On the optimization of XBRL Taxonomies Architecture from Semantic Interoperability Prespective

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Introduction

- This presentation is part of an ongoing project.

- The main project focuses on overcoming semantic interoperability challenges in XBRL documents at runtime.

- One of the main influencing factors on semantic interoperability are architectural ones.

Problem statement

■Architecture of Discoverable Taxonomy Sets (DTS) is composed of different components:

- The structure and relations of XBRL documents

- Conventions of namespace

- schema and link base naming

- …

■Although it is usually ignored, architecture-related decisions can impose great impact on taxonomy quality factors, especially interoperability of XBRL-based information.

Architectural factors

- Different architectural factors can be important from interoperability perspective

  - Cohesion

  - Naming

  - Unity

  - …

- We utilize the factors from software engineering and other fields

Cohesion, a well-known factor

- the relations of elements defined in XML Schema Definition (XSD) and Extensible Markup Language (XML) documents can be analyzed by utilizing two well-known metrics in the field of software engineering:

- This measures have been also used in field on ontology engineering.

- Cohesion refers to the degree to which the elements of a module belong together.

Cohesion, a well-known factor

- on the scope of schemas and link bases as modules of XBRL taxonomies:

    - this definition can be used to measure the degree to which the elements of a schema or link base are related to similar domains, industries, statement and etc.

Architectural changes in IFRS

- A good example is IFRS taxonomy

- IFRS taxonomy was reformed from 2014 by splitting the elements of Small Medium Enterprises (SME) and full categories into two separate schema files.

- In the previous versions, a single schema covered all the concepts related to these two categories.

- This was probably done in order to mandate the rule which prohibited combining SME and full concepts in same hierarchies.

- As a result of this decision, many of elements are duplicated. Moreover, comparability of information related to large companies and small and medium companies was restricted to a great extent.

Architectural changes in IFRS

In this research, architectural impacts of these changes will be analyzed and possible enhancements would be proposed while considering the separation need of these two categories. Moreover, the architectural changes in some regional taxonomies extended from IFRS will be considered as another case study.

Architectural changes in Iran Capital market Taxonomy architecture
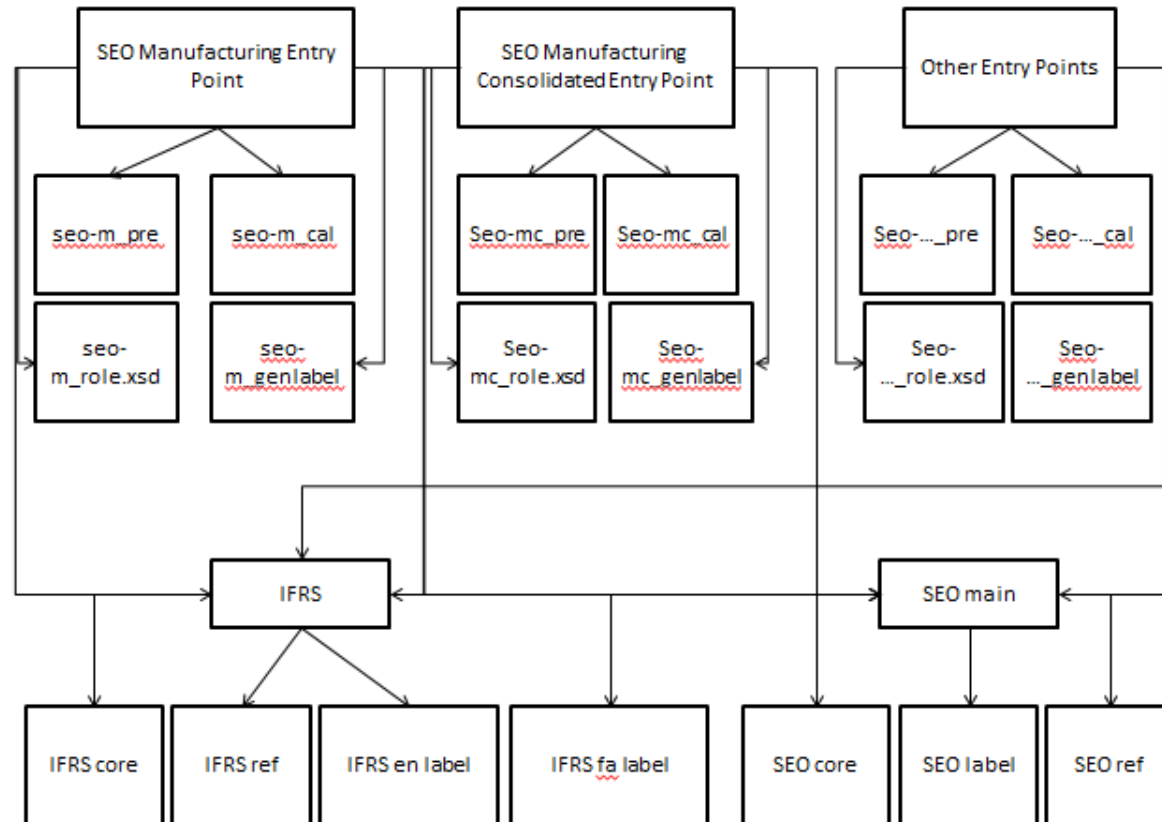
Optimizing the architecture

- Identifying the architectural factors which may affect interoperability of XBRL documents, it is possible to utilize optimization algorithms to maximize the interoperability.

- for this purpose, the first step is to formulate the XBRL architectural enhancement, as an optimization problem.

- Therefore, the Discoverable Taxonomy Set (DTS), in addition to elements and resources in each document, would be considered as the target set for optimization.

Designing a fitness function

The overall fitness function is as follows:

$$FF = \sum_{i=1}^{k} w * RF_i$$

This Fitness function comprises many rating factors.

One of the possible rating factors is as following:

$$RF_i = \frac{1}{\alpha \sum_{i=1}^{n} Cohesion(Schema_i)}$$

Evaluation of results

The results of this research would be evaluated using the well known Interoperability criteria:

$$Precision = \frac{A+E}{E}$$

$$Recall = \frac{A+E}{A}$$

$$F = \frac{2Precision.Recall}{Precision+Recall}$$

$$Completness = \frac{U_i \cap S}{U_i}$$

$$Relevency = \frac{U_i \cap S}{S}$$

…

Thank you for your attention