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**EFFECTIVE XBRL PROCESSING FOR
SUBMISSION OF IFRS-COMPATIBLE
FINANCIAL REPORTS**

Master's thesis

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Author's declaration of originality

I hereby certify that I am the sole author of this thesis. All the used materials, references to the literature and the work of others have been referred to. This thesis has not been presented for examination anywhere else.

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Abstract

The aim of this work is to investigate advantages employing international financial reporting standards and include describing the reporting language for submitting the accounting information called XBRL – its specifications, features and comparison with alternative ways of presenting business information.

Given XBRL review and underlined shortcomings and difficulties linked to lack of existing APIs and inability to operate with the technology in convenient way the solution is to be invented. Finally the solution architecture is provided of how to apply usage of business reporting advanced technology on the basis of real existing platform solution.

Conclusions related to the advanced way of providing financial reports using extensible business reporting language with a help of invented engine show that this can be easily processed by computers so that financial reporting becomes more reliable and clear to process.

This thesis is written in English and is 58 pages long, including 3 chapters, 27 figures and 4 tables.

Annotatsioon

Antud magistritöö eesmärgiks on uurida millised on eelised rahvusvaheliste finantsaruandluse standartide kasutamisest edastades raamatupidamisandmed. Samuti kirjeldada kaasaegne viis majandus andmete levitamiseks ja mis on selle viisi plussid ja miks see standard on puudulik. Toodud uuringute käigus tehakse kindlaks majanduslikku otstarbekust ja peamine kasu standardite kohaldamisel ja võrreldakse standartide erinevus sõltuvalt regioonist kus nad on defineeritud.

Lõputöö koosneb sissejuhatusest rahvusvaheliste finantsaruandluse standarditega. Teine osa sisaldab aruandluse keele kirjeldamist mis on kasutatud raamatupidamisandmete esitamiseks - see on spetsifikatsioonid, omadused ja alternatiivsete viise esitada ettevõtte andmed võrdlus.

Arvestades XBRL puudusi ja raskusi, mis on seotud olemasolevate API puudumisega ja võimetusega kasutada tehnoloogia mugavalt, lahendus on leiutatud. Lõpuks lahendus arhitektuur on sätestatud, kuidas rakendada aruandluse arenenud tehnoloogia kasutamist reaalse olemasoleva platvormi lahenduse baasil.

Loodud lahendus ja selle kasutamise järelused seotud reportide esitamisega kasutades xbrl (ehk extensible business reporting language) ja leiutatud xbrl mootoriga, mis võimaldab luua lihtsalt arvutiga töödeldava funktsionaalsust, et finantsaruandlus saab usaldusväärsemaks ja selgeks protsessiks.

Lõputöö on kirjutatud inglise keeles ning sisaldab teksti 58 leheküljel, 3 peatükki, 27 joonist, 4 tabelit.

List of abbreviations and terms

| | |
|-------|---|
| XBRL | eXtensible Business Reporting Language |
| IFRS | International Financial Reporting Standards |
| GDP | Gross domestic product |
| XML | Extensible Markup Language |
| JAXB | Java Architecture for XML Binding |
| DTS | Discoverable Taxonomy Set |
| Xlink | XML Linking Language |
| FDI | Foreign Direct Investment |
| IASB | International Accounting Standards Board |
| EU | European Union |
| API | Application Programming Interface |
| OMR | Omani rials, the ISO 4217 code for the currency of Oman |
| WCM | Web content management |
| CMP | Container-Managed Persistence |
| US | United States |
| IAS | International Accounting Standards |
| OSS | One Stop Shop |
| IT | Information technology |
| CR | Commercial registry |
| EJB | Enterprise Java Beans |

| | |
|---------|-----------------------------------|
| JDBC | Java Database Connectivity |
| JTA | Java Transaction API |
| MVC | Model–view–controller |
| JDK | Java Development Kit |
| JSP | Java Server Pages |
| JSON | JavaScript Object Notation |
| REST | Representational state transfer |
| WAR | Web application archive |
| AJAX | asynchronous JavaScript and XML |
| Java EE | Java Enterprise Edition |
| JNDI | Java Naming and Directory |
| JAR | Java Archive |
| POM | Project Object Model |
| JSR | Java Specification Requests |
| HTML | HyperText Markup Language |
| CSS | Cascading Style Sheets |
| JAXB | Java Architecture for XML Binding |
| JAX-WS | Java API for XML Web Services |
| SOAP | Simple Object Access Protocol |
| PDF | Portable Document Format |

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Introduction

The fast industrial and technological advancements has changed the needs of world's economy. It led to the significant increase of international agreements and connections between the companies. Governments also react to those changes and take different regulations and standards that should be considered when making any legal business activities in the region. One of the regulations is to force each foundation to make their activity transparent and easily trackable. Considerably clear, standardized and analyzable without any obstacles business area is a good background for being an investments friendly country.

For this need there is an opportunity to submit annual reports of financial activities. However, concepts of financial activities may not be simply justified for any type of the foundation and be universal to any kind of company. Additionally, there are a lots of differences between the countries and even between different regions within the country and each region based on the rules accepted by governments requires various data to be provided to guarantee compliance with rules. Variety of different regulations and normative acts related to finance creates a wide range of ways financial data can be represented.

Respectively there is a need for a standardized way to describe the financial performance of an entity. Accounting standards provide high quality, reliable financial information and can be accepted by any capital markets followed by the standards. Furthermore, common global standards designed for business affairs make it possible to grow international trades and shareholding, which is important for companies with agencies in several countries. Following the agreed way of financial reporting also creates an opportunity to track unfavorable business entities and evaluate risks may be assigned with dealing with those.

The aim of this work is to describe usefulness of international financial reporting standards. The first, describe why following the standards creates value for healthy business practices, why is it important for the state, how it makes entity activities transparent and why it prevents corruption. The second, to compare different practices how it is possible to fill the annual financial reports. The third, step by step describe how to improve and implement one of the most advanced tools for the annual reporting.

1. Introducing IFRS

1.1. Economical usefulness

As international financial reporting standards were created the main idea was to make bring all financial markets to one and the same position of filling the annual reports. Consequently it leads to effective way of evaluating the reported data and helps concerned parties see more transparent and easily accountable picture all around the world.

Developed framework faces the public concerns, it ensures stable global economy in long-term, traceability is a tool to fostering trust because nothing is hidden from the public and if so it can be exposed.

International financial reporting standards transparency is achievable by making financial information internationally comparable, which itself brings the quality to the data and makes it possible for investors to make a better, more economically calculated and balanced decisions.[3]

Improved accountability is considered to be a information sharing between capital holder and the providers of that capital and the accepted pattern serves as such a lack of information remover. It also ensures that management is feeling pressure and responsibility to the people who entrusted their money to it and provides participants with clear business relationship. IFRS gives information which can be compared globally and it is important to controllers all over the world.

As a source which helps to improve capital distribution because investors and other market participants are able to reveal opportunities and risks around the world, standards are enhancing efficiency of economics. Vitally important is the fact that IFRS as a unified way of reporting decreases the cost of capital and international reporting costs. International financial reporting standards are developed independently from special interests and totally representing public interests which ensures principles all over the world.[4]

1.2. Benefit of IFRS adoption

It is obvious that all financial markets are intertwined nowadays, it is hard to imagine the company which doesn't depend on or works with only separate state or a country. Even little small companies are trying their best to achieve the best profit by using materials from abroad for example. All investments related people are permanently looking for the best opportunity to get dividends from their operations and they have no borders doing that. To evaluate the potential returns of the investments or cooperation with companies from other market all the entities need reliable financial information to deal with which could be comparable with their own understanding [12]. There are a lot of foreign investments happening today:

| | 2007 | 2013 |
|---------------------------------|--------------------|--------------------|
| Foreign Direct Investment (FDI) | 2.170 trillion USD | 1.281 trillion USD |

Table 1. The amounts of cross-border investment

As seen from the table the numbers are enormous. In addition ownership of foreign stocks in 2013 was 14 trillion US dollars and investors from United States held over 9 trillion US dollars of cross-border corporate stocks and bonds.

IFRS contributes to improvement of comparability and transparency of financial data by helping investors to identify the risks and decrease costs bound with financial statement preparations. By enhancing the quality of financial information and ensuring it is done correctly, successively and strictly enables all the parties make better economic decisions.

There were held dozens of academic studies regarding benefits if adoption of international financial reporting standards and it became revealed and proved that standards improve efficiency of such an investments which were decided with certain IFRS based analysis.

The markets are more efficient when IFRS are applied because the usefulness of financial data reported in single standardized way is undeniable, there are less lags, huge growth of qualitative analysis and as following increased investments. Lots of studies show

how businesses benefit from adoption of the standards, starting from impact of easily comparable reports and opportunity better understand and measure the risks, additionally providing comparability of different markets making financial accounting borderless.

The standards set the concepts of how the acquirer defines and measures acquired assets while dealing with business combination. Also how he recognizes liabilities and how identifies interest in the acquiree. Financial statement represents all the required information. In addition gains from the bargains are considered and it is established in IFRS, any goodwill gained in the business contribution is measured. One more of the principles of international financial reporting standards is to define what information is to be uncover in order to enable people to evaluate the nature of the business combination from the financial statements. It gives a useful overview of financial effects to be while dealing with business combinations.[8]

1.3. IFRS profiles

Overall understanding of impact of the standards adoption by for-profit businesses is admitted to be a necessity globally. To effectively use the standards in all jurisdictions and making benefit from acquired information IFRS is acknowledged to gather essential information around the world. It is necessary to implement to enable a progress the trustees can reach using common principles of accounting all around the world. Assessing success of a single set of principles to reach the goal of international accounting benefits IFRS foundation is developing the profiles on regular basis in each separate jurisdiction.

Information used to the profiles settings is gather from different sources, as development continued responses from various parties were investigated and all relevant surveys were held to ensure profiles to be accurate. Foundation makes certain that related bodies are asked to view developed profiles and ascertain all the regulations are provided. All the provided responses from all the parties including international audit companies are considered and represented in improved versions of profile drafts. Results of developed profiles are assumed to be relevant for assessing the role of international financial reporting standards in both developing and developed capital markets.

As a profile gets ready it consists of the following set of details containing each jurisdiction and references to relevant documents if exists:

- Mandatory or optional
- Sources details information and requirements were gathered from
- Public commitment to global accounting standards and international financial reporting standards
- The degree of the use of the standards by for-profit organizations
- List of the companies and financial institutions applied the IFRS
- Consolidated financial statements or separate company statements
- Auditor’s report
- Legal powers
- Standards internalization (translations)

1.3.1. IFRS profiles comparison

As a comparison are taken Estonia and Oman profiles because the thesis implementation included the analysis of the existing implementation of Estonian and developed for Oman.

| Profile | Estonia | Oman |
|------------------|--|--|
| | Accounting standards required for publicly accountable entities | |
| Listed companies | <p>Estonia is subject to the EU’s IAS Regulation which requires application of IFRS for the consolidated financial statements of European companies whose securities trade in a regulated securities market.</p> <p>The Regulation gives member states the option to require or permit IFRS as adopted by the EU in separate company financial statements (statutory accounts) and/or in the financial statements of</p> | <p>The Executive Regulation of the Capital Market Law states that every issuer (listed companies) shall prepare financial statements in accordance with IFRS.</p> <p>The Code of Corporate governance also requires companies to prepare financial statements in accordance with IFRS.</p> |

| | | |
|--|---|-----------------------------|
| | companies whose securities do not trade on a regulated securities market. | |
| Banks and other financial institutions | All must follow IFRS as adopted by the EU even if not publicly traded, including: <ul style="list-style-type: none"> • credit institutions • insurance undertakings • financial holding companies • mixed financial holding companies • investment firms | IFRS required. |
| Separate company financial statements | IFRS as adopted by the European Union | IFRS required |
| IFRS endorsement | | |
| Standards companies follow | IFRS as adopted by the EU. | IFRS as issued by the IASB. |
| Modifications to IFRS | In adopting IFRS, the EU modified some sections of IAS 39 Financial Instruments: Recognition and Measurement. | None |
| Auditor's report compliance | IFRS as adopted by the EU. | IFRS |

Table 2. IFRS profiles comparison [12]

2. XBRL usage specifics and features

2.1. What XBRL stands for

2.1.1. Business Reporting

Business activities always involve the use of financial reporting. There are a lot of regulations which oblige business entities to reveal their tax return to the government, submit annual reports and be honest with co-partners by reporting inter-departmental sales figures.

These kinds of accountabilities provide information regarding different kinds of relative information depending on the field of activity of a company or the type of statement. Data about period of the report is contained, different income related fields, the number of clients, also report represents status and conditions of sales, numbers of equipment items, etc.

There is a need to provide one and the same facts in different reporting forms, which makes the work of the reporter much more complex and additionally increases a probability of mistakes and discrepancies. Business reporting respectively needs to be more customizable and data in it must be dynamically reusable. XBRL provides an opportunity for making such a reports. Report creation using XBRL adds much convenience since it eliminates possibility of mismatched data, defines the forms needed to be reported so reporter does not need to bother about configuring each form each time something has to be submitted. In addition machine always validates provided fields and helps the reporter not to miss anything or shows what is not reported correctly. Computer format enables different parties working with annual reports to get only the information they need, sorting information improves the work of accountings receivers by removing irrelevant facts and showing the remaining in a receiver friendly format.

Common definitions standardize the way of making the reported business facts. The set of required fields and data is provided in a collection of rules specified in taxonomy, it ensures interpretation of reported fields to be the same in all reporting form types in different business spheres.

As a output of provided fields required in the taxonomy comes a final ready report called instance document. It refers to a taxonomy – a specific collection of rules on which it was created. Each included value in that document refers to certain concept of the taxonomy representation.

As described above XBRL improves creating of annual reports, enables sharing the information without hesitating information can be interpreted wrong way and raises the usability of filling the data by adding the hints of linked fields and validations in business reports. So XBRL benefits also imply better quality of business reporters as it helps to find calculation errors even on complex forms which is not quite that easy if everything is done by hand.

2.1.2. Extensible

As it was described in IFRS profiles comparison there exist different kinds of each country or region related requirements to add some elements to reported business facts. To improving convenience of that kind of operations XBRL provides extensibility. Consequently each additional requirement can be added as a part of existing specifications without overlapping and necessity to report two different forms. It same adds a quality to the report because helps to avoid mismatches and duplicates in provided information.

Another utility and usefulness of extensibility is opportunity to reach translations requirements. Most companies need to have reporting forms transitioned and translated to their own language, since business concepts are quite complex and it is not available to force all the people study foreign language. That means business reporting standard need to be configurable for using different languages and the same time use exactly identical set of fields reported. XBRL also is capable of doing so. Using taxonomy linkbases it creates references of the fields to the label of needed language. Technically set locale of the current user can ask any language provided in taxonomy and all the labels will be translated without changing the structure anyhow or removing provided data. It also applies to additional requirements of the countries, electronic reports enable to add separate specifications as a concepts to taxonomy and labels to those specifications are separately is taxonomy linkbase. Each locale can have its own linkbase or one linkbase might contain labels for each language.

2.1.3. Language

The last letter in the abbreviation means language. The language stands for XML-based representation using XML syntax and related XML technologies. Language indicates the format of defining facts, rules, calculations, labels and report document to be certain and unambiguous. It enables technically to ensure usage and handling of one and same information to provide one and the same result. Using computer science XBRL provides standard way of reporting financial activities.

2.2. Comparing Business Reporting Tools

2.2.1. Paper

Only a little bit more than a decade ago all the financial reports were gathered and manually printed or even written by hand on a printed paper forms. All relevant accounting facts were sent on the piece of paper to interested bodies who could manually investigate these papers and find needed information from there. These typed up forms, each on a separate page, because different agencies required different types of forms, represented the way of how financial reporting worked those days.

The other disadvantage of such an approach is lacking of flexibility, make paper financial statements changes be immediately reused by all reporters is a complex challenge. The new requirement should be announced to each of participants and explained separately.

Paper filled reports cannot be additionally checked and verified for the absence of errors, wrongly counted data or any discrepancies.

For example here is one hand written and hand filled report form part, very crude and schematic example:

| | | |
|--------|-------------------------------|------------|
| | | 27/08/2014 |
| Assets | | |
| | Non-current assets | |
| | Property, plant and equipment | 1250 |
| | Investment property | 550 |
| | Total non-current assets | 1700 |

Table 3. Paper report calculation error

As can be seen, the number of total non-current assets is calculated wrong which is very unlikely, but the example is simplified and the real form will consist of much more non-current assets and numbers will be different. The probability of miscalculation mistakes is quite high, and no tool to check if everything was calculated correct exists. These kind of inappropriate reports are highly likely when everything is done by hand.

More filling everything by hand results in stimulating cheating and corruption. Each company proceeding from the interests can send different parties different info about its financial activities and situation. To get loans from banks financial activities may be reported in such way to show good financial results and stability, since financial situation can't be good if company wants to get credit. In order to be clean in front of the law correctly formed report is needed to be sent to government. Respectively tax department will get a report designed and adapted so that company does not have unpaid taxes or other violations. All that disables transparency, no one gets correct information of how the business is going anywhere.

2.2.2. XBRL

There are a lot of reasons why financial statements receivers prefer and consider it most accurate and convenient to use open international standard for digital business reporting, in other words XBRL format based reports. Older paper-based reports are preferably replaced with more effective digital versions.

Users have more reliable reporting information which can be validated without any difficulties and spending much time by user himself. Data can be shared between organizations immediately and be analyzed rapidly. Basically the analysis provided from XBRL format is equivalent to the one professional investor funds can offer, so investors who acquire securities in their own name can receive the same analysis as if he referred to the fund.

Professional investors also make use from the digital reporting format since they have to collect big amount of the information concerning different stocks and analyze gathered data to make corresponding decisions which won't be disadvantageous or unprofitable. XBRL allows to reduce costs related to collecting the facts and consolidation of economic performance by combining them into groups, in addition data is more reliable.[1]

Precise and meticulous understanding of financial performance of certain entity capital in the market enables interested corporate finance parties to benefit from spreading XBRL formatted financial statements. Moreover accurate analysis exposes share prices which also improves understanding of financial activities.

Furthermore stock coverage which is needed to analyze the performance of companies is advantageous for big corporations which more easily receive the stock overall picture, and since more and more analysis is being done large companies are delighted to receive that information.

Not only financial giants gain a benefit from XBRL format of reporting distribution, by offering digital data small companies acquire attention of analysts faster and consequently benefit from XBRL application.

Also technical aspects of usage the interactive reporting are as significant as listed above. Since XBRL offers different sorts of validation and calculation rules the reliability and correctness of the submitted report is always higher in comparison with paper-based reports for example.[2]

Here is the same report introduced in comparison of paper reporting way, but represented in electronic format:

| 27/08/2014 | |
|-----------------------------------|-------------|
| Assets | |
| Non-current assets | |
| Property, plant and equipment | 1250 |
| Investment property | 550 |
| * Total non-current assets | 1700 |

Figure 1. XBRL format report calculation error

And validated against defined rules:

Form was saved but there were errors discovered

- Value of 1700 provided for the 'Total non-current assets (27/08/2014)' does not equal to the total of values, which is 1800!

Figure 2. Validation error message

The same number of total non-current assets is calculated wrong, but electronic annual report example shows an error then trying to save the form with incorrect data. The real form consists of much more non-current assets and each value provided is calculated. The probability of miscalculation mistakes is quite high as on paper report, but XBRL format allows to use tool to check if everything was calculated correct. Consequently if XBRL can validate such a calculation so total amounts can be also calculated by the system if software developed supports such functionality. So while filling the forms using XBRL supported software there is no way to make such a mistake as wrong calculation or enter different number for the same field in the field is presented in several forms.

2.3. Taxonomy

XBRL taxonomy is reporting hierarchical dictionary, collection of linked documents called the DTS (Discoverable Taxonomy Set). Those reusable definitions define items of data using specific tags with attributes and interrelationships with other items. XBRL accounting terms may be defined in multiple taxonomies since it may be required for different business reporting purposes. Discoverable set of the taxonomies contains multiple taxonomies in order to reuse different schemas with relations between each other in order to face the need of covering different organizations, regulators or companies specific business reporting needs.

The XBRL instance document references the electronic description for financial statements called taxonomy schema document. A set of XML files which can reference other files and so on taxonomy documents represent authoritative definitions, that contain all of the reporting terms used in a financial report. As an example the IFRS taxonomy consists of more than forty files including three schemas. There are all elements defined including presentation linkbases and multi-lingual translations. Accordingly there is an opportunity to extend the taxonomy by adding different linkbases or languages and all added documents can be referenced by existing taxonomy. Any base taxonomy can be extended if any regulation requires to report some additional information. Not only extension means adding new fields, new translations or any other information to the report, it is also possible to override existing set of rules, modify the structure, remove information from the base version.[5]

Taxonomy is easily adaptable in order to enable business users to change it to their particular demand while taking as a basis the main taxonomy to ensure elements are remained compatible.

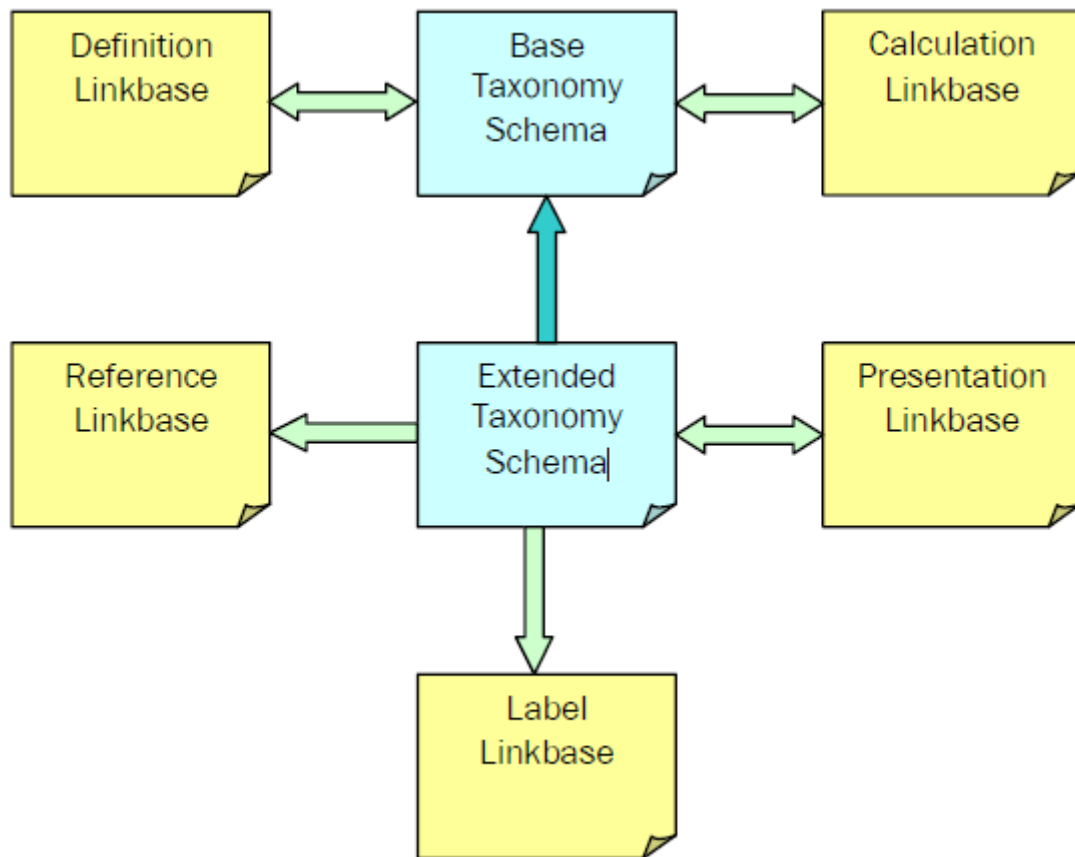


Figure 3. Taxonomy anatomy [10]

The figure above presents linkbases relation to the schema. Worth mentioning that there are unidirectional connections as well as bi-directional. Reference and label linkbases link elements only from the taxonomy to external resources, they are unidirectional. Definition, presentation and calculation layers are bi-directional and provide relationships descriptions between elements, point from one part of the taxonomy to another.

Linkbases are the components of a taxonomy, set of links which include locators, arcs and relationships between elements and specified external resources. Locators are elements which are placed in 'loc' elements and reference the concept located in taxonomy schema. Arcs are elements which describe connection between concepts using label provided by the locator. Arcs can show relationship between concept and resource as well. There are different kinds of linkbases in XBRL.

Here is an example of locator and arc usage:


```

<link:loc xlink:type="locator"
  xlink:href="full_ifrs-cor_2014-03-05.xsd#ifrs-
full_StatementOfFinancialPosition"
  xlink:label="StatementOfFinancialPosition"/>

<link:loc xlink:type="locator"
  xlink:href="full_ifrs-cor_2014-03-05.xsd#ifrs-full_Assets"
  xlink:label="Assets"/>

<link:presentationArc xlink:type="arc"
  xlink:arcrole="http://www.xbrl.org/2003/arcrole/parent-child"
  xlink:from="StatementOfFinancialPosition"
  xlink:to="Assets"/>

```

Figure 4. Locator in presentation linkbase

The relationships that describe the type of relationship are identified by ‘arcrole’ attribute. In the particular example above type of relation is parent-child. The attributes to and from point to locators. In that case the relation defines that Assets is a child of ‘StatementOfFinancialPosition’.

2.3.1. Definition Linkbase

The definitions of the concepts provide different kinds of information representing different kind of role and relationship. The occurrence of one concept the instance document required the presence of other concepts as an example. Definition linkbase supports the following types of connections:

- general-special
That kind of relationship exists between concepts and defines specialization and generalization of concepts. As an example connection of type is-a-kind-of, like province in Estonia or state in US is a representation of part of the country. So the part of the country is a general and province or state are specials. General-special relationships work that way as a specialization cannot reference own generalization.
- essence-alias
This relation type is applicable to several similar concepts. If there are defined concepts with same meaning this relationship is used. This approach can be used to identify two objects named different but representing the same essence. As

those objects are of same essence they must be of same type and same period and have same value. By essence-alias arcrole may be related car and automobile as an example of such kind of relationship.

- similar-tuples

That relation takes place between tuple concepts and represents the same as essence-alias but only for item concepts. The relationship is applied for tuples with equivalent definitions. Those tuples can for example contain different elements but be with the same definition or like for example email address which can be of different format but represent the same data.

- requires-element

This relationship is between concepts which defines requirements within an instance document to make element require presence of some other element if provided. If value of the from concept presents in the instance document, then a instance creator must provide value of the concept as well. It is made to enable regulations require some important connected information together without hiding components.

2.3.2. Calculation linkbase

Calculation arcs a made to increase the reliability and accuracy of the financial reports represented in XBRL format, as they enable using relationships between concepts to define different calculation rules.

Items which can be either added or subtracted must be of same context and unit.

| Calculation Relationships | Weight | Balance |
|---|--------|---------|
| ☐ [210011] Statement of financial position, current/non-current | | |
| ☐ ifrs-full:EquityAndLiabilities | | credit |
| ☐ (1) ifrs-full:Equity | +1 | credit |
| (1) ifrs-full:IssuedCapital | +1 | credit |
| (1) ifrs-full:RetainedEarnings | +1 | credit |
| (1) ifrs-full:SharePremium | +1 | credit |
| (-1) ifrs-full:TreasuryShares | -1 | debit |
| (1) ifrs-full:OtherEquityInterest | +1 | credit |
| (1) ifrs-full:OtherReserves | +1 | credit |
| ☒ (1) ifrs-full:Liabilities | +1 | credit |
| ☒ ifrs-full:Assets | | debit |

Figure 5. Calculation linkbase representation. Calculation relationships.

Calculation linkbase definition shows which of the elements should be summed up and what element represents the summation result. This approach helps to validate instance against certain calculation rules.

As shown in the figure above in calculation relationships elements are grouped the way they need to be calculated against rules, so the group referred as a sub element of Equity are placed in the tree as follows. Each level elements to be summed up have own weight attribute which shows either addition of element is required or a subtraction.

An example is provided below:

```
<link:calculationArc
  xlink:type="arc"
  xlink:arcrole="http://www.xbrl.org/2003/arcrole/summation-
item"
  xlink:from="Equity"
  xlink:to="SharePremium"
  weight="1.0"/>

<link:calculationArc
  xlink:type="arc"
  xlink:arcrole="http://www.xbrl.org/2003/arcrole/summation-
item"
  xlink:from="Equity"
  xlink:to="TreasuryShares"
  weight="-1.0"/>
```

Figure 6. Calculation relationships configuration

As shown in the Figure the calculation arcs are pointing to the relationships between equity, treasury shares and share premium. The arc has a weight attribute which defines a multiplication factor for the calculated item. Worth mentioning that options provided by the calculation linkbase are very limited, not possible to sum up the difference between facts for the same concept within different periods.

2.3.3. Reference Linkbase

Reference appeared in the taxonomy are links to the published authoritative statements in financial literature. The reference linkbase only refers to related publication without showing its content, all needed to find and identify the paragraph but no more.

It is made for users to be able to identify each element meaning in case something is not clear. Business reports created always reference to some financial reporting standards and different kind of regulations applied to them. It is important that person who creates or fills the report instance correctly understands what each fact represents and that is why links to the referred paragraphs are included. Specific terminology and concepts in the standards must be explained in order user requests it, otherwise it is not possible to submit correct report.

Reference linkbase is a support module for that kind of functionality. It uses concept-reference arcrole to link the element with corresponding reference, which will forward to the correct documents and paragraphs in it.

There exists several roles of references:

- reference – default reference
- definitionRef - precise definition of a concept
- disclosureRef, mandatoryDisclosureRef and recommendedDisclosureRef - explanation of the requirements
- unspecifiedDisclosureRef - explanation of unspecified structural and completeness requirements
- presentationRef - explanation of the presentation of a concept
- measurementRef - method for measuring values
- commentaryRef - commentary on the concept
- exampleRef - documentation which provides an example

```
<link:loc
  xlink:href="ifrs-om-cor_2014_12_31.xsd#ifrs-om_RestatedMember"
  xlink:label="loc_1"
  xlink:type="locator"/>
```

```
<link:reference
  xlink:label="res_1"
```

```

xlink:role="http://www.xbrl.org/2003/role/disclosureRef"
xlink:type="resource">
<ref:Name>IAS</ref:Name>
<ref:Number>8</ref:Number>
<ref:IssueDate>2014-01-01</ref:IssueDate>
<ref:Paragraph>28</ref:Paragraph>
<ref:Subparagraph>f</ref:Subparagraph>
<ref:Clause>i</ref:Clause>
<ref:URI>
http://eifrs.ifrs.org/eifrs/XBRL?type=IAS&num=8&date=201
4-03-17&anchor=para_28_f_i&doctype=Standard
</ref:URI>
<ref:URIDate>2014-03-05</ref:URIDate>
</link:reference>

<link:referenceArc
  xlink:arcrole="http://www.xbrl.org/2003/arcrole/concept-
reference"
  xlink:from="loc_1"
  xlink:to="res_1"
  xlink:type="arc"/>

```

Figure 7. Reference linkbase example

Provided example is of disclosureRef reference role, contains reference for explanation of the requirements. Arcrole is concept-reference which means that the arc is used to point from a concept to a reference. As it is seen no textual information provided within reference tag, only name of the reference, date it was defined and link to the document mentioning paragraph number.



Figure 8. Reference linkbase example

2.3.4. Presentation Linkbase

In order to create a structure of the presented elements presentation linkbase is used. The business report needs to have a human readable structure and presentation arcs create that hierarchical structure.

The presentation may include preferredLabel attribute that shows the type of label certain element requires, as there is an obvious need to distinguish total fields from other fields for example.

```
<link:presentationArc
  xlink:type="arc"
  xlink:arcrole="http://www.xbrl.org/2003/arcrole/parent-child"
  xlink:from="NoncurrentLiabilitiesAbstract"
  xlink:to="NoncurrentLiabilities"
  order="9.0"
  preferredLabel="http://www.xbrl.org/2003/role/totalLabel"/>
```

Figure 9. Presentation arc with preferred label

Organized structure of the report is essential aspect, as seen from the example hierarchy is ensured by defining parent-child (from-to) relationship. In case One element has many children they can be ordered using order attribute.

2.3.5. Label Linkbase

XBRL gives an opportunity to reach the goal of a standard which can be applicable all over the world. It is possible to create taxonomies in as many languages as necessary, the only thing needed is a translator who will provide needed language support, no any modifications to any other structures of the taxonomy components needed. Additionally XBRL is capable of creation of different types of labels, so called label roles:

- label - default labels
- terseLabel - short labels
- verboseLabel - exact description labels
- positiveLabel, positiveTerseLabel and positiveVerboseLabel - labels for positive values
- negativeLabel, negativeTerseLabel and negativeVerboseLabel - labels for negative values
- zeroLabel, zeroTerseLabel and zeroVerboseLabel - labels for values of zero
- totalLabel - total value labels
- periodStartLabel and periodEndLabel - values on start or end of a period
- documentation - documentation labels

- definitionGuidance, disclosureGuidance, presentationGuidance, easurementGuidance, commentaryGuidance and exampleGuidance - explanation labels

This label linkbase allows to immediately open the reports to groups of people speaking in different languages only by changing the language in the system. This means that it's possible to display the same reports with the same set of elements and ordering to different countries representatives without any duplications or additional work.

Elements can be connected to labels with different languages. An example that describes definitions of labels of the IFRS element LoansReceivedFromGovernment in English and Arabic is provided below:

```
<link:label
  xlink:type="resource"
  xlink:label="label_LoansReceivedFromGovernment"
  xlink:role="http://www.xbrl.org/2003/role/label"
  xml:lang="en">
  Loans received from government
</link:label>
```

Figure 10. English label

```
<link:label
  xlink:type="resource"
  xlink:label="label_LoansReceivedFromGoverment"
  xlink:role="http://www.xbrl.org/2003/role/label"
  xml:lang="om">
  الحكومة من القروض
</link:label>
```

Figure 11. Arabic label

```
<link:labelArc
  xlink:type="arc"
  xlink:arcrole="http://www.xbrl.org/2003/arcrole/concept-label"
  xlink:from="LoansReceivedFromGovernment"
  xlink:to="label_LoansReceivedFromGoverment"/>
```

Figure 12. Label arc

As other arcs label arc has own role concept-label which shows a from which concept to which label is a relation. As can be seen from the definition of labels there is a lang attribute which represents which language is used for presenting current label element.

Different label roles can be defined for one and the same element. The main idea for this is to be able to make creator of the report see information in more user-friendly and convenient way. As many financial facts may be presented for a certain date or a period, it is more convenient to show the user label of an appropriate type. The main factor here is that period definition doesn't affect the reporting element itself, because information about the period is contained in a context of instance document, but element's preferred label can be declared as period start for example to show the user more understandable and informative title.

The example below shows how two different labels are assigned to one element by applying different role attributes on labels.

```
<link:label
  xlink:type="resource"
  xlink:label="label_RestatedMember"
  xlink:role="http://www.xbrl.org/2003/role/label"
  xlink:title="label_RestatedMember"
  xml:lang="en">
Currently stated
</link:label>

<link:label
  xlink:type="resource"
  xlink:label="periodStartLabel_RestatedMember"
  xlink:role="http://www.xbrl.org/2003/role/periodStartLabel"
  xlink:title="periodStartLabel_RestatedMember"
  xml:lang="en">
Restated balance at
</link:label>
```

Figure 13. Label types

In financial reporting requirement the expression of restated balance represented value for the certain the date for which they are being reported. The type of the label allows to define corresponding label for that purpose by leaving the space to add related date from the context to the end of the label for the attractive user interface.

2.4. XBRL instance

XBRL instance document contains the data belonging to one report, including reference to the taxonomy in order the provided data to be applicable with a schema.

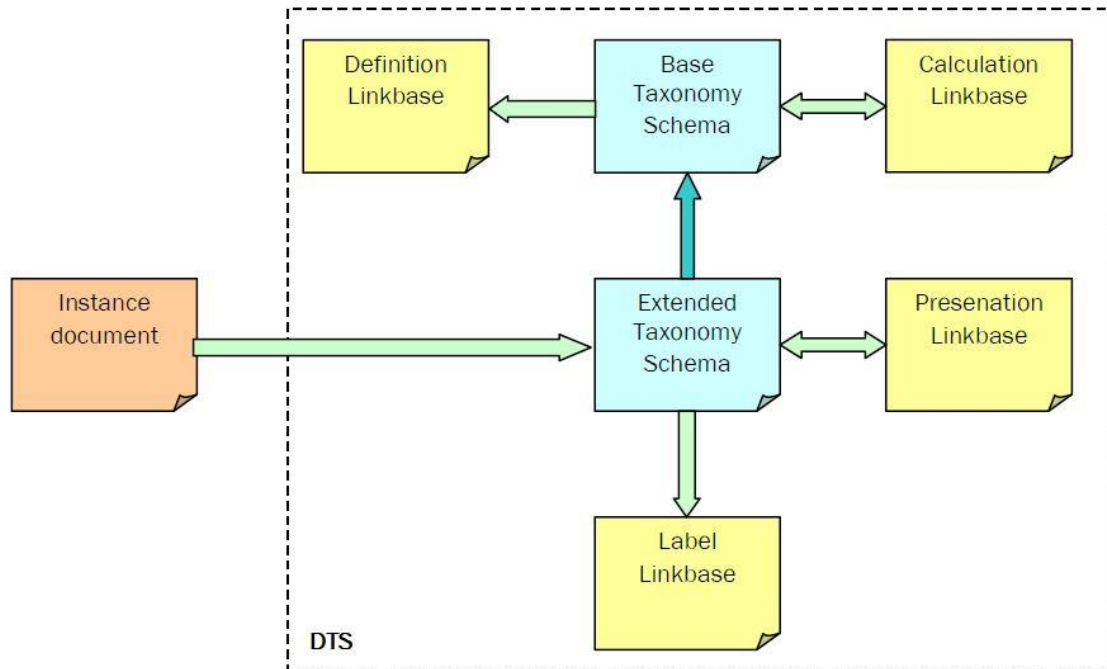


Figure 14. XBRL instance taxonomy reference [10]

All reported data within a document is reported in a context (the fiscal year or the start of a period). The document contains all contexts for the report which are defined in taxonomy as well as references and labels.

2.4.1. Instance document

Root element

Instance begins with xbrl root element. One xbrl instance is enclosed in one xbrl tag.

Instance includes the following sort of data:

- Reference to one or more taxonomies the instance is based on
- References to linkbases
- Context
- Units

- Facts
- Footnotes

References

The xbrl instance may include multiple external resources references:

- Reference to taxonomy
If taxonomy not defined there is no use of the data provided in the document, there is no meaning values can represent. At least one taxonomy schema file must be declared.
- Linkbase reference
This is an optional reference which may include additional information.
- Role and arcrole reference
Custom arcroles are to be referenced in xbrl instance document

Context

So that bring the meaning to the facts reported each element must have a context reference. Contexts elements defined in the instance document include id with which items reference to the context.

To understand the facts reported in an instance document, they need to have a context. The context provided in XBRL contains the entity doing the reporting, the period on which is reported. A context must have an id attribute which is used to refer to the context from the items in the report.

Unit

Values provided need to have unit of measurement, so that value can be interpret. Unit element has id attribute as a reference for value elements in the instance document.

Example of unit:

```
<unit id="OMR">
  <measure>iso4217:OMR</measure>
</unit>
```

Item Facts

Items in the XBRL instance document have context reference, unit reference and elements with numeric values must be with precision or decimals attribute to indicate accuracy.

2.5. XBRL limitations

The XBRL is a standard which works with financial related information constructing all elements into taxonomies and enables operating with the data presented in instance document based on the taxonomy. However, the standard does not have much adoption at the moment and APIs which work with XBRL are not directed to operating with the data on the fly.[6]

There is no approach created for accessing the data in complex. Since taxonomies are presented in large amount of data located in different files parsers are not effective enough even to show a set of fields with corresponding labels related to simple form.

Lack of performance while operating with XBRL is a current problem of adoption the technology. Searching for elements from the taxonomy takes time and does not meet requirements to be user attractive as other web applications.

All of the inconveniences of the requests made to gather information make XBRL not that flexible and can't be considered to be a good, fast and user friendly web application to enable business reporting process to be much easier and enjoyable process.

3. XBRL engine implementation

In order to meet requirements of operating with XBRL format and make the standard to be easily adjustable, flexible and fast responsive for processing financial data the XBRL engine was created.

3.1. Solution architecture

3.1.1. One stop shop platform

As there is a need to create country base business register in order to collect financial annual reports of the entities officially existed the one stop shop platform is developed. As all the interested parties of analyzing, filling and submitting those reports need to be able to access the corresponding report data using the system the following architecture was a necessity to be created.

Software architecture describes how the components of integrated IT solution are envisioned in the One Stop Shop platform. Various technologies used to deliver the proposed design are presented.

One Stop Shop application provides online way of submitting and processing of annual reporting as well as e-applications related to commercial registration, licensing, etc.

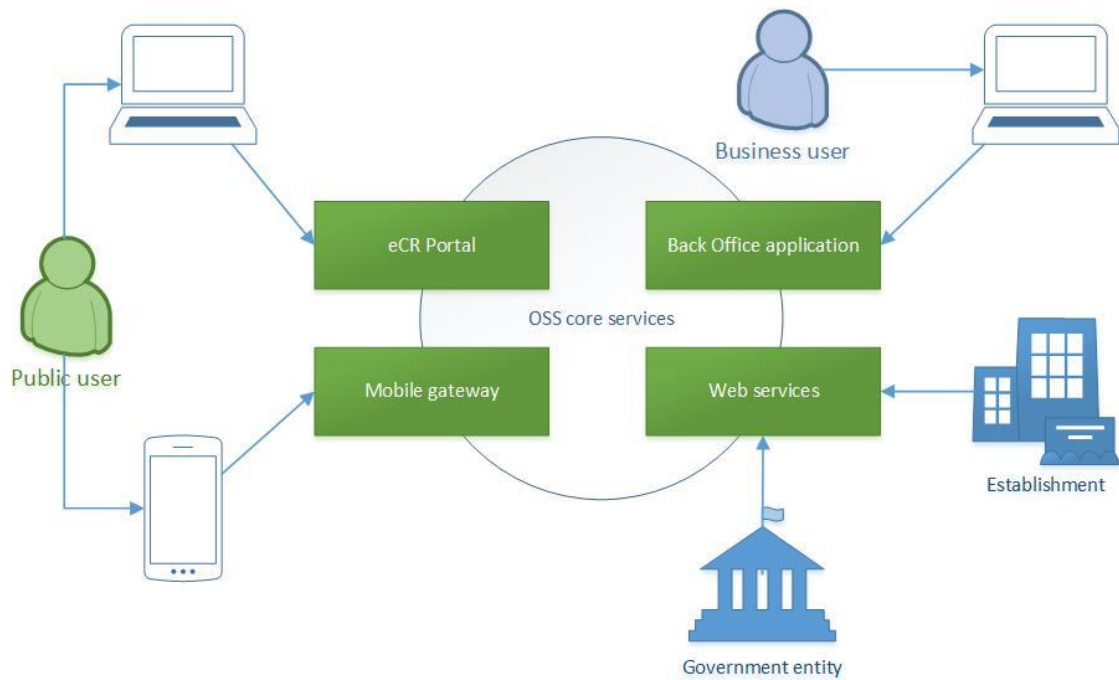


Figure 15. OSS application overview

OSS users can be divided into three major groups:

- Public user – these are the investors, company representatives who use OSS application on the Internet. The functionality available is limited to applying for services offered by eCR Portal and Mobile application.
- Business user – these users are government officials and employees of Ministry of Commerce and Industry are limited in functionality based on their role in the system. Depending on the role and permissions, they are allowed to verify, approve e-applications or submit e-application in behalf of an investor or have administrative rights for managing metadata, users, etc. all through Back Office application.
- Government & Establishments – this type of users are client applications which are integrating with Web services offered by OSS application. Their roles and permissions are managed the same way by OSS application as previous two groups of users.

The components presented in the figure describing application structure:

- eCR Portal incorporates functionalities that are available for public users

- Back Office application is for the Ministry of Commerce and Industry internal personnel, manages backend processing of annual reporting inspections, risks assignment, licensing management, application meta-data management.
- Web Services module exposes web services offered to other government entities but also consumes web services offered by them.
- Mobile Services module is a communication channel for mobile applications.
- Core Services is distributed module that consists of services offered to presentation layer modules, and it implements the core, reusable business logic across all channels.

3.1.2. Technologies and frameworks

Spring Framework

Spring framework is used as the main framework that glues together all the other software components. Spring framework hides complexities and promotes code reuse which result in better software quality. Spring structures whole applications in a consistent, productive manner, in order to create a coherent architecture. It offers services for use throughout an application, not merely in a single architectural tier.

The main features through which Spring framework delivers its proposition include:

- Flexible dependency injection with XML and annotation-based configuration styles;
- Powerful abstractions for working with common Java EE specifications such as EJB, JDBC and JTA;
- First-class support for other common open source frameworks: Spring Web MVC, Java Portlet 2.0, Spring Web Services;
- Rich testing facilities for unit tests as well as for integration tests

EJB 3

EJB 3 is a technology for developing the business and persistence layers. Enterprise Java Beans 3.0 is a deep overhaul and simplification of the EJB specification. EJB 3.0 has fully embraced Java Annotations introduced in JDK 5.0 and provides the API for CMP entity beans by using Hibernate as the EJB 3.0 Java Persistence engine.

Spring Web MVC

Spring Web MVC framework is designed around the basic model-view-controller pattern, and allows for configurable handler mappings, view resolution, locale and theme resolution, as well as support for uploading files.

The framework offers the following key features:

- Reusable business code, no need for duplication. Existing business objects can be used as command or form objects.
- Customizable binding and validation. Type mismatches are automatically converted as application-level validation errors that keep the offending value, localized date and number binding instead of String-only form objects with manual parsing and conversion to business objects.
- Customizable locale and theme resolution, support for JSPs with or without Spring tag library.
- Total independence on view technology (JSP, Velocity, XML, JSON); same controller code can be reused across multiple delivery channels.
- Out-of-the-box support to create RESTful web services, through the `@Controller` and `@PathVariable` annotations.

Java Portlet 2.0 (JSR 268)

Java Portlet 2.0 technology is used as core technology in the development of the eCR portal, through the usage of Spring Web MVC extension Portlet MVC framework

- Provides capabilities for coordination between different portlets that can be implemented by different parties and packaged in different WAR files.
- Provides capabilities for a portlet to dynamically serve a resource, including static and dynamic resources;
- Extended support for incorporating AJAX content;
- Added support for caching of resources;
- Possibility to add common behavior through the use of portlet filters;
- Separate tag library;
- Container runtime options, that allow portlet to define additional runtime behavior or change the default behavior.

3.1.3. OSS core services

OSS core services is a distributed component of the OSS system composed solely of EJBs. It contains two important modules. One is a business API which provides domain model and service interfaces of OSS business layer. Second module contains business and persistence layer implementation of the business API.

Business API module is built as Java library and distributed to other components of the OSS system (eCR Portal, OSS Back Office, OSS web services and Mobile services) as common service.

Business implementation module is built as standard Java web application. It contains implementation of business interfaces using Java EE specification with EJB 3 technology and it is used to deploy EJBs into application servers EJB container. Once EJBs are deployed into container they can be accessed through JNDI by other components of the OSS system.

OSS core services can be viewed as separate Maven project containing several modules:

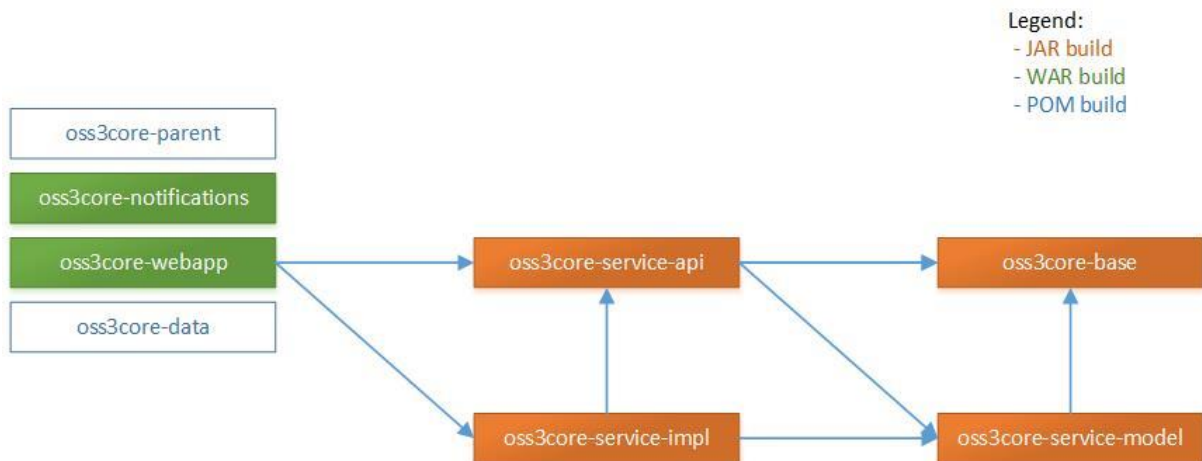


Figure 16. OSS core module

3.1.4. eCR portal

The eCR portal component is implemented on top of Java Portlet (JSR-286) technology in conjunction with Spring Web MVC and JSP. The generated web interfaces are compliant with HTML5 and CSS 2.1 standards.

The eCR portal serves as the main front-end for submitting annual reports as well as submitting new CR and license applications, updating CR information, etc. The functionalities implemented in eCR are available to a subset of user roles such as guest or unauthenticated user or service provider. It consist of several presentation layer modules such as OSS theme, WCM, portlet (JSR-286) applications, etc. When it comes to business logic and persistence, eCR portal modules relies on OSS core services, similar to other OSS system components.

The main functionalities implemented in eCR Portal is:

- CR registry: submitting new CR application, updating existing CR, searching CR information;
- MyCR: view aggregate information about user's CRs, view user's task calendar, applications, announcements, licenses and debts register;
- Announcements: list of users announcements, enter new announcement, view details of announcement;
- Debt register: register debt, search for debt, display details of debt record, cancel debt record
- Official gazette: browse, search and view laws; browse, search and view news;
- Licenses and notices: license/notice simulator, new license and change license applications, renew licenses, view license status, cancel license;
- Management of delegation rights

eCR Portal component can be views as separate Maven project made of following Maven modules:

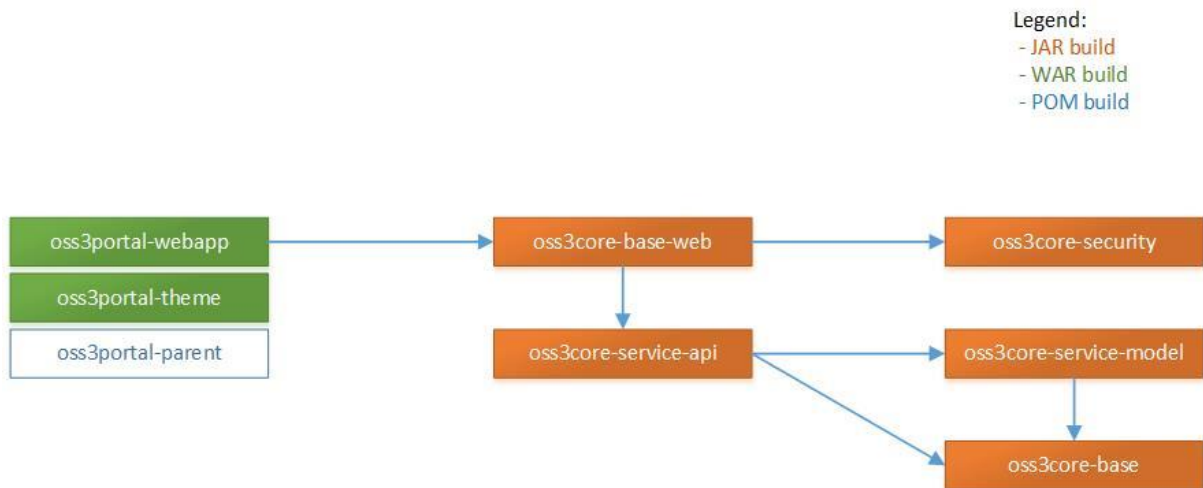


Figure 17. OSS portal module

oss3portal-parent module contains only pom.xml. This POM defines a set of Maven coordinates related to OSS portal application.

oss3portal-theme component is a web application which represents the face of OSS portal. It contains static resources such as CSS, images and JavaScript files.

Oss3portal-webapp represents collection of portlet applications deployed together as portal web application. It is implemented using JSR-286 specification, Spring Webflow framework and JSP presentation layer technologies. Portlet applications do not implement service and persistence payer but rather rely on OSS core services module.

Internationalization and localization is implemented using Spring Frameworks internationalization and localization support. Depending on the locale setting of user's browser, the appropriate language is selected adapting software to regional differences. eCR Portal application supports two languages: English and Arabic. It also supports adding any number of new languages. As locale-specific components and translating texts are presented in taxonomy then it is easily applicable to the multi-lingual support.

3.1.5. OSS Back Office

Back Office is the module for the Ministry of Commerce and Industry internal personnel, manages backend processing of annual reports inspections, assigning risks, licensing management.

OSS back office is a separate Maven project made of following Maven modules:
oss3bo-parent and oss3bo-webapp.

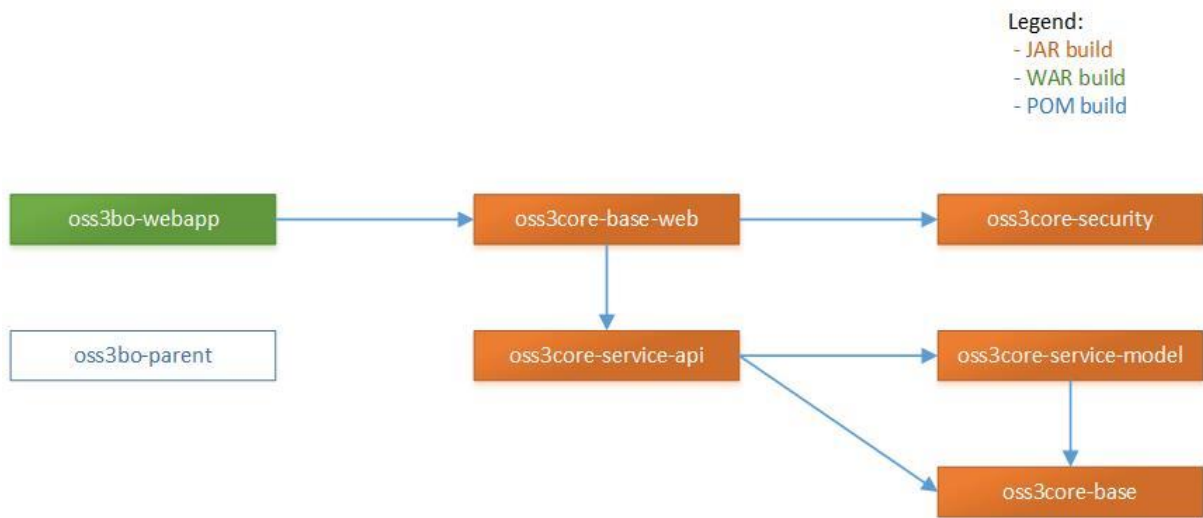


Figure 18. OSS Back Office module

oss3bo-parent module contains only pom.xml. Role of parent module is exactly the same as in other OSS parent modules.

oss3bo-webapp module represents OSS back office web application. It is single deployable artifact implemented by using presentation layer technologies: Spring WebFlow and JSP. Back office application also relies on Drools rule engine to perform validation of user submitted forms in conjunction with Spring's validation.

The same as eCR portal OSS back office application also supports two languages: English and Arabic. Internationalization and localization is implemented the same using Spring Frameworks internationalization and localization support.

3.1.6. OSS web services

OSS web services component of OSS system serves as integration point between MoCI and other government and non-government agencies. It publishes XML (SOAP) services using JAX-WS specification and JAXB for marshaling of XML documents.

OSS web services component can be viewed, similarly as before, as separate Maven project made of following Maven modules:

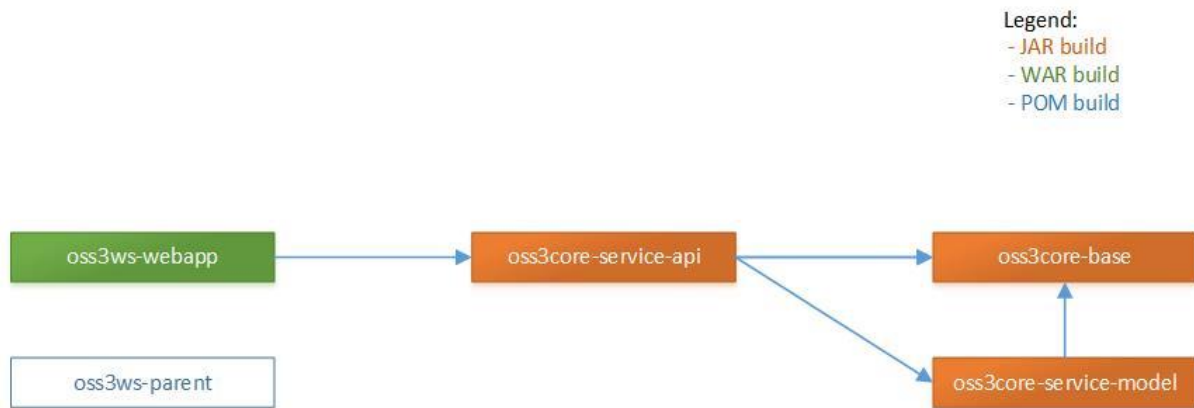


Figure 19. OSS web services module

Again oss3ws-parent module contains only pom.xml.

oss3ws-webapp application is used to expose OSS core services as SOAP web services. It is implemented using latest JAX-WS and JAXB specification. Since web services domain model differs both in structure and technology from OSS core services model, OSS web services application also performs domain model transformation.

3.2. Annual reporting module architecture

3.2.1. Overview

Annual reporting module which allows to fill and submit financial reports includes the following functionality:

- Renewal of licenses of economic activities and data regarding CR
- Reuse of old reported data during renewal
- Management of taxonomy
- Annual report information and financial figures output to external entities
- Report auditing process
- The system highlights the changes based on the Annual report

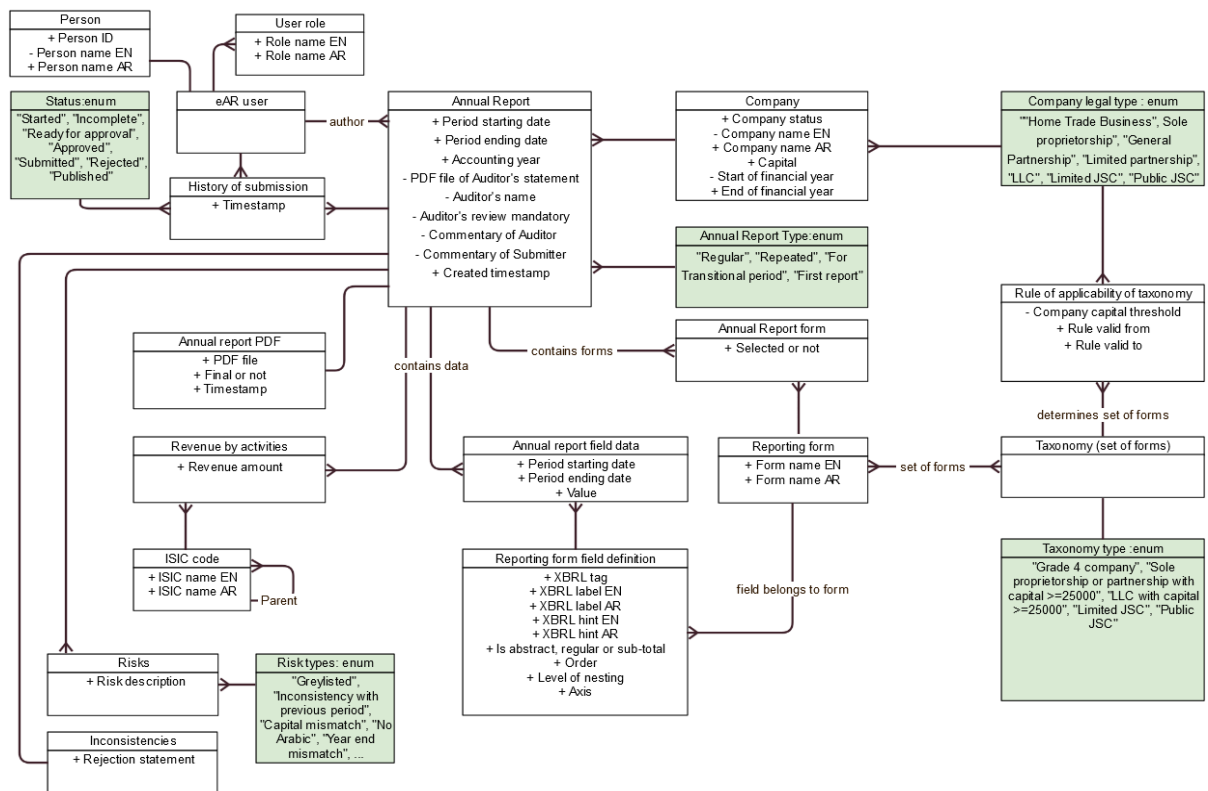


Figure 20. Business domain model of annual reports

Given domain model shows all annual reporting elements which provide filling the functionality requirements. It includes all the objects for storing report data, transformation to the appropriate set of forms. Annual reports are intended to give shareholders and other interested people information about the company's activities and financial performance and show if there are any inconsistencies or any doubtful data provided in the report. Risks assignment is presented to show suspicious reports. All the information regarding report creators and any relevant information the model represents.

In order accounting information belongs to a business entity there is a company existing in the commercial register with a set of fields required for taxonomy to be applied for a specific type of company. As the rules applied to the company with certain type and capital the annual report has a list of forms including optional needed to be filled and submitted. The forms include a collection of fields in them and each field has all the corresponding information including labels, calculation rules and references. Submitted reports are checked for any potential deficiencies and if any each report is assigned with

a risk of a certain type. For making possible to operate the report in different states and by different people and sub-systems, for example submitting the report is done by user in a portal, after back office worker gets it with risks already assigned or performs a check himself and send it back to the user for correcting, there is a lifecycle of the report with statuses defined and user's information.

Typical annual reports for financial year include:

- Accounting policies
- Balance sheet
- Cash flow statement
- Contents: non-audited information
- Profit and loss account
- Notes to the financial statements
- Chairpersons statement
- Authorized managers' Report
- Operating and financial review
- Auditors report

3.2.2. Business process diagram

The following shows the process of submission of the financial report.

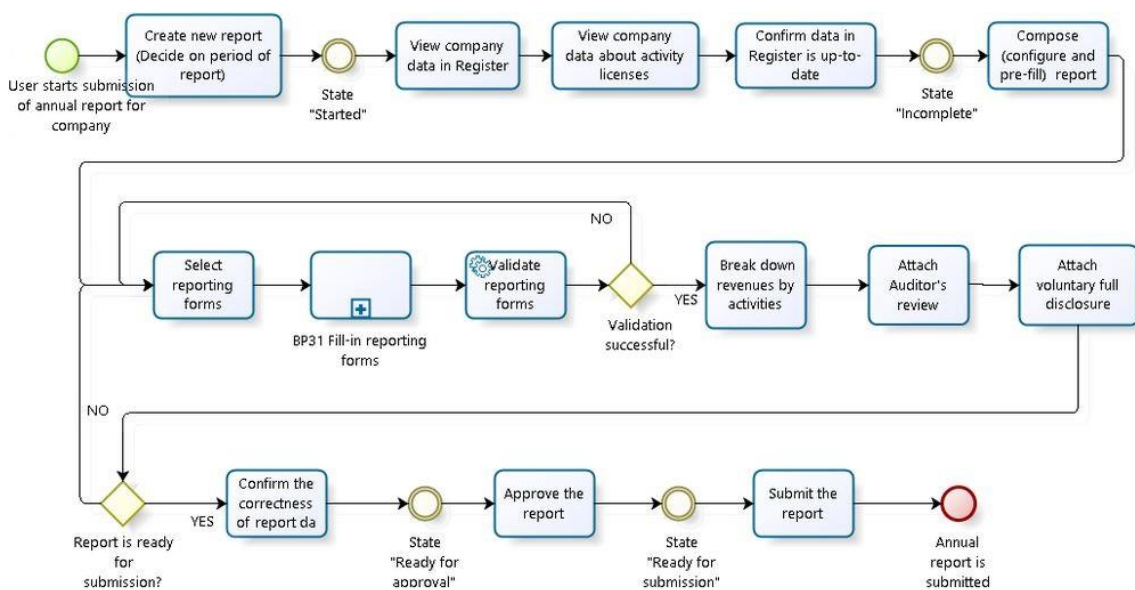


Figure 21. Report submission business process diagram

Starting the report

Annual reports shall not be submitted if company is not yet formally registered and if company was registered less than six months ago.

Deciding on report period

Duration of reporting period is 12 months and corresponds to the dates of start and end of financial year registered in Commercial Register. Duration of reporting period can be modified and shall be not less than 6 months and not over than 18 months. Reporting period cannot overlap with other periods. Reporting period cannot span to dates in future.

Review company data in commercial register

In order to proceed with submission of annual report, Company shall confirm the data in Commercial Register is up-to-date.

Selection of reporting forms

Forms of annual reports depend from the legal type and registered capital of the company.

Completion and validation of reporting forms

Electronic annual report is completed and validated against rules and verification for reporting forms and is specified in XBRL language.

Auditor's review

Attaching auditor's review for electronic annual report is mandatory for companies

Approval and submission of annual report

User with appropriate role submits or approves the annual report.

3.3. Metamodel

3.3.1. Purpose and overview

The fact that whole set of the taxonomy has more than fifty files requires to investigate the performance of the application using and parsing this amount of data on the fly.

Moreover, different taxonomy extensions like adding multi-lingual support increase amount of related but not structured data significantly.

Consequently the main goal is to process all the information to some clear structure that can be parsed essentially fasted and preferably be represented as one file. Metamodel is that kind of representation of whole taxonomy including all the data to meet XBRL requirements.

3.3.2. Metamodel generation methodology

XBRL API

XBRLAPI is an open source Java implementation of an API that supports analysis of XBRL data sources, both taxonomies and the business reports that are based upon them.

Metamodel generator uses XBRL API for providing all sorts of element represented in taxonomy. Arc, concepts, label resources, locators, role types, reference parts, reference resources and even constants to make operations with needed types of elements are all provided by XBRL API.

Jaxb

As metamodel XML is generated project is developed to evolve the code for the serialization the java architecture for XML binding. Jaxb is a technology which make it possible to map Java classes to XML representations. So in the output of metamodel generator work comes structures XML file which can be later serialized to java classes much faster than acquiring needed information from the taxonomy files, which as described above may contain more than 50 xml files and if taxonomy provides multi-lingual support than amount of files and total size of the taxonomy becomes very heavy.

Multithreading

Multithreading is used to operate with provided files in parallel. In order to create different reporting forms there is a need to construct the whole form object with all related information provided in taxonomy, seek for each element and each label of each type for the element and adding all of it to the reporting form. Since amount of data to be parsed is enormous, multithreading gives an opportunity to start searching related data for each reporting form in parallel with other reporting forms, so metamodel could

be generated faster. So is applied to execute multiple processes concurrently in order to accelerate the metamodel generation.

Structure and correlation with XBRL

Metamodel is represented as one XML document which contains all the XBRL discoverable taxonomy set included information.

As metamodel generation complete and all information gather in one file and the container for all of these entries is the xbrl root element which has taxonomy version date attribute defined as it could be possible to reference the instance generated based on the metamodel against appropriate taxonomy in the future.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<xbrl taxonomyVersionDate="2014-12-31">
  <forms>
    <entry code="210011"
linkRoleUri="http://www.mocioman.gov.om/xbrl/role/StatementOfFin
ancialPositionCurrentNoncurrentCompaniesWithCapital25000OMRAndMo
re">
      <name>
        <entry key="om">
          متداول غير/متداول المالي، المركز بيان
        </entry>
        <entry key="en">
          Statement of financial position, current/non-current
        </entry>
      </name>
    </entry>
  </forms>
</xbrl>
```

Figure 22. Metamodel form entry sample xml

Each reporting form root element contains unique code of the form, and all provided translations referencing to the language. Taxonomy version is represented in the root element of the document.

Presentation is represented inside <presentations> tag of each form entry. This part of metamodel defines how should the report be structured, what type of fields are there and overall user interface related information is defined here:

```

<entry
  abstract="false"
  period="INSTANT"
  type="MONETARY"
  level="3"
  name="NoncurrentBiologicalAssets"
  namespace="http://xbrl.ifrs.org/taxonomy/2014-03-05/ifrs-full"
  order="7.0">
<labels>
  <language key="om">
    <label key="DOCUMENTATION">
      متداولة الغير البيولوجية الأ صول مقدار.
    </label>
    <label key="DEFAULT">المتداولة غير البيولوجية الأ صول</label>
  </language>
  <language key="en">
    <label key="DOCUMENTATION">
      The amount of non-current biological assets.
    </label>
    <label key="DEFAULT">Non-current biological assets</label>
  </language>
</labels>
<ancestors>
  <entry>210011</entry>
</ancestors>
<references>
  <entry label="res_21">
    <data>
      <entry key="subparagraph">f</entry>
      <entry key="paragraph">54</entry>
      <entry key="issuedate">2014-01-01</entry>
      <entry key="name">IAS</entry>
      <entry key="number">1</entry>
      <entry key="uridate">2014-03-05</entry>
      </entrykey="uri">
http://eifrs.ifrs.org/eifrs/XBRL?type=IAS&num=1&date=2014-03-17&anchor=para\_54\_f&doctype=Standard
    </entry>
  </data>
</entry>
</references>
<children/>
</entry>

```

Figure 23. Metamodel presentation element

If presentation entry has children they are represented the same structure elements but located if <children> tag of their parent element. Again all translations provided are defined.

All the taxonomy provided information regarding type of the field, ordering, labels of all languages and all the types and references are gathered inside the presentation entry element.

So there comes the calculation definition:

```
<calculations>
  <entry
    balance="DEBIT"
    level="0"
    name="Assets"
    namespace="http://xbrl.ifrs.org/taxonomy/2014-03-05/ifrs-full"
  />
  <entry
    balance="CREDIT"
    level="0"
    name="EquityAndLiabilities"
    namespace="http://xbrl.ifrs.org/taxonomy/2014-03-05/ifrs-full"
  />
</calculations>
```

Figure 24. Metamodel element calculation

Calculation entries are also define within the presentation entry related to current reporting form, as seen elements are summarized depending on being credit or debit fields and added to the same level elements with corresponding sign.

3.4. XBRL Engine

3.4.1. Functionality of XBRL engine

| Name | Functionality |
|----------------------------|---|
| Taxonomy type configurator | Back-office configure reporting requirements (available reporting forms and submission steps) based on company type |
| Forms renderer | Render web-form for specific reporting form based on the presentation |

| | |
|---------------------------------|---|
| Forms pre-filler | Pre-fill reporting form (with persisted data of currently selected form including data of preceding reporting period) |
| XBRL parser | Import xbrl file, validate against taxonomy |
| PDF renderer | Render human-readable pdf document from web-forms or uploaded xbrl file |
| Forms persister | Save web-form into xbrl file |
| Taxonomy validator | Validate content of web-form or uploaded xbrl file against taxonomy |
| Out-of-taxonomy rules validator | Validate content of xbrl file against validation rules outside of taxonomy |
| Assessor job | Automatic job, which marks reports with risks of potential fraud or mistake |

Table 4. Functionality of XBRL

3.4.2. Technical architecture

XBRL Engine is a common concept which includes functionality to read, generate and transform XBRL taxonomies and instances files.

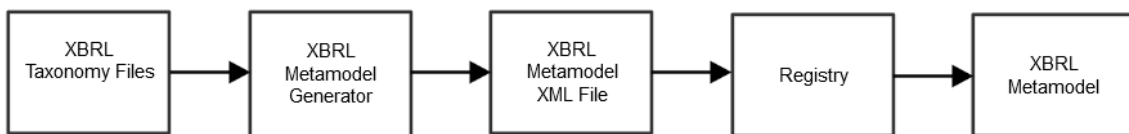


Figure 25. Metamodel generator technical architecture

Metamodel related number of modules:

- XBRL metamodel generator – module to create representative of the set of taxonomy files generated to one XML

- Registry - provides information about available registered reporting form metamodels and elements

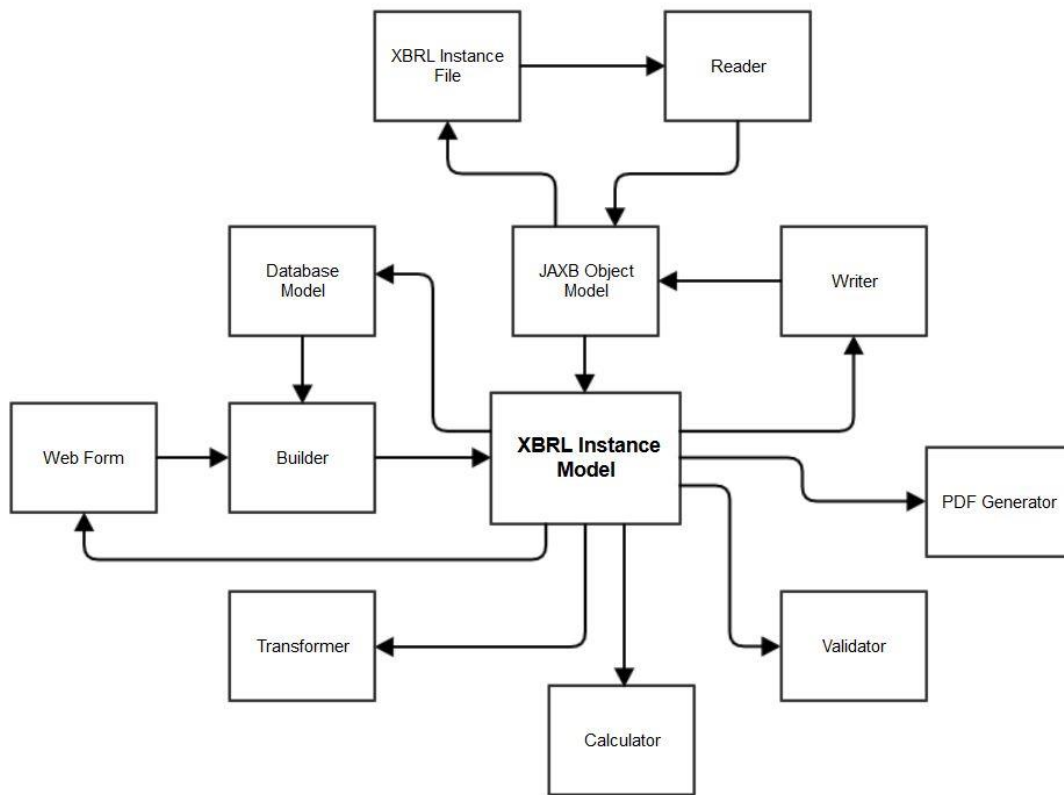


Figure 26. Technical architecture

XBRL Engine consists of a number of modules aimed to perform certain specific functionality:

- Reader - reads XBRL instance file into instance model
- Writer - used to generate XBRL instance files based on instance model (converting it to JAXB-generated object model)
- Validator - similarly to calculator, validates total values provided in XBRL instance
- Calculator - used to calculate given reporting form totals based on instance provided
- Builder - builds XBRL instance based on values provided

As there are three types of fields presented in the report there are three tables separate for each type of field and are extended from base field table, the reasoning for this specific approach is done in order to create and map different entity objects in Java. That allows better validation implementation and all related differences in formatting each separate kind of values.

There is also presented a table with assigned risks to the report with type of risk defined and report related information.

As there is a need to store documents of different types related to annual reports there is a table which stores document related information and it's reference to report entity.

3.4.4. PDF data format

The main objective to collect Electronic Annual Reports in a format of structured machine-readable files is to provide government agencies with a quality data, which easy to validate, process and perform further mass analysis.

However, business users - investors, market researchers, competitors, and even back-office inspectors - have to have the representation of submitted data in a conventional layout, similar to hard-copy documents what companies used to prepare in their regular life. The objective of human-readable version of electronic annual report is to provide users with such representation. It has a format of Adobe Acrobat PDF file, which is a standard, widely used and well-known format of document distribution for the business communities.

System functionality shall ensure that both machine-readable XBRL files and human-readable PDF have the same data.

Human-readable version of annual report is the one which can be purchased by interested parties. It is also one of the options (along with XBRL package) of exposing annual report to governmental agencies.

Summary

The goal of this thesis was to investigate digital way of submitting business annual reports, analyzing IFRS and the advantages those standards provide for financial reporting. Pointing out the main reasons for having XBRL for preparing standards compatible financial statements and comparing digital approach with conventional way of reporting. The XBRL engine was proposed and developed to meet the problems related to inability to adopt the technology for conventional use.

As a result the author has provided overview of the standards adoption, economic usefulness and differences applied in various authorities. There was reviewed XBRL with the major terms of the concept of business reporting, explained benefits of this kind of approach over the old-style paper-based reporting. Furthermore, all the key features of electronic business reporting language were presented.

Moreover, the author described XBRL technology related specifics and introduced taxonomy. Each element was described to complete the correlations with reporting standards and how the XBRL is structured to ensure the reporting support. Analysis of the standard showed the shortcomings and limited APIs to work with XBRL in an effective way so the author introduced XBRL engine for effective XBRL processing.

To reveal the invention of XBRL engine which gives an opportunity to be able to process XBRL in a convenient and fast way author describes an implementation of the XBRL based reporting capability, pointing out what architectural preparations are done to provide the system capable of handling business reports. In addition the transformations of taxonomy and need for invented engine approach are explained. All implementation features which ensure the use of all the advantages of extensible business reporting language as well as IFRS are provided.

Kokkuvõte

Antud töö eesmärgiks oli uurida elektroonilist lähenemist aasta aruannete esitamiseks, analüüsides IFRS ja eelised need standardid annavad finantsaruandluseks. Välja toodud XBRL kasutamise peamised põhjused valmistades standard-ühilduvad finantsaruanded ja samuti võrreldud digitaalne aruanne lähenemine tavalise aruandluse viisiga. XBRL mootor oli pakutud ja arenenud et rahuldada probleeme seotud tehnoloogia piirangutega ja puuduliku kohanemisega.

Tulemuseks on lõputöö autor on teinud ülevaade finants standardite vastuvõrmisest ja majanduslikku otstarbekust. XBRL-i põhi mõisted olid kirjeldatud ärikontseptsiooni aruandluse poolest ning selgitatud selle lähenemise kasu üle vanamoelise paberil aruandlusest. Veelgi enam kõik põhi elemendid elektroonilisest äriinfo edastamise keelest olid esitatud.

Lisaks autor on kirjeldanud XBRL tehnoloogiaga seotud spetsiifikat ja tutvustas taksonoomiat. Iga element oli lahti seletatud selleks et näitama korrelatsiooni rahvusvaheliste finantsaruandlus standarditega ja näitama kuidas XBRL on üles ehitatud et tagada aruandluse toetamine. Standardite analüüs näitas puudusi ja piiratud API-d XBRL-iga efektiivseks töötamiseks ja selleks autor tutvustas XBRL mootori tõhusa XBRL töötlemiseks.

XBRL mootori leiutis annab võimaluse töödelda XBRL mugavalt ja kiiresti ja autor on töö tulemuseks kirjeldanud rakenduse mis toetab XBRL baasil aruanne esitamist. Süsteemi arhitektuurne ettevalmistus välja toodud mis on võimeline tagada aruannete töötlemist ja esitamist. Lisaks taksonoomia transformatsioonid ja vajadus leiutatud mootorist on selgitatud. Kõik rakendatud funktsionaalsus mis tagab XBRL eelisi kasutamist ja samuti tagab rahvusvaheliste finantsaruandlus standardite eelisi on töös antud.

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