A Semantics-Based Graph for the Bib-1 Access Points of the Z39.50 Protocol

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Necessity of the Bib-1 Semantics-Based Graph

• Clarification and better understanding of the:
  – exact semantics of every Access Point
  – Access Point inter-relationships

Graph Usage

• When Z39.50 query transformations are involved either for:
  – Query optimization
  – Access Points replacement due to unsupported Access Points, or in heterogeneous information retrieval environments

  • As a guidance to the end user for posing more precise queries

Z39.50 Query mechanism

• The query mechanism specifies
  – Predefined abstract Access Points combined with specific attributes (Attribute Sets)
  – Query languages (query types)

• Recognition (not necessarily implementation) of the Attribute Set Bib-1 is required by the general conformance requirements of the protocol
  – The use attribute in the Bib-1 specifies an Access Point (e.g. Title, Author, etc.)
Access Points Semantics

- The semantics of the Access Points are defined in the "Attribute Set BIB-1 (Z39.50-1995): Semantics" document
  - Which represents consensus among the members of the Z39.50 Implementors Group (ZIG)
  - Maintained as an official document of the Z39.50 Maintenance Agency
  - Defines the semantics of the Access Points using the tag values of representative MARC bibliographic format fields
- An example
  - Access Point Author-name-Personal (or use attribute with value 1004) includes the data from the fields with MARC Tags {100, 400, 700, 800}

Method Description

- The procedure for the creation of the graph consists of three steps
- We create the graph of the Access Points, according to their subset relationships

Access Points subset relationship

- An Access Point is considered as a subset of an other one, if the set of the data fields used to create the first is a subset of the set of the data fields used to create the second
- An example:
  - Author-name = {100, 110, 111, 400, 410, 411, 700, 710, 711, 800, 810, 811}
  - Author-name-personal = {100, 400, 700, 800}
- The Access Point Author-name-personal is considered being a subset of the Author-name

Graph Specification

- We represent the relationships between the Access Points with a directed graph G
  - Vertices represent Access Points
  - Edges represent subset relationships
- \(<i, j>\) is an edge of the graph if and only if Access Point \(i\) is a subset of the Access Point \(j\)
- The Access Points Author-name and the Author-name-personal will be represented by two vertices of the graph and their subset relationship from the edge \(<Author-name-personal, Author-name>\)
Let’s consider that the Bib-1 Attribute Set consists only of the next four Access Points:
- *Any*. From its definition, can be thought as the superset of all the supported Access Points
- *Abstract*={520}
- *Data-acquisition*={541-subfield-d}
- *Notes*={500, 501, ..., 520, ..., 535, 536, ..., 541, ..., 586}

We can see that:
- All Access Points are subsets to *Any*
- Access Points *Abstract* and *Data-acquisition* are subsets of the *Note* Access Point

### Construction of the Graph: Step 1

- Vertices represent the Access Points
- Edges represent the subset relationships

### Construction of the Graph: Step 2

- Application of the topological sorting algorithm
- The ordering is feasible due to the transitive and irreflexive properties of the proper subset relation

### Construction of the Graph: Step 3

- Remove edges implied by transitivity (i.e. delete the derivate subset relationships)
  - Number the vertices of the graph in the previous step from left to right
  - For each vertex, keep the incoming edge from the highest numbered vertex only

*Graph G after the topological sorting*
A practical Use of the Graph - I

- Consider two Z39.50 sources where:
  - The first supports the Access Point Author-name (i.e. can answer queries using this Access Point)
  - The second supports the Access Point Author-name-personal
  - Assume that both sources support the same value combinations for the remaining attribute types

- Obviously, all request to the first one for selecting data using the Access Point Author-name-personal will fail

A practical Use of the Graph - II

- A smart client could substitute the Access Point Author-name-personal with the Access Point Author-name into the queries, taking into account their subset relationship
  - The client could avoid the query failure
  - Unavoidably, the precision of the resulting query will be less than the precision of the original one

Future Extensions

- To create the semantics-based graph of the Access Points according to their intersection relationship (common fields)
- To check if the graph with the subset relationship is possible to combined with the graph with the intersection relationship and how.
- To apply our methods using the Bib-2 Attribute Set
  - The Bib-2 is designed for searching databases containing descriptions of a wide range of bibliographic materials