Abstracting XBRL Formula

Formula Meta Description

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Formula Meta Description

Motivation

The Eurofiling project, a descendent of Corep/Finrep projects, has to consist of (at least) two important parts: an XBRL taxonomy and an XBRL Formula – a close companion to a taxonomy. Without properly defined formulas covering all the important aspects of report filing, the quality of the reports will always be in question.

The purpose of this document is to present a method of effective XBRL Formula development using Formula Meta Description (FMD). FMD is an abstract way of describing business rules of data in a way which is easily understood by other project participants.

The idea of meta description of validation rules has been already implemented and proved to be useful. Thanks to some generalizations it might be used within the Eurofiling project.

DPM

It seems that a method of taxonomy development has been worked out. A Data Point Model (DPM) is used to describe basic concepts, dimensions and the relationships between them.

Besides the fact that DPM is an abstract model of reports, it is also a <u>kind of tool</u> which allows all project participants to <u>communicate effectively</u>.

It is important that all key aspects of taxonomy development are discussed and agreed before a taxonomy is created. It is much easier to discuss a model without any technical details which are unnecessary at that stage of the project.

The second important observation is that DPM almost completely describes a taxonomy and makes it relatively easy to generate a taxonomy automatically. It helps a lot in development because it is quite easy to regenerate a taxonomy after making changes in an abstract model, e.g. dimension values, names, IDs, etc.
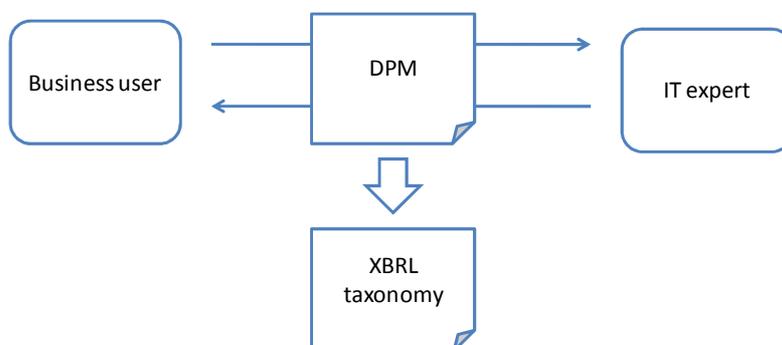
FMD

Besides the fact that FMD is an abstract model of validations, it is also a <u>kind of tool</u> which allows all project participants to <u>communicate effectively</u>.

It is important that all key aspects of taxonomy development are discussed and agreed before a set of XBRL Formulas is created.

The FMD describes validations completely and it is possible to generate an XBRL Formula automatically. It is easy to fully regenerate formulas after making changes in an abstract model of validations or after changing an XBRL taxonomy.
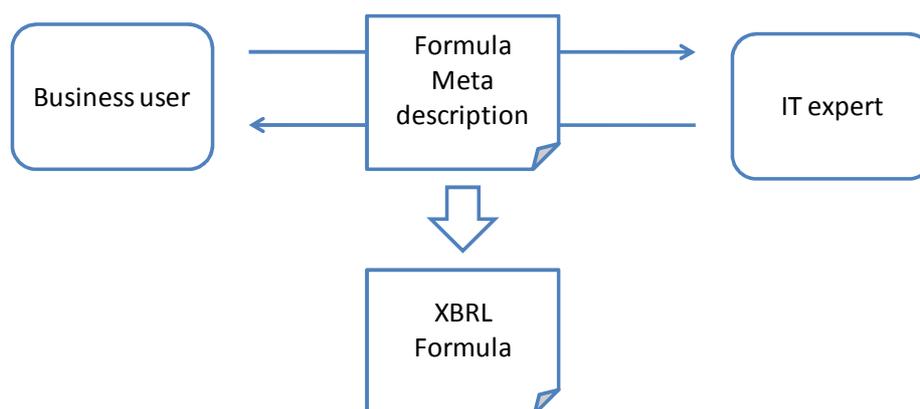
Excel calculations

Every time business users define anything regarding reports, they work with forms, rows, columns and cells. Many XBRL projects utilize Excel spreadsheets in the early stages. It is a widely available tool with a table (form) as the basic data structure. Therefore Excel is the tool of first choice for many people.

Using Excel is also the simplest way of expressing validations and calculations. Business users are generally able to prepare Excel formulas very quickly. In the beginning it is the simplest way of describing relationships between data. However, simple relationships become more sophisticated. As a set of Excel calculations grows, it becomes more difficult to maintain.

The most important reason for this is that multidimensional taxonomies require validation rules defined in a multidimensional manner.

Multidimensional validations

The expression power of XBRL Formula and the need for multidimensional validations is explained in the example below.

<u>Example 1. A calculation over exposure class dimension</u>

```
exposure class : total standardised approach =
exposure class : Central Governments and central banks + ...
... + exposure class : Securitisation positions
```

Such a validation rule as a whole is not easily applicable to a Excel table. It is very easy to define the calculation for a few concepts, but there is a wide variety of situations which eventually lead to inconsistencies. In fact, this rule is applied to many rows in a table or even many tables.

Meanwhile, the above COREP related formula expressed in XBRL Formula replaces **234** (!!!) simple formulas defined 'the Excel way'. This is a big savings in time and labour.

The taxonomies within Eurofiling project has been designed to be multidimensional from the very beginning. Consequently, all validations and calculations will have to be defined in a multidimensional manner. Otherwise there would be hundreds of redundant calculations and the maintenance process would require a huge effort.

XBRL Formula require a user-friendly notation

Business people do not express relations in XML tags. Therefore FMD was invented. FMD tries to be as close to natural language as possible.

Interest Income Total (FinancialInstitutions) =
   InterestIncome–CashAndBalancesWithCentralBanks +
   InterestIncome–FinancialAssetsHeldForTrading +
   InterestIncome–FinancialAssetsDesignatedAsFairValueThroughProfitOrLoss +
   InterestIncome–AvailableForSaleFinancialAssets +
   InterestIncome–LoansAndReceivables +
   InterestIncome–HeldToMaturityInvestments +
   InterestIncome–HedgingDerivatives +
   InterestIncome–OtherAssets

Natural language

	Value
Consolidated Profit or Loss (Presentation)	
Financial and Operating Income and Expenses	
Interest Income, Total [Financial Institutions]	
Interest Income, Cash and Balances with Central Banks	
Interest Income, Financial Assets Held for Trading	
Interest Income, Financial Assets Designated as Fair Value Through Profit or Loss	
Interest Income, Available-For-Sale Financial Assets	
Interest Income, Loans and Receivables	
Interest Income, Held-to-Maturity Investments	
Interest Income, Hedging Derivatives	
Interest Income, Other Assets	
Interest Expense, Total [Financial Institutions]	
Interest Expense, Deposits from Central Banks	
Interest Expense, Financial Liabilities Held for Trading	
Interest Expense, Financial Liabilities Designated as Fair Value Through Profit or Loss	
Interest Expense, Financial Liabilities Measured at Amortised Cost	

Visual representation

F;ifrs_gp_InterestIncomeTotalFinancialInstitutions;;;D =

  F;ifrs_gp_InterestIncomeCashAndBalancesWithCentralBanks;;;D +
  F;ifrs_gp_InterestIncomeFinancialAssetsHeldForTrading;;;D +
  F;ifrs_gp_InterestIncomeFinancialAssetsDesignatedAsFairValue..
              ThroughProfitOrLoss;;;D +
  F;ifrs_gp_InterestIncomeAvailableForSaleFinancialAssets;;;D +
  F;ifrs_gp_InterestIncomeLoansAndReceivables;;;D +
  F;ifrs_gp_InterestIncomeHeldToMaturityInvestments;;;D +
  F;p_FINREP_InterestIncomeHedgingDerivatives;;;D +
  F;p_FINREP_InterestIncomeOtherAssets;;;D

Formula meta-description

```
xlink:arcrole
xlink:to="fac
  <uf:singleMeasure xlink:type="resource" xlink:label="fact_1_filter_unit">
   <uf:measure>
    <uf:qname>p1:PLN</uf:qname>
   </uf:measure>
  </uf:singleMeasure>
  <variable:variableFilterArc xlink:type="arc"
xlink:arcrole="http://xbrl.org/arcrole/2008/variable-filter" xlink:from="fact_1"
xlink:to="fact_1_filter_unit" complement="false" cover="true"/>
   <variable:variableArc xlink:type="arc"
xlink:arcrole="http://xbrl.org/arcrole/2008/variable-set"
xlink:from="variable_set_formula_BANK_solvency ratio calc." xlink:to="fact_1"
name="v_fact_1"/>
   <variable:generalVariable xlink:type="resource" xlink:label="constant_5"
select="100" bindAsSequence="false"/>
  <variable:variableArc xlink:type="arc"
xlink:arcrole="http://xbrl.org/arcrole/2008/variable-set"
xlink:from="variable_set_formula_BANK_solvency ratio calc."
xlink:to="constant_5" name="v_constant_5"/>
....................
```

XBRL Formula

Formula Meta Description

Formula Meta Description was defined with a few criteria in mind:

1) **FMD notation should be easy for everyone to understand.**
   It is assumed that business users would accept that way of expressing relationships or at least they would be able to review and correct them.

2) **FMD should have a formal notation.**
   As a result translators might generate an XBRL formula as a product of an FMD formula. On the other hand FMD might be generated as a product of visual editors.

3) **FMD should facilitate a multidimensional model of taxonomy.**
   Thanks to this, one will gain additional benefits of XBRL Formula (compactness and exceptional expression power compared to Excel calculations).

4) **FMD is addressed to business users.**
   FMD is not intended to cover all possible XBRL formulas. It is intended to cover all rules important from a business point of view.

Example 2.

The rule 'a monetary concept might be reported only once within a given context' might be treated as technical one because a context is closer to the technical aspect of a taxonomy and XBRL instances than to the business aspect of reporting. Therefore it is not necessary to express this in FMD.

Example 3.

The rule 'a summation of all items referred to by breakdown must be equal to a total' is a business rule and must be easily expressed by FMD.

FDM definition

All business rules have been categorized into a few basic types. All of them are described and explained in the table below.

Basic type	Corresponding XBRL Formula	Description (with examples)
calculation	consistency assertion	The FMD calculation is a formula intended to calculate a value and put the result into a given fact. The calculation is in the form: $A = B + C + …$ As far as the XBRL validator can only check the consistency of a report, the FMD calculation expressed in an XBRL formula can only be transformed into an assertion. The XBRL validator can only check the consistency of a report; therefore, the FMD calculation can be represented in an XBRL Formula only as an assertion. Common mathematical operators, parentheses and functions are allowed. There can be only one argument to the left side and an expression to the right side.
logical relationship	value assertion	The FMD logical relationship is for examining left and right statement with a logical operator. The logical relationship is in the form: $A + B + C + … = X + Y + Z + …$
conditional relationship	value assertion + precondition	The FMD conditional relationship is for examining a logical condition but only when a second condition is true. The conditional relationship is in the form: if (A > 0) then (B + C + .. > = X + Y + ..)
complex relationship	value assertion	The FMD complex relationship is for any logical statement which doesn't fit the basic types described above. The complex relationship is in the form: isNotNull(A) or (B >= C) and (D > 0)
existence assertion	existence assertion	The FMD existence assertion is for examining if a given fact occurs in an instance. For symmetry, the existence of a given fact in an instance file can be permitted. The existence assertion is in the form: isNotNull(A) if the existence of fact A is required, and isNull(A) if the existence of fact A is prohibited.

All these defined formula types can be used in a few variants depending on the data addressing method. All addressing variants are described below.

Addressing variant	Description
simple	A formula operates just on single facts. Arguments point to an exact 'data point'. The simple variant is most commonly used by end-users.
dimensional	The dimensional variant means that a relationship described by a mathematical expression relates to dimensions. A dimensional rule is applied to a set of concepts – a concept filter is applied to a rule.
'over-dimensional-mode'	An 'over-dimensional-mode' variant of addressing allows the user to express the relationship applied to a concept. To some extent it is similar to calculation link-base applied to a dimensional model. An XBRL formula is valid for any combination of dimensions. A filter over dimensions can be used, which is an advantage of the 'over-dimensional-mode' addressing variant. Therefore it is much more precise than a standard XBRL calculation link-base.
tuple	An FMD is powerful enough to describe assertions and formulas within a single tuple. The tuple variant will not be discussed in detail here because of the limited use of tuples in Eurofiling taxonomies.

FMD steps

A few examples have been prepared in order to explain Formula Meta Description preparation. These examples also present the usefulness and compactness of an advanced XBRL formula.

Example 4. An example data table

The table below shows a simplified example of an already-defined taxonomy with a presentation layer. Let's assume that A is the ID of an 'Asset' concept, L is the ID of a 'Liabilities' concept, etc. The dimension 'Currency' consists of currencies: 'PLN', 'EUR' and 'T' (for total).

	Dim_Currency: PLN [DimCurr:PLN]	Dim_Currency: EUR [DimCurr:EUR]	Dim_Currency: Total [DimCurr:T]
[A] Assets			
[L] Liabilities			
[E] Equities			

Example 5. Addressing data within a table

Every relationship has to use a data addressing scheme of some kind. The most common one for end-users is an Excel-like positional system: A1 + B2 + etc., where A, B, … are rows and 1, 2, … are columns.

In the table above, row and column IDs might be used. In this case a Cartesian product of a concept vector [A, L, E] and dimension of currencies [PLN, EUR, total] produces a set of addresses.

It is important to notice that a DPM defines intersections (in XBRL terms) or final addresses (in natural language) in exactly the same way.

	Dim_Currency: PLN [DimCurr:PLN]	Dim_Currency: EUR [DimCurr:EUR]	Dim_Currency: Total [DimCurr:T]
[A] Assets	**A; DimCurr:PLN**	**A; DimCurr:EUR**	**A; DimCurr:T**
[L] Liabilities	**L; DimCurr:PLN**	**L; DimCurr:EUR**	**L; DimCurr:T**
[E] Equities	**E; DimCurr:PLN**	**E; DimCurr:EUR**	**E; DimCurr:T**

Example 6. Validation rules – simple addressing variant – calculations

A basic relationship can be expressed between all valid addresses defined in the table above.

Let's assume that the column 'total' should be calculated. (It should in fact be calculated by the reporter's application while validated only by the regulator's application.) Therefore we use a 'calculation' type in a simple addressing variant.

```
A;DimCurr:T  =  A;DimCurr:PLN  +  A;DimCurr:EUR

L;DimCurr:T  =  L;DimCurr:PLN  +  L;DimCurr:EUR

E;DimCurr:T  =  E;DimCurr:PLN  +  E;DimCurr:EUR
```

Example 7. Validation rules – simple addressing variant – assertions

A relationship among assets, liabilities and equities can only be checked. Therefore we use a 'value assertion'. Assertions will be expressed in the simple addressing variant.

```
A;DimCurr:PLN  =  L;DimCurr:PLN  +  E;DimCurr:PLN

A;DimCurr:EUR  =  L;DimCurr:EUR  +  E;DimCurr:EUR

A;DimCurr:T    =  L;DimCurr:T    +  E;DimCurr:T
```

Increasing the number of concepts (rows) in a report causes an increase in the number of calculations. It refers to the number of values within a dimension as well.

Example 8.

Taking into account the multidimensional way of modelling reports, the calculations from Example 6 can be defined in the multidimensional addressing variant.

```
*;DimCurr:T  :=  *;DimCurr:PLN  +  *;DimCurr:EUR    applied to {A, L, E}
```

Example 9.

'Over-dimensional-mode' type of assertion is used to express relationships between concepts.
This addressing variant is very similar to basic XBRL calculation link-base. The difference is that

calculation link-base is applied to <u>every</u> combination of possible dimensions. FMD enables filters on dimensions.

```
A;*   =   L;*   +   E;*                    applied to {DimCurr}
```

The two validations defined in Examples 8 and 9 replace the six validations defined in Examples 6 and 7.

The Eurofiling taxonomy will use the multidimensional model in a much more consistent way than it was previously used (Corep/Finrep). This means that multidimensional validations will simply be a necessity.

FMD technical details

The table below shows a matrix of all the possible combinations of basic types and addressing variants of validations.

<table>
<tr><td rowspan="2"></td><td rowspan="2"></td><td colspan="4"><u>Variant</u></td></tr>
<tr><td>simple</td><td>dimensional</td><td>over-dimensional-mode</td><td>tuple</td></tr>
<tr><td rowspan="5"><u>Basic type</u></td><td>calculation</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>logical relationship</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>conditional relationship</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>complex relationship</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>existence assertion
• obligatory value
• forbidden value</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
</table>

FMD addressing

The basic building block of the meta description is addressing; XBRL is all about addressing data. XBRL was designed with special attention to automatic processing. Using XML as a foundation has given XBRL tremendous flexibility and has opened doors to existing technology resources.

The XBRL Formula is an obvious consequence of XBRL data accessing (the other side of addressing). A data addressing notation could be anything but should meet these criteria:

1. the notation should be easy to understand;

2. it should be capable of expressing dimension and tuples;

3. it should have a formal language definition, i.e. BNF in the case of automated processing;

4. and it should be consistent with XBRL facts, or in other words there must be an unambiguous, two-way transition between meta-address and XBRL 'address'.

It's worth mentioning that DPM also meets the fourth criterion.

XBRL meta-address

The FMD address (called 'meta-address' below) looks like this:

> **taxonomy_alias;concept_ID;set_of_dimensions;period_type**

Where:

- taxonomy_alias – an optional alias of a taxonomy namespace, e.g. C-COREP, F-FINREP, etc; an empty field is used for the current taxonomy

- concept_ID – the ID of the concept defined in the taxonomy, e.g. p_ca_SolvencyRatio; it might be replaced by '*' in the 'over-dimensional-mode' addressing variant for each listed concept

- set_of_dimensions – a set of dimension values (if applicable), e.g. d_Counterpts_ByCounterpartiesDimension:d_Counterpts_Retail; a set might be replaced by '*' in the dimensional addressing variant

- period_type – an attribute derived from the taxonomy which covers period aspect using one letter shortcuts: S-start, E-end,D-duration and F-forever. The 'S' and the 'E' refer to instance periods for the beginning and the end of abstractly defined period for XBRL instance. Duration means interval from start to end values. Forever do not have to be additionally parameterized. If start, end or duration period types are used appropriate formulas requires parameters to represent start and end date

The **concept_ID** and the **set_of_dimensions** are defined by XBRL ID, however other ID's can also be used. In the following examples, next to XBRL ID's, there are also examples with Polish technical labels. Another option is a qname of a concept. This option ensures consistency with any taxonomy.

This meta-address meets all the criteria defined above and additionally:

- is able to cover all intrinsic taxonomy formulas and even cross-taxonomy formulas,

- covers all existing taxonomies,

- and is able to express formulas over tuples.

Example 10. A simple non-dimensional address

			C for COREP
			XBRL ID
			no dimensions
			end value of instant concepts
C;	p_ca_SolvencyRatio;	;	E

Example 11. An address with a dimension value

				F for FINREP
				XBRL ID dimension
				end value of instant concepts
F;	ifrs_gp_AvailableForSaleFinancialAssetsLoanAndAdvances;	d_Counterpts_ByCounterpartiesDimension: d_Counterpts_Retail;	E	

FMD Calculations

This document is not intended to give complete specifications of an FMD but to explain the concept and to give some examples. There are a few examples covering calculations, but they do not exhaust all possible options.

Simple addressing

Simple addressing doesn't require any special syntax. It is just an arithmetic expression with fields (also known as 'data-points') as arguments. Exactly the same calculation is shown using XBRL IDs and Polish technical labels as meta-addresses.

<u>Example 12.</u>

```
(XBRL IDs)

"C;p-mi_MultiplicationFactorXAveragePrevious60workingDaysVaR;
        d-mr_MRiskIMDimension:d-mr_MRiskIMTotalPosition;E" =

        "C;p-mi_MultiplicationFactorXAveragePrevious60workingDaysVaR;
        d-mr_MRiskIMDimension:d-mr_MRiskIMTradedDebtInstruments;E" +

        "C;p-mi_MultiplicationFactorXAveragePrevious60workingDaysVaR;
        d-mr_MRiskIMDimension:d-mr_MRiskIMEquities;E" + …


(Polish technical labels)

"C;CMI0002;CDMR000:CDMR127;E" = "C;CMI0002;CDMR000:CDMR129;E" +
        "C;CMI0002;CDMR000:CDMR132;E" + …
```

'Over-dimensional-mode' addressing

A more complex addressing scheme requires some syntactical glue. A 'let' clause is used for defining a filter over dimensions and an 'in' clause for an arithmetic sentence for expressing calculation.

Example 13.

```
(XBRL IDs)

let ( dimension = "d-cr_ CreditRiskDimension: *,*" )
in ( "C;p-cm-ca_CreditRiskCapitalRequirements;*;*" =
            "C;p-cm-cr_RiskWeightedExposureAmount;*;*" * 0.08 )



(Polish technical labels)

let ( dimension = "CDCR000:*,*" )
in ( "C;CXX0005;*;*" = "C;CXX0040;*;*" * 0.08 )
```

A 'let' clause produces all possible valid combinations of dimensions against the taxonomy and the arguments of the sentence given in the 'in' clause.

In this case,

```
dimension = "d-cr_ CreditRiskDimension:*,*"
```

means 'all possible members combinations of all dimensions where CreditRiskDimension exists'.

At the moment, in the current version of Polish COREP, the calculation above will be performed:

- 558 times for filter   dimension = "d-cr_ CreditRiskDimension:*,*"

- 1032 times for filter   dimension = "*"

Dimensional addressing

Another complex addressing scheme – dimensional addressing – uses the same syntax as 'over-dimensional-mode' addressing. The only difference is that the 'let' clause contains a measure filter.

Example 14.

```
(XBRL IDs)

let ( measure = { 'p-cm-cr_RiskWeightedExposureAmounts',
        'p-cm-cr_CreditRiskCapitalRequirements' } )

in ( "C;*;d-ec_ExposureClassDimension:d-ec_IRBECRetail,*;*" =
        "C;*;d-ec_ExposureClassDimension:d-ec_IRBECRetailOfWhichSME,*;*" +
        "C;*;d-ec_ExposureClassDimension:d-ec_IRBECOtherRetail,*;*" +
        "C;*;d-ec_ExposureClassDimension:d-ec_IRBECQualifyingRevolving,*;*" +
        "C;*;d-ec_ExposureClassDimension:d-ec_IRBECSecuredByRealEstate,*;*" )


(Polish technical labels)

let ( measure = { 'CXX0005', 'CXX0040' } )

in ( "C;*;CDEC000:CDEC025,*;*" =
      "C;*;CDEC000:CDEC029,*;*" + "C;*;CDEC000:CDEC027,*;*" +
      "C;*;CDEC000:CDEC026,*;*" + "C;*;CDEC000:CDEC028,*;*" )
```
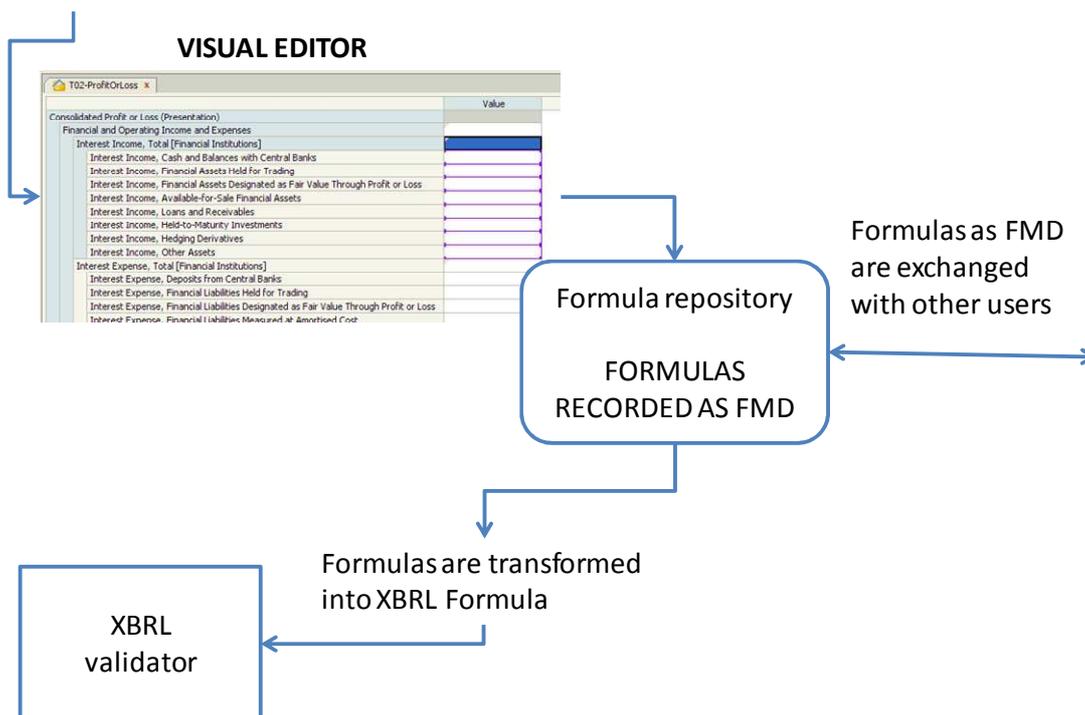
The measure filter assigns a list of concepts to which a calculation will be applied.

FMD – business scenarios

Visual formula editor

This document describes the formal part of an FMD (syntax, meta-addressing, etc.), which end-users do not need at all. The proper tool for end-users is simply a visual editor.

FMD is the perfect format for storing formulas. A visual editor serves all objects (tables, layouts, etc.) defined within a taxonomy in order to support the user. A visual editor produces and stores formulas into a repository as a meta description (FMD).

An FMD repository is crucial to building a proper end-user tool. Formulas can be managed – versioned, exchanged, improved, displayed, etc.

FMD formulas can be transformed into XBRL Formula format in order to validate XBRL instances.

Formula optimizer

An XBRL Formula allows taxonomy developers to build advanced validations. Advanced functions might not be always obvious to any person involved in designing validations even if there is a proper tool (visual editor) available.

Initially, all calculations and assertions might be prepared in a simple addressing scheme. The simple addressing scheme is very similar to Excel's way of addressing cells. It should be up to business users which scheme they choose.

A set of calculations and assertions utilizing simple addressing scheme → FMD optimizer → Optimized set
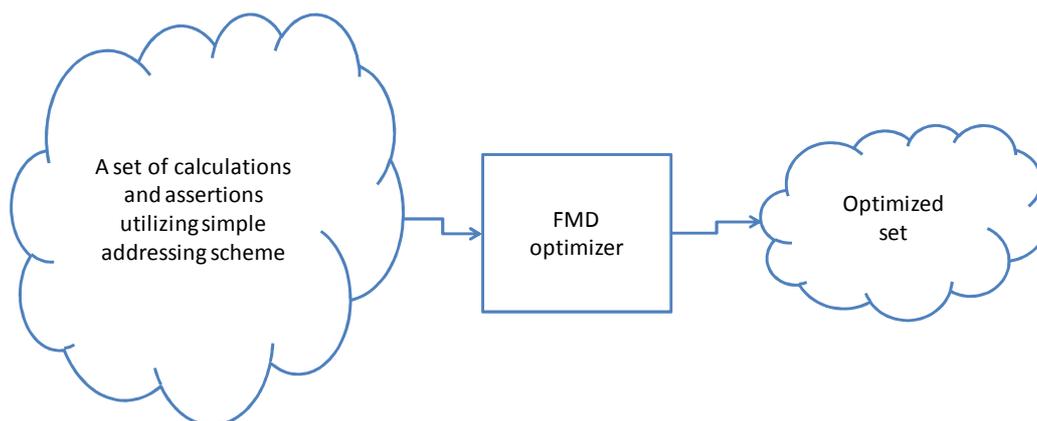
An FMD optimizer groups the formulas and tries to replace a group with a dimensional or 'over-dimensional' formula.

It is a common-sense approach to assume that formulas might not be optimal. They might be prepared by many people, at different times, following different approaches, etc.

A formula optimizer always tries to produce the best result. Moreover, an optimizer can suggest possible improvements, e.g. when one value of an explicit dimension is omitted, it could warn of inconsistent dimension usage.

One can assume that an optimized set will always be more compact and easier to maintain and manage.

Example 15. Sample calculation representations

Natural language

Solvency ratio = (total funds for solvency purposes + short term capital) / (total capital requirements *
12.5) * 100%

FMD (Polish technical labels)

"C;CCA0135;;E" = ("C;CXX0011;;E" + "C;CCA0056;;E") / ("C;CXX0008;;E" * 12.5) * 100

FMD (XBRL IDs)

"C;p-ca_SolvencyRatio;;E" =
       ("C;p-cm-ca_TotalOwnFundsSolvencyPurposes" + "C;p-ca-pl_KapitalKrotkoterminowy;;E")
         / ("C;p-cm-ca_CapitalRequirements;;E" * 12.5) * 100

XBRL Formula

```xml
<?xml version="1.0" encoding="UTF-8"?>
<link:linkbase xmlns:link="http://www.xbrl.org/2003/linkbase" xmlns:ea="http://xbrl.org/2008/assertion/existence"
               xmlns:ssf="http://xbrl.org/2008/filter/segment-scenario" xmlns:xperr="http://www.w3.org/2004/10/xqt-errors"
               xmlns:ca="http://xbrl.org/2008/assertion/consistency" xmlns:bf="http://xbrl.org/2008/filter/boolean"
               xmlns:va="http://xbrl.org/2008/assertion/value" xmlns:variable="http://xbrl.org/2008/variable"
               xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:xpdt="http://www.xbrl.org/2004/10/xpath-datatypes"
               xmlns:mf="http://xbrl.org/2008/filter/match" xmlns:gen="http://xbrl.org/2008/generic"
               xmlns:label="http://xbrl.org/2008/label" xmlns:cf="http://xbrl.org/2008/filter/concept"
               xmlns:formula="http://xbrl.org/2008/formula" xmlns:vf="http://xbrl.org/2008/filter/value"
               xmlns:fn="http://www.w3.org/2005/xpath-functions" xmlns:gf="http://xbrl.org/2008/filter/general"
               xmlns:xfie="http://www.xbrl.org/2008/function/instance/error"
               xmlns:reference="http://xbrl.org/2008/reference" xmlns:ef="http://xbrl.org/2008/filter/entity"
               xmlns:df="http://xbrl.org/2008/filter/dimension" xmlns:uf="http://xbrl.org/2008/filter/unit"
               xmlns:validation="http://xbrl.org/2008/validation" xmlns:rf="http://xbrl.org/2008/filter/relative"
               xmlns:pf="http://xbrl.org/2008/filter/period" xmlns:tf="http://xbrl.org/2008/filter/tuple"
               xmlns:xfi="http://www.xbrl.org/2008/function/instance" xmlns:p0="http://www.c-ebs.org/eu/fr/esrs/corep/2006-
               07-01/p-cm-ca-2006-07-01" xmlns:p1="http://www.xbrl.org/2003/iso4217"
               xmlns:p4="http://sis.nbp.pl/corep/1.1.1/p-ca-pl-2007-10-01" xmlns:p6="http://www.c-
               ebs.org/eu/fr/esrs/corep/2006-07-01/p-ca-2006-07-01" xmlns:p7="http://www.xbrl.org/2003/instance"
               xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
               xsi:schemaLocation="http://xbrl.org/2008/assertion/existence existence-assertion.xsd
               http://xbrl.org/2008/filter/segment-scenario segment-scenario-filter.xsd
               http://xbrl.org/2008/assertion/consistency consistency-assertion.xsd http://xbrl.org/2008/filter/boolean
               boolean-filter.xsd http://xbrl.org/2008/assertion/value value-assertion.xsd http://xbrl.org/2008/variable
               variable.xsd http://www.w3.org/1999/xlink xlink-2003-12-31.xsd http://xbrl.org/2008/filter/match match-
               filter.xsd http://xbrl.org/2008/generic generic-link.xsd http://xbrl.org/2008/label generic-label.xsd
               http://xbrl.org/2008/filter/concept concept-filter.xsd http://xbrl.org/2008/formula formula.xsd
               http://xbrl.org/2008/filter/value value-filter.xsd http://xbrl.org/2008/filter/general general-filter.xsd
               http://xbrl.org/2008/reference generic-reference.xsd http://xbrl.org/2008/filter/entity entity-filter.xsd
               http://xbrl.org/2008/filter/dimension dimension-filter.xsd http://xbrl.org/2008/filter/unit unit-filter.xsd
               http://www.xbrl.org/2003/linkbase xbrl-linkbase-2003-12-31.xsd http://xbrl.org/2008/validation validation.xsd
               http://xbrl.org/2008/filter/relative relative-filter.xsd http://xbrl.org/2008/filter/period period-filter.xsd
               http://xbrl.org/2008/filter/tuple tuple-filter.xsd">
 <link:roleRef roleURI="http://www.xbrl.org/2008/role/link" xlink:type="simple"
               xlink:href="http://www.xbrl.org/2008/generic-link.xsd#standard-link-role"/>
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               xlink:href="http://www.xbrl.org/2008/variable.xsd#variable-set"/>
 <link:arcroleRef arcroleURI="http://xbrl.org/arcrole/2008/variable-filter" xlink:type="simple"
               xlink:href="http://www.xbrl.org/2008/variable.xsd#variable-filter"/>
 <link:arcroleRef arcroleURI="http://xbrl.org/arcrole/2008/variable-set-filter" xlink:type="simple"
               xlink:href="http://www.xbrl.org/2008/variable.xsd#variable-set-filter"/>
 <link:arcroleRef arcroleURI="http://xbrl.org/arcrole/2008/variable-set-precondition" xlink:type="simple"
               xlink:href="http://www.xbrl.org/2008/variable.xsd#variable-set-precondition"/>
 <link:arcroleRef arcroleURI="http://xbrl.org/arcrole/2008/boolean-filter" xlink:type="simple"
               xlink:href="http://www.xbrl.org/2008/boolean-filter.xsd#boolean-filter"/>
 <gen:link xlink:type="extended" xlink:role="http://www.xbrl.org/2003/role/link">
   <formula:formula xlink:type="resource" xlink:label="variable_set_fromula_NBP_NIE_SLOWNIKOWE_1" aspectModel="dimensional"
               implicitFiltering="true" source="variable_soruce" value="( $v_fact_1 + $v_fact_2 ) / ( $v_fact_3 *
               $v_constant_4 ) * $v_constant_5">
     <formula:aspects>
       <formula:concept/>
       <formula:entityIdentifier/>
       <formula:period/>
       <formula:unit/>
       <formula:occFragments occ="scenario"/>
       <formula:occFragments occ="segment"/>
     </formula:aspects>
   </formula:formula>
   <variable:factVariable xlink:type="resource" xlink:label="fact_1" bindAsSequence="false" nils="true"/>
   <cf:conceptName xlink:type="resource" xlink:label="fact_1_filter_concept">
     <cf:concept>
       <cf:qname>p0:TotalOwnFundsSolvencyPurposes</cf:qname>
```

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      </cf:concept>
    </cf:conceptName>
    <variable:variableFilterArc xlink:type="arc" xlink:arcrole="http://xbrl.org/arcrole/2008/variable-filter"
            xlink:from="fact_1" xlink:to="fact_1_filter_concept" complement="false" cover="true"/>
    <uf:singleMeasure xlink:type="resource" xlink:label="fact_1_filter_unit">
      <uf:measure>
        <uf:qname>p1:PLN</uf:qname>
      </uf:measure>
    </uf:singleMeasure>
    <variable:variableFilterArc xlink:type="arc" xlink:arcrole="http://xbrl.org/arcrole/2008/variable-filter"
            xlink:from="fact_1" xlink:to="fact_1_filter_unit" complement="false" cover="true"/>
    <variable:variableArc xlink:type="arc" xlink:arcrole="http://xbrl.org/arcrole/2008/variable-set"
            xlink:from="variable_set_fromula_NBP_NIE_SLOWNIKOWE_1" xlink:to="fact_1" name="v_fact_1"/>
    <variable:generalVariable xlink:type="resource" xlink:label="constant_5" select="100" bindAsSequence="false"/>
    <variable:variableArc xlink:type="arc" xlink:arcrole="http://xbrl.org/arcrole/2008/variable-set"
            xlink:from="variable_set_fromula_NBP_NIE_SLOWNIKOWE_1" xlink:to="constant_5" name="v_constant_5"/>
    <variable:generalVariable xlink:type="resource" xlink:label="constant_4" select="12.5" bindAsSequence="false"/>
    <variable:variableArc xlink:type="arc" xlink:arcrole="http://xbrl.org/arcrole/2008/variable-set"
            xlink:from="variable_set_fromula_NBP_NIE_SLOWNIKOWE_1" xlink:to="constant_4" name="v_constant_4"/>
    <variable:factVariable xlink:type="resource" xlink:label="fact_3" bindAsSequence="false" nils="true"/>
    <cf:conceptName xlink:type="resource" xlink:label="fact_3_filter_concept">
      <cf:concept>
        <cf:qname>p0:CapitalRequirements</cf:qname>
      </cf:concept>
    </cf:conceptName>
    <variable:variableFilterArc xlink:type="arc" xlink:arcrole="http://xbrl.org/arcrole/2008/variable-filter"
            xlink:from="fact_3" xlink:to="fact_3_filter_concept" complement="false" cover="true"/>
    <uf:singleMeasure xlink:type="resource" xlink:label="fact_3_filter_unit">
      <uf:measure>
        <uf:qname>p1:PLN</uf:qname>
      </uf:measure>
    </uf:singleMeasure>
    <variable:variableFilterArc xlink:type="arc" xlink:arcrole="http://xbrl.org/arcrole/2008/variable-filter"
            xlink:from="fact_3" xlink:to="fact_3_filter_unit" complement="false" cover="true"/>
    <variable:variableArc xlink:type="arc" xlink:arcrole="http://xbrl.org/arcrole/2008/variable-set"
            xlink:from="variable_set_fromula_NBP_NIE_SLOWNIKOWE_1" xlink:to="fact_3" name="v_fact_3"/>
    <variable:factVariable xlink:type="resource" xlink:label="fact_2" bindAsSequence="false" nils="true"/>
    <cf:conceptName xlink:type="resource" xlink:label="fact_2_filter_concept">
      <cf:concept>
        <cf:qname>p4:KapitalKrotkoterminowy</cf:qname>
      </cf:concept>
    </cf:conceptName>
    <variable:variableFilterArc xlink:type="arc" xlink:arcrole="http://xbrl.org/arcrole/2008/variable-filter"
            xlink:from="fact_2" xlink:to="fact_2_filter_concept" complement="false" cover="true"/>
    <uf:singleMeasure xlink:type="resource" xlink:label="fact_2_filter_unit">
      <uf:measure>
        <uf:qname>p1:PLN</uf:qname>
      </uf:measure>
    </uf:singleMeasure>
    <variable:variableFilterArc xlink:type="arc" xlink:arcrole="http://xbrl.org/arcrole/2008/variable-filter"
            xlink:from="fact_2" xlink:to="fact_2_filter_unit" complement="false" cover="true"/>
    <variable:variableArc xlink:type="arc" xlink:arcrole="http://xbrl.org/arcrole/2008/variable-set"
            xlink:from="variable_set_fromula_NBP_NIE_SLOWNIKOWE_1" xlink:to="fact_2" name="v_fact_2"/>
    <variable:factVariable xlink:type="resource" xlink:label="variable_soruce" bindAsSequence="false" nils="true"/>
    <cf:conceptName xlink:type="resource" xlink:label="variable_soruce_filter_concept">
      <cf:concept>
        <cf:qname>p6:SolvencyRatio</cf:qname>
      </cf:concept>
    </cf:conceptName>
    <variable:variableFilterArc xlink:type="arc" xlink:arcrole="http://xbrl.org/arcrole/2008/variable-filter"
            xlink:from="variable_soruce" xlink:to="variable_soruce_filter_concept" complement="false" cover="true"/>
    <uf:singleMeasure xlink:type="resource" xlink:label="variable_soruce_filter_unit">
      <uf:measure>
        <uf:qname>p7:pure</uf:qname>
      </uf:measure>
    </uf:singleMeasure>
    <variable:variableFilterArc xlink:type="arc" xlink:arcrole="http://xbrl.org/arcrole/2008/variable-filter"
            xlink:from="variable_soruce" xlink:to="variable_soruce_filter_unit" complement="false" cover="true"/>
    <variable:variableArc xlink:type="arc" xlink:arcrole="http://xbrl.org/arcrole/2008/variable-set"
            xlink:from="variable_set_fromula_NBP_NIE_SLOWNIKOWE_1" xlink:to="variable_soruce" name="variable_soruce"/>
    <pf:period xlink:type="resource" xlink:label="variable_set_fromula_NBP_NIE_SLOWNIKOWE_1_1_filter" test="xfi:is-instant-
            period(.)"/>
    <variable:variableSetFilterArc xlink:type="arc" xlink:arcrole="http://xbrl.org/arcrole/2008/variable-set-filter"
            xlink:from="variable_set_fromula_NBP_NIE_SLOWNIKOWE_1"
            xlink:to="variable_set_fromula_NBP_NIE_SLOWNIKOWE_1_1_filter" complement="false"/>
    <ef:identifier xlink:type="resource" xlink:label="variable_set_fromula_NBP_NIE_SLOWNIKOWE_1_2_filter" test="fn:true()"/>
    <variable:variableSetFilterArc xlink:type="arc" xlink:arcrole="http://xbrl.org/arcrole/2008/variable-set-filter"
            xlink:from="variable_set_fromula_NBP_NIE_SLOWNIKOWE_1"
            xlink:to="variable_set_fromula_NBP_NIE_SLOWNIKOWE_1_2_filter" complement="false"/>
  </gen:link>
</link:linkbase>
```