



Cloud Monitoring and Analytics Platform

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Project Overview

Business Use Case: Global Market is a B2B novelty goods importer and distributor operating from the Houston, Texas. They sell to retailers across the United States including specialty stores, supermarkets, computing stores, tourist attraction shops, and some wholesalers. After recent expansion, they built a data warehouse for analytical reporting.

However, they face below challenges:-

1. The business lacks a semantic layer that would separates different functions like sales, marketing, procurement and logistics without any complexity.
2. Analysts need to create IT tickets to request an engineer to get the data for them which is time-consuming, costly and often result in inconsistent data copies.
3. Complex security and governance. Need to limit the data view according to region or territory.
4. Difficulties in handling chilled food requirements due to lack of a monitoring system that could monitor the chiller room's temperature.

Project Overview

Solution :

- ▶ **P1:** Build a dimensional model per business process
- ▶ **P2:** Provision self-service reporting to enable business to focus on their key priorities rather than writing technical queries to analyze data
- ▶ **P3:** Implement row-level security on AAS model
- ▶ **P4:** Build a streaming solution for real-time infrastructure monitoring and anomaly detection

Azure Analysis Service
(AAS) model

Power BI Service

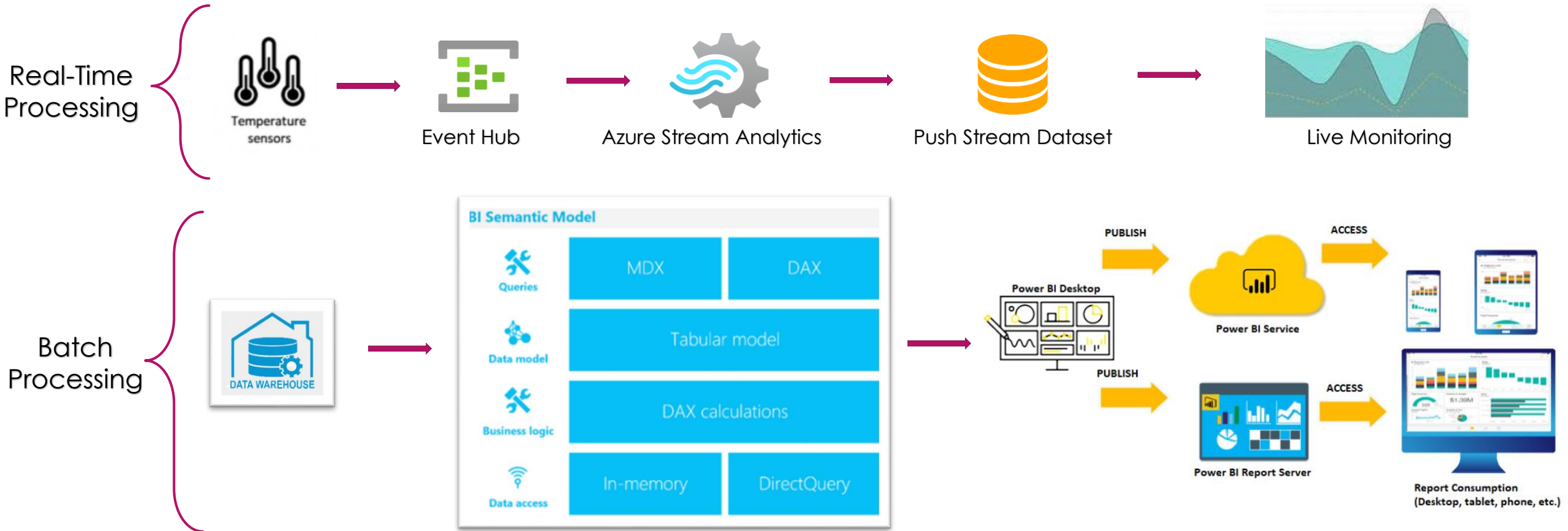
AAS model RLS

Azure Event Hub, Stream
Analytics

Tech Stack

Service/Tool	Use	Benefits
Azure Analysis Service (AAS) model	AAS is a PaaS service that provides enterprise-grade data models in the cloud. Used to perform ad hoc data analysis using tools like Power BI and Excel.	<ul style="list-style-type: none">• Scalability: Provides Live connection mode in Power BI, removing 1 GB size limitations• Pause/Resume to save cost• High performance and easy maintenance
Azure Event Hubs and Stream Analytics	<p>Event Hubs is a fully managed, real-time data ingestion service. It enables us to stream millions of events per second from any source.</p> <p>Stream Analytics - Real-time analytics and complex event-processing engine.</p> <p>The patterns identified can be used to trigger actions and initiate workflows such as creating alerts, feeding information to a reporting tool, or storing transformed data for later use.</p>	<ul style="list-style-type: none">• Stream analytics use familiar SQL that is extensible with JavaScript and C# custom code for more advanced features.• Visualization through an automatically updating dashboard with a “real time” view.• Assist managers with real-time decision-making on perishable goods planning.
Power BI	BI tool which allows users to connect to multiple data sources, transform data, create reports and share them.	<ul style="list-style-type: none">• Power BI service (SaaS) provides collaboration by apps and workspace, admin control features, security, paginated and embedded reports, gateway connections etc.

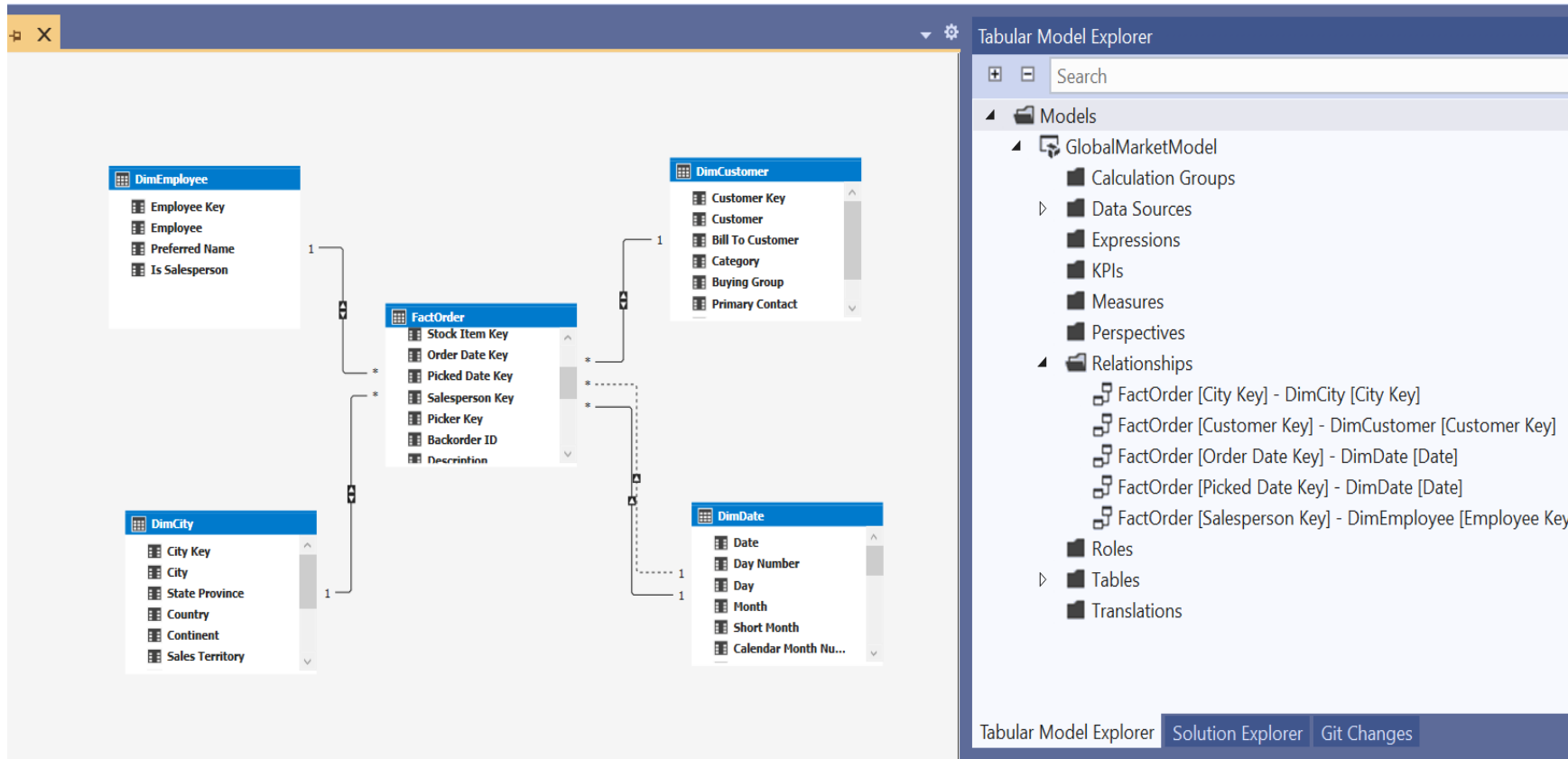
Project Architecture



Approach

- ▶ A Purchase Order tabular model is created with Global Market Data Warehouse as the data source. Using star schema, we create appropriate bi-directional relationships which will enable us to cross-filter or slice in both directions of the relationships. We also create some calculated columns and measure for future reporting.
- ▶ We create roles in the model to limit users to see data within their assigned territory. This will implement row-level security within our data model.
- ▶ A .NET application is created to simulate temperature sensors readings. The live event streams are ingested into Azure Event Hub.
- ▶ We build a query in Azure Stream Analytics which consumes data from the event hub and outputs the maximum, minimum, and average temperature per sensors in a tumbling window of 6 seconds.
- ▶ The streaming output is stored as a Power BI dataset. This adds a real-time, automated channel to our reporting infrastructure where we can visualize sensor data and actions on anomalies.

Purchase Order (PO) Model



Star schema PO model to support analytical queries related to purchase orders by vendors or item categories, picker/packer productivity or order demand per demographic.

Fact Grain: Order Line #

Azure Event Hub and Stream Analytics

1. Send data to Event Hub

2. Input: Event Hub

4. Output: Power BI

3. Query producing results every 6 secs

```
Microsoft Windows [Version 10.0.19044.1766]
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C:\Users\shefa>cd C:\Users\shefa\OneDrive\Documents\Notebooks\P7-Azure Stream Analytics\eh-gtfs

C:\Users\shefa\OneDrive\Documents\Notebooks\P7-Azure Stream Analytics\eh-gtfs>dotnet run
Downloading bus data...Sending message: {"Id":"0","TemperatureCelcius":5.2,"SensorId":"H-Sensor-01","EventTime":2022-06-28T17:07:45.1058926+05:30"}
1 sent...Sending message: {"Id":"1","TemperatureCelcius":3.1478663948587453,"SensorId":"H-Sensor-01","EventTime":2022-06-28T17:07:51.5891866+05:30"}
2 sent...Sending message: {"Id":"2","TemperatureCelcius":3.543096541540277,"SensorId":"H-Sensor-01","EventTime":2022-06-28T17:07:57.5166122+05:30"}
3 sent...Sending message: {"Id":"3","TemperatureCelcius":2.774939360038815,"SensorId":"H-Sensor-01","EventTime":2022-06-28T17:08:01.6593081+05:30"}
4 sent...Sending message: {"Id":"4","TemperatureCelcius":2.869486302495695,"SensorId":"H-Sensor-01","EventTime":2022-06-28T17:08:06.8125058+05:30"}
5 sent...Sending message: {"Id":"5","TemperatureCelcius":3.134626325701655,"SensorId":"H-Sensor-01","EventTime":2022-06-28T17:08:13.3097547+05:30"}
6 sent...Sending message: {"Id":"6","TemperatureCelcius":2.532323464207502,"SensorId":"H-Sensor-01","EventTime":2022-06-28T17:08:18.0705669+05:30"}
7 sent...Sending message: {"Id":"7","TemperatureCelcius":3.313932806818715,"SensorId":"H-Sensor-01","EventTime":2022-06-28T17:08:24.2024883+05:30"}
```

> real-time-streaming-job
real-time-streaming-job | Query ☆ ...

Query language docs Open in Visual Studio Share feedback Refresh

Inputs (1)
GTFS-Data

Outputs (1)
out-bi

Test query Save query Discard changes

```
1 WITH CTE AS (
2 SELECT hd.SensorId,
3 ROUND(CAST(MIN(hd.TemperatureCelcius) AS FLOAT),2) AS MinTemp,
4 ROUND(CAST(AVG(hd.TemperatureCelcius) AS FLOAT),2) AS AvgTemp,
5 ROUND(CAST(MAX(hd.TemperatureCelcius) AS FLOAT),2) AS MaxTemp,
6 CAST(System.Timestamp() AS DATETIME) AS Time
7 FROM [GTFS-Data] hd
8 GROUP BY TumblingWindow(second, 6), hd.SensorId
9 )
10 SELECT *,
11 CASE WHEN MaxTemp>=5 and MinTemp<2.5 then 1 else 0 end Anomaly
12 INTO [out-bi]
13 from cte
14
```

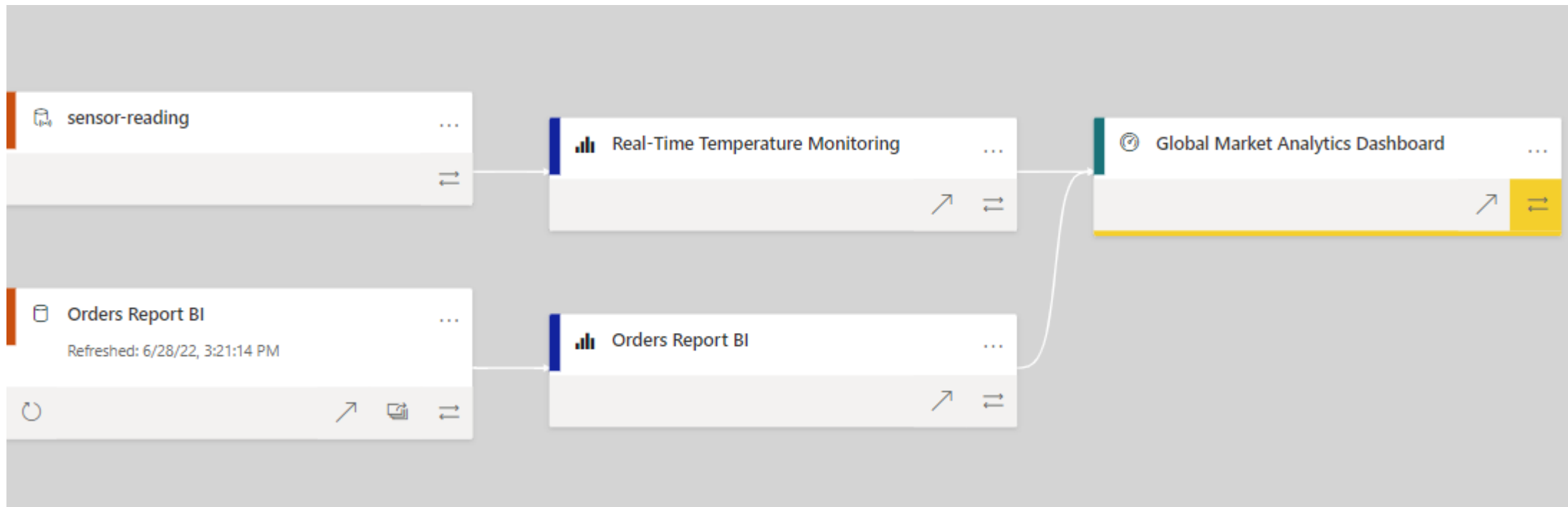
Input preview Test results

Showing sample events from 'GTFS-Data'.

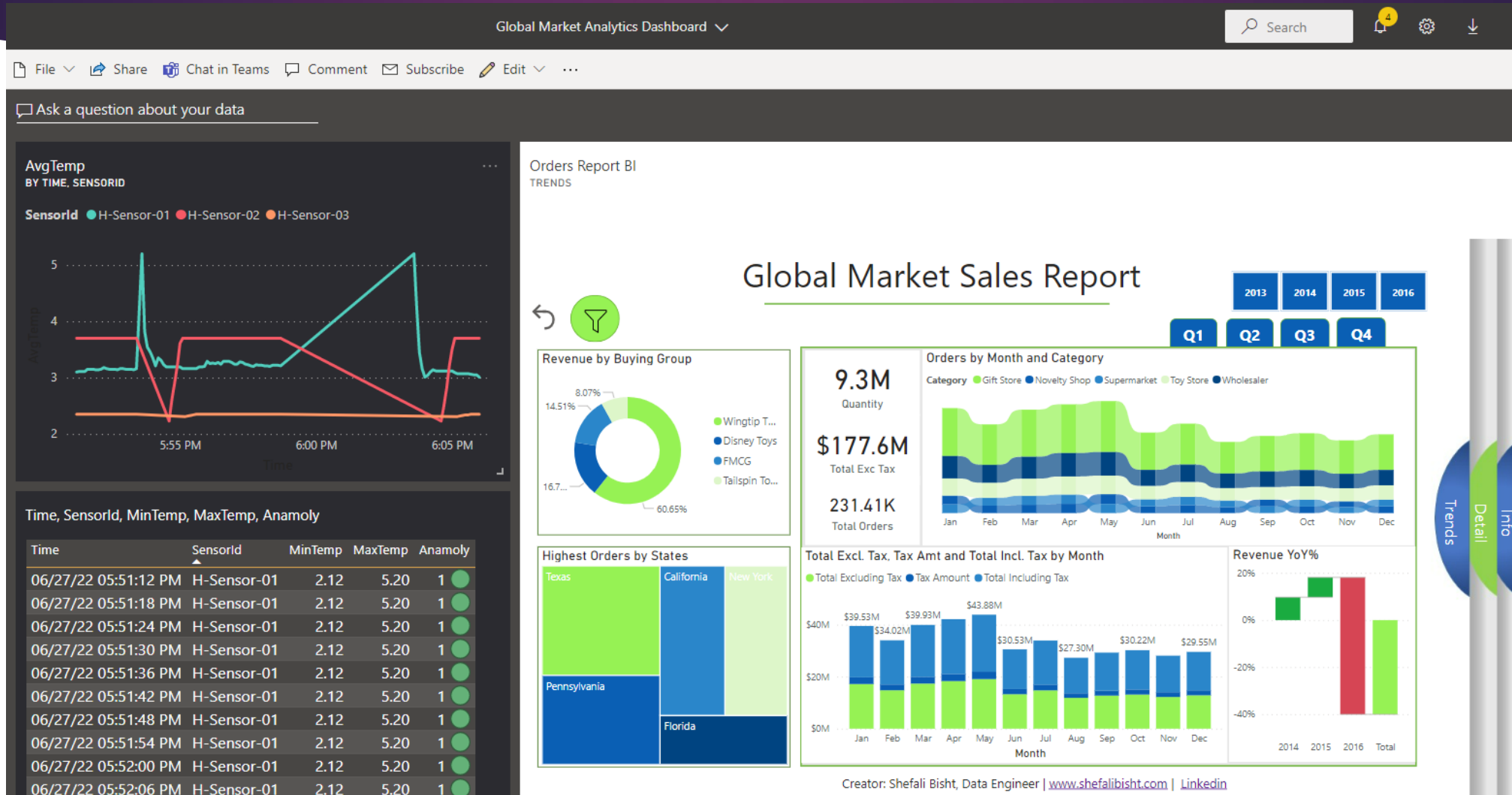
Id	TemperatureCelcius	SensorId	EventTime	EventProcessedUtcTime	Pa
string	float	string	datetime	datetime	big
"4"	2.869486302495695	"H-Sensor-01"	"2022-06-28T17:08:06.8..."	"2022-06-28T11:39:12.4..."	1
"3"	2.774939360038815	"H-Sensor-01"	"2022-06-28T17:08:01.6..."	"2022-06-28T11:39:12.4..."	1
"2"	3.543096541540277	"H-Sensor-01"	"2022-06-28T17:07:57.5..."	"2022-06-28T11:39:12.4..."	1
"1"	3.1478663948587453	"H-Sensor-01"	"2022-06-28T17:07:51.5..."	"2022-06-28T11:39:12.4..."	1
"0"	5.2	"H-Sensor-01"	"2022-06-28T17:07:45.1..."	"2022-06-28T11:39:12.4..."	1

Success

Global Analytics Dashboard Lineage



Global Analytics Dashboard



[View Report](#)

Power BI - Trends

Modeling View Help Format

Gridlines Lock objects

Global Market Sales Report

- Wingtip Toys
- Disney Toys
- FMCG
- Tailspin Toys

1.0M Quantity

\$18.3M Total Exc Tax

23.49K Total Orders

Orders by Month

Category: Gift Store

Total Excl. Tax, Tax Amt and Total Incl

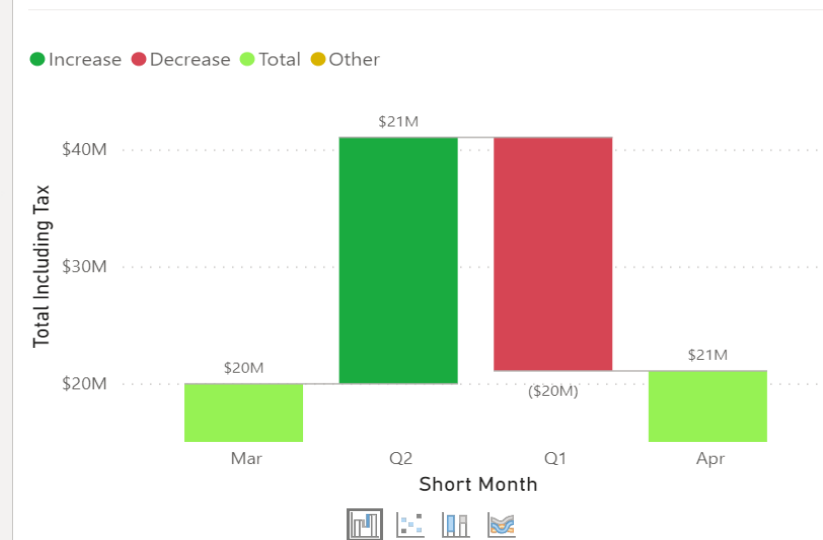
Jan: \$39.53M, Feb: \$34.02M, Mar: \$39.93M, Apr: \$42.14M

Creator: Shefali Bisht, Data Engineer | [www](#)

Here's the analysis of the 5.51% increase in Total Including Tax between Mar and Apr

Total Including Tax
BY SHORT MONTH AND QUATER

'Q2' accounted for the majority of the increase among QUATER, offsetting the decrease of 'Q1'.



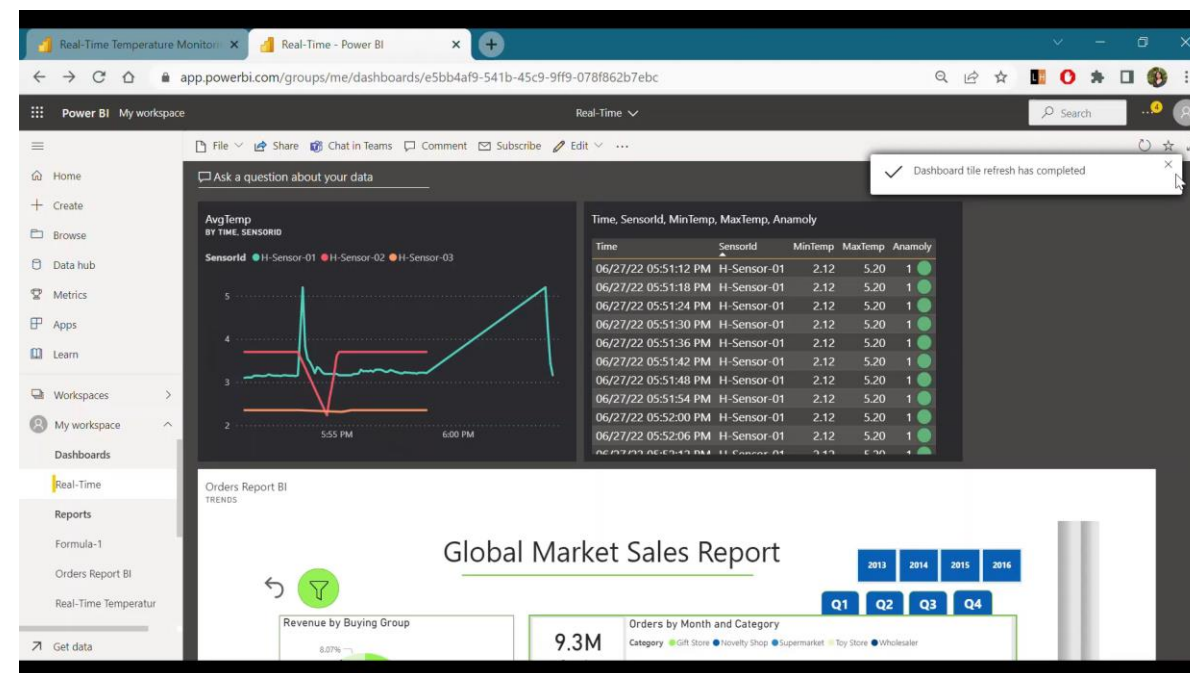
Global Market Sales Report

2013 2014 2015 2016

what is the total orders by employee

Employee	TotalOrders
Archer Lamble	~22K
Kayla Woodcock	~21K
Taj Shand	~20K
Hudson Hollinworth	~19K
Sophia Hinton	~18K
Jack Potter	~17K
Hudson Onslow	~16K
Lily Code	~15K
Anthony Grosse	~14K
Amy Trefl	~13K

Dashboard to monitor temperature in real-time



[Click to View](#)



Thank You!