

ClickHouse: Building For Fast

Big Data London
September 22nd, 2022



Ryadh Dahimene



Dale McDiarmid



The 1971 Italian
Grand Prix was won
by 1% of 1 second.

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JCDecaux

Information

Information

WHSmith

NEED EXPRESS

YARD REMEDIES
Natural Organic Health & Beauty



From: https://en.wikipedia.org/wiki/Peter_Gethin

Comprehend the Millisecond Scale

Some examples

- **1.000692286 ms** – time taken for light to travel 300 km in a vacuum
- **2.27 ms** – cycle time for pitch A440, the most commonly used pitch for tuning musical instruments
- **4 ms** – typical average seek time for a 10,000 rpm hard disk
- **16 ms** – frame refresh rate of an LCD at 60 Hz
- **50 ms** – cycle time for the lowest audible tone, 20 Hz

- **860 ms** – average human resting heart cycle time



```
SELECT formatReadableQuantity(count())  
FROM github_events
```

Query id: a3a99921-3f4e-4c7b-a33a-2fcbe2bc1053

```
formatReadableQuantity(count())  
5.06 billion
```

1 row in set. Elapsed: 0.002 sec.

```
SELECT  
    year,  
    count() AS stars  
FROM github_events  
WHERE (event_type = 'WatchEvent') AND (repo_name = 'ClickHouse/ClickHouse')  
GROUP BY toYear(created_at) AS year  
ORDER BY stars DESC
```



```
SELECT
    year,
    count() AS stars
FROM github_events
WHERE (event_type = 'WatchEvent') AND (repo_name = 'ClickHouse/ClickHouse')
GROUP BY toYear(created_at) AS year
ORDER BY stars DESC
```

year	stars
2021	7781
2020	5144
2022	4390
2019	949

4 rows in set. Elapsed: 0.014 sec. Processed 114.10 thousand rows, 3.32 MB (7.87 million rows/s., 228.93 MB/s.)

~60

Try it yourself: tinyurl.com/bdl-demo



What is ClickHouse?

Your (soon-to-be) favorite database!

Open source **column-oriented** **distributed** **OLAP** database

Developed since
2009, OSS 2016
25,000+ GitHub stars
1k+ contributors
300+ releases

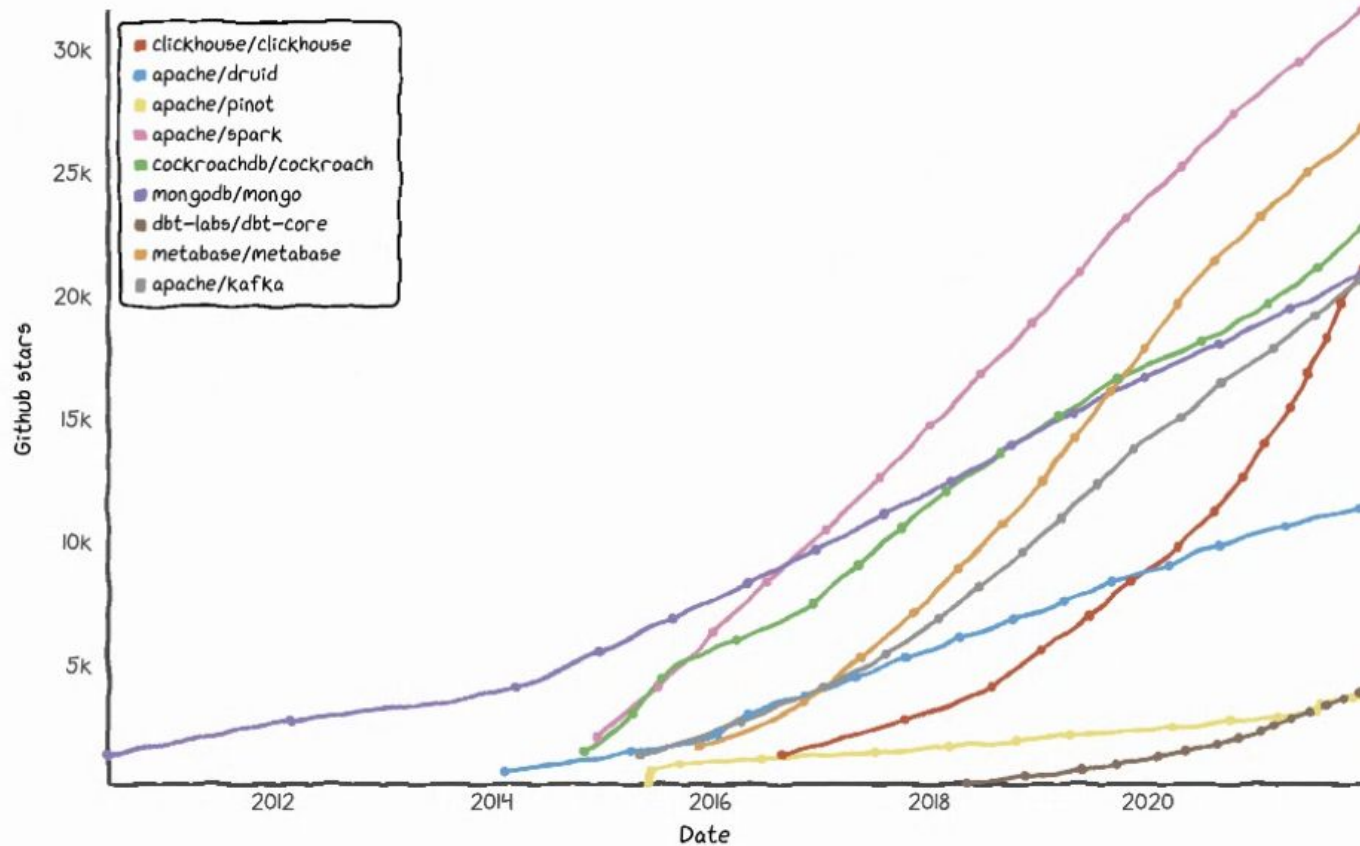
Best for aggregations
Files per column
Sorting and indexing
Background merges

Replication
Sharding
Multi-master
Cross-region

Analytics use cases
Aggregations
Visualization
Mostly immutable data



Star history



Key Features

Some of the cool things ClickHouse can do

Speaks SQL

Most SQL-compatible UIs, editors, applications, frameworks will just work!

Lots of writes

Millions of writes per second!

Distributed

Replicated and sharded, largest known cluster is 4000 servers.

Highly efficient storage

Lots of encoding and compression options.

Very fast queries

Scan and process even billions of rows per second and uses vectorized query execution.

Cloud is on it's way

We will very soon release ClickHouse Cloud! 🚀



What is Fast ?

And why does it matter?







Aspect 1: Fast Operations

Time to setup ClickHouse



Demo: Fast Ops

ClickHouse Cloud



120s



Aspect 2: Fast Ingestion

Time to load data



Demo: Get Data In

Ingest One Billion Rows





Aspect 3: Fast Queries

Time to extract insights from raw data



Demo: Queries

Understand the Github data

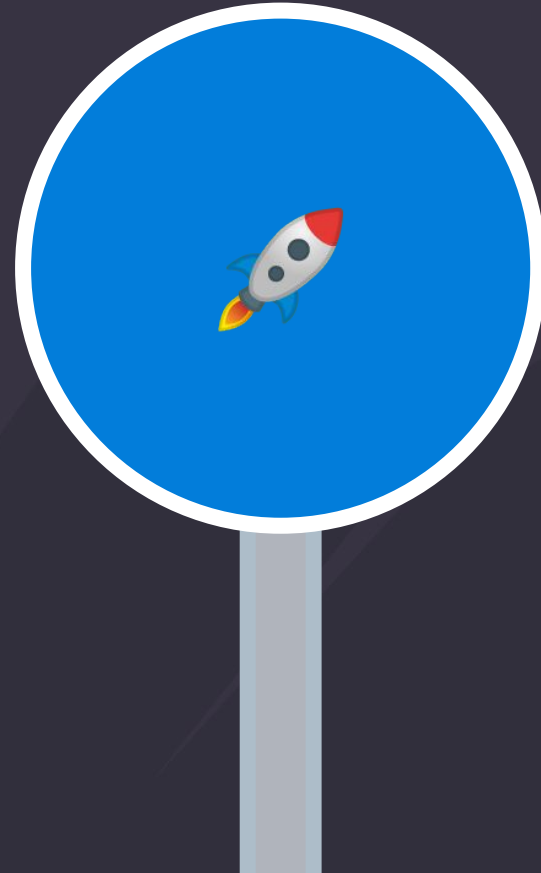


0.5s



Aspect 4: Fast Innovation

A culture of Fast



A Culture of Fast

Some examples

- Monthly releases. Eg. 22.9.xxx
- LTS version every 6 months (March and August)
- Story: **ClickHouse Keeper**

Main tasks

✓ Provide alternative for ZooKeeper

Implementation of a server with ZooKeeper interface inside ClickHouse.

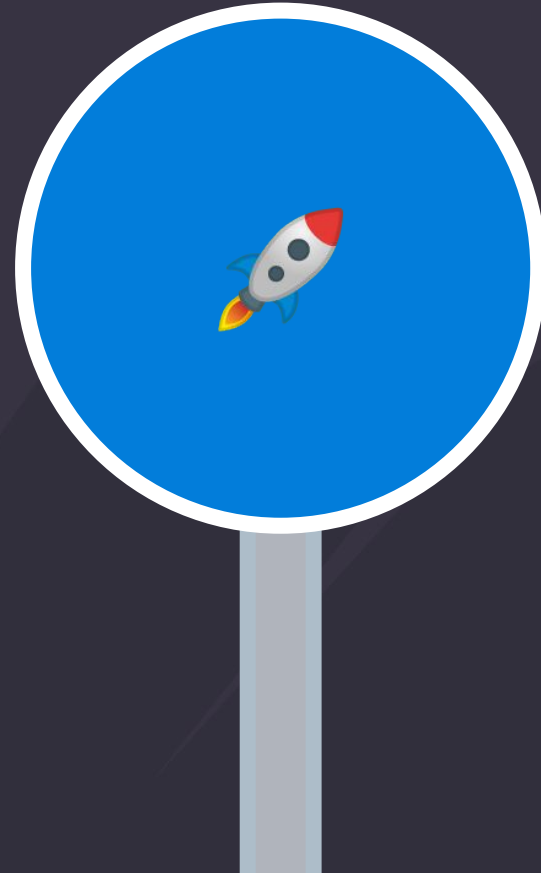
Done, @alesapin

```
#15090 #16877 #19580 #20585 #21425 #21677 #21593 #21690 #22274 #26150 #28981 #31150 #30880 #30678 #30372  
#30170 #29417 #29367 #29268 #29223 #29071 #29030 #28526 #28519 #28360 #28152 #28190 #28197 #28143 #28080  
#27818 #27125 #26874 #25428 #25421 #24533 #24499 #24448 #24412 #24059 #24017 #23077 #23038 #22992  
#22743 #22707 #22470 #22373 #22274 #21677
```



Aspect 5: Benchmarks

How to measure performance



Detailed Comparison

	ClickHouse (c6a.metal, 500gb gp2)	Redshift (4×ra3.16xlarge)	SingleStore (12×S24)	Snowflake (64×3XL)	Snowflake (32×2XL)	Snowflake (128×4XL)	Redshift (serverless)	StarRocks (tuned) (c6a.4xlarge, 500gb gp2)	Si
Load time:	137s (×1.00)	1829s (×13.36)	1043s (×7.62)	2524s (×18.44)	2524s (×18.44)	2524s (×18.44)	1889s (×13.80)	604s (×4.41)	25
Data size:	13.57 GiB (×1.46)	24.52 GiB (×2.63)	17.90 GiB (×1.92)	11.46 GiB (×1.23)	11.46 GiB (×1.23)	11.46 GiB (×1.23)	28.22 GiB (×3.03)	16.52 GiB (×1.77)	11.46
Q0.	0.00s (×1.08)	0.02s (×3.28)	0.04s (×4.92)	0.05s (×5.81)	0.05s (×6.11)	0.06s (×6.99)	0.20s (×20.65)	0.04s (×4.92)	0
Q1.	0.01s (×1.15)	0.03s (×1.88)	0.00s (×0.50)	1.25s (×63.10)	0.32s (×16.70)	1.93s (×96.85)	0.03s (×1.99)	0.02s (×1.50)	0.
Q2.	0.02s (×1.55)	0.04s (×2.31)	0.01s (×1.00)	0.33s (×16.75)	0.28s (×14.25)	0.22s (×11.60)	0.04s (×2.42)	0.10s (×5.50)	1.
Q3.	0.02s (×1.65)	0.06s (×3.44)	0.01s (×1.00)	0.18s (×9.55)	0.17s (×8.80)	0.21s (×10.80)	0.04s (×2.31)	0.12s (×6.50)	0
Q4.	1.56s (×13.23)	0.11s (×1.00)	0.23s (×2.02)	0.27s (×2.31)	0.26s (×2.23)	0.37s (×3.22)	0.30s (×2.63)	0.62s (×5.29)	0
Q5.	0.74s (×4.02)	0.18s (×1.00)	0.25s (×1.40)	0.30s (×1.66)	0.33s (×1.80)	0.33s (×1.81)	0.33s (×1.85)	0.93s (×5.05)	0
Q6.	0.02s (×1.40)	0.03s (×1.94)	0.00s (×0.50)	0.06s (×3.60)	0.06s (×3.50)	0.05s (×3.05)	0.14s (×7.41)	0.11s (×6.00)	0
Q7.	0.03s (×1.90)	0.03s (×2.19)	0.01s (×1.00)	0.19s (×10.20)	0.28s (×14.50)	0.36s (×18.40)	0.22s (×11.42)	0.02s (×1.50)	0.
Q8.	0.28s (×1.99)	0.13s (×1.00)	0.31s (×2.24)	0.32s (×2.30)	0.31s (×2.26)	0.48s (×3.40)	0.68s (×4.83)	0.58s (×4.12)	0
Q9.	0.28s (×1.00)	1.41s (×4.84)	0.85s (×2.93)	0.41s (×1.43)	0.42s (×1.45)	0.50s (×1.73)	1.55s (×5.29)	0.68s (×2.35)	0
Q10.	0.12s (×1.30)	0.09s (×1.00)	0.09s (×1.01)	0.25s (×2.60)	0.24s (×2.54)	0.30s (×3.17)	0.66s (×6.81)	0.09s (×1.01)	0
Q11.	0.10s (×1.22)	0.10s (×1.25)	0.08s (×1.00)	0.25s (×2.89)	0.23s (×2.72)	0.29s (×3.33)	0.33s (×3.73)	0.09s (×1.11)	0
Q12.	0.16s (×1.00)	0.16s (×1.00)	0.26s (×1.60)	0.29s (×1.78)	0.33s (×2.00)	0.32s (×1.95)	0.34s (×2.10)	0.84s (×5.05)	0
Q13.	0.21s (×1.00)	0.31s (×1.41)	0.43s (×1.97)	0.39s (×1.80)	0.49s (×2.26)	0.44s (×2.00)	0.61s (×2.76)	1.54s (×6.95)	0
Q14.	0.17s (×1.00)	0.18s (×1.04)	0.27s (×1.52)	0.30s (×1.71)	0.35s (×1.95)	0.32s (×1.78)	0.36s (×2.01)	1.00s (×5.49)	0
Q15.	0.15s (×1.03)	0.14s (×1.00)	0.36s (×2.41)	0.26s (×1.79)	0.30s (×2.03)	0.28s (×1.91)	0.32s (×2.17)	0.55s (×3.65)	0
Q16.	0.36s (×1.05)	0.34s (×1.00)	0.75s (×2.17)	0.39s (×1.13)	0.46s (×1.35)	0.35s (×1.03)	0.39s (×1.15)	2.35s (×6.75)	0
Q17.	0.28s (×1.00)	0.39s (×1.39)	0.71s (×2.53)	0.43s (×1.56)	0.46s (×1.63)	0.99s (×3.52)	0.53s (×1.91)	0.37s (×1.33)	0
Q18.	0.81s (×1.60)	0.66s (×1.31)	0.96s (×1.88)	0.51s (×1.00)	0.66s (×1.30)	0.56s (×1.10)	0.82s (×1.61)	4.38s (×8.51)	0
Q19.	0.02s (×2.56)	0.03s (×3.89)	0.01s (×1.97)	0.31s (×31.21)	0.16s (×16.34)	0.28s (×28.35)	0.03s (×3.45)	0.00s (×0.98)	0.
Q20.	0.15s (×2.06)	0.34s (×4.32)	0.20s (×2.63)	0.28s (×3.63)	0.31s (×4.03)	0.25s (×3.24)	0.24s (×3.07)	0.93s (×11.75)	0
Q21.	0.17s (×1.22)	0.36s (×2.49)	0.14s (×1.00)	0.25s (×1.72)	0.29s (×2.01)	0.29s (×2.03)	0.59s (×3.98)	0.87s (×5.87)	0
Q22.	0.36s (×1.15)	1.03s (×3.25)	0.31s (×1.00)	0.48s (×1.52)	0.42s (×1.34)	0.48s (×1.52)	0.93s (×2.95)	1.94s (×6.09)	0
Q23.	0.82s (×14.68)	1.35s (×24.04)	0.39s (×7.05)	0.49s (×8.84)	0.70s (×12.44)	0.42s (×7.66)	0.91s (×16.26)	2.20s (×38.94)	0.
Q24.	0.05s (×4.98)	0.09s (×8.30)	0.08s (×7.22)	0.18s (×15.57)	0.20s (×16.77)	0.18s (×15.57)	0.07s (×6.08)	0.14s (×12.04)	0.
Q25.	0.04s (×1.00)	0.08s (×1.62)	0.08s (×1.64)	0.17s (×3.25)	0.18s (×3.49)	0.20s (×3.84)	0.07s (×1.37)	0.13s (×2.55)	0
Q26.	0.06s (×1.00)	0.08s (×1.34)	0.07s (×1.18)	0.19s (×2.88)	0.20s (×3.01)	0.40s (×6.06)	0.07s (×1.15)	0.15s (×2.35)	0
Q27.	0.28s (×2.06)	0.30s (×2.18)	0.13s (×1.00)	0.40s (×2.91)	0.33s (×2.43)	0.32s (×2.37)	0.40s (×2.90)	1.51s (×10.86)	0
Q28.	0.94s (×1.92)	1.05s (×2.16)		0.54s (×1.12)	0.65s (×1.33)	0.48s (×1.00)	0.80s (×1.64)	5.57s (×11.32)	0
Q29.	0.43s (×2.06)	0.20s (×1.00)	0.34s (×1.64)	0.75s (×3.59)	0.87s (×4.14)	0.74s (×3.53)	1.13s (×5.37)	1.11s (×5.26)	1
Q30.	0.11s (×1.00)	0.16s (×1.40)	0.17s (×1.46)	0.37s (×3.12)	0.28s (×2.37)	0.31s (×2.60)	0.33s (×2.74)	0.52s (×4.31)	0



Benchmarks

Performance obsession

- Our own at benchmark.clickhouse.com



Fast



**Operations
Ingestion
Queries
Innovation
Benchmarks**



Thank you!

Come to chat to us on our booth !
clickhouse.com/cloud 🚀