link for the complete ERD

Framework Overview

The automation script included with this framework will deploy the data model in a BigQuery warehouse in the customer's GCP instance. The script will also populate the tables of this data model with synthetic data. The Looker Studio dashboard will reference this data and provide the

lifecycle of purchase order status updates along with detailed metrics of POs, PO lines, ASNs and ASN lines.

This framework can be further extended by the customer to leverage BigQuery as its platform to ingest data from existing master data applications (e.g. Product Master, Customer Master, Supplier Master, Location Master, etc) and transactional data applications (e.g. ERP, WMS, TMS, etc). It will further ingest (if available as input) or aggregate (calculate based on historical data) some data elements in BigQuery views.

These tables and views will then be consumed by:

- The visualization engine to generate visibility use cases
- AutoML and Vertex AI platforms to build and train predictive models

From the data flow perspective, the fully developed enterprise solution will:

- Land the raw dataset in the staging tier of the framework
- Transform the data to the framework schema in the processing tier
- Generate views and dashboards for customers, products, nodes and inventory activities in the reporting tier

Framework design principles and data model

This data model has been designed with the following design principles in mind:

1. Focus on model structures that can be used for business Analytics.
2. Setup data in order to feed AI/ML and time series models for forecasting.
3. Allow multiple financial years' worth of data to coexist.
4. Allow for maintaining history of price changes and zone-based pricing.
5. PII data is not necessary. However, if provided will be maintained separately.
6. Incorporate reference tables with metadata to support optimizations.
7. Create models for developing scenario modeling and discrete event simulations.
8. Take an 80/20 approach to only model key datasets rather than be overly prescriptive.
9. Make the models ISV agnostic so that retailers can develop their own vernacular.
10. Design in "many-to-many" flexibility for supply chain, sales & purchase orders.

Table Groups

All of the tables are grouped under the following categories. These groups are described in a subsequent section of this writing.

1. Reference Data
2. Master Data
3. Transaction Data - Sales
4. Transaction Data - Purchases

5. Analytical data - Activity Summary

Table Group - Reference Data

This table group maintains metadata that is used to describe store & DC layouts, replenishment schedules and associate tasks. These tables are designed to provide the necessary metadata required for any “digital twin” simulations such as scenario modeling or discrete event simulations.

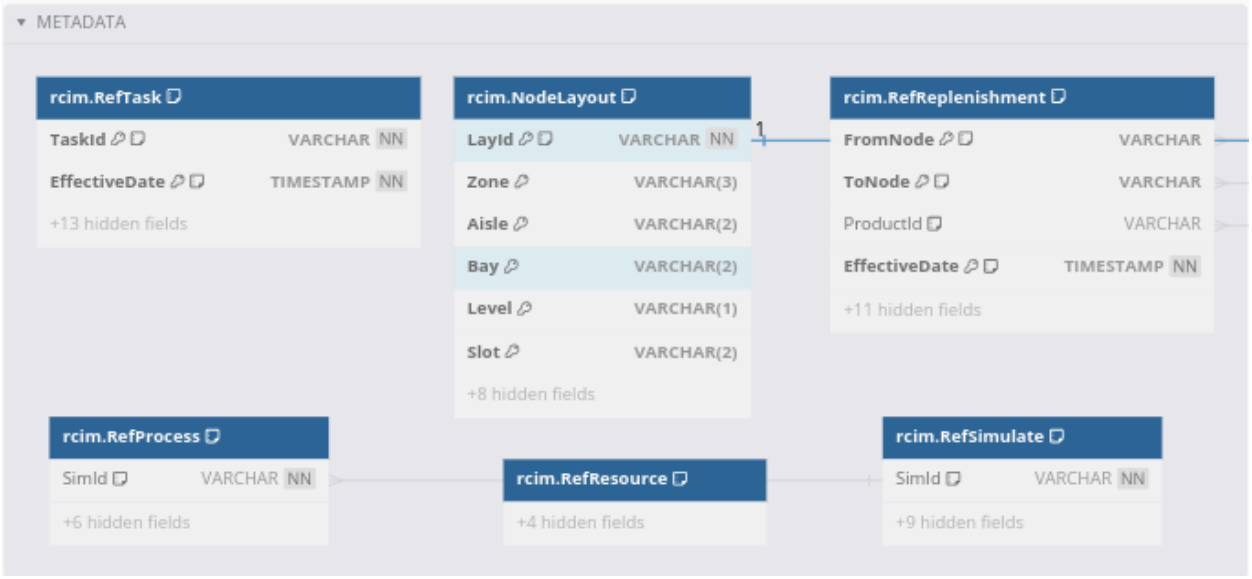


Table	Purpose
RefTask	Definitions of associate tasks.
RefProcess	Definition of processes.
RefResource	Definition of constraint resources.
RefReplenishment	Schedule of replenishments
NodeLayout	Definition of the physical store & DC layouts
RefSimulate	Definition of discrete event simulation models.

Table Group - Master Data

This group of tables contains the reference tables for master data such as product, customer, location/node, trading partners such as suppliers, carriers etc. They in turn are referenced in many of the transaction tables.

Table	Purpose
RefTradingPartner	Definition of all trading partners denoted by type.
RefAssociate	Definition of all the frontline associates; Store, DC & MFG.
RefNode	Definition of all supply and demand nodes.
RefCustomer	Definition of all known customers.
RefProduct	Definition of all products.
RefProductPrice	Product pricing at the product/node level.
RefPII	Vault containing any PII data, identified by a PII token.

Table Group - Transactional Data - Sales

All B2C sales; in the store (i.e. POS) and digitally are defined here; irrespective of if it is a “known” customer or not.

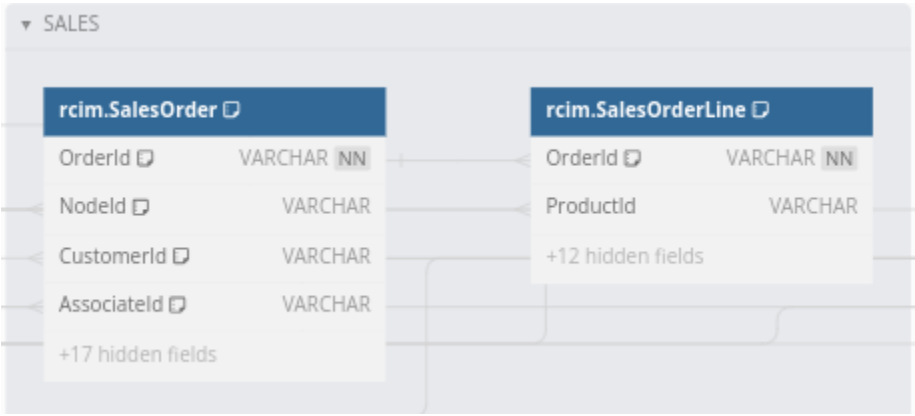


Table	Purpose
SalesOrder	All customer sales across all channels.
SalesOrderLine	Line items associated with each sales order.

Table Group - Transactional data - Purchases

All purchase orders and their related ASNs are defined here.

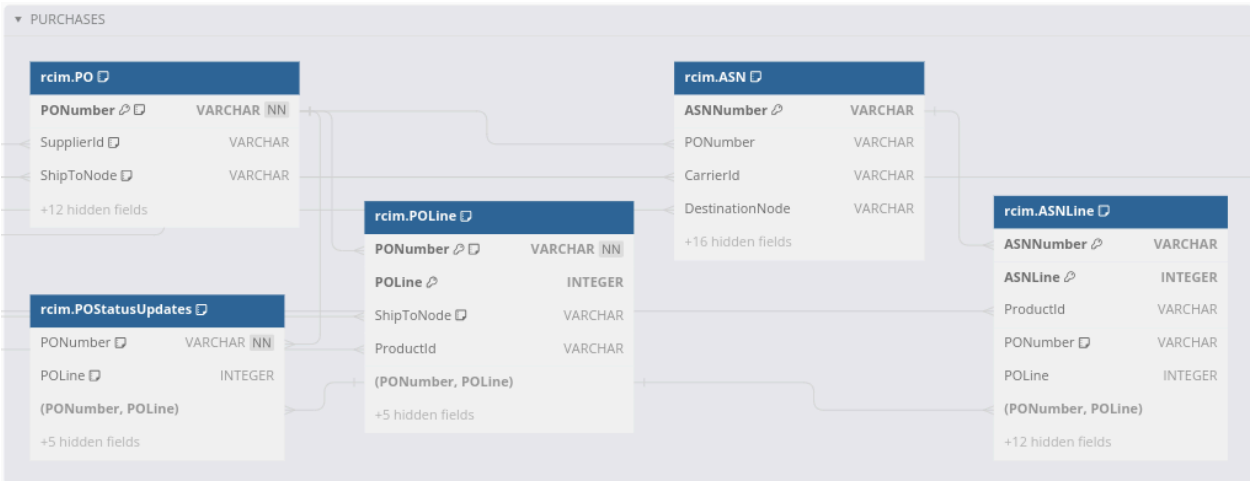


Table	Purpose
PO	All purchase orders
POLine	All line items associated with a PO
POStatusUpdates	Records the full life cycle of PO & POLine statuses including dwell times.
ASN	All advance ship notices received from suppliers.

Table	Purpose
ASNLine	Line items associated with ASNLine.

Table Group - Analytical data - Activity Summary

These tables are designed to be derived tables which aggregate all the activities for a given entity; for e.g. Customer, Node/PO or Stock. These tables will be fine tuned to incorporate any aggregated metrics such as CLTV, AOV, Lead Times etc.

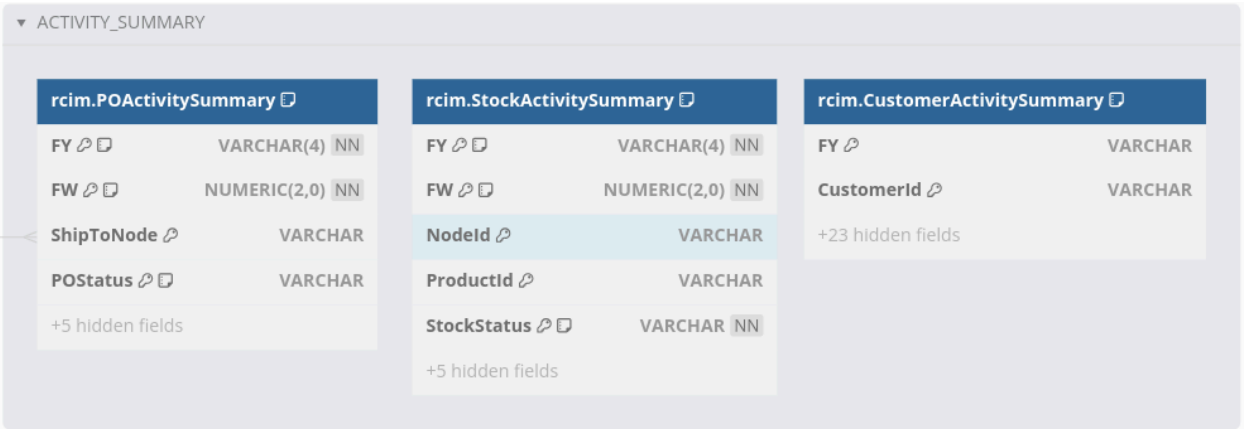


Table	Purpose
POActivitySummary	Consolidated and summarized view into all inbound POS at a node level.
StockActivitySummary	A daily/weekly Clos-of-Business (COB) node/SKU level unit positions of inventory.
CustomerActivitySummary	Consolidated and summarized view into all customer sales orders.

Sample Dashboard

PO #	PO Upd Dt	Prod ID	PO Upd St...	PO Upd Line	ASN #	ASN PO Line	PO Line Order Qty	PO Order Amt	ASN Promi...	ASN Shipp...
po-94612172	Jan 17, 2024, 5:58:...	aINVGuUcWaWohQlEnZ...	Shipped	649317886...	asn-GB60Q...	5269231651065	89	$34.8	94	90
po-94612172	Jan 17, 2024, 5:58:...	VoSkwvSCBfNneJpszNcl	Shipped	649317886...	asn-GB83S...	5269231651065	39	$34.8	94	90
po-94612172	Jan 17, 2024, 5:58:...	VoSkwvSCBfNneJpszNcl	Shipped	649317886...	asn-GB83S...	8167090446713	39	$34.8	51	46
po-94612172	Jan 17, 2024, 5:58:...	tClFYTjvegvvfoUPcJqG	Shipped	649317886...	asn-GB86X...	6493178862486	58	$34.8	81	79
po-94612172	Jan 17, 2024, 5:58:...	tClFYTjvegvvfoUPcJqG	Shipped	649317886...	asn-GB86X...	5269231651065	58	$34.8	94	90
po-94612172	Jan 17, 2024, 5:58:...	tClFYTjvegvvfoUPcJqG	Shipped	649317886...	asn-GB86X...	8167090446713	58	$34.8	51	46
po-94612172	Jan 17, 2024, 5:58:...	tClFYTjvegvvfoUPcJqG	Shipped	649317886...	asn-GB86X...	4440235164300	58	$34.8	76	71
po-94612172	Jan 17, 2024, 5:58:...	tClFYTjvegvvfoUPcJqG	Shipped	649317886...	asn-GB86X...	2558317312128	58	$34.8	87	82
po-94612172	Jan 17, 2024, 5:58:...	tClFYTjvegvvfoUPcJqG	Shipped	649317886...	asn-GB97M...	1490532676025	58	$34.8	42	38

- **Filters :** Dashboard information can be filtered with following variables
  - Period - Financial Year, Weeks
  - ShippingTo - ShipToNodes of POLines
  - POType - This list can be dynamic based on customer specific POTypes
- **Trend Lines**
  - For each POStatus, there will be two trend lines, one for Order quantity (units) and the other for order amounts ($$$)
- **PO Information Table**
  - Information on specific POs based on filter criteria
  - Can be nested information from PO, POLines, ASN, ASNLines and POStatuses

Please refer to this github link for detailed steps on how to deploy this framework.

Conclusion

As mentioned earlier, the current version of this framework is an accelerator with an automation script providing the deployable data model with associated synthetic data. It is also providing an out-of-the box Looker Studio dashboard focusing on a very specific visibility use case of the status update lifecycle of purchase orders. The base data model of this framework includes additional entities for customers, products, suppliers and tasks and the framework can be extended for use cases around customer experience, inventory visibility, supplier risk, associate productivity, etc in future releases. Google retail/CPG customers can deploy this framework standalone or with other GCP frameworks like Cortex and enable additional use cases with their complementary enterprise data.

Contact a Google Cloud sales rep to find out how you can get started today