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AnalyticDB-V
A Hybrid Analytical Engine Towards Query Fusion for Structured and Unstructured Data

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1. Background

2. System design

3. Optimization

4. Evaluation

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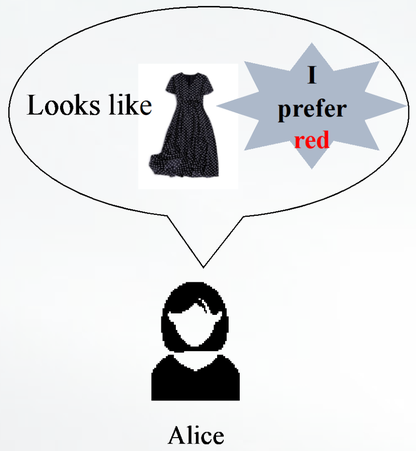
1.1 Background



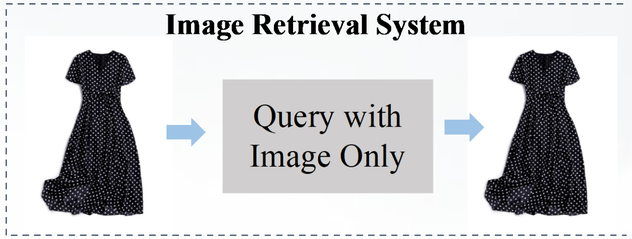


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Image Retrieval System	✗	✗	✗	✗	✓
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1.2 Background

AI

High dimension

Hybrid analytics

SQL syntax

AnalyticDB-V

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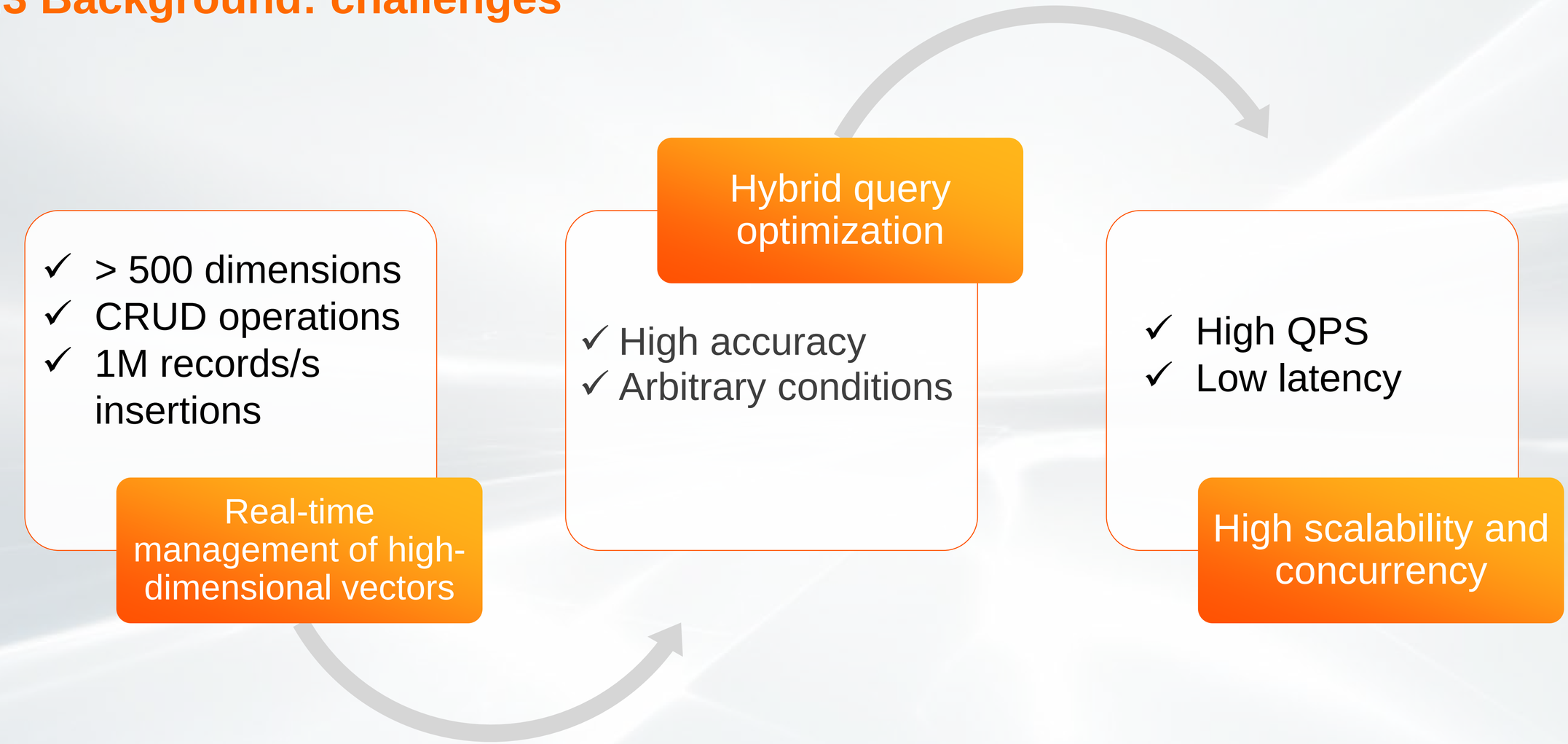
1.3 Background: challenges



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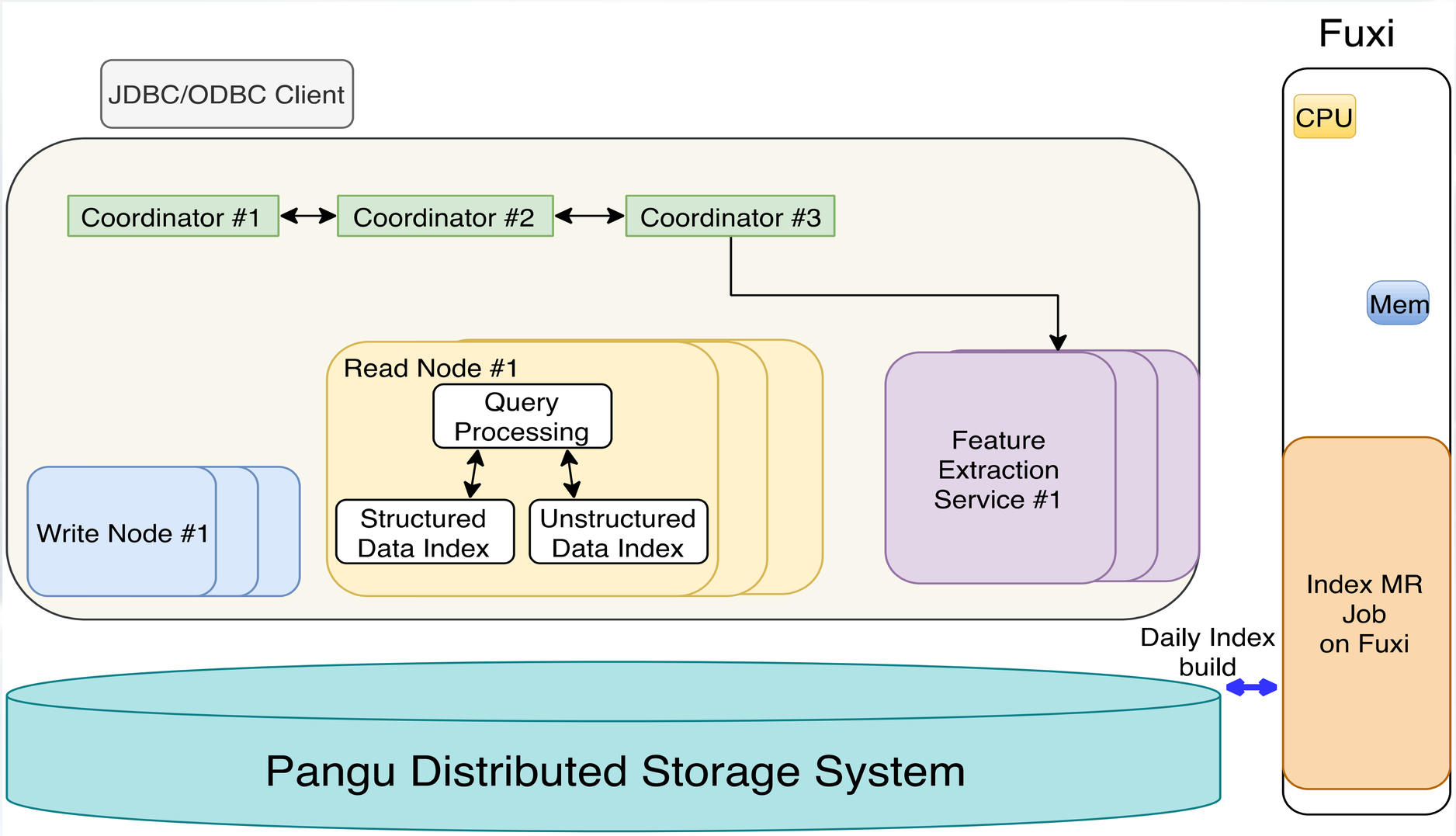
2.1 System design: overview



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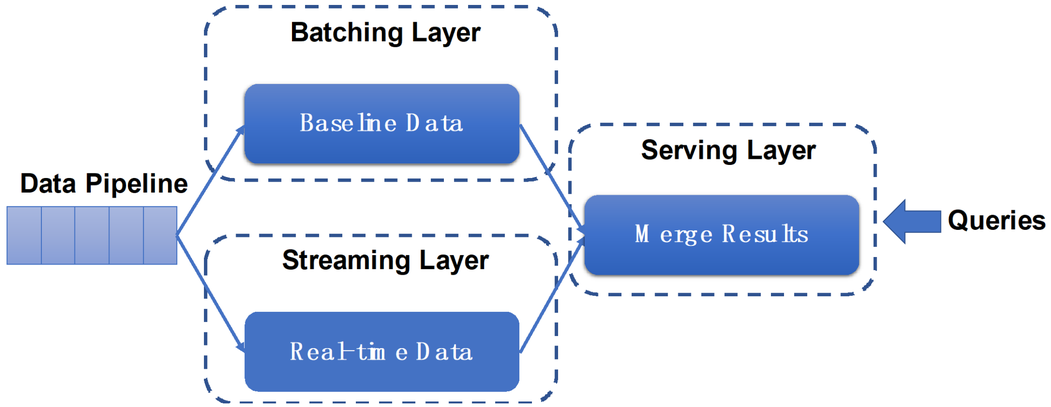
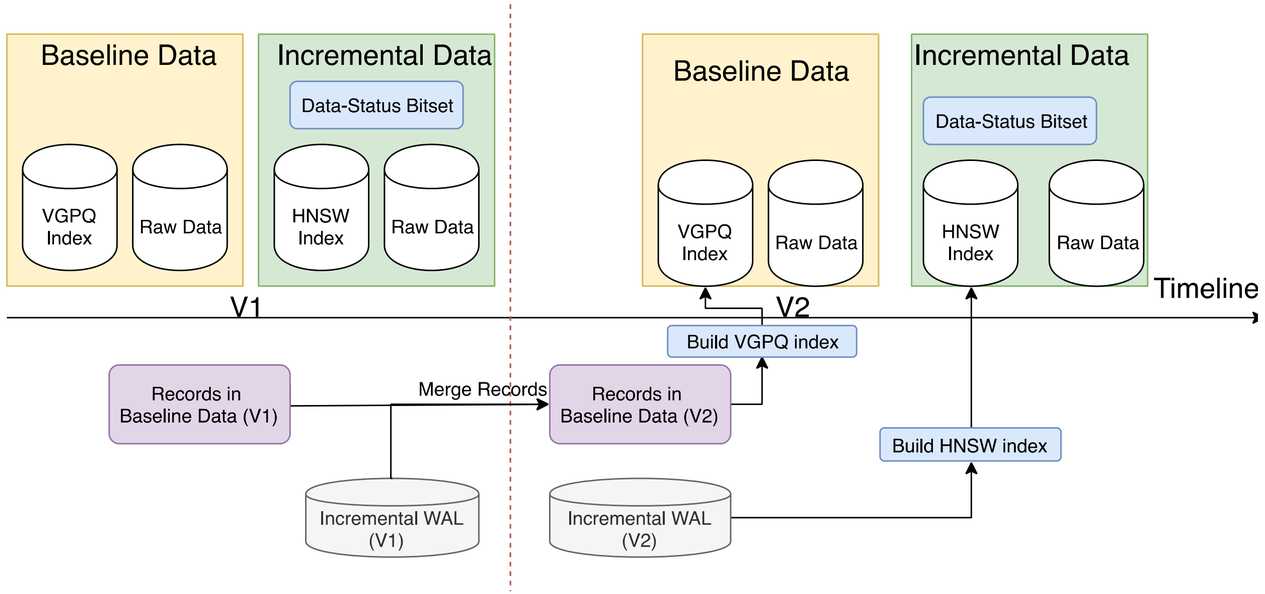
2.1 System design: Lambda framework

- **Query**
  - Query is running on both baseline data and incremental data.
  - VGPQ index is used for baseline data for low memory consumption.
  - HNSW index is used for incremental data for real-time index building.
- **Manipulation**
  - Support INSERT, UPDATE, and DELETE
  - Delete bitset is used to mark deleted rows.
  - Update is treated as delete + insert.
- **Merge**
  - Old baseline + incremental -> new baseline data
  - Data vacuum, remove deleted data.
  - Rebuild VGPQ index





Baseline Data and Incremental Data in ADBV

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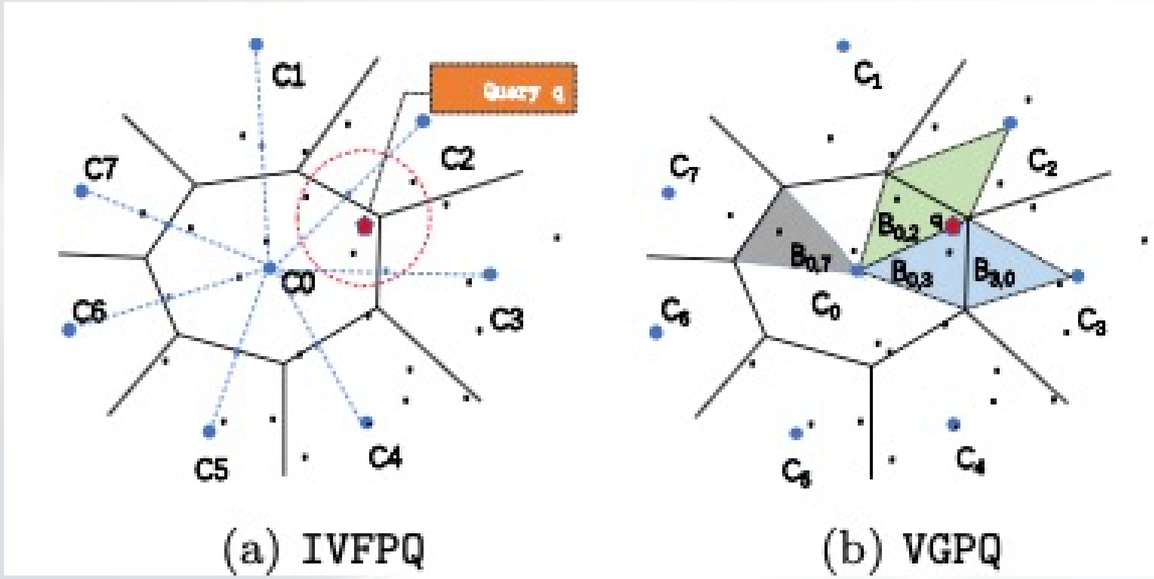
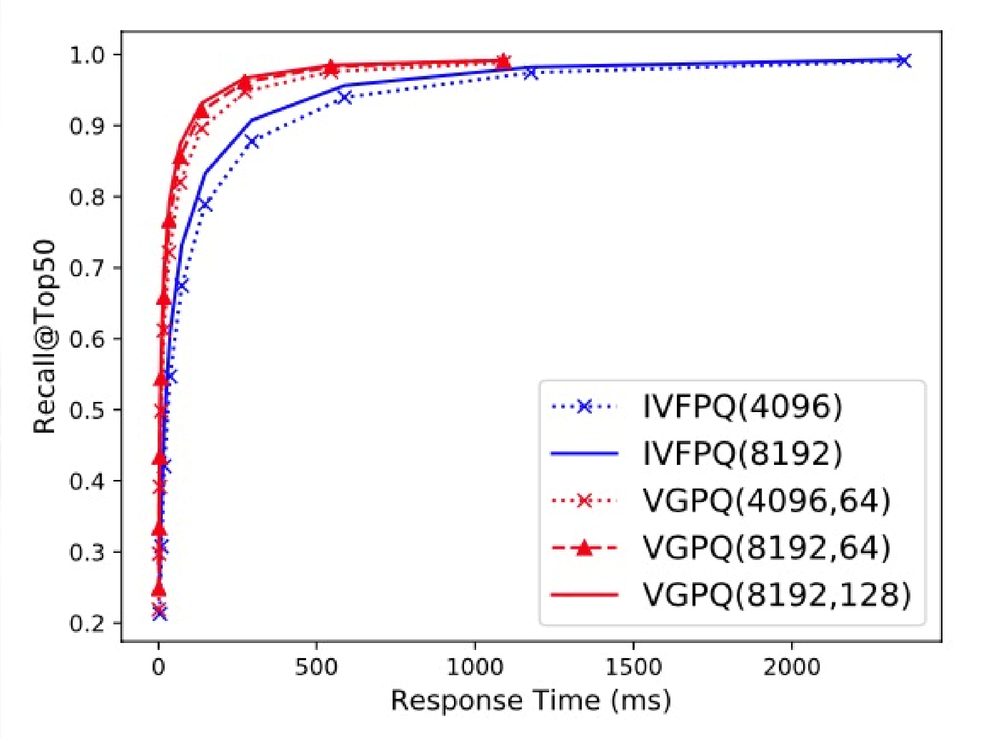
3.1 Optimization: Voronoi graph product quantization(VGPQ)



Motivation of VGPQ



Performance of VGPQ

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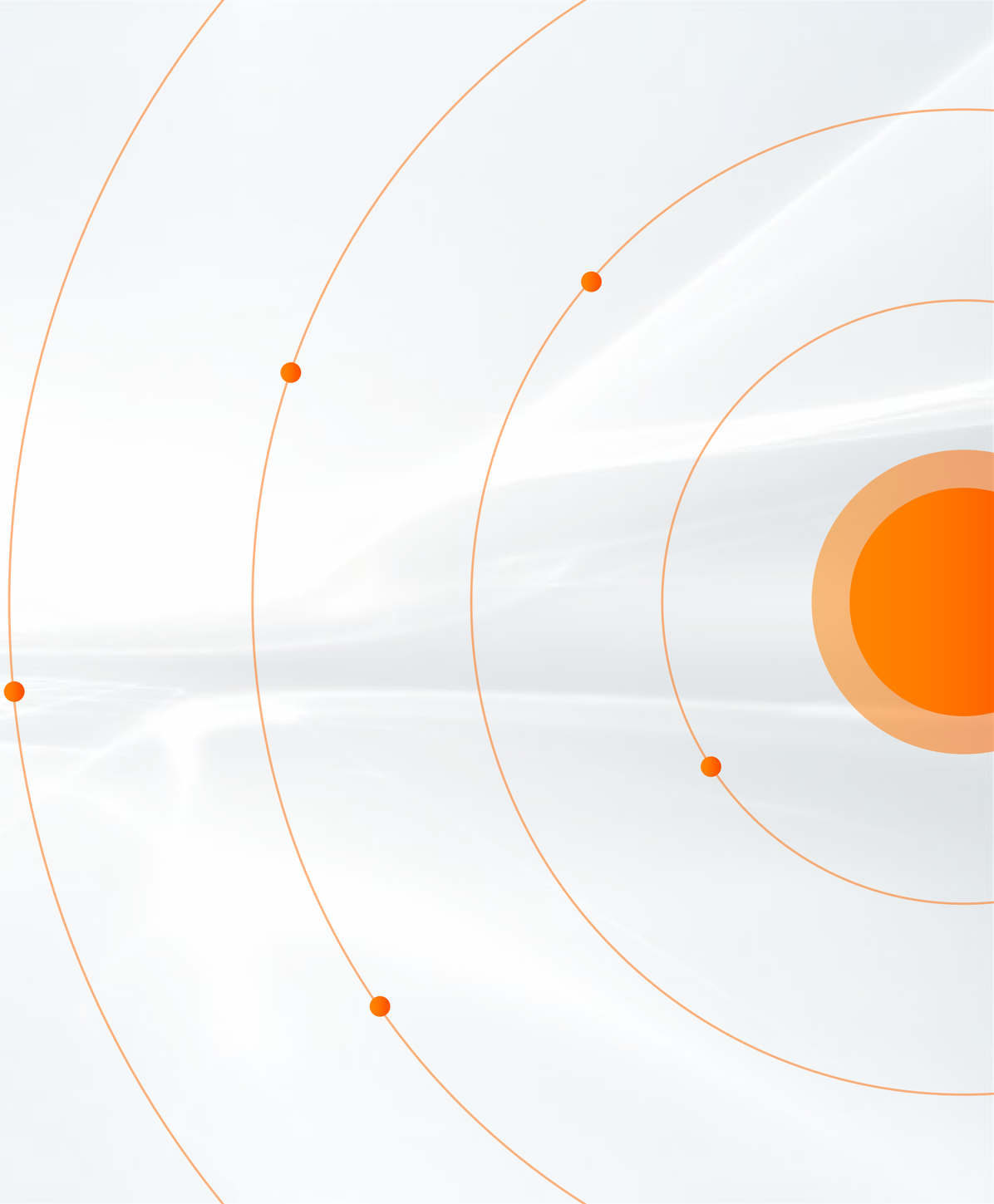

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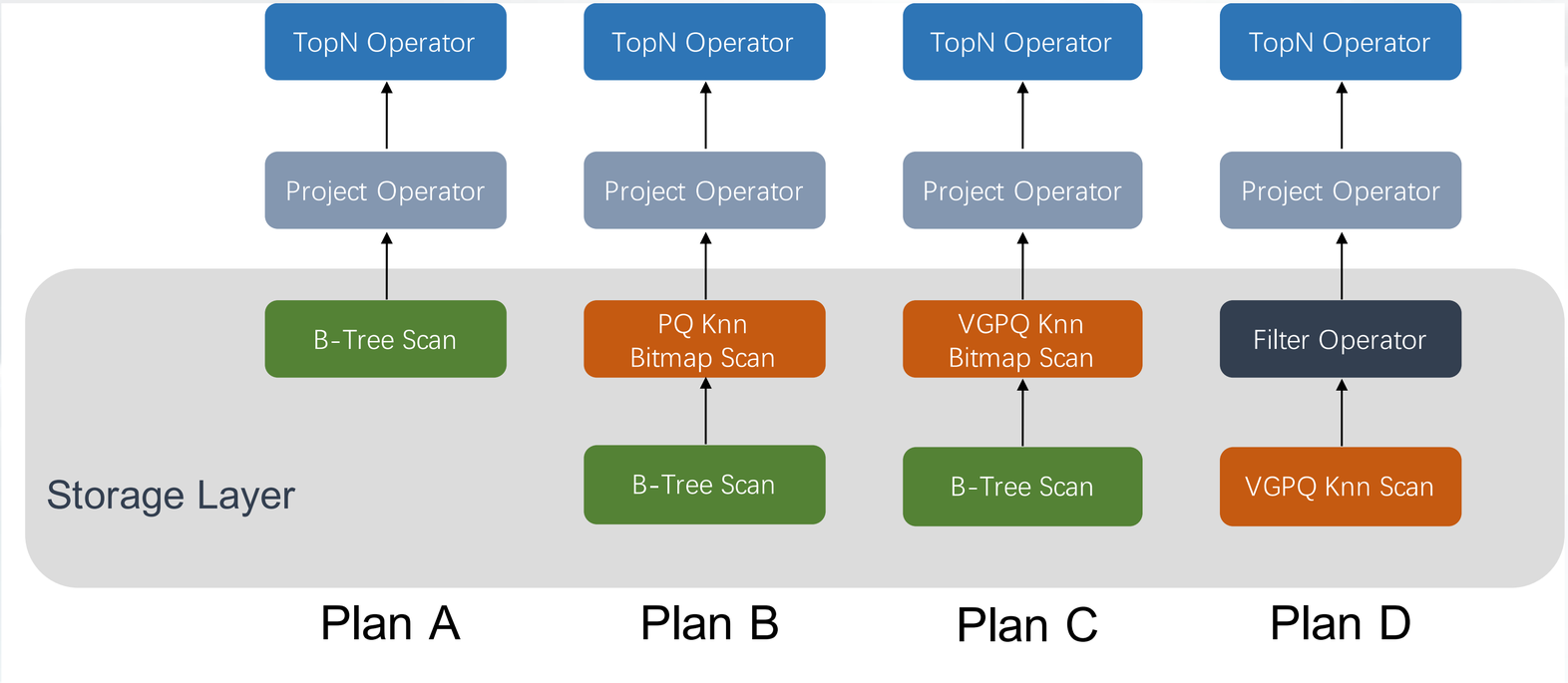
3.2 Optimization: Hybrid query optimization

```
1       SELECT id, DISTANCE(f, FEATURE_EXTRACT('img'))
2                as distance
3       FROM T
4       --structured predicates
5       WHERE T.c >= p1 and T.c <= p2
6       ORDER BY distance,
7       -- return top-k closest tuples
8       LIMIT k;
```

Hybrid Query Optimizer



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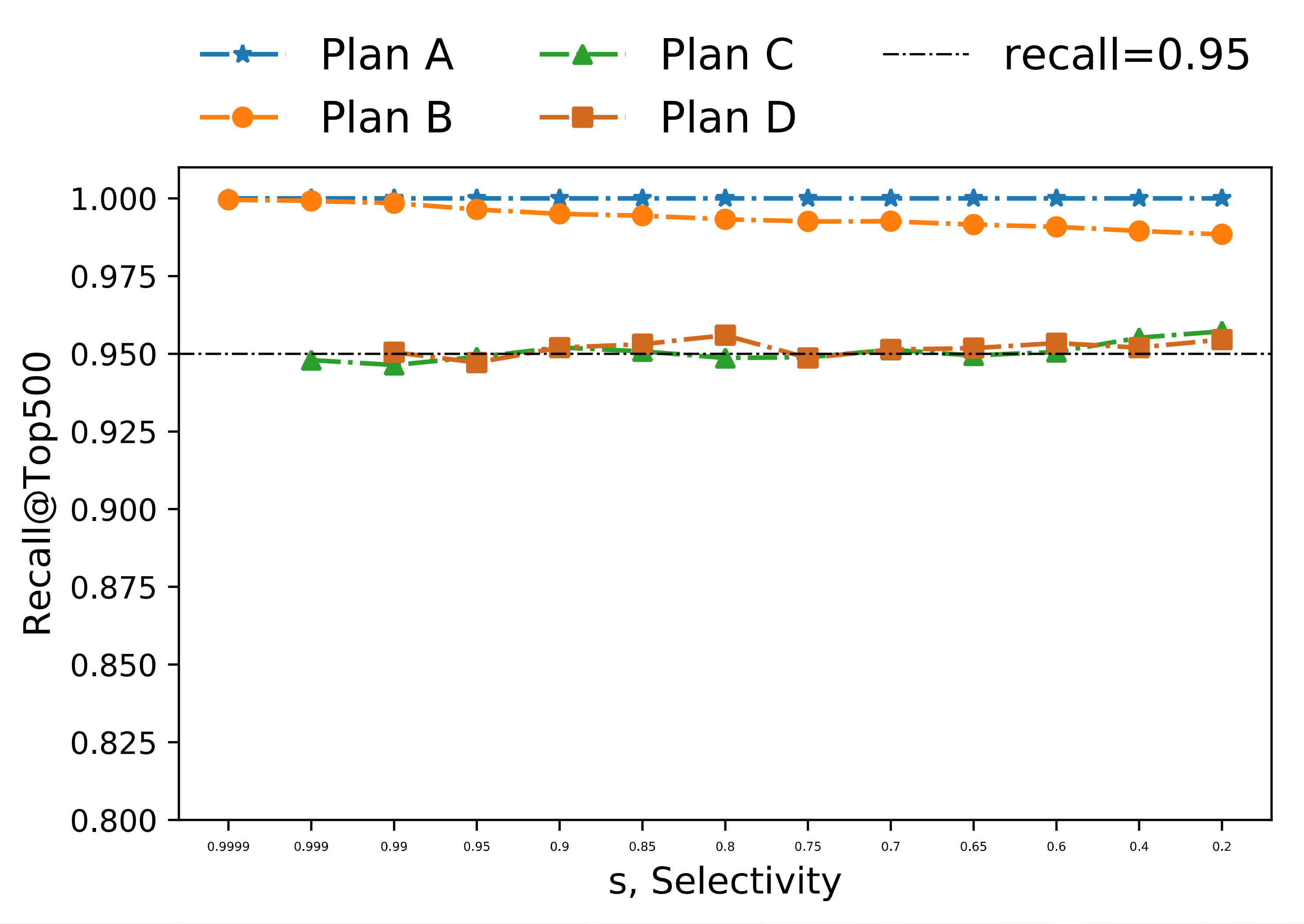
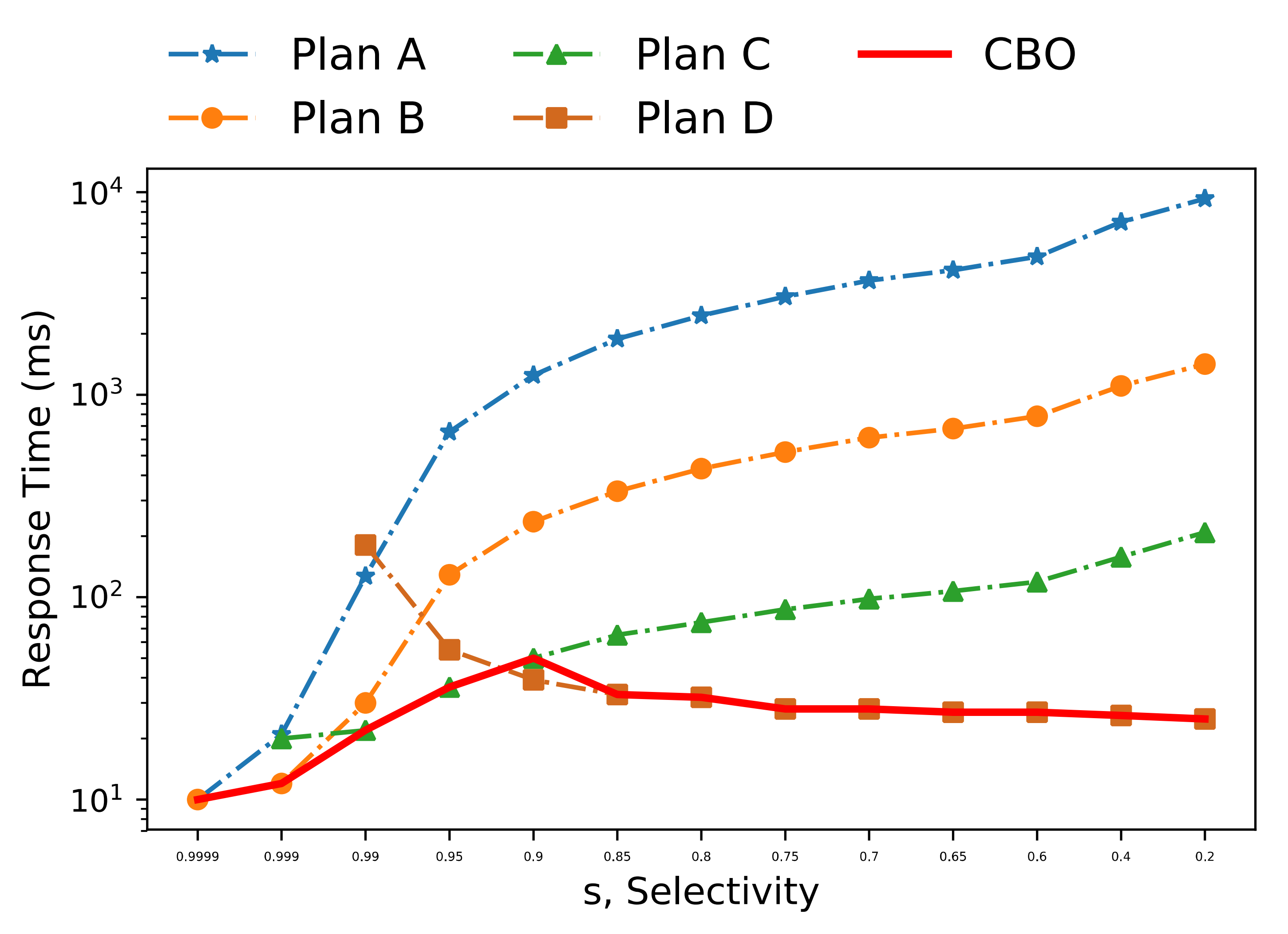
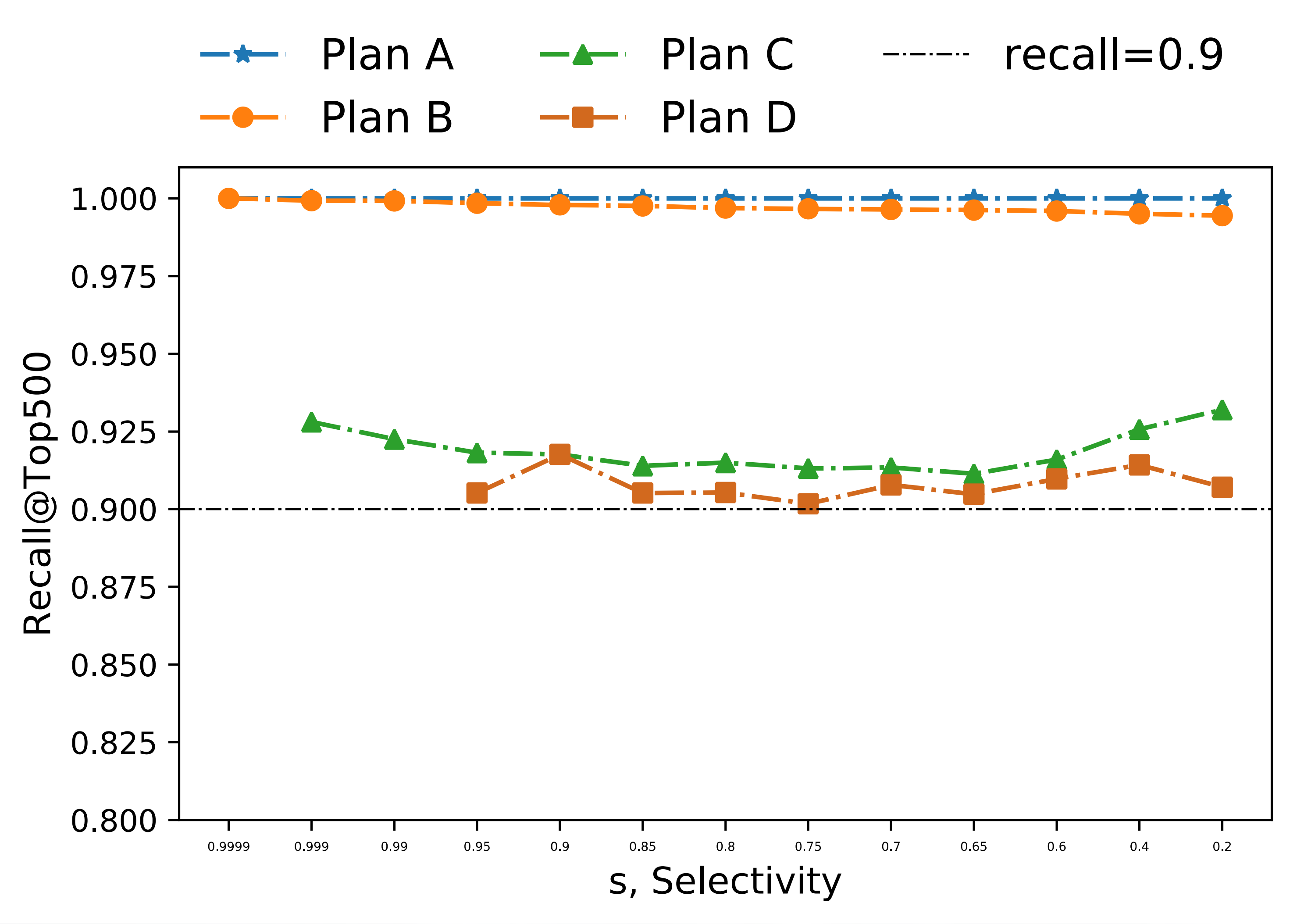
3.2 Optimization: Hybrid query optimization

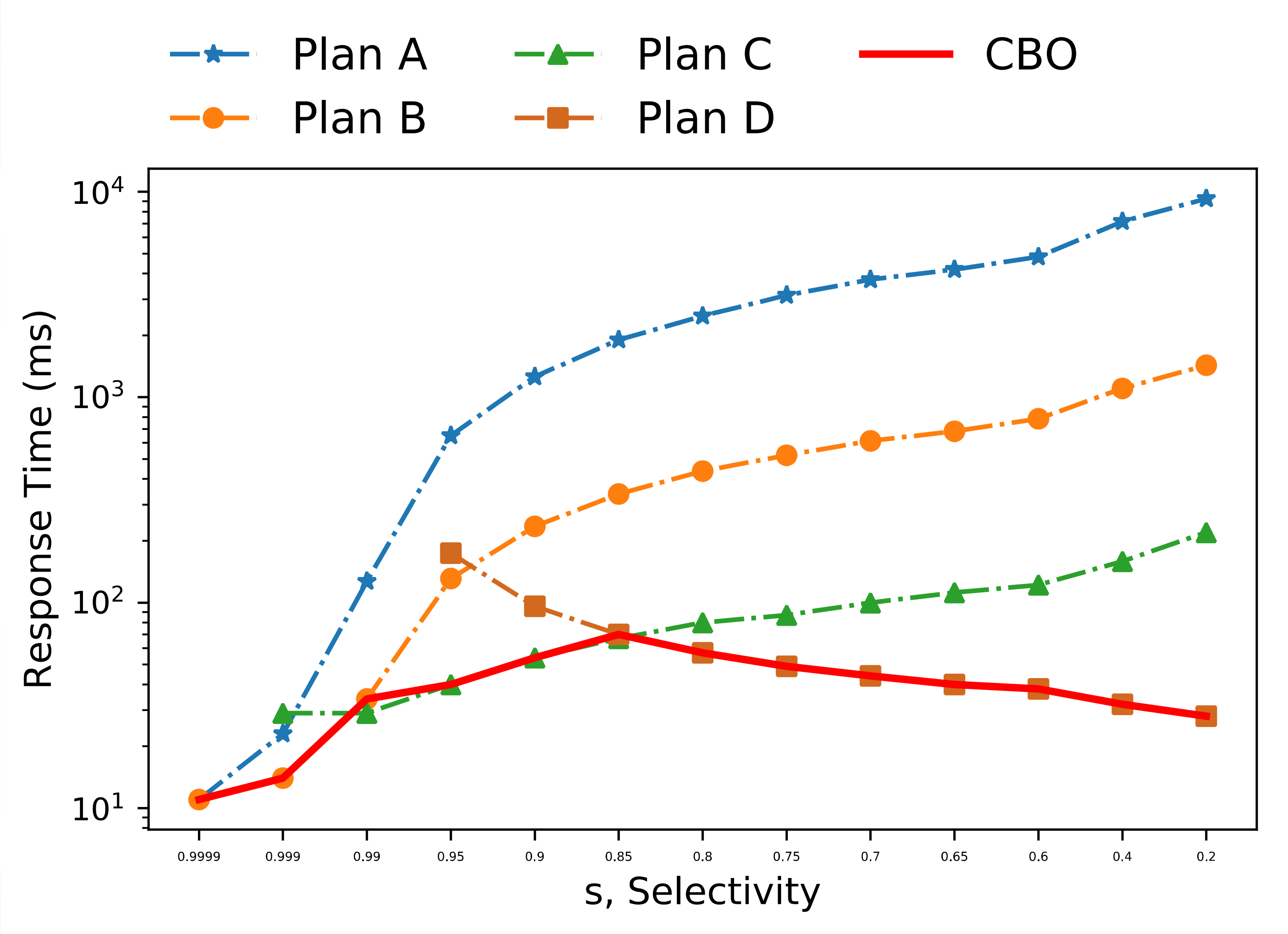
Topk=50 recall=95%



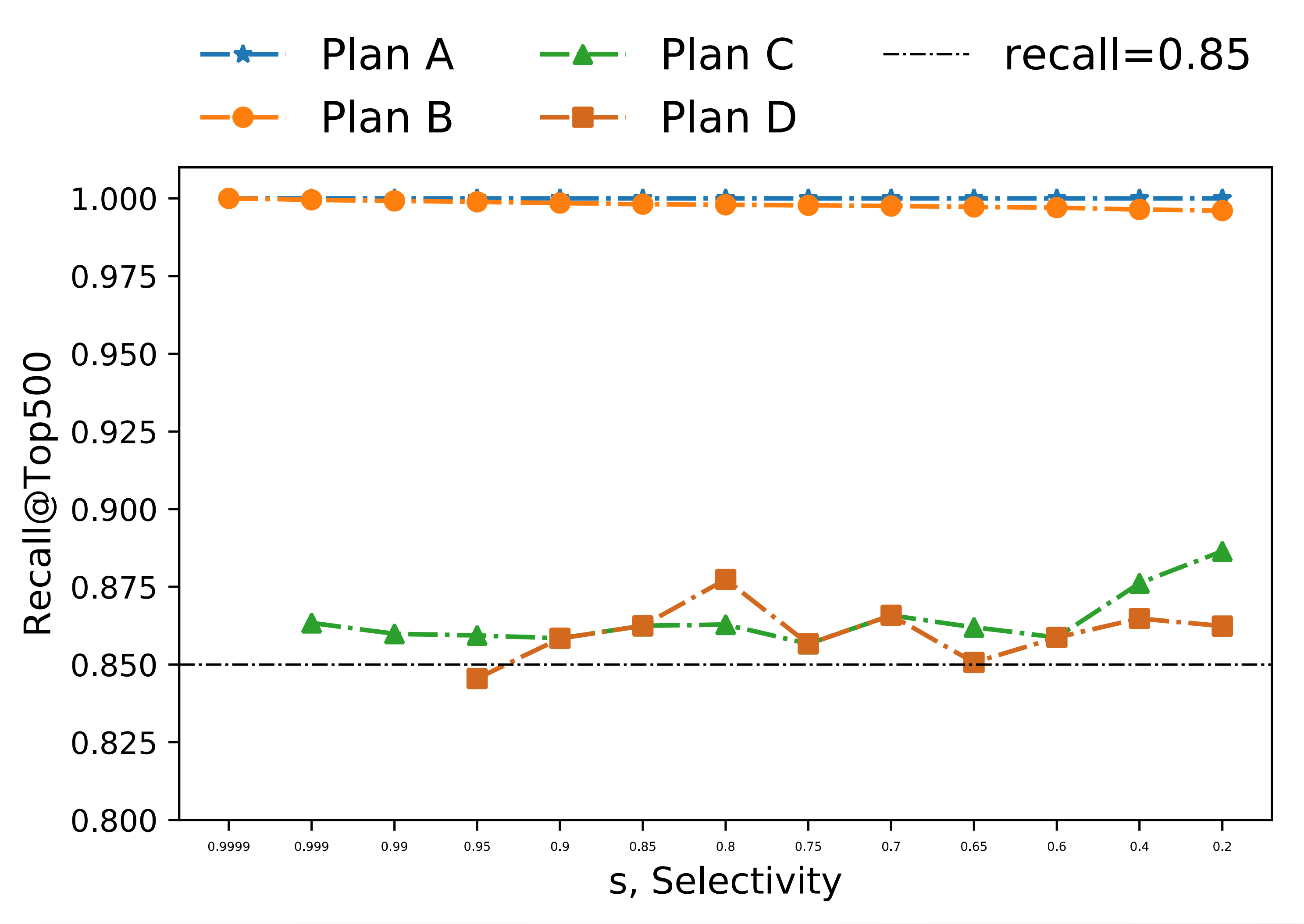


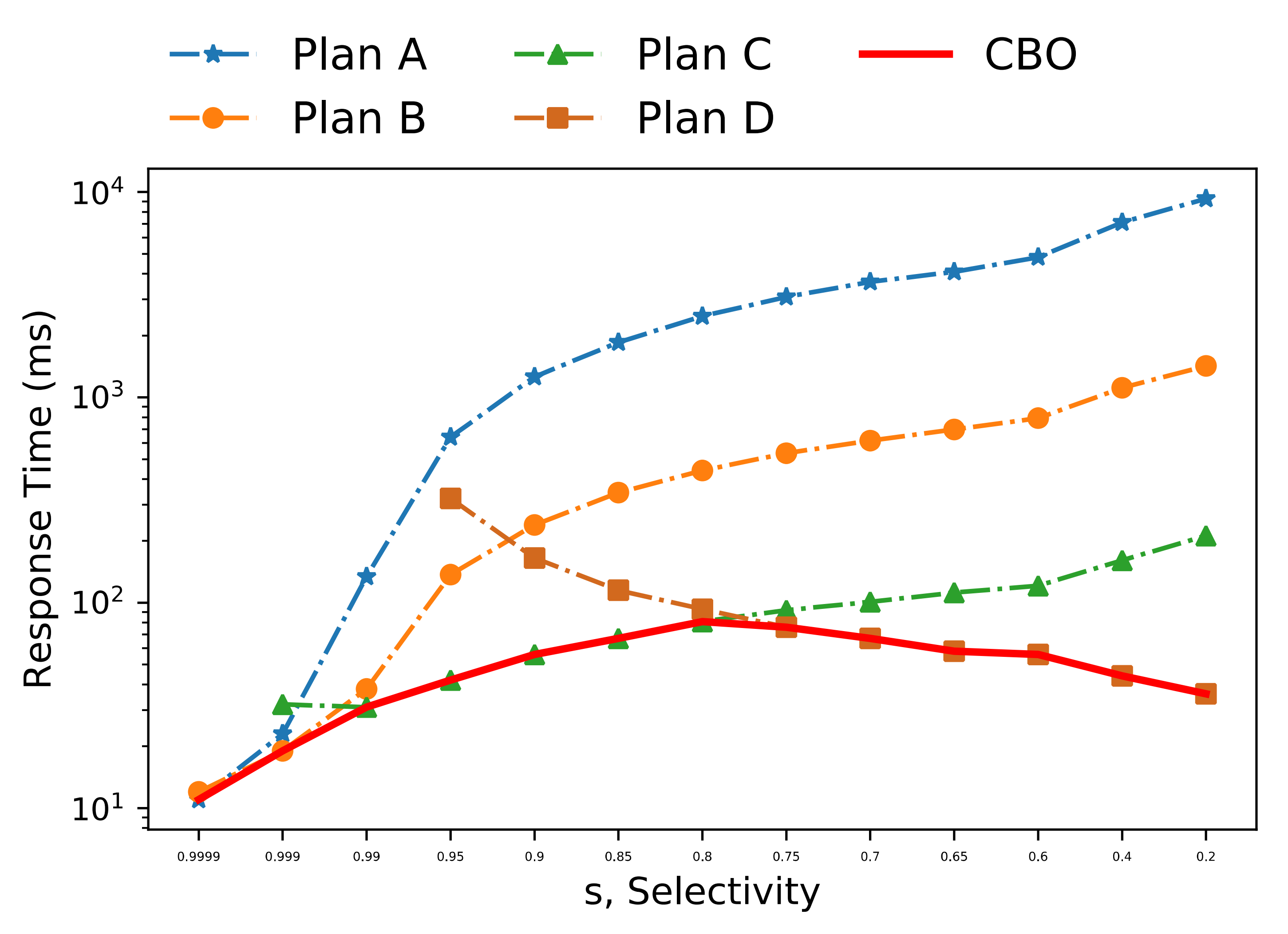
Topk=250 recall=90%





Topk=500 recall=85%





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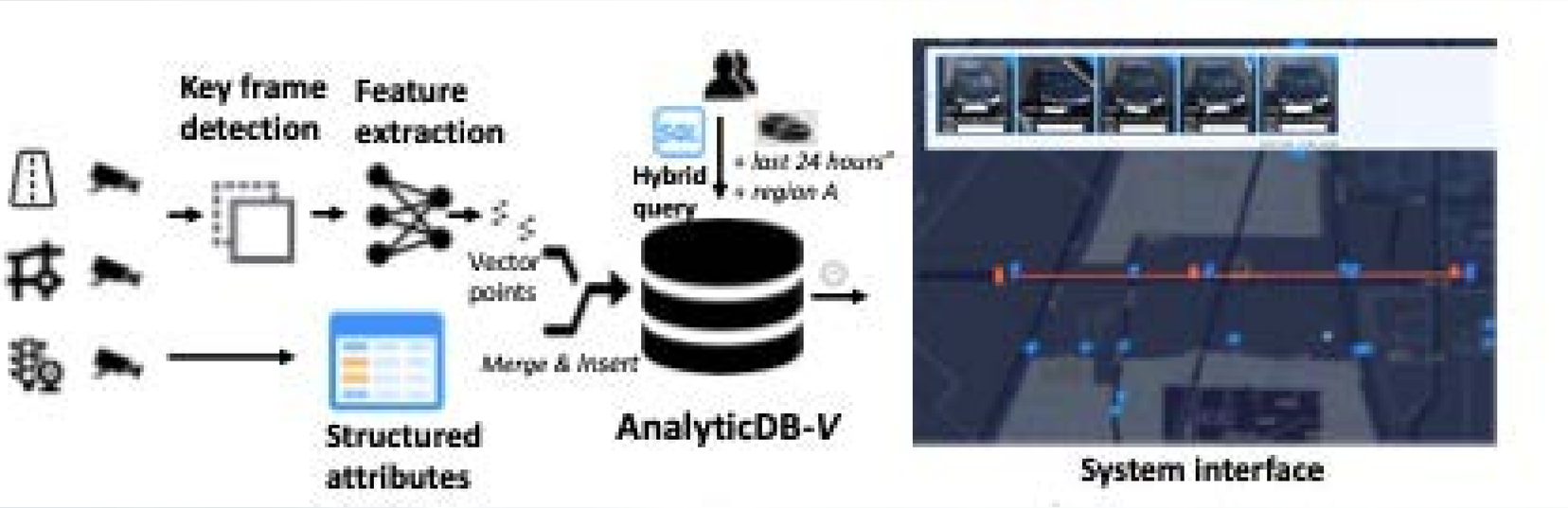
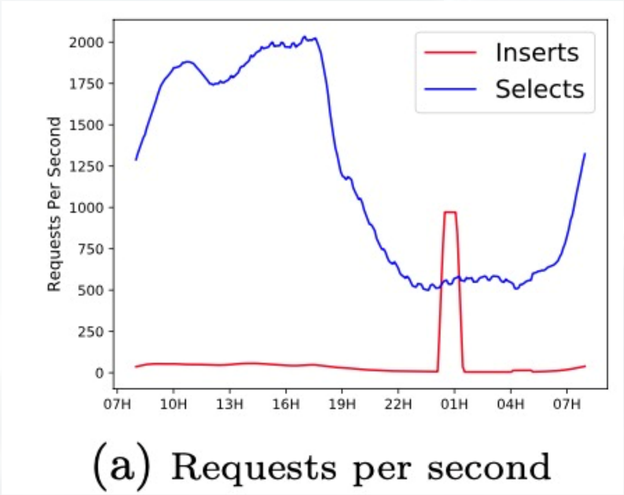
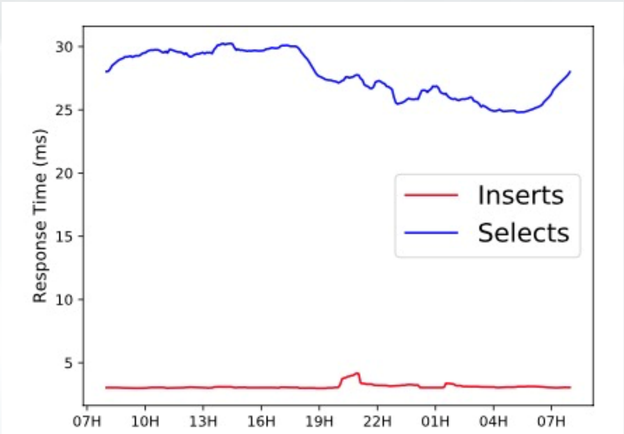
4 Evaluation



Use case study



(a) Requests per second



(b) Average Response Time per operation

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Thank you