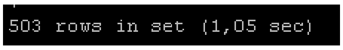
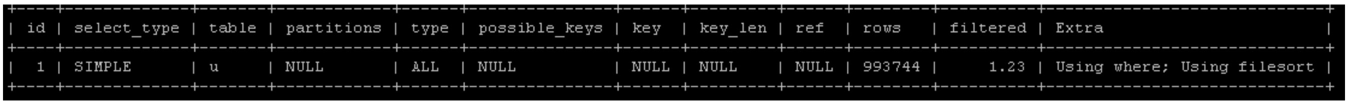
Проверяем запрос

SELECT u.id, u.first_name, u.second_name, u.birthdate, COALESCE(u.biography,'-') as biography, u.city from user u WHERE u.first_name LIKE 'A%' AND u.second_name LIKE 'A%' ORDER BY u.id;



```
503 rows in set (1,05 sec)
```

EXPLAIN SELECT u.id, u.first_name, u.second_name, u.birthdate, COALESCE(u.biography,'-') as biography, u.city from user u WHERE u.first_name LIKE 'A%' AND u.second_name LIKE 'A%' ORDER BY u.id;

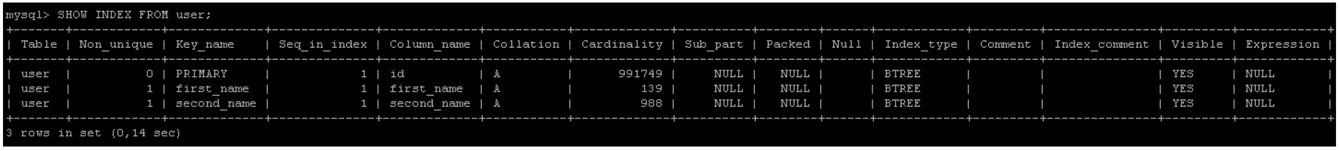


```
+----+-------------+-------+------------+------+---------------+------+---------+------+--------+----------+-----------------------------+
| id | select_type | table | partitions | type | possible_keys | key  | key_len | ref  | rows   | filtered | Extra                       |
+----+-------------+-------+------------+------+---------------+------+---------+------+--------+----------+-----------------------------+
|  1 | SIMPLE      | u     | NULL       | ALL  | NULL          | NULL | NULL    | NULL | 993744 |     1.23 | Using where; Using filesort |
+----+-------------+-------+------------+------+---------------+------+---------+------+--------+----------+-----------------------------+
```

Создаем индексы:

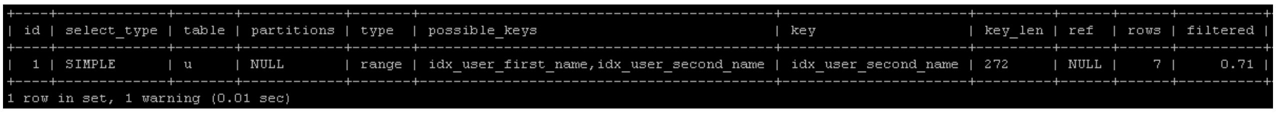
Делаем отдельные индексы по полям **first_name** и **second_name** чтобы выполнялась интервальная выборка при поиске с префиксом LIKE prefix%
Primary key(id) - для сортировки

ALTER TABLE `test1`.`user`
ADD PRIMARY KEY (`id`),
ADD INDEX `first_name` (`first_name` ASC) VISIBLE,
ADD INDEX `second_name` (`second_name` ASC) VISIBLE;

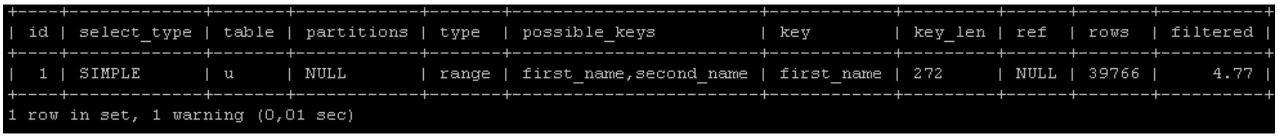


```
mysql> SHOW INDEX FROM user;
+-------+------------+-------------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+---------+------------+
| Table | Non_unique | Key_name    | Seq_in_index | Column_name | Collation | Cardinality | Sub_part | Packed | Null | Index_type | Comment | Index_comment | Visible | Expression |
+-------+------------+-------------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+---------+------------+
| user  |          0 | PRIMARY     |            1 | id          | A         |      991749 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
| user  |          1 | first_name  |            1 | first_name  | A         |         139 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
| user  |          1 | second_name |            1 | second_name | A         |         988 |     NULL |   NULL |      | BTREE      |         |               | YES     | NULL       |
+-------+------------+-------------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+---------+------------+
3 rows in set (0,14 sec)
```

EXPLAIN SELECT u.id, u.first_name, u.second_name, u.birthdate, COALESCE(u.biography,'-') as biography, u.city from user u WHERE u.first_name LIKE 'A%' AND u.second_name LIKE 'A%' ORDER BY u.id;



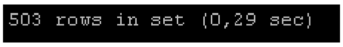
```
+----+-------------+-------+------------+-------+-------------------------------------------+----------------------+---------+------+------+----------+
| id | select_type | table | partitions | type  | possible_keys                             | key                  | key_len | ref  | rows | filtered |
+----+-------------+-------+------------+-------+-------------------------------------------+----------------------+---------+------+------+----------+
|  1 | SIMPLE      | u     | NULL       | range | idx_user_first_name,idx_user_second_name  | idx_user_second_name | 272     | NULL |    7 |     0.71 |
+----+-------------+-------+------------+-------+-------------------------------------------+----------------------+---------+------+------+----------+
1 row in set, 1 warning (0.01 sec)
```



```
+----+-------------+-------+------------+-------+------------------------+------------+---------+------+-------+----------+
| id | select_type | table | partitions | type  | possible_keys          | key        | key_len | ref  | rows  | filtered |
+----+-------------+-------+------------+-------+------------------------+------------+---------+------+-------+----------+
|  1 | SIMPLE      | u     | NULL       | range | first_name,second_name | first_name | 272     | NULL | 39766 |     4.77 |
+----+-------------+-------+------------+-------+------------------------+------------+---------+------+-------+----------+
1 row in set, 1 warning (0,01 sec)
```

EXTRA: Using index condition; Using where; Using MRR; Using filesort

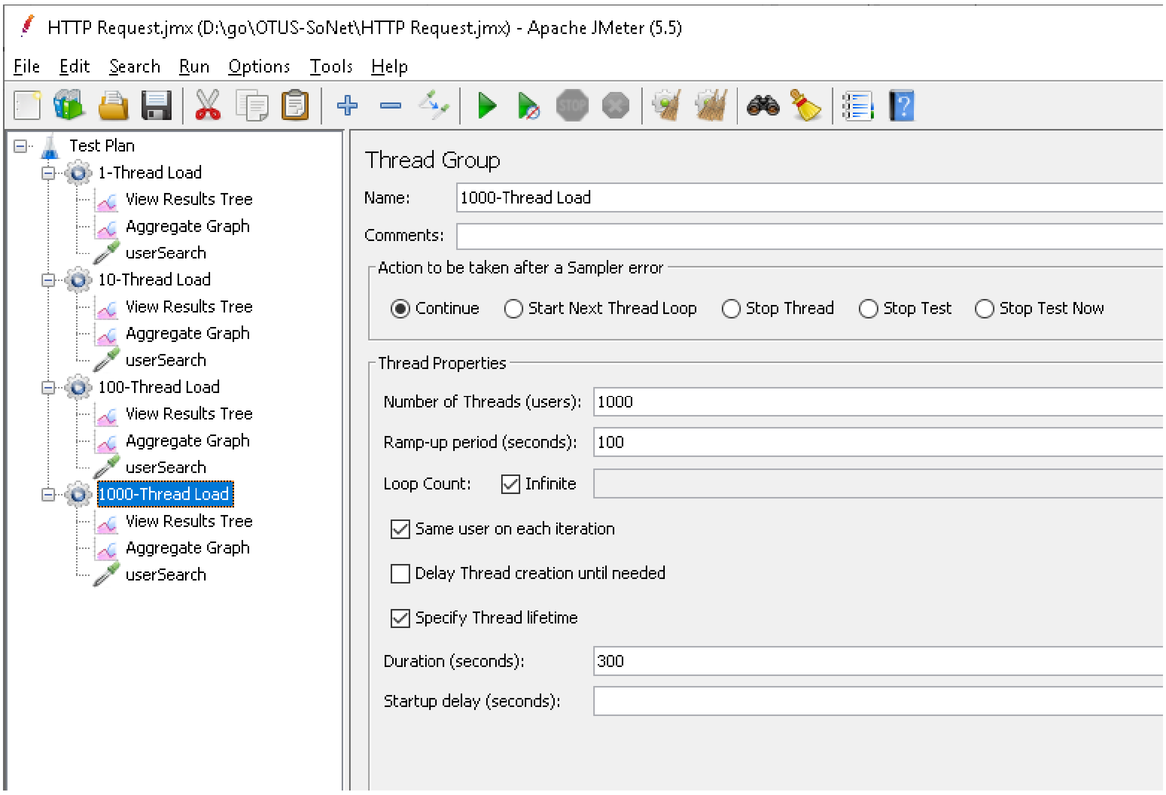
SELECT u.id, u.first_name, u.second_name, u.birthdate, COALESCE(u.biography,'-') as biography, u.city from user u WHERE u.first_name LIKE 'A%' AND u.second_name LIKE 'A%' ORDER BY u.id;



```
503 rows in set (0,29 sec)
```

Тестирование

4 испытания по длительностью по 5минут каждое, с нагрузкой в 1/10/100/1000 потоков



Thread Group

Name: 1000-Thread Load

Comments:

Action to be taken after a Sampler error

● Continue ○ Start Next Thread Loop ○ Stop Thread ○ Stop Test ○ Stop Test Now

Thread Properties

Number of Threads (users): 1000

Ramp-up period (seconds): 100

Loop Count: ☑ Infinite

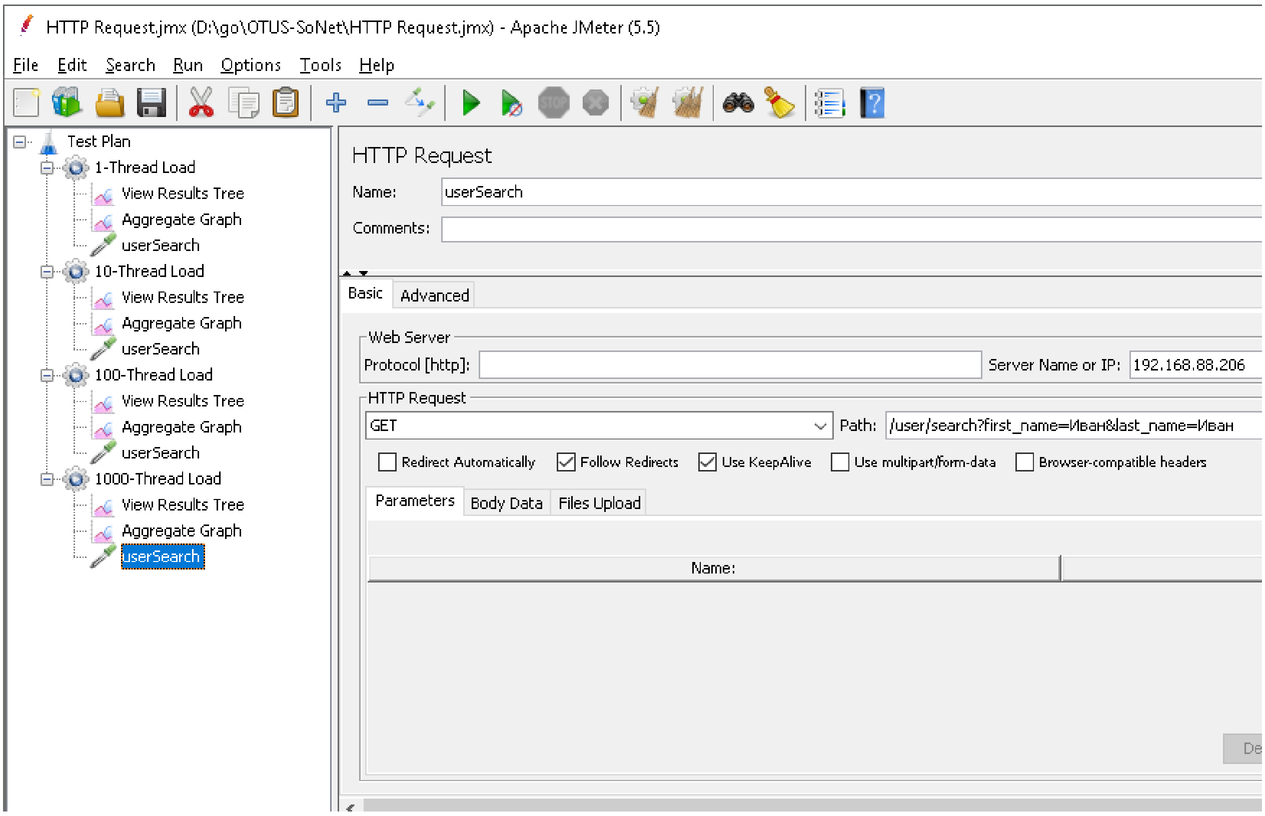
☑ Same user on each iteration

□ Delay Thread creation until needed

☑ Specify Thread lifetime

Duration (seconds): 300

Startup delay (seconds):



HTTP Request

Name: userSearch

Comments:

Web Server

Protocol [http]: Server Name or IP: 192.168.88.206

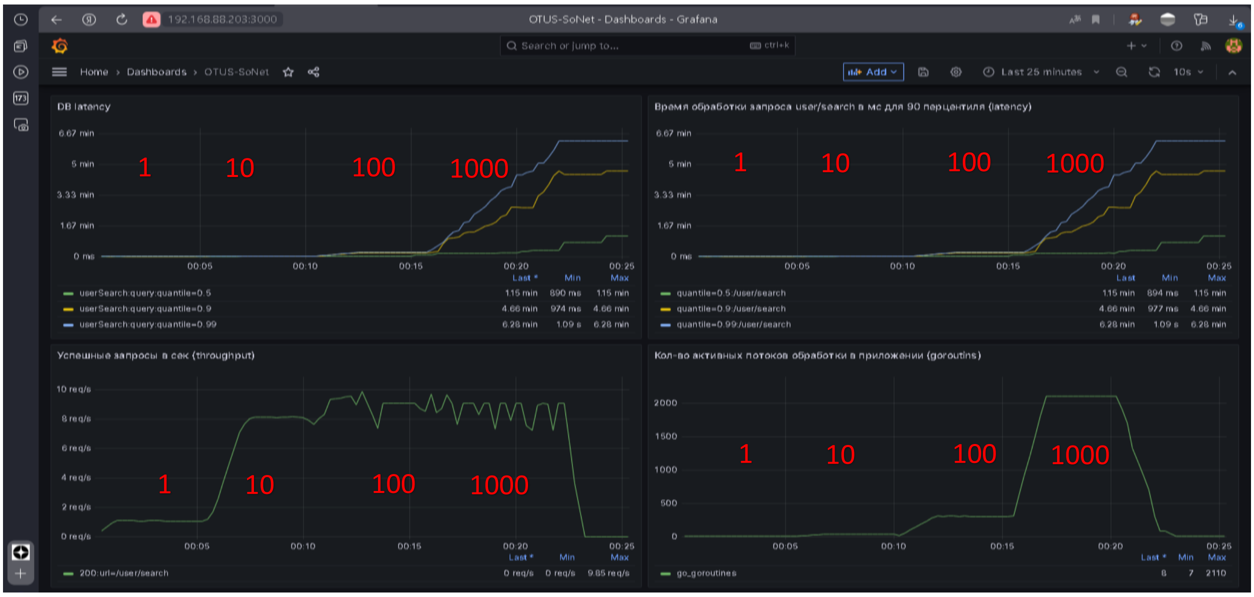
HTTP Request

GET Path: /user/search?first_name=Иван&last_name=Иван

□ Redirect Automatically ☑ Follow Redirects ☑ Use KeepAlive □ Use multipart/form-data □ Browser-compatible headers

Name:

Общая картина для всех 4 испытаний без индексов:


192.168.88.203:3000
OTUS-SoNet - Dashboards - Grafana
Search or jump to...
ctrl+k
Home › Dashboards › OTUS-SoNet
Add
Last 25 minutes
10s
DB latency
6.67 min
5 min
3.33 min
1.67 min
0 ms
00:05
00:10
00:15
00:20
00:25
1
10
100
1000
Время обработки запроса user/search в мс для 90 перцентиля (latency)
Успешные запросы в сек (throughput)
10 req/s
8 req/s
6 req/s
4 req/s
2 req/s
0 req/s
Кол-во активных потоков обработки в приложении (goroutins)
2000
1500
1000
500
0

DB latency

	Last *	Min	Max
userSearch:query:quantile=0.5	1.15 min	890 ms	1.15 min
userSearch:query:quantile=0.9	4.66 min	974 ms	4.66 min
userSearch:query:quantile=0.99	6.28 min	1.09 s	6.28 min

Время обработки запроса user/search в мс для 90 перцентиля (latency)

	Last	Min	Max
quantile=0.5:/user/search	1.15 min	894 ms	1.15 min
quantile=0.9:/user/search	4.66 min	977 ms	4.66 min
quantile=0.99:/user/search	6.28 min	1.09 s	6.28 min

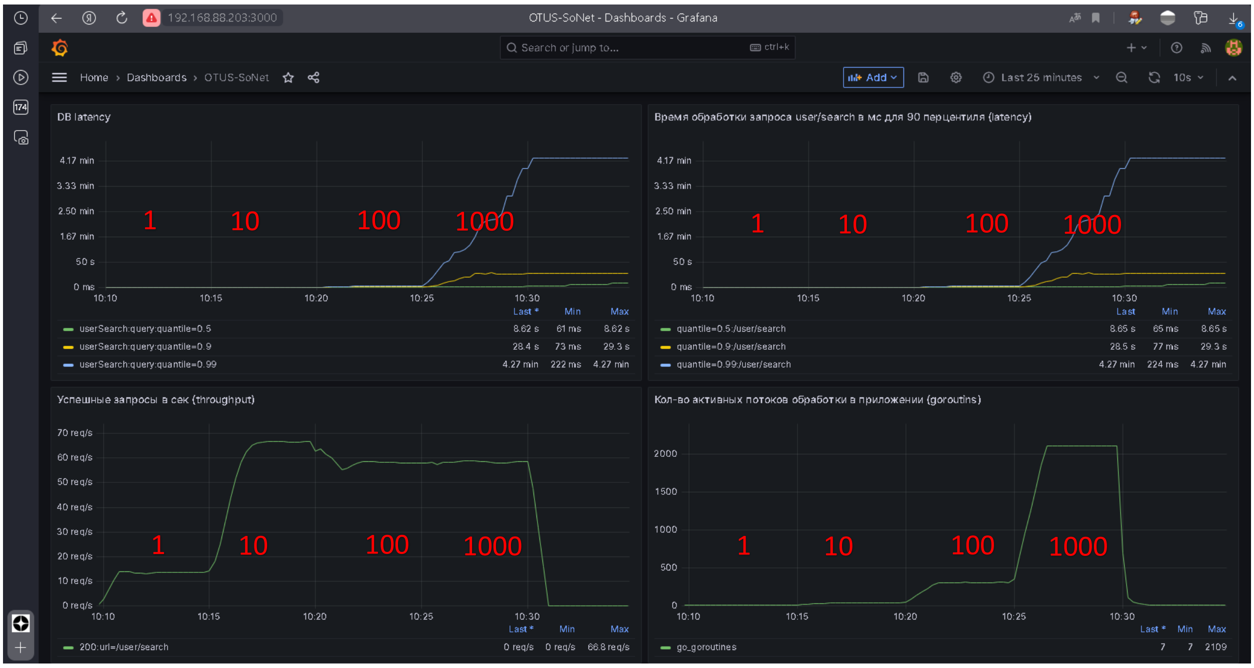
Успешные запросы в сек (throughput)

	Last *	Min	Max
200:url=/user/search	0 req/s	0 req/s	9.85 req/s

Кол-во активных потоков обработки в приложении (goroutins)

	Last *	Min	Max
go_goroutines	8	7	2110

Общая картина для всех 4 испытаний с индексами:



DB latency

	Last *	Min	Max
userSearch:query:quantile=0.5	8.62 s	61 ms	8.62 s
userSearch:query:quantile=0.9	28.4 s	73 ms	29.3 s
userSearch:query:quantile=0.99	4.27 min	222 ms	4.27 min

Время обработки запроса user/search в мс для 90 перцентиля (latency)

	Last	Min	Max
quantile=0.5:/user/search	8.65 s	65 ms	8.65 s
quantile=0.9:/user/search	28.5 s	77 ms	29.3 s
quantile=0.99:/user/search	4.27 min	224 ms	4.27 min

Успешные запросы в сек (throughput)

	Last *	Min	Max
200:url=/user/search	0 req/s	0 req/s	66.8 req/s

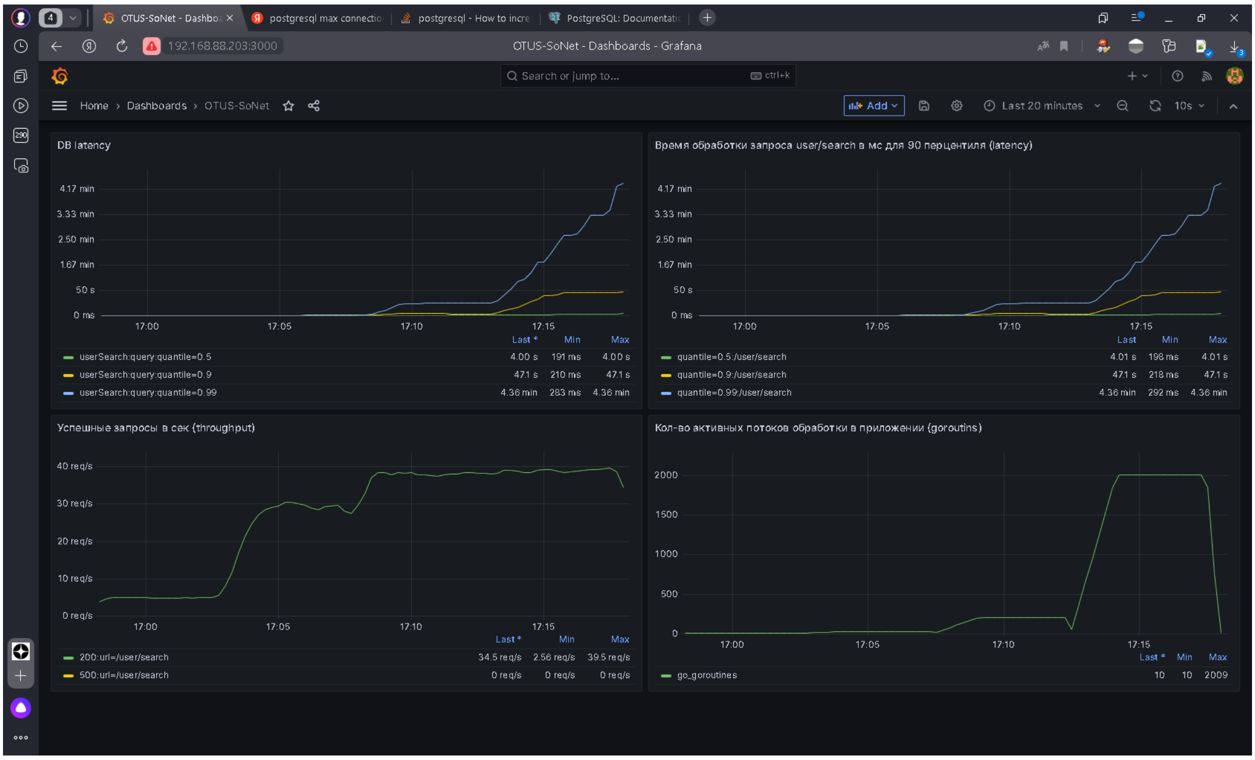
Кол-во активных потоков обработки в приложении (goroutins)

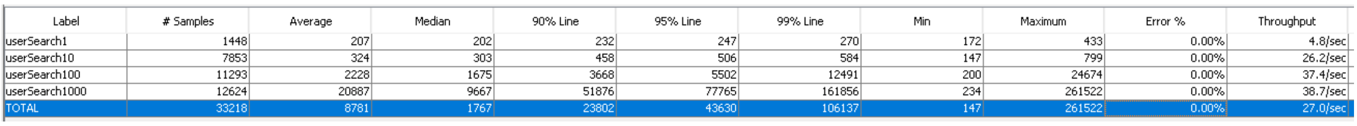
	Last *	Min	Max
go_goroutines	7	7	2109

Сравнительная таблица:

Параметр	Пользователей	Без индекса		С индексом	
		мин	макс	мин	макс
Latency (90 перцентиль), ms	1	974	1090	73	73
	10	1290	1310	151	152
	100	10000	12600	1430	1850
	1000	61800	162000	5060	27200
Throughput, rps	1	1	1	14	14
	10	8	8	65	66
	100	7	9	55	58
	1000	7	9	57	59

PostgreSQL:


OTUS-SoNet - Dashbo
postgresql max connectio
postgresql - How to incre
PostgreSQL: Documentati
192.168.88.203:3000
OTUS-SoNet - Dashboards - Grafana
Search or jump to...
ctrl+k
Home › Dashboards › OTUS-SoNet
Add
Last 20 minutes
10s
DB latency
4.17 min
3.33 min
2.50 min
1.67 min
50 s
0 ms
17:00
17:05
17:10
17:15
Last * Min Max
userSearch:query:quantile=0.5 4.00 s 191 ms 4.00 s
userSearch:query:quantile=0.9 47.1 s 210 ms 47.1 s
userSearch:query:quantile=0.99 4.36 min 283 ms 4.36 min
Время обработки запроса user/search в мс для 90 перцентиля (latency)
4.17 min
3.33 min
2.50 min
1.67 min
50 s
0 ms
17:00
17:05
17:10
17:15
Last Min Max
quantile=0.5:/user/search 4.01 s 198 ms 4.01 s
quantile=0.9:/user/search 47.1 s 218 ms 47.1 s
quantile=0.99:/user/search 4.36 min 292 ms 4.36 min
Успешные запросы в сек (throughput)
40 req/s
30 req/s
20 req/s
10 req/s
0 req/s
17:00
17:05
17:10
17:15
Last * Min Max
200:url=/user/search 34.5 req/s 2.56 req/s 39.5 req/s
500:url=/user/search 0 req/s 0 req/s 0 req/s
Кол-во активных потоков обработки в приложении (goroutins)
2000
1500
1000
500
0
17:00
17:05
17:10
17:15
Last * Min Max
go_goroutines 10 10 2009



Label	# Samples	Average	Median	90% Line	95% Line	99% Line	Min	Maximum	Error %	Throughput
userSearch1	1448	207	202	232	247	270	172	433	0.00%	4.8/sec
userSearch10	7853	324	303	458	506	584	147	799	0.00%	26.2/sec
userSearch100	11293	2228	1675	3668	5502	12491	200	24674	0.00%	37.4/sec
userSearch1000	12624	20887	9667	51876	77765	161856	234	261522	0.00%	38.7/sec
TOTAL	33218	8781	1767	23802	43630	106137	147	261522	0.00%	27.0/sec

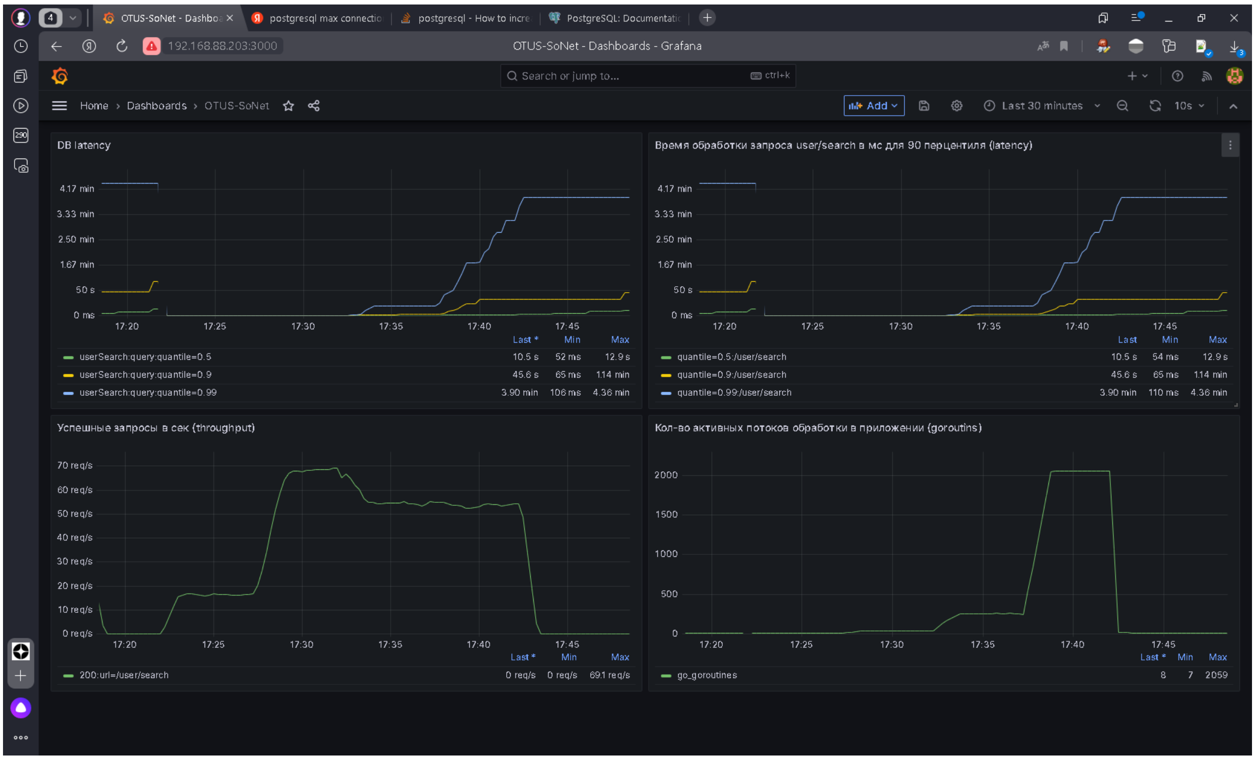
```
EXPLAIN SELECT u.id, u.first_name, u.second_name, u.birthdate, COALESCE(u.biography,'-') as
biography, u.city from public.user u WHERE u.first_name LIKE 'A%' AND u.second_name LIKE 'A%'
ORDER BY u.id;
                                   QUERY PLAN
--------------------------------------------------------------------------------------------------
 Sort  (cost=45559.10..45559.11 rows=1 width=136)
   Sort Key: id
   ->  Gather  (cost=1000.00..45559.09 rows=1 width=136)
         Workers Planned: 2
         ->  Parallel Seq Scan on "user" u  (cost=0.00..44558.99 rows=1 width=136)
               Filter: (((first_name)::text ~~ 'A%'::text) AND ((second_name)::text ~~ 'A%'::text))
(6 rows)
```

```
ALTER TABLE public.user ADD PRIMARY KEY (id);
CREATE INDEX idx_first_name ON public.user (first_name);
```

```
EXPLAIN SELECT u.id, u.first_name, u.second_name, u.birthdate, COALESCE(u.biography,'-') as
biography, u.city from public.user u WHERE u.first_name LIKE 'A%' AND u.second_name LIKE 'A%'
ORDER BY u.id;
                                   QUERY PLAN
--------------------------------------------------------------------------------------------------
 Sort  (cost=45595.24..45595.24 rows=1 width=136)
   Sort Key: id
   ->  Gather  (cost=1000.00..45595.22 rows=1 width=136)
         Workers Planned: 2
```

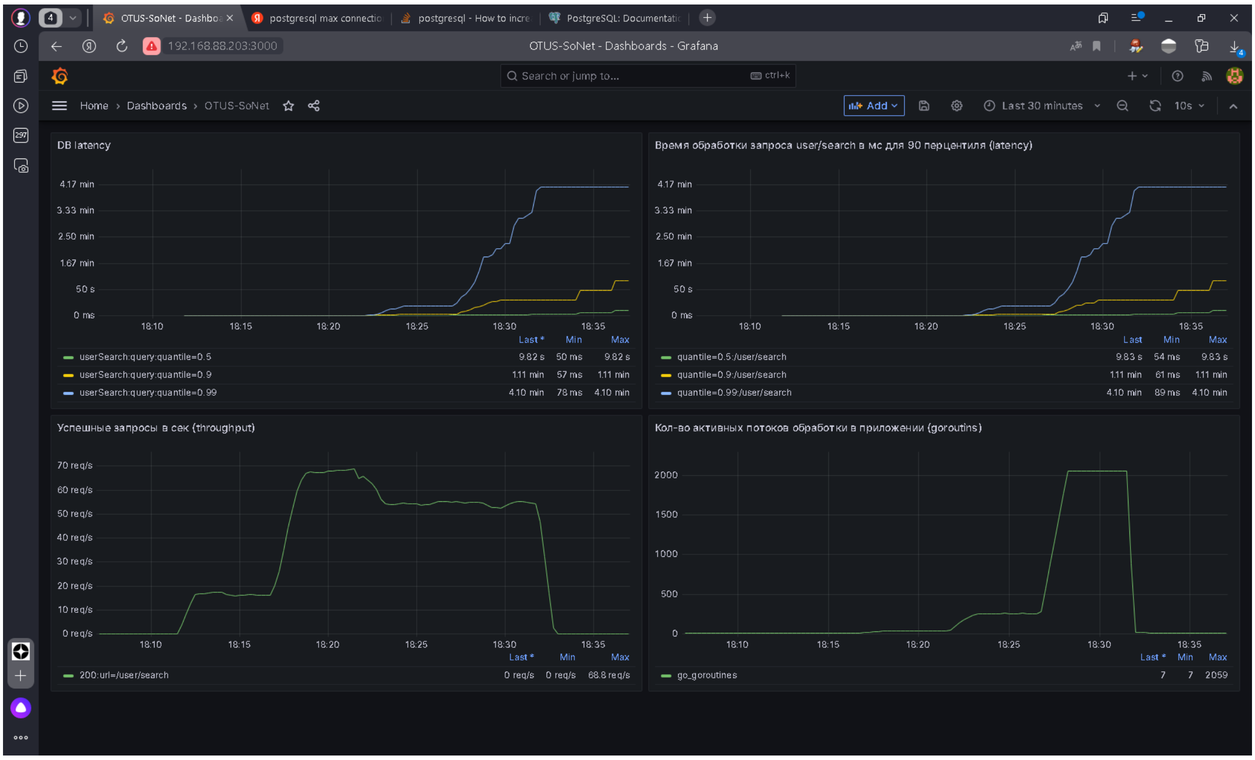
```
        ->  Parallel Seq Scan on "user" u  (cost=0.00..44595.12 rows=1 width=136)
              Filter: (((first_name)::text ~~ 'A%'::text) AND ((second_name)::text ~~ 'A%'::text))
(6 rows)
```

MySQL 50connects



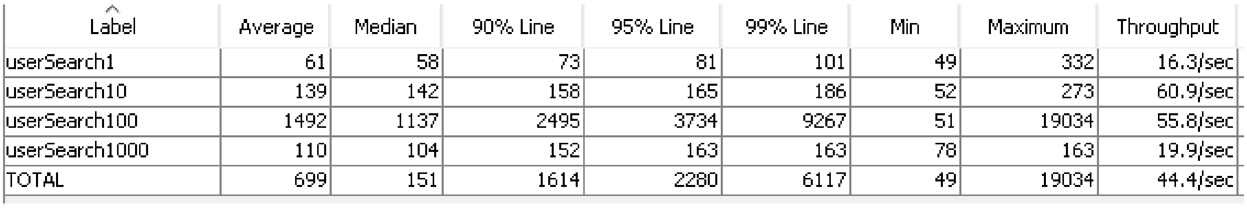
```
DB latency
                                   Last *     Min       Max
userSearch:query:quantile=0.5      10.5 s     52 ms     12.9 s
userSearch:query:quantile=0.9      45.6 s     65 ms     1.14 min
userSearch:query:quantile=0.99     3.90 min   106 ms    4.36 min

Время обработки запроса user/search в мс для 90 перцентиля (latency)
                                   Last       Min       Max
quantile=0.5:/user/search          10.5 s     54 ms     12.9 s
quantile=0.9:/user/search          45.6 s     65 ms     1.14 min
quantile=0.99:/user/search         3.90 min   110 ms    4.36 min

Успешные запросы в сек (throughput)
                                   Last *     Min       Max
200:url=/user/search               0 req/s    0 req/s   69.1 req/s

Кол-во активных потоков обработки в приложении (goroutins)
                                   Last *     Min       Max
go_goroutines                      8          7         2059
```

PostgreSQL 50 connects:



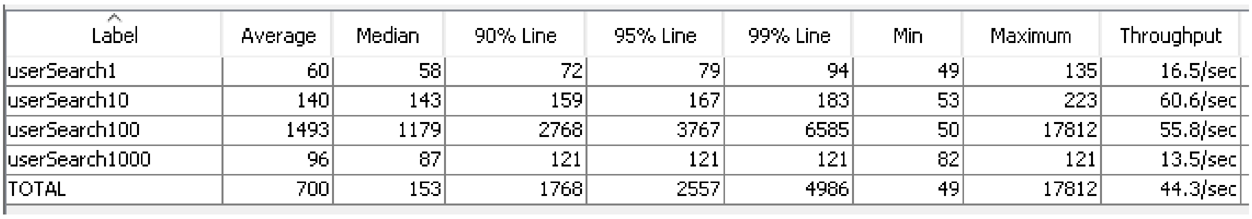
```
DB latency
                                   Last *     Min       Max
userSearch:query:quantile=0.5      9.82 s     50 ms     9.82 s
userSearch:query:quantile=0.9      1.11 min   57 ms     1.11 min
userSearch:query:quantile=0.99     4.10 min   78 ms     4.10 min

Время обработки запроса user/search в мс для 90 перцентиля (latency)
                                   Last       Min       Max
quantile=0.5:/user/search          9.83 s     54 ms     9.83 s
quantile=0.9:/user/search          1.11 min   61 ms     1.11 min
quantile=0.99:/user/search         4.10 min   89 ms     4.10 min

Успешные запросы в сек (throughput)
                                   Last *     Min       Max
200:url=/user/search               0 req/s    0 req/s   68.8 req/s

Кол-во активных потоков обработки в приложении (goroutins)
                                   Last *     Min       Max
go_goroutines                      7          7         2059
```

MySQL:



Label	Average	Median	90% Line	95% Line	99% Line	Min	Maximum	Throughput
userSearch1	61	58	73	81	101	49	332	16.3/sec
userSearch10	139	142	158	165	186	52	273	60.9/sec
userSearch100	1492	1137	2495	3734	9267	51	19034	55.8/sec
userSearch1000	110	104	152	163	163	78	163	19.9/sec
TOTAL	699	151	1614	2280	6117	49	19034	44.4/sec

PostgreSQL:



Label	Average	Median	90% Line	95% Line	99% Line	Min	Maximum	Throughput
userSearch1	60	58	72	79	94	49	135	16.5/sec
userSearch10	140	143	159	167	183	53	223	60.6/sec
userSearch100	1493	1179	2768	3767	6585	50	17812	55.8/sec
userSearch1000	96	87	121	121	121	82	121	13.5/sec
TOTAL	700	153	1768	2557	4986	49	17812	44.3/sec