Catcher: A Cache Analysis System for Top-k Pub/Sub Service

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Problem

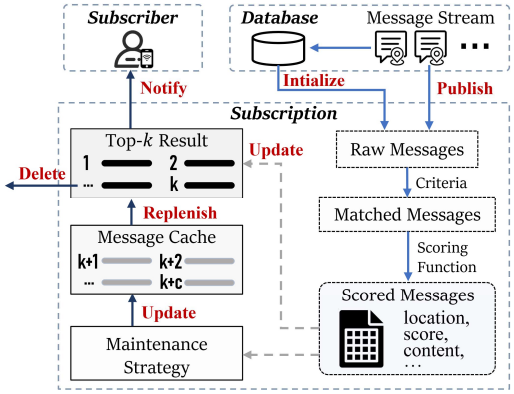
Top-k Pub/Sub (TkPS) service returns up-to-date top-k ranked messages to subscribers, which is computationally prohibitive in large-scale scenarios.

- $R_s \in M, |R_s| = s.k,$
- $\forall m \in R_s, \forall m' \in M \setminus R_s, s.R(m) \geq s.R(m').$

Continous top-k query

Accelerate

Message cache
(a.k.a. buffer or top-k refiller)



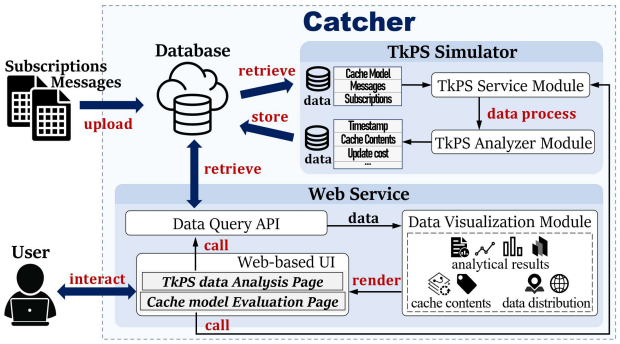
Maintenance of top-k results using message cache in TkPS services

Motivations

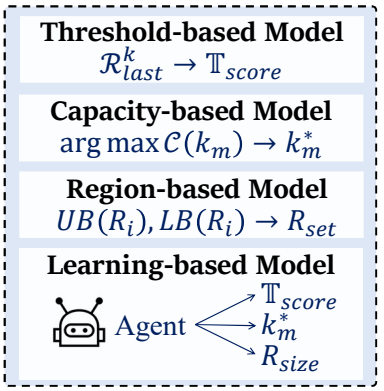
- While maintenance strategy is important for message caches, a reliable system is currently lacking to assist developers in exploring and establishing the connections between effective strategic decisions and factors like data distribution.
- The nature of TkPS service necessitates that users conduct a retrospective analysis of the maintenance process.

System Overview

- Analyzes the process of top-k result maintenance.
- Discovers the deficiencies in maintenance strategies.
- Optimizes cache models.
- Offers real-time evaluation of cache models in different datasets.



Overview of the Catcher architecture

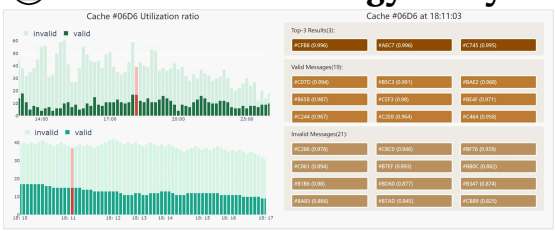


Demonstration

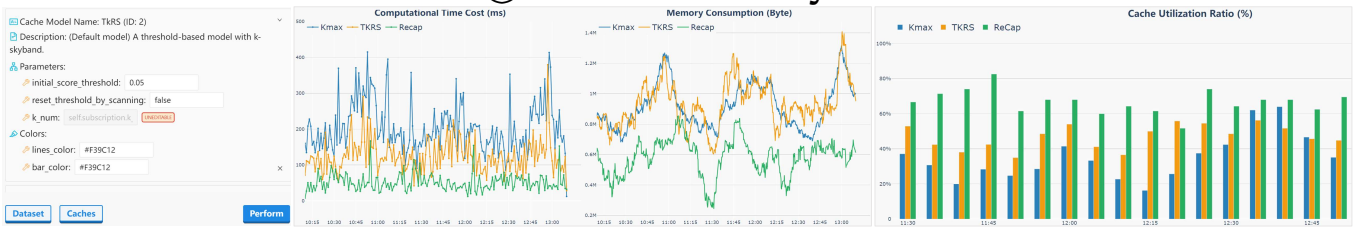
(3 User Scenarios) Used Dataset: 200K ride orders + 30K subscriptions

① Cache Performance Analysis

② Maintenance Strategy Analysis



③ Cache Model Analysis



Conclusion

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Motivated by the challenge of developing cache models in TkPS services, we demonstrate the cache analysis system ***Catcher***. It analyzes the performance of cache models and identifies their deficiencies by deploying them within simulated TkPS services. It helps users improve their techniques by addressing existing issues and understanding the impact of factors like message distribution and subscription parameters.