My Favourite Features

And a bit of roadmap

2024

ClickHouse

What is ClickHouse?

Open source

Developed since
2009 - OSS 2016
31k+ Github stars
1.3k+ contributors
500+ releases

column-oriented

Best for aggregations
Files per column
Sorting and indexing
Background merges

distributed

Replication
Sharding
Multi-master
Cross-region

OLAP database

Analytics use cases
Aggregations
Visualizations
Mostly immutable data

Key Features

Some of the cool things ClickHouse can do

1 Speaks SQL

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

2 Lots of writes

Up to several million writes per second - per server.

3 Distributed

Replicated and sharded, largest known cluster is 4000 servers.

4 Highly efficient storage

Lots of encoding and compression options - e.g. 20x from uncompressed CSV.

5 Very fast queries

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

6 Joins and lookups

Allows separating fact and dimension tables in a star schema.

ClickHouse Core

ClickHouse

ClickHouse Core Roadmap 2024

https://github.com/ClickHouse/ClickHouse/issues/58392

- **SQL compatibility**
  - Enable Analyzer by default
  - JOINs reordering and extended pushdown
  - Correlated subqueries (with decorrelation)
- **Data storage & Interfaces**
  - Adaptive mode for async inserts
  - Semistructured data (prod readiness)
  - Lightweight updates (production readiness)
  - Transactions for Replicated tables
  - Vector search (production readiness)
  - Inverted indices (production readiness)
  - Support for Iceberg Data Catalog
  - Support for Hive-style partitioning
- **Security**
  - Encapsulation of access control for views
  - Resource scheduler
- **Query processing**
  - Parallel replicas with task callbacks (production readiness)
  - Parallel replicas with parallel distributed INSERT SELECT
  - Adaptive thresholds for data spilling on disk
- **Architectural Change**
  - Distributed cache
  - Stateless worker for background operations
  - Stateless worker for select queries (R&D)
- **Experiments & research**
  - PromQL support
  - Streaming queries
  - Key-value data marts
  - Unique key constraints

Faster Onboarding

Core recent features and roadmap

Insertion

Make it easier for user to insert data in ClickHouse:

- Semi-structured columns
- Async Insert by default
- Parallel replicas with parallel INSERT SELECT

Reading

Improved performance and better integration to make it easier to read data.

- Parallel replicas with task callbacks (production readiness)
- Improve Iceberg Table engine
- Improve Delta Lake Table Engine

Ease of Use

Making ClickHouse easier to use by simplifying features, making it more a “out of the box” experience:

- PromQL Support
- Adaptive threshold for data spilling on disk

Data Insertion and Manipulation

Core recent features and roadmap

Async Insert

Making asynchronous insert the default behavior in ClickHouse

- Adjustable Asynchronous Insert Timeout
- Consistent INSERTs into multiple MVs

Lightweight Operations

Delete data frequently without impacting performance

- Lightweight operations at query time
- Materialization of lightweight operations

Transactions

Bring ACID properties to use cases important to ClickHouse users

- BEGIN TRANSACTION, COMMIT and ROLLBACK statements (experimental on MergeTree)

More flexible analytics

Core recent features and roadmap

Analyzer by default

Enabling Analyzer by default opens many possibilities in ClickHouse

- Implement Analyzer in ClickHouse
- Enable Analyzer by default
- Simplify existing code
- Implement cost based optimizer

Extended JOIN support

Faster JOINs for more use cases; automatic JOIN algorithm selection

- Dynamic JOIN algorithm selection and JOIN rewrite (dep. Analyzer)
- Joins reordering and extended pushdown
- Support more operators for joins

Indexing / Search

More functionality and seamless migrations / ecosystem integrations

- Vector search indices (Production ready)
- Inverted indices (Production ready)

Blog / Engineering

ClickHouse Release 24.8 LTS

The ClickHouse Team
Sep 3, 2024

Another month goes by, which means it's time for another release!

ClickHouse version 24.8 contains **19 new features** 🎁 **18 performance optimisations** 🛷 **65 bug fixes** 🐞

This release is an LTS (Long Term Support) one, which means it will be supported for 12 months after release. To learn more about Stable and LTS releases, see the documentation.

In this release, we've got the newly revamped JSON type, a table engine for time-series data, exactly-once processing of Kafka messages, and of course, join improvements!

What's new in ClickHouse

19 new features

- ★ Multiquery Mode By Default
- ★ Vitual Column_etag
- ★ Hive-Style Partitioning
- ★ printf function
- ★ Tagged Query Cache
- ★ Control Of Projections During Merges

8 performance opimisations

- ★ Optimisations for Subcolumns
- ★ OPTIMIZE Query For Join Tables
- ★ Faster Merges
- ★ Faster Drop Database

65 bug fixes

Interesting new features

- ★ Analyzer In Production
- ★ New Kafka Engine
- ★ TimeSeries Engine
- ★ JSON Data Type

The New Kafka Engine 🧪

The Kafka engine exists in ClickHouse since 2017
— it implements streaming consumption and data pipelines from Kafka.

Its downside: non-atomic commit to Kafka and to ClickHouse, leading to the possibility of duplicates in the case of retries.

Now there is an option to manage the offsets in Keeper:

```
SET allow_experimental_kafka_offsets_storage_in_keeper = 1;

CREATE TABLE ... ENGINE = Kafka(
    'localhost:19092', 'topic', 'consumer', 'JSONEachRow')
SETTINGS
    kafka_keeper_path = '/clickhouse/{database}/kafka',
    kafka_replica_name = 'r1';
```

Developer: János Benjamin Antal.

The New Kafka Engine 🧪

```
CREATE TABLE ... ENGINE = Kafka(
    'localhost:19092', 'topic', 'consumer', 'JSONEachRow')
SETTINGS
    kafka_keeper_path = '/clickhouse/{database}/kafka',
    kafka_replica_name = 'r1';
```

With the new option it does not rely on Kafka to track the offsets,
and does it by itself with ClickHouse Keeper.

If an insertion attempt fails, it will take exactly the same chunk of data and repeat the insertion, regardless of network or server failures.

This enables deduplication and makes the consumption exactly-once.

Developer: János Benjamin Antal.

TimeSeries Engine 🧪

Now ClickHouse supports Prometheus protocols for remote write and read.

The new, TimeSeries Engine implements storage for metrics.

```
SET allow_experimental_time_series_table = 1;

CREATE TABLE tbl ENGINE = TimeSeries; -- the default options.

CREATE TABLE tbl ENGINE = TimeSeries
    DATA ENGINE = MergeTree
    TAGS ENGINE = ReplacingMergeTree
    METRICS ENGINE = ReplacingMergeTree;
```

Developer: Vitaly Baranov.

TimeSeries Engine 🧪

```
$ cat /etc/clickhouse-server/config.d/prometheus.yaml
prometheus:
    port: 8053
    handlers:
        my_rule_1:
            url: '/write'
            handler:
                type: remote_write
                database: default
                table: tbl
        my_rule_2:
            url: '/read'
            handler:
                type: remote_read
                database: default
                table: tbl
        my_rule_3:
            url: '/metrics'
            handler:
                type: expose_metrics
```

TimeSeries Engine 🧪

ClickHouse is listening the Prometheus protocol
and ready to receive metrics.

TimeSeries engine is simple to use, but allows many customizations:
— put some tags (e.g., hostname) into separate columns;
— adjust table's primary key;
— adjust column types;
— ...

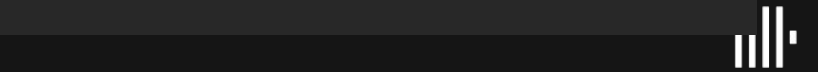
But there is more work to do:
— support for PromQL;

Developer: Vitaly Baranov.

OVERLAY

```
SELECT overlay('Hello, world!', 'test', 8, 5)
AS res
```

```
   ┌─res─────────┐
1. │ Hello, test! │
   └─────────────┘
```

OVERLAY

```
WITH 'Hello, world!' AS s,
     'test' AS replacement,
     8 AS pos,
     5 AS length
SELECT concat(substring(s, 1, pos - 1), replacement,
substring(s, pos + length)) AS res


    ┌─res─────────┐
1.  │ Hello, test! │
    └─────────────┘
```


Describing A Release

```
$ sudo docker run --rm clickhouse/clickhouse-server:24.8 clickhouse-local --query
"SELECT * FROM system.contributors ORDER BY name" > contributors_24.8.txt

$ sudo docker run --rm clickhouse/clickhouse-server:24.9 clickhouse-local --query
"SELECT * FROM system.contributors ORDER BY name" > contributors_23.9.txt
```


Describing A Release

```
numbersix at thevillage in ~/clickhouse-mac
$ ./clickhouse local --query "
    SELECT arrayStringConcat(groupArray(line), ', ')
    FROM file('contributors_24.9.txt', LineAsString)
    WHERE line NOT IN (
        SELECT *
        FROM file('contributors_24.8.txt', LineAsString))
        FORMAT TSVRaw"

1on, Alexey Olshanskiy, Alexis Arnaud, Austin Bruch, Denis Hananein, Dergousov,
Gabriel Mendes, Konstantin Smirnov, Kruglov Kirill, Marco Vilas Boas, Matt Woenker,
Maxim Dergousov, Michal Tabaszewski, NikBarykin, Oleksandr, Pedro Ferreira, Rodrigo
Garcia, Samuel Warfield, Sergey (Finn) Gnezdilov, Tuan Pham Anh, Zhigao Hong,
baolin.hbl, gao chuan, haozelong, imddba, kruglov, leonkozlowski, m4xxx1m, marco-vb,
megao, mmav, neoman36, okunev, siyuan
```


JSON Object Format

JSON Data Type 🧪

```
SET allow_experimental_json_type = 1;

CREATE TABLE test (time DateTime, data JSON) ORDER BY time;

-- or with parameters:
data JSON(
    max_dynamic_paths = N,
    max_dynamic_types = M,
    some.path TypeName,          -- a type hint
    SKIP path.to.skip,           -- ignore some paths
    SKIP REGEXP 'paths_regexp')
```

Developer: Pavel Kruglov.

JSON Data Type 🧪

How it works:

— Analyzes the JSON and infers data types for every path.

— Stores every path and every distinct type as a subcolumn.

— Up to the maximum number, when it will fallback
to storing the rest of the paths together.

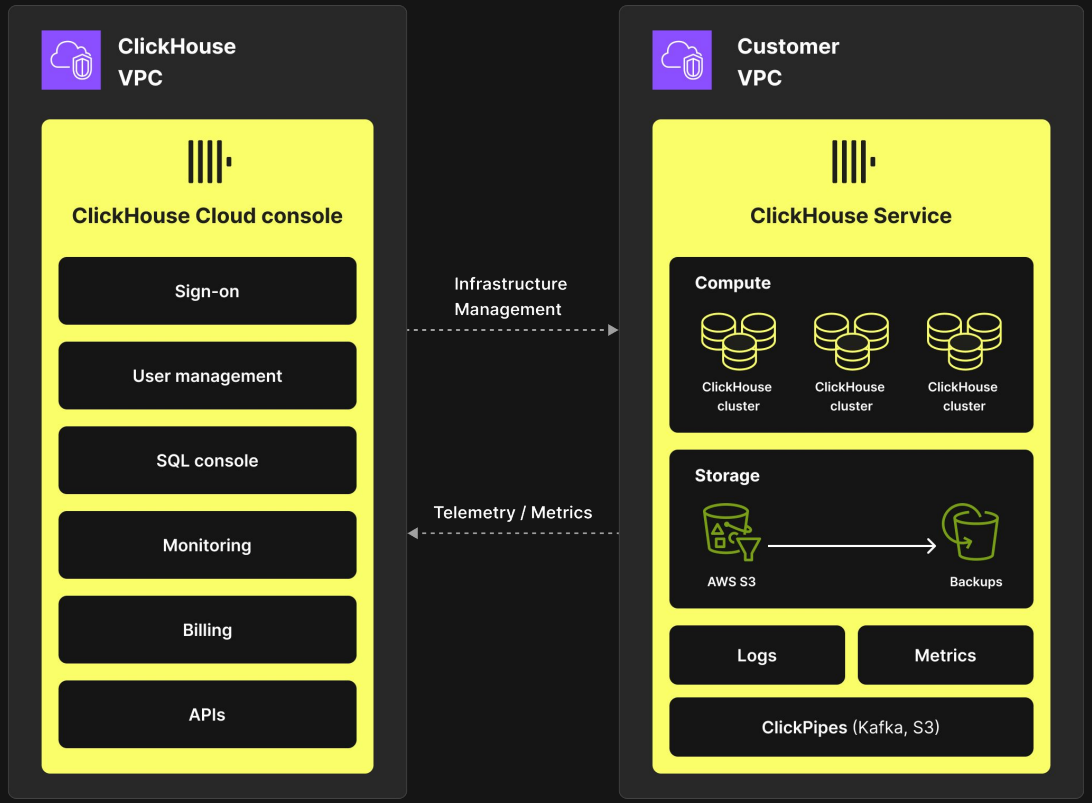
It enables fast column-oriented storage and queries
on arbitrary semistructured data!

Developer: Pavel Kruglov.

Saved Queries as APIs

BYOC Architecture (AWS)[Private Preview]

- Compute and Storage will reside in Customer' VPC
- Only service health metrics will be accessible from the ClickHouse VPC for Monitoring and Management
- All web assets will be hosted on ClickHouse VPC - includes User Management, Service Configuration, SQL Console,..



Compute-Compute Separation[Private Preview]

With Compute-Compute separation, services can allocate dedicated compute for specific operations - eg: Streaming Ingest vs Adhoc Reporting, while sharing the same storage

- Compute units can be scaled independently
- Eliminates bottlenecks due to resource contention