# Realtime Store Visit Predictions at Scale

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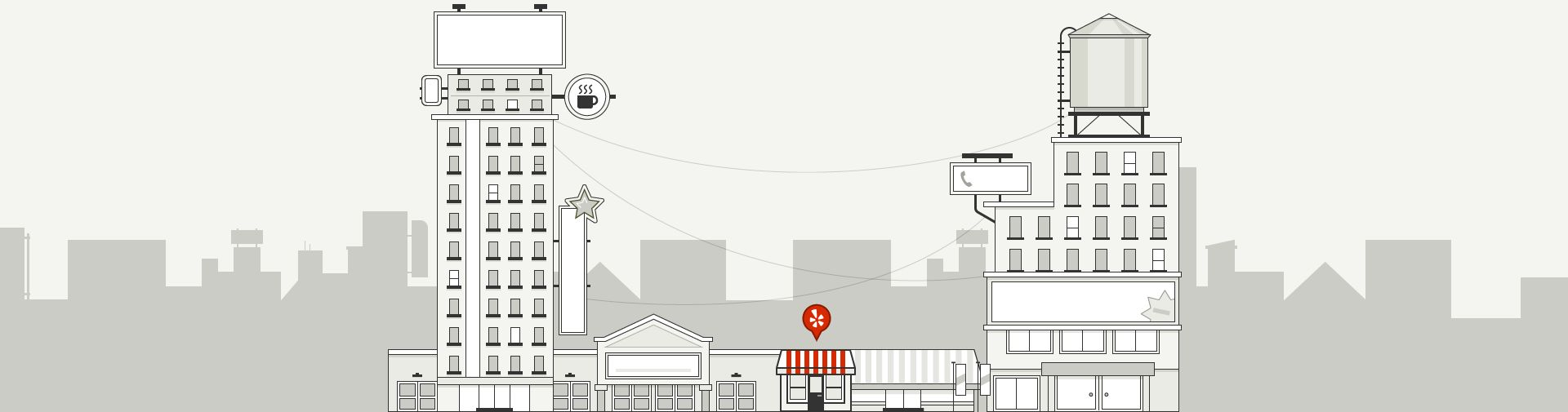
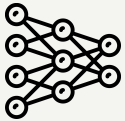


# Outline

Product



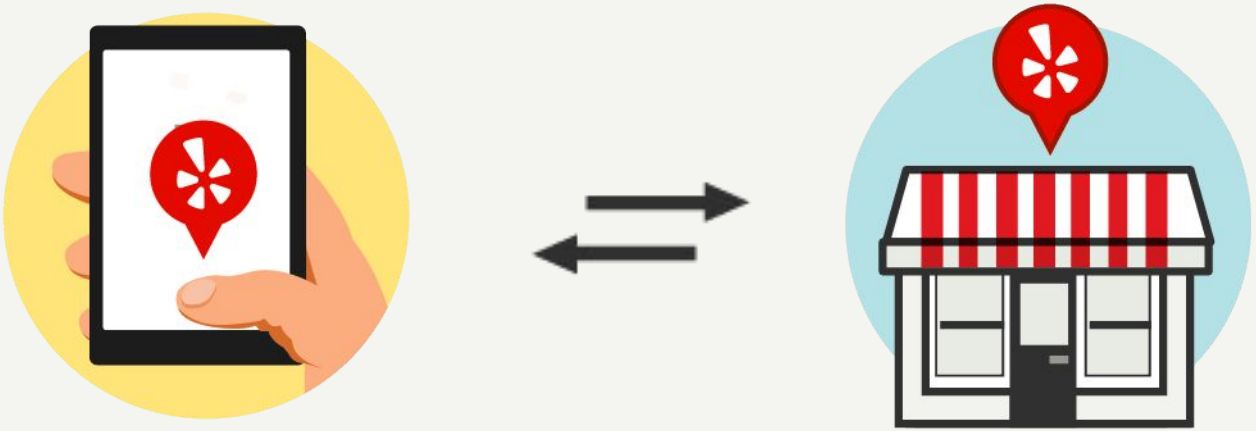
Algorithm

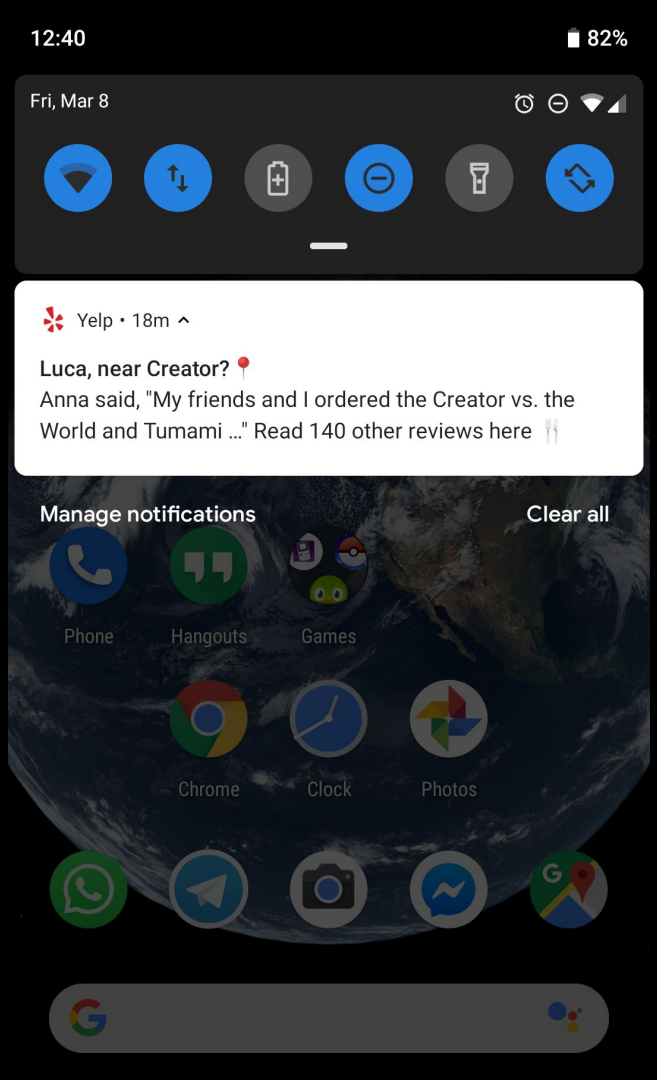
Flink Implementation

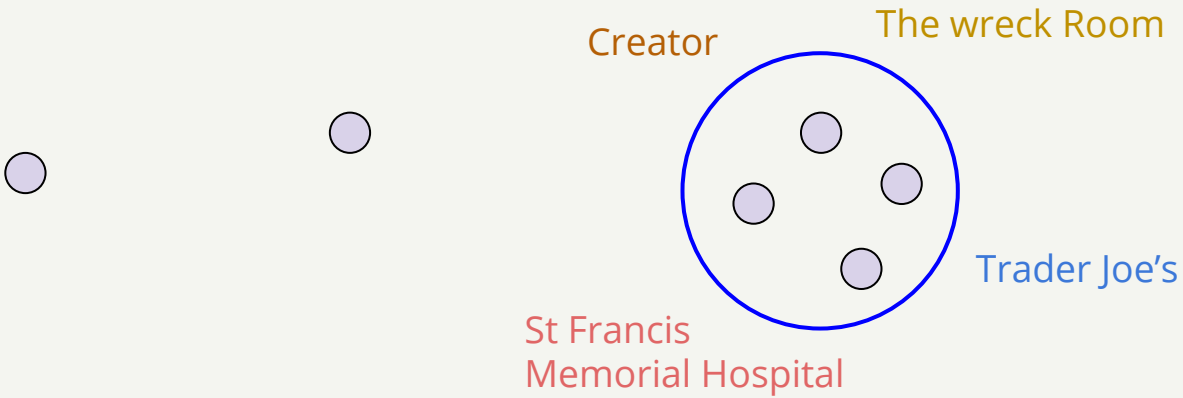
Impact

# Yelp's Mission

Connecting people with great local businesses.




12:40
82%
Fri, Mar 8
Yelp • 18m
Luca, near Creator?
Anna said, "My friends and I ordered the Creator vs. the World and Tumami ..." Read 140 other reviews here
Manage notifications
Clear all
Phone
Hangouts
Games
Chrome
Clock
Photos


Creator
The wreck Room
Trader Joe’s
St Francis
Memorial Hospital

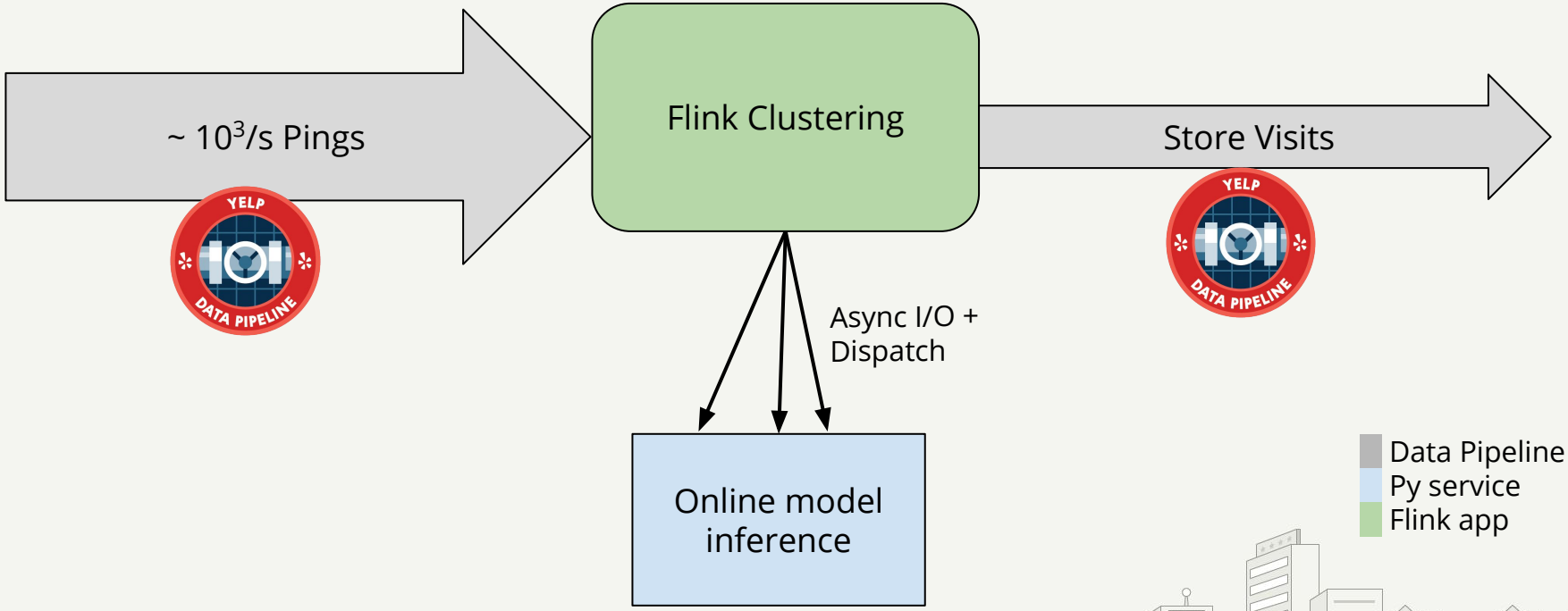
# XGBoost ML model

| **Input location** |
| --- |
| Luca<br>@ California & Hyde St. |

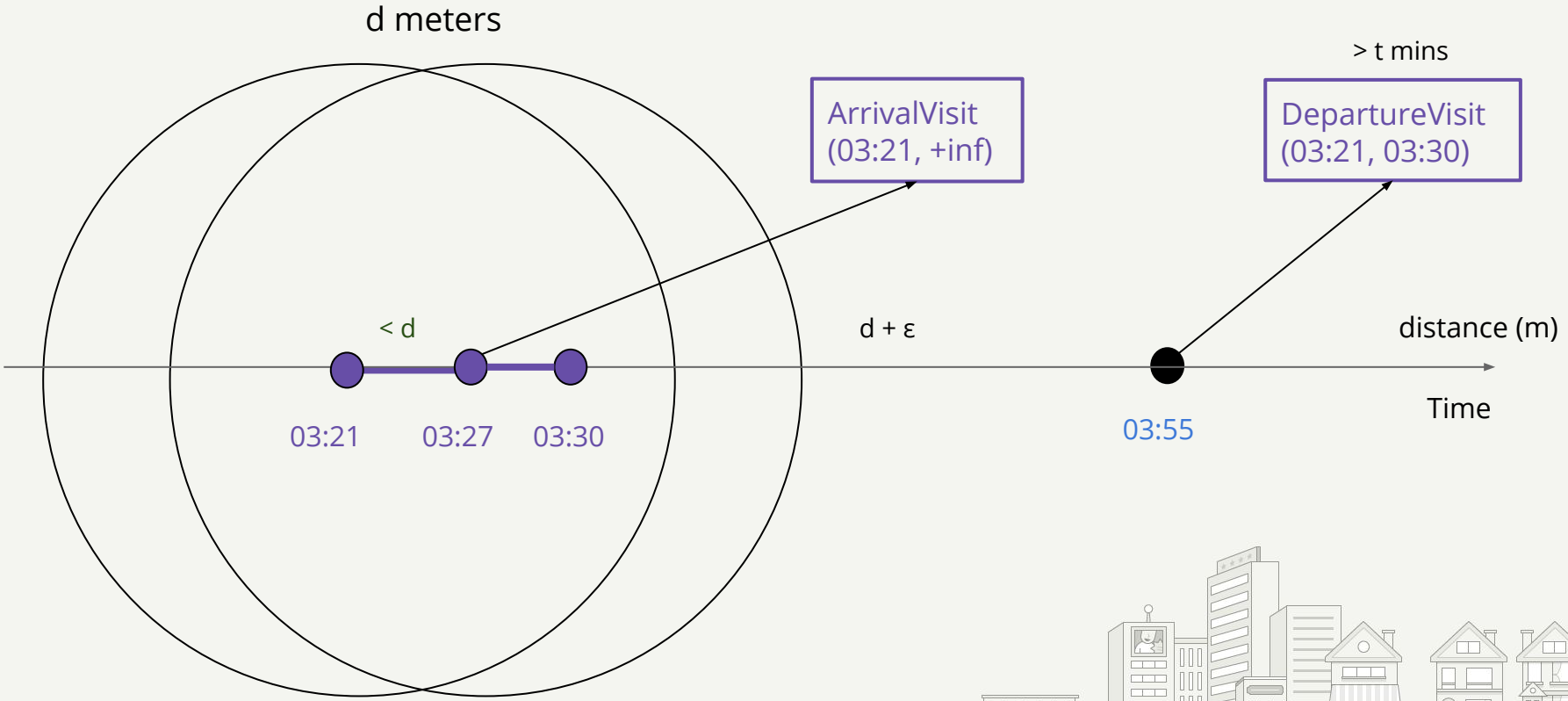
| **Candidate Businesses** |
| --- |
| Creator |
| Trader Joe’s |
| The Wreck Room |
| St. Francis Hospital |
| … |

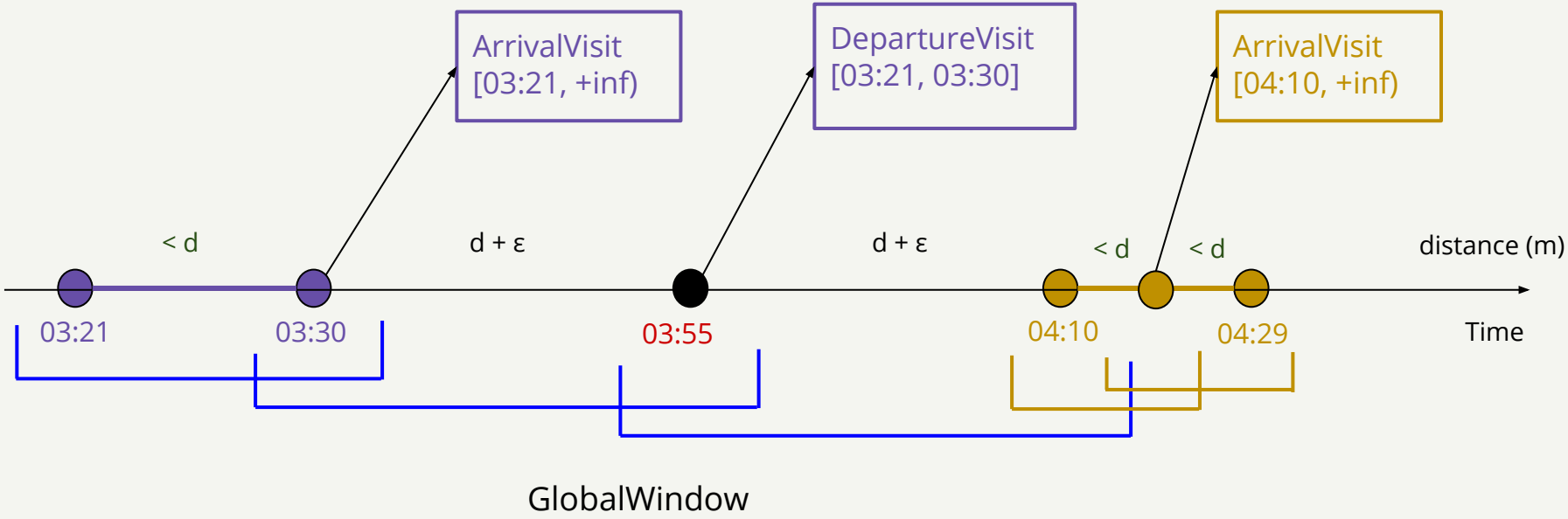
?

# System overview



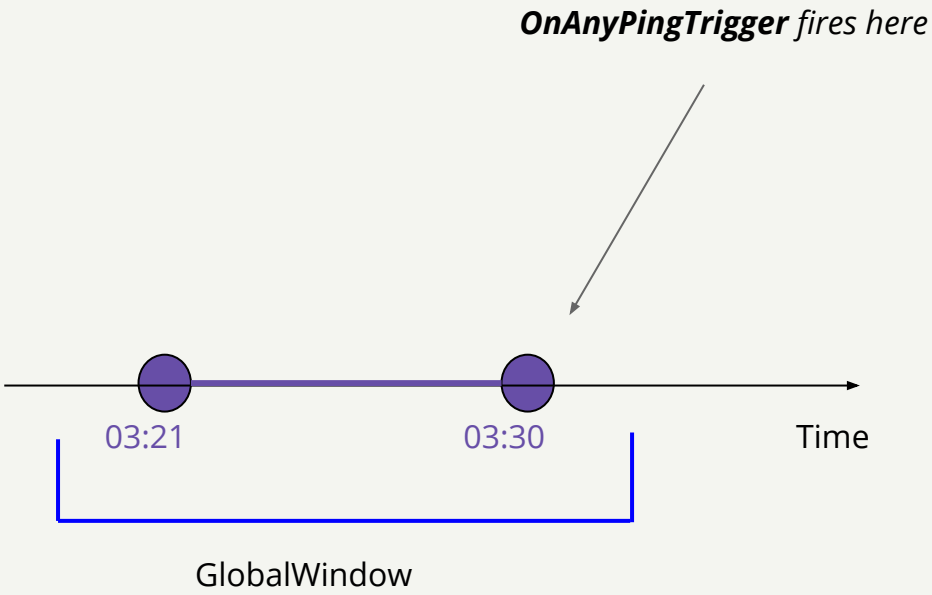
# Clustering --> ProcessWindowFunction





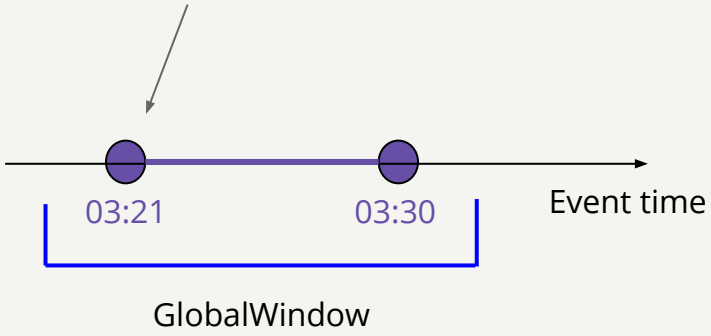

GlobalWindow

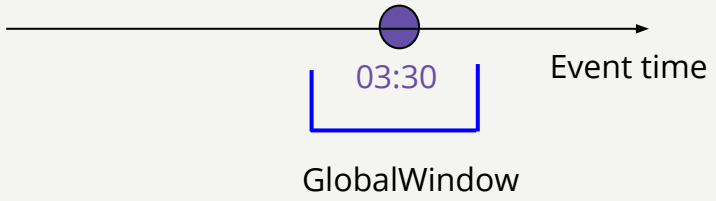
# Custom Trigger



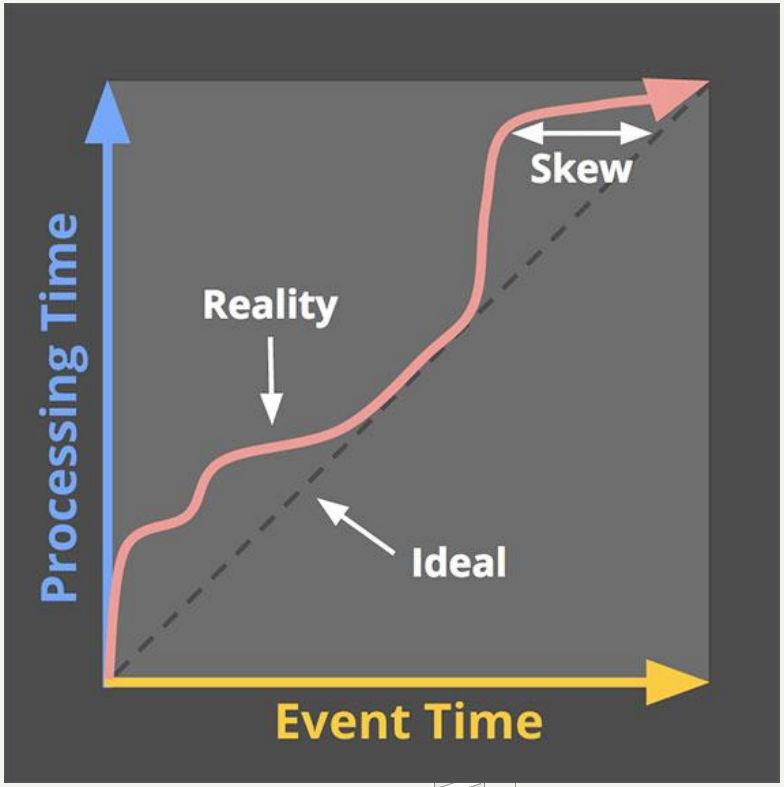
# Count Evictor

***CountEvictor*** *removes the oldest ping*

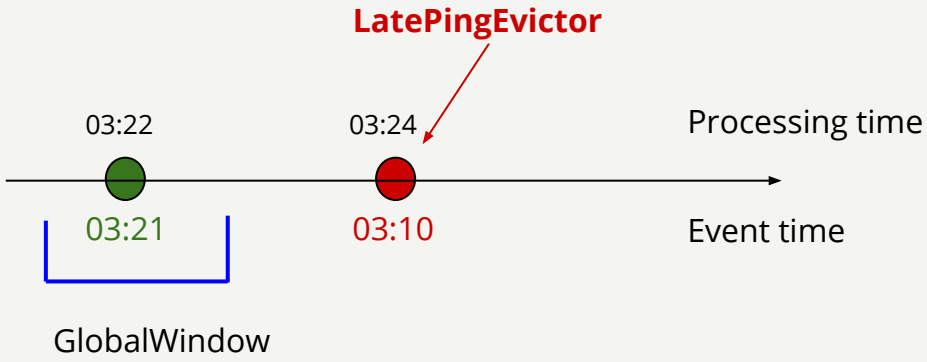


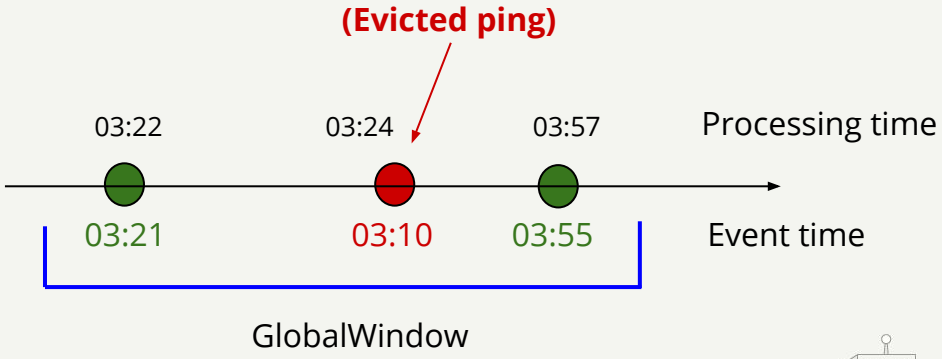



- Mobiles go offline
- Mobiles clocks can be off




* Picture from https://www.oreilly.com/ideas/the-world-beyond-batch-streaming-101 by Tyler Akidau


LatePingEvictor
03:22
03:24
Processing time
03:21
03:10
Event time
GlobalWindow


(Evicted ping)
03:22
03:24
03:57
Processing time
03:21
03:10
03:55
Event time
GlobalWindow

| Location (Input) | Candidate businesses | Features | | | Confidence score |
|---|---|---|---|---|---|
| | | Distance | Directions | ... | |
| Luca<br>@ California & Hyde St. | Creator | 0.001 | 0.026 | ... | 0.99 |
| | Trader Joe's | 0.021 | 0.071 | ... | 0.13 |
| | St. Francis Hospital | ... | ... | ... | ... |
| | ... | ... | ... | ... | ... |

# Origins story

- Fragile in-house state
- No concurrency, no scaling
- At-least-once guarantee --> duplicate pushes

# Impact

**x10** Visits recall increase

up to **~ $10^3$** ML predictions / sec

**14** Flink instances down from ~$10^2$ Python

~ **x5** times cheaper

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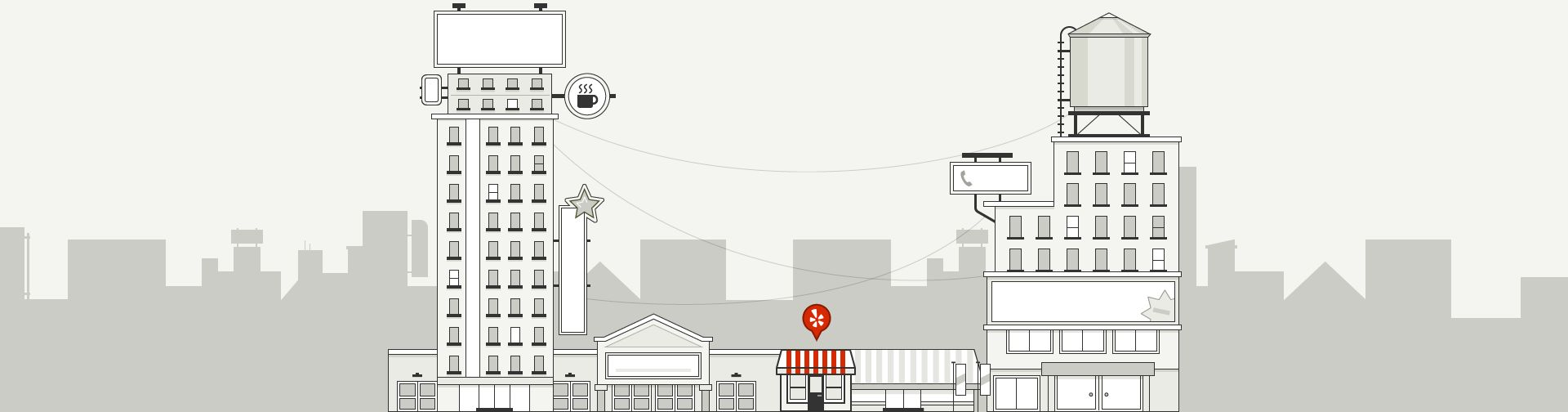
yelp.com/careers