Trino at Quora: Speed, Cost, Reliability Challenges and Tips

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Reviewed by Gabriel Fernandes de Oliveira - Software Engineer @ Quora

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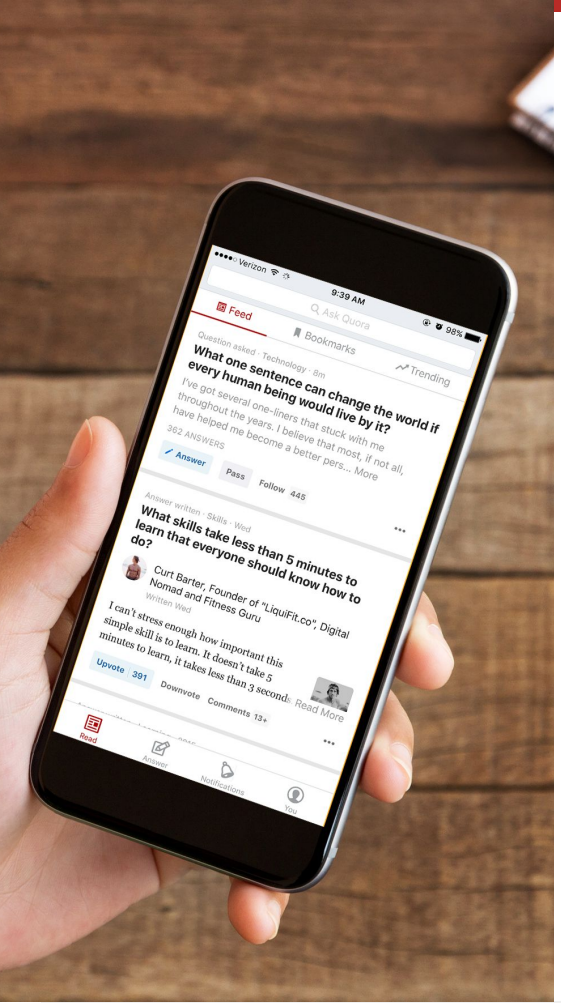

What is Quora?

Our mission is to share and grow the world's knowledge.

Overview

- How is Trino used at Quora?
- Cost Challenges
- Performance Challenges
- Reliability Challenges
- Summary

How is Trino used at Quora?

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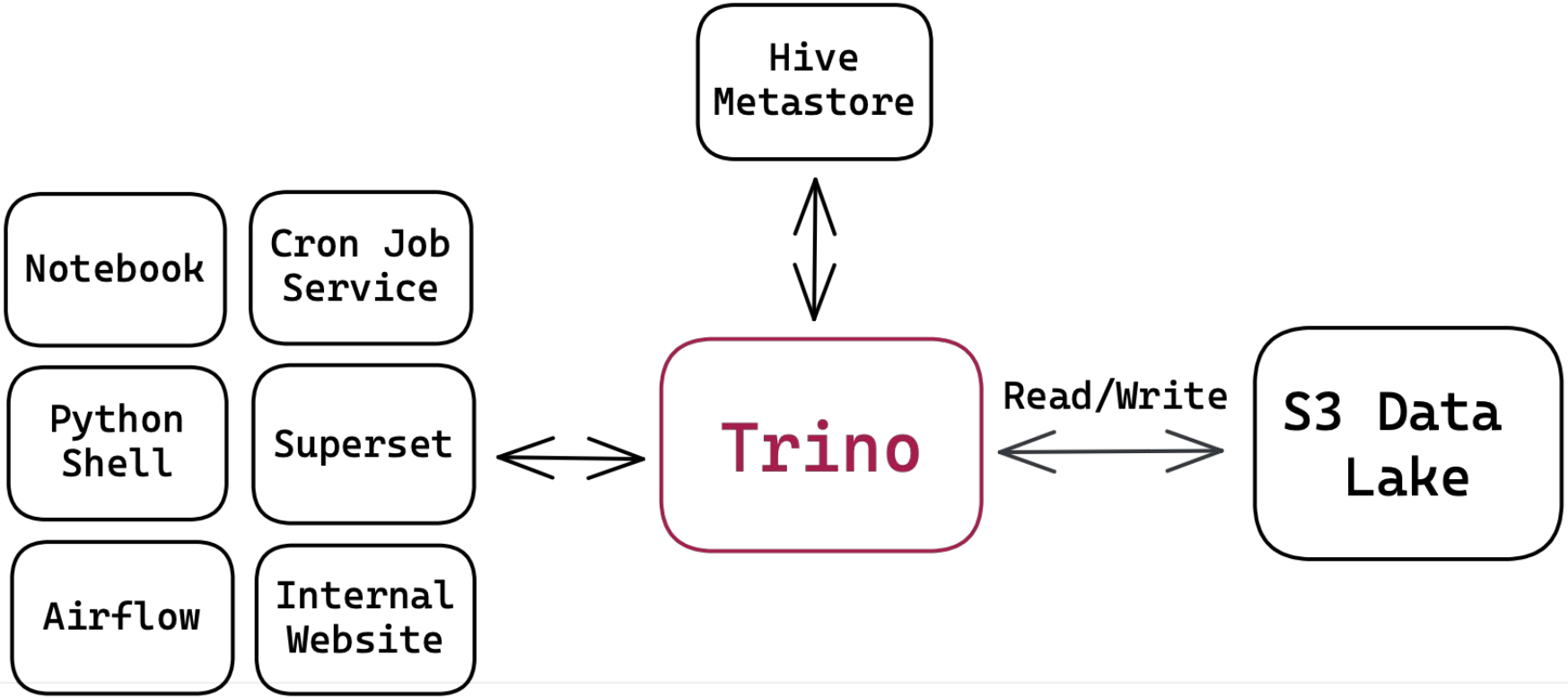


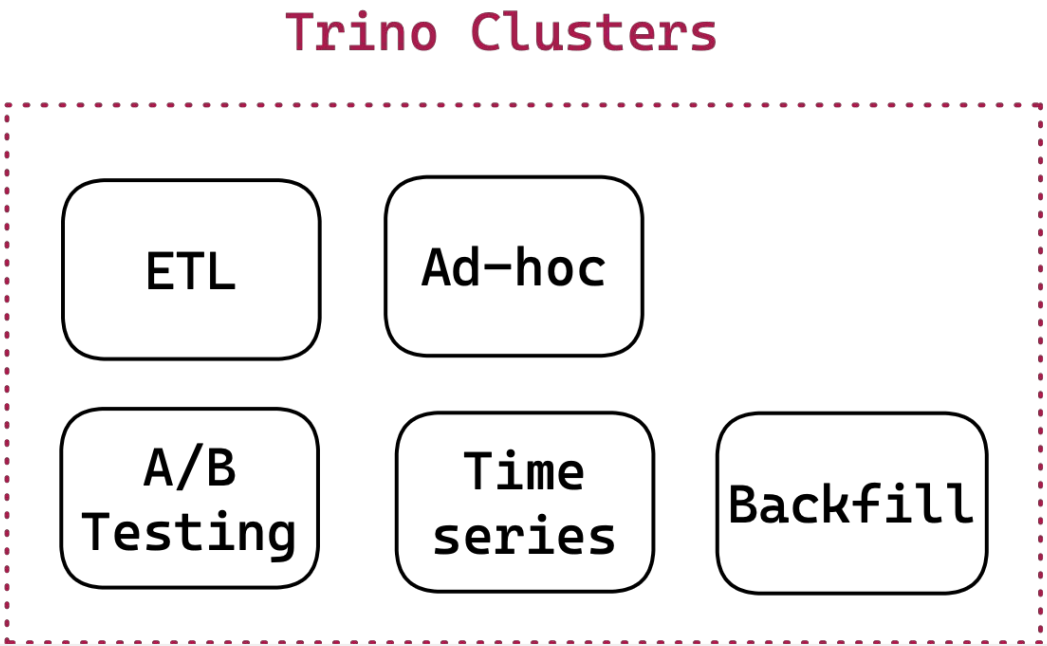
How is Trino used at Quora?

Main use cases of Trino at Quora:

- ETL
- Ad-hoc
- A/B Testing
- Time series
- Backfill

How is Trino used at Quora?

Quora maintains many Trino clusters, one dedicated to each use case.



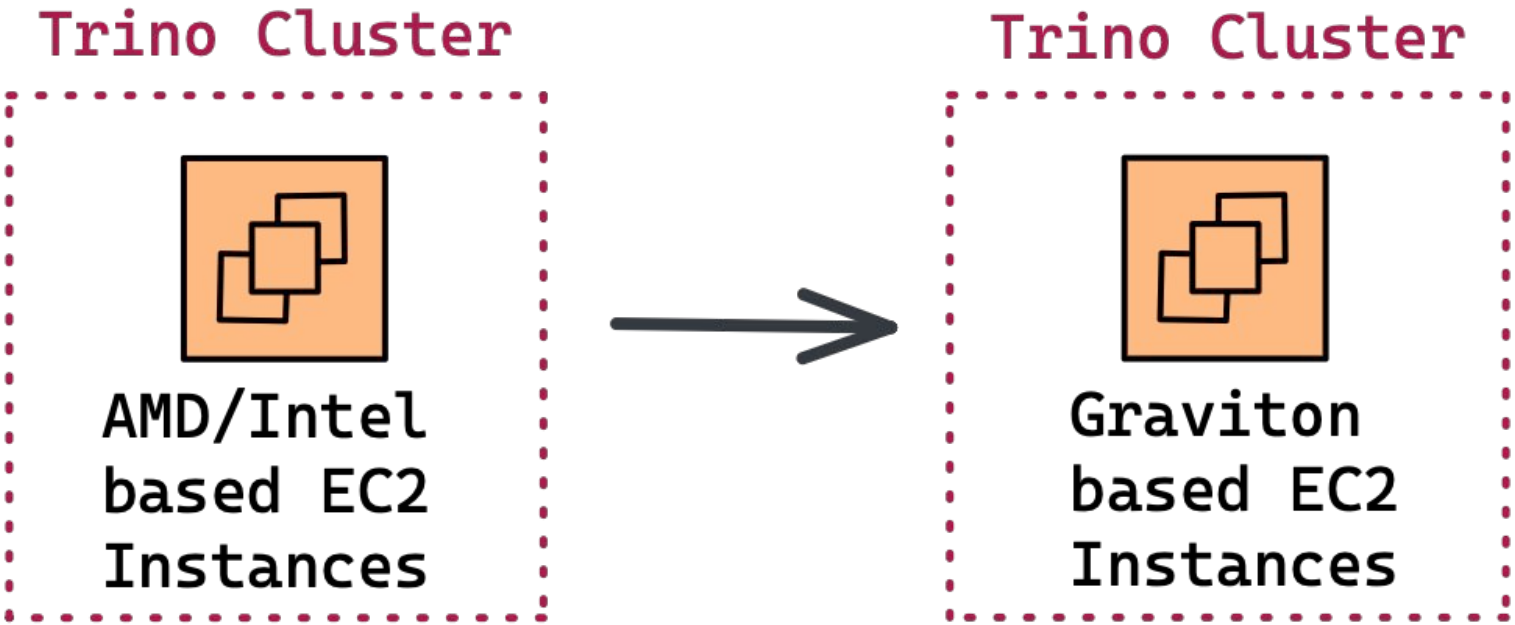
Cost Challenges

Strategies to Reduce Infrastructure Cost

- Use Graviton instances
- Auto-scale
- Optimize ETL Query Efficiency

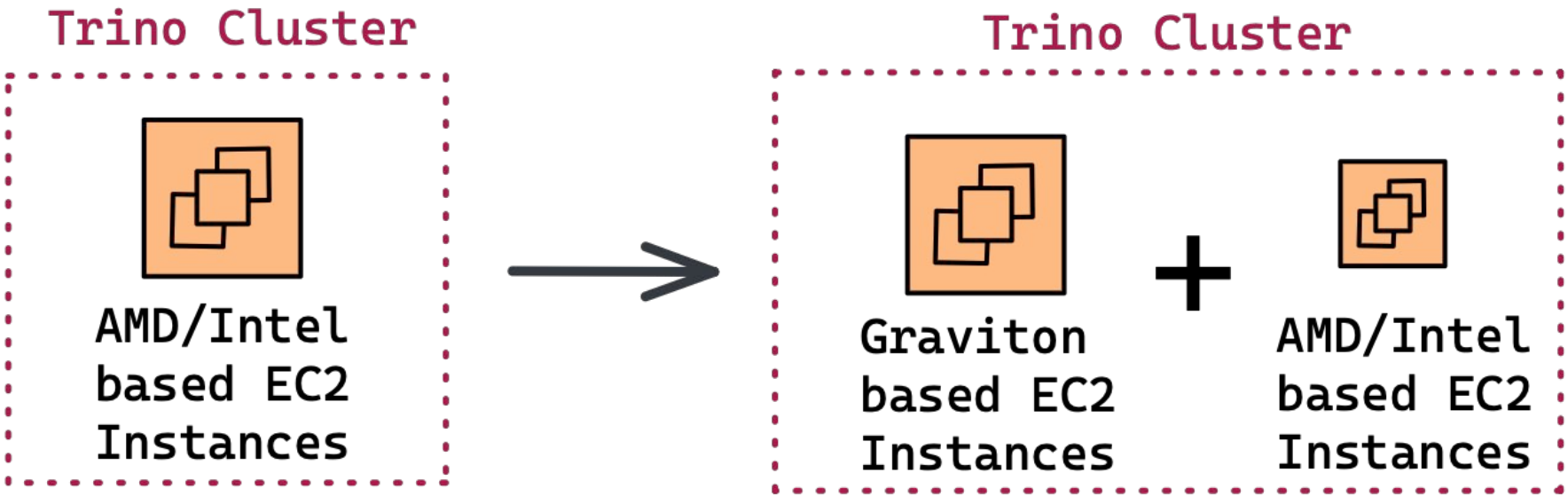
1) Use Graviton instances

In August 2020, we moved all of Trino clusters to Graviton EC2 Instances.

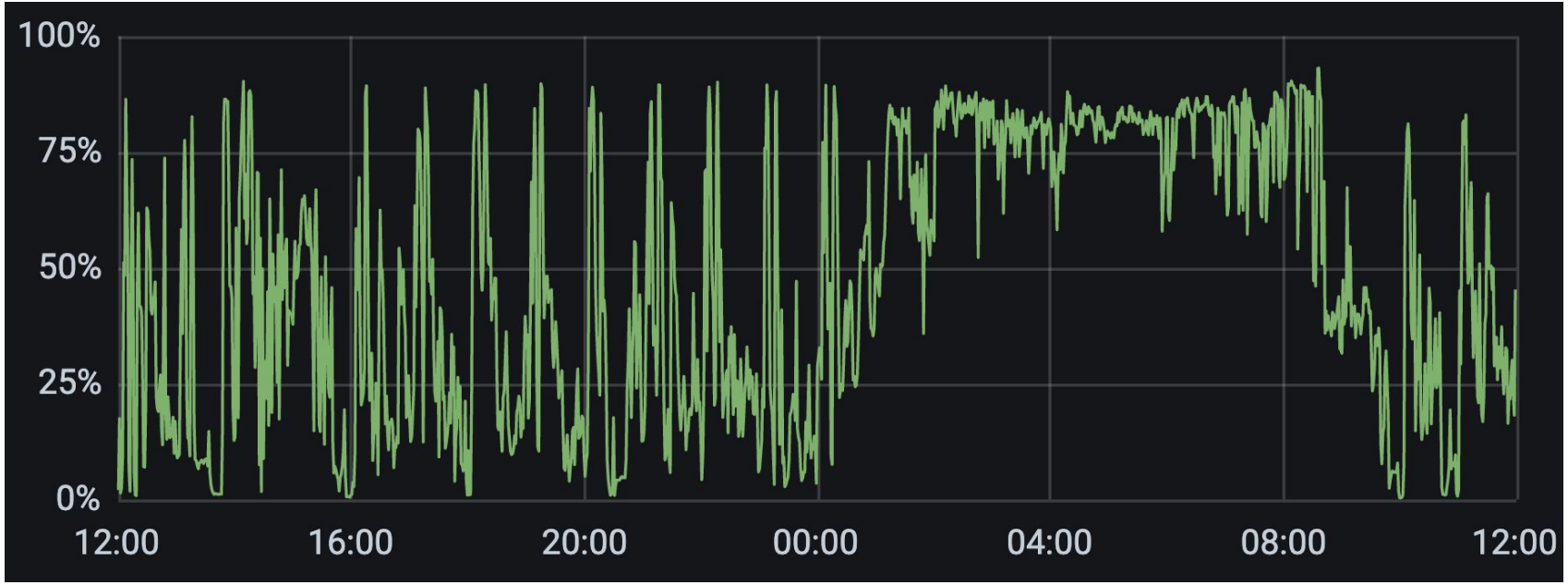


1) Use Graviton instances

Challenge: Instance availability issue.



2) Auto-scale



Average CPU utilization of our ETL cluster ***without*** auto-scaling in a single day.

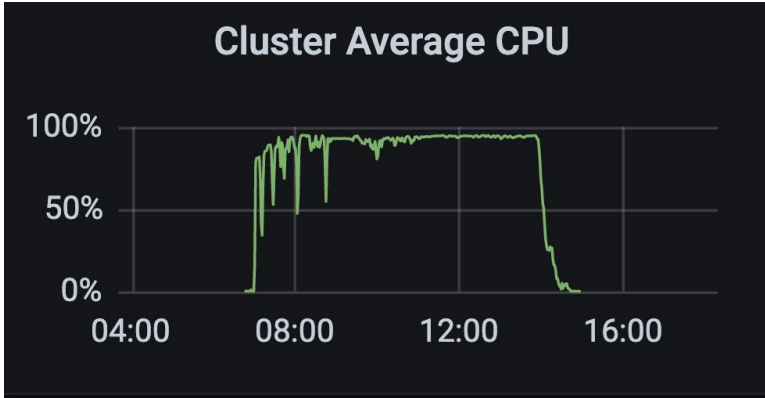
2) Auto-scale

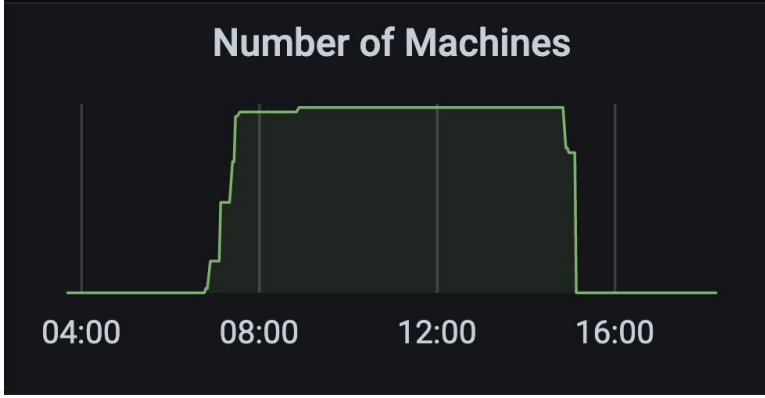
The scaling strategies vary based on the use cases:

Trino Cluster	Auto Scaling Strategy
ETL	Scale based on CPU utilization.
Ad-hoc	Scale up during the day; Scale down during the night and weekends.
Backfill	Automatically scale up/down when users submit a backfill job.

2) Auto-scale

Trino Cluster	Auto Scaling Strategy
A/B Testing	Problem: ● The workload is very heavy. ● Takes a couple of hours per day. Solution: ● Only start the cluster after dependent data is ready; ● Immediately shut down the cluster after queries are finished.





3) Optimize ETL Query Efficiency

Query Optimization: Apply the "**WHERE**" clause to the partition keys.

Table A is a Hive table **partitioned by dt column*
1658448000000 is epoch in milliseconds (July 22, 2022 12:00:00 AM)
1658491200000 is epoch in milliseconds (July 22, 2022 12:00:00 PM)

Suboptimal

```
SELECT columnA FROM A
WHERE
    A.time > 1658448000000
    AND A.time < 1658491200000
```

Better

```
SELECT columnA FROM A
WHERE
    A.dt = DATE'2022-07-22'
    AND A.time > 1658448000000
    AND A.time < 1658491200000
```

3) Optimize ETL Query Efficiency

- Build a tool to automatically detect ETL queries that scan too many partition keys.
- Contact query owners.

3) Optimize ETL Query Efficiency

Use the tool to find corner cases that Predicate Pushdown couldn't handle in the *Hive Connector.*

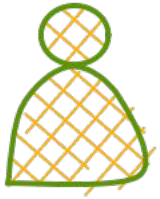
```
WHERE
    (A.dt = DATE'2022-07-17' AND A.time ≥ B.time - 604800000000)
      OR
    (A.dt = DATE'2022-07-18' AND A.time < 1658188800000000)
      OR
    A.dt = DATE'2022-07-23'
```

Table A is a Hive table **partitioned by dt column*

```
WHERE
    A.dt IN (DATE'2022-07-17', DATE'2022-07-18', DATE'2022-07-23')
        AND
    (
        (A.dt = DATE'2022-07-17' AND A.time ≥ B.time - 604800000000)
          OR
        (A.dt = DATE'2022-07-18' AND A.time < 1658188800000000)
          OR
        A.dt = DATE'2022-07-23'
    )
```

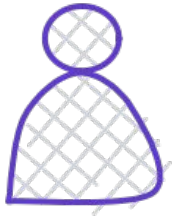
Performance Challenges

Performance Challenges



User

is Trino slow today? This is quite a heavy query but it usually takes around 15min, it's taking almost an hour now: query



User

is Trino slow for other folks today? i have a query running for close to 2 hours now, didn't expect it to take this long (but maybe it's an issue specific to my query)

+1 1 😢 1

Identifying and Preventing Slow Workers

Symptom:

Execution progress skewness

The elapsed time for task 2.16 was 40 minutes, while most tasks took 3 minutes; Bytes/s for task 2.16 was 17.1M while most tasks had a higher Bytes/s.

Tasks

Show ▾ Auto-Refresh: On

ID ▲	Host	State	⏸	▶	🔖	✓	Rows	Rows/s	Bytes	Bytes/s	Elapsed	CPU Time	Buffered
2.0	[redacted]	FINISHED	0	0	0	2585	6.18B	3.64M	40.8G	24.6M	28.27m	1.70h	0
2.1	[redacted]	FINISHED	0	0	0	6051	9.53B	61.3M	62.9G	414M	2.59m	1.09h	0
2.2	[redacted]	FINISHED	0	0	0	5675	9.02B	58.3M	59.6G	394M	2.58m	1.13h	0
2.3	[redacted]	FINISHED	0	0	0	2712	6.08B	5.12M	40.2G	34.7M	19.79m	1.57h	0
2.4	[redacted]	FINISHED	0	0	0	5630	8.74B	56.5M	57.6G	381M	2.58m	1.14h	0
2.5	[redacted]	FINISHED	0	0	0	5555	8.64B	55.8M	57.0G	377M	2.58m	1.13h	0
2.6	[redacted]	FINISHED	0	0	0	2345	5.44B	3.97M	35.9G	26.8M	22.86m	1.56h	0
2.7	[redacted]	FINISHED	0	0	0	5688	8.93B	57.4M	58.9G	388M	2.59m	1.15h	0
2.8	[redacted]	FINISHED	0	0	0	5775	9.16B	59.0M	60.5G	399M	2.59m	1.11h	0
2.9	[redacted]	FINISHED	0	0	0	5445	8.71B	56.5M	57.5G	382M	2.57m	1.15h	0
2.10	[redacted]	FINISHED	0	0	0	2102	5.26B	3.31M	34.6G	22.3M	26.48m	1.78h	0
2.11	[redacted]	FINISHED	0	0	0	1952	5.03B	4.31M	33.2G	29.2M	19.42m	1.48h	0
2.12	[redacted]	FINISHED	0	0	0	5575	8.81B	57.2M	58.1G	386M	2.57m	1.15h	0
2.13	[redacted]	FINISHED	0	0	0	5775	9.17B	59.5M	60.5G	402M	2.57m	1.13h	0
2.14	[redacted]	FINISHED	0	0	0	2527	6.17B	4.04M	40.6G	27.3M	25.44m	1.[illegible]3h	0
2.15	[redacted]	FINISHED	0	0	0	5961	9.47B	61.4M	62.4[illegible]	415M	2.57m	1.11h	0
2.16	[redacted]	FINISHED	0	0	0	2537	6.12B	2.54M	40.3G	17.1M	40.22m	2.33h	0
2.17	[redacted]	FINISHED	0	0	0	5715	8.93B	57.9M	59.0G	392M	2.57m	1.14h	0
2.18	[redacted]	FINISHED	0	0	0	5484	8.65B	56.1M	57.1G	379M	2.57m	1.16h	0
2.19	[redacted]	FINISHED	0	0	0	5801	9.04B	58.6M	59.7G	396M	2.57m	1.14h	0
2.20	[redacted]	FINISHED	0	0	0	5907	9.57B	62.1M	63.2G	420M	2.57m	1.09h	0
2.21	[redacted]	FINISHED	0	0	0	5628	8.92B	57.9M	58.9G	391M	2.57m	1.13h	0
2.22	[redacted]	FINISHED	0	0	0	5890	9.30B	60.1M	61.3G	406M	2.58m	1.11h	0

Identifying and Preventing Slow Workers

Other symptoms of slow workers:

- Below-average CPU utilization.
- Below-average Load.
- …

Identifying and Preventing Slow Workers

If a Trino worker runs for a long time, it is more likely to become a “slow worker”.

Solution:

- Gracefully restart worker nodes that have been running for more than 24 hours.
- Build a detector that alerts when a worker node with a low CPU or load outlier is found.

Reliability Challenges

Be cautious when overwriting the Trino configurations

A recent example of cluster being unhealthy due to overwriting one of the configurations:

?

- Runnable drivers and worker parallelism drop to zero
- Long GC pauses on the coordinator
- Connection errors between workers and coordinators
- We tried killing some queries in the hope of freeing up some resources, but the cluster cannot recover from the slowness quickly

Be cautious when overwriting the Trino configurations

- After digging into the heap dump of the coordinator, we found **query history** used a lot of memory.
- Reducing **`query.min-expire-age`** solves the issue.

`query.min-expire-age`

- **Type:** duration
- **Default value:** `15m`

The minimal age of a query in the history before it is expired. An expired query is removed from the query history buffer and no longer available in the Web UI.

Monitoring

We built different components to monitor the health of our Trino clusters:

- Collect information on every query sent to Trino through EventListener.
- Monitor Trino query failure rate.
- Periodically send health check queries to Trino clusters.
- Track workers' uptime, alerting if any worker runs for over 36 hours.
- Track Trino's JMX metrics.

Summary

Summary

Cost Challenges

- Using Graviton for better cost-efficiency
- Apply auto-scaling rules
- Optimize ETL query efficiency

Performance Challenges

- Gracefully restart all Trino workers in the “rolling” fashion to prevent slow workers

Reliability Challenges

- Avoid misconfiguration
- Monitoring

Thank you!

Questions?

Quora