

Introduction to NoSQL

INTRODUCTION TO NOSQL



Jake Roach
Data Engineer

Traditional relational data stores (RDBMS)

- Organize data in tables, using columns and rows
- Leverage SQL to manage and manipulate data
- Enforce integrity through constraints on databases and tables



What is NoSQL?

Definition: NoSQL stands for "not only SQL", and is a set of data storage tools and techniques that allows for structured, semi-structured, and unstructured data to be stored and retrieved.

Characteristics:

- Allows for a wider range of data to be persisted and accessed
- More flexible with regards to schema, captures data as it changes
- Better scaling and performance
- Provides a new challenge for data professionals

NoSQL data stores

Tabular

title	pages	price
Data Analytics	528	28.60
R in Action	656	56.99
...
Practical SQL	464	27.99

- "Rectangular"
- Using columns and rows

Non-tabular

```
{  
  "title": "Python for Data Analysis",  
  "price": 53.99,  
  ...  
}
```

```
"weather": "sunny"
```

- Semi-structured format
- More flexible schema

NoSQL data stores

Column-oriented

A NoSQL data store that stores data by column, rather than row, and can be queried with SQL-like syntax. Allows for faster querying of data, especially when running analytical queries.

Use case: large, analytics datasets



Document

A NoSQL data store that leverages a more flexible schema, made up of documents that can have their own structure. Documents are typically stored in JSON format.

Use case: user-generated data, such as reviews



More NoSQL data stores

Key-value

A NoSQL data storage tool that stores data as a collection of key-value pairs, and are best used with simple data that is written and read at a high frequency.

Use case: IoT (Internet of Things) data, mobile applications

Graph

A NoSQL data store that persists data in a network of nodes and edges. In graph databases, each node represents an entity, and each edge represents a relationship between those entities.

Use case: social networks



Let's practice!

INTRODUCTION TO NOSQL

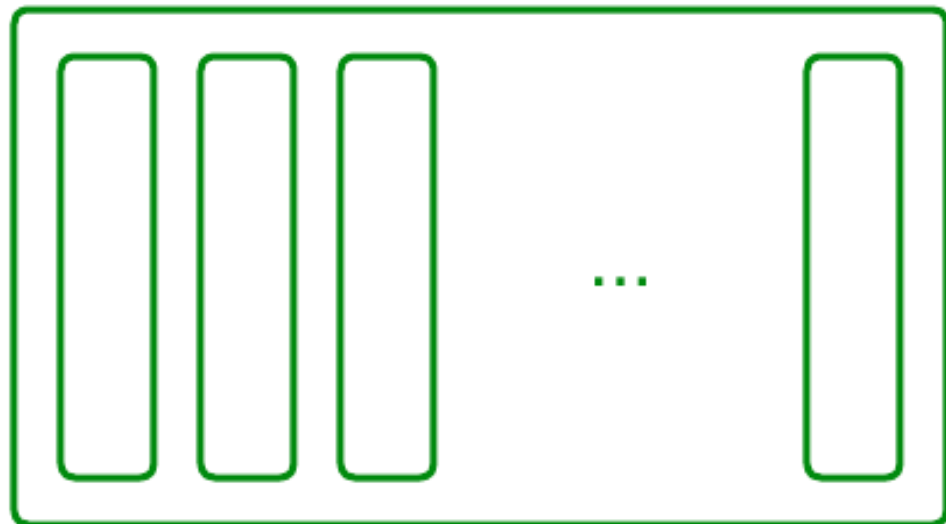
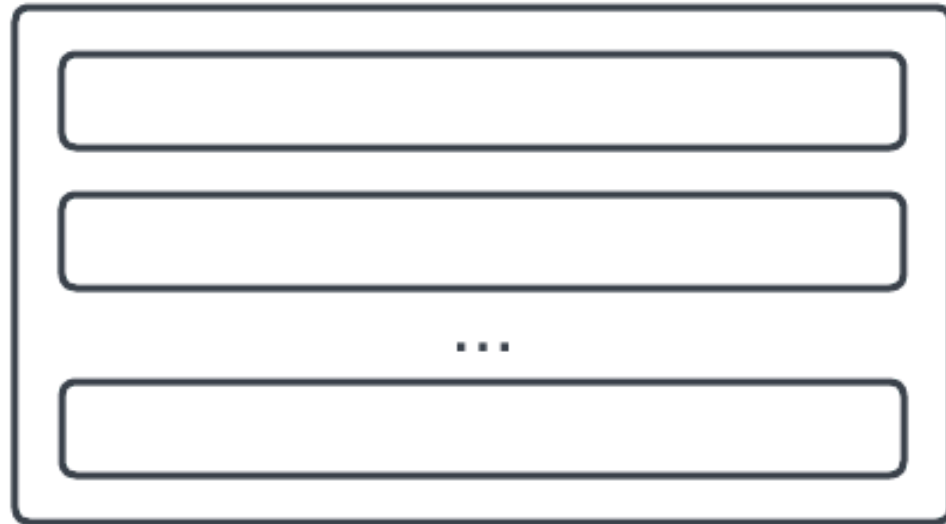
Tabular NoSQL data stores

INTRODUCTION TO NOSQL



Jake Roach
Data Engineer

Tabular data stores



Column-oriented databases:

- Store data in columns, rather than rows
- Allow for selective column read and retrieval
- Easier schema changes
- Better data compression, query performance



Querying a column-oriented database

title	pages	price
Data Analytics	528	28.60
R in Action	656	56.99
...
Practical SQL	464	27.99

title	pages	price
Data Analytics	528	28.60
R in Action	656	56.99
...
Practical SQL	464	27.99

```
SELECT
    title,
    price
FROM books
WHERE price < 50.00;
```

- SQL-like syntax
- Column-elimination and selective reads/retrieval
- Automatic data clustering

Query execution in column-oriented data stores

```
SELECT
    title,
    price
FROM books
WHERE price < 50.00;
```

title	pages	price
Data Analytics	←	28.60
R in Action	656	56.99
...
Practical SQL	←	27.99

This query executes by:

- Accessing `price` column, identify records with `price < 50.00`
- Retrieving corresponding values from `title` column

Later, we'll look at:

- Optimizing data loads and deletes
- Creating performant `JOIN` s
- Working with semi-structure data

Connecting to a Snowflake database

```
import snowflake.connector

conn = snowflake.connector.connect(
    user="<user>",
    password="<password>",
    account="<account_identifier>",
    database="<database_name>",
    schema="<schema_name>",
    warehouse="<warehouse_name>"
)
```

- The `conn` variable will be created for you, pre-exercise

Writing and executing Snowflake queries

```
# Build a query in a string (or multi-line string)
query = """
SELECT
    title,
    price
FROM books
WHERE price < 50.00;
"""

# Execute the query, print the results
results = conn.cursor().execute(query).fetch_pandas_all()
print(results)
```

Let's practice!

INTRODUCTION TO NOSQL

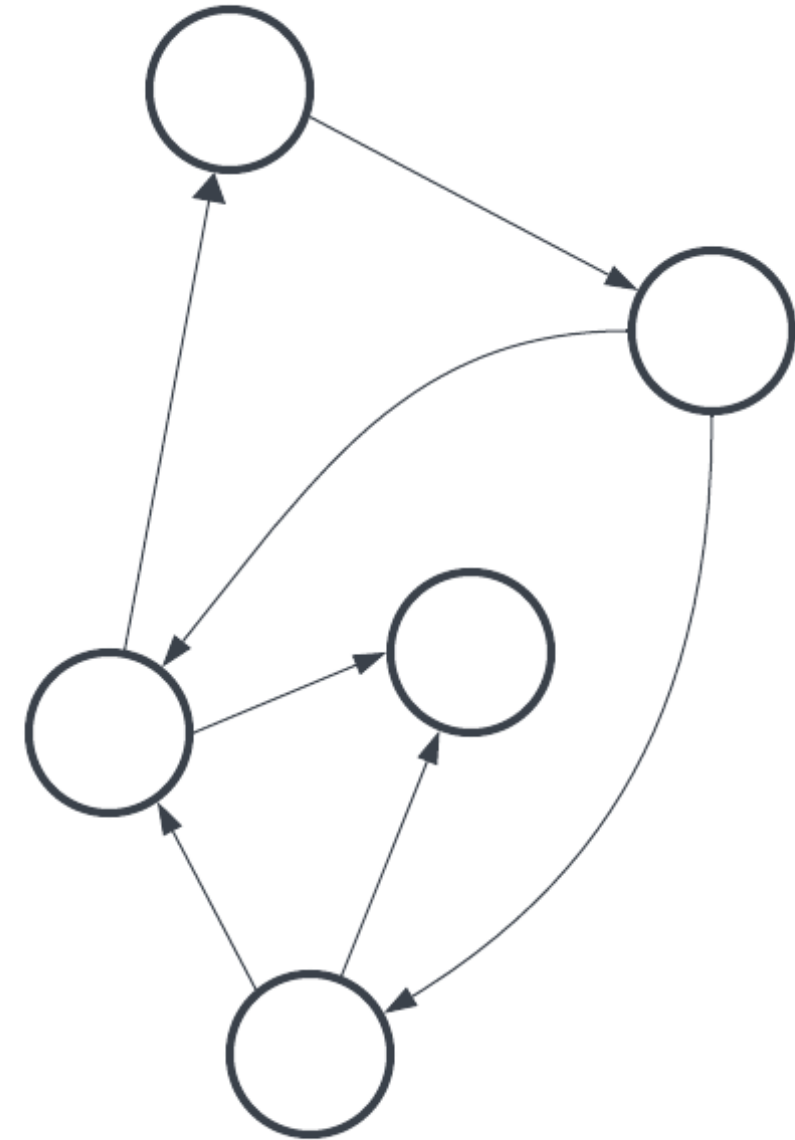
Non-tabular NoSQL data stores

INTRODUCTION TO NOSQL



Jake Roach
Data Engineer

Non-tabular NoSQL data stores



Document databases

Definition: A NoSQL data storage tool that stores data in a flexible, semi-structured format, made up of key-value, key-array, and key-object pairs (similar to JSON).



```
{  
  "title": "Python for Data Analysis",  
  "price": 53.99,  
  "topics": [  
    "Data Science",  
    "Data Analytics",  
    ...  
  ],  
  "author": {  
    "first": "William"  
    ...  
  }  
}
```

Querying JSON data with Postgres JSON

books
<pre>{ "title": "Python ...", "price": 53.99, "author": { "first": "William", "last": "McKinney" } } { "title": "Robust ...", "price": 32.99, "author": { "first": "Patrick", "last": "Viafore" } }</pre>

SELECT

books -> 'title' AS title,

books -> 'price' AS price

FROM data_science_resources

WHERE

books -> 'author' ->> 'last' = 'Viafore';

Resulting in the following output:

title	price
Robust Python ...	32.99

Connecting to a Postgres database

```
import sqlalchemy

# Create a connection string, and an engine
connection_string = "postgresql+psycopg2://<user>:<password>@<host>:<port>/<database>"
db_engine = sqlalchemy.create_engine(connection_string)
```

To create a connection to a Postgres database:

- Form a connection string
- Create an engine using `sqlalchemy`

Writing and executing Postgres JSON queries

```
import pandas as pd

# Build the query
query = """
    SELECT
        books -> 'title' AS title,
        books -> 'price' AS price
    FROM data_science_resources;
"""

# Execute the query
result = pd.read_sql(query, db_engine)
print(result)
```

To write and execute a query:

- Build a query in a string
- Pass `query` and `db_engine` to the `pd.read_sql()` function
- Print the resulting DataFrame

Other non-tabular NoSQL data stores

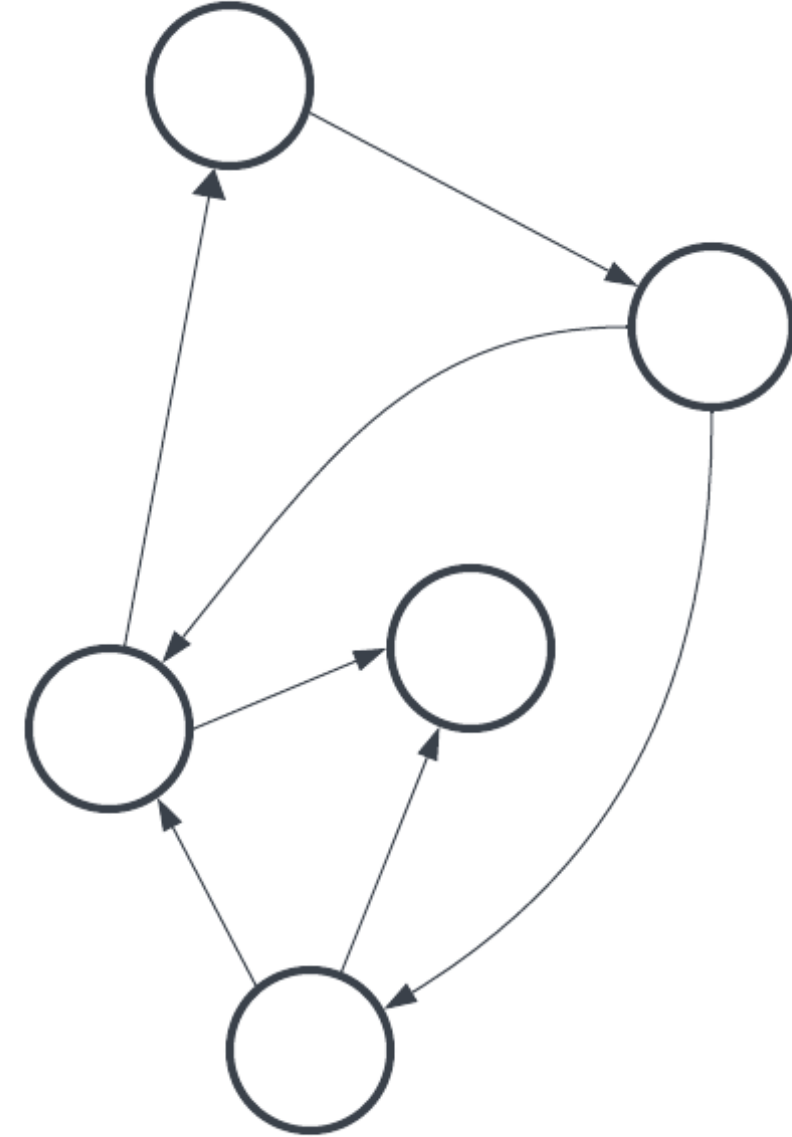
Key-value

```
{  
  "name": "Jane Doe",  
  "age": 25,  
  "email": "jdoe@datacamp.com"  
}
```



redis

Graph



Let's practice!

INTRODUCTION TO NOSQL