Xpirit

Think ahead. Act now.

Managing and querying datasets with Data Factory, Cosmos DB and Azure Functions.

Marc Duiker

The Case

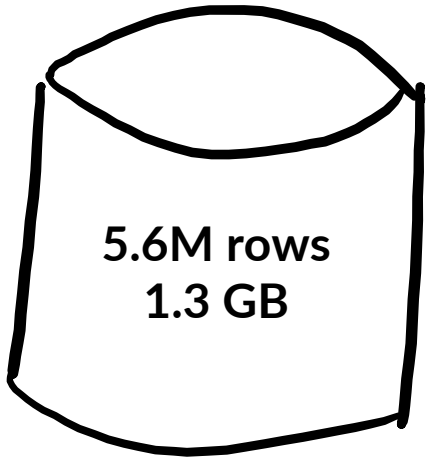
A murder has happened in New York City on 29th Jan 2014.

The suspect most likely escaped by using a taxi.

It's our job to find out which taxi the suspect could have used.

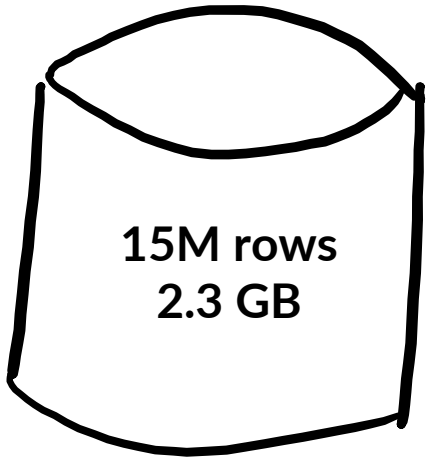
Original data sources

NYPD Complaint Data 2014



https://data.cityofnewyork.us/Public-Safety/NYPD-Complaint-Data-Historic/qgea-i56i

NYC Taxi Trip Data 2014



https://www.kaggle.com/kentonnlp/2014-new-york-city-taxi-trips

NYPD Complaint Data (trimmed down)

CSV with 39k records for Jan 2014

Attributes

- **Date & time**
- **Offense classification (KY_CD)**
- **Latitude & longitude**
- **…**

More details in *NYPD_Complaint_Data_Column_Descriptions.csv*

NYPD_Complaint_Data_Historic_first1000.csv

```
CMPLNT_NUM,CMPLNT_FR_DT,CMPLNT_FR_TM,CMPLNT_TO_DT,CMPLNT_TO_TM,RPT_DT,KY_CD,OFNS_DESC,PD_CD,PD_DESC,CRM_ATPT_CPTD_CD,LAW_CAT_CD,JUR
101109527,12/31/2015,23:45:00,,,12/31/2015,113,FORGERY,729,"FORGERY,ETC.,UNCLASSIFIED-FELO",COMPLETED,FELONY,N.Y. POLICE DEPT,BRONX
153401121,12/31/2015,23:36:00,,,12/31/2015,101,MURDER & NON-NEGL. MANSLAUGHTER,,,COMPLETED,FELONY,N.Y. POLICE DEPT,QUEENS,103,OUTSI
569369778,12/31/2015,23:30:00,,,12/31/2015,117,DANGEROUS DRUGS,503,"CONTROLLED SUBSTANCE,INTENT TO",COMPLETED,FELONY,N.Y. POLICE DE
968417082,12/31/2015,23:30:00,,,12/31/2015,344,ASSAULT 3 & RELATED OFFENSES,101,ASSAULT 3,COMPLETED,MISDEMEANOR,N.Y. POLICE DEPT,QU
641637920,12/31/2015,23:25:00,12/31/2015,23:30:00,12/31/2015,344,ASSAULT 3 & RELATED OFFENSES,101,ASSAULT 3,COMPLETED,MISDEMEANOR,N
365661343,12/31/2015,23:18:00,12/31/2015,23:25:00,12/31/2015,106,FELONY ASSAULT,109,"ASSAULT 2,1,UNCLASSIFIED",ATTEMPTED,FELONY,N.Y
608231454,12/31/2015,23:15:00,,,12/31/2015,235,DANGEROUS DRUGS,511,"CONTROLLED SUBSTANCE, POSSESSI",COMPLETED,MISDEMEANOR,N.Y. POLI
265023856,12/31/2015,23:15:00,12/31/2015,23:15:00,12/31/2015,118,DANGEROUS WEAPONS,792,WEAPONS POSSESSION 1 & 2,COMPLETED,FELONY,N.Y
989238731,12/31/2015,23:15:00,12/31/2015,23:30:00,12/31/2015,344,ASSAULT 3 & RELATED OFFENSES,101,ASSAULT 3,COMPLETED,MISDEMEANOR,N
415095955,12/31/2015,23:10:00,12/31/2015,23:10:00,12/31/2015,341,PETIT LARCENY,338,"LARCENY,PETIT FROM BUILDING,UN",COMPLETED,MISDE
731283092,12/31/2015,23:05:00,12/31/2015,23:15:00,12/31/2015,341,PETIT LARCENY,343,"LARCENY,PETIT OF BICYCLE",COMPLETED,MISDEMEANOR
178090167,12/31/2015,23:00:00,12/31/2015,23:05:00,12/31/2015,341,PETIT LARCENY,338,"LARCENY,PETIT FROM BUILDING,UN",COMPLETED,MISDE
898496564,12/31/2015,23:00:00,,,12/31/2015,109,GRAND LARCENY,406,"LARCENY,GRAND FROM PERSON, BAG OPEN/DIP",COMPLETED,FELONY,N.Y. PO
566081066,12/31/2015,23:00:00,,,12/31/2015,109,GRAND LARCENY,415,"LARCENY,GRAND FROM PERSON,PICK",COMPLETED,FELONY,N.Y. POLICE DEPT
584555879,12/31/2015,23:00:00,,,12/31/2015,113,FORGERY,729,"FORGERY,ETC.,UNCLASSIFIED-FELO",COMPLETED,FELONY,N.Y. POLICE DEPT,BROOK
715942154,12/31/2015,23:00:00,12/31/2015,23:05:00,12/31/2015,105,ROBBERY,386,"ROBBERY,PERSONAL ELECTRONIC DEVICE",COMPLETED,FELONY,
338440707,12/31/2015,23:00:00,12/31/2015,23:10:00,12/31/2015,109,GRAND LARCENY,411,"LARCENY,GRAND FROM EATERY, UNATTENDED",COMPLETE
433257334,12/31/2015,23:00:00,12/31/2015,23:05:00,12/31/2015,359,OFFENSES AGAINST PUBLIC ADMINI,748,"CONTEMPT,CRIMINAL",COMPLETED,M
761004485,12/31/2015,23:00:00,12/31/2015,23:05:00,12/31/2015,344,ASSAULT 3 & RELATED OFFENSES,101,ASSAULT 3,COMPLETED,MISDEMEANOR,N
234892198,12/31/2015,22:55:00,12/31/2015,23:10:00,12/31/2015,351,CRIMINAL MISCHIEF & RELATED OF,259,"CRIMINAL MISCHIEF,UNCLASSIFIED
231688534,12/31/2015,22:53:00,12/31/2015,22:55:00,12/31/2015,235,DANGEROUS DRUGS,511,"CONTROLLED SUBSTANCE, POSSESSI",COMPLETED,MIS
340513307,04/06/2015,12:00:00,04/10/2015,18:00:00,12/21/2015,104,RAPE,155,RAPE 2,COMPLETED,FELONY,N.Y. POLICE DEPT,QUEENS,110,INSID
704037588,12/31/2015,22:50:00,12/31/2015,22:57:00,12/31/2015,235,DANGEROUS DRUGS,511,"CONTROLLED SUBSTANCE, POSSESSI",COMPLETED,MIS
549465293,12/31/2015,22:50:00,12/31/2015,22:58:00,12/31/2015,106,FELONY ASSAULT,105,STRANGULATION 1ST,COMPLETED,FELONY,N.Y. POLICE
693907266,12/31/2015,22:45:00,12/31/2015,22:50:00,12/31/2015,118,DANGEROUS WEAPONS,793,WEAPONS POSSESSION 3,COMPLETED,FELONY,N.Y. P
371600116,12/31/2015,22:45:00,12/31/2015,22:50:00,12/31/2015,344,ASSAULT 3 & RELATED OFFENSES,101,ASSAULT 3,COMPLETED,MISDEMEANOR,N
359273994,12/31/2015,22:45:00,12/31/2015,22:55:00,12/31/2015,344,ASSAULT 3 & RELATED OFFENSES,101,ASSAULT 3,COMPLETED,MISDEMEANOR,N
415805453,12/31/2015,22:45:00,,,12/31/2015,118,DANGEROUS WEAPONS,793,WEAPONS POSSESSION 3,COMPLETED,FELONY,N.Y. POLICE DEPT,BROOKLY
251546004,12/31/2015,22:40:00,12/31/2015,22:50:00,12/31/2015,235,DANGEROUS DRUGS,567,"MARIJUANA, POSSESSION 4 & 5",COMPLETED,MISDEM
624630216,12/31/2015,22:40:00,12/31/2015,22:56:00,12/31/2015,347,INTOXICATED & IMPAIRED DRIVING,905,"INTOXICATED DRIVING,ALCOHOL",C
149811574,12/31/2015,22:37:00,12/31/2015,22:57:00,12/31/2015,351,CRIMINAL MISCHIEF & RELATED OF,259,"CRIMINAL MISCHIEF,UNCLASSIFIED
749998471,12/31/2015,22:35:00,12/31/2015,22:41:00,12/31/2015,235,DANGEROUS DRUGS,567,"MARIJUANA, POSSESSION 4 & 5",COMPLETED,MISDEM
508630273,12/31/2015,22:35:00,12/31/2015,22:53:00,12/31/2015,578,HARRASSMENT 2,638,"HARASSMENT,SUBD 3,4,5",COMPLETED,VIOLATION,N.Y.
```

NYC Taxi Trip Data (trimmed down)

CSV with 477k records for 29th Jan 2014

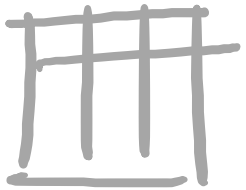
Attributes

- **Pickup date & time**
- **Pickup latitude & longitude**
- **…**

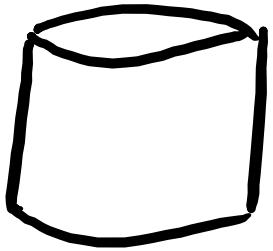
nyc_taxi_data_2014_first1000.csv

```
vendor_id,pickup_datetime,dropoff_datetime,passenger_count,trip_distance,pickup_longitude,pickup_latitude,rate_code,store_and_fwd_f
CMT,2014-01-09 20:45:25,2014-01-09 20:52:31,1,0.6999999999999996,-73.994770000000003,40.736828000000003,1,N,-73.982226999999995,40
CMT,2014-01-09 20:46:12,2014-01-09 20:55:12,1,1.3999999999999999,-73.982392000000004,40.773381999999998,1,N,-73.960448999999997,40.
CMT,2014-01-09 20:44:47,2014-01-09 20:59:46,2,2.2999999999999998,-73.988569999999996,40.739406000000002,1,N,-73.986626000000001,40.
CMT,2014-01-09 20:44:57,2014-01-09 20:51:40,1,1.7,-73.960212999999996,40.770463999999997,1,N,-73.979862999999995,40.777050000000003
CMT,2014-01-09 20:47:09,2014-01-09 20:53:32,1,0.90000000000000002,-73.995371000000006,40.717247999999998,1,N,-73.984367000000006,40
CMT,2014-01-09 20:45:07,2014-01-09 20:51:01,1,0.90000000000000002,-73.983811000000003,40.749654999999997,1,N,-73.989746999999994,40
CMT,2014-01-09 20:44:04,2014-01-09 21:05:45,1,3.6000000000000001,-73.984138000000002,40.726317000000002,1,N,-73.962868999999998,40.
CMT,2014-01-09 20:43:23,2014-01-09 20:52:07,1,2.1000000000000001,-73.979906,40.745849999999997,1,N,-73.959090000000003,40.773639000
CMT,2014-01-09 20:43:04,2014-01-09 20:54:29,1,3.3999999999999999,-73.981147000000007,40.758918000000001,1,N,-73.942509999999999,40.
CMT,2014-01-09 20:50:23,2014-01-09 20:58:10,1,2.2999999999999998,-73.955192999999994,40.765467999999998,1,N,-73.979022999999998,40.
CMT,2014-01-09 20:51:36,2014-01-09 21:15:07,1,9.5,-73.885274999999993,40.773048000000003,1,N,-73.980879000000002,40.777383999999998
CMT,2014-01-09 20:48:04,2014-01-09 21:01:37,1,3.2999999999999998,-73.991782000000001,40.748911,1,N,-73.988359000000003,40.714205,CR
CMT,2014-01-09 20:47:49,2014-01-09 20:56:11,2,1.8,-73.965716999999998,40.758674999999997,1,N,-73.984059000000002,40.737448000000001
CMT,2014-01-09 20:48:47,2014-01-09 20:56:52,2,1.3999999999999999,-73.977008999999995,40.751620000000003,1,N,-73.982642999999996,40.
CMT,2014-01-09 20:47:51,2014-01-09 21:02:31,3,2.6000000000000001,-73.977655999999996,40.753680000000003,1,N,-73.952248999999995,40.
CMT,2014-01-09 20:49:49,2014-01-09 21:20:38,1,11.199999999999999,-73.788265999999993,40.647542000000001,1,N,-73.949224999999998,40.
CMT,2014-01-09 16:51:35,2014-01-09 17:00:17,1,1.7,-74.007503,40.725991999999998,1,N,-  col# 7, "pickup_latitude"  .734583000000001,CRD,8.5,
CMT,2014-01-09 16:43:29,2014-01-09 16:59:15,1,4.7000000000000002,-74.014865999999998,40.709353,1,N,-73.986084000000005,40.759081000
CMT,2014-01-09 16:46:50,2014-01-09 16:56:41,1,1.6000000000000001,-73.967675,40.763109,1,N,-73.952590999999998,40.778185999999998,CR
CMT,2014-01-09 16:47:00,2014-01-09 17:37:58,1,17.899999999999999,-73.781730999999994,40.644728999999998,2,N,-73.978604000000004,40.
CMT,2014-01-09 16:51:14,2014-01-09 16:51:34,1,0,-73.790554999999998,40.643934999999999,2,N,-73.790554999999998,40.643931000000002,C
CMT,2014-01-09 16:42:16,2014-01-09 16:58:42,1,2.1000000000000001,-73.988810000000001,40.751013,1,Y,-73.996002000000004,40.726658,CR
CMT,2014-01-09 16:42:05,2014-01-09 17:30:27,1,14.300000000000001,-74.013684999999995,40.709328999999997,1,N,-73.885670000000005,40.
CMT,2014-01-09 16:43:37,2014-01-09 16:56:23,1,1.6000000000000001,-73.970117000000002,40.752862,1,N,-73.954138,40.764080999999997,CR
CMT,2014-01-09 16:46:36,2014-01-09 16:52:44,1,1.3,-73.991541999999995,40.738917999999998,1,N,-73.994747000000004,40.724133999999999
CMT,2014-01-09 16:49:16,2014-01-09 17:01:00,1,1.3,-73.960639,40.768771999999998,1,N,-73.976676999999995,40.765340000000002,CRD,9,1,
CMT,2014-01-09 16:48:12,2014-01-09 16:52:09,3,0.80000000000000004,-73.979729000000006,40.781711000000001,1,Y,-73.976643999999993,40
CMT,2014-01-09 16:44:22,2014-01-09 16:47:59,1,0.59999999999999998,-73.975379000000004,40.761056000000004,1,N,-73.979162000000002,40
CMT,2014-01-09 16:50:42,2014-01-09 17:10:17,1,3.7999999999999998,-73.946211000000005,40.772990999999998,1,N,-73.994018999999994,40.
CMT,2014-01-09 16:48:14,2014-01-09 16:57:56,1,1.8,-73.992153999999999,40.731084000000003,1,N,-73.975376999999995,40.750450999999998
CMT,2014-01-09 16:48:35,2014-01-09 16:55:40,1,1.2,-73.990262000000001,40.729050999999998,1,N,-73.995738000000003,40.741028,CRD,6.5,
CMT,2014-01-09 16:48:42,2014-01-09 17:13:00,1,2.2999999999999998,-73.989091999999999,40.736671999999999,1,N,-73.985742000000002,40.
```

What can we use on Azure?



Csv



Storage

Transfer

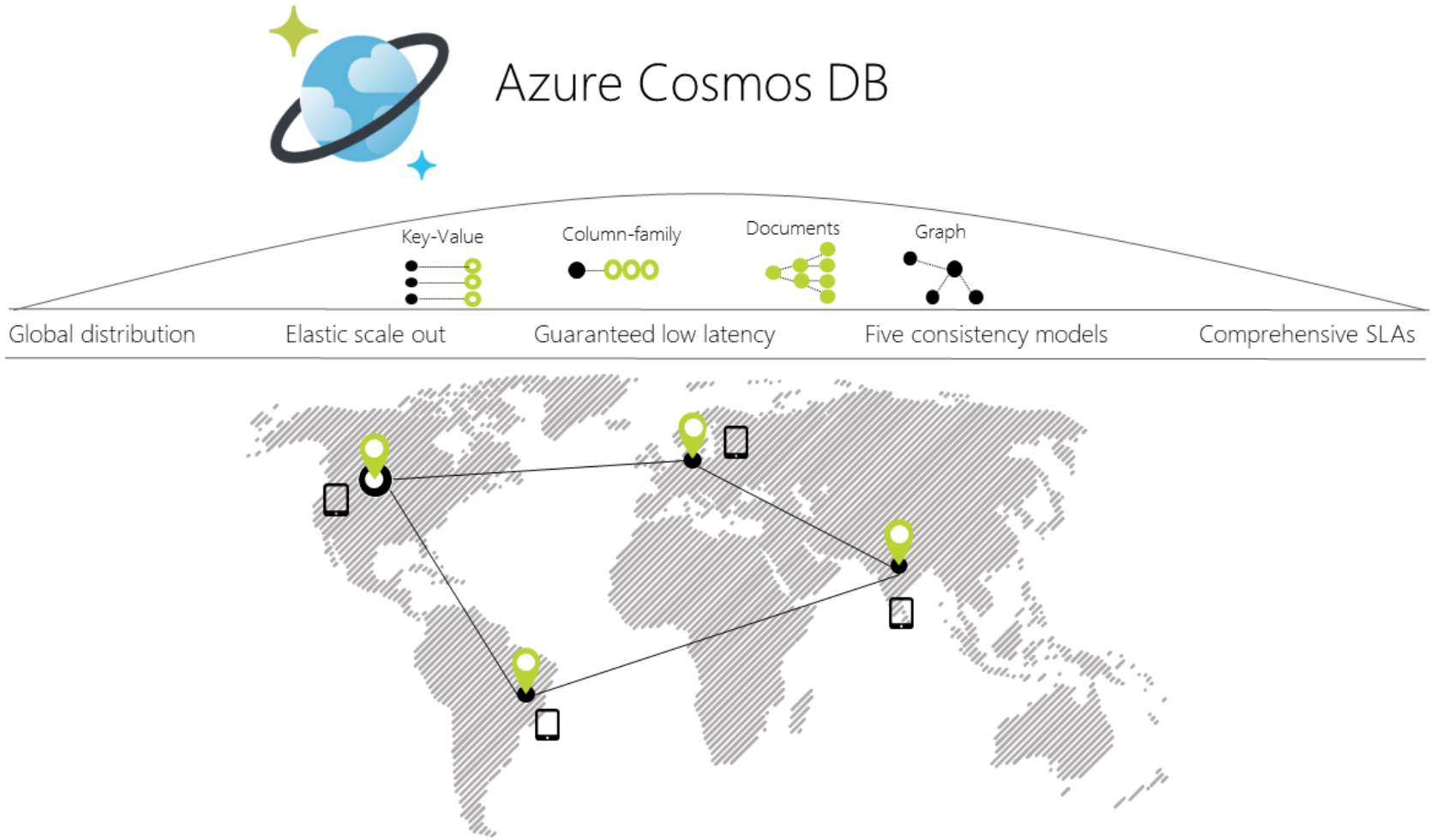
Query

Cosmos DB

Data Factory

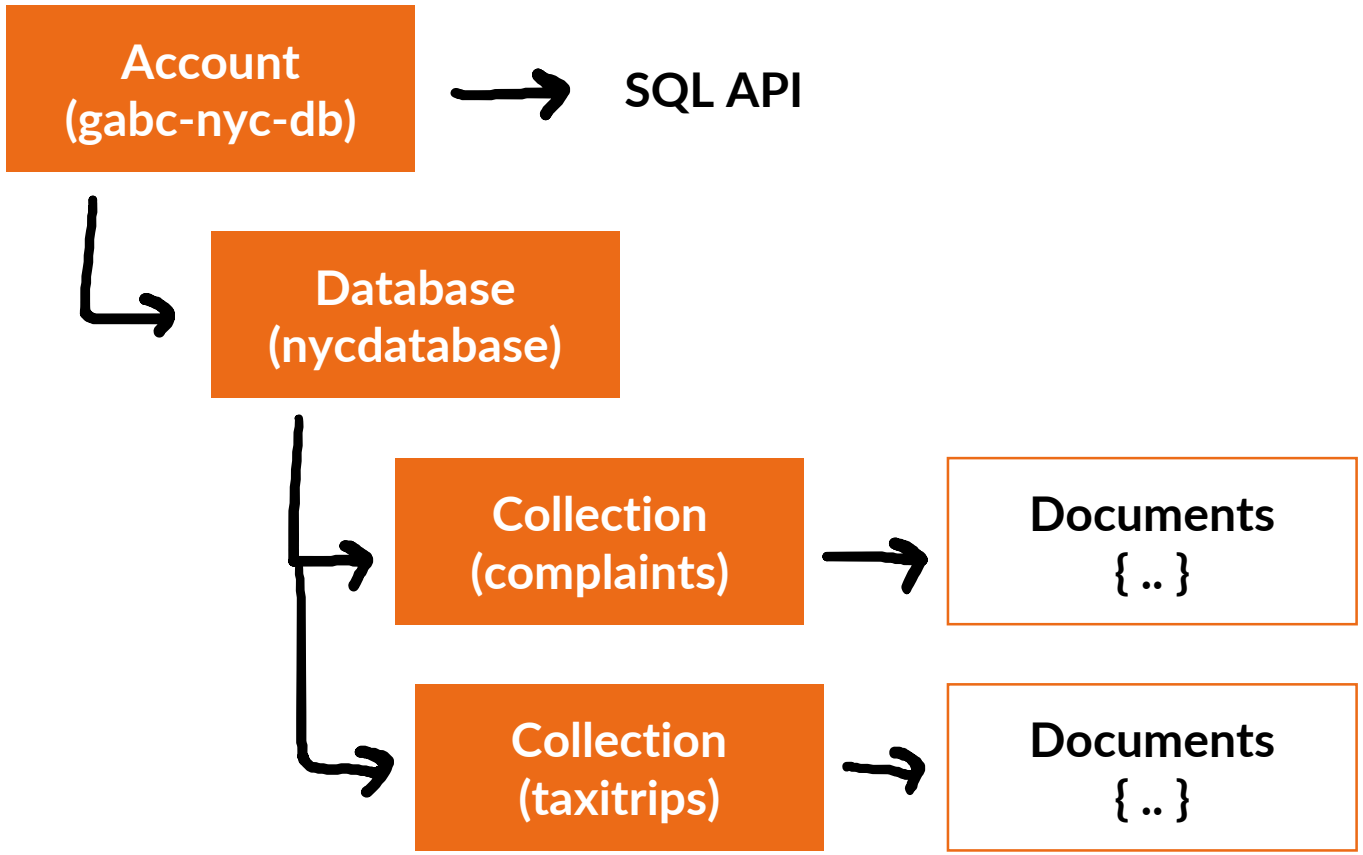
Azure Functions

Cosmos DB



Xpirit
Think ahead. Act now.

Cosmos DB: databases & collections



Xpirit
Think ahead. Act now.

Cosmos DB: GeoJSON

Azure Cosmos DB supports indexing and querying of geospatial point data that's represented using the GeoJSON specification.

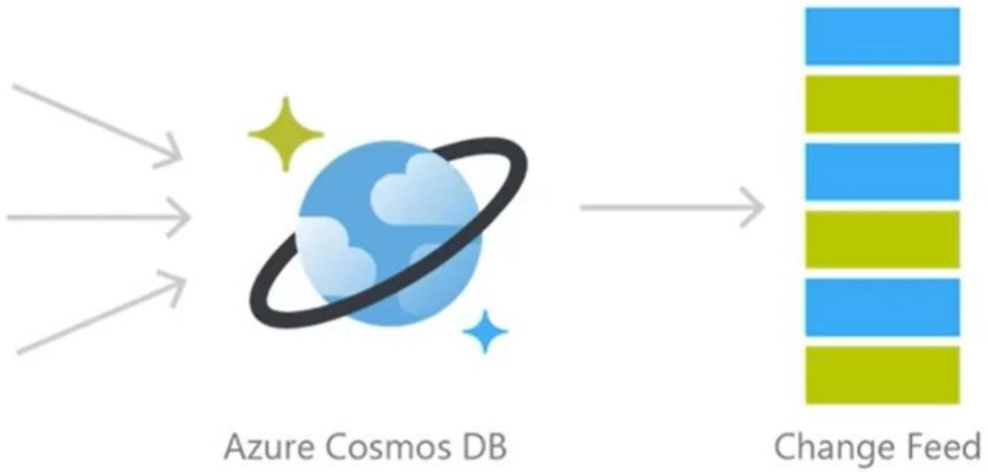
```
{
  "type":"Point",
  "coordinates":[-73.88, 40.76]
}
```

https://docs.microsoft.com/en-us/azure/cosmos-db/geospatial

Xpirit
Think ahead. Act now.

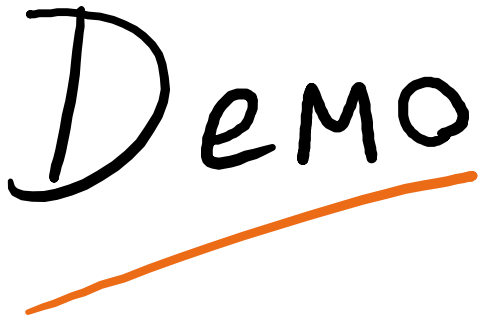
Cosmos DB: Change feed

- **Cosmos DB persists events about insertion and updates to documents in the change feed.**



Xpirit
Think ahead. Act now.

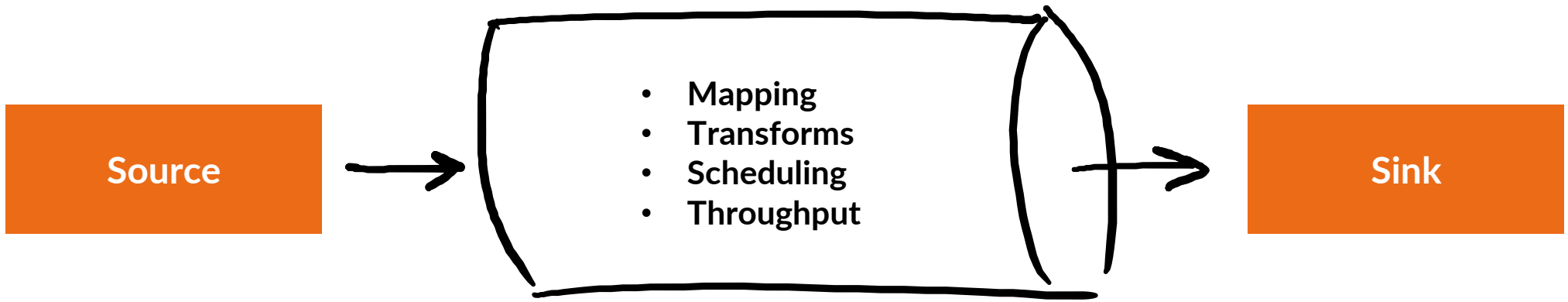
Cosmos DB



Xpirit
Think ahead. Act now.

Azure Data Factory (v2)

Preview!



Data Factory: source schema

- When importing a csv DataFactory looks at the first line of data to determine the data types.
- Inspect the data for empty and numeric values
  - “” → empty value for String, Int64 or Double?
  - 0 → Int64 or Double?
- Sometimes numbers are categories (String).

Azure Data Factory

Demo

https://datafactoryv2.azure.com/

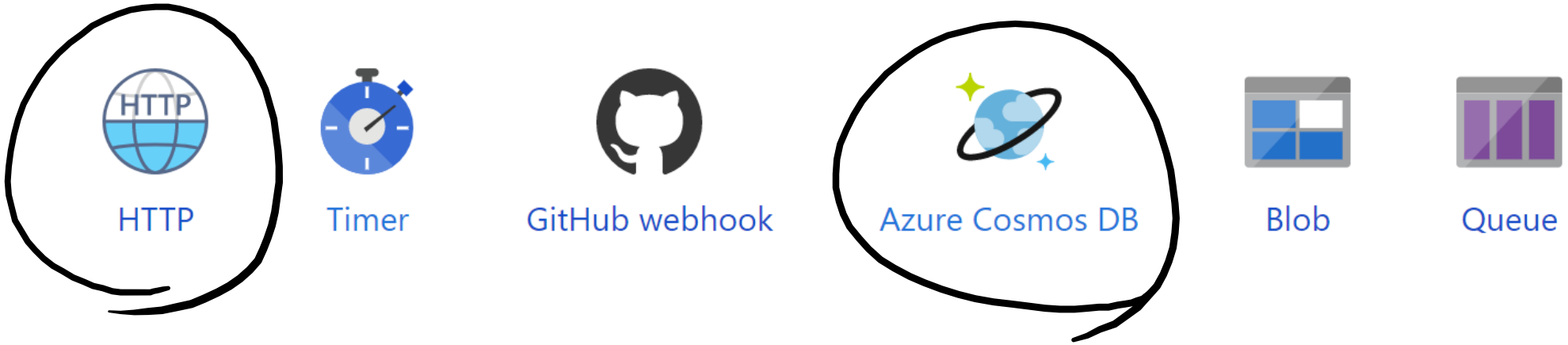
Xpirit
Think ahead. Act now.

Azure Functions (Runtime 2)

- **Serverless compute service to run code on demand**
- **Support for various languages: C#, F#, Node.js, Java, or PHP**
- **Automatic scaling**
- **Pay-per-use**

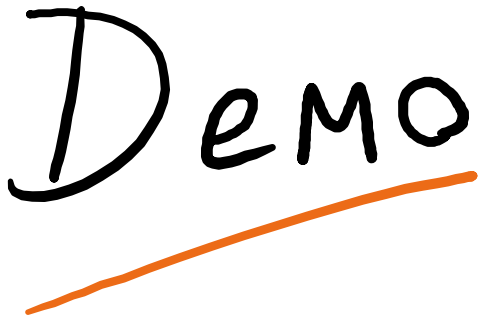
Xpirit
Think ahead. Act now.

Azure Functions Triggers



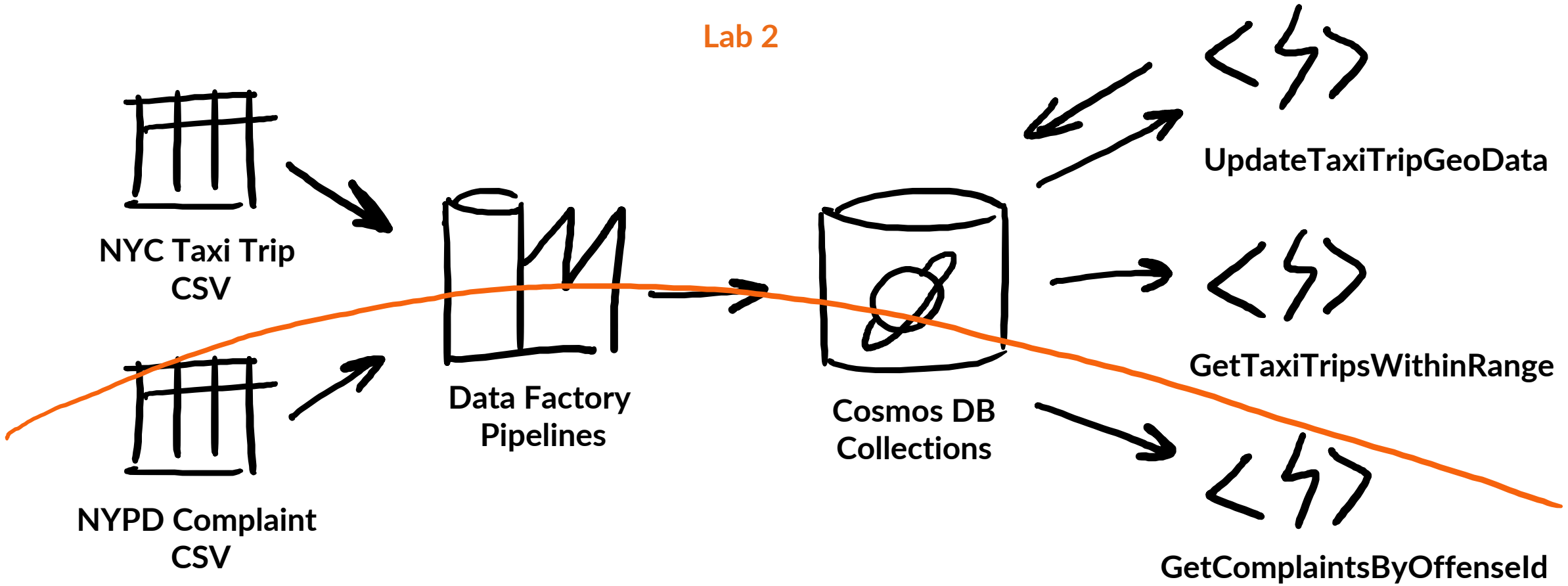
Xpirit
Think ahead. Act now.

Azure Functions



Xpirit
Think ahead. Act now.

Integrating the services



Hands-on labs

https://github.com/XpiritBV/GABC2018_HandsOnLabs/