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

Собираем Dockerfile для clickhouse.

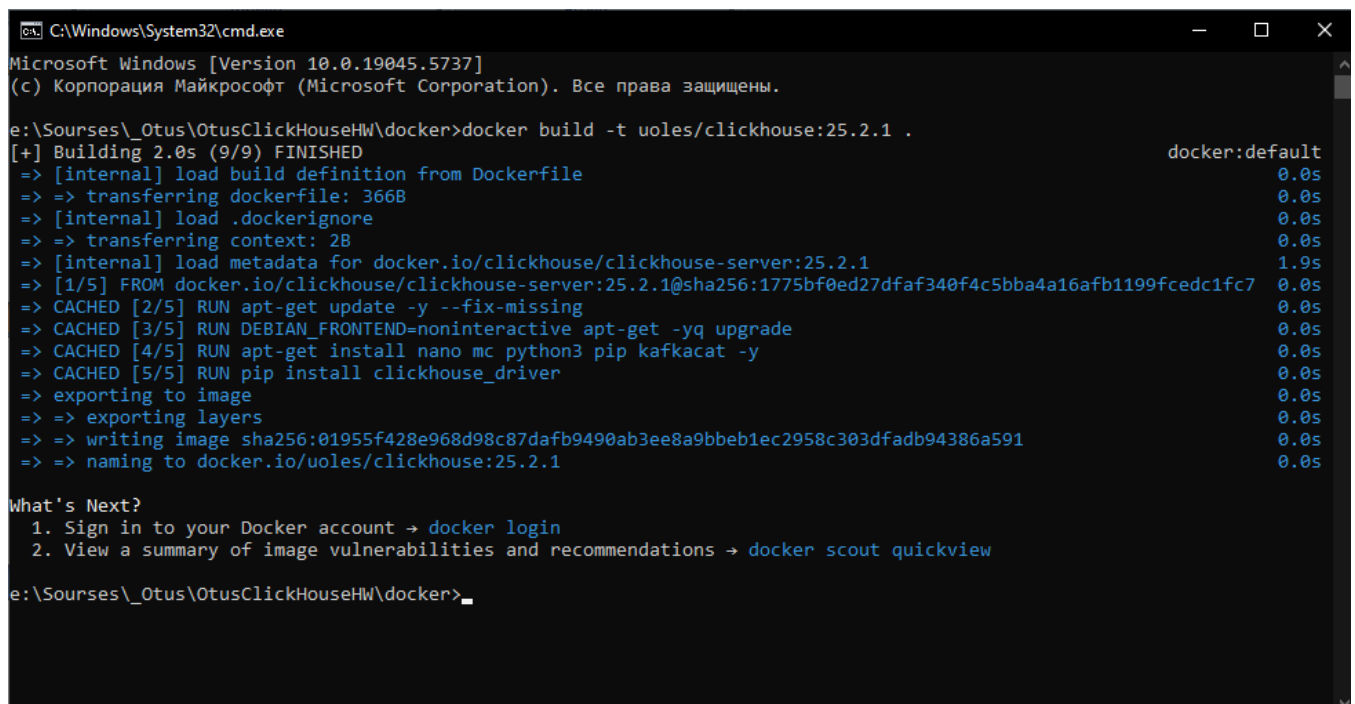Dockerfile:

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 .

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);
```
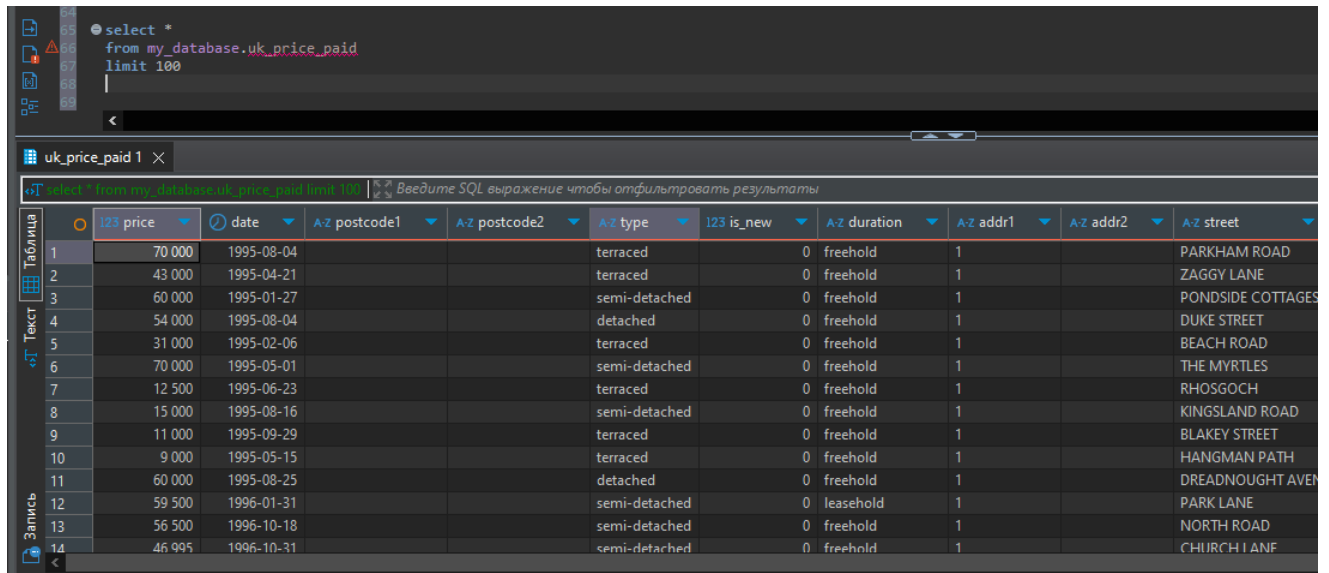
Вставка данных:

```
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:

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.
40%   0.498 sec.
50%   0.518 sec.
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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| 20% | 0.475 sec. |
| 30% | 0.480 sec. |
| 40% | 0.480 sec. |
| 50% | 0.480 sec. |
| 60% | 0.480 sec. |
| 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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| 10% | 0.476 sec. |
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| 40% | 0.476 sec. |
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| 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: 2.005, RPS: 24072092.014, MiB/s: 1018.304, result RPS: 12030656.273, result MiB/s: 474.575.

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| 10% | 0.476 sec. |
| 20% | 0.476 sec. |
| 30% | 0.480 sec. |
| 40% | 0.480 sec. |
| 50% | 0.481 sec. |
| 60% | 0.481 sec. |
| 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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| 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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| 10% | 0.474 sec. |
| 20% | 0.474 sec. |
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| 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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| 40% | 0.478 sec. |
| 50% | 0.478 sec. |
| 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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| 10% | 0.475 sec. |
| 20% | 0.476 sec. |
| 30% | 0.478 sec. |
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| 60% | 0.481 sec. |
| 70% | 0.483 sec. |
| 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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| 30% | 0.479 sec. |
| 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. |
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| 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.

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| 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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| 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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| 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. |
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| 60% | 0.646 sec. |
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| 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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| 30% | 0.640 sec. |
| 40% | 0.640 sec. |
| 50% | 0.655 sec. |
| 60% | 0.655 sec. |
| 70% | 0.655 sec. |
| 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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| 40% | 0.652 sec. |
| 50% | 0.655 sec. |
| 60% | 0.655 sec. |
| 70% | 0.656 sec. |
| 80% | 0.660 sec. |
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| 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.

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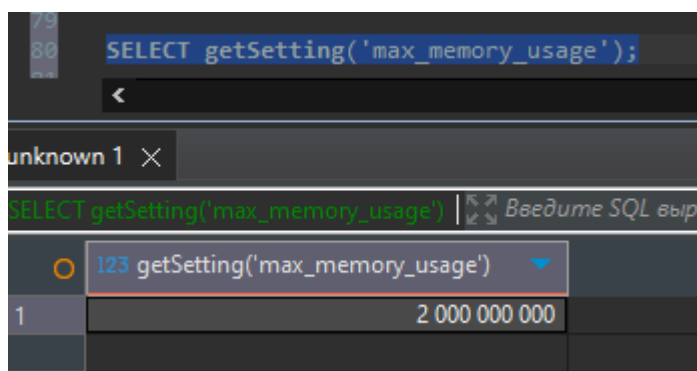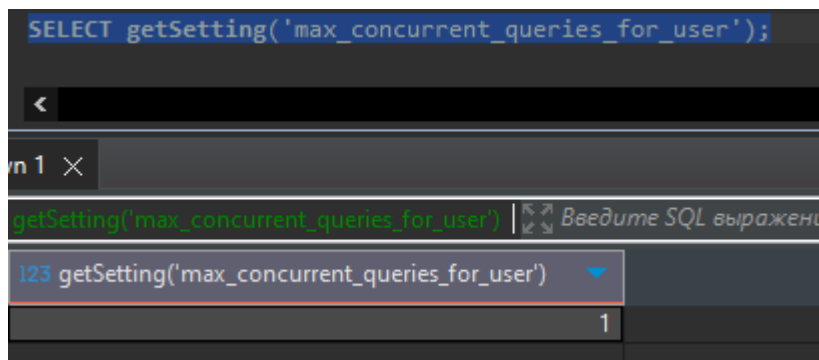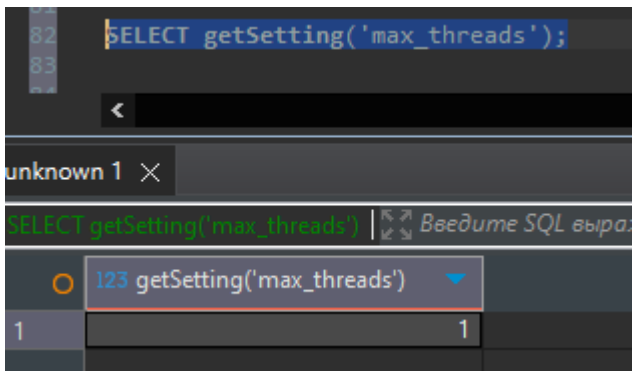/etc/clickhouse-server/users.d/user.xml

 1 v <clickhouse>
 2 v     <profiles>
 3 v         <default>
 4               <max_memory_usage>20000000</max_memory_usage>
 5               <max_memory_usage_for_user>20000000</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
```