

XBRL Interoperability through a Multidimensional Data Model



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Summary

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- ❖ Introduction.
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- ❖ XBRL Data Model.
- ❖ XBRL Multidimensional Data Model.
- ❖ Conclusions and future work.

Abstract

Summary

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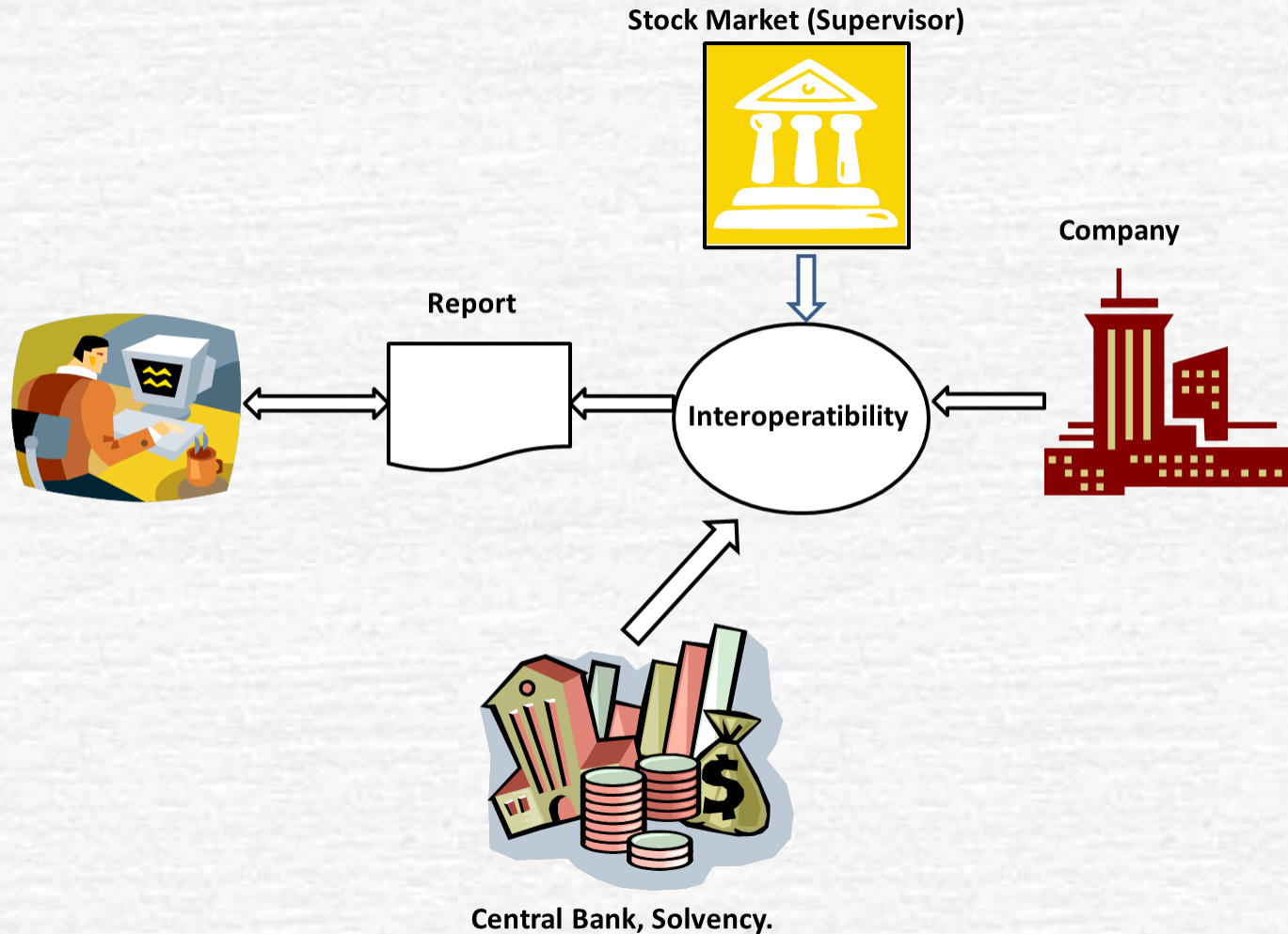
- ❖ Great development in XML and Data Warehouse applications.
- ❖ Companies and financial institutions need more economic information.
- ❖ This information must be reliable and on time.
- ❖ eXtensible Business Reporting Language (XBRL) standard.
- ❖ This language is mainly used in accounting reports.
- ❖ A set of taxonomies, which define different accounting regulations of a specific report.
- ❖ XBRL represents business information, and is multidimensional, and therefore the logical destination is a Data Warehouse (DW).
- ❖ This paper proposes to automate the mapping between XBRL, and the Multidimensional data model.
- ❖ To provide more clarity to this complex language.
- ❖ Improve the interoperability.

Introduction I

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- ❖ The accounting reports are governed by strict regulations, such as the International Financial Reporting Standard (IFRS), or the Accounting General Plan in Spain.
- ❖ These reports require a large amount of Information Technology (IT).
- ❖ These reports must be interoperable.

Introduction II

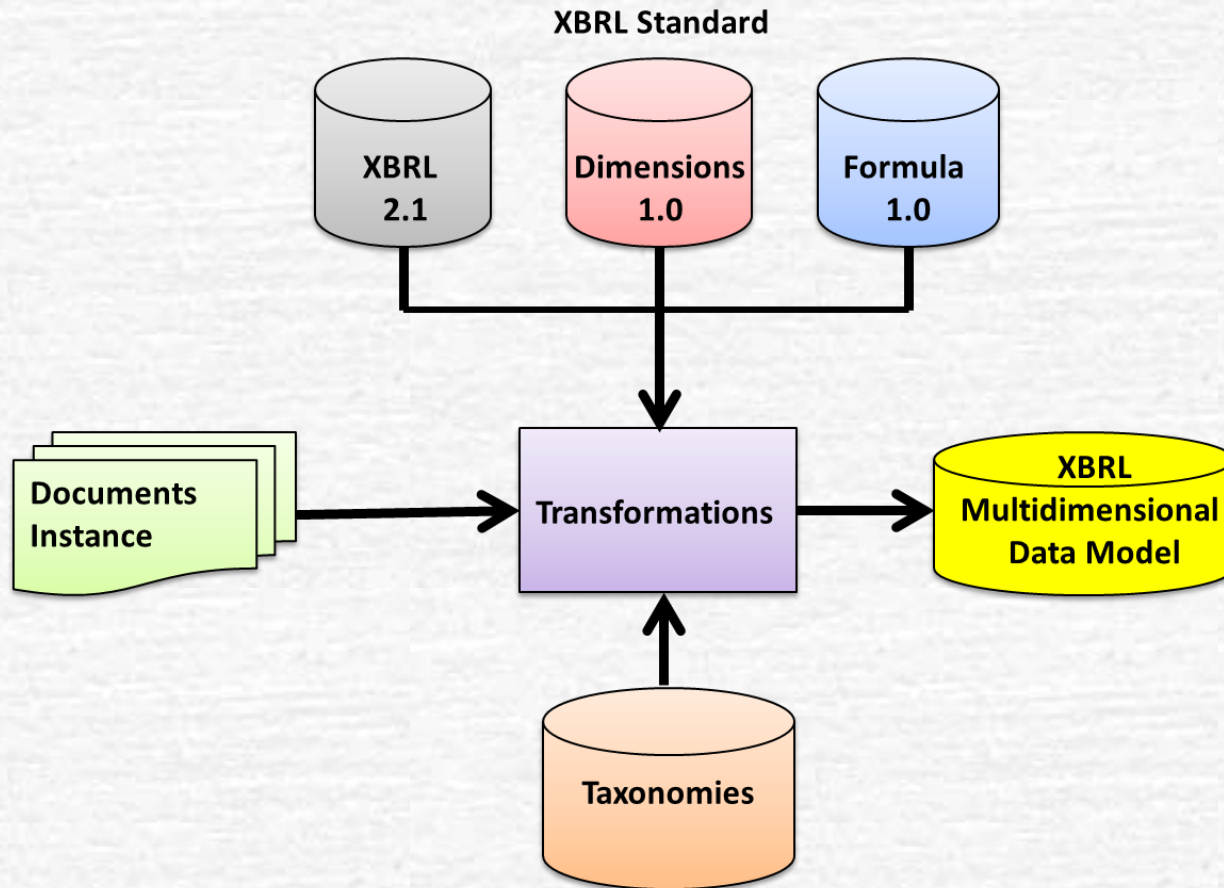


Introduction III

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- ❖ A limitation of XBRL is the size of the document instances.
- ❖ This paper presents a mapping between the XBRL data model, and the Multidimensional Data Model (MDM).

Introduction IV



XBRL Language I

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- ❖ Enron Corporation (December, 2001).
- ❖ April 1998 Charles Hoffman proposed to automate the exchange of financial information.
- ❖ To send balance sheets between Town Councils, and the Treasury Ministry.
- ❖ To send results of corporate accounts to the Association of Spanish Property and Commercial Registrars in Spain.
- ❖ Financial statements to Central Banks.

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- ❖ Bank of Spain, National Commission of Securities Market of Spain (CNMV), Bank of Portugal, Deutsche Börse, European Bank Authority (EBA), in the UK, Companies House, Her Majesty Revenue and Customs (HMRC), in the U.S., Board of Governors of the Federal Reserve System (FED), US Securities and Exchange Commission (SEC), and other countries as Japan, India, China (Shanghai Stock Exchange (SSE)), and so on.

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- ❖ A financial report is based on business rules such as IFRS, Basel II (Convention on the law and banking regulation), and others.
- ❖ These standards may be international, and/or national and/or local and/or company, or of financial institutions.
- ❖ This set of rules can be inherited or overwritten.
- ❖ Uses XML syntax and related technologies like XML Schema, XLink, XPath and Namespaces to provide semantic meaning

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- ❖ A report consists of an XBRL instance (XML document instance), which is the report itself.
- ❖ Report has a set of XML Schemas or XBRL Schemas, called Discoverable Taxonomy Set (DTS), which specify the economic concepts.

XBRL Language V

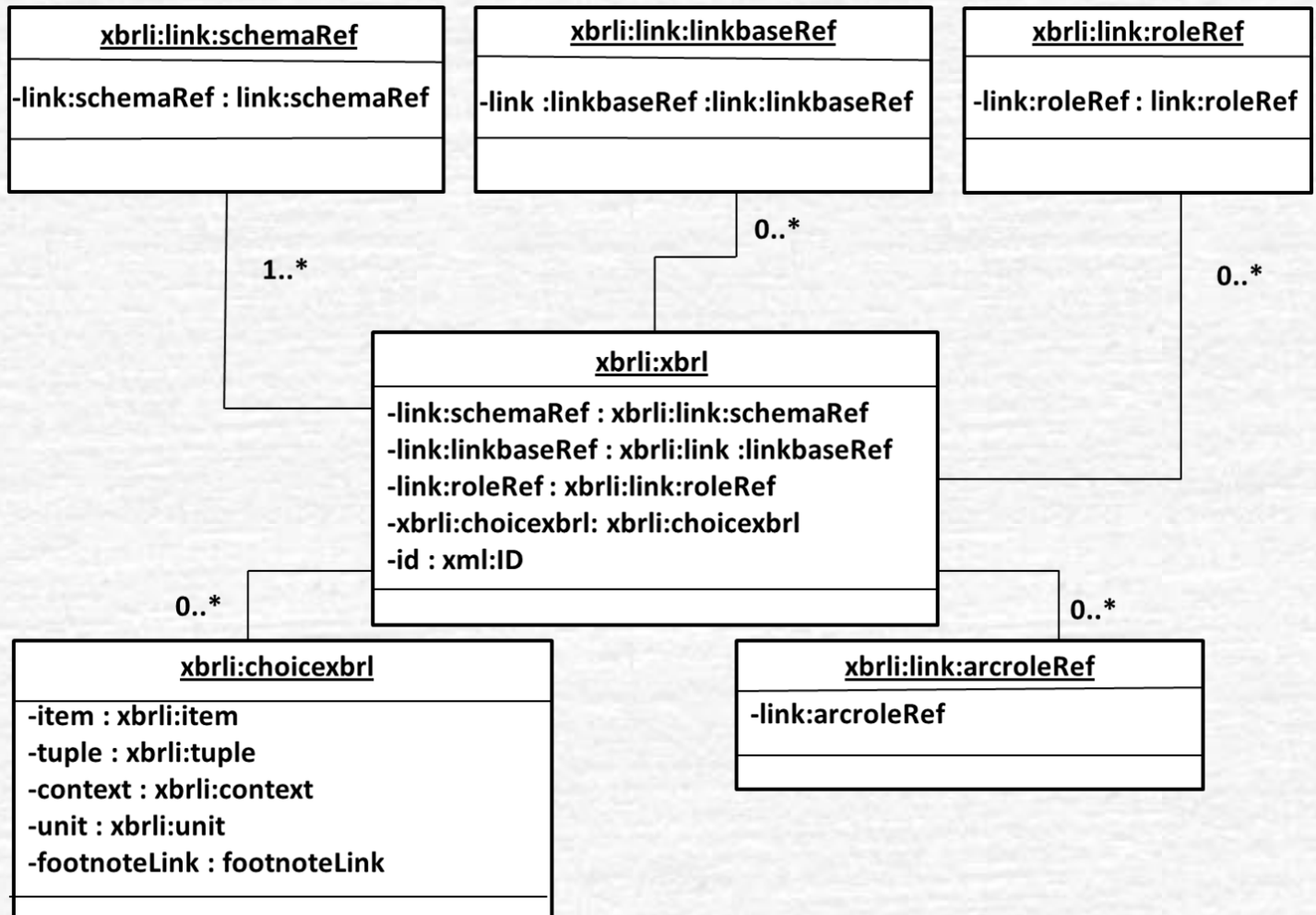
❖ Each XBRL Schema or XML Schema Consists of roles:

- Label
- Presentation
- Reference
- Definition
- Calculation
- Dimension
- Formula
- Rendering

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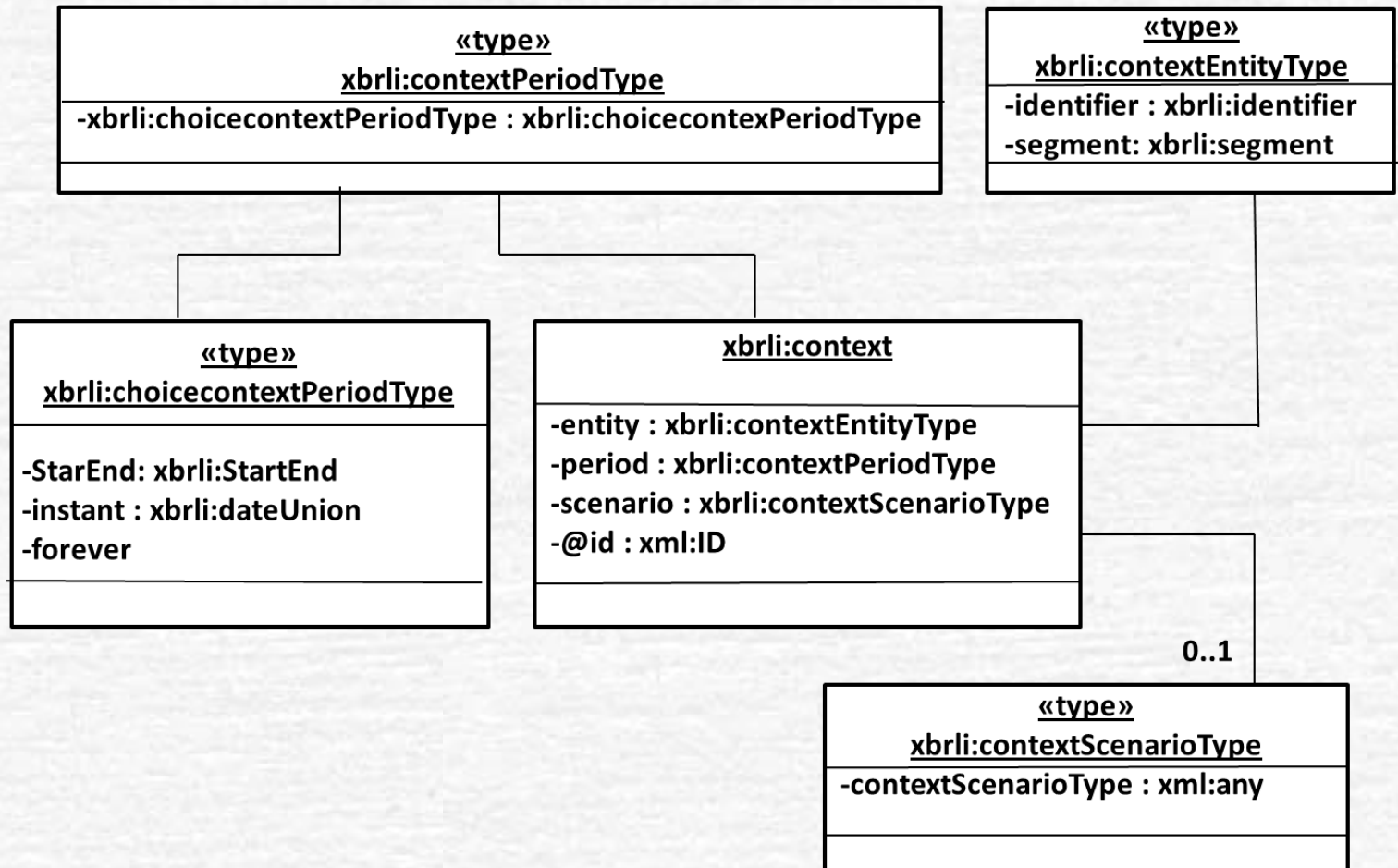
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XBRL Language VII

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XBRL Data Model I

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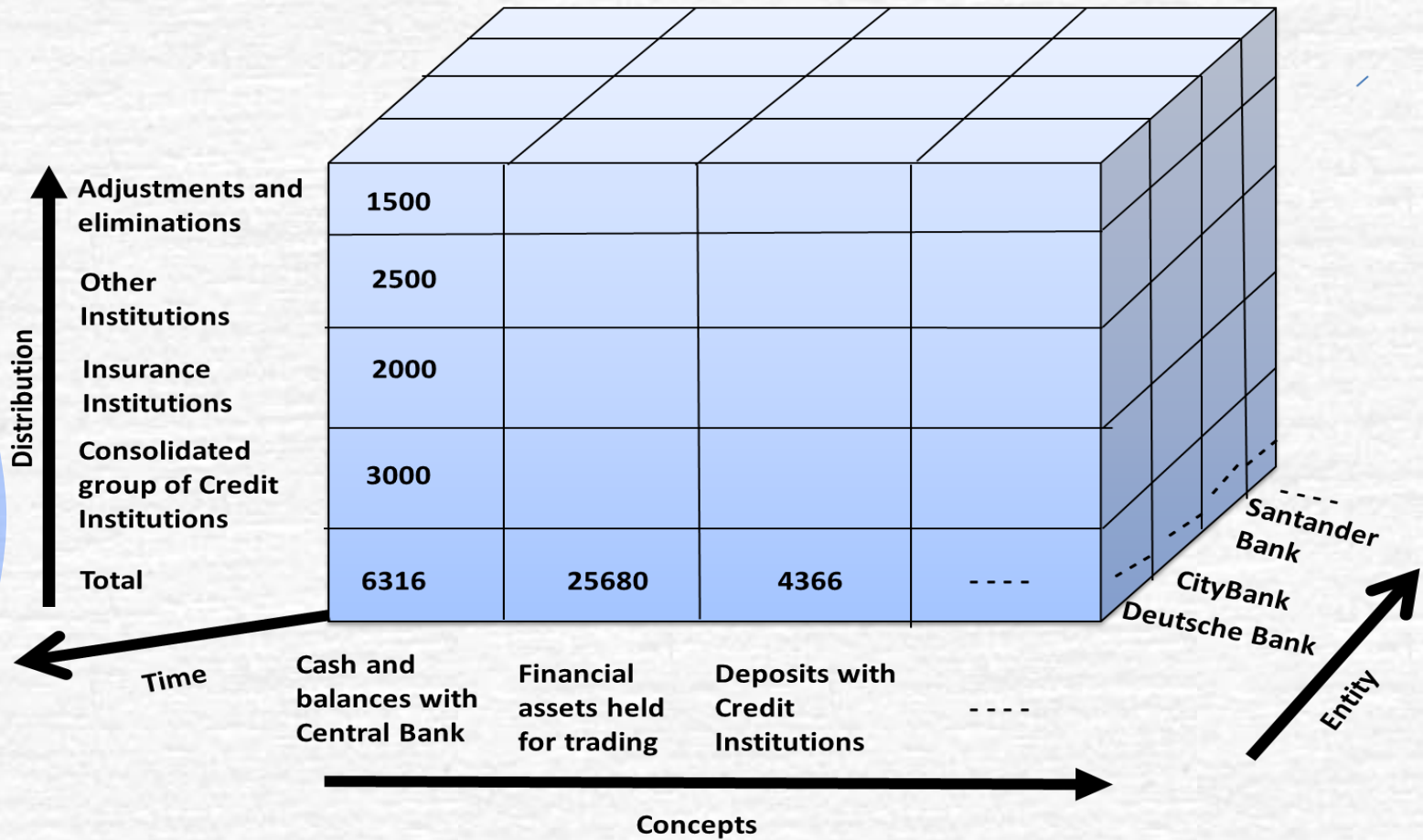
- ❖ A specific XBRL report is analyzed.
- ❖ This report is the 6610, Public Sector Consolidated Balance (Bank of Spain, 2008).
- ❖ Concepts (items, or rows, *primary items* in XBRL).
- ❖ The columns are dimensions and dimension attributes, different contexts.

XBRL Data Model II

IS1. Public Sector Consolidated Balance

Assets Presentation	Total	Distribution			
		Consolidated group of credit institutions	Insurance Institutions	Other Institutions	Adjustments and eliminations
1. Cash and balances with Central Banks	6,316	316	2,000	2,500	1,500
2. Financial assets held for trading total	25,680				
2.1 Trading portfolio of deposit banks	4,366				
2.2 Trading portfolio of customer credit	6,384				
2.3 Financial assets held for trading other debt instruments	3,086				

XBRL Data Model III



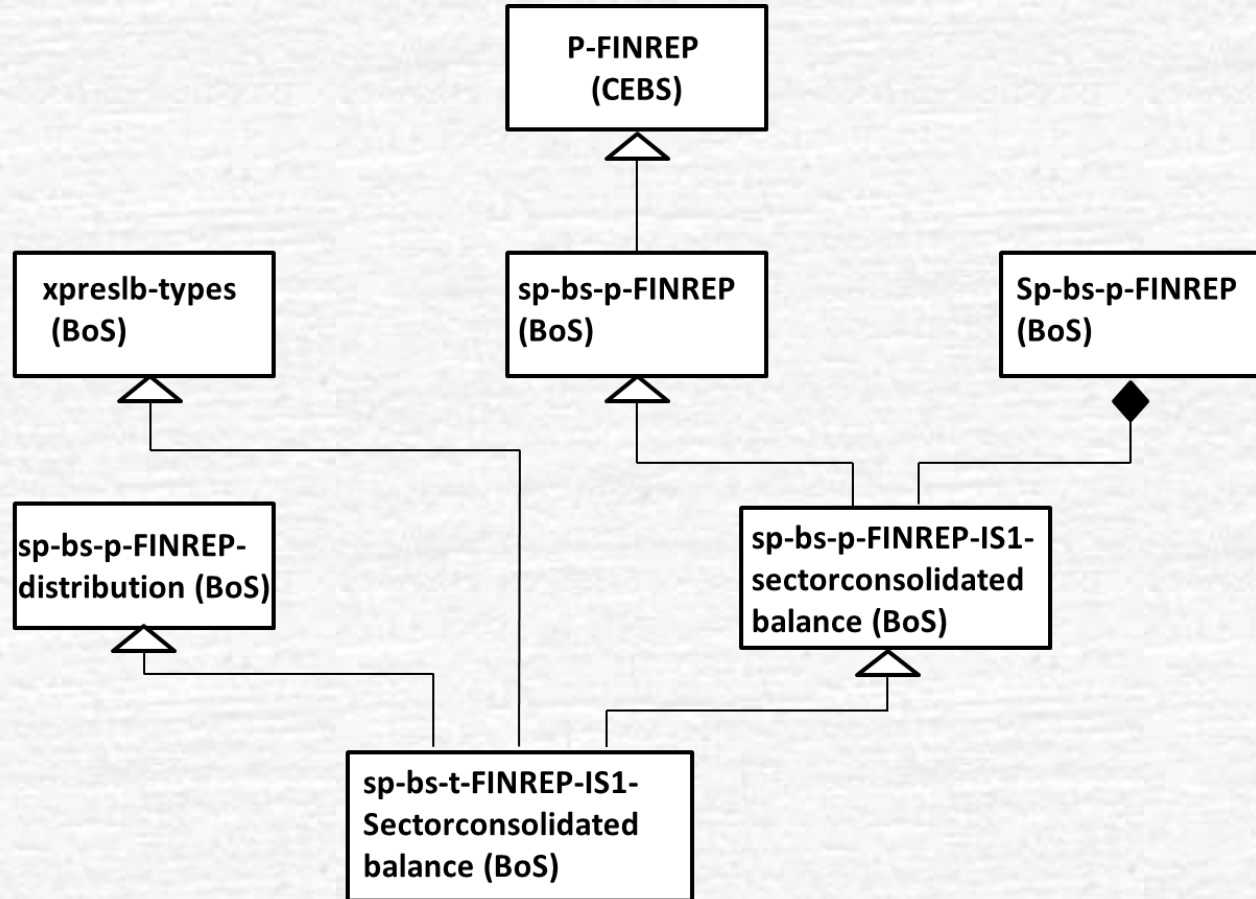
XBRL Data Model IV

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- ❖ A *primary item* defines a concept, the concept type, and the measure unit.
- ❖ The *context* defines the set of dimensions of a fact.
- ❖ This report is only for an entity (financial institution), but it is necessary to store all entities, because of each institution has to send the same report type.
- ❖ A snowflake model will be obtained.

XBRL Data Model V

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```
<?xml version="1.0" encoding="UTF-8"?>
<!-- Generated by Fujitsu XWand B0125T -->
<xbrli:xbrl xmlns:es-be-FR-pc="http://www.bde.es/es/fr/esrs/finrep/6-2008/2008-11-26/es-be-finrep-consolidado" xmlns:xbrldi="http://xbrl.org/2006/xbrldi" xmlns:
<link:schemaRef xlink:type="simple" xlink:href="http://www.bde.es/es/fr/esrs/finrep/6-2008/2008-11-26/es-be-finrep-consolidado.xsd"/>
<xbrli:context id="Context_Instant">
  <xbrli:entity>
    <xbrli:identifier scheme="http://www.ecb.int/stats/money/mfi">ES9000</xbrli:identifier>
    <xbrli:segment>
      <xbrldi:explicitMember dimension="es-be-cm-dim:Agrupacion">es-be-cm-dim:AgrupacionIndividual</xbrldi:explicitMember>
    </xbrli:segment>
  </xbrli:entity>
  <xbrli:period>
    <xbrli:instant>2008-09-30</xbrli:instant>
  </xbrli:period>
</xbrli:context>
<xbrli:context id="IS1">
  <xbrli:entity>
    <xbrli:identifier scheme="http://www.ecb.int/stats/money/mfi">ES9000</xbrli:identifier>
    <xbrli:segment>
      <xbrldi:explicitMember dimension="es-be-cm-dim:Agrupacion">es-be-cm-dim:AgrupacionIndividual</xbrldi:explicitMember>
    </xbrli:segment>
  </xbrli:entity>
  <xbrli:period>
    <xbrli:startDate>2008-07-01</xbrli:startDate>
    <xbrli:endDate>2008-09-30</xbrli:endDate>
  </xbrli:period>
</xbrli:context>
<xbrli:unit id="EURO">
  <xbrli:measure>iso4217:EUR</xbrli:measure>
</xbrli:unit>
<es-be-p-FINREP:PromemoriaRiesgosContingentes decimals="-3" contextRef="Context_Instant" unitRef="EURO">0</es-be-p-FINREP:PromemoriaRiesgosContingentes>
<ifrs-gp:CashAndBalancesWithCentralBanks decimals="-3" contextRef="Context_Instant" unitRef="EURO">6316000</ifrs-gp:CashAndBalancesWithCentralBanks>
<ifrs-gp:FinancialAssetsHeldForTradingTotal decimals="-3" contextRef="Context_Instant" unitRef="EURO">25680000</ifrs-gp:FinancialAssetsHeldForTradingTotal>
</xbrli:xbrl>
```

XBRL Data Model VII

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- ❖ Schema starts by adding the necessary namespaces.
- ❖ The set of XML Schemas is defined.
- ❖ This document instance has to be validated to this set of XML Schemas.
- ❖ Context.
- ❖ Segment.
- ❖ The scenario shows the specific pairs of dimension and the dimension attribute of business logic.
- ❖ Unit.

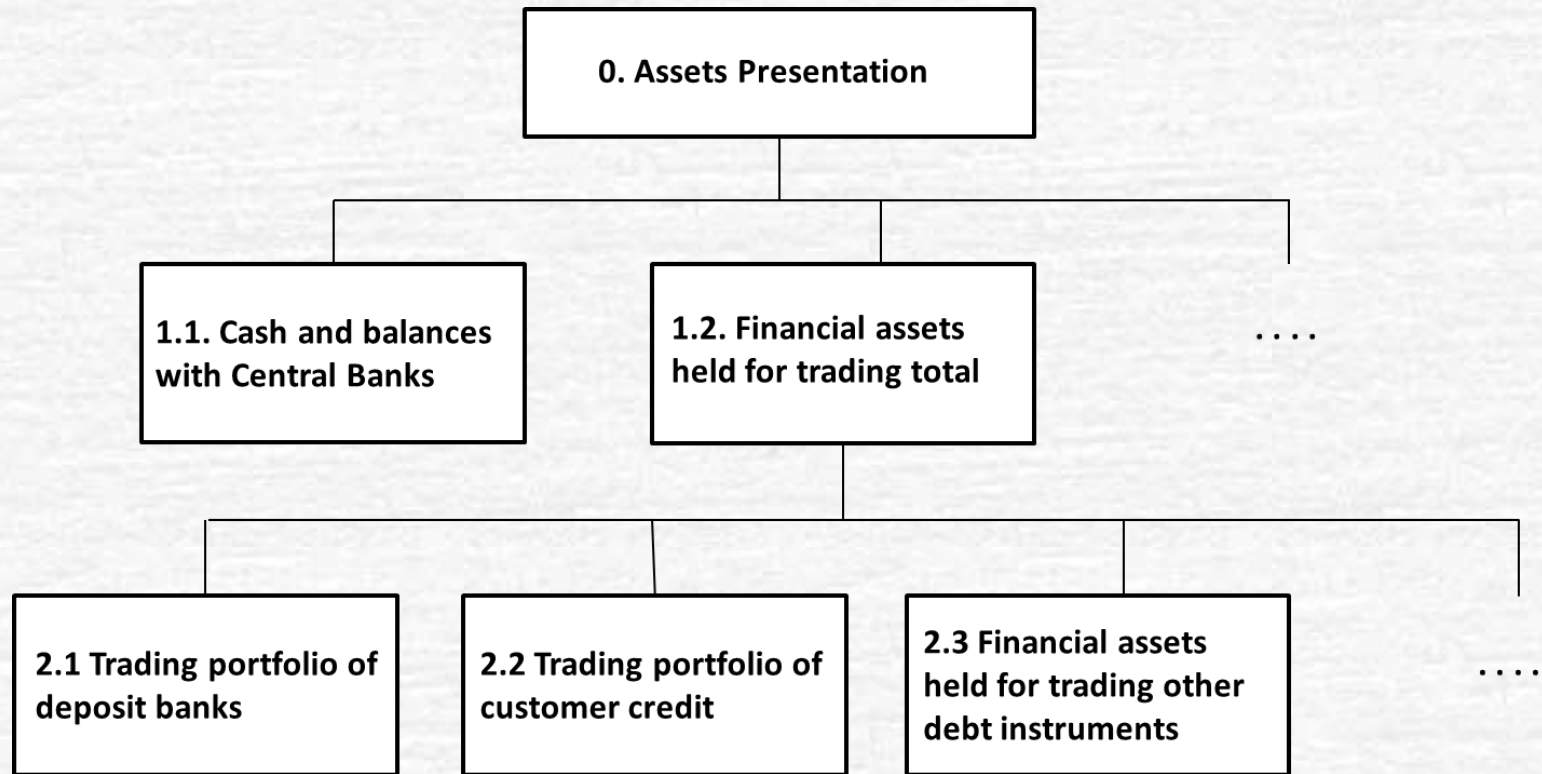
XBRL Data Model VIII

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- ❖ calculation rule as: Let $Z \in \text{Items of a taxonomy}$, $A_i \in \text{Items of the taxonomy}$, and $w_i \in R$, where $\forall i = 1..n$, and $w_i \neq 0$. Then $Z = \sum_{i=1}^n A_i * w_i$.
- ❖ The structure of the concepts is hierarchical.
- ❖ The reference data.
- ❖ Footnotes.

XBRL Data Model IX

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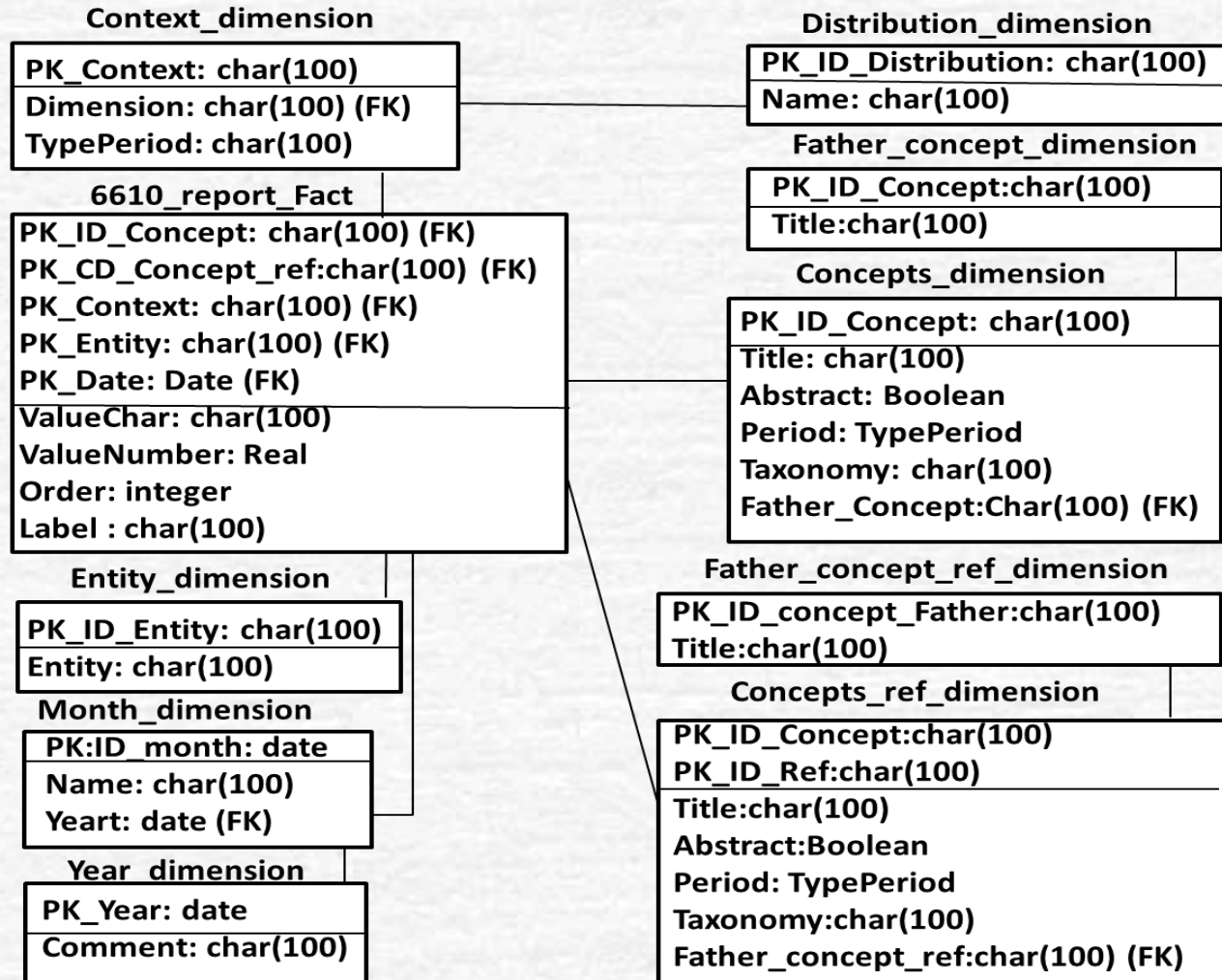


XBRL Multidimensional Data Model I

- ❖ The dynamic of the model is studied.
- ❖ Structure of metadata is analyzed, as fact schema, fact attributes, dimensions, dimension attributes, and hierarchies.
- ❖ Rules of the schema will be studied.

XBRL Multidimensional Data Model II

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XBRL Multidimensional Data Model III

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- ❖ Report $\rightarrow\rightarrow$ Context; Context \rightarrow Entity.
- ❖ Context \rightarrow PeriodTime.
- ❖ Segment \rightarrow (Dimension, Dimension attributes).
- ❖ Scenario $\rightarrow\rightarrow$ (Dimension, Dimension attributes).
- ❖ Concept \rightarrow name or ID, type; Concept, primary item \rightarrow Fact_Type, Fact_periodType.
- ❖ Two new dimensions are for the concept "father". One dimension is related to concepts with references, and another to concepts without reference.
- ❖ Primary item \rightarrow Concept; Dimension \rightarrow Concept; Dimension attribute \rightarrow Concept.

XBRL Multidimensional Data Model IV

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- ❖ . Context, Primary item, Period, Entity \rightarrow fact.
- ❖ Context, Primary item, Period, Entity, Version \rightarrow Fact.
- ❖ Concept \rightarrow Order.
- ❖ Concept \rightarrow FatherConcept.
- ❖ Let P , Q , and R be predicates, and let $accounting_rule(P, Q, R)$ be a rule, where R is the result of the arithmetic operation between P , and Q . And let it be $true(R) \begin{cases} 1 \text{ if } R \text{ is true.} \\ 0 \text{ if } R \text{ is false.} \end{cases}$. Then the rule of semantic validation is defined as $\forall P, Q, R (R, accountingRule(P, Q, R) \rightarrow True(R))$.
- ❖ Footnote $\rightarrow \rightarrow$ Concept.

XBRL Multidimensional Data Model IV

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- ❖ Concept $\rightarrow \rightarrow$ Label; Concept, language \rightarrow Title. Concept \rightarrow Label.
- ❖ A concept has 0..N references.
- ❖ Hypercube (in the XBRL Data Model) is a constraint that defines the set of dimensions permitted or prohibited.

Conclusions and future work

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- ❖ Clarify the XBRL data model in a Multidimensional data model.
- ❖ Map both data models.
- ❖ Automation of this mapping is proposed.
- ❖ Each report is a fact, but this fact is composed of other facts, the data of the report. Each fact is determined by a basic concept and a set of dimensions.
- ❖ In general, the reports contain different data, and these data have different meanings in space and time, but the report has a meaning by itself.

Conclusions and future work

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- ❖ We have published a proof of concept of mapping a XBRL report to a RDBMS in <http://openfilin.info> → Tools → Proof of concept, XBRL reports vs. RDBMS.
- ❖ Rules and semantic constraints that haven't been analyzed in this paper.
- ❖ Is possible to automatize the mapping between the XBRL and the MDM.
- ❖ We map to a commonly used Conceptual Model that is MDM.

XBRL Interoperability through a Multidimensional Data Model



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