

# YeSQL: Battling the NoSQL Hype Cycle with Postgres

BRUCE MOMJIAN



This talk explores how new NoSQL technologies are unique, and how existing relational database systems like Postgres are adapting to handle NoSQL workloads.

*Creative Commons Attribution License*

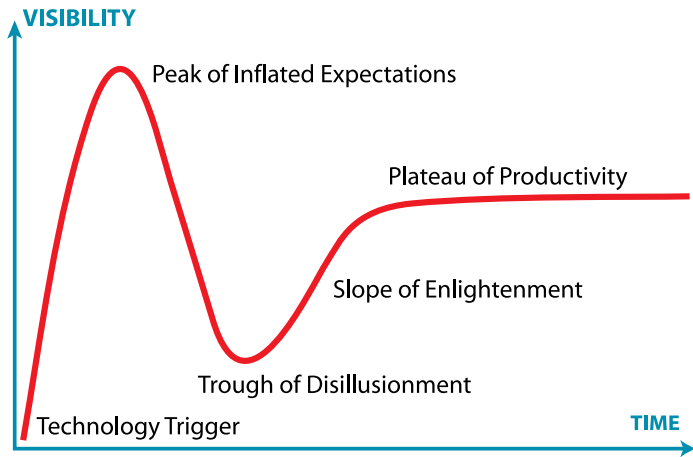
*<http://momjian.us/presentations>*

*Last updated: November, 2018*

# Outline

1. Hype Cycle
2. History of relational challenges
3. NoSQL goals
4. Postgres adaptations
5. Future directions

# 1. Hype Cycle



[http://en.wikipedia.org/wiki/Hype\\_cycle](http://en.wikipedia.org/wiki/Hype_cycle)

## 2. History of Relational Challenges

- ▶ Object databases
- ▶ XML databases

### 3. NoSQL Goals

There is no single NoSQL technology. They all take different approaches and have different features and drawbacks:

- ▶ Key-value stores, e.g., Redis
- ▶ Document store, e.g., MongoDB (JSON)
- ▶ Columnar stores: Cassandra
- ▶ Graph databases: Neo4j

These are mostly aggregate-oriented — see Martin Fowler's video at [https://www.youtube.com/watch?v=qI\\_g07C\\_Q5I](https://www.youtube.com/watch?v=qI_g07C_Q5I).

# Why NoSQL Exists

Generally, NoSQL is optimized for:

- ▶ Fast simple queries
- ▶ Auto-sharding
- ▶ Flexible schemas

# NoSQL Sacrifices

- ▶ A powerful query language
- ▶ A sophisticated query optimizer
- ▶ Data normalization
- ▶ Joins
- ▶ Referential integrity
- ▶ Durability

# Are These Drawbacks Worth the Cost?

- ▶ **Difficult Reporting** Data must be brought to the client for analysis, e.g., no aggregates or data analysis functions. Schema-less data requires complex client-side knowledge for processing
- ▶ **Complex Application Design** Without powerful query language and query optimizer, the client software is responsible for efficiently accessing data and for data consistency
- ▶ **Durability** Administrators are responsible for data retention



# When Should NoSQL Be Used?

- ▶ Massive write scaling is required, more than a single server can provide
- ▶ Only simple data access pattern is required
- ▶ Additional resource allocation for development is acceptable
- ▶ Strong data retention or transactional guarantees are not required
- ▶ Unstructured duplicate data that greatly benefits from column compression

# When Should Relational Storage Be Used?

- ▶ Easy administration
- ▶ Variable workloads and reporting
- ▶ Simplified application development
- ▶ Strong data retention

# Postgres Adaptations

Postgres has many NoSQL features without the drawbacks:

- ▶ Schema-less data types, with sophisticated indexing support
- ▶ Transactional schema changes with rapid addition and removal of columns
- ▶ Durability by default, but controllable per-table or per-transaction

# Schema-Less Data: JSON and JSONB

```
CREATE TABLE customer (id SERIAL, data JSONB);
```

```
INSERT INTO customer VALUES (DEFAULT, '{"name" : "Bill", "age" : 21}');
```

```
SELECT data->>'name' FROM customer  
WHERE data->>'age' = '21';  
?column?
```

```
-----  
Bill
```

```
-- this lookup is indexable  
SELECT data->>'name' FROM customer  
WHERE data @> '{"age" : 21}'::jsonb;  
?column?
```

```
-----  
Bill
```

# Incremental JSON Improvements

- ▶ 9.2 (2012): JSON data type (syntax checking)
- ▶ 9.3 (2013): JSON extraction and conversion functions
- ▶ 9.4 (2014): JSONB (binary JSON) and GIN index improvements
- ▶ 9.5 (2016): JSONB generation and manipulation functions

JSONB matches or beats MongoDB in performance and storage size, except for update operations, which are slower.

# Easy Relational Schema Changes

```
ALTER TABLE customer ADD COLUMN status CHAR(1);  
BEGIN WORK;  
ALTER TABLE customer ADD COLUMN debt_limit NUMERIC(10,2);  
ALTER TABLE customer ADD COLUMN creation_date TIMESTAMP WITH TIME ZONE;  
ALTER TABLE customer RENAME TO cust;  
COMMIT;
```

# NoSQL Access via Foreign Data Wrappers

Foreign data wrappers (SQL MED) allow queries to read and write data to foreign data sources. Foreign database support includes:

- ▶ Cassandra (columnar)
- ▶ CouchDB (document)
- ▶ MongoDB (document)
- ▶ Neo4j (graph)
- ▶ Redis (key-value)

The transfer of aggregates and sorts to foreign servers is not yet implemented. Join transfer is implemented in Postgres 9.6.

<http://www.postgresql.org/docs/current/ddl-foreign-data.html>

[http://wiki.postgresql.org/wiki/Foreign\\_data\\_wrappers](http://wiki.postgresql.org/wiki/Foreign_data_wrappers)

# Future Directions

- ▶ Parallelism
- ▶ Auto-sharding using foreign data wrappers and parallelism



# Conclusion



<http://momjian.us/presentations>

<http://flickr.com/photos/vpickering/3617513255>