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The University of Manchester

NoSQL Database Design

COMP23111 – Database Systems

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Data Modelling Overview

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The balancing act!

Application Needs

Database
Performance

Data Retrieval
Patterns

We must consider its data usage:

- Queries
- Updates
- Data Processing

NoSQL Relaxes some Strict Constructs

- Schema
- Document Structure
- Atomicity

Data Modelling Overview (Schema)

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Collections in NoSQL (MongoDB) do not require document schema by default (SQL Databases require a Schema before Data Insertion)

Data types for each field in a collection may differ across documents within the same collection

Changing a documents structure is as simple as updating the document directly

n.b. We can enforce schema in NoSQL (MongoDB)

Data Modelling Overview (Document Structure)

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NoSQL Databases allow for both a:

- Normalised Schemas
- Denormalised Schema

In MongoDB these are known as embedding & referencing respectively

Embedding

- Captures relationships between data by storing data in a single document structure
- Achieved by embedding document structures in a field or array within a document

Referencing

- Stores the relationships between data by including links or references from one document to another
- Resolved to access the related data

Data Model Design (Embedded)

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```
{
  _id : <ObjectId>,
  name : "Smith",
  products : [{
    code : "A-547",
    name : "iPhone 8",
    details : "Price: $850.00 and FREE shipping"
  },
  {
    code : "A-549",
    name : "MacBook Pro",
    details : "Price: $1800.00 and FREE shipping"
  }
],
  contact : {
    address : "Oxford Road, M15 6GH",
    phone : "+447872222222"
  }
}
```

Product : one-to-many

Embedded sub-document

Contact : one-to-one

When Should we Embed?

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Embedding is advisable when:

Related items are frequently used or fetched together

There is a one-to-one relationship between two documents

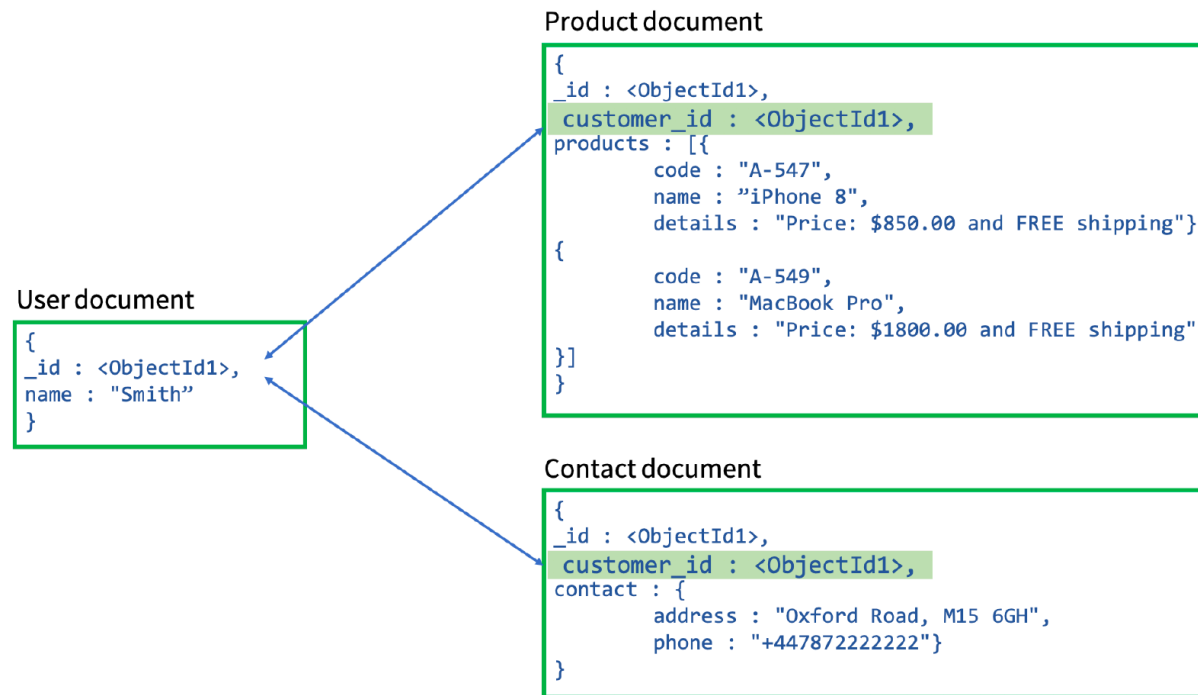
The document, that will be embedded, is not a key document.

Data does not change or does not grow much

Related documents have similar volatility

Data Model Design (Referencing)

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When Should we Reference?

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Referencing is advisable when:

When embedding would result in substantial data duplication

When embedded documents grow

To present more complex "many-to-many" relationships

The document, that will be embedded, is a key document

Requirement for fast writes



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Data Model Examples