

# YeSQL: Battling the NoSQL Hype Cycle with Postgres

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

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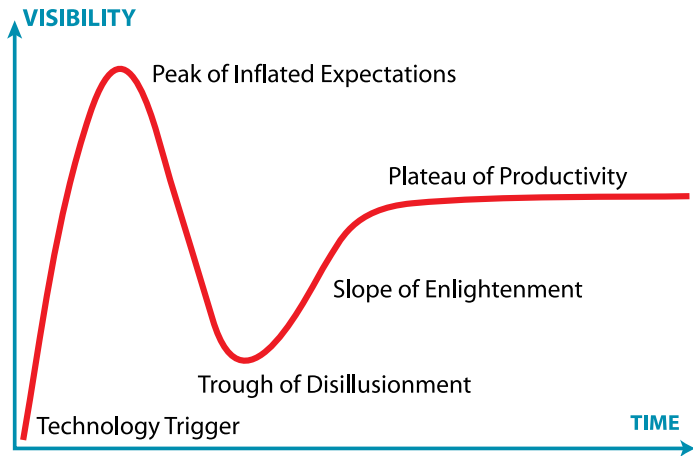
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# Outline

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/static/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

