Some challenges by relational mode
why NoSQL?

- Impedance mismatch
  - the Object-Relational mismatch between
    - the objects in the application code and
    - the database model of tables, rows, and columns
  - ORM (Object-Relational Mapping) frameworks as a translation layer
    - e.g., ActiveRecord, Hibernate
    - helpful, but the difference cannot be hidden completely
- Many-to-One & Many-to-Many relationships
  - Normalization removes duplication, but introduces many-to-one mapping

History of data models

Repeating the history?

- Hierarchical model
  - IMS (Information Management System) by IBM in the 1970s
  - Tree structure, similar to the JSON model used by document database
  - Worked well for one-to-many (but NOT many-to-many) relationships
    - Not support JOINs
- Better solutions
  - Network model - the CODASYL model
    - Support many-to-many relationships with more than one parent
    - Query through access paths, but very complex for developer to code and change
  - Relational model
    - query optimizer is the key to win in the long run
      - automatically choose ‘access path’ for data operations
      - complicated, but provides a general solution (no programming)
- Document databases use hierarchical model
  - have nested records with their parent record (rather than in a separate table)
  - document reference as a unique identifier, resolved at read time by JOIN or follow-up queries