Query-driven Data Completeness Management

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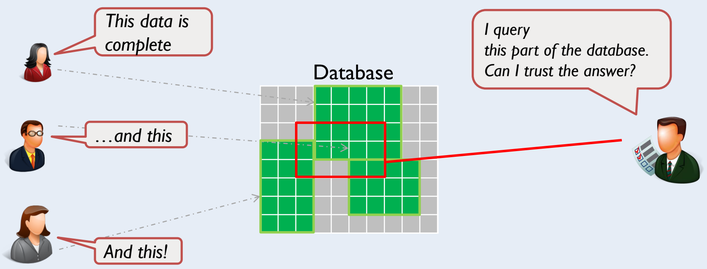
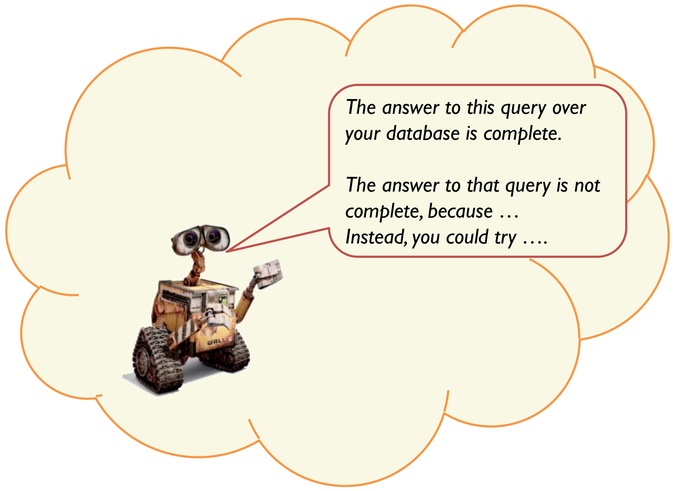
Overview:

- *Incompleteness*: Databases often do not contain all the information that they should, either because of delays in the data insertion process or because information is not entered at all
- *Metadata*: Ofent, information about which data is in a database exists or can be derived from business processes
- *Quality information need*: User want to know which queries over a database are reliable (complete)



Goal:

A framework for managing information about database completeness



Challenges

- How to *describe* the completeness of parts of a database?
- How to *reason* whether query answers are reliable (complete)?
- How can the reasoning be efficiently *implemented*?
- How can *completeness information* be *extracted* from business processes?
- How can completeness information be *used in business intelligence*?

Achievements

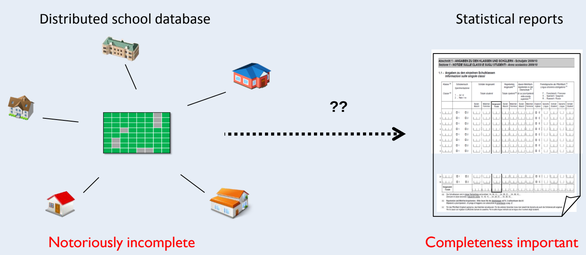
- Framework for reasoning about database completeness using conjunctive-query formalisms
- Boolean completeness (Yes/No)
- Tractable reasoning procedures for such statements and SQL-SELECT-PROJECT-JOIN queries
- Reasoning for databases with NULL values

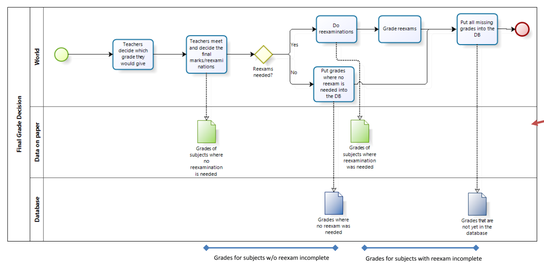
Use Case: School Data Management in South Tyrol

Distributed IT-infrastructure exists, but schools are largely autonomous in their management
→ *Besides core data, many schools manage themselves using other software or using Excel or paper.*
→ *Central database is largely incomplete*

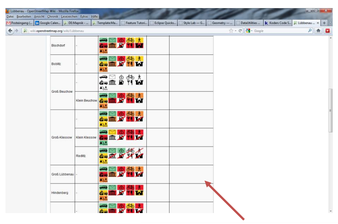
Example: Vocational schools put final grades into the database, others often not

- Query: How many pupils at high schools have grade A in?
  - Result cannot be trusted, data could be missing
- Query: How many pupils at vocational schools have grade A in?
  - Result can be trusted!





Extraction of completeness information from process descriptions



Meta information about the completeness of Openstreetmap

Application Scenarios

- Data of organisations, where data management policies are not very strict or where data is maintained also in other forms (paper, MS Excel, ..)
- Data integration: Information about the completeness of the integrated data based on knowledge about the content of the sources
- Voluntarily created data such as Wikipedia or Openstreetmap

- Checking Query Completeness over Incomplete Data, Simon Razniewski and Werner Nutt, Workshop on Logic in Databases (LID), Uppsala, Sweden, 2011
- Completeness of Queries over Incomplete Databases, Simon Razniewski and Werner Nutt, Intl Conf on Very Large Databases (VLDB), Seattle, USA, 2011
- Incomplete Databases: Missing Records and Missing Values, Werner Nutt, Simon Razniewski and Gil Vegliach, Workshop on Data Quality in Data Integration Systems (DQDI), Busan, South Korea, 2012