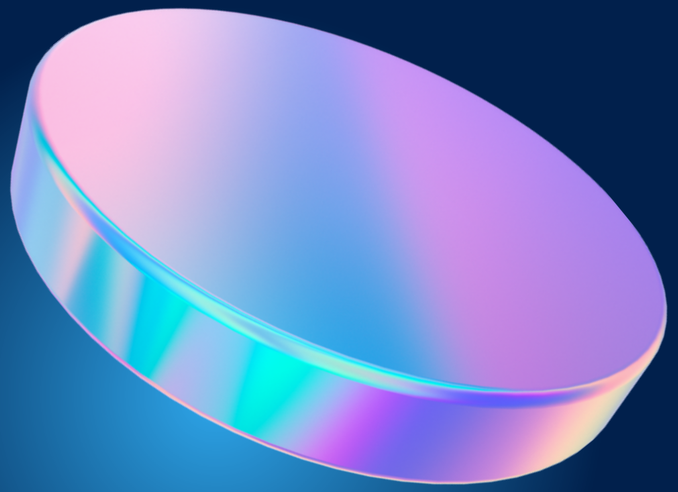
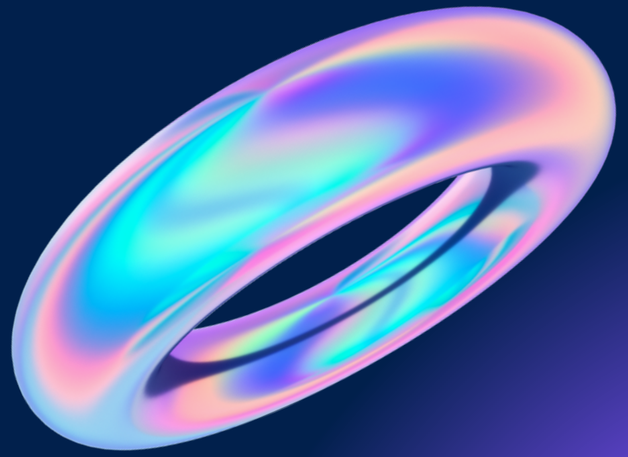
Modern Data Architectures

Group 5





Data source

- We decided to exploit the Daily Prices for Spanish Gas Stations (2007-2022), retrieved from Kaggle
- Since 2007, Spanish gas stations must send their daily prices to the Spanish regulatory authorities, as described in ITC/2308/2007. This data is published daily in the Spanish Open Data Catalog.
- Our dataset is the aggregated version of this data
- Parquet format (column-based storage format, good for querying and good compression)

Data source

Daily Prices for Spanish Gas Stations (2007-2022)

spanish_gas_prices_000000000000.parquet (79.33 MB)

REFERENCE

Daily Prices for Spanish Gas Stations (2007-2022)

Kaggle is the world’s largest data science community with powerful tools and resources to help you achieve your...

k kaggle.com

Data source format

- Structured data tables, useful for storing big data.
- Parquet format (column-based storage format, good for querying and good compression).
- Gives better-summarized data and follows type-specific encoding.

We acted as a group of analytics consultants hired by Repsol. The company asked us to provide them with some useful business insights:

- Price development for the two most common fuel types for the period 2020 – 2022.
- Other top competitors to Repsol in the year 2022.
- Top 10 and bottom 10 gas stations of the Repsol in terms of price ranking.

Data RoadMap

Data Ingestion

Ingesting our data in its raw format through Apache NiFi and storing it in HDFS

Data Storage

Storing the data in Hadoop HDFS and checking its root and format

Data Processing

Transforming the data to a readable dimension and prepare it to analysis through Apache Spark

Data Serving

Based on the processed data the conclusions are readily served to REPSOL.

Data RoadMap

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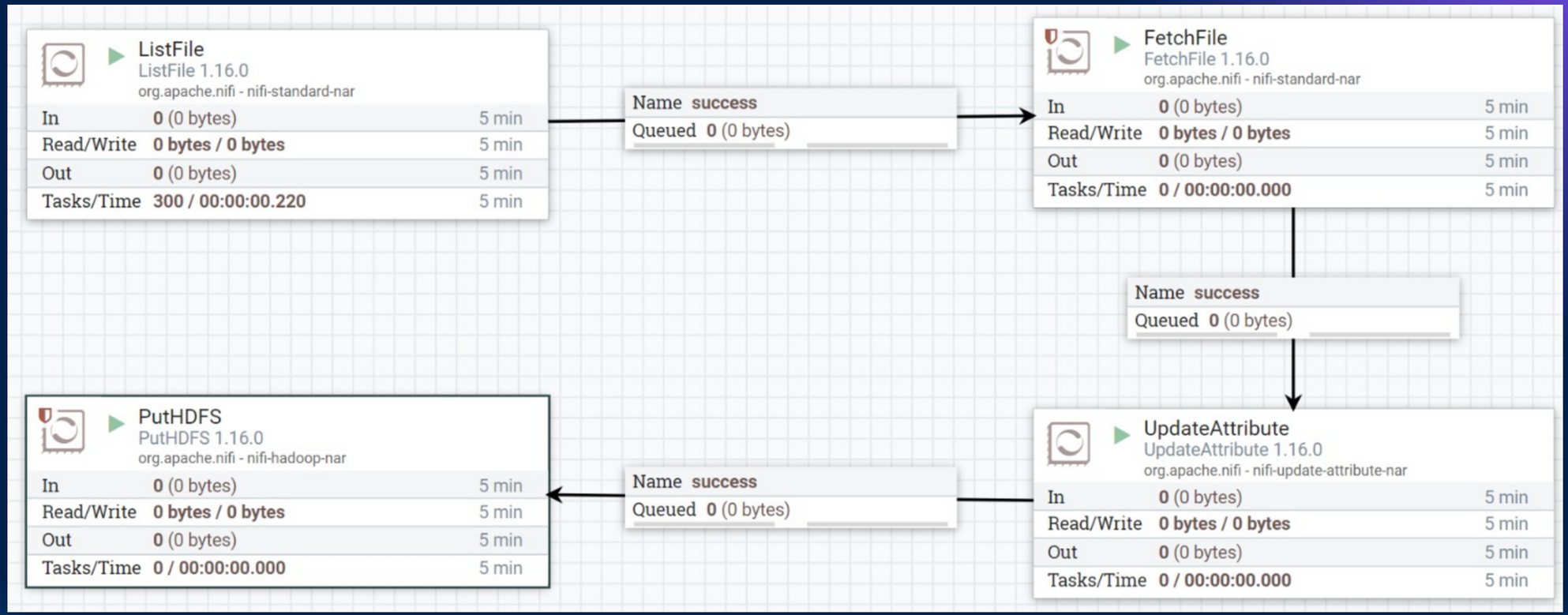
Batch Ingestion

After uploading our main .parquet file in a Folder, we set up the Apache NiFi framework with 4 processors in sequence:

- ListFile
- FetchFile
- UpdateAttribute
- PutHDFS

Each of those has been configured to ingest the data, store it in HDFS and delete it from the root source.

Batch Ingestion



APACHE nifi

Data Read by NiFi

Status History

Status History

Type
PutHDFS

Id
15726bff-0185-1000-4ec5-de8675f5b8cd

Group Id
156f5ec2-0185-1000-6dd5-c7dd177767ba

Name
PutHDFS

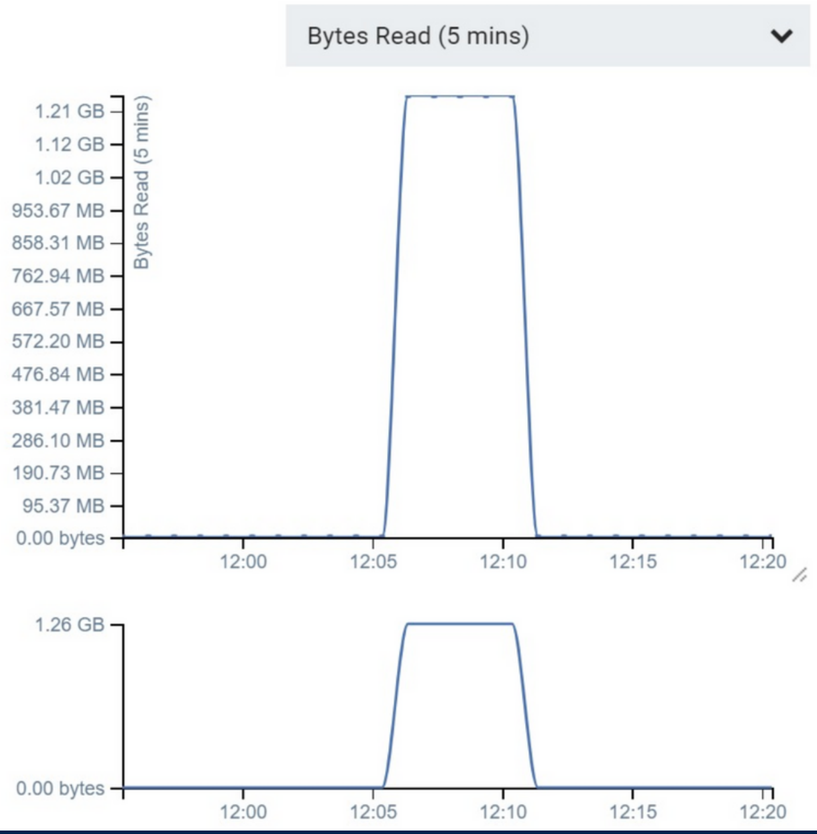
Start
12/15/2022 11:55:22.934

End
12/15/2022 12:20:23.193

NiFi

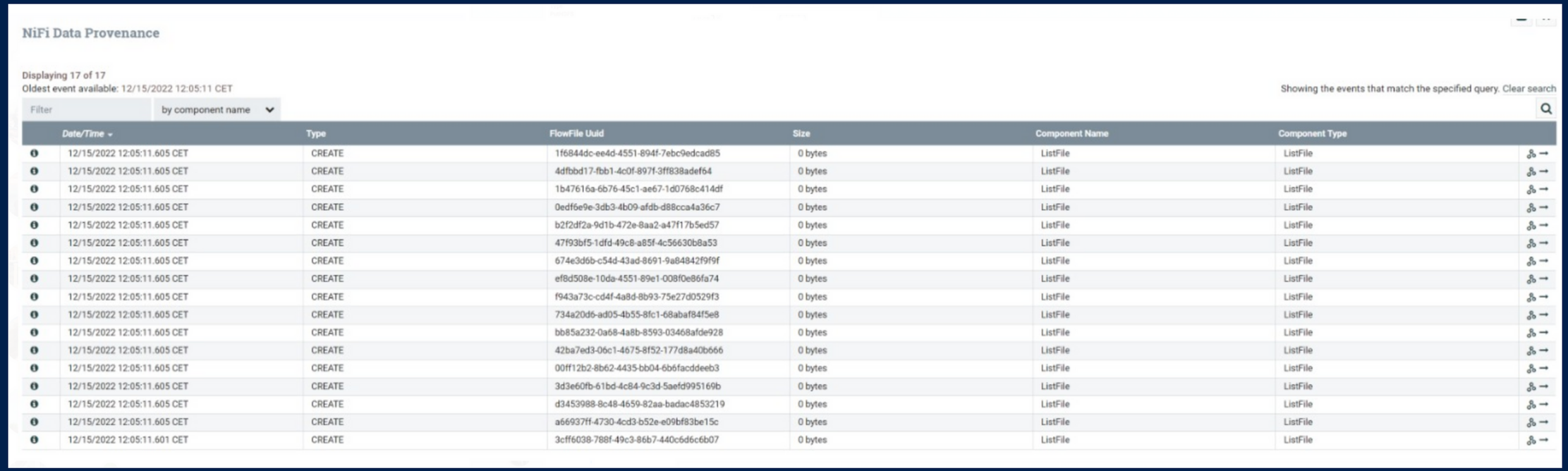
Min / Max / Mean
0.00 bytes / 1.26 GB / 247.20 MB

NiFi



APACHE nifi

NiFi data Provenance



NiFi Data Provenance

Displaying 17 of 17
Oldest event available: 12/15/2022 12:05:11 CET

Showing the events that match the specified query. Clear search

Filter | by component name

Date/Time	Type	FlowFile Uuid	Size	Component Name	Component Type
12/15/2022 12:05:11.605 CET	CREATE	1f6844dc-ee4d-4551-894f-7ebc9edcad85	0 bytes	ListFile	ListFile
12/15/2022 12:05:11.605 CET	CREATE	4dfbbd17-fbb1-4c0f-897f-3ff838adef64	0 bytes	ListFile	ListFile
12/15/2022 12:05:11.605 CET	CREATE	1b47616a-6b76-45c1-ae67-1d0768c414df	0 bytes	ListFile	ListFile
12/15/2022 12:05:11.605 CET	CREATE	0edf6e9e-3db3-4b09-afdb-d88cca4a36c7	0 bytes	ListFile	ListFile
12/15/2022 12:05:11.605 CET	CREATE	b2f2df2a-9d1b-472e-8aa2-a47f17b5ed57	0 bytes	ListFile	ListFile
12/15/2022 12:05:11.605 CET	CREATE	47f93bf5-1dfd-49c8-a85f-4c56630b8a53	0 bytes	ListFile	ListFile
12/15/2022 12:05:11.605 CET	CREATE	674e3d6b-c54d-43ad-8691-9a84842f9f9f	0 bytes	ListFile	ListFile
12/15/2022 12:05:11.605 CET	CREATE	ef8d508e-10da-4551-89e1-008f0e86fa74	0 bytes	ListFile	ListFile
12/15/2022 12:05:11.605 CET	CREATE	f943a73c-cd4f-4a8d-8b93-75e27d0529f3	0 bytes	ListFile	ListFile
12/15/2022 12:05:11.605 CET	CREATE	734a20d6-ad05-4b55-8fc1-68abaf84f5e8	0 bytes	ListFile	ListFile
12/15/2022 12:05:11.605 CET	CREATE	bb85a232-0a68-4a8b-8593-03468afde928	0 bytes	ListFile	ListFile
12/15/2022 12:05:11.605 CET	CREATE	42ba7ed3-06c1-4675-8f52-177d8a40b666	0 bytes	ListFile	ListFile
12/15/2022 12:05:11.605 CET	CREATE	00ff12b2-8b62-4435-bb04-6b6facddeeb3	0 bytes	ListFile	ListFile
12/15/2022 12:05:11.605 CET	CREATE	3d3e60fb-61bd-4c84-9c3d-5aefd995169b	0 bytes	ListFile	ListFile
12/15/2022 12:05:11.605 CET	CREATE	d3453988-8c48-4659-82aa-badac4853219	0 bytes	ListFile	ListFile
12/15/2022 12:05:11.605 CET	CREATE	a66937ff-4730-4cd3-b52e-e09bf83be15c	0 bytes	ListFile	ListFile
12/15/2022 12:05:11.601 CET	CREATE	3cff6038-788f-49c3-86b7-440c6d6c6b07	0 bytes	ListFile	ListFile

APACHE nifi

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Data Storage

Streaming Storage

Batch Storage

DFS

All the data at scale.

Data Storage

Streaming Storage

Batch Storage

DFS

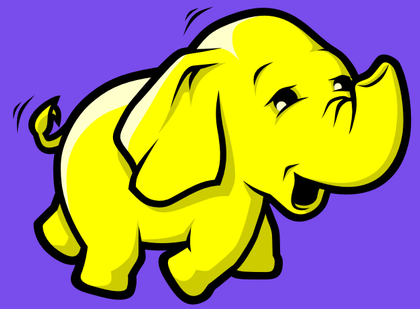
All the data at scale.

Batch Storage

Distributed File System

- Unit of storage: File
- Unit of structure: Folder
- Structure: Hierarchical (File System)
- Data access: Path

Hadoop HDFS



Core Idea

Run applications (processing) in the nodes that store the data (storage).

VS single machine:

1. Efficient
2. Cost-effective

Main Drawback

- All its nodes up and running
- Low-latency

Batch Storage

Browse Directory

/datalake/raw/gas Go!

Show 25 entries Search:

Permission	Owner	Group	Size	Last Modified	Replication	Block Size	Name
-rw-r--r--	osbdet	hadoop	75.66 MB	Dec 15 12:05	1	128 MB	spanish_gas_prices_000000000000.parquet
-rw-r--r--	osbdet	hadoop	75.64 MB	Dec 15 12:05	1	128 MB	spanish_gas_prices_000000000001.parquet
-rw-r--r--	osbdet	hadoop	75.72 MB	Dec 15 12:05	1	128 MB	spanish_gas_prices_000000000002.parquet
-rw-r--r--	osbdet	hadoop	75.51 MB	Dec 15 12:05	1	128 MB	spanish_gas_prices_000000000003.parquet
-rw-r--r--	osbdet	hadoop	75.68 MB	Dec 15 12:05	1	128 MB	spanish_gas_prices_000000000004.parquet
-rw-r--r--	osbdet	hadoop	75.59 MB	Dec 15 12:05	1	128 MB	spanish_gas_prices_000000000005.parquet
-rw-r--r--	osbdet	hadoop	75.63 MB	Dec 15 12:05	1	128 MB	spanish_gas_prices_000000000006.parquet
-rw-r--r--	osbdet	hadoop	75.62 MB	Dec 15 12:05	1	128 MB	spanish_gas_prices_000000000007.parquet
-rw-r--r--	osbdet	hadoop	75.63 MB	Dec 15 12:05	1	128 MB	spanish_gas_prices_000000000008.parquet
-rw-r--r--	osbdet	hadoop	75.59 MB	Dec 15 12:05	1	128 MB	spanish_gas_prices_000000000009.parquet
-rw-r--r--	osbdet	hadoop	75.61 MB	Dec 15 12:05	1	128 MB	spanish_gas_prices_000000000010.parquet
-rw-r--r--	osbdet	hadoop	75.51 MB	Dec 15 12:05	1	128 MB	spanish_gas_prices_000000000011.parquet
-rw-r--r--	osbdet	hadoop	75.6 MB	Dec 15 12:05	1	128 MB	spanish_gas_prices_000000000012.parquet
-rw-r--r--	osbdet	hadoop	75.73 MB	Dec 15 12:05	1	128 MB	spanish_gas_prices_000000000013.parquet
-rw-r--r--	osbdet	hadoop	75.6 MB	Dec 15 12:05	1	128 MB	spanish_gas_prices_000000000014.parquet
-rw-r--r--	osbdet	hadoop	75.56 MB	Dec 15 12:05	1	128 MB	spanish_gas_prices_000000000015.parquet
-rw-r--r--	osbdet	hadoop	75.55 MB	Dec 15 12:05	1	128 MB	spanish_gas_prices_000000000016.parquet

Showing 1 to 17 of 17 entries Previous 1 Next

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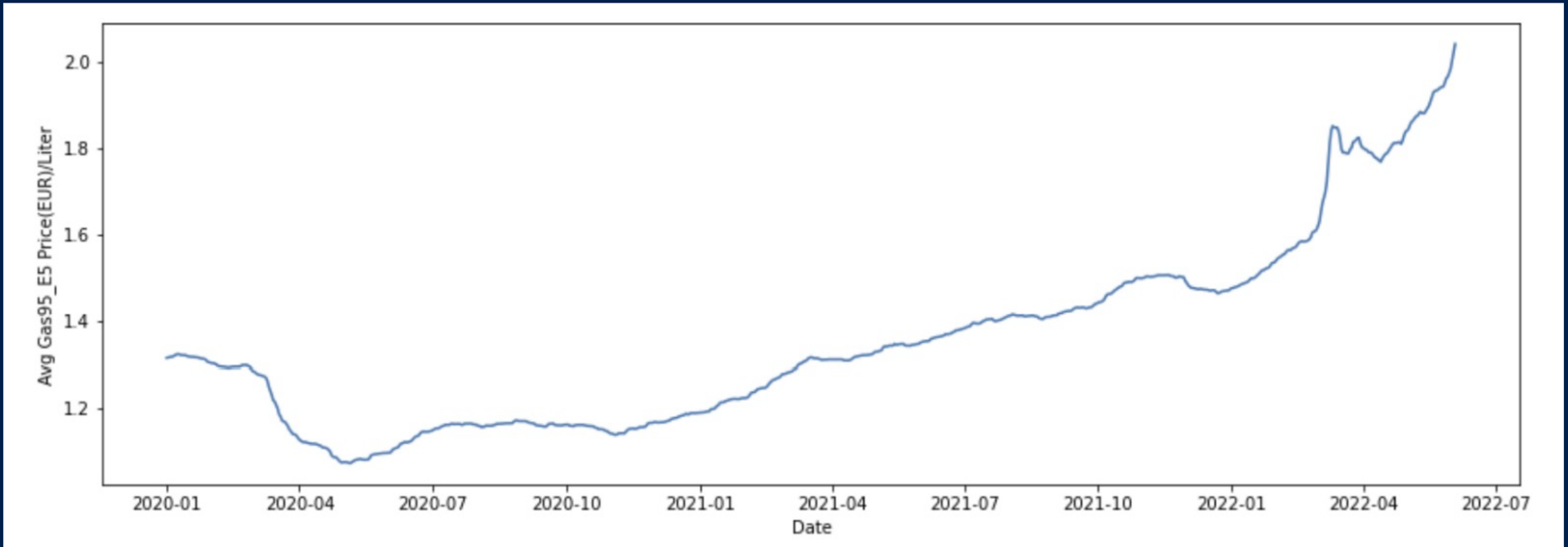
Batch Processing

Data Analysis: (GAS) Price Development 2020-2022, EUR/Liter

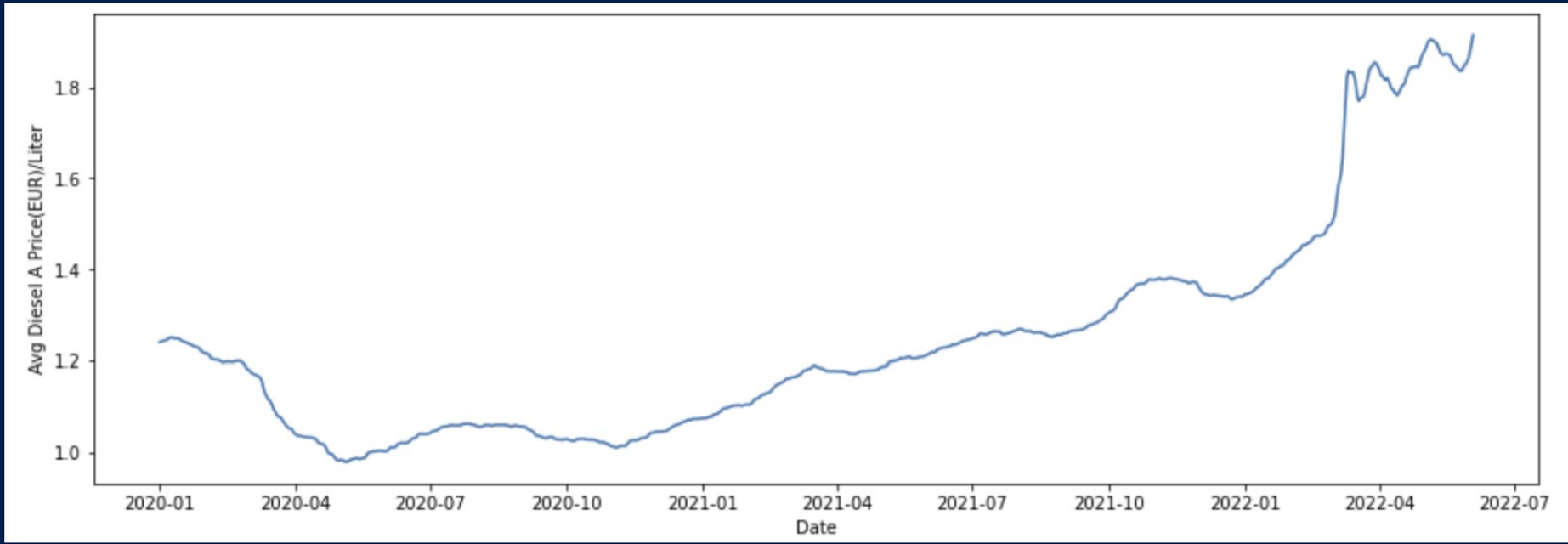


Price drop in Q1-Q2 2020 due to lockdowns

Price increase in Q1-Q2 2022 due to supply chain issues and RU/UA conflict

Batch Processing

Data Analysis: (DIESEL) Price Development 2020-2022, EUR/Liter

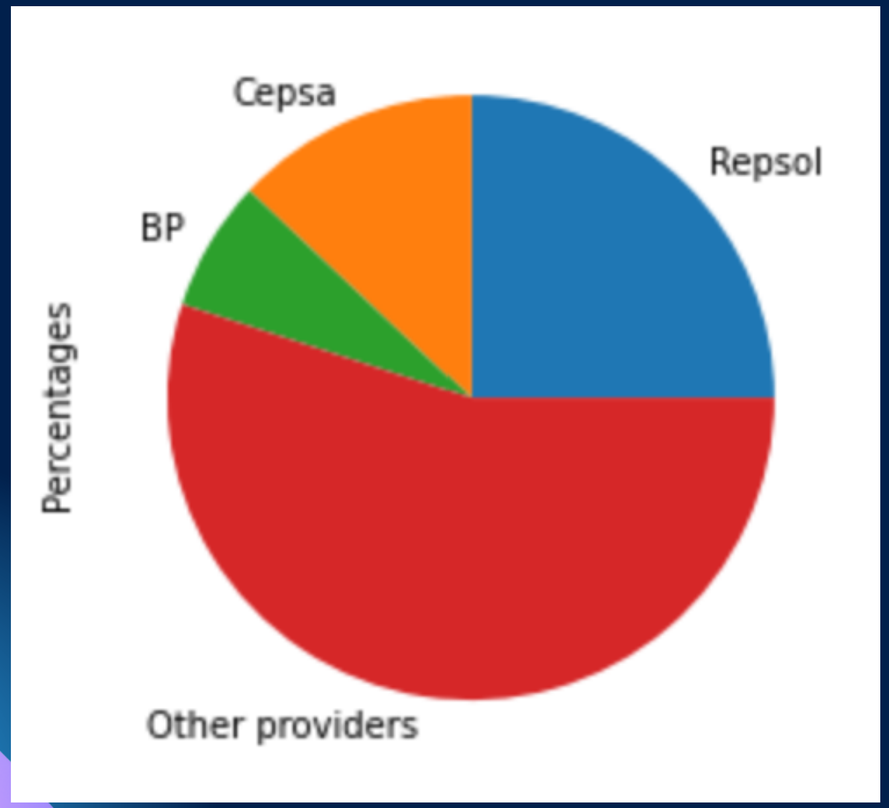


Price drop in Q1-Q2 2020 due to lockdowns

Price increase in Q1-Q2 2022 due to supply chain issues and RU/UA conflict

Batch Processing

Data Analysis: Repsol has the highest share of stations on the Spanish market (29% of total gas stations)

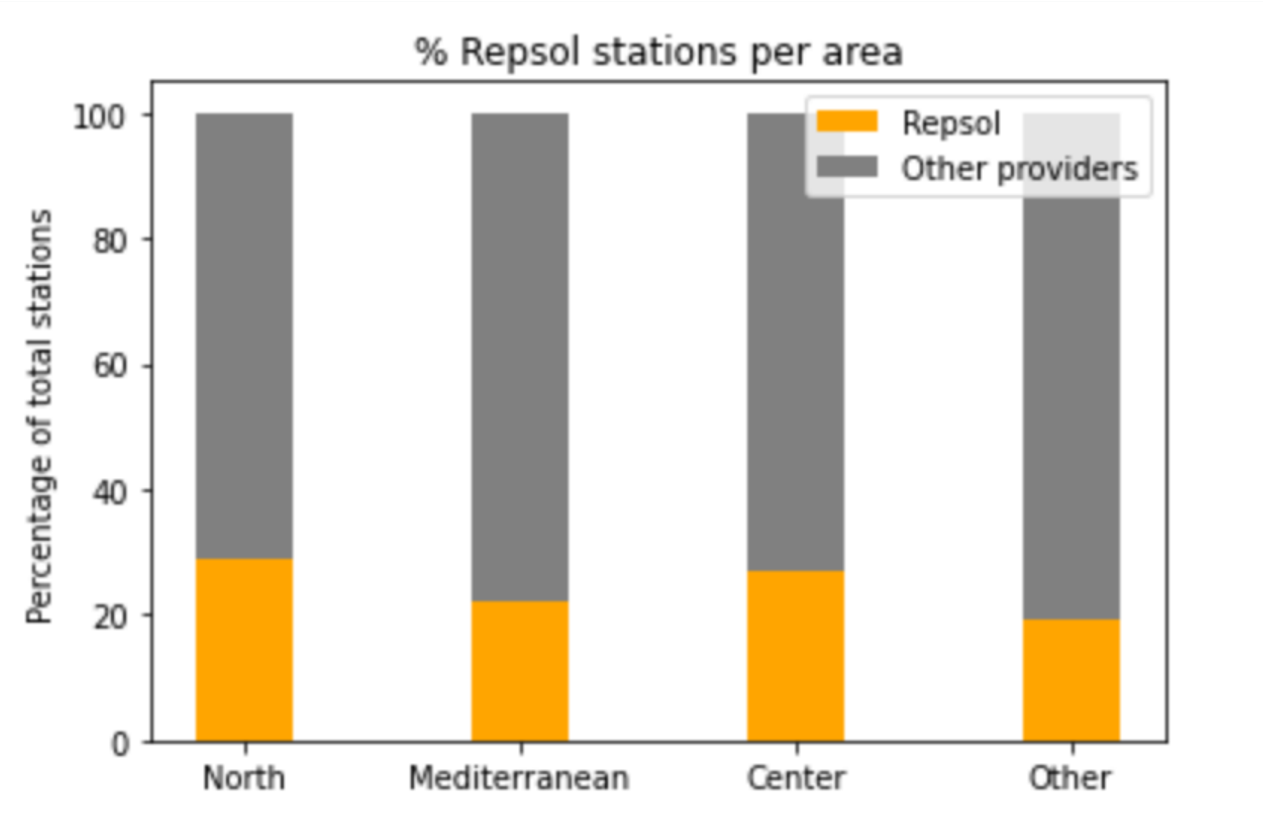


Overview of gas stations,
% vs. total count of stations in Spain,
split by company:

- Repsol: 25%
- Cepsa: 13%
- BP: 7%
- Rest of companies: 55%

Batch Processing

Data Analysis: Repsol is evenly present in all macro-areas of Spain, with no clear geographical outliers (~25% in each).



*We divided Spain in four macro-areas: North regions, Mediterranean ones , Center ones and Others (incl. islands, offshore territories etc.)

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Batch Processing

(GAS) Ranking: Repsol stations with bottom 10 average prices in 2022

station_id	town	province_name	region_name	Area	average 2022 gas prices
12703	MONTEMAYOR ...	CÓRDOBA	Andalucia	Mediterranean	1.2590000000000
10356	NAVALMORAL DE LA ...	CÁCERES	Extremadura	Center	1.2890000000000
5844	BADAJOZ ...	BADAJOZ	Extremadura	Center	1.2890000000000
1920	ESTIVELLA ...	VALENCIA / VALÈNCIA	Comunidad Valenciana	Mediterranean	1.2890000000000
11184	RIBESALBES ...	CASTELLÓN / CASTELLÓ	Comunidad Valenciana	Mediterranean	1.2900000000000
14742	GIJON ...	ASTURIAS	Asturias	North	1.2934823530000
9824	TORREVIEJA ...	ALICANTE	Comunidad Valenciana	Mediterranean	1.3670000000000
11222	TORREVIEJA ...	ALICANTE	Comunidad Valenciana	Mediterranean	1.3759230770000
10715	NAVALVILLAR DE PE...	BADAJOZ	Extremadura	Center	1.3790000000000
4901	HORCAJO DE LOS MO...	CIUDAD REAL	Castilla la Mancha	Center	1.3990000000000

Lowest gas prices are concentrated mostly in Mediterranean and Center. We recommend a further cost/revenue deep-dive to establish how viable these gas stations are commercially.

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Batch Processing

(DIESEL) Ranking: Repsol stations with bottom 10 average prices in 2022

station_id	town	province_name	region_name	Area	average 2022 diesel prices
10715	NAVALVILLAR DE PE...	BADAJOZ	Extremadura	Center	1.0390000000000
1920	ESTIVELLA ...	VALENCIA / VALÈNCIA	Comunidad Valenciana	Mediterranean	1.1090000000000
3848	VALENCIA ...	VALENCIA / VALÈNCIA	Comunidad Valenciana	Mediterranean	1.1090000000000
12703	MONTEMAYOR ...	CÓRDOBA	Andalucia	Mediterranean	1.1090000000000
5844	BADAJOZ ...	BADAJOZ	Extremadura	Center	1.1390000000000
9824	TORREVIEJA ...	ALICANTE	Comunidad Valenciana	Mediterranean	1.1870000000000
11184	RIBESALBES ...	CASTELLÓN / CASTELLÓ	Comunidad Valenciana	Mediterranean	1.2150000000000
8842	MIGUEL ESTEBAN ...	TOLEDO	Castilla la Mancha	Center	1.2400000000000
4901	HORCAJO DE LOS MO...	CIUDAD REAL	Castilla la Mancha	Center	1.2490000000000
14842	BARBATE ...	CÁDIZ	Andalucia	Mediterranean	1.2490000000000

Lowest diesel prices are concentrated mostly in Mediterranean and Center. We recommend a further cost/revenue deep-dive to establish how viable these gas stations are commercially.

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Batch Processing

(GAS) Ranking: Repsol stations with top 10 average prices in 2022

station_id	town	province_name	region_name	Area	average 2022 gas prices
15522	ALQUEZAR ...	HUESCA	Aragón	North	2.1300000000000
15541	SANTANDER ...	CANTABRIA	Cantabria	North	2.1090000000000
15247	VALDEALGORFA ...	TERUEL	Aragón	North	2.0900000000000
15406	ALHAMA DE MURCIA ...	MURCIA	Murcia	Mediterranean	2.0755555560000
15515	MONFARRACINOS ...	ZAMORA	Castilla y León	Center	2.0630000000000
15481	CASA PUERTO ...	MURCIA	Murcia	Mediterranean	2.0390000000000
10498	LORCA ...	MURCIA	Murcia	Mediterranean	2.0290000000000
15531	TORRES DE ALBANCH...	JAÉN	Andalucia	Mediterranean	2.0245000000000
15217	VALENCIA ...	VALENCIA / VALÈNCIA	Comunidad Valenciana	Mediterranean	2.0163043480000
6488	BAUL ...	GRANADA	Andalucia	Mediterranean	2.0119350650000

Area North has the highest gas prices in the analysed period.

Batch Processing

(DIESEL) Ranking: Repsol stations with top 10 average prices in 2022

station_id	town	province_name	region_name	Area	average 2022 diesel prices
15247	VALDEALGORFA ...	TERUEL	Aragón	North	2.0900000000000
15531	TORRES DE ALBANCH...	JAÉN	Andalucia	Mediterranean	1.9825000000000
15492	MADRID ...	MADRID	Madrid	Center	1.9824210530000
3369	AMETLLA DE MAR (L...	TARRAGONA	Cataluña	Mediterranean	1.9796296300000
15447	VALDEPEÑAS ...	CIUDAD REAL	Castilla la Mancha	Center	1.9778888890000
15323	VALDEPEÑAS ...	CIUDAD REAL	Castilla la Mancha	Center	1.9778888890000
15522	ALQUEZAR ...	HUESCA	Aragón	North	1.9700000000000
15406	ALHAMA DE MURCIA ...	MURCIA	Murcia	Mediterranean	1.9670740740000
15355	LEPE ...	HUELVA	Andalucia	Mediterranean	1.9650701750000
15471	SANT MARTI D'ALBA...	BARCELONA	Cataluña	Mediterranean	1.9627500000000

Highest diesel prices are observed in most areas.
Region Aragón, and town Valdealgorfa in particular, is in Top 3 most expensive fuel types both for gas and diesel.

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Data Serving

Through the exploitation of different instruments from the data value chain, we have been able to ingest and store the data in batch and process it in order to deliver objective data for our client, on which strategic decisions could be easily leveraged.

However, in order to take definitive decisions on the destiny of the highlighted distributors, it would be interesting to gather and analyze internal data regarding the volume of gasoline sold in each of the stations, geo-specific factors should also be taken into account.

Thank You

Lia Dollison
Ludovico Gandolfi
Lakshmi Priyanka Jakka
Hang Chi Ku
Ivan Lopez
Igancio Pire Rubio
Roman Zotkin