{Ontology: Resource} x {Matching : Mapping} x {Schema : Instance} :: Components of the same challenge

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Ontologies enable us to elevate syntactic and structural processing in an information system/Web to an information system/Web powered with semantic processing. Experience has shown that monolithic and tightly coupled approaches seldom succeed, and majority of information systems and applications will need to deal with plurality of ontologies in a loosely coupled environment (i.e., independently evolving ontologies and inter-ontology relationships, existence of different contexts for different users/applications etc.) Development of such loosely-coupled multi-ontology environments entails development of techniques for ontology mapping/alignment, multi-ontology query processing, and much more.

The terms matching and mapping are highly interrelate and some times interchangeably used. Matching is the process of identifying that entities in two schemas are semantically the related, while mapping refers to the transformations that allow one to transform a component of one ontology into that of another. Similar to the focus on database schema matching and integration in late 80s and early 90s, we are recently seeing a huge interest in ontology mapping research where the focus has mostly been at the schema level. In this context, we seek to observe the following:

- Dealing with ontology (schema) level issues alone is of little value. The power of an ontology largely comes from its instances, so the ontology matching and mapping need to include both schema and instance objects.
- The harder problem beyond matching and mapping ontology schemas is matching or disambiguating their instances.
    - Matching instances of one schema to another sometimes requires more complex mappings than the hierarchical / subsumption mappings produced at the schema level.
    - Providing such complex mappings requires sophisticated matching techniques and mapping representations.
- Limiting the modeling of a match to equivalence, subtype/supertype, hypernym/hyponym relationships and those handled by subsumption and membership computations is a good start but not sufficient for interoperability of systems whose schemas are related by more complex relationships.
    - We must develop support for named relationships as well as semantic proximity (modeling different shades of gray or "relatedness" in relating objects at the schema and instance levels)
    - Additionally, more comprehensive solutions will require us to understand semantics that range from implicit, explicit and powerful semantics, encompassing the modeling of relationships that are based on formal, statistical and probabilistic representations.

This talk will attempt to characterize the complex yet important problems related to ontology matching, often taking examples from complex real-world ontologies. It will present some thoughts on strongly linking two sides of the same coin, for example how instance (corpus/repository) mining can lead to discovery of semantic matches and further aid in the specification of the mapping transformations. In addition we will also look at what the process of matching or disambiguation at the instance level brings to this space. In this process, we will also share some past relevant work in the database community [1] that new researchers in the Ontology Matching area may wish to keep in view, identify new challenges we now face that were not addressed in earlier schema mapping/integration efforts, and also weave some of the relevant recent research at LSDIS.

[1] A. Sheth, "Early work in database research on schema mapping/merging/transformation, semantic heterogeneity, and use of ontology and description logics for schematic and semantic integration", Dagstuhl Seminar 04391 on Semantic Interoperability and Integration, September 2004.