Respect Weather

weather app for humans

Cloud Computing 2024

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the project was not easy bit we manage

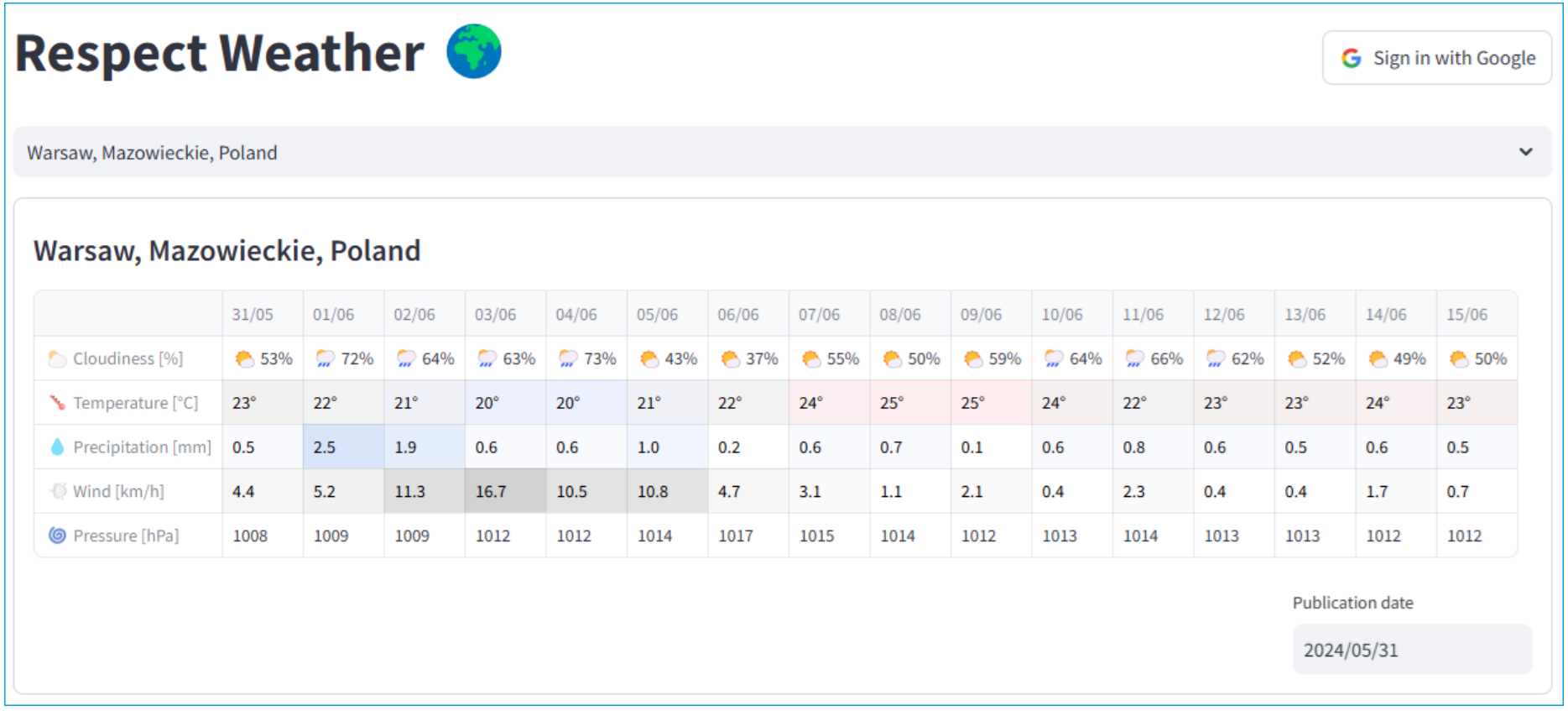
Respect Weather - idea

- Web weather application
- Short-term weather forecasts
  - up to 16 days
  - basic meteorological features
  - obtained from GEFS
- Historical data about weather conditions
- Expandable list of predefined locations
- User authentication & special functionality

📣 Showtime!

https://streamlit-app-uxtw4konlq-ew.a.run.app

📣 Showtime!



	31/05	01/06	02/06	03/06	04/06	05/06	06/06	07/06	08/06	09/06	10/06	11/06	12/06	13/06	14/06	15/06
Cloudiness [%]	53%	72%	64%	63%	73%	43%	37%	55%	50%	59%	64%	66%	62%	52%	49%	50%
Temperature [°C]	23°	22°	21°	20°	20°	21°	22°	24°	25°	25°	24°	22°	23°	23°	24°	23°
Precipitation [mm]	0.5	2.5	1.9	0.6	0.6	1.0	0.2	0.6	0.7	0.1	0.6	0.8	0.6	0.5	0.6	0.5
Wind [km/h]	4.4	5.2	11.3	16.7	10.5	10.8	4.7	3.1	1.1	2.1	0.4	2.3	0.4	0.4	1.7	0.7
Pressure [hPa]	1008	1009	1009	1012	1012	1014	1017	1015	1014	1012	1013	1014	1013	1013	1012	1012

Figure 1: Basic appearance of the application.

📣 Showtime!

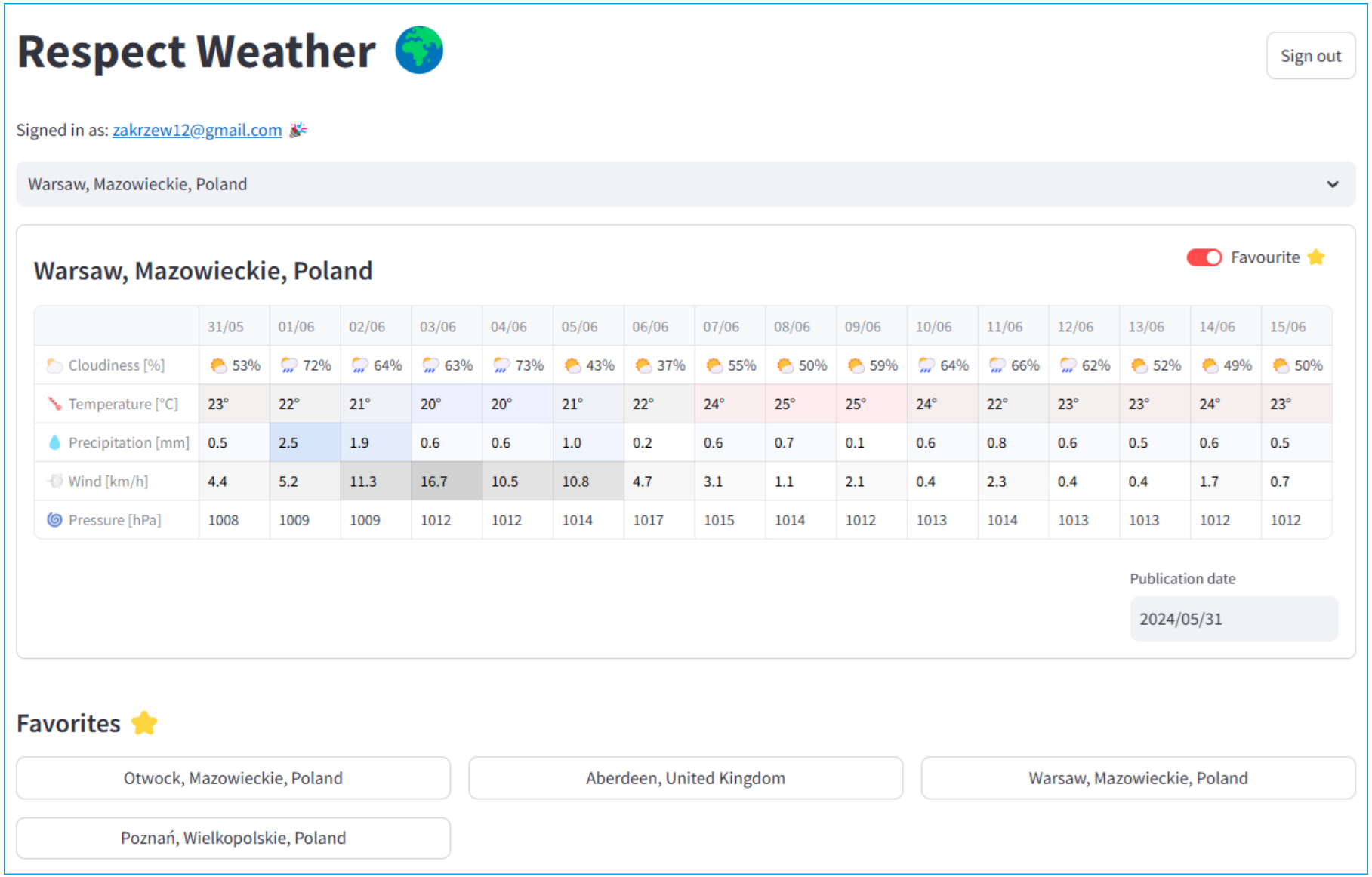


Figure 2: Appearance of the application after logging in.

📕 Microservices diagram - ETL process

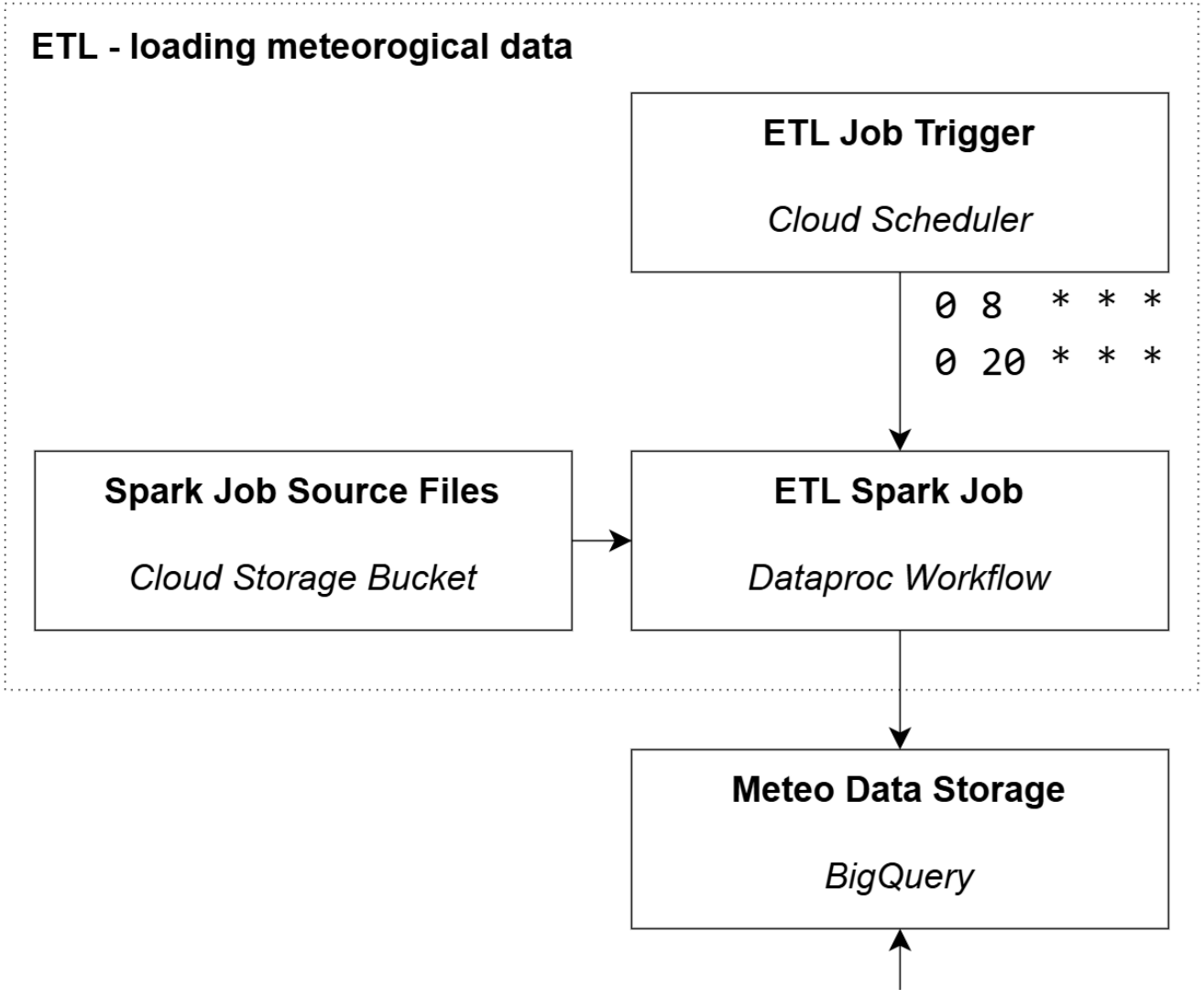


Figure 3: Diagram of microservices and connections - ETL process.

📕 Microservices diagram - storage, API, UI

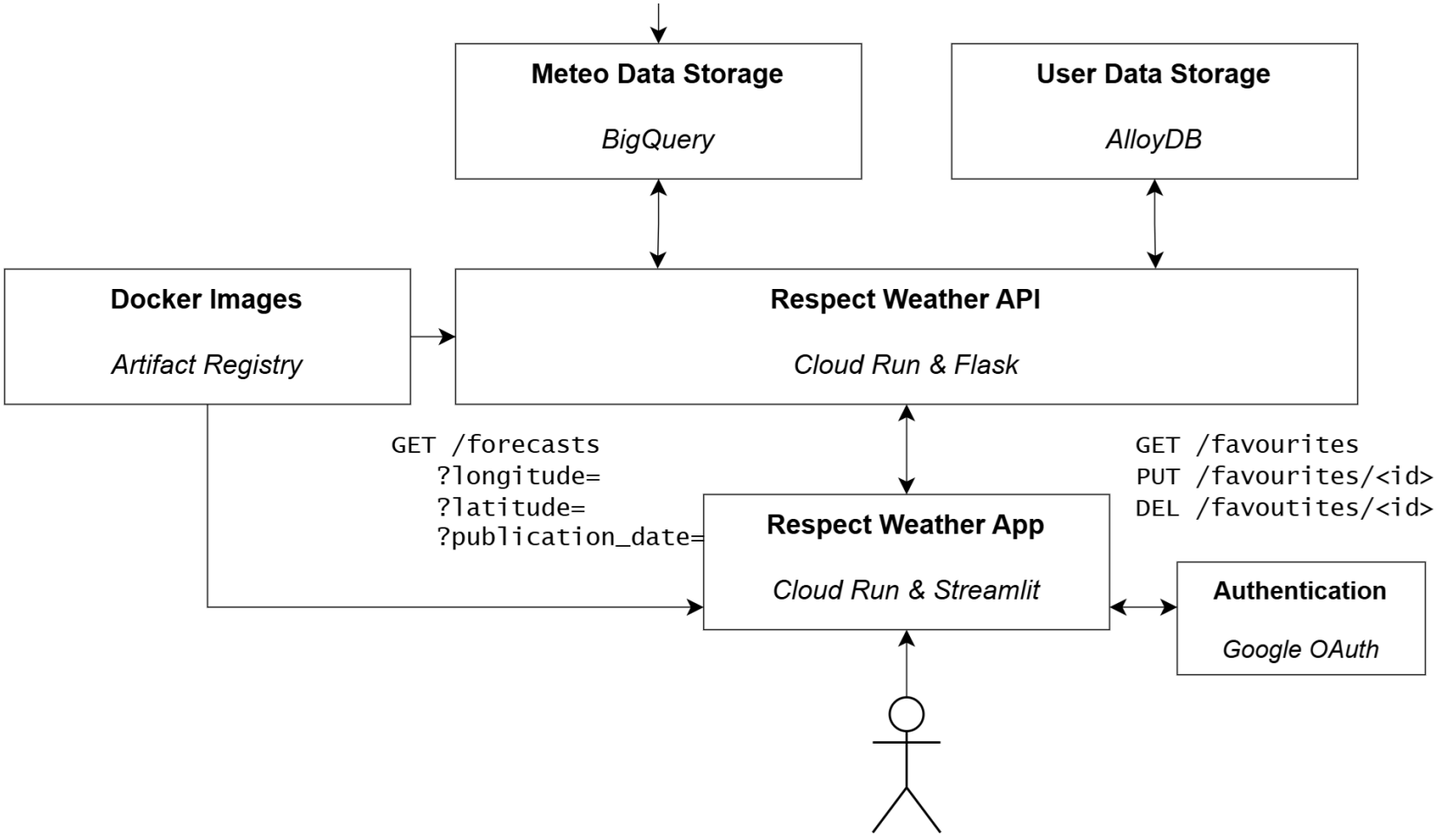


Figure 4: Diagram of microservices and connections - storage, API, UI.

📜 APIs

Respect Weather API $\Longleftrightarrow$ databases

- `pandas-gbq`
- `google-cloud-alloydb-connector`

Respect Weather API $\Longleftrightarrow$ Respect Weather App

- `GET /forecasts?longitude=&latitude=&publication_date=`
- `GET /favourites`
- `PUT /favourites/<location_id>`
- `DELETE /favourites/<location_id>`

Storage

BigQuery	AlloyDB
transformed weather data	users data
tabular	tabular
high volume	low volume
read-only	read & write
eventual consistency	high consistency

Weather forecasts

Meteorological variables

- u10 (wind u-component)
- v10 (wind v-component)
- tp (total precipitation)
- tcc (total cloud cover)
- t2m (temperature)
- prmls (pressure)

latitude	longitude	time	step	valid_time	u10	v10
90.0	0.0	2023-11-25	7 days	2023-12-02	2.43	0.66
90.0	0.5	2023-11-25	7 days	2023-12-02	2.44	0.64
90.0	1.0	2023-11-25	7 days	2023-12-02	2.44	0.62
90.0	1.5	2023-11-25	7 days	2023-12-02	2.45	0.59
90.0	2.0	2023-11-25	7 days	2023-12-02	2.45	0.57

Table 1: Sample GEFS data in tabular form

Large-scale assumptions

ETL process

- Dataproc Cluster on which Workflows are launched can be scaled up
- ETL process is designed as a PySpark Job and can be parallelized

Storage

- BigQuery with partitioned table is perfect for large volumes of data
- AlloyDB is claimed to have superior performance, scale, and availability

API and app

- Cloud Run services, on which the API and Streamlit App are based, could also be scaled up

🤝 SLA, SLO, SLI

SLO: Service Level Objectives

- Availability: aim for 99.9% system uptime monthly.
- Response rate: achieve a 99.5% success rate in responding to user requests.
- Processing time: ensure 95% of requests are processed within 1 second.
- Data freshness: Update weather forecasts in the app within 25 minutes of their release.

SLI: Service Level Indicators

- Monitoring system uptime.
- Tracking the percentage of successfully handled requests.
- Measuring the average time taken to process requests.
- Observing the timeliness of weather data updates in the app.