zalando

NOSQL INSIDE SQL

STRATEGY AND TACTICS

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Не отвлекайся на всякий вздор

Только Postgres
Только хардкор

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➔ Jsonb internals and performance-related factors

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- ➔ Jsonb internals and performance-related factors
- ➔ Benchmarks

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- ➔ Jsonb internals and performance-related factors
- ➔ Benchmarks
- ➔ How to shoot yourself in the foot

Internals

Performance-related factors

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Performance-related factors

➔ On-disk representation

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Performance-related factors

- ➔ On-disk representation
- ➔ In-memory representation

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Performance-related factors

- ➔ On-disk representation
- ➔ In-memory representation
- ➔ Indexing support

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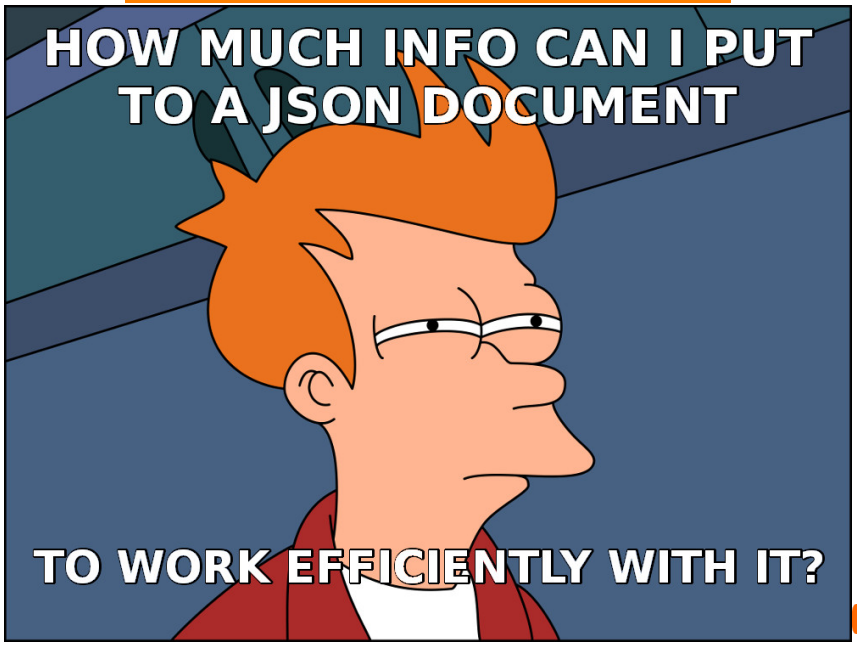
HOW MUCH INFO CAN I PUT TO A JSON DOCUMENT
TO WORK EFFICIENTLY WITH IT?

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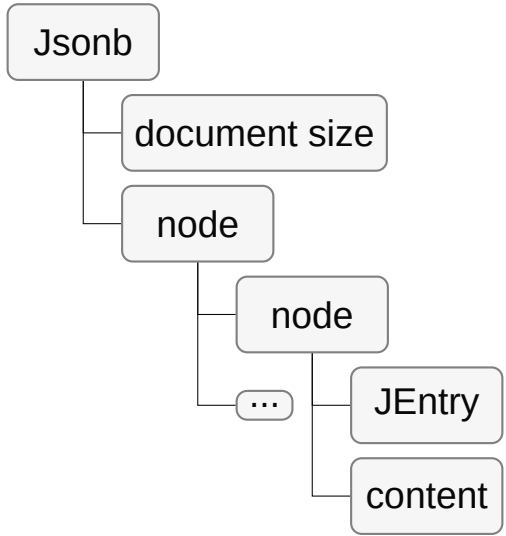

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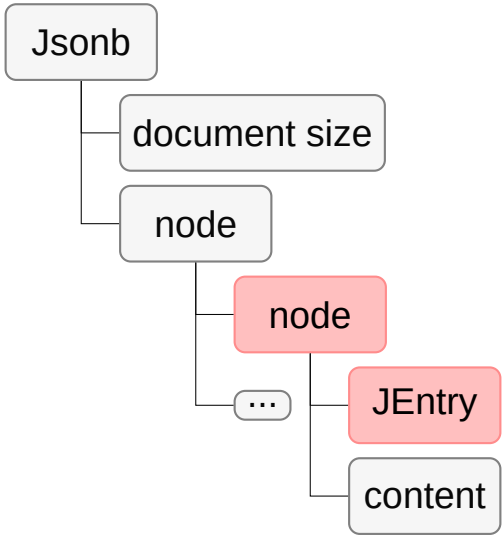
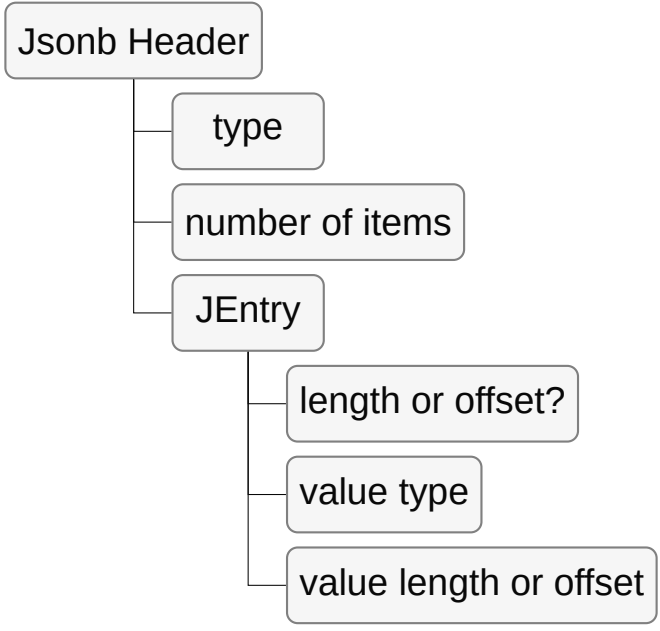


zalando


Jsonb Header
type
number of items
JEntry
length or offset?
value type
value length or offset

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JB_OFFSET_STRIDE

- JEntry may contains a value lenght or offset
- Offset = access speed
- Length = compressibility
- Every **JB_OFFSET_STRIDE**'th JEntry contains an offset
- Rest of them contain length

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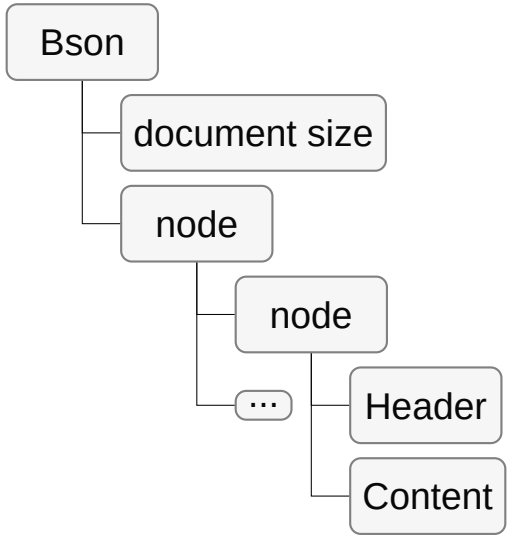
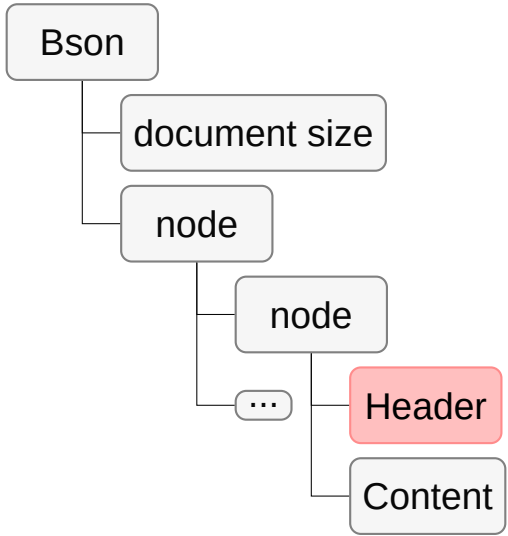
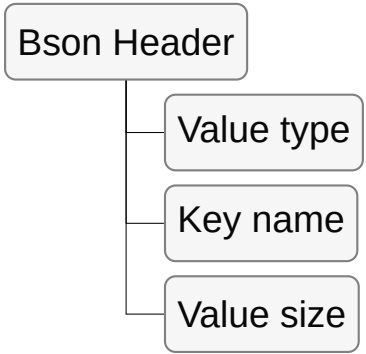


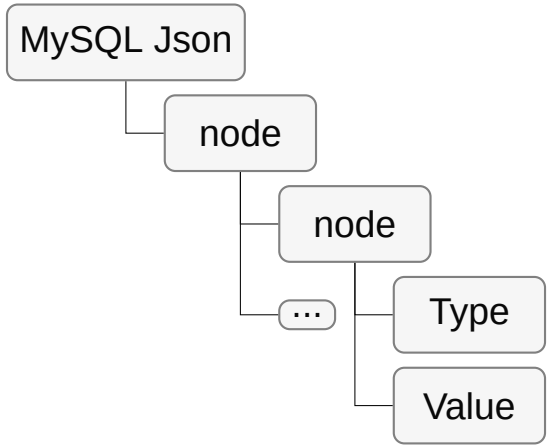
zalando



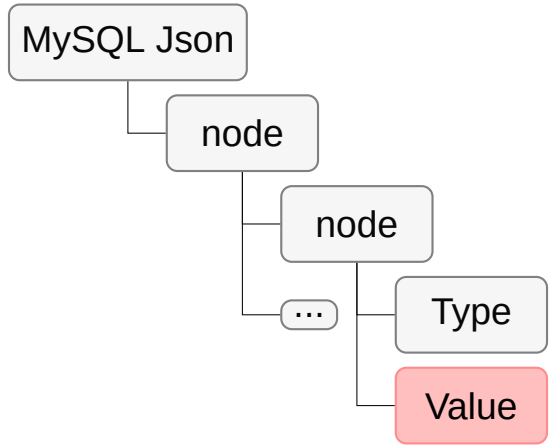
zalando



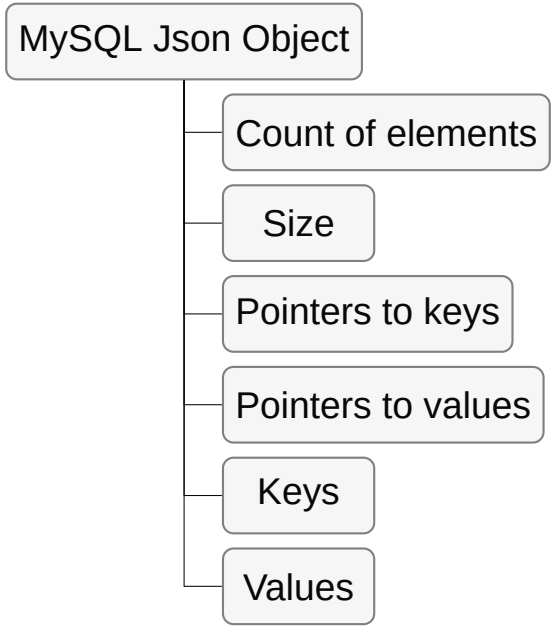
zalando



zalando



zalando


MySQL Json Object
Count of elements
Size
Pointers to keys
Pointers to values
Keys
Values

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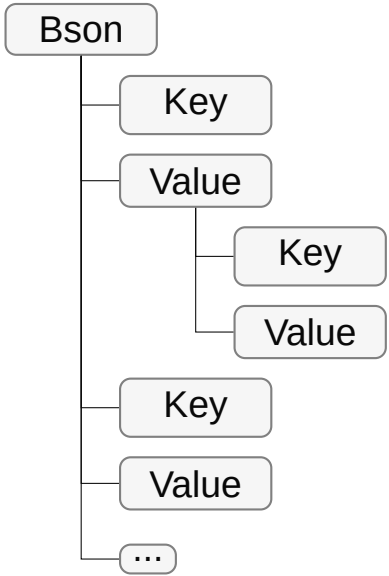
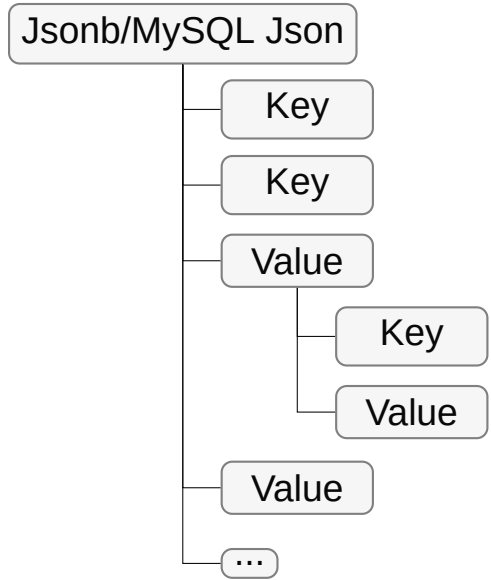

Bson
Key
Value
Key
Value
Key
Value
...


Jsonb/MySQL Json
Key
Key
Value
Key
Value
Value
...

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```
{"a": 3, "b": "xyz"}
```


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```
select pg_relation_filepath(oid),
relpages from pg_class
where relname = 'table_name';

 pg_relation_filepath | relpages
----------------------+----------
 base/40960/325477    |        0
(1 row)
```

```
\x10\x03\x00\x00\x00ab\x00\x00\x00\x00\x00\x00\x80\x03\x00xyz\x00\x00\x00\x00
```

```
bson.dumps({"a": 3, "b": u"xyz"})
```

```
\x17\x00\x00\x00\x10a\x00\x03\x00\x00\x00\x02b\x00\x04\x00\x00\x00xyz\x00\x00
```


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$ hexdump -C database/table.ibd

```
\x00\x02\x00\x18\x00\x12\x00\x01\x00\x13\x00\x01\x00\x05\x03\x00\x0c\x14\x00ab\x03xyz\x00
```


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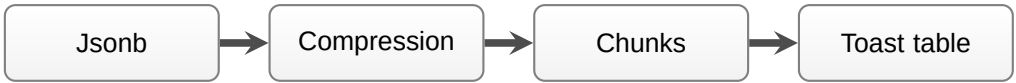
TOAST



- TOAST_TUPLE_THRESHOLD bytes (normally 2 kB)
- PostgreSQL and MySQL use LZ variation
- MongoDB uses snappy block compression

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Alignment

Variable-length portion is aligned to a 4-byte

```
insert into test
values('{"a": "aa", "b": 1}');
```

```
abaa\x20\x00\x00\x00\x00\x80\x01\x00
```

```
insert into test
values('{"a": 1, "b": "aa"}');
```

```
\x00\x00ab\x00\x00\x20\x00\x00\x00\x00\x80\x01\x00aa
```


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In-memory representation

- ➔ Tree-like representation (JsonbValue, Document, Json_dom)
- ➔ Little bit more expensive but more convenient to work with
- ➔ Mostly in use to modify data (except MySQL)
- ➔ Most of the read operations use on-disk representation

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Indexing support

- Postgresql – single field, multiple fields, entire document
- MongoDB – single field, multiple fields
- MySQL – virtual columns, single field, multiple fields

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PG indexing details

- ➔ JGIN_MAXLENGTH
- ➔ jsonb_path
- ➔ jsonb_path_ops

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Benchmarks

GREAT PERFORMANCE

AWS EC2

m4.xlarge instance

separate instance (database and generator)

16GB memory, 4 core 2.3GHz

Ubuntu 16.04

Same VPC and placement group

AMI that supports HVM virtualization type

at least 4 rounds of benchmark

PostgreSQL 9.6.3

MySQL 5.7.9

MongoDB 3.4.4

YCSB 0.9

10^6 rows and operations

AWS EC2

Configuration

shared_buffers

effective_cache_size

max_wal_size

innodb_buffer_pool_size

write concern level (journaled or transaction_sync)

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Document types

“simple” document
10 key/value pairs (100 characters)

“large” document
100 key/value pairs (200 characters)

“complex” document
100 keys, 3 nesting levels (100 characters)

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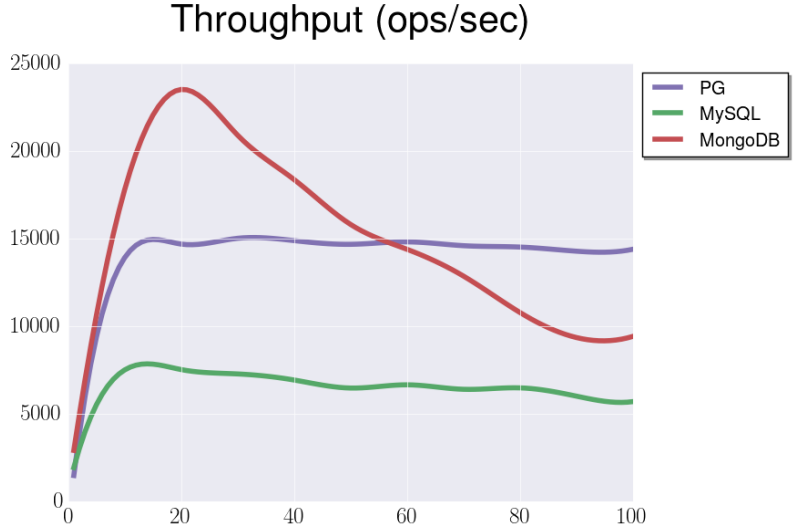
Select, GIN

”simple” document

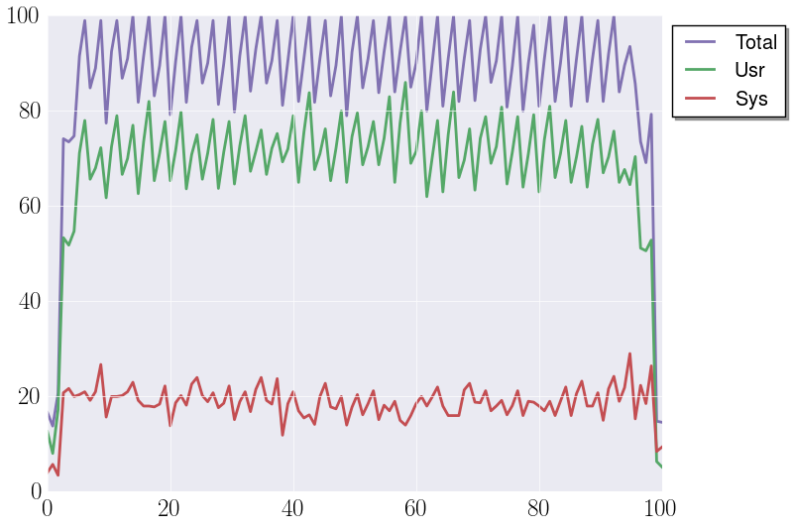
jsonb_path_ops

where data @> ’{”key”: ”value”}’::jsonb

zalando


Throughput (ops/sec)
25000
20000
15000
10000
5000
0
0
20
40
60
80
100
PG
MySQL
MongoDB

zalando



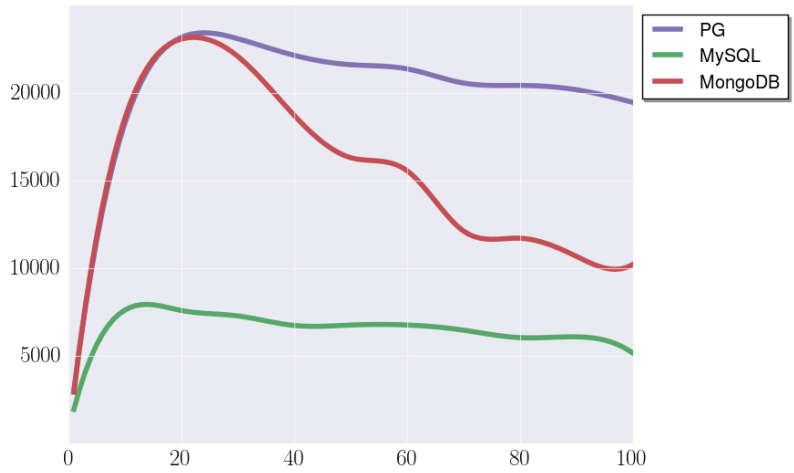
zalando

Select, BTree

”simple” document

btree

zalando


Throughput (ops/sec)
PG
MySQL
MongoDB
20000
15000
10000
5000
0
20
40
60
80
100

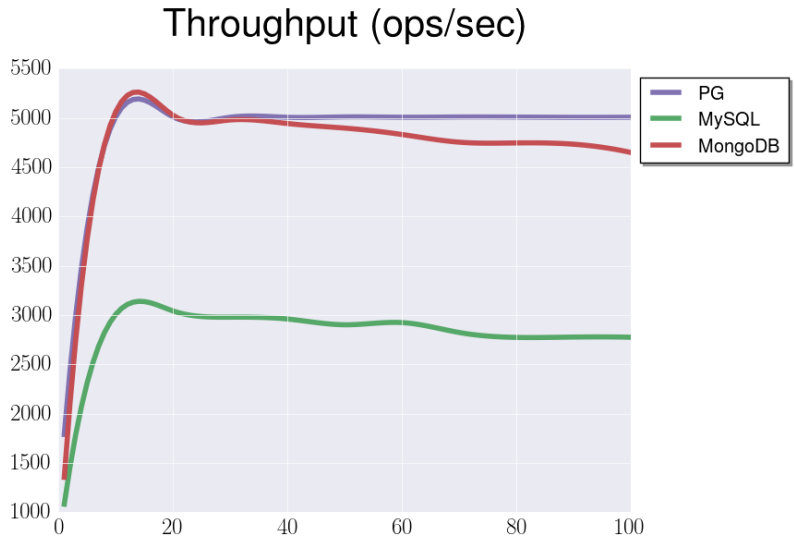
zalando

Select, BTree

”complex” document

btree

zalando


Throughput (ops/sec)
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
0
20
40
60
80
100
PG
MySQL
MongoDB

zalando

Scalability

”simple” document

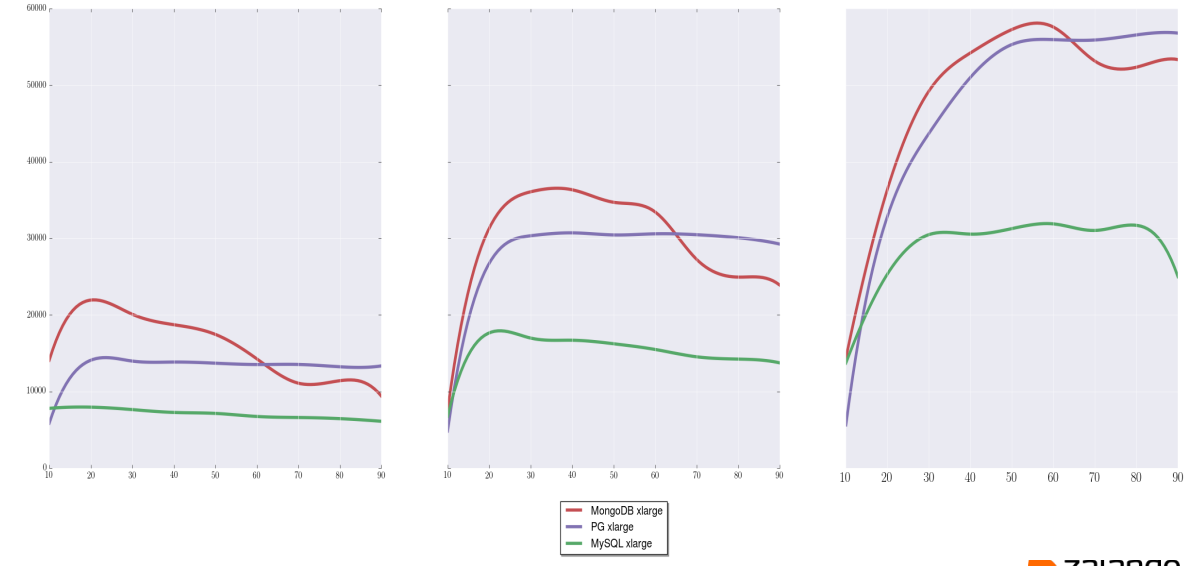
m4.large

m4.xlarge

m4.2xlarge

zalando

Throughput (ops/sec)



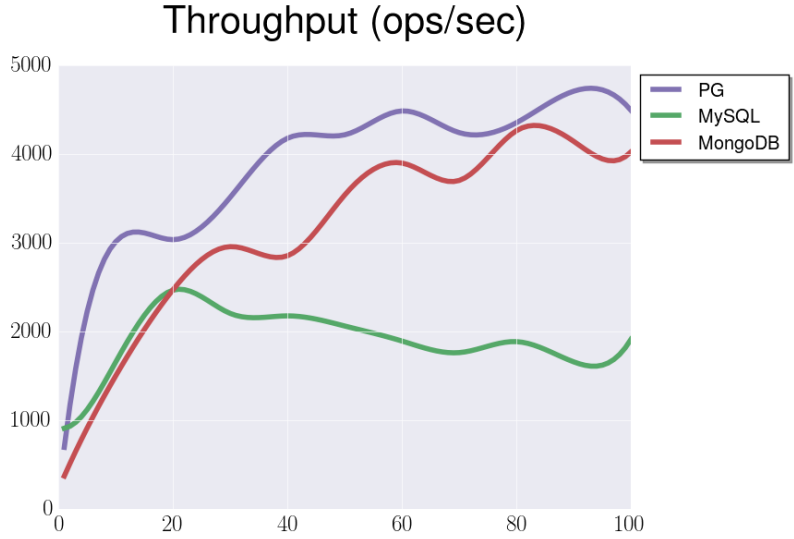
zalando

Insert

”simple” document

journaled

zalando


Throughput (ops/sec)
5000
4000
3000
2000
1000
0
0
20
40
60
80
100
PG
MySQL
MongoDB

zalando

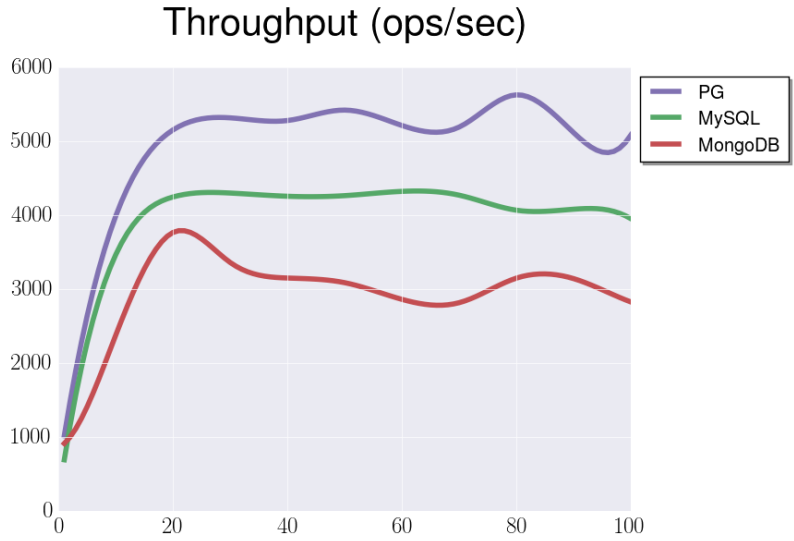
Update 50%, Select 50%

”simple” document

Update one field

transaction_sync

zalando


Throughput (ops/sec)
6000
5000
4000
3000
2000
1000
0
0
20
40
60
80
100
PG
MySQL
MongoDB

zalando

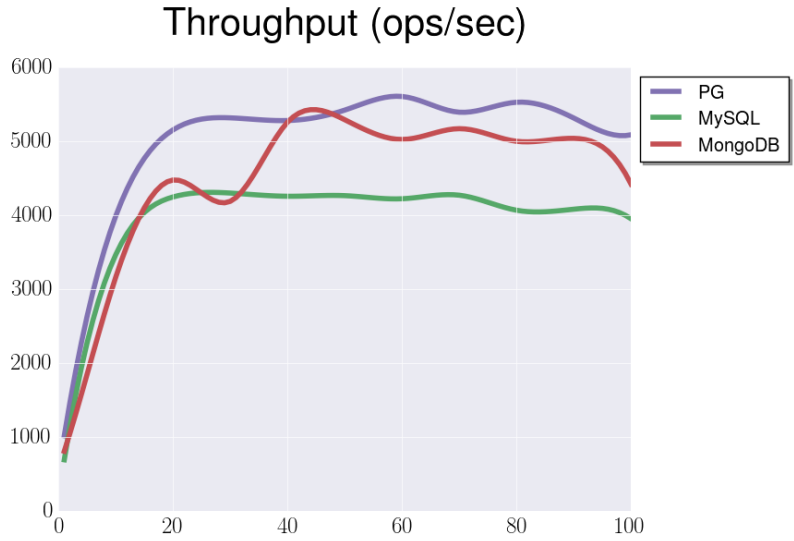
Update 50%, Select 50%

”simple” document

Update one field

journaled

zalando


Throughput (ops/sec)
6000
5000
4000
3000
2000
1000
0
0
20
40
60
80
100
PG
MySQL
MongoDB

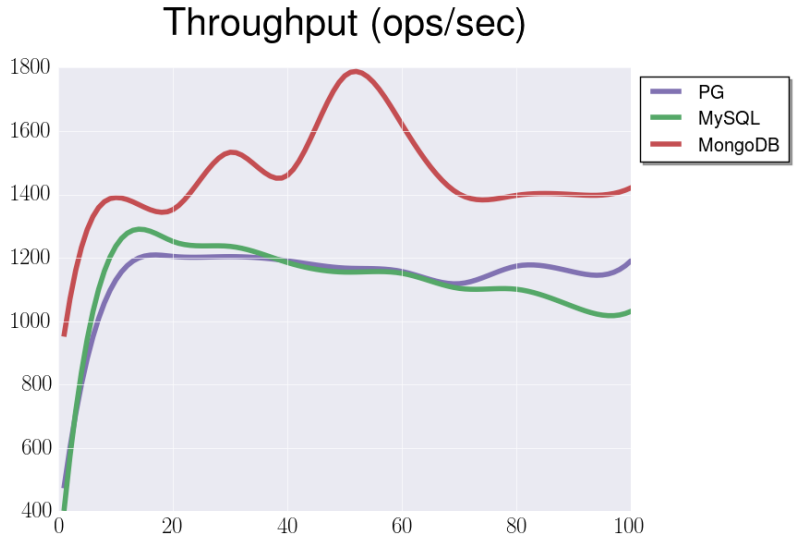
zalando

Update 50%, Select 50%

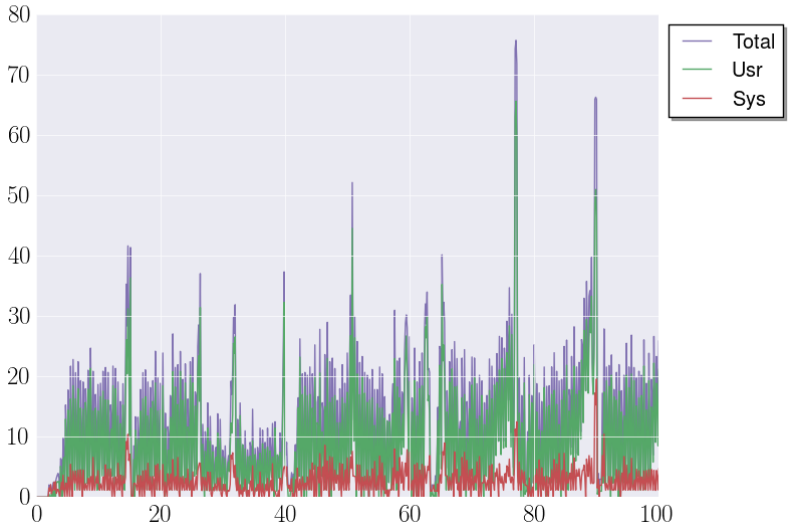
”large” document

Update one field

zalando

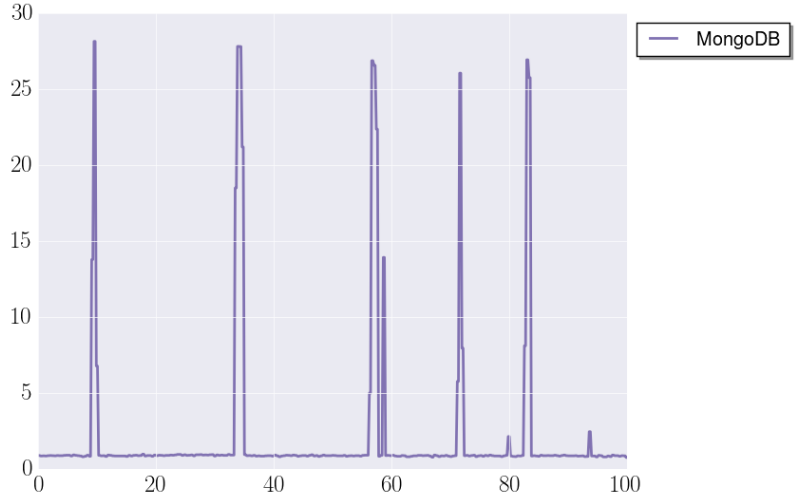

Throughput (ops/sec)
1800
1600
1400
1200
1000
800
600
400
0
20
40
60
80
100
PG
MySQL
MongoDB

zalando



zalando

IO queue size



zalando

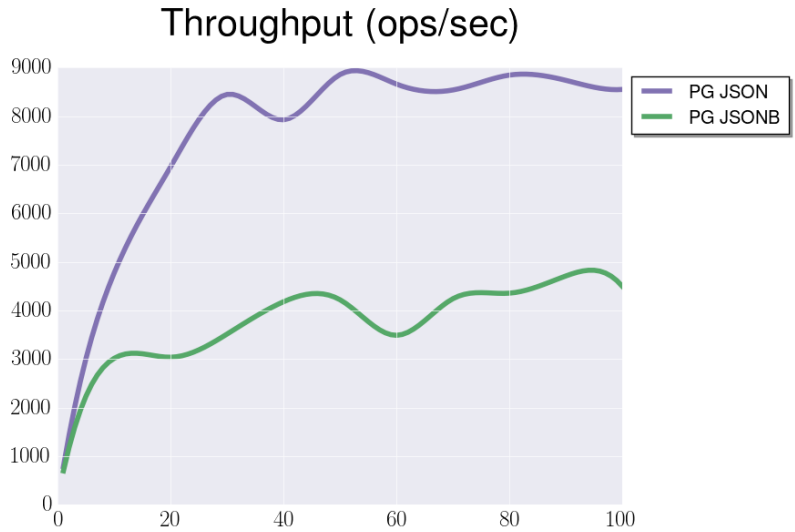
JSON vs JSONB

”simple” document

btree

insert

zalando


Throughput (ops/sec)
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
20
40
60
80
100
PG JSON
PG JSONB

zalando

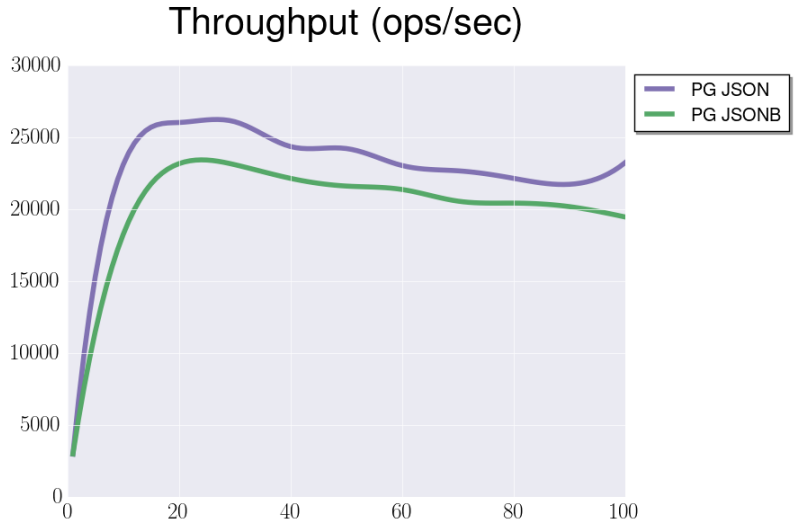
JSON vs JSONB

”simple” document

btree

select

zalando


Throughput (ops/sec)
30000
25000
20000
15000
10000
5000
0
0
20
40
60
80
100
PG JSON
PG JSONB

zalando

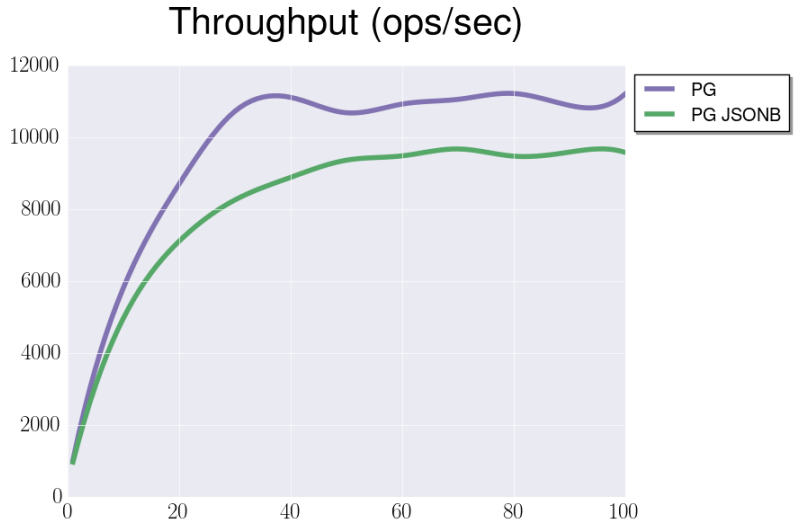
SQL vs JSONB

”simple” document

btree

insert

zalando


Throughput (ops/sec)
12000
10000
8000
6000
4000
2000
0
0
20
40
60
80
100
PG
PG JSONB

zalando

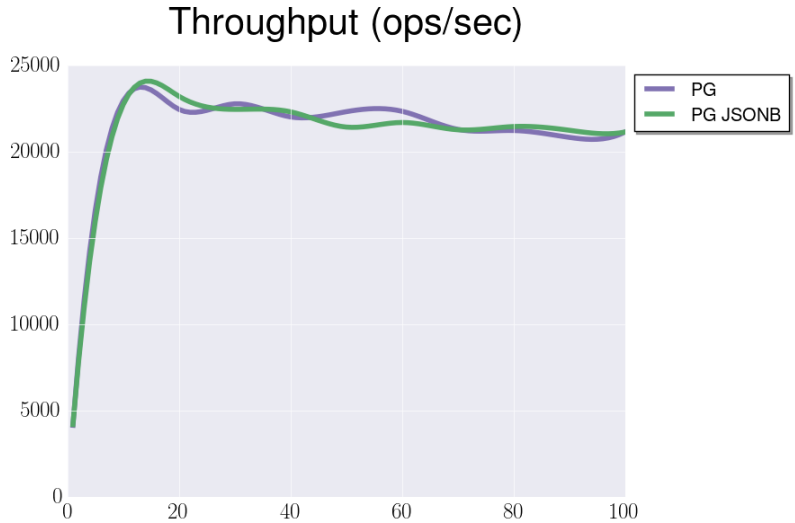
SQL vs JSONB

”simple” document

btree

select

zalando


Throughput (ops/sec)
25000
20000
15000
10000
5000
0
0
20
40
60
80
100
PG
PG JSONB

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How to bring it down acci-
dentally?

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- ➔ Update one field of a document
- ➔ DETOAST of a document
  (select, constraints, procedures etc.)
- ➔ Reindex of an entire document

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Document slice

”large” document

One field from a document

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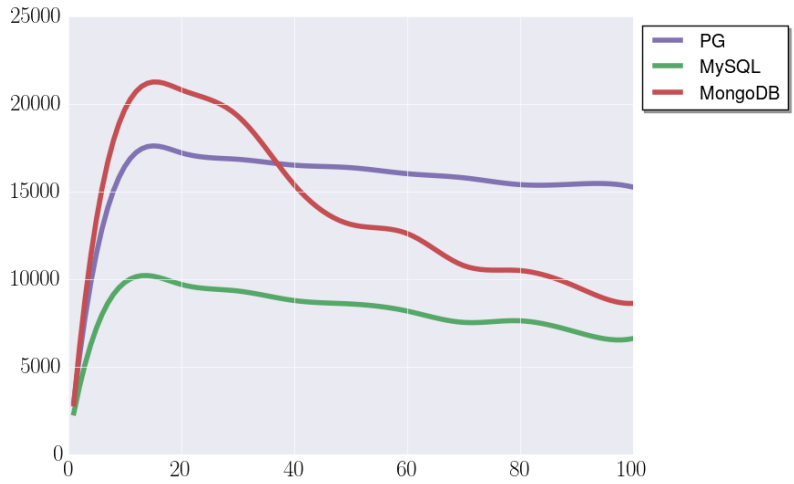
Throughput (ops/sec)
25000
20000
15000
10000
5000
0
0
20
40
60
80
100
PG
MySQL
MongoDB

zalando

Document slice

”large” document

10 fields from a document

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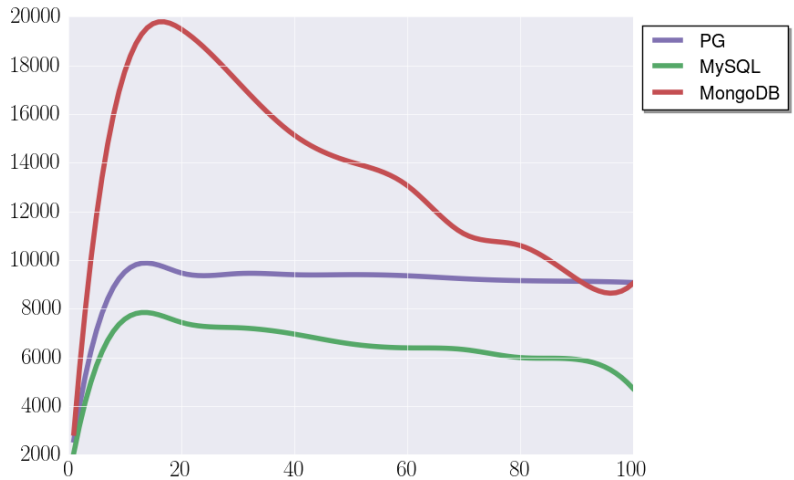
Throughput (ops/sec)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
20
40
60
80
100
PG
MySQL
MongoDB

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Document slice

```
create type test as ("a" text, "b" text);
insert into test_jsonb
values('{"a": 1, "b": 2, "c": 3}');
select q.* from test_jsonb,
jsonb_populate_record(NULL::test, data) as q;
 a | b
---+---
 1 | 2
(1 row)
```


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SET STORAGE EXTERNAL

TOAST_TUPLE_THRESHOLD

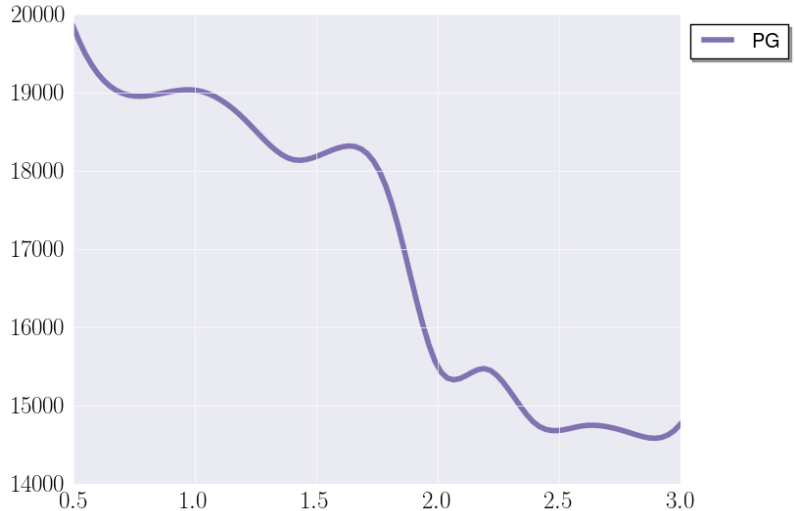
”simple” document

40 threads

different document size

select

zalando


Throughput, 40 clients
20000
19000
18000
17000
16000
15000
14000
0.5
1.0
1.5
2.0
2.5
3.0
PG

zalando

Select, GIN

”simple” document

jsonb_path_ops

where data @> jsonb_build_object(’key’, ’value’)

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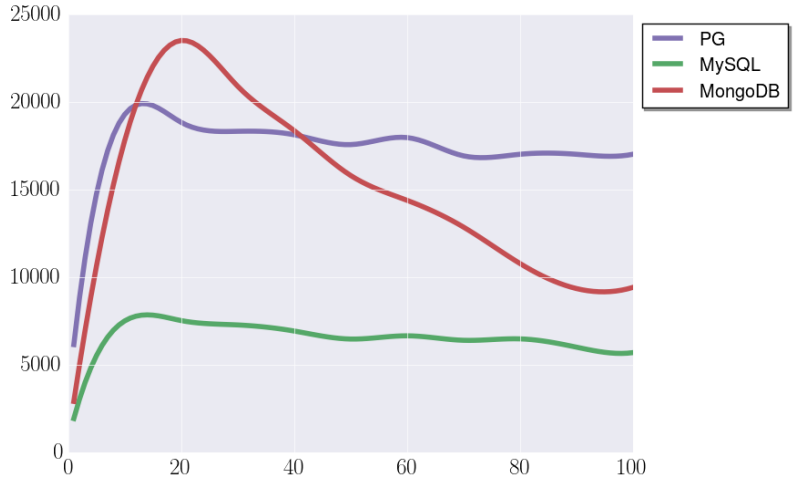
Throughput (ops/sec)
25000
20000
15000
10000
5000
0
0
20
40
60
80
100
PG
MySQL
MongoDB

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➔ Jsonb is more that good for many use cases

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- ➔ Jsonb is more that good for many use cases
- ➔ Benchmarks above are only ”hints”

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- ➔ Jsonb is more that good for many use cases
- ➔ Benchmarks above are only ”hints”
- ➔ You need your own tests

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Questions?

github.com/erthalion

@erthalion

9erthalion6 at gmail dot com

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