

Neo4j

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Roadmap

1. Data model and schema
2. Consistency and Replication
3. Security and Performance
4. Specific use cases and bit of history
5. Demo

Data model

Neo4j is a **graph database**.

There are two main types of graph databases:

- Property graph model
- RDF graph model

Property graph model

In Neo4j information is organized as nodes, relationship and properties.

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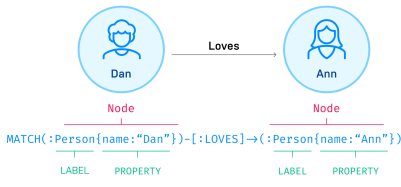


Figure 1: Example of the property graph model¹

In the property graph model, **nodes** are the **entities** in the graph. **Relationship** provide directed, named connections between two nodes entities.

Database schema

placeholder for now

Consistency

- Neo4j provides strong consistency.
- Neo4j employs causal consistency model.
- Isn't recommended DBMS when working with WAN.

Replication

- Raft protocol.
- Leader/Follower Model.
- High Availability and Fault Tolerance.

Security

- Schema-based Security²
- Role-based access control³

Schema-based Security

- Protect the nodes and relationships by controlling users' ability to traverse and read from different parts of the graph.
- Ensures that only authorized users have access to the data they need to protect sensitive data.

Role-based access control

- An approach, where you can apply restrictions to roles assigned to users at any level of granularity throughout the graph.
- Simplifies the task of assigning permissions and helps ensure that your data is secure.

Performance

- Compared to relational DBMS (MySQL in this case)
- Compared to other NoSQL DBMS

Compared to MySQL

Based on the benchmark using real-world data from Career Village, the experiment done by Rodrigues et. al, showed that Neo4j was faster than MySQL in most cases, particularly in pattern matching and recursive queries. However, MySQL has advantages in terms of data consistency and transactional support.

Category	Query	Neo4j	MySQL
Selection	Q1	2ms	31ms
	Q2	8ms	323ms
	Q3	32ms	438ms
Recursive	Q4	2ms	757ms
	Q5	2ms	290ms
	Q6	3ms	305ms
Aggregation	Q7	43ms	146ms
	Q8	18ms	40ms
	Q9	62ms	290ms
Pattern Matching	Q10	5ms	360ms
	Q11	10ms	455ms
	Q12	1ms	68ms

Figure 2: Performance comparison between Neo4j and MySQL⁴

Compared to MySQL

In the benchmark the following types of queries were used:

- selection/search
- recursion
- aggregation
- pattern matching

Compared to other NoSQL DBMS (1/2)

Based on the WDBench, a benchmark for graph databases focused on querying the Wikidata, Neo4j was the slowest of all tested graph databases, on all types of queries.⁵

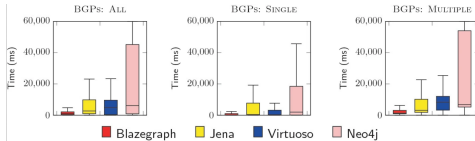


Figure 3: Basic Graph Patterns queries

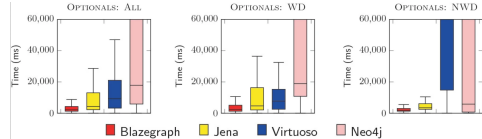


Figure 4: Optional Graph Patterns queries

Compared to other NoSQL DBMS (2/2)

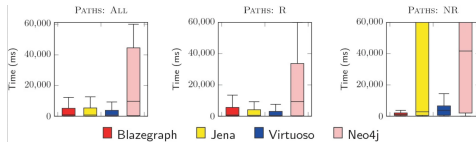


Figure 5: Path Patterns queries

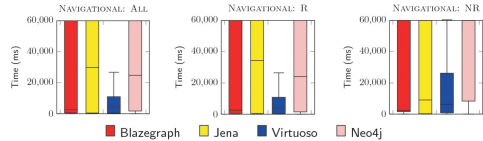


Figure 6: Navigational Graph Patterns queries

Specific use cases

- Recommendation Systems.
- Fraud Detection.
- Network and IT Operations.

Market share and famous cases

Without specific market share numbers, with slight research it's clear that graph databases is a growing market, as enterprises recognize the value of graph analytics in providing insights.

- NASA - uses Neo4j to manage the assembly of the International Space Station.
- eBay - uses Neo4j for real-time delivery routing, customer service, and offering personalized recommendations to its users.
- Adobe - uses Neo4j to understand user behavior for better product recommendations and targeted marketing.

Demo