

02 ДЗ - Развертывание и базовая конфигурация, интерфейсы и инструменты.

Собираем Dockerfile для clickhouse.

Dockerfile:

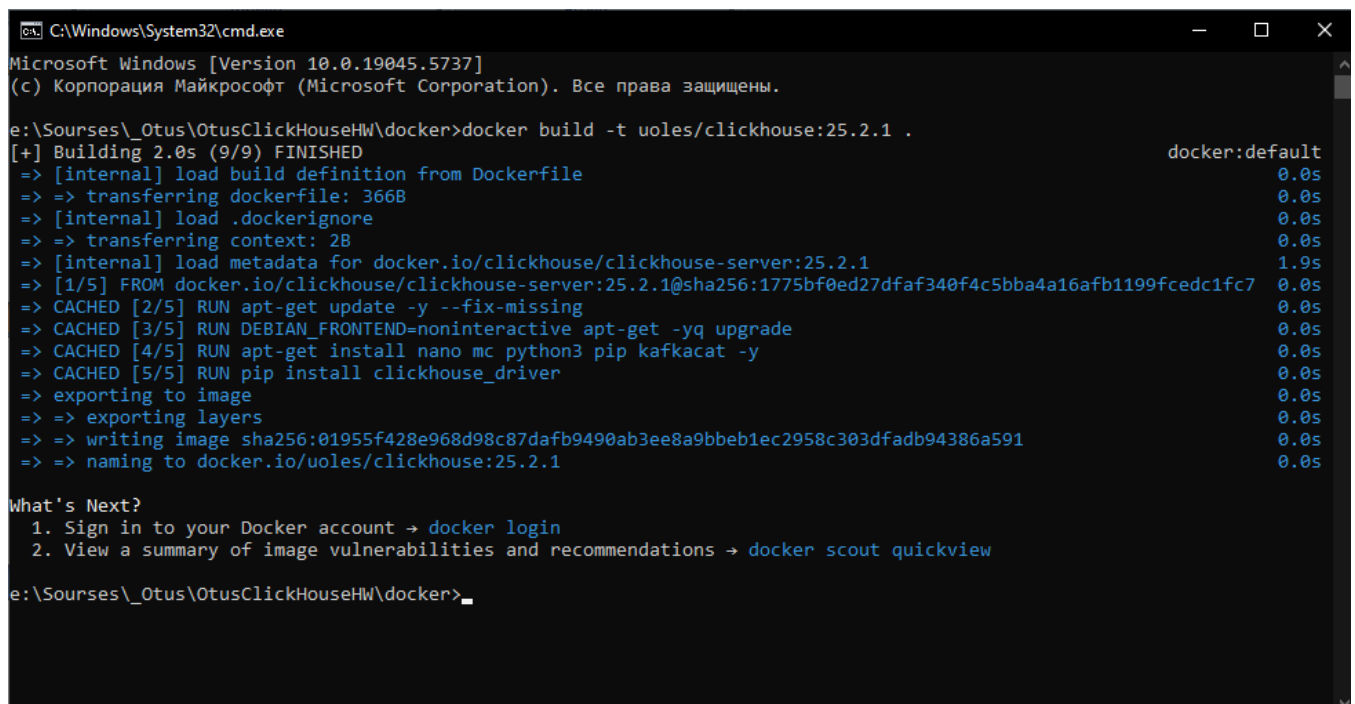
```
FROM clickhouse/clickhouse-server:25.2.1
MAINTAINER Maksim Kulikov max.uoles@rambler.ru

RUN apt-get update -y --fix-missing
RUN DEBIAN_FRONTEND=noninteractive apt-get -yq upgrade
RUN apt-get install nano mc python3 pip kafkacat -y
RUN pip install clickhouse_driver

EXPOSE 8123 9000
ENTRYPOINT ["/entrypoint.sh"]
```

Собираем образ командой:

docker build -t uoles/clickhouse:25.2.1 .



```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.19045.5737]
(c) Корпорация Майкрософт (Microsoft Corporation). Все права защищены.

e:\Sources\Otus\OtusClickHouseHW\docker>docker build -t uoles/clickhouse:25.2.1 .
[+] Building 2.0s (9/9) FINISHED                                docker:default
=> [internal] load build definition from Dockerfile             0.0s
=> => transferring dockerfile: 366B                             0.0s
=> [internal] load .dockerignore                               0.0s
=> => transferring context: 2B                                    0.0s
=> [internal] load metadata for docker.io/clickhouse/clickhouse-server:25.2.1 1.9s
=> [1/5] FROM docker.io/clickhouse/clickhouse-server:25.2.1@sha256:1775bf0ed27dfaf340f4c5bba4a16afb1199fcedc1fc7 0.0s
=> CACHED [2/5] RUN apt-get update -y --fix-missing             0.0s
=> CACHED [3/5] RUN DEBIAN_FRONTEND=noninteractive apt-get -yq upgrade 0.0s
=> CACHED [4/5] RUN apt-get install nano mc python3 pip kafkacat -y 0.0s
=> CACHED [5/5] RUN pip install clickhouse_driver               0.0s
=> exporting to image                                           0.0s
=> => exporting layers                                           0.0s
=> => writing image sha256:01955f428e968d98c87dafb9490ab3ee8a9bbeb1ec2958c303dfadb94386a591 0.0s
=> => naming to docker.io/uoles/clickhouse:25.2.1              0.0s

What's Next?
 1. Sign in to your Docker account -> docker login
 2. View a summary of image vulnerabilities and recommendations -> docker scout quickview

e:\Sources\Otus\OtusClickHouseHW\docker>
```

Запускаем контейнер командой:

```
docker run -d
-p 18123:8123
-p 19000:9000
-e CLICKHOUSE_DB=my_database
-e CLICKHOUSE_USER=username
-e CLICKHOUSE_DEFAULT_ACCESS_MANAGEMENT=1
-e CLICKHOUSE_PASSWORD=password
--name clickhouse-server-02
--ulimit nofile=262144:262144
uoles/clickhouse:25.2.1
```

Создаем таблицу и заливаем данные.

Набор тестовых данных брал этот:

<https://clickhouse.com/docs/ru/getting-started/example-datasets/uk-price-paid>

Создаем таблицу:

```
CREATE TABLE my_database.uk_price_paid (  
    price UInt32,  
    date Date,  
    postcode1 LowCardinality(String),  
    postcode2 LowCardinality(String),  
    type Enum8('terraced' = 1, 'semi-detached' = 2, 'detached' = 3, 'flat' = 4, 'other' = 0),  
    is_new UInt8,  
    duration Enum8('freehold' = 1, 'leasehold' = 2, 'unknown' = 0),  
    addr1 String,  
    addr2 String,  
    street LowCardinality(String),  
    locality LowCardinality(String),  
    town LowCardinality(String),  
    district LowCardinality(String),  
    county LowCardinality(String)  
)  
ENGINE = MergeTree  
ORDER BY (postcode1, postcode2, addr1, addr2);
```

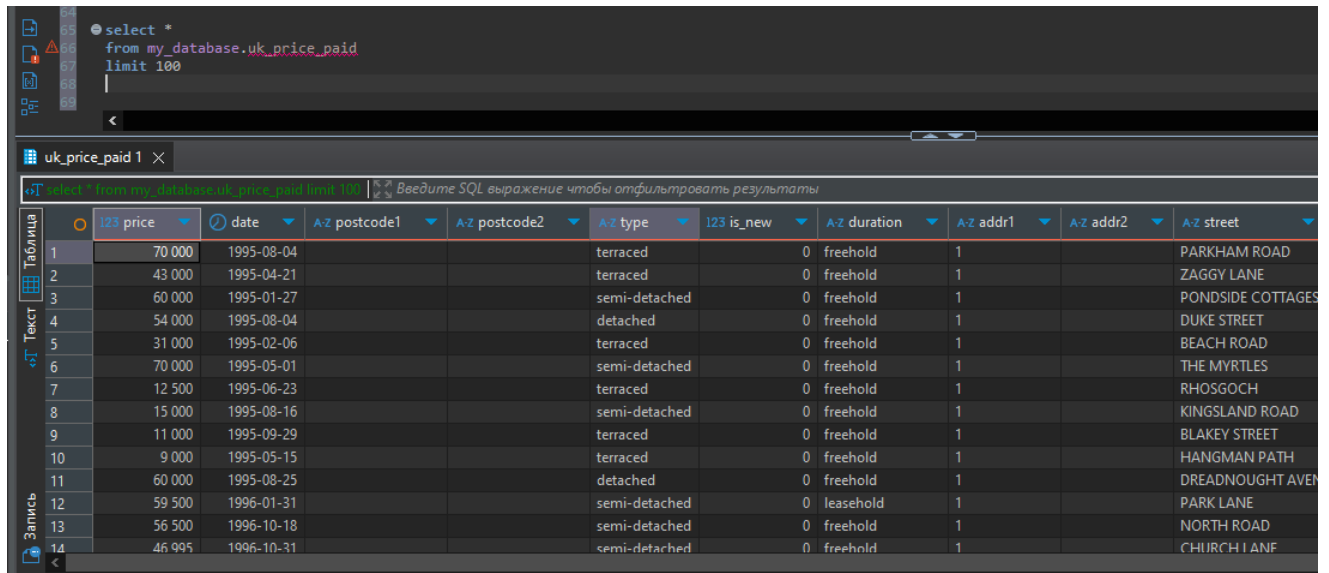
Вставка данных:

```
INSERT INTO my_database.uk_price_paid  
WITH  
    splitByChar(' ', postcode) AS p  
SELECT  
    toUInt32(price_string) AS price,  
    parseDateTimeBestEffortUS(time) AS date,  
    p[1] AS postcode1,  
    p[2] AS postcode2,  
    transform(a, ['T', 'S', 'D', 'F', 'O'], ['terraced', 'semi-detached', 'detached', 'flat', 'other']) AS type,  
    b = 'Y' AS is_new,  
    transform(c, ['F', 'L', 'U'], ['freehold', 'leasehold', 'unknown']) AS duration,  
    addr1,  
    addr2,  
    street,  
    locality,  
    town,  
    district,  
    county  
FROM url(  
    'http://prod.publicdata.landregistry.gov.uk.s3-website-eu-west-1.amazonaws.com/pp-complete.csv',  
    'CSV',  
    'uuid_string String',  
    'price_string String',  
    'time String',  
    'postcode String',  
    'a String',  
    'b String',  
    'c String',  
    'addr1 String',  
    'addr2 String',  
    'street String',  
    'locality String',
```

town String,
district String,
county String,
d String,
e String'

) SETTINGS max_http_get_redirects=10;

Проверяем данные:



The screenshot shows a database client interface. At the top, a SQL query is entered: `select * from my_database.uk_price_paid limit 100`. Below the query, the results are displayed in a table. The table has columns: `price`, `date`, `postcode1`, `postcode2`, `type`, `is_new`, `duration`, `addr1`, `addr2`, and `street`. The results show 14 rows of data, including property prices and addresses.

| | price | date | postcode1 | postcode2 | type | is_new | duration | addr1 | addr2 | street |
|----|--------|------------|-----------|-----------|---------------|--------|-----------|-------|-------|--------------------|
| 1 | 70 000 | 1995-08-04 | | | terraced | 0 | freehold | 1 | | PARKHAM ROAD |
| 2 | 43 000 | 1995-04-21 | | | terraced | 0 | freehold | 1 | | ZAGGY LANE |
| 3 | 60 000 | 1995-01-27 | | | semi-detached | 0 | freehold | 1 | | PONDSIDE COTTAGES |
| 4 | 54 000 | 1995-08-04 | | | detached | 0 | freehold | 1 | | DUKE STREET |
| 5 | 31 000 | 1995-02-06 | | | terraced | 0 | freehold | 1 | | BEACH ROAD |
| 6 | 70 000 | 1995-05-01 | | | semi-detached | 0 | freehold | 1 | | THE MYRTLES |
| 7 | 12 500 | 1995-06-23 | | | terraced | 0 | freehold | 1 | | RHOSGOCH |
| 8 | 15 000 | 1995-08-16 | | | semi-detached | 0 | freehold | 1 | | KINGSLAND ROAD |
| 9 | 11 000 | 1995-09-29 | | | terraced | 0 | freehold | 1 | | BLAKEY STREET |
| 10 | 9 000 | 1995-05-15 | | | terraced | 0 | freehold | 1 | | HANGMAN PATH |
| 11 | 60 000 | 1995-08-25 | | | detached | 0 | freehold | 1 | | DREADNOUGHT AVENUE |
| 12 | 59 500 | 1996-01-31 | | | semi-detached | 0 | leasehold | 1 | | PARK LANE |
| 13 | 56 500 | 1996-10-18 | | | semi-detached | 0 | freehold | 1 | | NORTH ROAD |
| 14 | 46 995 | 1996-10-31 | | | semi-detached | 0 | freehold | 1 | | CHURCH LANE |

Запускаем бенчмарк и тестируем производительность.

Заходим в контейнер:

```
docker exec -it clickhouse-server-02 bash
```

Тестируем командой:

```
clickhouse-benchmark --user username --password password -i 10 --query "SELECT * FROM my_database.uk_price_paid LIMIT 6000000 OFFSET 6000000"
```

Результат без настроек (дефолтные):

Loaded 1 queries.

Queries executed: 2.

localhost:9000, queries: 2, QPS: 1.951, RPS: 23433605.734, MiB/s: 991.244, result RPS: 11707561.698, result MiB/s: 462.173.

| | |
|-----|------------|
| 0% | 0.498 sec. |
| 10% | 0.498 sec. |
| 20% | 0.498 sec. |
| 30% | 0.498 sec. |
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| 60% | 0.518 sec. |
| 70% | 0.518 sec. |
| 80% | 0.518 sec. |
| 90% | 0.518 sec. |
| 95% | 0.518 sec. |

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| 99% | 0.518 sec. |
| 99.9% | 0.518 sec. |
| 99.99% | 0.518 sec. |

Queries executed: 5.

localhost:9000, queries: 3, QPS: 2.073, RPS: 24883216.753, MiB/s: 1052.425, result RPS: 12437451.504, result MiB/s: 490.469.

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| 70% | 0.480 sec. |
| 80% | 0.482 sec. |
| 90% | 0.482 sec. |
| 95% | 0.482 sec. |
| 99% | 0.482 sec. |
| 99.9% | 0.482 sec. |
| 99.99% | 0.482 sec. |

Queries executed: 8.

localhost:9000, queries: 3, QPS: 2.080, RPS: 24978178.971, MiB/s: 1056.884, result RPS: 12482077.332, result MiB/s: 492.505.

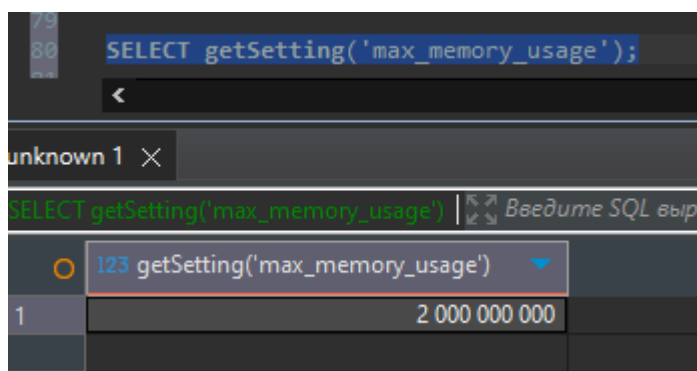
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| 80% | 0.481 sec. |
| 90% | 0.481 sec. |
| 95% | 0.481 sec. |
| 99% | 0.481 sec. |
| 99.9% | 0.481 sec. |
| 99.99% | 0.481 sec. |

Queries executed: 10.

localhost:9000, queries: 10, QPS: 2.005, RPS: 24072092.014, MiB/s: 1018.304, result RPS: 12030656.273, result MiB/s: 474.575.

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| 70% | 0.482 sec. |
| 80% | 0.483 sec. |
| 90% | 0.498 sec. |
| 95% | 0.518 sec. |
| 99% | 0.518 sec. |
| 99.9% | 0.518 sec. |
| 99.99% | 0.518 sec. |

Выставил ограничение памяти - 2GB



Loaded 1 queries.

Queries executed: 2.

localhost:9000, queries: 2, QPS: 1.957, RPS: 23499118.293, MiB/s: 994.561, result RPS: 11744297.701, result MiB/s: 463.163.

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| 40% | 0.488 sec. |
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| 60% | 0.523 sec. |
| 70% | 0.523 sec. |
| 80% | 0.523 sec. |
| 90% | 0.523 sec. |
| 95% | 0.523 sec. |
| 99% | 0.523 sec. |
| 99.9% | 0.523 sec. |
| 99.99% | 0.523 sec. |

Queries executed: 5.

localhost:9000, queries: 3, QPS: 2.073, RPS: 24884154.369, MiB/s: 1052.017, result RPS: 12437920.155, result MiB/s: 490.488.

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| 20% | 0.474 sec. |
| 30% | 0.480 sec. |
| 40% | 0.480 sec. |
| 50% | 0.480 sec. |
| 60% | 0.480 sec. |
| 70% | 0.480 sec. |
| 80% | 0.483 sec. |
| 90% | 0.483 sec. |
| 95% | 0.483 sec. |
| 99% | 0.483 sec. |
| 99.9% | 0.483 sec. |
| 99.99% | 0.483 sec. |

Queries executed: 8.

localhost:9000, queries: 3, QPS: 2.066, RPS: 24805128.840, MiB/s: 1049.538, result RPS: 12398420.592, result MiB/s: 489.094.

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| 30% | 0.478 sec. |
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| 60% | 0.478 sec. |
| 70% | 0.478 sec. |
| 80% | 0.488 sec. |
| 90% | 0.488 sec. |
| 95% | 0.488 sec. |
| 99% | 0.488 sec. |
| 99.9% | 0.488 sec. |
| 99.99% | 0.488 sec. |

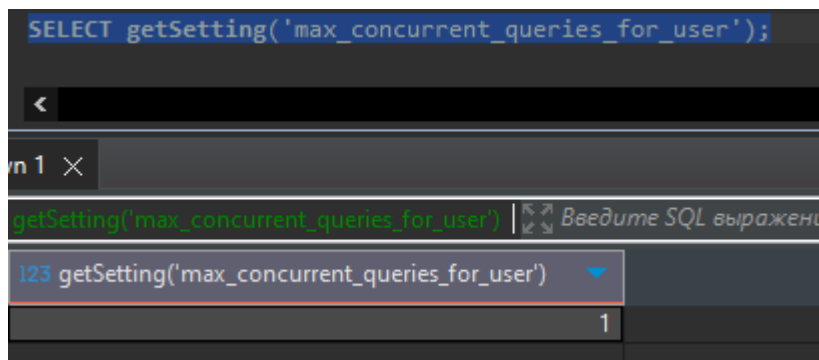
Queries executed: 10.

localhost:9000, queries: 10, QPS: 2.005, RPS: 24069096.883, MiB/s: 1018.102, result RPS: 12030801.248, result MiB/s: 474.406.

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| 80% | 0.488 sec. |
| 90% | 0.488 sec. |
| 95% | 0.523 sec. |
| 99% | 0.523 sec. |
| 99.9% | 0.523 sec. |
| 99.99% | 0.523 sec. |

Ограничение параллельных запросов на пользователя – 1.



Loaded 1 queries.

Queries executed: 2.

localhost:9000, queries: 2, QPS: 1.984, RPS: 23849595.434, MiB/s: 1008.369, result RPS: 11903213.224, result MiB/s: 468.369.

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| 40% | 0.479 sec. |
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| 60% | 0.520 sec. |
| 70% | 0.520 sec. |
| 80% | 0.520 sec. |
| 90% | 0.520 sec. |
| 95% | 0.520 sec. |
| 99% | 0.520 sec. |
| 99.9% | 0.520 sec. |
| 99.99% | 0.520 sec. |

Queries executed: 5.

localhost:9000, queries: 3, QPS: 2.074, RPS: 24891373.791, MiB/s: 1052.458, result RPS: 12441528.660, result MiB/s: 490.500.

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| 30% | 0.482 sec. |
| 40% | 0.482 sec. |
| 50% | 0.482 sec. |
| 60% | 0.482 sec. |
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| 80% | 0.482 sec. |
| 90% | 0.482 sec. |
| 95% | 0.482 sec. |
| 99% | 0.482 sec. |
| 99.9% | 0.482 sec. |
| 99.99% | 0.482 sec. |

Queries executed: 8.

localhost:9000, queries: 3, QPS: 2.084, RPS: 25022156.332, MiB/s: 1058.069, result RPS: 12504053.667, result MiB/s: 492.652.

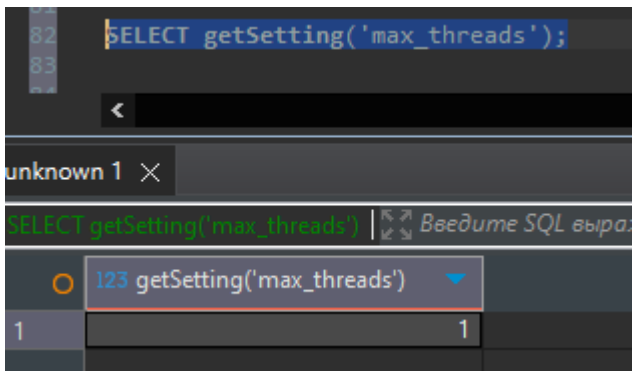
| | |
|--------|------------|
| 0% | 0.472 sec. |
| 10% | 0.472 sec. |
| 20% | 0.472 sec. |
| 30% | 0.476 sec. |
| 40% | 0.476 sec. |
| 50% | 0.476 sec. |
| 60% | 0.476 sec. |
| 70% | 0.476 sec. |
| 80% | 0.481 sec. |
| 90% | 0.481 sec. |
| 95% | 0.481 sec. |
| 99% | 0.481 sec. |
| 99.9% | 0.481 sec. |
| 99.99% | 0.481 sec. |

Queries executed: 10.

localhost:9000, queries: 10, QPS: 2.017, RPS: 24220080.665, MiB/s: 1024.267, result RPS: 12102140.056, result MiB/s: 476.929.

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| 20% | 0.475 sec. |
| 30% | 0.476 sec. |
| 40% | 0.479 sec. |
| 50% | 0.479 sec. |
| 60% | 0.479 sec. |
| 70% | 0.481 sec. |
| 80% | 0.482 sec. |
| 90% | 0.482 sec. |
| 95% | 0.520 sec. |
| 99% | 0.520 sec. |
| 99.9% | 0.520 sec. |
| 99.99% | 0.520 sec. |

Ограничение потоков – 1



Loaded 1 queries.

Queries executed: 2.

localhost:9000, queries: 2, QPS: 1.506, RPS: 18105512.605, MiB/s: 755.584, result RPS: 9033292.568, result MiB/s: 352.058.

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| 0% | 0.660 sec. |
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| 20% | 0.660 sec. |
| 30% | 0.660 sec. |
| 40% | 0.660 sec. |
| 50% | 0.664 sec. |
| 60% | 0.664 sec. |
| 70% | 0.664 sec. |
| 80% | 0.664 sec. |
| 90% | 0.664 sec. |
| 95% | 0.664 sec. |
| 99% | 0.664 sec. |
| 99.9% | 0.664 sec. |
| 99.99% | 0.664 sec. |

Queries executed: 4.

localhost:9000, queries: 2, QPS: 1.519, RPS: 18269401.820, MiB/s: 762.423, result RPS: 9115060.992, result MiB/s: 355.245.

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| 0% | 0.652 sec. |
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| 20% | 0.652 sec. |
| 30% | 0.652 sec. |
| 40% | 0.652 sec. |
| 50% | 0.662 sec. |
| 60% | 0.662 sec. |
| 70% | 0.662 sec. |
| 80% | 0.662 sec. |
| 90% | 0.662 sec. |
| 95% | 0.662 sec. |
| 99% | 0.662 sec. |

| | |
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| 99.9% | 0.662 sec. |
| 99.99% | 0.662 sec. |

Queries executed: 6.

localhost:9000, queries: 2, QPS: 1.550, RPS: 18637197.230, MiB/s: 777.772, result RPS: 9298563.311, result MiB/s: 362.396.

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| 10% | 0.643 sec. |
| 20% | 0.643 sec. |
| 30% | 0.643 sec. |
| 40% | 0.643 sec. |
| 50% | 0.646 sec. |
| 60% | 0.646 sec. |
| 70% | 0.646 sec. |
| 80% | 0.646 sec. |
| 90% | 0.646 sec. |
| 95% | 0.646 sec. |
| 99% | 0.646 sec. |
| 99.9% | 0.646 sec. |
| 99.99% | 0.646 sec. |

Queries executed: 8.

localhost:9000, queries: 2, QPS: 1.542, RPS: 18546556.039, MiB/s: 773.989, result RPS: 9253340.156, result MiB/s: 360.634.

| | |
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| 0% | 0.640 sec. |
| 10% | 0.640 sec. |
| 20% | 0.640 sec. |
| 30% | 0.640 sec. |
| 40% | 0.640 sec. |
| 50% | 0.655 sec. |
| 60% | 0.655 sec. |
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| 80% | 0.655 sec. |
| 90% | 0.655 sec. |
| 95% | 0.655 sec. |
| 99% | 0.655 sec. |
| 99.9% | 0.655 sec. |
| 99.99% | 0.655 sec. |

Queries executed: 10.

localhost:9000, queries: 10, QPS: 1.505, RPS: 18102791.404, MiB/s: 755.470, result RPS: 9031934.893, result MiB/s: 352.005.

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| 80% | 0.660 sec. |
| 90% | 0.662 sec. |
| 95% | 0.664 sec. |
| 99% | 0.664 sec. |
| 99.9% | 0.664 sec. |
| 99.99% | 0.664 sec. |

Изменение памяти в целом не повлияло на результаты, что 2GB, что 200MB. Повлияло ограничение кол-ва параллельных запросов и потоков – показатели ухудшились.

/etc/clickhouse-server/users.d/user.xml

```

1 v <clickhouse>
2 v   <profiles>
3 v     <default>
4       <max_memory_usage>200000000</max_memory_usage>
5       <max_memory_usage_for_user>200000000</max_memory_usage_for_user>
6       <max_concurrent_queries_for_user>1</max_concurrent_queries_for_user>
7       <max_threads>1</max_threads>
8     </default>
9   </profiles>
10 </clickhouse>
11

```