

Introduction
to NoSQL
Databases

Skill Networks
and Coursera

Overview of
NoSQL

Characteristics
of NoSQL
Databases

Key-Value
NoSQL
Databases

Document-
Based NoSQL
Databases

Column-Based
NoSQL
Databases

Graph NoSQL
Databases

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April 27, 2025

Overview of NoSQL

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What is NoSQL?

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- NoSQL = Not Only SQL
- Family of non-relational databases
- Flexible schemas, designed for modern applications
- Provide horizontal scalability, fault tolerance, and availability

History of NoSQL

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- 1970-2000: Dominated by relational databases
- 2000s: Internet boom - need for high scalability and availability
- Innovations: Google's MapReduce, Amazon's Dynamo
- Emergence of open-source NoSQL databases: Cassandra, MongoDB, CouchDB, HBase

Why NoSQL?

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- Flexible data models (unstructured, semi-structured data)
- Horizontal and vertical scalability
- High availability and fault tolerance
- Designed for distributed environments

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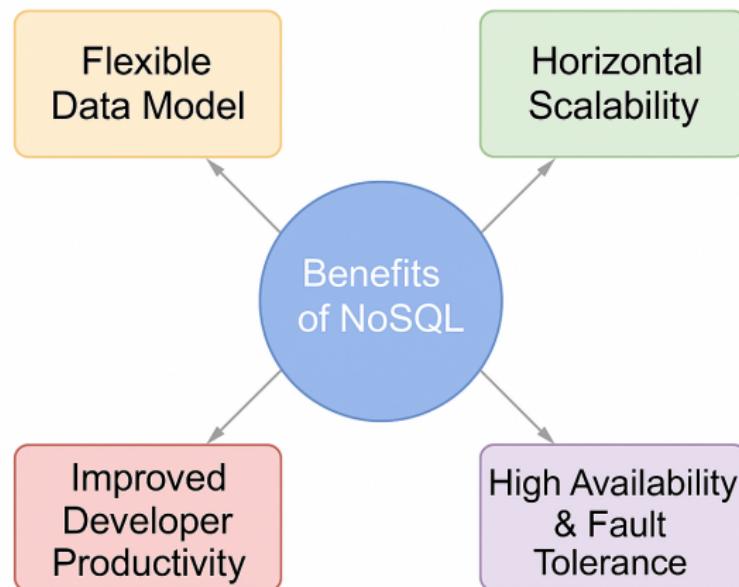
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- Non-relational architecture
- Open-source origins
- Specialized for specific use cases
- Flexible schemas for agile development

Benefits of NoSQL

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- Scalability (elastic horizontal scaling)
- Performance (low latency with high concurrency)
- High availability (distributed replication)
- Cost-efficient (cloud and commodity hardware)
- Flexible schemas and intuitive data models

Key-Value NoSQL Databases

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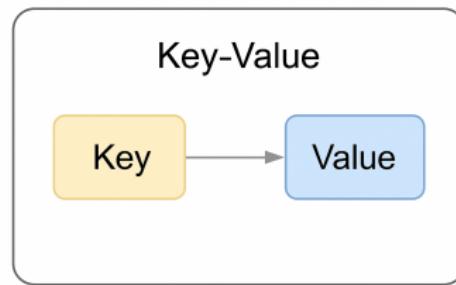
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- Data stored as key and opaque value blob
- Simple CRUD operations
- Highly scalable and easily sharded
- Examples: Amazon DynamoDB, Redis, Oracle NoSQL

Key-Value Use Cases

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- Session management
- User profile storage
- Shopping cart data

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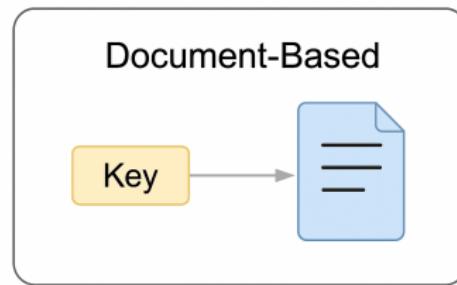
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Document Databases

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- Extends key-value model with visible, queryable documents
- Flexible schema (JSON, XML)
- Horizontal scalability and indexing support
- Examples: MongoDB, CouchDB, IBM Cloudant

Document Use Cases

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- Event logging
- Blogging platforms
- Operational datasets for web/mobile apps

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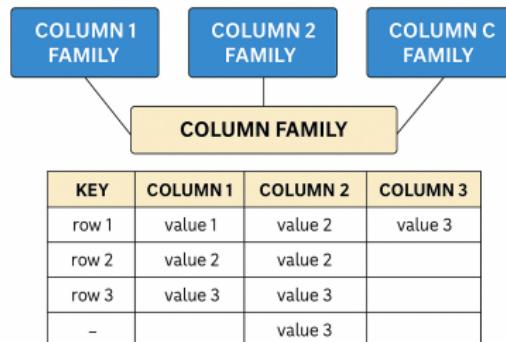
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- Inspired by Google's Bigtable
- Store data in columns grouped into families
- Ideal for large, sparse datasets
- Examples: Cassandra, HBase, Accumulo

Column Use Cases

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- Data warehousing and business intelligence
- IoT data management
- Financial and scientific analysis

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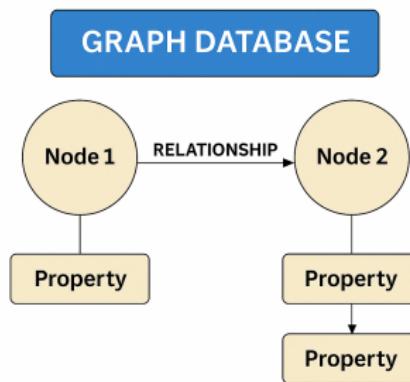
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- Store entities (nodes) and relationships (edges)
- Efficient for traversing highly connected data
- ACID-compliant
- Examples: Neo4j, ArangoDB, Amazon Neptune

Graph Use Cases

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- Social networking
- Routing and spatial applications
- Recommendation engines