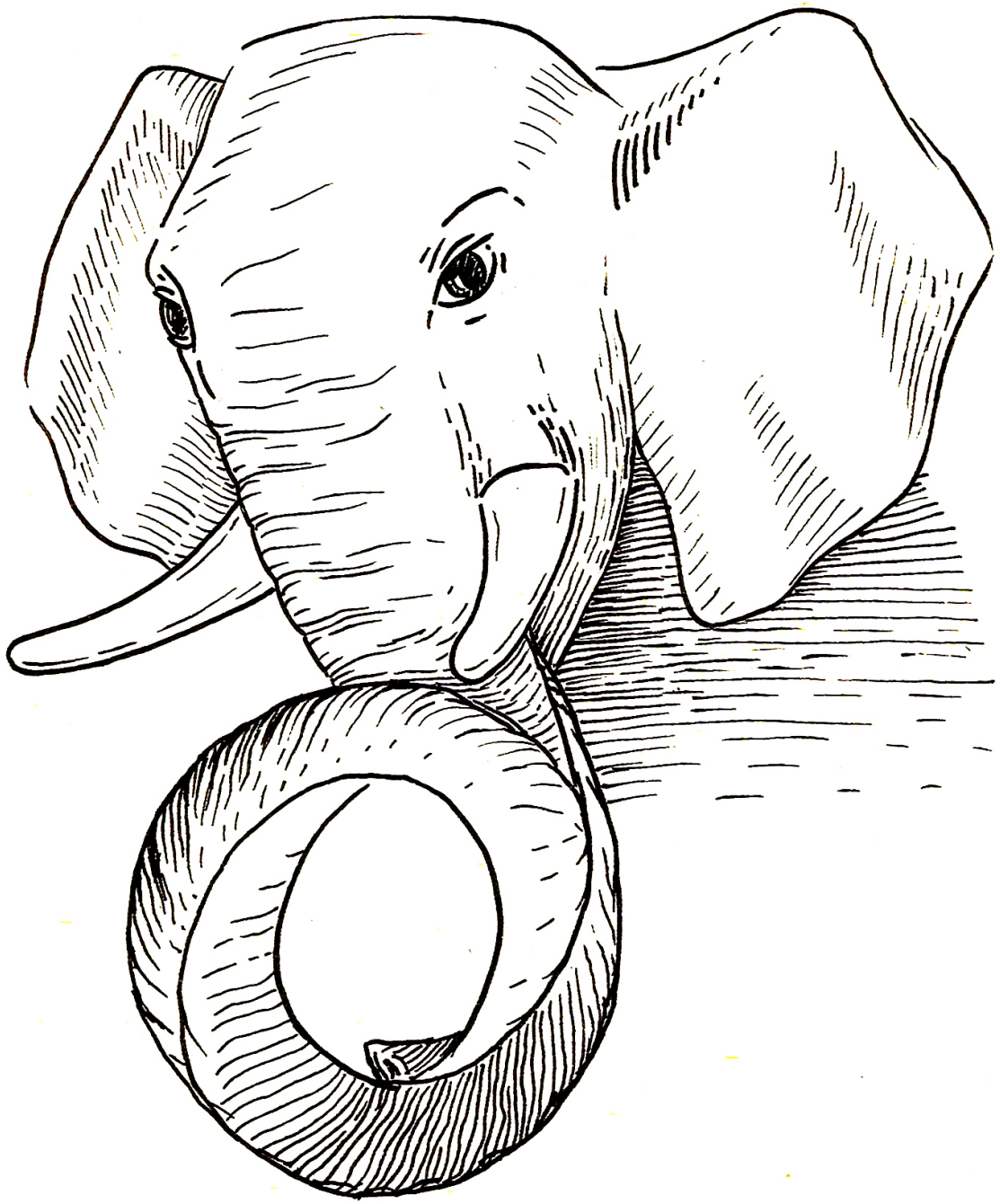
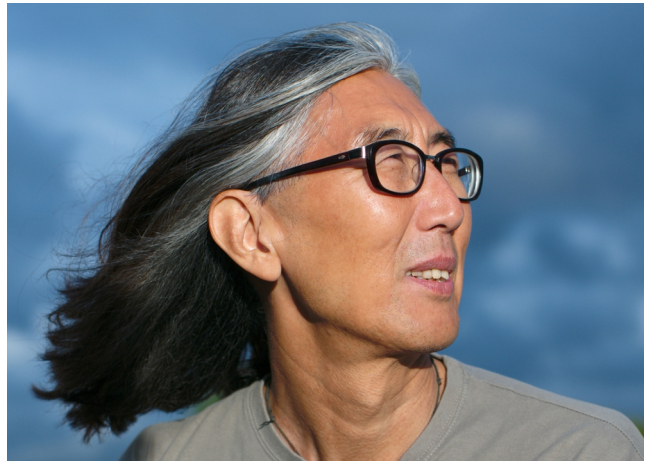


Viva, the NoSQL Postgres !

Oleg Bartunov
Lomonosov Moscow University,
Postgres Professional

FOSDEM '18 Brussels 3 & 4 February 2018



Oleg Bartunov

Major PostgreSQL contributor

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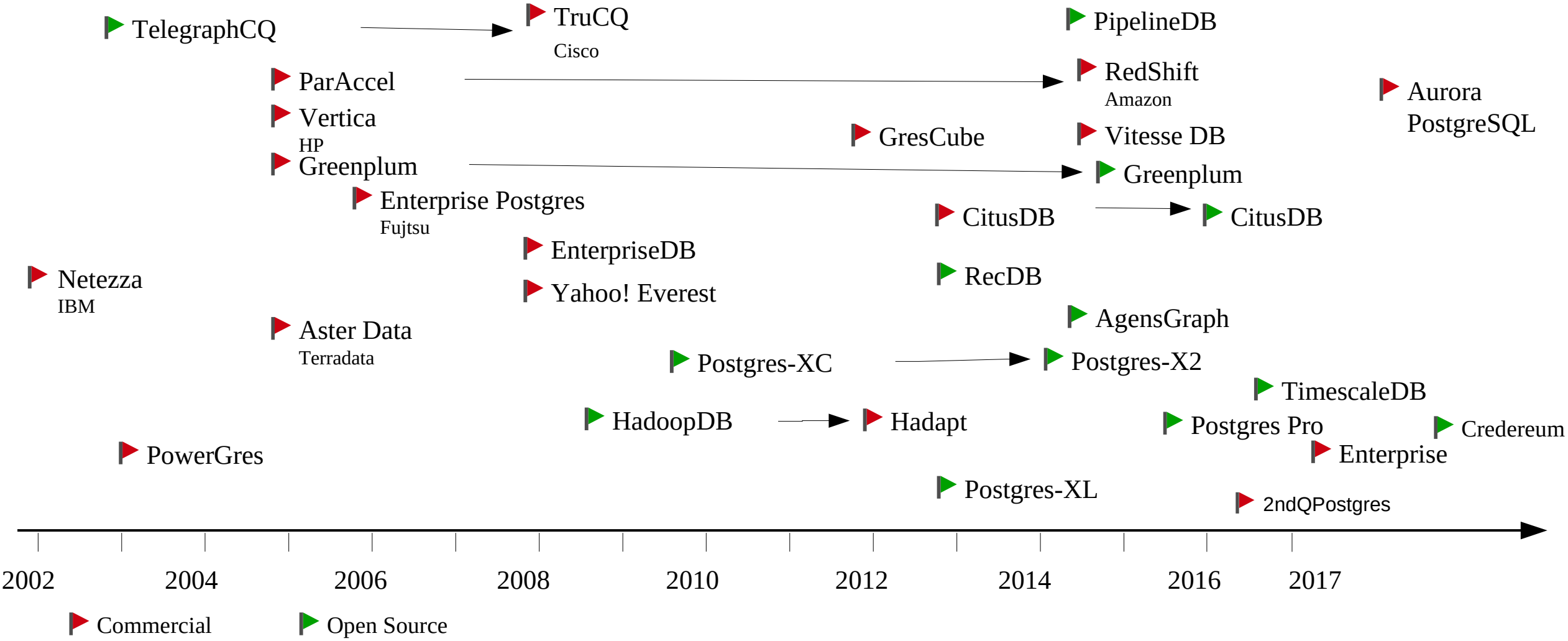
Since 1995

Five concepts in 15 minutes

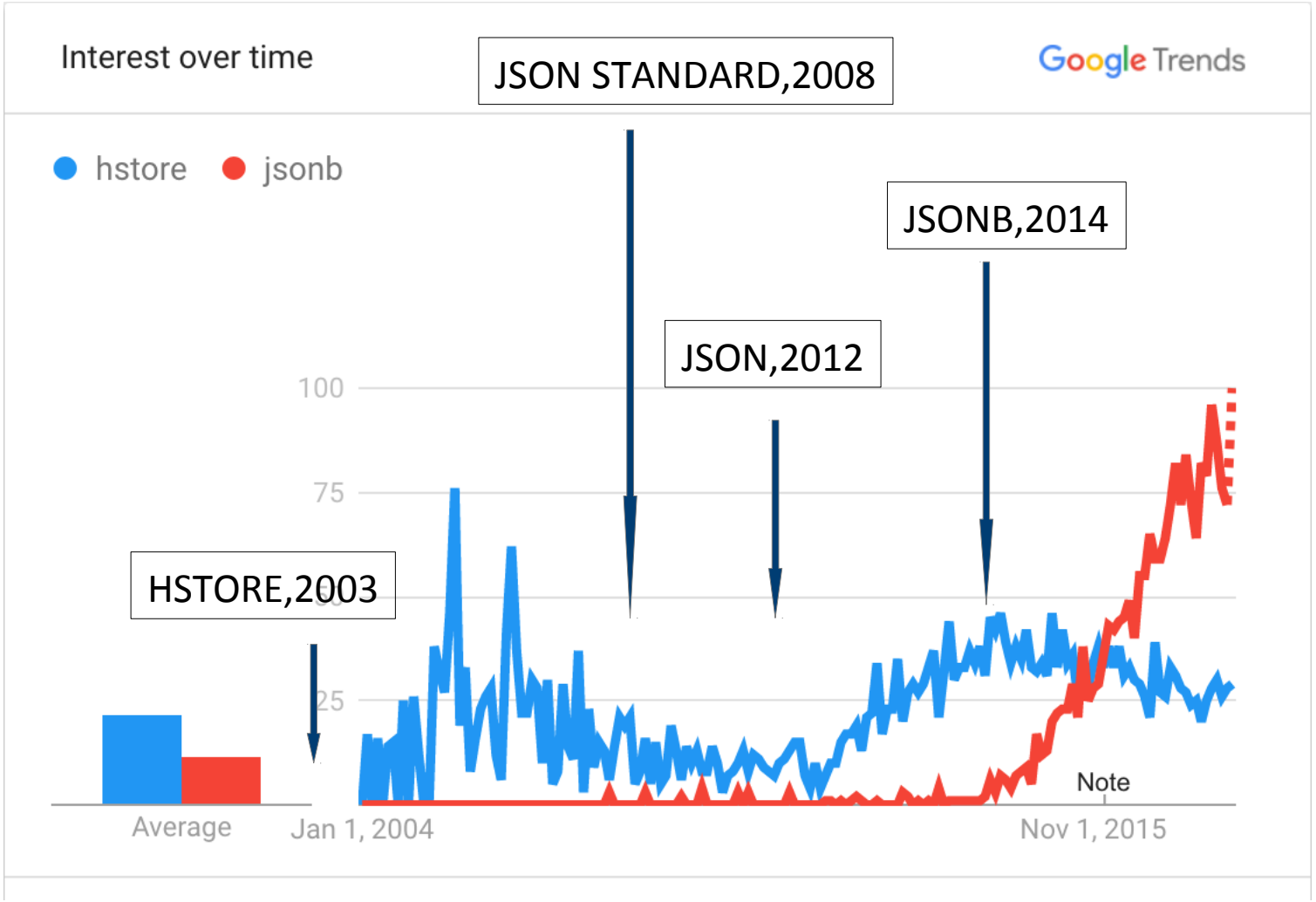
1) PostgreSQL is a COOL universal database
2) NoSQL in PostgreSQL is a MATURE feature
3) NoSQL PostgreSQL is fast
4) NoSQL PostgreSQL has GOOD roadmap
5) ALL YOU NEED IS Postgres !

PostgreSQL Forks: OLTP, MPP, OLAP, CLOUD, GIS, STREAM, TIMESERIES, GPU



NoSQL PostgreSQL is MATURE

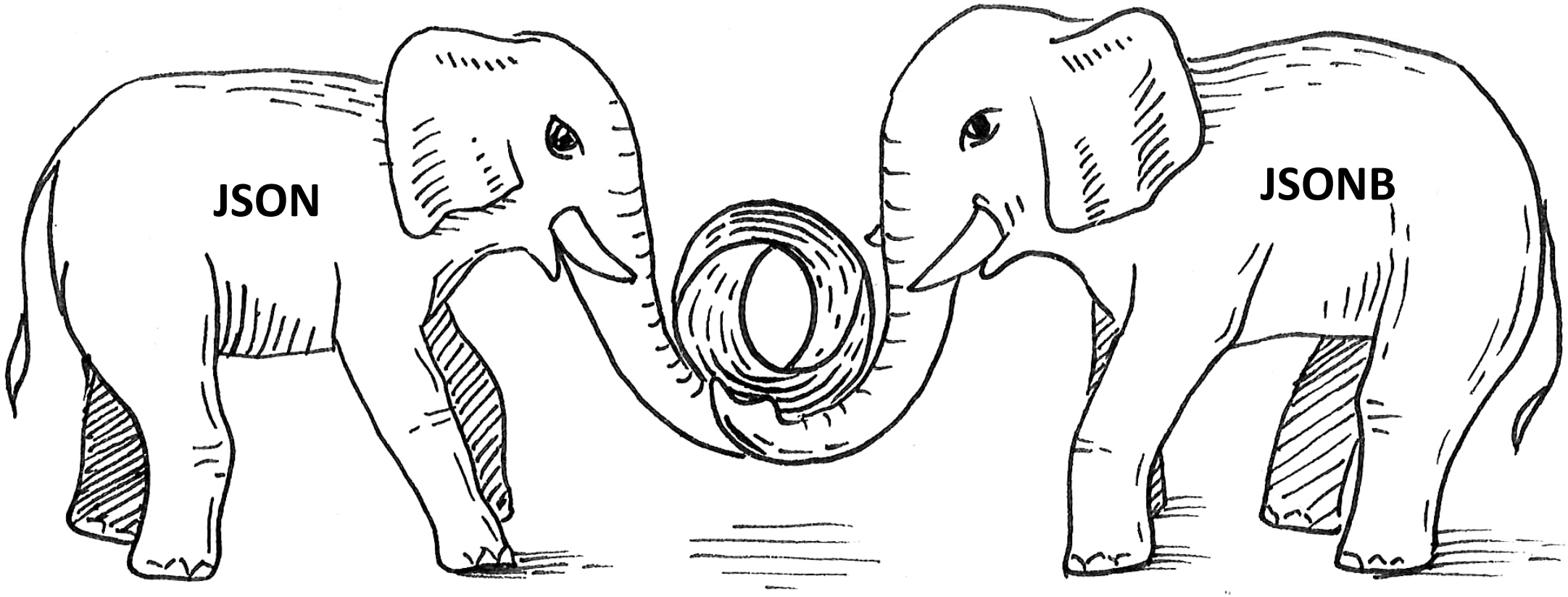
- HSTORE — binary key-value storage, index support
- 2003 — initial release
- 2006 — part of PostgreSQL



Two JSON data types !!!

Textual storage «as is»

Binary storage, index support



A lot of functionality !

SQL/Foundation recognizes JSON after 8 years

SQL/JSON in PostgreSQL

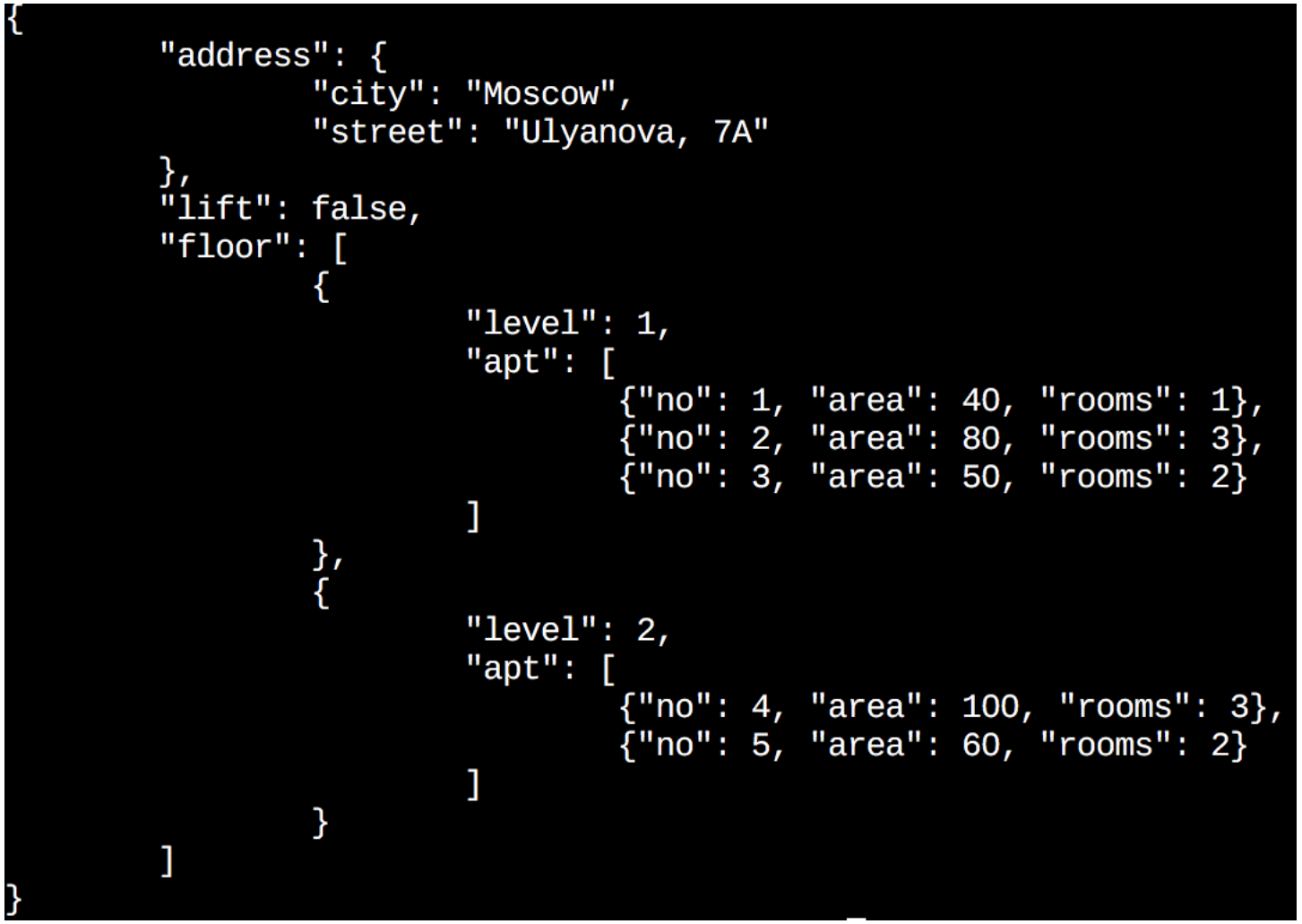
- PostgreSQL implementation (1 year of development)
  - Uses native data types JSON, JSONB
  - JSONPATH data type for SQL/JSON path language
  - Nine functions SQL/JSON functions for constructing:
    - JSON_OBJECT, JSON_ARRAY, JSON_OBJECTAGG, JSON_ARRAYAGG
  - and retrieving
    - JSON_VALUE, JSON_QUERY, JSON_TABLE, IS [NOT] JSON, JSON_EXISTS
  - Extensions: more methods, JSONB op JSONPATH

SQL/JSON in PostgreSQL

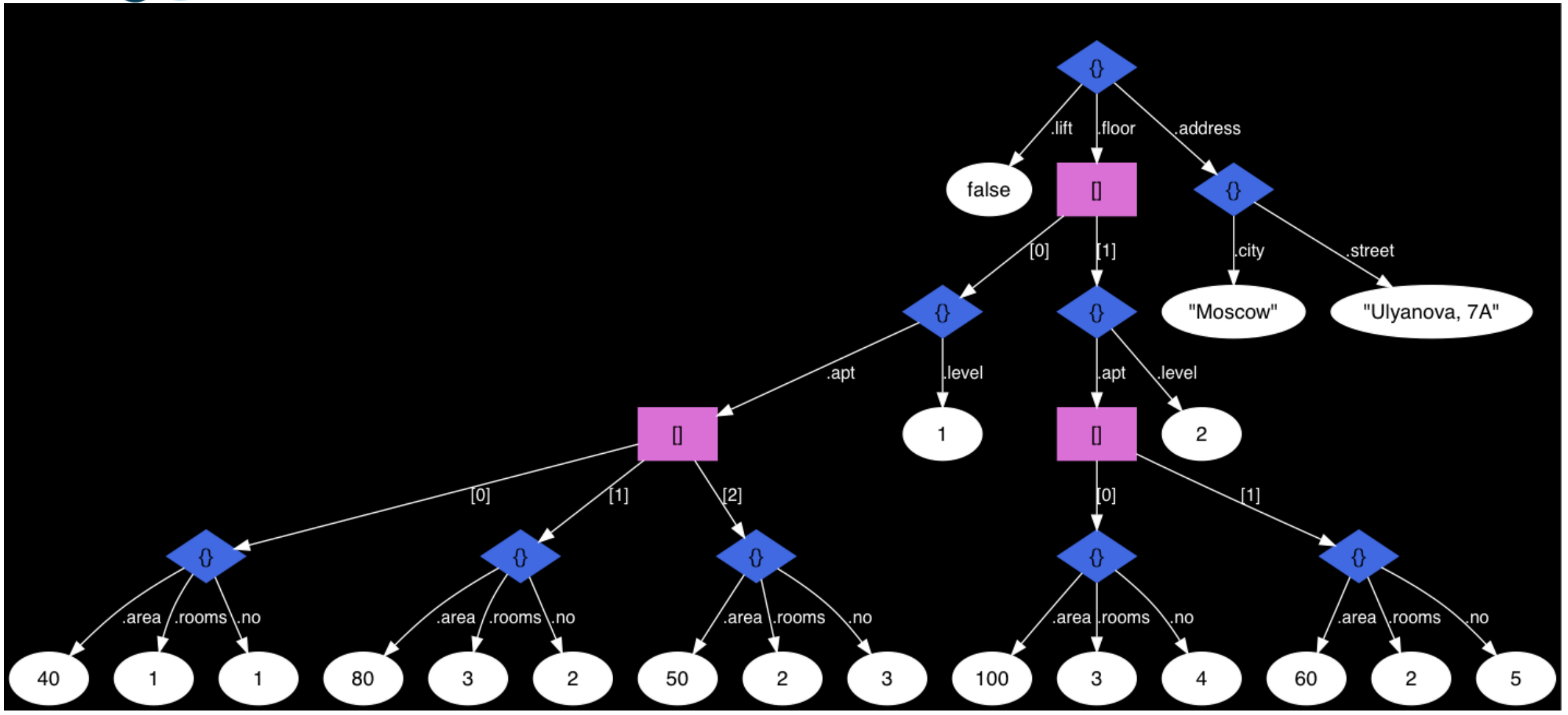
- SQL-2016 path language specifies the parts (the projection) of JSON data to be retrieved by path engine for SQL/JSON functions.
- **Jsonpath —** the binary data type for SQL/JSON path expression to effective query JSON data.

```
SELECT JSON_QUERY(js,
   '$.floor[*] ? (@.level >1).apt[*] ? (@.area>$min && @.area < $max).no'
                    PASSING 40 AS min, 90 AS max )
FROM house;
```

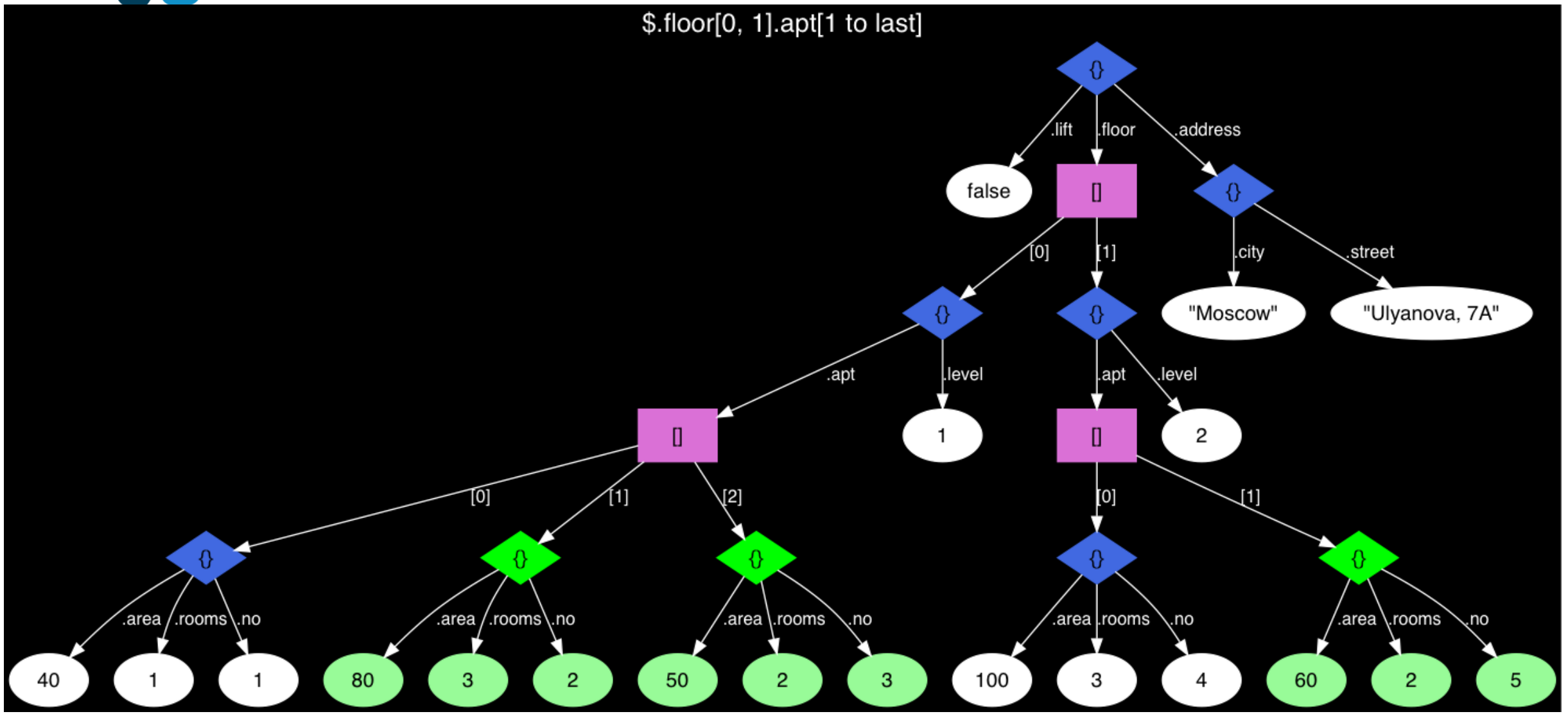
Visual guide on jsonpath



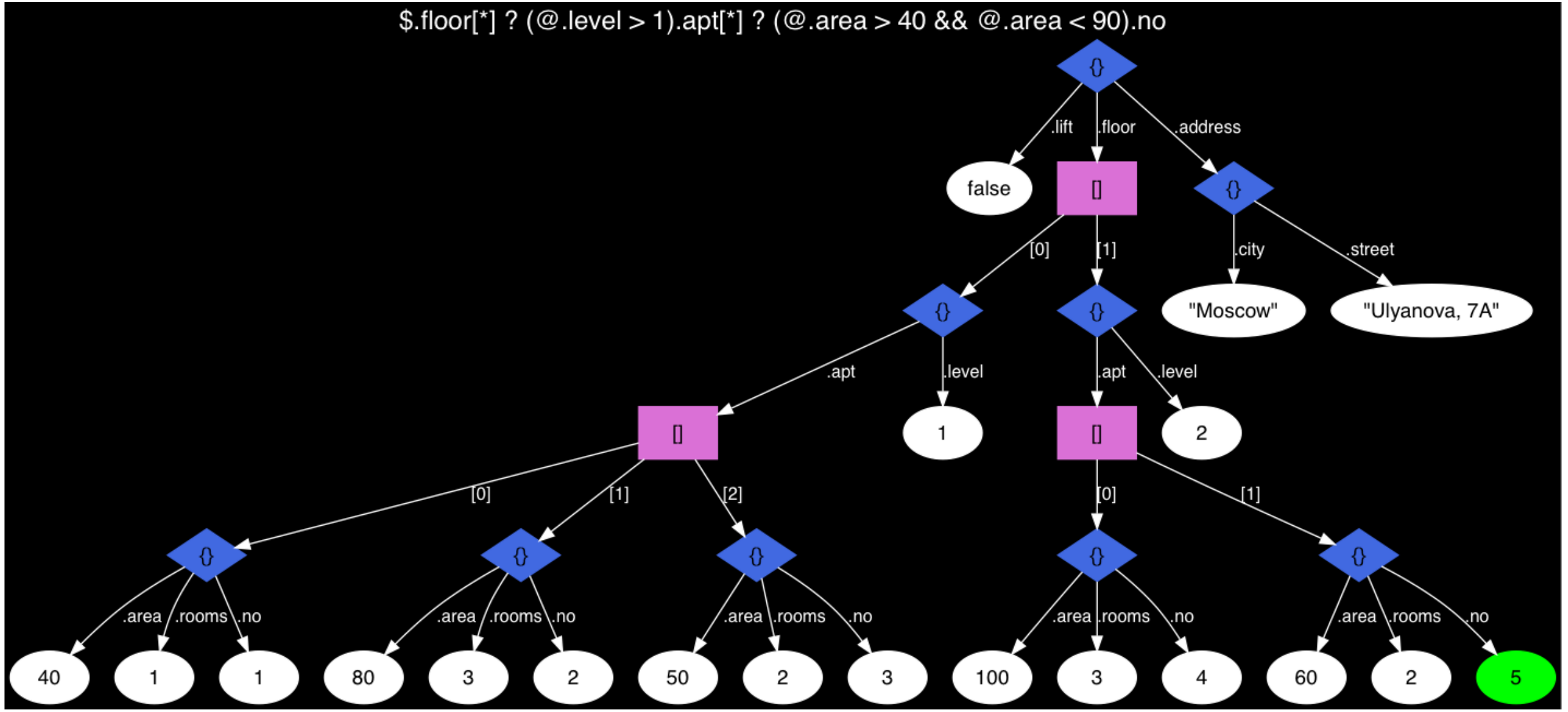
2-floors house



$.floor[0, 1].apt[1 to last]



$.floor[*]?(@.level >1).apt[*]?(@.area>40 && @.area < 90).no



$.floor[0, 1].apt[1 to last]

```
SELECT JSON_QUERY(js, '$.floor[0, 1].apt[1 to last]' WITH WRAPPER) FROM house;
                                                  ?column?
-----------------------------------------------------------------------------
 [{"no": 2, "area": 80, "rooms": 3}, {"no": 3, "area": 50, "rooms": 2},
  {"no": 5, "area": 60, "rooms": 2}]
(1 row)
```

JSON_TABLE — relational view of json

```
SELECT  apt.*
FROM
  house,
  JSON_TABLE(js, '$.floor[0, 1]' COLUMNS (
    level int,
    NESTED PATH '$.apt[1 to last]' COLUMNS (
      no int,
      area int,
      rooms int
    )
  )) apt;
 level | no | area | rooms
-------+----+------+-------
     1 |  2 |   80 |     3
     1 |  3 |   50 |     2
     2 |  5 |   60 |     2
(3 rows)
```

SQL/JSON indexing

- Uses existing GIN indexes

  CREATE INDEX ON bookmarks USING gin
  (JSON_QUERY(js, '$.tags.term' WITH WRAPPER) jsonb_path_ops);

- Index only selected parts of json (parameters for opclass, PG 11-12)

  CREATE INDEX ON bookmarks USING gin
  (js jsonb_path_ops(projection='$.tags[*].term'));
  Index size: 33Mb vs 292 Mb (full json)

  It is possible to index several paths:
  CREATE INDEX ON bookmarks USING gin
  (js jsonb_path_ops(projection='$.tags[*].term, $.id, $.links'));

SQL/JSON availability

- Currently under review for PG 11
- Github Postgres Professional repository
  https://github.com/postgrespro/sqljson
- WEB-interface to play with SQL/JSON
  http://sqlfiddle.postgrespro.ru/#!21/0/1819
- Technical Report (SQL/JSON) - available for free
  http://standards.iso.org/ittf/PubliclyAvailableStandards/c067367_ISO_IEC_TR_19075-6_2017.zip

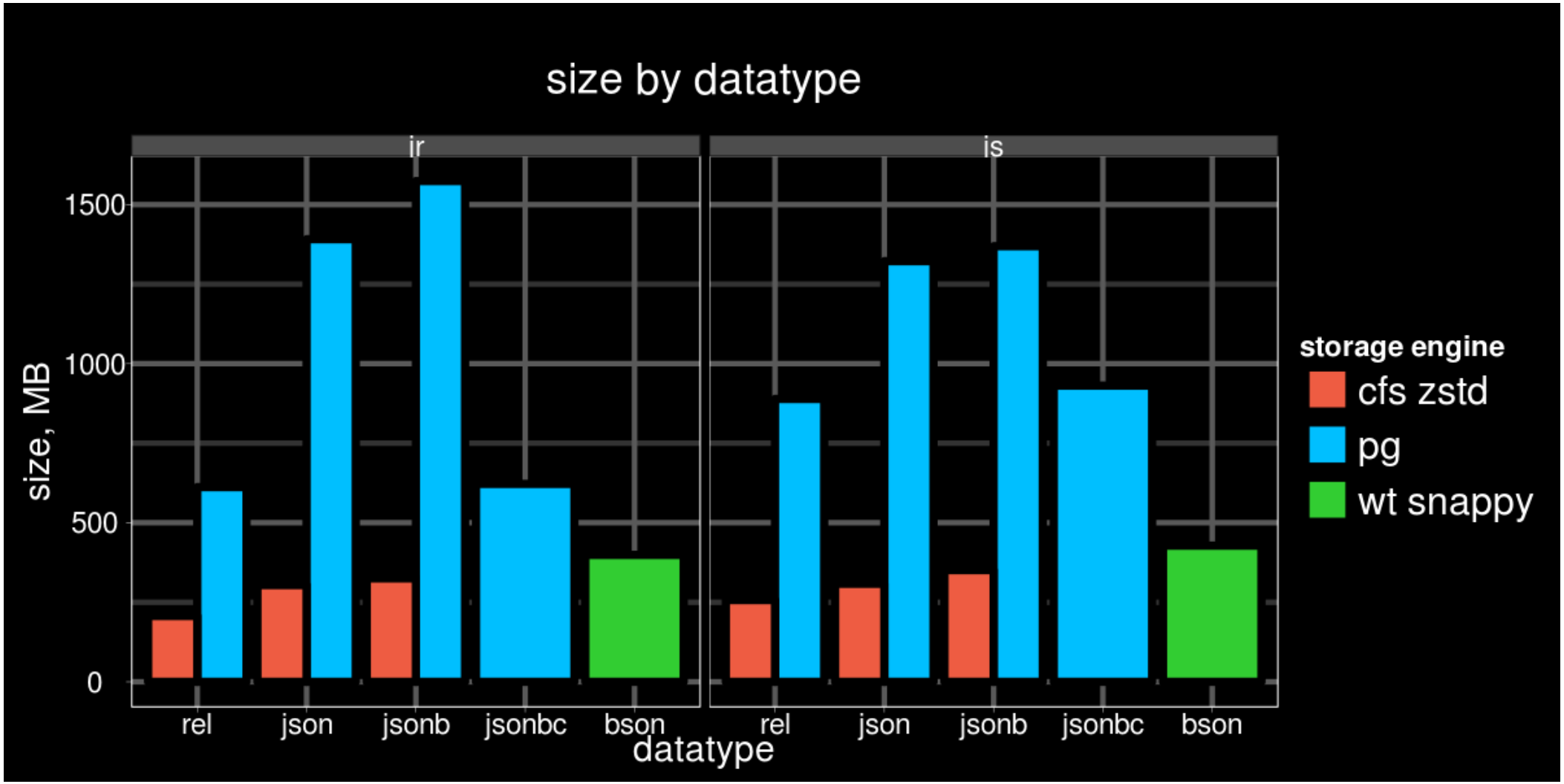
JSONB COMPRESSION

- JSONB is a «fat» data type — keys could be up to 2^28, 256 Mb !

  «looooooooooooooooooooooooong_key1»:1,
  «veeeeeeeeeery_looooooooooooooooooooooooong_key2»:2

- Dictionary compression using
  CUSTOM Compression API (PG 11)

jsonb compression: table size

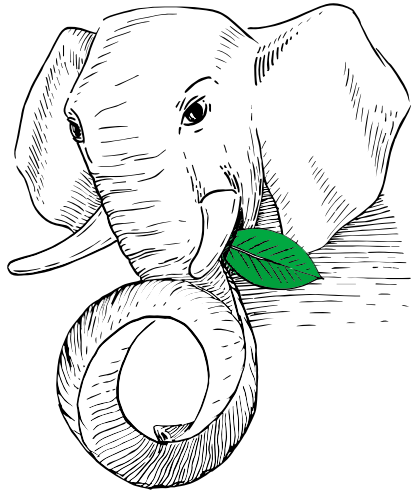


jsonb compression: summary

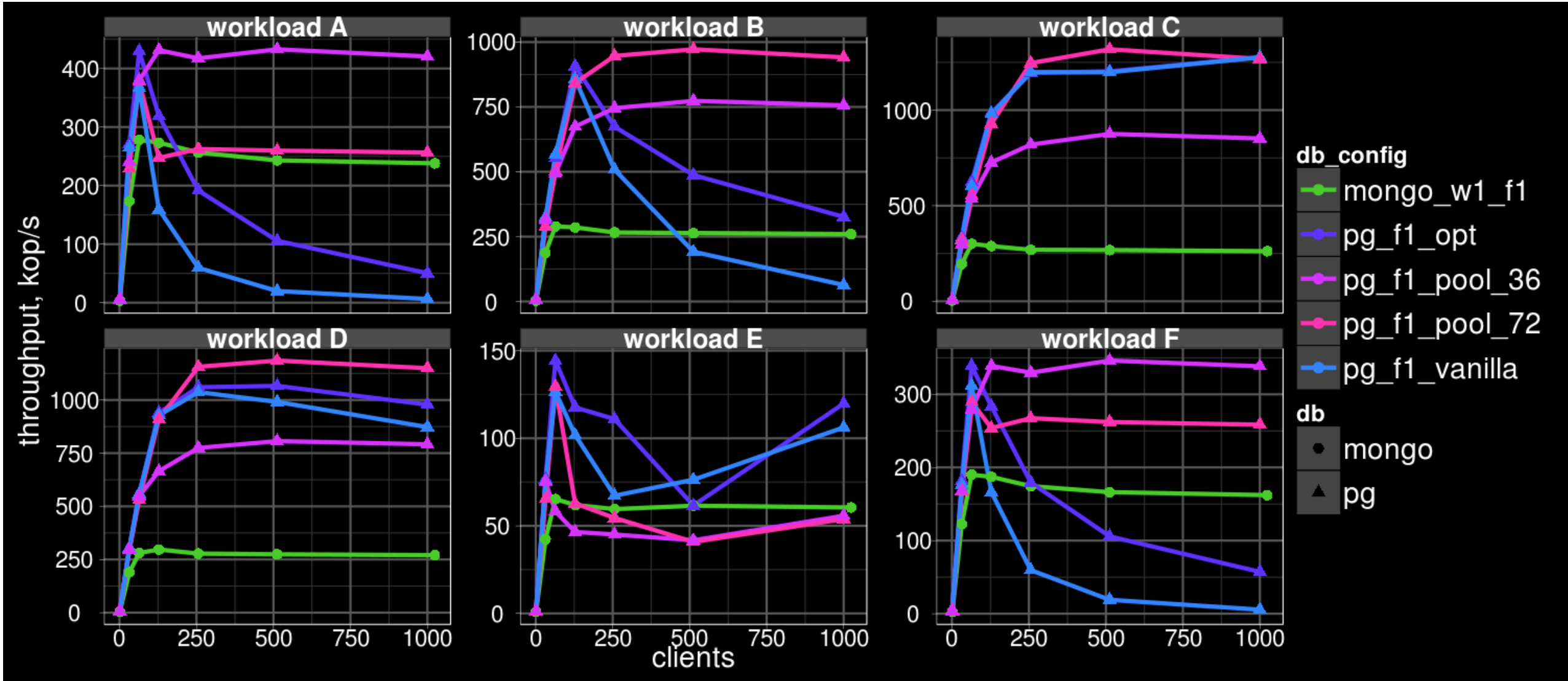
- jsonbc can reduce jsonb column size to its relational equivalent size
- jsonbc has a very low CPU overhead over jsonb and sometimes can be even faster than jsonb
- jsonbc compression ratio is significantly lower than in page level compression methods
- Availability:
  - Under review for PG 11

NoSQL Postgres is fast !

- Yahoo! Cloud Serving Benchmark (YSCSB) - de-facto standard benchmark for NoSQL databases
- We run YCSB for PostgreSQL 10, MongoDB 3.4.5
  - 1 server with 72 cores, 3 TB RAM, 2 TB SSD for clients
  - 1 server with 72 cores, 3 TB RAM, 2 TB SSD for database
  - 10Gbps switch
- In most practical cases PostgreSQL is faster MongoDB
- PostgreSQL performance degrades in high-contention writes (zipfian distribution of queries, high number backends >100)
- Avoid high-contention with built-in pool of connections (PG 12)



Built-in pool of connections helps !!!



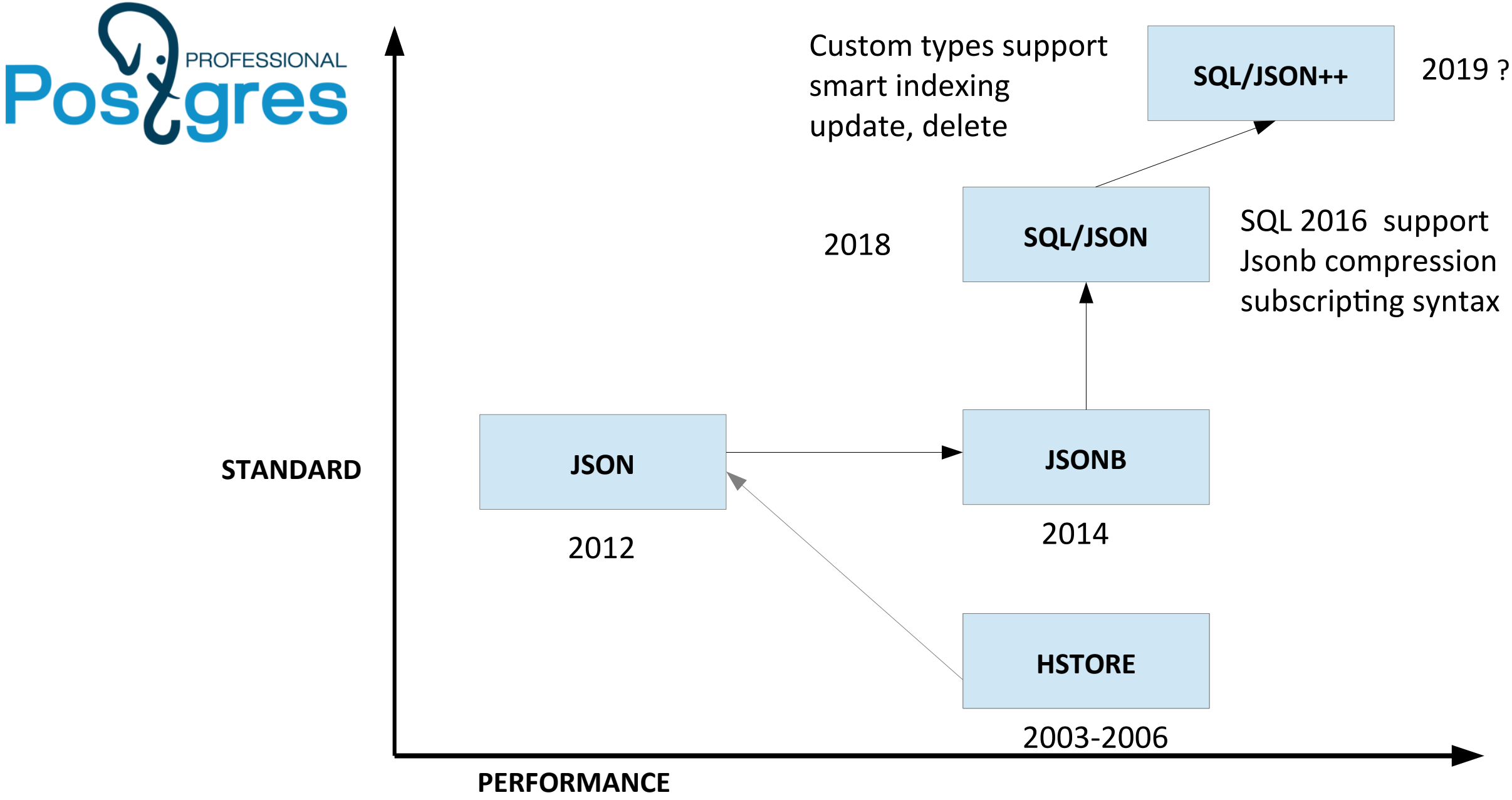
JSONB subscripting syntax (PG11)

- Based on «Generic type subscripting» on commitfest https://commitfest.postgresql.org/15/1062/
  Extends array syntax to support other types

```
UPDATE test_table set ARR[1] = 100;

SELECT JS['a']['a1']['a2'] FROM test_table;

UPDATE test_table SET JS['a']['b'] = '2'::jsonb;
```


Custom types support
smart indexing
update, delete
SQL/JSON++
2019 ?
2018
SQL/JSON
SQL 2016 support
Jsonb compression
subscripting syntax
JSON
JSONB
2012
2014
HSTORE
2003-2006
STANDARD
PERFORMANCE

Summary

- Postgres is already a good NoSQL database + clear roadmap
- Move from NoSQL to Postgres to avoid nightmare !
- SQL/JSON provides better flexibility and interoperability (PG 11)
- JSONB dictionary compression is really useful (PG 11)
- In most practical cases PostgreSQL is faster MongoDB
- PostgreSQL performance degrades in high-contention writes (zipfian distribution of queries, high number backends >100)
- Avoid high-contention with built-in pool of connections (PG 12)
- More slides: https://goo.gl/3XVzQD


ALL
YOU
NEED
POSTGRES
IS