1. Logical Theory Describing Financial Report

This section provides a comprehensive introduction to a logical theory that describes a financial report. This logical theory provides a logical conceptualization that professional accountants and software engineers can use to communicate about financial reports that are machine readable.

Frameworks[1] help communication and understanding.

What are conspicuously missing from the minds of most professional accountants and software engineers are a framework[2], principles[3], and a theory[4] relating to how to think about digital financial reports.

This section provides and explains that framework and theory. It provides a high-level overview of the general purpose financial report and how to model an XBRL-based version of such a general purpose financial report.

1.1. Essence of a general purpose financial report

A general purpose financial report is a high-fidelity, high-resolution, high-quality information exchange mechanism. The report is a compendium of complex logical information required by statutory requirements and regulatory rules plus whatever management of an economic entity wants to voluntarily disclose. The report represents quantitative and qualitative information about the financial condition and financial performance of an economic entity. There are a number of different financial reporting schemes[5] that might be used to create that report: US GAAP, IFRS, IPSAS, GAS, FAS, etc.

Financial reports are not uniform. Financial reports are not forms, they have variability. This consciously allowed variability is an essential, characteristic trait of robust reporting schemes such as US GAAP, IFRS, and others. This variability contributes to the richness, high-fidelity, and high-resolution of reported financial information that is unique to an industry sector, a style of reporting, or an economic entity. This variability is a feature of such reporting schemes. Different reporting styles, different subtotals used to aggregate details, and using some specific approach given a set of allowed alternatives are examples of variability. Variability does not mean "arbitrary" or "random". There are known identifiable patterns.

Consider the following use case of a general purpose financial report:

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[1] *Understanding the Need for a Framework and Theory*, http://xbrl.squarespace.com/journal/2015/9/20/understanding-the-need-for-a-framework-and-theory.html

[2] *Open Source Framework for Implementing XBRL-based Digital Financial Reporting*, http://xbrlsite.azurewebsites.net/2019/Framework/FrameworkEntitiesSummary.html

[3] Digital Financial Reporting General Principles, http://xbrlsite.azurewebsites.net/2017/IntelligentDigitalFinancialReporting/Part01_Chapter02.2_Principles.pdf

[4] *Financial Report Semantics and Dynamics Theory*, http://xbrl.squarespace.com/fin-report-sem-dyn-theory/

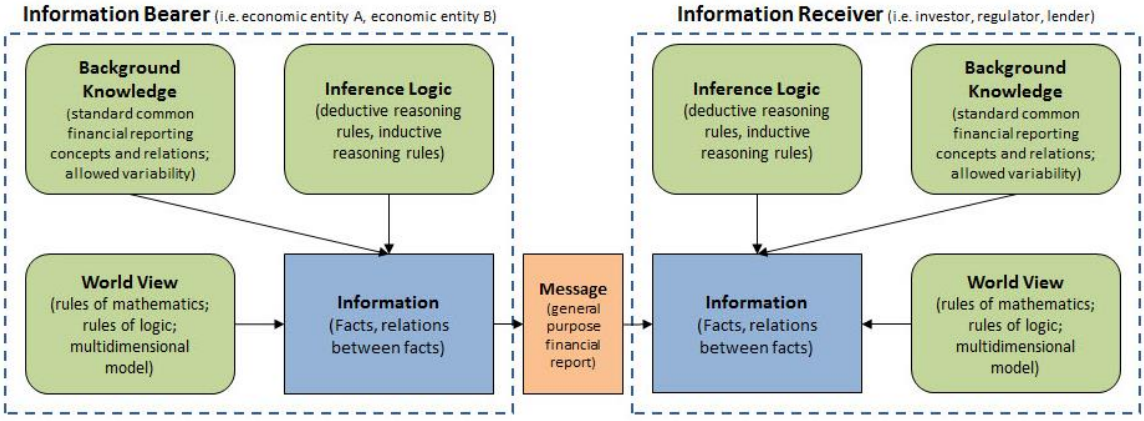
[5] Charles Hoffman, CPA, *Comparison of Financial Reporting Schemes High Level Concepts*, http://xbrlsite.azurewebsites.net/2018/Library/ReportingSchemes-2018-12-30.pdf

> Two economic entities, A and B, each have information about their financial position and financial performance. They must communicate their information to an investor who is making investment decisions which will make use of the combined information so as to draw some conclusions. All three parties (economic entity A, economic entity B, investor) are using a common set of basic logical principles (facts, statements, deductive reasoning, inductive reasoning, etc.), common financial reporting standard concepts and relations (i.e. US GAAP, IFRS, IPSAS, etc.), and a common world view so they should be able to communicate this information fully, so that any inferences which, say, the investor draws from economic entity A's information should also be derivable by economic entity A itself using basic logical principles, common financial reporting standards (concepts and relations), and common world view; and vice versa; and similarly for the investor and economic entity B.

The following is a set of principles related to a general purpose financial report:

- A general purpose financial report is a high-fidelity, high-resolution, high-quality information exchange mechanism.
- Prudence dictates that using information from a financial report should not be a guessing game.
- All formats conveying information should convey the exact same meaning be that format paper, e-paper, or some machine readable format.
- Explicitly stated information from information bearers or reliably derived information is preferable to requiring information receivers to make assumptions.
- Double entry accounting enables processes that allow for the detection of information errors and to distinguish errors (unintentional) from fraud (intentional).
- Catastrophic logical failures are to be avoided at all cost as they cause systems to completely fail.

Depicted graphically; the essence of what is taking place when an economic entity, an information bearer, provides information to some information receiver such as an investor, regulator, or lender; is such:



All of this can be described logically in a manner that is easy for a professional accountant to understand. A logical theory, such as the *Logical Theory Describing a*

Business Report[6], defines and describes things. A general purpose financial report is a specialization of the more general business report.

Rules are used to articulate allowed variability and "channel" creators of reports in the right direction and therefore control variability, keeping the variability within standard limits. That keeps report quality where it needs to be. Rules enable things like preventing a user from using a concept meant to represent one thing from unintentionally being used to represent something different. Further, the discipline of describing something in a form a computer algorithm can understand also assists you in understanding the world better; weeding out flaws in your understanding, myths, and misconceptions about accounting and reporting standards.

The *Method of Implementing a Standard Digital Financial Report Using the XBRL Syntax*[7] is a document that explains a best practice based, open standard approach to implementing a financial report leveraging the forth coming OMG Standard Business Report Model (SBRM).

To understand the above method, I created a project which represents a portion of the International Public Sector Accounting Standards (IPSAS) step-by-step using that method[8].

1.2. Financial Report is a Logical System

There are many approaches which can be used to describe something logically. A **logical system** (a.k.a. logical theory) is one such approach which enables a community of stakeholders trying to achieve a specific goal or objective or a range of goals/objectives to agree on important common models, structures, and statements for capturing meaning or representing a shared understanding of and knowledge in some universe of discourse.

A financial report is a logical system. Financial reports represent economic phenomena in words and numbers. A financial report is a faithful representation of a set of claims made by an economic entity about the financial position and financial performance of an economic entity. (i.e. a financial report is not arbitrary, is not random, is not illogical).

A logical system or logical theory is made up of a set of models, structures, terms, associations, assertions, and facts[9]. In very simple terms,

- **Logical theory**: A *logical theory* is a set of models that are consistent with and permissible per that logical theory.
- **Model**: A *model* is a set of structures. A model is a permissible interpretation of a theory.

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[6] Charles Hoffman, CPA and Rene van Egmond, *Logical Theory Describing a Business Report*, http://xbrlsite.azurewebsites.net/2019/Library/LogicalTheoryDescribingBusinessReport.pdf

[7] Charles Hoffman, CPA and Raynier van Egmond, *Method of Implementing a Standard Digital Financial Report Using the XBRL Syntax*, http://xbrlsite.azurewebsites.net/2019/Library/MethodForImplementingStandardFinancialReportUsingXBRL.pdf

[8] International Public Sector Accounting Standards XBRL Taxonomy Prototype Project, http://xbrl.squarespace.com/journal/2019/1/16/international-public-sector-accounting-standards-xbrl-taxono.html

[9] Charles Hoffman, CPA, *Explanation of a Financial Report Logical System in Simple Terms*, http://xbrl.squarespace.com/journal/2019/11/1/explanation-of-a-financial-report-logical-system-in-simple-t.html

- **Structure**: A *structure* is a set of statements which describe the associations and assertions of the structure. (A structure provides context.)
- **Statement**: A statement is a proposition, claim, assertion, belief, idea, or fact about or related to the universe of discourse to which the logical theory relates. There are four broad categories of statements:
  - **Terms**: Terms are statements that define ideas used by the logical theory such as "assets", "liabilities", and "equity".
  - **Associations**: Associations are statements that describe permissible interrelationships between the terms such as "assets is part-of the balance sheet" or "operating expenses is a type-of expense" or "assets = liabilities + equity" or "an asset is a 'debit' and is 'as of' a specific point in time and is always a monetary numeric value".
  - **Assertions**: Assertions are statements that describe expectations that tend to be IF…THEN…ELSE types of relationships such as "IF the economic entity is a not-for-profit THEN net assets = assets - liabilities; ELSE assets = liabilities + equity".
  - **Facts**: Facts are statements about the numbers and words that are provided by an economic entity within their financial report. For example, "assets for the consolidated legal entity Microsoft as of June 20, 2017 was $241,086,000,000 expressed in US dollars and rounded to the nearest millions of dollars.

A logical system is said to be **consistent** if there are no contradictions with respect to the statements made by the logical system.

A logical system can have high to low **precision** and high to low **coverage**. *Precision* is a measure of how precisely the information within a logical system has been represented as contrast to reality for the universe of discourse. *Coverage* is a measure of how completely information in a logical system has been represented relative to the reality for a universe of discourse.

If the models, structures, terms, associations, assertions, and facts have high precision and high coverage, and if all the statements within the logical system are consistent; then the logical system can be proven to be properly functioning. If you have a properly functioning logical system then you can create a chain of reasoning[10].

For more information on the financial report logical system see *Special Theory of Machine-based Automated Communication of Semantic Information of Financial Statements*[11] and watch this video play list[12].

[10] Charles Hoffman, CPA, *Constructing a Chain of Reasoning*, http://xbrl.squarespace.com/journal/2019/9/26/constructing-a-chain-of-reasoning.html

[11] *Special Theory of Machine-based Automated Communication of Semantic Information of Financial Statements*, http://xbrl.squarespace.com/journal/2019/12/30/special-theory-of-machine-based-automated-communication-of-s.html

[12] YouTube, Understanding the Financial Report Logical System, https://www.youtube.com/playlist?list=PLqMZRUzQ64B7EWamzDP-WaYbS_W0RL9nt

1.3. Framework for Representing a Business Report

The *Open Source Framework for Implementing XBRL-based Digital Financial Reporting*[13] is a framework for representing an XBRL-based digital financial report. Ultimately, that open source framework will be replaced by the forthcoming OMG Standard Business Report Model (SBRM)[14] framework. Both frameworks are the same. Both of the above frameworks are consistent with the logical conceptualization represented later in this document.

1.4. Financial Report Semantics and Dynamics Theory

A **theory** describes absolutes. Theories are the real thing. A theory describes the object of its focus. A theory does not simplify. Theories are irreducible, the foundation on which new metaphors can be built. A successful theory can become a fact. A theory describes the world and tries to describe the principles by which the world operates. A theory can be right or wrong, but it is characteristic by its intent: the discovery of essence.

The *Financial Report Semantics and Dynamics Theory*[15] provides a formal set of self-evident logical principles that no one would argue with (called axioms) and deductions which can be proven by constructing a chain of reasoning by applying axioms (called theorems) and then provides verification that these axioms and theorems hold up against a set of 8,098 XBRL-based financial reports submitted to the Securities and Exchange Commission by pubic companies which show that these logical principles are true about financial reports.

Axioms and theorems assert knowledge. Constraints are restrictions on existing knowledge. Constraints can be used to detect incomplete information. Constraints can be used to check knowledge for inconsistencies and contradictions.

The theory provides additional information such as an ethics or worldview of a financial report which helps tie other important information together.

The theory also explains the dynamics or "mechanics" or the mechanical nature of a financial report. While the information expressed by a financial report is far from mechanical, the mechanism by which the information is expressed be that using printed paper or some digital technology is in fact mechanical.

To obtain a thorough understanding of the theory you are encouraged to read through the entire *Financial Report Semantics and Dynamics Theory*.

The remainder of this section articulates information from that theory which helps one to understand the pieces of a financial report and how the pieces interact with one another. This section uses broad brush strokes to paint the high-level big picture. Subsequent sections dive into the details.

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[13] Open Source Framework for Implementing XBRL-based Digital Financial Reporting, http://xbrlsite.azurewebsites.net/2019/Framework/FrameworkEntitiesSummary.html

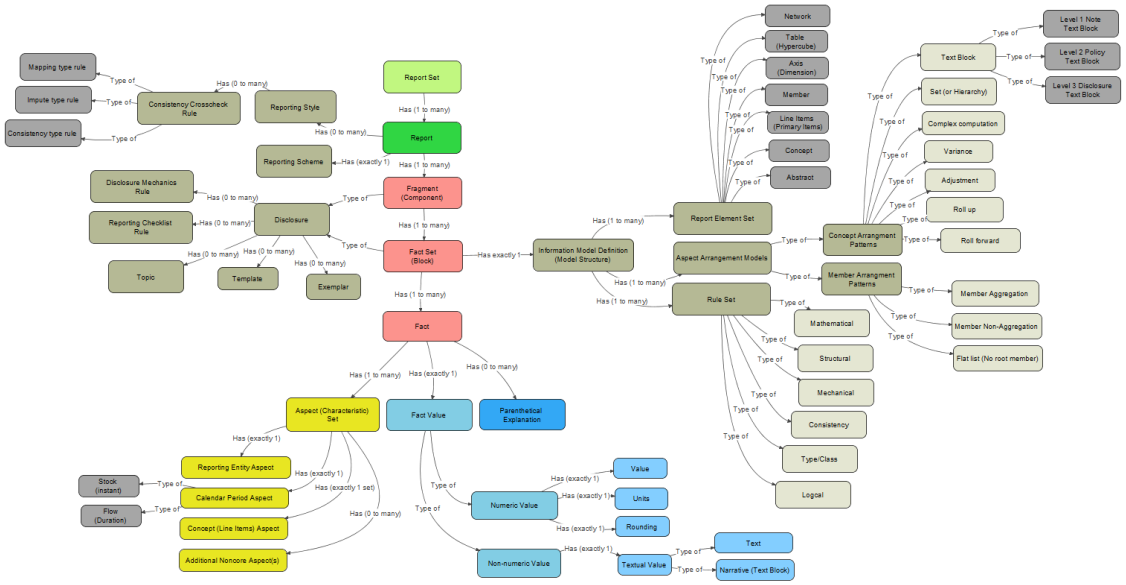
[14] *OMG Standard Business Report Model (SBRM) Initial Submission Information*, http://xbrl.squarespace.com/journal/2019/11/15/omg-standard-business-report-model-sbrm-initial-submission-i.html

[15] Charles Hoffman and Rene van Egmond, *Financial Report Semantics and Dynamics Theory*, http://xbrl.squarespace.com/fin-report-sem-dyn-theory/

First we define the pieces of a financial report and relations between the pieces. We will then provide a narrative which helps the reader better comprehend those pieces and relations.

1.5. Visual representation of logical model of financial report

The following is a visual image of the pieces that make up a financial report and the relationship between those pieces[16]:



The remainder of this document strives to explain the pieces that make up a financial report and the relations between those pieces that are useful to business professionals and software engineers that are trying to create software to be used to create or work with an XBRL-based digital general purpose financial report. For additional details, please refer to the chapter *Financial Report Object Properties*[17]. Software engineers might find the chapter *Reconciliation of Models*[18] helpful. Software engineers will likely find the *Conceptual Model*[19] helpful.

1.6. Understanding that conceptual models help understanding

Conceptual models help communication and understanding. Every professional accountant understands the electronic spreadsheet which has a high-level conceptual model: workbooks, spreadsheets, rows, columns, and cells:

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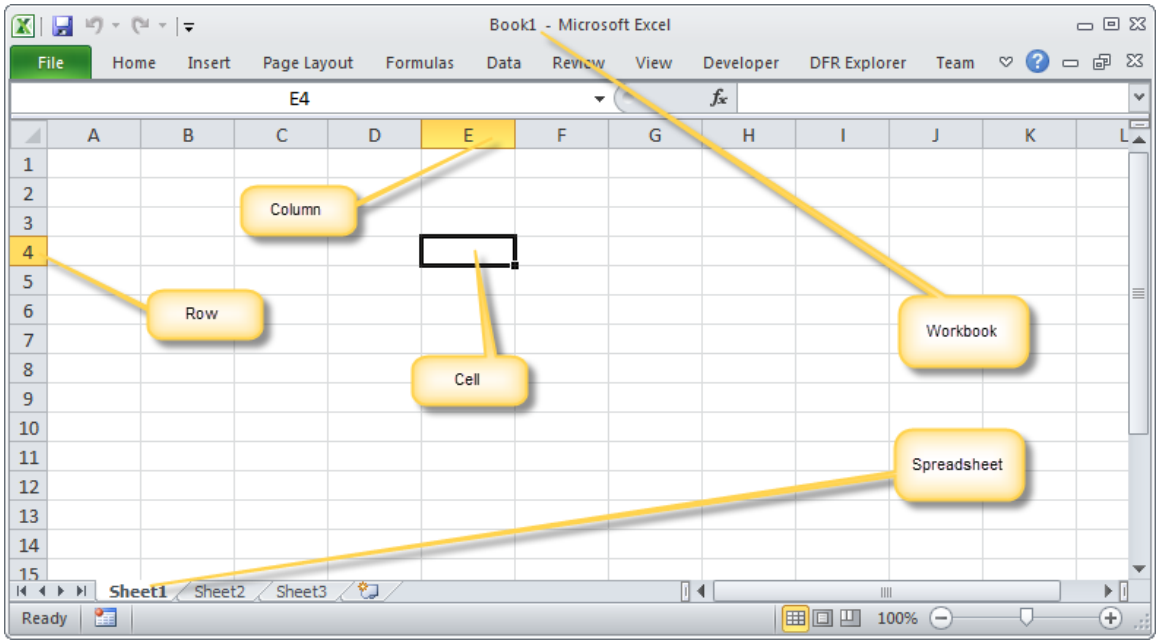
[16] *Visual representation of the logical model of a financial report*, http://xbrlsite.azurewebsites.net/2016/conceptual-model/LogicalModel-2019-03-10.jpg

[17] Charles Hoffman, CPA and Rene van Egmond, *Financial Report Object Properties*, http://xbrlsite.azurewebsites.net/2017/IntelligentDigitalFinancialReporting/Part05_Chapter08.3_FinancialReportSemanticObjectProperties.pdf

[18] Charles Hoffman, CPA and Rene van Egmond, *Reconciliation of Models*, http://xbrlsite.azurewebsites.net/2017/IntelligentDigitalFinancialReporting/Part05_Chapter08.2_ReconciliationOfModels.pdf

[19] *Conceptual Model*, http://xbrl.squarespace.com/conceptual-model/



Just like the workbooks, spreadsheets, columns, rows, and cells of a spreadsheet help you understand, describe, and related to electronic spreadsheets; the multidimensional conceptual model helps you relate to XBRL-based digital financial reports conceptual model.

1.7. Digital financial reports follow the multidimensional model

Professional accountants work with multidimensional information every day and generally don't realize that fact. In fact, many things are inherently multidimensional[20]. Information reported in a financial report is absolutely multidimensional.

You might be familiar with the term multidimensional from business intelligence (BI) software. BI terms tend to represent the technical artifacts that are used to represent real world business phenomenon. Our terms describe the business phenomenon themselves, not a technical implementation. Further, BI dimensional model which is based on online analytical processing (OLAP) works slightly differently than our model which describes how the real world works. For example, in the real world there are numbers, text, and prose; but OLAP is focused only on numbers. In the real world, financial reports provide facts that represent totals; but in OLAP totals are calculated on the fly. Our model describes the real world. BI describes an implementation. Further, BI is non-standard so every implementation can use different terms and our model is based on XBRL, a global standard.

1.8. Basic logical conceptualization of a financial report

A scalar is a fact which has no characteristics; it stands on its own. For example, the value of pi is a scalar, the value never changes; it always has the same value for everyone. (Pi or π is the ratio of a circle's circumference to its diameter and always has the value of equal to 3.14)

[20] YouTube, *Introduction to the Multidimensional Model for Professional Accountants*, https://www.youtube.com/watch?v=A5AAruLUud4

Fact Value
3.14

A financial **report**[21] communicates facts. A **fact**[22] defines a single, observable, reportable piece of information contained within a financial report, or **fact value**[23], contextualized for unambiguous interpretation or analysis by one or more distinguishing characteristics or aspects. For example, below are two facts with the values of "2,000" and "1,000". However, the two facts above are not contextualized.

Fact Value
2,000
1,000

An **aspect**[24] describes a fact. An aspect provides information necessary to describe a fact or distinguish one fact from another fact within a report. For example, below you see the concept aspect of the numbers "2,000" and "1,000" which relates to the concepts "Revenues" and "Net income" respectively:

Concept Aspect	Fact Value
Revenues	2,000
Net income	1,000

To fully describe a fact you need more than just one aspect. In XBRL-based financial reports, a fact must always provide three **core aspects**[25]: reporting entity that reported the fact, calendar period of the reported fact, and the concept that describes the reported fact. Below you see two facts which are characterized by three core aspects which are used to differentiate the two facts from one another.

Reporting Entity Aspect	Calendar Period Aspect	Concept Aspect	Fact Value
ABC Company	Jan 1, 2019 to Dec 31, 2019	Revenues	2,000
ABC Company	Jan 1, 2019 to Dec 31, 2019	Net income	1,000

In XBRL-based financial reports, in addition to the core aspects that you always must use, creators of reports can also provide additional **noncore aspects**[26]. A noncore aspect is simply some additional aspect that is created to further distinguish facts beyond the capabilities of the three core aspects. Below you see the noncore aspect "Legal Entity Aspect" has been added to the two facts we have been working with:

[21] Report, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Report.html
[22] Fact, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Fact.html
[23] Fact Value, http://xbrlsite.azurewebsites.net/2019/Framework/Details/FactValue.html
[24] Aspect, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Aspect.html
[25] Core Aspect, http://xbrlsite.azurewebsites.net/2019/Framework/Details/CoreAspect.html
[26] Noncore Aspect, http://xbrlsite.azurewebsites.net/2019/Framework/Details/NoncoreAspect.html

Reporting Entity Aspect	Legal Entity Aspect	Calendar Period Aspect	Concept Aspect	Fact Value
ABC Company	Consolidated entity	Jan 1, 2019 to Dec 31, 2019	Revenues	2,000
ABC Company	Consolidated entity	Jan 1, 2019 to Dec 31, 2019	Net income	1,000

Fact values can be **numeric**[27] or **nonnumeric**[28]. Numeric fact values require additional information to describe the units of the numeric fact and the rounding that is used to report the numeric fact. **Units**[29] and **rounding**[30] are properties of the fact value that provide information necessary to describe numeric fact values. Below you see that the units of "US Dollars" and that the rounding of "Thousands of dollars":

Reporting Entity Aspect	Legal Entity Aspect	Calendar Period Aspect	Concept Aspect	Fact Value	Units	Rounding
ABC Company	Consolidated entity	Jan 1, 2019 to Dec 31, 2019	Revenues	2,000	US Dollars	Thousands of dollars
ABC Company	Consolidated entity	Jan 1, 2019 to Dec 31, 2019	Net income	1,000	US Dollars	Thousands of dollars

To summarize where we are thus far and to be crystal clear; below you see one fact. That single fact is characterized by a set of four aspects. The numeric fact value is described as having units of "US Dollars" and that the fact value is rounded to the nearest "Thousands of dollars".

Reporting Entity Aspect	Legal Entity Aspect	Calendar Period Aspect	Concept Aspect	Fact Value	Units	Rounding
ABC Company	Consolidated entity	Jan 1, 2019 to Dec 31, 2019	Revenues	2,000	US Dollars	Thousands of dollars

A **fact set**[31] is a set of facts which go together (tend to be cohesive and share a certain common nature) for some specific purpose within a financial report. A common synonym for fact set is fact table. The term block is a synonym for fact set. Below you see three facts that make up a fact set that are used to describe the breakdown of revenues by geographic area.

Reporting Entity Aspect	Legal Entity Aspect	Geographic Area Aspect	Calendar Period Aspect	Concept Aspect	Fact Value	Units	Rounding
ABC Company	Consolidated entity	All Geographic Areas Combined	Jan 1, 2019 to Dec 31, 2019	Revenues	2,000	US Dollars	Thousands of dollars
ABC Company	Consolidated entity	North America	Jan 1, 2019 to Dec 31, 2019	Revenues	1,000	US Dollars	Thousands of dollars
ABC Company	Consolidated entity	South America	Jan 1, 2019 to Dec 31, 2019	Revenues	1,000	US Dollars	Thousands of dollars

[27] Numeric Fact Value, http://xbrlsite.azurewebsites.net/2019/Framework/Details/NumericFactValue.html
[28] Nonnumeric Fact Value, http://xbrlsite.azurewebsites.net/2019/Framework/Details/NonnumericFactValue.html
[29] Units, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Units.html
[30] Rounding, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Rounding.html
[31] Fact Set, http://xbrlsite.azurewebsites.net/2019/Framework/Details/FactSet.html

Rules[32] guide, control, suggest, or influence behavior. Rules cause things to happen, prevent things from happening, or suggest that it might be a good idea if something did or did not happen. Rules help shape judgment, help make decisions, help evaluate, help shape behavior.

Don't make the mistake of thinking that rules are completely inflexible and that you cannot break rules. Sure, maybe there are some rules that can never be broken. Maybe there are some rules that you can break. It helps to think of breaking rules as penalties in a football game. The point is that the guidance, control, suggestions, and influence offered by business rules are a choice of business professionals. The meaning of a rule is separate from the level of enforcement someone might apply to the rule.

A rule states a fact about the world. A synonym for rule is *assertion*.

So, considering our fact set below we know that the value "2,000" is for the concept "Revenues", for the period "Jan 1, 2019 to Dec 31, 2019", relates to the legal entity "Consolidated entity", of the reporting entity "ABC Company" and is the total of all "Geographic Areas". "North America" and "South America" are part of the *whole* "All Geographic Areas Combined". A rule that expresses that relationship might be expressed as:

"All Geographic Areas Combined = North America + South America".

Rules both describe and can be used to verify that reported facts are consistent with the provided description. There are many different types of rules including mathematical, structural, mechanical, logical, and accounting related rules.

Reporting Entity Aspect	Legal Entity Aspect	Geographic Area Aspect	Calendar Period Aspect	Concept Aspect	Fact Value	Units	Rounding
ABC Company	Consolidated entity	All Geographic Areas Combined	Jan 1, 2019 to Dec 31, 2019	Revenues	2,000	US Dollars	Thousands of dollars
ABC Company	Consolidated entity	North America	Jan 1, 2019 to Dec 31, 2019	Revenues	1,000	US Dollars	Thousands of dollars
ABC Company	Consolidated entity	South America	Jan 1, 2019 to Dec 31, 2019	Revenues	1,000	US Dollars	Thousands of dollars

Grain[33] is the level of depth of information or granularity. The lowest level of granularity is the actual transaction, event, circumstance, or other phenomenon represented as the actual transaction within an accounting system. The highest level of granularity is the summarized information that is represented as a line item of say the income statement.

Considering the fact set you see below the fact outlined in red is one level of granularity as contrast to the other two facts that are outlined in green which provides the same information as is provided by the fact outlined in red, but at a different level of granularity.

[32] Rule, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Rule.html

[33] Grain, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Grain.html

Reporting Entity Aspect	Legal Entity Aspect	Geographic Area Aspect	Calendar Period Aspect	Concept Aspect	Fact Value	Units	Rounding
ABC Company	Consolidated entity	All Geographic Areas Combined	Jan 1, 2019 to Dec 31, 2019	Revenues	2,000	US Dollars	Thousands of dollars
ABC Company	Consolidated entity	North America	Jan 1, 2019 to Dec 31, 2019	Revenues	1,000	US Dollars	Thousands of dollars
ABC Company	Consolidated entity	South America	Jan 1, 2019 to Dec 31, 2019	Revenues	1,000	US Dollars	Thousands of dollars

And so hopefully you get an idea of the logical model of a financial report. Now we want to shift gears a bit and be a bit more specific as to how financial reports are represented using XBRL.

An **information model definition**[34] is created to represent each fragment of a report using the XBRL format. The following pieces, or **report elements**[35], are used to construct the information model description: **Network**[36], **Table**[37], **Axis**[38], **Member**[39], **Line Items**[40], **Abstract**[41], and **Concept**[42].

Below you see the information model description of the structure of a fragment of a report, in this case one fact set which is used to describe the components of inventory:

#	Label	Report Element Class	Period Type	Balance	Name
1	**Inventory, by Compoment [Table]**	[Table]			gaap:InventoryByCompomentTable
2	**Legal Entity [Axis]**	[Axis]			frm:LegalEntityAxis
3	Consolidated Entity [Member]	[Member]			frm:ConsolidatedEntityMember
4	**Inventory, by Component [Line Items]**	[Line Items]			gaap:InventoryByComponentLineItems
5	Inventory, by Component [Roll Up]	[Abstract]			gaap:InventoryByComponentRollUp
6	Finished Goods	[Concept] Monetary	As Of	Debit	gaap:FinishedGoods
7	Work in Progress	[Concept] Monetary	As Of	Debit	gaap:WorkInProgress
8	Raw Material	[Concept] Monetary	As Of	Debit	gaap:RawMaterial
9	Inventory	[Concept] Monetary	As Of	Debit	gaap:Inventory

Something is important to point out. We mentioned that in XBRL you have core aspects and noncore aspects. In the typical software application created today, the core aspects reporting entity and calendar period are not represented in the information model description that is typically created by software applications.

Below you see a truer information model description which includes the reporting entity and the calendar period. Also, per the US GAAP XBRL Taxonomy, the IFRS XBRL Taxonomy the term "[Axis]" is used as a synonym of "Aspect". Axis and aspect are synonyms and mean the same thing. Also "Period" and "Calendar Period" are the same thing.

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[34] Information Model Definition, http://xbrlsite.azurewebsites.net/2019/Framework/Details/InformationModelDefinition.html

[35] Report Element, http://xbrlsite.azurewebsites.net/2019/Framework/Details/ReportElement.html

[36] Network, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Network.html

[37] Table, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Table.html

[38] Axis, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Axis.html

[39] Member, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Member.html

[40] Line Items, http://xbrlsite.azurewebsites.net/2019/Framework/Details/LineItems.html

[41] Abstract, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Abstract.html

[42] Concept, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Concept.html

#	Label	Report Element Class	Period Type	Balance	Name
1	**Inventory, by Compoment [Table]**	[Table]			gaap:InventoryByCompomentTable
2	**Reporting Entity [Axis]**	[Axis]			xbrl:ReportingEntityAxis
3	http://regulator.gov/id#1234567890	[Member]			http://regulator.gov/id#1234567890
4	**Period [Axis]**	[Axis]			xbrl:PeriodAxis
5	12/31/2010	[Member]			12/31/2010
6	12/31/2009	[Member]			12/31/2009
7	**Legal Entity [Axis]**	[Axis]			frm:LegalEntityAxis
8	Consolidated Entity [Member]	[Member]			frm:ConsolidatedEntityMember
9	**Inventory, by Component [Line Items]**	[Line Items]			gaap:InventoryByComponentLineItems
10	Inventory, by Component [Roll Up]	[Abstract]			gaap:InventoryByComponentRollUp
11	Finished Goods	[Concept] Monetary	As Of	Debit	gaap:FinishedGoods
12	Work in Progress	[Concept] Monetary	As Of	Debit	gaap:WorkInProgress
13	Raw Material	[Concept] Monetary	As Of	Debit	gaap:RawMaterial
14	Inventory	[Concept] Monetary	As Of	Debit	gaap:Inventory

Another part of the information model description is the mathematical rules that are used to describe and verify the roll up relations of the concepts that are a part of the information model description. Here is the roll up relations that are part of this information model description.

#	Label	Report Element Class	Weight	Balance	Name
1	Inventory	[Concept] Monetary			gaap:Inventory
2	Finished Goods	[Concept] Monetary	+1	Debit	gaap:FinishedGoods
3	Work in Progress	[Concept] Monetary	+1	Debit	gaap:WorkInProgress
4	Raw Material	[Concept] Monetary	+1	Debit	gaap:RawMaterial

Another part of the information model description is the facts within the fact set themselves. Here is the fact set or the **fact table**[43] for the facts that go with the information model description provided above.

#	Reporting Entity [Aspect]	Period [Aspect]	Concept [Aspect]	Legal Entity [Aspect]	Fact Value	Unit	Rounding
1	http://regulator.gov/id#1234567890	12/31/2010	Finished Goods	Consolidated Entity [Member]	600,000	USD	Thousands
2	http://regulator.gov/id#1234567890	12/31/2009	Finished Goods	Consolidated Entity [Member]	600,000	USD	Thousands
3	http://regulator.gov/id#1234567890	12/31/2010	Work in Progress	Consolidated Entity [Member]	300,000	USD	Thousands
4	http://regulator.gov/id#1234567890	12/31/2009	Work in Progress	Consolidated Entity [Member]	300,000	USD	Thousands
5	http://regulator.gov/id#1234567890	12/31/2010	Raw Material	Consolidated Entity [Member]	100,000	USD	Thousands
6	http://regulator.gov/id#1234567890	12/31/2009	Raw Material	Consolidated Entity [Member]	100,000	USD	Thousands
7	http://regulator.gov/id#1234567890	12/31/2010	Inventory	Consolidated Entity [Member]	1,000,000	USD	Thousands
8	http://regulator.gov/id#1234567890	12/31/2009	Inventory	Consolidated Entity [Member]	1,000,000	USD	Thousands

A software application takes the information model description structure, the information model description rules provided, the facts that are included within the fact set, and known best practices for rendering a business report that are coded into the software application in some manner and then generates a human-readable rendering of the reported information for a fragment or fact set of a report.

The following is the **rendering**[44] of the inventory components disclosure that we are working with above:

[43] Fact Table, TO DO…
[44] Rendering, TO DO…

Reporting Entity [Aspect]	http://regulator.gov/id#1234567890
Legal Entity [Aspect]	Consolidated Entity [Member]

Concept [Aspect]	Period [Aspect] 12/31/2020	12/31/2019
Inventory, by Component [Roll Up]		
Finished Goods	600,000	600,000
Work in Progress	300,000	300,000
Raw Material	100,000	100,000
Inventory	1,000,000	1,000,000

Different software applications will provide slightly different renderings using the same XBRL-based input information.

Component: (Network and Table)	
Network	JG - Schedule - **Inventory, by Component**
Table	Inventory, by Component [Table]

Reporting Entity [Axis]	1234567890 http://regulator.gov/id
Legal Entity [Axis]	Consolidated Entity [Member]
Unit [Axis]	USD

Inventory, by Component [Line Items]	Period [Axis] 2010-12-31	2009-12-31
Inventory, by Component [Roll Up]		
Finished Goods	600	600
Work in Progress	300	300
Raw Material	100	100
Inventory	1,000	1,000

Here is what the information model description looks like in that software application:

Label	Report Element Class	Period	Balance	Preferred Label Role	Name
Inventory, by Compoment [Table]	[Table]			Standard Label	gaap:InventoryByCompomentTable
Legal Entity [Axis]	[Axis]			Standard Label	frm:LegalEntityAxis
Consolidated Entity [Member]	[Member]			Standard Label	frm:ConsolidatedEntityMember
Inventory, by Component [Line Items]	[LineItems]			Standard Label	gaap:InventoryByComponentLineItems
Inventory, by Component [Roll Up]	[Abstract]			Standard Label	gaap:InventoryByComponentRollUp
Finished Goods	[Concept] Monetary	As Of	Debit	Standard Label	gaap:FinishedGoods
Work in Progress	[Concept] Monetary	As Of	Debit	Standard Label	gaap:WorkInProgress
Raw Material	[Concept] Monetary	As Of	Debit	Standard Label	gaap:RawMaterial
Inventory	[Concept] Monetary	As Of	Debit	Standard Label	gaap:Inventory

Here is what the roll up rule relations representation looks like in that software application:

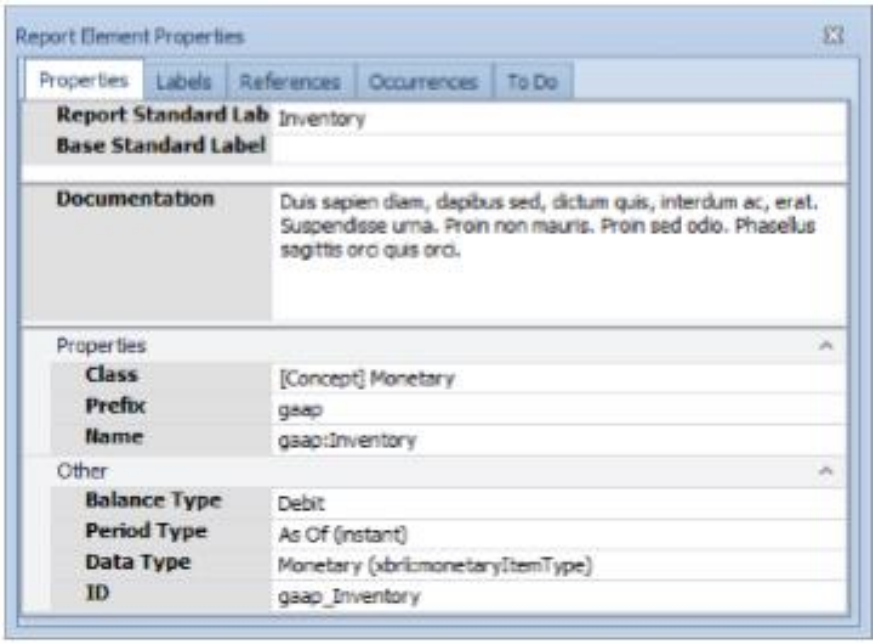
Label	Report Element Class	Balance	Weight	Name
Inventory, by Compoment [Table]	[Table]		0	gaap:InventoryByCompomentTable
Inventory	[Concept] Monetary	Debit	0	gaap:Inventory
Finished Goods	[Concept] Monetary	Debit	1	gaap:FinishedGoods
Work in Progress	[Concept] Monetary	Debit	1	gaap:WorkInProgress
Raw Material	[Concept] Monetary	Debit	1	gaap:RawMaterial

Software applications use the rule relations that describe or explain the relations to verify that reported facts are consistent with that explanation. Here is the software application interface for verifying that the reported facts are consistent with the rules that explain the relations between the facts:

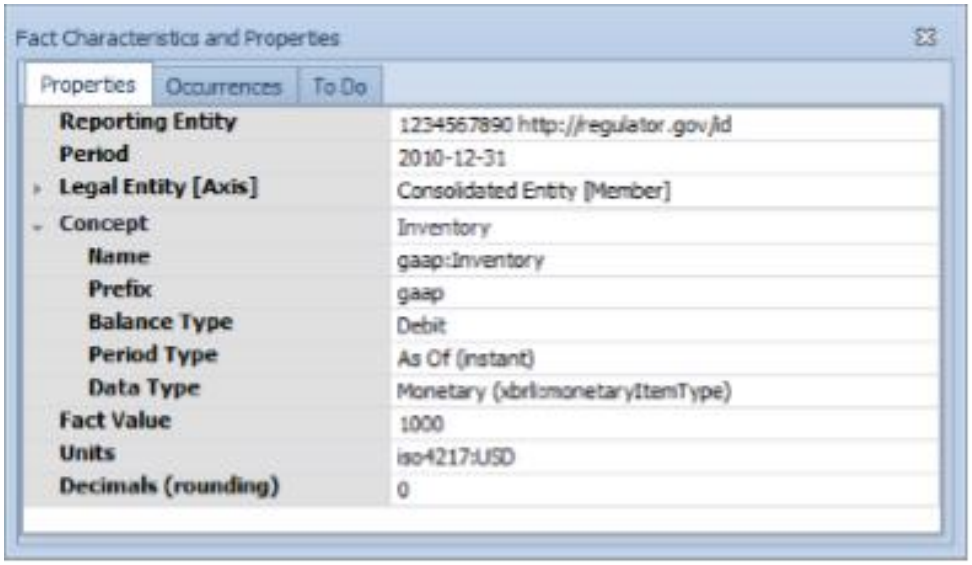
Label	Rendered Value	Op	Reported Value	Calculated Value	Balance	Result	Name
Inventory, by Component [Line Items]							gaap:InventoryByComponentLineItems
Inventory, by Component [Roll Up]							gaap:InventoryByComponentRollUp
Finished Goods	600	+	600		Debit		gaap:FinishedGoods
Work in Progress	300	+	300		Debit		gaap:WorkInProgress
Raw Material	100	+	100		Debit		gaap:RawMaterial
Inventory	1,000		1,000	1,000	Debit	Verified	gaap:Inventory

Label	Rendered Value	Op	Reported Value	Calculated Value	Balance	Result	Name
Inventory, by Component [Line Items]							gaap:InventoryByComponentLineItems
Inventory, by Component [Roll Up]							gaap:InventoryByComponentRollUp
Finished Goods	600	+	600		Debit		gaap:FinishedGoods
Work in Progress	300	+	300		Debit		gaap:WorkInProgress
Raw Material	100	+	100		Debit		gaap:RawMaterial
Inventory	1,000		1,000	1,000	Debit	Verified	gaap:Inventory

Information about the properties of each report element which makes up the information model description should be accessible to the user of the business report:



Information about the properties of each fact which is represented within the report is accessible to the user of the financial report:



This same information is provided for each and every fact set that makes up a financial report. Facts could be used in multiple fact sets. The facts used in fact sets must be consistent within a fact set and between the individual fact sets that make up a report.

1.9. Advanced Logical Conceptualization

A financial report can be broken down into fragments. A **fragment**[45] is a set of one to many *fact sets* which go together some specific purpose within a report. For example, a balance sheet is a fragment of a financial report that is made up of two fact sets: a roll up of assets and a roll up of liabilities and equity. Fragments can be categorized into Document, Statement, Disclosure, and Schedule.

Each fact set has a concept arrangement pattern property. A **concept arrangement pattern**[46] specifies the nature of the relationship between the concept aspect of an information model definition.

A **set**[47] is a type of concept arrangement pattern where concepts have no mathematical relations. Essentially, a set is a flat list of concepts. A synonym for set is hierarchy.

A **roll up**[48] is a type of concept arrangement pattern which represents a basic roll up type mathematical relationship: Fact A + Fact B + Fact C = Fact D (a set of items and a total).

A **roll forward**[49] is a type of concept arrangement pattern which represents a basic roll forward mathematical relation: Beginning balance (stock) + change1 (flow) + change2 (flow) + change3 (flow) = Ending balance (stock).

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[45] Fragment, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Fragment.html
[46] Concept Arrangement Pattern, http://xbrlsite.azurewebsites.net/2019/Framework/Details/ConceptArrangementPattern.html
[47] Set, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Set.html
[48] Roll Up, http://xbrlsite.azurewebsites.net/2019/Framework/Details/RollUp.html
[49] Roll Forward, http://xbrlsite.azurewebsites.net/2019/Framework/Details/RollForward.html

An **adjustment**[50] is a type of concept arrangement pattern which represents a basic mathematical reconciliation between an originally stated value and a restated value usually due to a correction or error: Originally stated balance + adjustment1 + adjustment2 + adjustment3 = restated balance.

A **variance**[51] is a type of concept arrangement pattern which represents a mathematical difference between two reporting scenarios: Amount (projected scenario) + Amount(variance) = Amount (actual scenario).

A **complex computation**[52] is a type of concept arrangement pattern which represents any arbitrary mathematical relationship between a set of numeric facts. A complex computation is comprised of some flat set of numeric concepts and a rule that represents the mathematical relation between that set of concepts.

A **roll forward info**[53] is a type of concept arrangement pattern which represents a non-mathematical relation of information about a roll forward.

A **text block**[54] is a type of concept arrangement pattern which represents a non-mathematical relationship in the form of prose. A text block concept arrangement pattern is comprised of exactly one concept. There are three sub classes or type of text blocks: **Level 1 Note Text Block**[55], **Level 2 Policy Text Block**[56], and **Level 3 Disclosure Text Block**[57].

Each fact set has a member arrangement pattern property. A **member arrangement pattern**[58] expresses the relations between members within an aspect other than the concept aspect (which is explained by the concept arrangement pattern).

The members of an axis might be related mathematically. **Member aggregation**[59] is a type of member arrangement pattern where the members of an axis roll up the same as the roll up concept arrangement pattern. **Member flat**[60] list is a type of member aggregation pattern where the members for a flat list. **Member nonaggregating**[61] is a type of member arrangement pattern where the members of an axis are not related mathematically but simply are used to differentiate reported facts.

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[50] Adjustment, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Adjustment.html
[51] Variance, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Variance.html
[52] Complex Computation, http://xbrlsite.azurewebsites.net/2019/Framework/Details/ComplexComputation.html
[53] Roll Forward Info, http://xbrlsite.azurewebsites.net/2019/Framework/Details/RollForwardinfo.html
[54] Text Block, http://xbrlsite.azurewebsites.net/2019/Framework/Details/TextBlock.html
[55] Level 1 Note Text Block, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Level1NoteTextBlock.html
[56] Level 2 Policy Text Block, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Level2PolicyTextBlock.html
[57] Level 3 Disclosure Text Block, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Level3DisclosureTextBlock.html
[58] Member Arrangement Pattern, http://xbrlsite.azurewebsites.net/2019/Framework/Details/MemberArrangementPattern.html
[59] Member Aggregation, http://xbrlsite.azurewebsites.net/2019/Framework/Details/MemberAggregation.html
[60] Member Flat List, http://xbrlsite.azurewebsites.net/2019/Framework/Details/MemberFlatList.html
[61] Member Nonaggregating, http://xbrlsite.azurewebsites.net/2019/Framework/Details/MemberNonaggregation.html

Reported facts could need additional arbitrary descriptive information. A **parenthetical explanation**[62] provides additional descriptive information about a fact. A synonym for parenthetical information is comment.

A financial **reporting scheme**[63] is a formal specification for how financial reports are to be created and the underlying accounting rules and is usually created by a standards setter or regulator. For example, US GAAP, IFRS, and IPSAS are all financial reporting schemes. Financial reports are not forms. Financial reporting schemes allow for a certain amount of flexibility and variability when reporting certain specific disclosures or subtotals contained within a disclosure. A **disclosure**[64] is a set of one to many fact sets or a set of one to many fragments which form an accounting disclosure that is either required by statutory or regulatory rules or provided at the discretion of a reporting entity. A **template**[65] is a representation of a possible disclosure that can be used as a prototype in the process of creating a report. An **exemplar**[66] is a representation of a disclosure from an existing report of some economic entity that can be leveraged in the process of creating a report.

Because variability exists in the allowed possible approaches that economic entities represent their financial disclosures, different economic entities have different reporting styles. A **reporting style**[67] is a set of relations, consistency crosscheck rules, mapping rules, and impute rules that are used to check fundamental accounting concept relations for a specific type of report or style of reporting. For example, a classified balance sheet and an order of liquidity balance sheet are two different reporting styles for creating a balance sheet.

A **consistency crosscheck rule**[68] is a type of rule that tests the relations of fundamental accounting concept relations within a report against a specified reporting style to make sure there are no inconsistencies or contradictions between reported facts within a report.

An **impute rule**[69] is a type of rule that explains how to logically derive a fact that have not been explicitly reported based on other facts that have been explicitly reported or which have been logically derived from other reported information. For example, an economic entity might not explicitly report the line item "Noncurrent assets"; but does report "Assets" and "Current assets". Given the impute rule "Assets = Current assets + Noncurrent assets"; the fact value for Noncurrent assets can be reliably derived logically using the other two reported facts and the impute rule.

A **mapping rule**[70] is a type of rule that explains how a base reporting scheme taxonomy concept reported by an economic entity relates to a fundamental

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[62] Parenthetical Explanation, http://xbrlsite.azurewebsites.net/2019/Framework/Details/ParentheticalExplanation.html

[63] Reporting Scheme, TO DO, http://xbrlsite.azurewebsites.net/2018/Library/ReportingSchemes-2018-12-30.pdf

[64] Disclosure, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Disclosure.html

[65] Template, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Template.html

[66] Exemplar, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Exemplar.html

[67] Reporting Style, http://xbrlsite.azurewebsites.net/2019/Framework/Details/ReportingStyle.html

[68] Consistency Crosscheck Rule, http://xbrlsite.azurewebsites.net/2019/Framework/Details/ConsistencyCrosscheckRule.html

[69] Impute Rule, http://xbrlsite.azurewebsites.net/2019/Framework/Details/ImputeTypeRule.html

[70] Mapping Rule, http://xbrlsite.azurewebsites.net/2019/Framework/Details/MappingTypeRule.html

accounting concept. For example, the notion of "Cost of Revenue" could be reported using the concept "Cost of Revenue", or "Cost of Goods and Services Sold", or "Cost of Goods Sold", or "Cost of Services Sold", etc. Basically, mapping rules enable information to be extracted from a report reliably.

A **disclosure mechanics rule**[71] is a type of rule that describes the structural and mechanical representation of a disclosure against a specification or prototype of that disclosure. For example, every disclosure that has the property of concept arrangement pattern of "roll up" must always have a total. A disclosure mechanics rule would specify the concept that would be used to represent that total. A specific disclosure, such as "inventory components roll up" would be required to use a specific concept such as "Inventory, Net" to represent that total. A disclosure mechanics rule would specify that concept. Other concepts might be used as alternatives to some specific total concept to represent a disclosure. A disclosure mechanics rule would specify those alternatives. Every Level 4 Disclosure Detail representation has some complementary Level 3 Disclosure Text Block representation. A disclosure mechanics rule would specify that relation.

A **type or class rule**[72] is a type of rule that expresses an allowed or a disallowed relation between two reporting scheme concepts for some reporting style. For example, the concept "Operating Expense (indirect operating expense)" would never be part of "Cost of Revenue (direct operating expense)", a type or class rule would be used to explicitly disallow this relation. Alternatively, explicitly allowed relations are also expressed using type or class rules.

A **reporting checklist rule**[73] is a type of rule that describes the reportability of a statutory or regulatory disclosure required by a reporting scheme. For example, some disclosures are always required. Other disclosures are required only if a specific line item is reported. Other disclosures could be used as alternatives for some other disclosure.

A **report set**[74] is a set of one to many reports. For example, if you are comparing the reports of an economic entity for the past five years, the five reports that you use to perform that analysis are your report set.

A **reporting entity aspect**[75] is a core aspect that distinguishes the economic entity which creates a report.

A **calendar period aspect**[76] is a core aspect that distinguishes the calendar period of a reported fact. A **stock**[77] is a type of calendar period aspect that is used to represent a fact as of a specific point in time. A synonym for stock is instant. A

[71] Disclosure Mechanics Rule, http://xbrlsite.azurewebsites.net/2019/Framework/Details/DisclosureMechanicsRule.html
[72] Type or Class Rule, http://xbrlsite.azurewebsites.net/2019/Framework/Details/TypeClassRule.html
[73] Reporting Checklist Rule, http://xbrlsite.azurewebsites.net/2019/Framework/Details/ReportingChecklistRule.html
[74] Report Set, http://xbrlsite.azurewebsites.net/2019/Framework/Details/ReportSet.html
[75] Reporting Entity Aspect, http://xbrlsite.azurewebsites.net/2019/Framework/Details/ReportingEntityAspect.html
[76] Calendar Period Aspect, http://xbrlsite.azurewebsites.net/2019/Framework/Details/CalendarPeriodAspect.html
[77] Stock, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Stock.html

flow[78] is a type of calendar period aspect that is used to represent a fact over a period of time. A synonym for stock is duration.

A **concept aspect**[79] is a core aspect that is used to express the concept that relates to a fact. Synonyms for concept aspect include primary item and line item.

A **fragment arrangement pattern**[80] is the relationship between fragments or the order or sequence of fragments within a report.

Prose[81] is a type of fact value that is structure in nature (i.e. a table, an ordered list, an unordered list, paragraphs of text, or any combination of those structures).

Text[82] is a type of fact value that is nonnumeric unstructured text (i.e. not prose).

A **logical rule**[83] is a type of rule expresses logical relations between entities that make up a report.

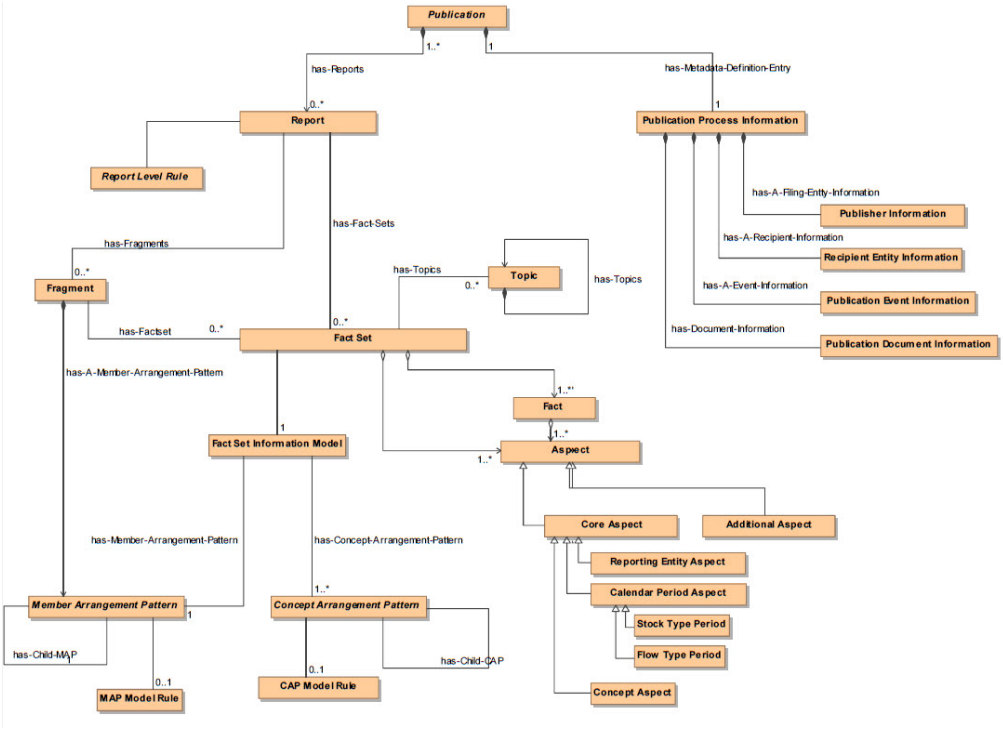
An **accounting rule**[84] is a type of logical rule that is used to express a logical assertion specifically related to accounting rules.

A **mechanical rule**[85] is a type of logical rule that is used to express the relations between the report elements that make up a disclosure.

1.10. Formal technical graphical view of model

The following UML model depicts the model of a report. A financial report is a type of business report. This model is a common standard model that all business reports follow and is documented by OMG via the Standard Business Report Model (SBRM)[86]:

[78] Flow, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Flow.html
[79] Concept Aspect, http://xbrlsite.azurewebsites.net/2019/Framework/Details/ConceptAspect.html
[80] Fragment Arrangement Pattern, http://xbrlsite.azurewebsites.net/2019/Framework/Details/FragmentArrangementPattern.html
[81] Prose, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Prose.html
[82] Text, http://xbrlsite.azurewebsites.net/2019/Framework/Details/Text.html
[83] Logical Rule, http://xbrlsite.azurewebsites.net/2019/Framework/Details/LogicalRule.html
[84] Accounting Rule, http://xbrlsite.azurewebsites.net/2019/Framework/Details/AccountingRule.html
[85] Mechanical Rule, http://xbrlsite.azurewebsites.net/2019/Framework/Details/MechanicalRule.html
[86] OMG, *Standard Business Report Model*, https://omgwiki.org/SBRM/doku.php



1.11. Breaking Down the Pieces of an XBRL-based Digital Financial Report

Do you realize that the average fact set of an XBRL-based digital financial report has 11 facts? This is skewed a little because a little over half of the fact sets are [Text Block]s. The information below is for a set of 6,023 XBRL-based financial reports submitted to the SEC by public companies[87]:

- Total reports: 6,023
- Total facts reported: 8,532,275
- *Average facts per report*: 1,416
- Total networks in all reports: 462,786
- *Average networks per report*: 77
- Total fact sets in all reports: 754,430
- *Average fact sets per report*: 125
- Average fact sets per network: 1.6
- *Average facts per network*: 18
- *Average facts per fact set*: 11

Of the 754,430 fact sets there are:

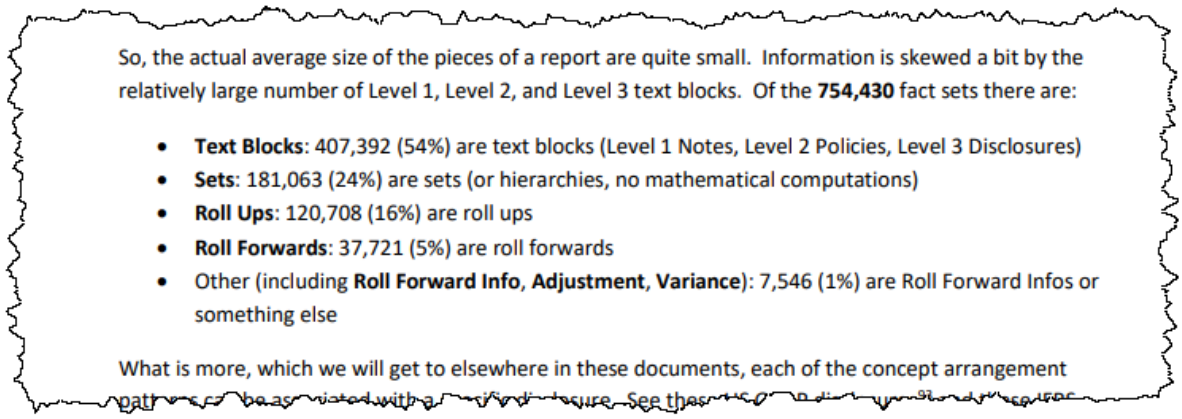
[87] *Breaking Down the Pieces of an XBRL-based Digital Financial Report*, http://xbrl.squarespace.com/journal/2019/4/9/breaking-down-the-pieces-of-an-xbrl-based-digital-financial.html

- Text blocks: 407,392 (54%) are text blocks (Level 1 Notes, Level 2 Policies, Level 3 Disclosures)
- Sets: 181,063 (24%) are sets (or hierarchies, no mathematical computations)
- Roll ups: 120,708 (16%) are roll ups
- Roll forwards: 37,721 (5%) are roll forwards
- Roll forward info: 7,546 (1%) are roll forward infos or something else

Rather than simply working with a report, software can interact with the primitive pieces and the functional or complex pieces of that report with good affect[88].

1.12. Establishing the Financial Report Logical Conceptualization

And so, every XBRL-based financial report submitted to the SEC using US GAAP or IFRS, the ESMA field tests[89], and all my prototypes[90] fit into my one common meta-meta-model. How do I know this? Because I loaded 100% of US GAAP and IFRS XBRL-based reports, ESMA field tests, and all my prototypes into my model[91] to be certain that my model was correct. Here are the results from one of those tests:


So, the actual average size of the pieces of a report are quite small. Information is skewed a bit by the relatively large number of Level 1, Level 2, and Level 3 text blocks. Of the **754,430** fact sets there are:

- **Text Blocks**: 407,392 (54%) are text blocks (Level 1 Notes, Level 2 Policies, Level 3 Disclosures)
- **Sets**: 181,063 (24%) are sets (or hierarchies, no mathematical computations)
- **Roll Ups**: 120,708 (16%) are roll ups
- **Roll Forwards**: 37,721 (5%) are roll forwards
- Other (including **Roll Forward Info**, **Adjustment**, **Variance**): 7,546 (1%) are Roll Forward Infos or something else

What is more, which we will get to elsewhere in these documents, each of the concept arrangement

I then created what I call my PROOF representation which includes every aspect of my model (i.e. the SBRM model) [92].

And so, you should be able to see the connections between the information from the 754,430 fact sets (a.k.a. Blocks) from above and the "Pattern" column in the PROOF representation which is used to TEST the meta-model to see if SBRM provides everything that is necessary below. (Note that "Hierarchy" and "Set" are synonyms). Every fragment of the report is represented in the rows. Every ROW is a STRUCTURE of a report that fits into the overall meta-model. Every COLUMN is a common PROPERTY of the STRUCTURE.

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[88] *Leveraging Functional Components for XBRL-based Digital Financial Reporting*, http://xbrlsite.azurewebsites.net/2019/Library/LeveragingFunctionalComponents.pdf

[89] ESMA Field Tests, http://xbrl.squarespace.com/journal/2018/7/10/esma-field-test-information-great-information-for-testing.html

[90] *Mastering XBRL-based Digital Financial Reporting*, http://xbrlsite.azurewebsites.net/2020/master/

[91] *Understanding Digital*, Page 46, http://xbrlsite.azurewebsites.net/2020/Library/UnderstandingDigital.pdf#page=46

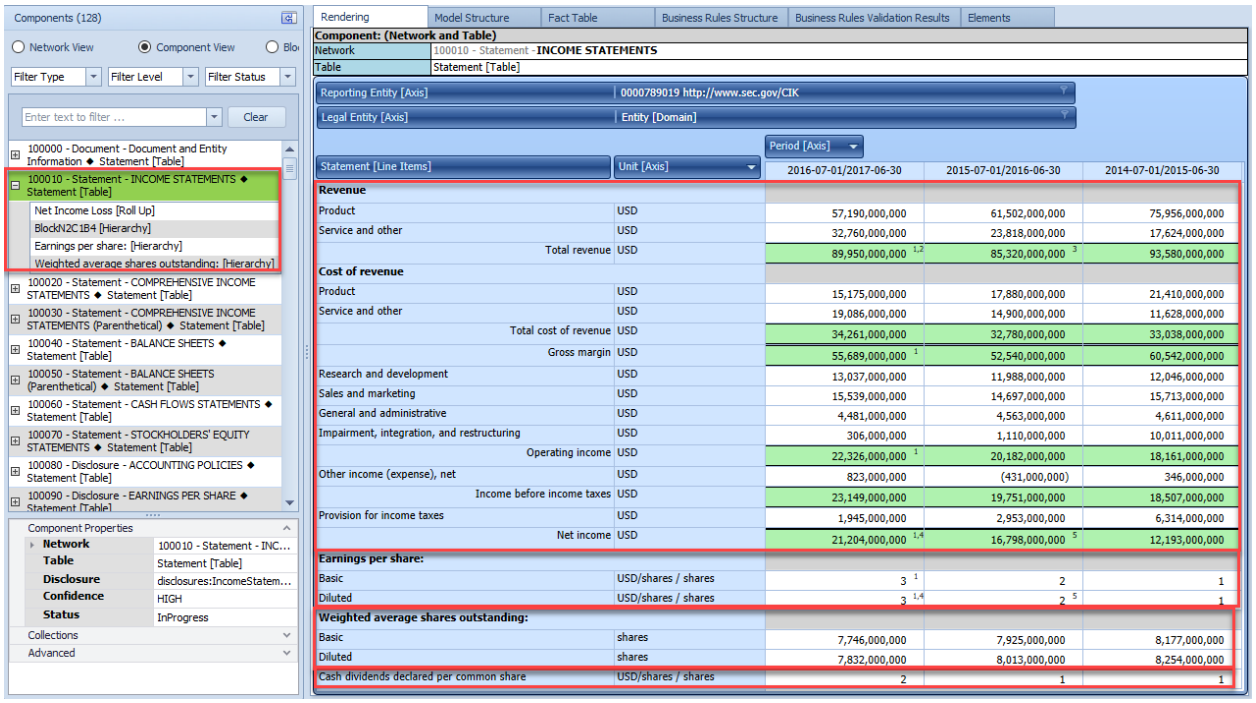
[92] Proof representation, http://xbrlsite.azurewebsites.net/2020/master/proof/index.html

Primary Information

#	Disclosure	Category	Level	Pattern	Disclosure Fo…	Disclosure Co…	Applicable	Representation Concept [TEXT BLOCK]	Representation Concept DETAIL
1	Balance Sheet	Unknown	Level4Detail	Hierarchy	True	CONSISTENT	True	NOT-EXPECTED	Assets
2	Basis of Reporting	Unknown	Level1TextBlock	TextBlock	True	CONSISTENT	True	Basis of Reporting [Text Block]	NOT-EXPECTED
3	Changes in Equity	Unknown	Level4Detail	RollForward	True	CONSISTENT	True	NOT-EXPECTED	Equity
4	Financial Highlights	Unknown	Level4Detail	Hierarchy	True	CONSISTENT	True	NOT-EXPECTED	Revenues
5	Income Statement	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Comprehensive Income
6	Nature of Operations	Unknown	Level1TextBlock	TextBlock	True	CONSISTENT	True	Nature of Operations [Text Block]	NOT-EXPECTED
7	Prior Period Errors	Unknown	Level4Detail	Adjustment	True	CONSISTENT	True	NOT-EXPECTED	Equity
8	Revenue Recognition Policy	Unknown	Level1TextBlock	TextBlock	True	CONSISTENT	True	Revenue Recognition Policy [Text Block]	NOT-EXPECTED
9	Segment Revenues	Unknown	Level4Detail	Hierarchy	True	CONSISTENT	True	NOT-EXPECTED	Revenues
10	Stock Plan Activity	Unknown	Level4Detail	RollForwardInfo	True	CONSISTENT	True	NOT-EXPECTED	Nonvested Fair Value
11	Variance Analysis	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Comprehensive Income

The SET of properties is the META-META MODEL of SBRM which is the SAME for EVERY economic entity that creates a report. This is likewise the SAME for every financial reporting scheme.

ROWs can be combined to create all of the arbitrary fragments of a report that are used to represent the complete report. For example, the Microsoft 10-K contains an income statement fragment[93]. That income statement fragment has FOUR structures:



Each **structure** is described in machine-readable terms using XBRL presentation, XBRL calculation, XBRL definition, and XBRL formula relations and resources. Structures can be examined using features implemented in software applications including a "Rendering" view which is human readable, a "Model Structure" which explains the model, a "Fact Table" which is a raw set of the facts included in the structure, "Business Rules Structure" which defines the mathematical rules, "Elements" which is a list of the elements include in the model structure.

[93] Microsoft Income Statement fragment, http://xbrlsite.azurewebsites.net/2017/Prototypes/Microsoft2017/evidence-package/#Rendering-StatementINCOMESTATEMENTS-us_gaap_StatementTable.html

1.13. Overview of key terminology of a digital financial report

The following terminology sets a foundation for discussing these principles. These terms explain the framework within which all work to create or review a digital financial report[94] is performed. This terminology was first introduced by the *Financial Report Semantics and Dynamics Theory*[95] which derived these terms. This terminology is intended to have very precise definitions in order to enable precise communication. These terms and the SBRM terms mean exactly the same thing. A few additional terms are added to achieve additional goals. The following is a brief summary of these important terms:

- **Report**: Report which communicates financial and nonfinancial information about an economic or accounting entity to users of that report. Financial reports contain facts, characteristics which describe those facts, parenthetical explanations of facts, relations between facts.
- **Fragment**: A fragment is a set of one or more fact sets. For example, a "balance sheet" is a fragment that is made up of two fact sets, an assets roll up and a liabilities and equity roll up.
- **Fact set**: A fact set (a.k.a. block or fact table) is a set of facts which go together (tend to be cohesive and share a certain common nature) for some specific purpose within a financial report. For example, an "income statement" is a fact set. The "Maturities of long-term debt" disclosure is a fact set.
- **Fact**: A fact is reported. A fact defines a single, observable, reportable piece of information contained within a financial report, or fact value, contextualized for unambiguous interpretation or analysis by one or more distinguishing characteristics. A fact value is one property of a fact; every fact has exactly one fact value. The set of characteristics of a fact is a property of the fact. For example, *Cash and cash equivalents* of 100,000 for the *consolidated entity* for the current balance sheet date of *December 31, 2014* which is *reported in US Dollars* is a fact.
- **Characteristic**: A characteristic (a.k.a. aspect) describes a fact. A characteristic or distinguishing aspect provides information necessary to describe a fact or distinguish one fact from another fact. A fact may have one or many distinguishing characteristics. For example, line item concept *Cash and cash equivalents* is a characteristic and the calendar period *December 31, 2014* are characteristics which describe a fact.
- **Parenthetical explanation**: Facts may have parenthetical explanations which provide additional descriptive information about the fact.
- **Rule**: A rule[96] is used to guide, control, suggest, or influence behavior. Rules cause things to happen, prevent things from happening, or suggest that it might be a good idea if something did or did not happen. Rules help shape

[94] *Digital financial reporting harnesses computers for speed, accuracy*, http://searchfinancialapplications.techtarget.com/opinion/Digital-financial-reporting-harnesses-computers-for-speed-accuracy

[95] See *Financial Report Semantics and Dynamics Theory*: http://xbrl.squarespace.com/fin-report-sem-dyn-theory/

[96] Charles Hoffman, CPA and Rene van Egmond, *Comprehensive Introduction to Business Rules*, http://xbrlsite.azurewebsites.net/2017/IntelligentDigitalFinancialReporting/Part01_Chapter02.4_ComprehensiveIntroductionToBusinessRules.pdf

judgment, help make decisions, help evaluate, help shape behavior, and help reach conclusions.

- **Relation**: A relation[97] is some interaction between the pieces which make up a financial report. Report components can be related to other report components. Reported facts can be related to other reported facts. Characteristics can be related to other characteristics. Business rules are a type of relation which describes computation type and logic-based relations. Classes or sets of concepts are relations.
- **Property**: A property is a trait, quality, feature, attribute, or peculiarity which is used to define its possessor and is therefore dependent on the possessor. A property belongs to something. For example, the color of a ball belongs to and is therefore is dependent on (is a property of) the ball. Financial reports have a set of properties. Fragments have a set of properties. Fact sets have a set of properties. Facts have a set of properties. Characteristics have a set of properties. Parenthetical explanations have a set of properties. Relations have a set of properties.
- **Block**: A block[98] is a part of a fact set that participates in the same concept arrangement pattern. For now, simply think about a block as a useful fragment of a financial report. A block and a fact set are the same thing.
- **Slot**: A slot is simply the idea of an allotted place where something can be logically and sensibly placed in a fragment of a financial report, or block, or fact set.
- **Disclosure**: A disclosure is simply a set of facts that is disclosed, a fact set.
- **Topic**: A topic is simply a set of disclosures that are grouped together for some specific reason.
- **Exemplar**: An exemplar is an example of a disclosure from some other existing financial report.
- **Template**: A template is a starting point or sample used to create a complete disclosure.
- **Information model definition**: An information model definition (a.k.a. report definition) is the definition of the fragments, fact sets, aspects, aspect arrangement patterns, rules, disclosures, reporting style, that define the structure of a report.
- **Report set**: A report set is simply a set of one or many reports that are being used together to, for example, create an entity comparison or period comparison of reports.
- **Reporting scheme**: A reporting scheme[99] is the financial reporting scheme used to create the information model definition.

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[97] *A Taxonomy of Part-Whole Relations*: http://csjarchive.cogsci.rpi.edu/1987v11/i04/p0417p0444/MAIN.PDF

[98] *Understanding Blocks, Slots, Templates and Exemplars*, http://xbrl.squarespace.com/journal/2015/5/11/understanding-blocks-slots-templates-and-exemplars.html

[99] *High level comparison of reporting schemes*, http://xbrlsite.azurewebsites.net/2018/Library/ReportingSchemes-2018-12-30.pdf

- **Reporting style**: A reporting style[100] describes the arrangement of high-level fundamental accounting concepts that are used to represent the balance sheet, income statement, statement of comprehensive income, and cash flow statement of a report.

1.14. Implementation model

Different software applications may choose to refer to things using different terms. Different XBRL taxonomies may refer to the same thing using different terms. For example, while the XBRL technical syntax uses the term "hypercube", the US GAAP XBRL Taxonomy uses the term "[Table]" to refer to the same construct. Similarly, XBRL uses the term "dimension" and the US GAAP XBRL Taxonomy uses the term "[Axis]".

1.14.1. Profiles

Differences in the implementation details of XBRL-based reporting are captured using the notion of a **profile**[101]. A profile, or application profile, is simply an approach to managing implementation details.

1.14.2. Report element categories

Further, different syntaxes use different terms. All this can get very confusing. Rather than trying to explain the reasoning and whims which cause these inconsistent terms; just learn these terms because you will see them within digital financial reports:

- **Network**: A Network is a technical artifact that really has no meaning by itself because those creating XBRL-based digital financial reports use networks in different ways. Sometimes networks are called groups.
- **Table**: A Table is the same thing that XBRL calls a hypercube. A Table or hypercube simply groups some set of Axes, Members, Line Items, Abstracts, and Concepts together. Again, because Table's are used inconsistently, they really have no meaning by themselves.
- **Axis**: An Axis is one approach to representing a Characteristic. Entity and period core aspects[102] are also in essence axes. An Axis is the same thing that XBRL calls a dimension or the SBRM model calls an Aspect.
- **Member**: A Member is a value of a Characteristic.
- **Line Items**: A Line Items is a type of dimension or Axis. Line Items is the same thing XBRL calls primary items.
- **Abstract**: An Abstract is simply used to organize, they provide no real meaning.

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[100] Charles Hoffman, CPA and Rene van Egmond, *Understanding Fundamental Accounting Concepts and Reporting Styles*, http://xbrlsite.azurewebsites.net/2017/IntelligentDigitalFinancialReporting/Part02_Chapter05.6_UnderstandingFundamentalAccountingConceptRelationsAndReportingStyles.pdf

[101] *XBRL-based Digital Financial Reporting Profiles and General Business Reporting Profile*, http://xbrlsite.azurewebsites.net/2018/Library/Profiles-2018-10-22.pdf

[102] XBRL International, *Open Information Model 1.0*, http://www.xbrl.org/Specification/oim/CR-2017-05-02/oim-CR-2017-05-02.html

- **Concept**: A Concept is a type of Member. A Concept is special in that it can be used to represent a Fact Value. Therefore, Concepts have data types.

1.14.3. Relations between report element categories

The implementation model constructs can be related in very specific ways. The following table shows the allowed relationships between the different categories of report elements:

		Parent						
		Network	Table	Axis	Member	LineItems	Abstract	Concept
Child	Network	Illegal XBRL	Illegal XBRL	Illegal XBRL	Illegal XBRL	Illegal XBRL	Illegal XBRL	Illegal XBRL
	Table	OK	Disallowed	Disallowed	Disallowed	Disallowed	OK	Disallowed
	Axis	Disallowed	OK	Disallowed	Disallowed	Disallowed	Disallowed	Disallowed
	Member	Disallowed	Disallowed	OK	OK	Disallowed	Disallowed	Disallowed
	LineItems	Disallowed	OK	Disallowed	Disallowed	Disallowed	Disallowed	Disallowed
	Abstract	OK	Disallowed	Disallowed	Disallowed	OK	OK	OK
	Concept	Disallowed	Disallowed	Disallowed	Disallowed	OK	OK	Not advised

1.14.4. Constructing fact sets using XBRL

If you want to understand the details of how fact sets are implemented in the XBRL technical syntax, you can read this section. If not, please skip this section. This section assumes that you have read the basic *XBRL Technical Primer*[103].

In XBRL, an information model description is created by creating Networks, putting Tables (hypercubes) in Networks, and then putting other report elements within Tables.

If you do not explicitly define a Table within a Network you basically have an implied Table. Facts are never free-floating in space, they always exist within a Network; and at least one Table always exists whether that Table is explicitly defined or implied.

And so, Networks and Tables (explicitly defined or implied) are used to represent the information model description of a report. Sometimes you MUST separate things using Networks to avoid conflicts; other times you get too choose whether to separate things using Networks. Tables work the same way; sometimes you MUST use them to separate fact sets and other times you get to choose.

A representation of information can have four possible states or features:

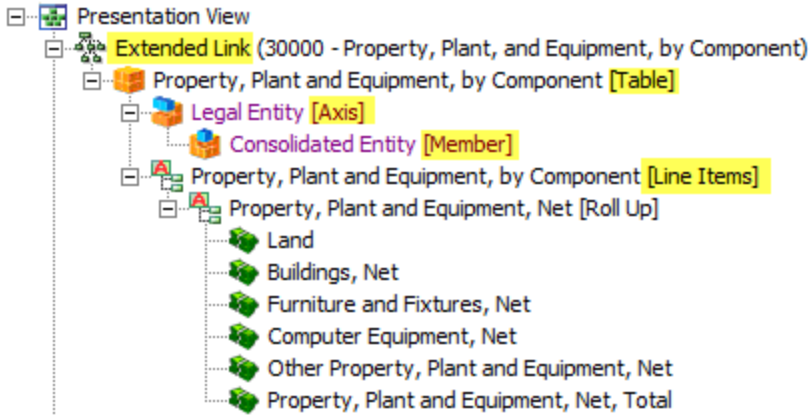
1. An information representation can be ***logically represented*** and ***easy to comprehend***.
2. An information representation can be ***logically represented*** and ***hard to comprehend***.
3. An information representation can be ***illogically represented*** and ***easy to comprehend (but illogical)***.
4. An information representation can be ***illogically represented*** and ***hard to comprehend (but illogical)***.

[103] Charles Hoffman, CPA and Rene van Egmond, XBRL Technical Primer, http://xbrlsite.azurewebsites.net/2017/IntelligentDigitalFinancialReporting/Part00_Chapter01.2_XBRLPrimer.pdf

States #3 and #4 are incorrect by definition. Information that is defined illogically is simply wrong. State #2 is not incorrect, but neither is it a best practice. State #1 is the only best practice, information that is logically represented and as easy to read as possible.

A best practice is a method or technique that has been generally accepted as superior to any other known alternatives because it produces results that are superior to those achieved by other means or because it has become a standard way of doing things. This chapter focuses on best practices.

In XBRL whether you use an explicitly defined Table or an implied Table, the representation of information follows exactly the same pattern as is shown below.



The following rules apply to the representation if the information model definition of a report and you have no power to change those rules what-so-ever:

1. XBRL technical syntax rules determine the relation between concepts represented within XBRL calculation relations.
2. XBRL technical syntax rules determine the relation between all report elements represented within XBRL definition relations.
3. XBRL technical syntax rules determine the relations between reporting entity information (a core aspect); there is no mechanism to represent such relations, so the relation is always a flat list of relations.
4. XBRL technical syntax rules determine the relations between period information (a core aspect); there is no mechanism to represent such relations, so the relations is always a flat list of relations.
5. Model structure rules (see section *Relations between report element categories* above) define the allowed relations between the categories of report elements in the XBRL presentation relations. XBRL does not define these relations rules.
6. If all of the above are true; then the only relations that you can determine when representing the information model definition of a report are:
    a. The relations between the Members of an Axis (i.e. Member Arrangement Patterns)
    b. The relations between the Concepts within a set of [Line Items] (i.e. Concept Arrangement Pattern)

Because rules #1 through #4 are enforced by the XBRL technical syntax all those rules are true by definition. Run #5 is a choice to some degree. Software users cannot represent illogical relations; but they can represent things in dumb ways. These dumb approaches are certainly not best practices and they tend to be inconsistent with the way the vast majority of XBRL-based financial reports are created.

The point here is the following: representing the information model definition of a report comes down to:

1. The order of the Concepts within a set of Line Items.
2. The order of the Members within an Axis.
3. The order of the report Fragments.

And so, understanding concept arrangement patterns, member arrangement patterns, and the flow of report fragments is necessary to create properly represented XBR-based reports[104].

1.14.5. Relations between concepts or concept arrangement patterns

Within a set of [Line Items], concepts are related to other concepts in specific ways. Concepts can be related to one another numerically. Concepts can be related logically. Concepts can be related mechanically. The following is a summary of concept arrangement patterns:

- **Roll up**: Fact A + Fact B + Fact C = Fact D (a total)
- **Roll forward**: Beginning balance + changes = Ending balance
- **Adjustment**: Originally stated balance + adjustments = restated balance
- **Variance**: Actual amount – Budgeted amount = variance
- **Complex computation**: Net income / Weighted average shares = earnings per share
- **Set** or **Hierarchy**: Facts are related in some way, but not numerically. (Note that the term hierarchy is an older term that is going to be phased out; the term set is preferred.)
- **Text Block**: A Text Block is prose that is worked with as one unit. Essentially a text block is a term used to refer to information that is represented as escaped XHTML.

Subsequent sections provide a more detailed explanation of concept arrangement patterns and examples of such patterns.

1.14.6. Relations between members or member arrangement patterns

Within an [Axis], the [Member]s of that [Axis] are arranged in specific ways which is called the Member Arrangement Pattern. Member Arrangement Patterns fall into two broad groups:

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[104] Charles Hoffman, CPA and Rene van Egmond, *Understanding Concept Arrangement Patterns, Member Arrangement Patterns, and Report Fragment Arrangement Patterns*, http://xbrlsite.azurewebsites.net/2017/IntelligentDigitalFinancialReporting/Part02_Chapter05.7_UnderstandingConceptArrangementPatternsMemberArrangementPatterns.pdf

- **Member Aggregation**: something composed exactly of their parts of some whole and nothing else; the sum of the parts is equal to the whole. Essentially, a Member Aggregation relation is a "whole-part" relation and is equivalent to a [Roll Up] Concept Arrangement Pattern.
- **Member Non-aggregation**: descriptive and differentiates one type or class of thing from some different type or class of thing; but the things do not add up to a whole. Essentially, a Member non-aggregation relation is an "is-a" type relation and is equivalent to a [Set] Concept Arrangement Pattern.

Note that XBRL does a poor job of providing information about the relationships between members that are other than a flat set of members. Complex hierarchies of members should be avoided.

Subsequent sections provide a more detailed explanation of member arrangement patterns and examples of such patterns.

1.14.7. Relations between report fragments or fragment arrangement patterns

A financial report has a flow, or an ordering or sequencing of the report fragments which make up the financial report. Financial report creators have flexibility as to this flow, for example an income statement could come before or after a balance sheet. These relations are called Fragment Arrangement Patterns.

- **Fragment**: Any specific part of a digital financial report.
- **Component**: Defined as a Network plus a Table
- **Block**: As stated previously, a block or fact set is a set of [Line Items] that have the same *Concept Arrangement Pattern* and same *Member Arrangement Pattern*.
- **Information model**: The Member Arrangement Pattern and Concept Arrangement Pattern of a Block.

1.14.8. Mechanical, structural, mathematical, consistency, type/class and logical relations

In addition to the relations that have been discussed thus far, other types of mechanical, structural, mathematical, consistency, type/class, and other logical relations can exist. For example:

- A specified report element could be required to be reported.
- A specified fact set could be required to be reported.
- Some set of facts must always be consistent and not contradict or be inconsistent with each other no matter what fact set the facts are reported within.
- A fact must always be a part of some other fact which is a whole and must never be reported as a part of that whole.
- A fact set representing some disclosure must always be reported as a roll forward (i.e. a roll up is not the proper information representation).

All of these sorts of relationships can be described in machine readable form and then leveraged by a software creation in the process of creating or using a digital financial report.

1.15. Understanding the utility of a block and a slot

Think of a financial report not as one big thing, but rather as thousands of much smaller pieces[105]. Reports can be broken down into pieces or fragments. Fragments can be further broken down into fact sets. A fact set is simply a set of reported facts that tend to be cohesive and share a certain common nature and therefore go together.

A **component** maps to an XBRL network plus one XBRL hypercube or [Table] (as called by the US GAAP XBRL Taxonomy). If a network contains two hypercubes, then the there are two components.

The term component was just made up in order to describe and discuss the notion of some specific Table within some specific Network. Some other term would work as well. By giving each different type of relation a name, the pieces can be referred to. The different types of pieces are related to other types of pieces in clear, consistent, logically coherent, and unambiguous ways[106].

Another term that I made up is the term "Block". As it turns out, the term Block and the term Fact Set are equivalent.

Imagine the lowest common fragment level that is used to work with some set of information reported in a digital financial report. I call that structure a "block"[107].

A **block** or fact set is a part of a fragment or component that participates in the same *concept arrangement pattern*[108]. By definition, all the concepts participate in the same Member Arrangement Pattern of a component (Network + Table). A roll up, roll forward, adjustment, and set (hierarchy) are all types of concept arrangement patterns. Every XBRL-based public company financial report is essentially a set of blocks. I estimate that there are about 754,430 blocks in the set of public company reports that I analyzed. 16% are roll ups, 5% are roll forwards, 24% are sets (hierarchies), and 54% are text blocks[109]. I know this because I measured the reports that I analyzed to figure out that blocks exist.

An **information model** is the combined *concept arrangement pattern* and *member arrangement pattern* of a block.

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[105] See Analysis of 6,751 XBRL-based Public Company 10-Ks Submitted to SEC, http://www.xbrlsite.com/DigitalFinancialReporting/Book2015/DigitalFinancialReporting-2015-04-29-C28.pdf

[106] See *Understanding Basic Mechanics of a Digital Financial Report*, http://www.xbrlsite.com/DigitalFinancialReporting/Book2015/DigitalFinancialReporting-2015-04-29-C05.pdf

[107] See Section 5.7 Notion of Block, http://www.xbrlsite.com/DigitalFinancialReporting/Book2015/DigitalFinancialReporting-2015-04-29-C05.pdf#page=5

[108] See page 11, http://www.xbrlsite.com/2015/Analysis/AnalysisSummary2014_PiecesOfReoprt.pdf#page=11

[109] I have a document that summarizes this information.

Blocks have something called a "slot"[110]. A **slot** is simply the idea of an allotted place where something can be logically and sensibly placed in a block. For example, a roll up has exactly *one* total and so *two* totals could never logically be added to a roll up.

Blocks and slots are in no way random. Blocks are used to represent information that is disclosed in a financial report in consistent ways, patterns. Balance sheets and the other primary financial statements are made up of blocks, long-term debt maturities disclosure and other disclosures are made up of blocks. Every fragment of a financial report is a set of one or many blocks. As I pointed out, blocks have very specific concept arrangement patterns: roll up, roll forward, text block, adjustment, hierarchy (set). Blocks are related to other blocks in very specific ways.

1.15.1. Basic block

Here is an example of a block that represents a roll up (the concept arrangement pattern) which has no [Axis] and therefore the most basic member arrangement pattern:

Property, Plant and Equipment, by Component [Line Items]	Period [Axis]	
	2010-12-31	2009-12-31
Property, Plant and Equipment, by Component [Roll Up]		
Land	1,000,000	1,000,000
Machinery and equipment, gross	2,000,000	2,000,000
Furniture and fixtures, gross	6,000,000	6,000,000
Accumulated depreciation	(1,000,000)	(1,000,000)
Property, plant and equipment, net	8,000,000	8,000,000

You cannot add a second total to a roll up as a roll up has only one total. It would not make logical sense to add a second total to a roll up. Therefore, adding second totals to a roll up should be disallowed within a software application.

It does make sense to add another concept to the set of line items which aggregate to the total. It also does make sense to add an entirely new period characteristic. A slot is simply a logical location where something can be added to a block. Exactly where slots exist in a block depends on the *concept arrangement pattern* and *member arrangement pattern* of the block. Every block in every report fragment or component works in exactly this same way.

If you are a professional accountant you innately understand how information is related in a set of information such as what is represented in the example shown above. And there are many, many other such report fragments within a financial report. But professional accountants don't call these pieces of information "blocks"

[110] See section 5.5. Understanding the notion of slot or opening, http://www.xbrlsite.com/DigitalFinancialReporting/Book2015/DigitalFinancialReporting-2015-04-29-C05.pdf#page=3

because they never needed to explain the mechanics and dynamics that are at work to a computer before. But to represent a financial report digitally and to interact with software applications that provide these digital representations of a financial report describing these mechanics and dynamics is necessary.

1.15.2. Slightly more complex block

Below is a slightly more complex block. The block below is made up of two roll ups and has a whole-part relation which semantically is really similar to a roll up. Professional accountants understand that the disclosure below both "foots" and "cross casts". However, the software vendor creating this application does not provide the single underscores and double underscores that explicitly show the mathematical relations. I have added green arrows to show the mathematical relations and green check marks to show that all the information does in fact foot and cross cast as expected:

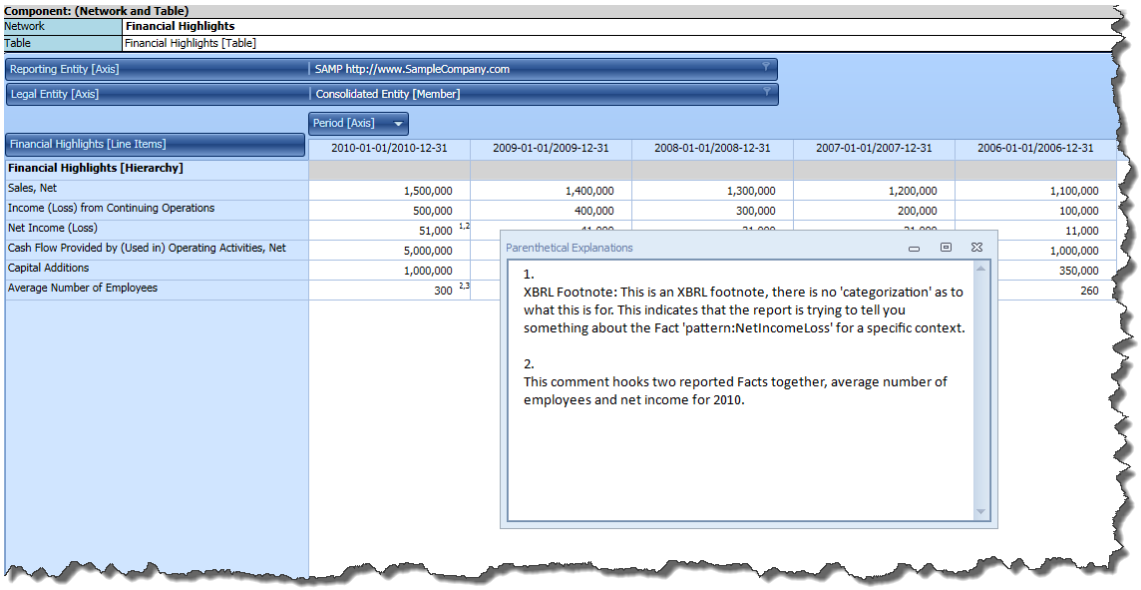
	0000000001			
	31-Dec-2011			
	All Available-for-Sale Debt and Equity Securities [Domain]	Treasury bills [Member]	Corporate bonds [Member]	Sovereign debt securities [Member]
Available-for-sale Securities, Contractual Maturities [Table]				
Available-for-sale Securities, Contractual Maturities [Line Items]				
Available-for-sale securities at amortized cost [Roll Up]				
Due in one year or less	$300,000,000	$100,000,000	$100,000,000	$100,000,000
Due after one year through five years	$300,000,000	$100,000,000	$100,000,000	$100,000,000
Due after five years through ten years	$300,000,000	$100,000,000	$100,000,000	$100,000,000
Due after ten years	$300,000,000	$100,000,000	$100,000,000	$100,000,000
No contractual maturity dates	$300,000,000	$100,000,000	$100,000,000	$100,000,000
Available-for-sale securities at amortized cost	$1,500,000,000	$500,000,000	$500,000,000	$500,000,000
Available-for-sale securities at estimated fair value [Roll Up]				
Due in one year or less	$300,000,000	$100,000,000	$100,000,000	$100,000,000
Due after one year through five years	$300,000,000	$100,000,000	$100,000,000	$100,000,000
Due after five years through ten years	$300,000,000	$100,000,000	$100,000,000	$100,000,000
Due after ten years	$300,000,000	$100,000,000	$100,000,000	$100,000,000
No contractual maturity dates	$300,000,000	$100,000,000	$100,000,000	$100,000,000
Available-for-sale securities at estimated fair value	$1,500,000,000	$500,000,000	$500,000,000	$500,000,000

The fragment above has two blocks. Each block has a roll up concept arrangement pattern. Each block shares the same member arrangement pattern which happens to be a whole-part relation. Logically, the whole-part member arrangement pattern relation is identical to the roll up concept arrangement pattern. It still makes sense to add concepts to the roll up. It still makes sense to add a new period. It also makes sense to add an additional [Member] to the [Axis]. (NOTE that this software does not show the name of the [Axis] "Period" or the other [Axis] which contains the [Member]s shown above.)

Imagine articulating all the things that are going on unconsciously in the mind of a professional accountant to a machine such as a computer in a manner that is explicitly understandable to the computer. That is why we are providing explicit names such as "block" and "slot" and "concept arrangement pattern" and "member arrangement pattern".

1.16. Understanding the notion of a parenthetical explanation

A parenthetical explanation is a comment that can be attached to any fact. A parenthetical explanation provides additional descriptive information for a fact. Below you see the line item "Net Income (Loss)" which has two parenthetical explanations.



1.17. Understand specific error risks and automated versus manual risk mitigation verification tasks

While the previous section discusses general risks that things are incorrect, incomplete, inaccurate, or don't fit together properly; this section points out specifics. Below is a summary of specific things that can go wrong, whether the fact that it is wrong can be detected using automated processes or whether manual processes must be used, and measurements from 2015, 2014, 2013, and 2012 where measurements are available: (automated tests only)

#	Goal or Desired State of Digital Financial Report	Automatable	Manual	FY 2015	FY 2014	FY 2013	FY 2012
1	**XBRL syntax**: XBRL technical syntax consistent with XBRL technical specification requirements	X		99.9%	99.9%	99.9%	99.9%
2	**EFM**: Consistent with requirements of EDGAR Filer automated and manual (EFM) syntax/semantics rules	X	X	Unknown	81.9%	Unknown	80.5%
3	**Model structure**: Consistent and unambiguous report level representation or model structure	X		99.9%	99.9%	99.9%	97.9%
4	**Root economic entity discovery**: Root entity of focus (economic entity, accounting entity) successfully and unambiguously detectable	X		99.7%	99.5%	99.2%	98.8%

5	**Key dates**: Current balance sheet date (document period end date) and income statement period (period context of document period end date) successfully and unambiguously detected	X		99.5%	99.3%	98.6%	Unknown
6	**FAC relations**: Fundamental accounting concept skeleton successfully and unambiguously detected and relations between concepts consistent	X		98.8%	98.7%	97.8%	97.9%
7	**Statement roll ups**: Primary financial statement roll up computations (balance sheet, income statement, statement of comprehensive income, cash flow statement) detected, intact, and foot	X		97.3%	92.0%	90.1%	84.9%
8	**Statement discovery**: Primary financial statements successfully discovered	X	X	97.3%	88.7%	87.8%	Generally successful
9	**Statement computations**: Primary financial statements foot and roll forward (cash flow statement, statement of changes in equity) appropriately	X		Unknown	92.0%	90.5%	84.9%
10	**Level 1 notes**: Level 1 footnote disclosures appropriate	X	X	Unknown	Unknown	Unknown	Unknown
11	**Industry specific**: Industry specific accounting concepts and relations valid	X	X	Unknown	Unknown	Unknown	Unknown
12	**Level 2 policies**: Level 2 policy text block disclosures appropriate		X	Fair	Fair	Fair	Unknown
13	**Level 3 Text Block disclosures**: Each Level 3 [Text Block] and related Level 4 detail disclosure match appropriately	X	X	Poor	Poor	Poor	Poor
14	**Level 4 detailed disclosures**: Each Level 4 detail disclosure valid including representation structure, mathematical computations, intersections with other components, etc.	X	X	Unknown	Unknown	Unknown	Unknown
15	**Required disclosures**: Required disclosures discovered	X		Unknown	Unknown	Unknown	Unknown
16	**Consistency with prior period**: Reported prior period information consistent with prior report current period information where appropriate	X	X	Unknown	Unknown	Unknown	Unknown
17	**Consistency of disclosures**: Disclosure rules have been met and make sense	X	X	Unknown	Unknown	Unknown	Unknown
18	**Concept selection appropriateness**: Report element selection is justifiable, defensible, and otherwise appropriate		X	Unknown	Unknown	Unknown	Unknown
19	**Reported facts full/false inclusion**: Reported facts appropriate		X	Unknown	Unknown	Unknown	Unknown
20	**Consistency of facts with peers**: Variance analysis of reported facts as compared to peer or peer group appropriately explainable	X	X	Unknown	Unknown	Unknown	Unknown
21	**Concept selection consistent with peers**: Report element selection is consistent with peers or peer groups as appropriate		X	Unknown	Unknown	Unknown	Unknown
22	**Disclosure full/false inclusion**: Disclosure checklist review for full inclusion		X	Unknown	Unknown	Unknown	Unknown
23	**True and fair representation**: True and fair representation of financial information of economic entity		X	Unknown	Unknown	Unknown	Unknown

This list is not fully inclusive, but there is nothing on the list that can be excluded from a process of verifying that a digital financial report is correct.

1.18. Example verification dashboard framework

The document *Blueprint for Creating Zero-Defect XBRL-based Digital Financial Reports*[111] provides additional information related to the validation described above and describes the notion of a defect-free XBRL-based digital financial report.

The following is a summary of example dashboards which can be helpful in understanding if an XBRL-based digital financial report is created appropriately.

1.18.1. Verify report

The following is a summary dashboard to verify one report:

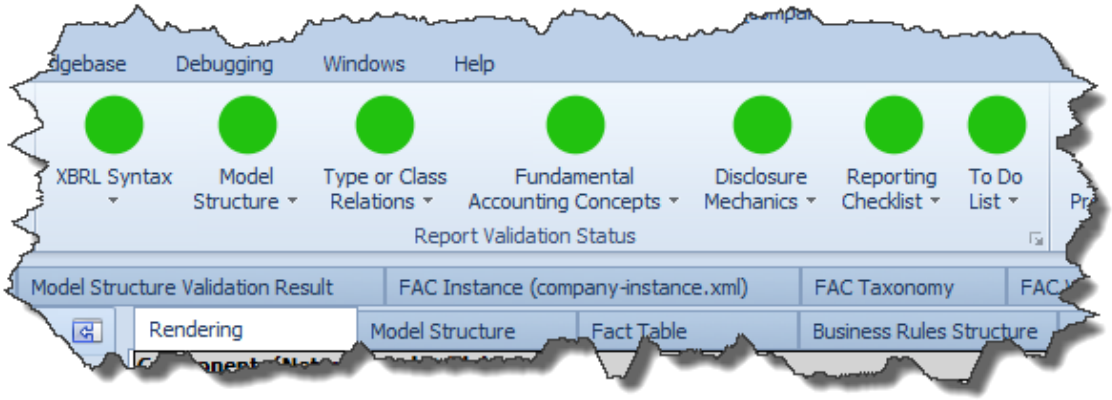
Signals

#	Category	Signal	Severity	Failures	Filings	Pass %	Fail %
1	SCI	usfac:IS9	REVIEW	1	1	0.00%	100.00%

Validations

#	CIK	Accession	Entity Registrant Name	Creation Software	Document Type	Fiscal Year	Fiscal Period	BS	IS	SCI	CF	x-Ambiguous Entity or Period	x-Missing BS, IS, CF Roll Ups	z-Other
1	0000104207	0000104207-13-000141	Walgreen Co	Accelus	10-Q	2013	Q1	0	0	1	0	0	0	0

Here is another dashboard for providing summary information about the consistency of an XBRL-based report to business rules used to verify the quality of that report:



The dashboard summarizes detailed information so professional accountants can quickly determine whether errors exist in XBRL-based digital financial reports where automated processes can be used. Below is an example of one section of the detailed report that feeds the summary dashboard:

[111] *Blueprint for Creating Zero-Defect XBRL-based Digital Financial Reports*, http://xbrlsite.azurewebsites.net/2017/Library/BlueprintForZeroDefectDigitalFinancialReports.pdf

Income Statement [Line Items]	Period [Axis]: 2015-01-01 - 2015-12-31 — Fact: Value	Origin
Net Income (Loss) [Roll Up]		
Income (Loss) from Continuing Operations After Tax [Roll Up]		
Income (Loss) from Continuing Operations Before Tax [Roll Up]		
Interest Income (Expense), After Provision for Losses [Roll Up]		
Interest Income (Expense), Net [Roll Up]		
Interest and Dividend Income, Operating	40,945,000	fac:InterestAndDividendIncomeOperating[us-gaap:InterestAndDividendIncomeOperating[40,945,000]]
Interest Expense, Operating	4,636,000	fac:InterestExpenseOperating[us-gaap:InterestExpense[4,636,000]]
Interest Income (Expense), Operating, Net	36,309,000	fac:InterestIncomeExpenseOperatingNet[us-gaap:InterestIncomeExpenseNet[36,309,000]]
Provision for Loan, Lease, and Other Losses	1,100,000	fac:ProvisionForLoanLeaseAndOtherLosses[us-gaap:ProvisionForLoanAndLeaseLosses[1,100,000]]
Interest Income (Expense) After Provision for Losses	35,209,000	fac:InterestIncomeExpenseAfterProvisionForLosses[us-gaap:InterestIncomeExpenseAfterProvisionForLoanLoss[35,209,000]]
Noninterest Income	7,272,000	fac:NoninterestIncome[us-gaap:NoninterestIncome[7,272,000]]
Noninterest Expense	29,755,000	fac:NoninterestExpense[us-gaap:NoninterestExpense[29,755,000]]
Income (Loss) from Continuing Operations Before Tax	12,726,000	fac:IncomeLossFromContinuingOperationsBeforeTax[us-gaap:IncomeLossFromContinuingOperationsBeforeIncomeTaxesMinorityInterestAndIncomeLossFromEquityMethodInvestments[12,726,000]]
Income Tax Expense (Benefit)	4,062,000	fac:IncomeTaxExpenseBenefit[us-gaap:IncomeTaxExpenseBenefit[4,062,000]]
Income (Loss) from Continuing Operations After Tax	8,664,000	fac:IncomeLossFromContinuingOperationsAfterTax[8,664,000] = fac:IncomeLossFromContinuingOperationsBeforeTax[us-gaap:IncomeLossFromContinuingOperationsBeforeIncomeTaxesMinorityInterestAndIncomeLossFromEquityMethodInvestments[12,726,000]] - fac:IncomeTaxExpenseBenefit[us-gaap:IncomeTaxExpenseBenefit[4,062,000]]
Income (Loss) from Discontinued Operations, Net of Tax	0	fac:IncomeLossFromDiscontinuedOperationsNetOfTax[0] = 0
Extraordinary Items of Income (Expense), Net of Tax	0	fac:ExtraordinaryItemsOfIncomeExpenseNetOfTax[0] = 0
Net Income (Loss)	8,664,000	fac:NetIncomeLoss[8,664,000] = fac:IncomeLossFromContinuingOperationsAfterTax[8,664,000] + fac:IncomeLossFromDiscontinuedOperationsNetOfTax[0] + fac:ExtraordinaryItemsOfIncomeExpenseNetOfTax[0]

1.18.2. Compare across reports

The following is a summary dashboard to verify across reports to determine if all reports are created correctly:

CIK	Accession	Entity Registrant Name	Creation Software	Document Type	Fiscal Year	Fiscal Period	BS	IS	SCI	CF	x-Ambiguous Entity or Period	x-Missing BS, IS, CF Roll Ups	x-Other
0000766704	0000766704-16-000055	WELLTOWER INC. /DE/	IBM Cognos CDM	10-K	2015	FY	0	0	1	0	0	0	0
0000766704	0000766704-15-000043	WELLTOWER INC. /DE/	IBM Cognos CDM	10-Q	2015	Q3	0	0	0	0	0	0	0
0000766704	0000766704-15-000031	HEALTH CARE REIT INC /DE/	IBM Cognos CDM	10-Q	2015	Q2	0	0	0	0	0	0	0
0000766704	0000766704-15-000021	HEALTH CARE REIT INC /DE/	IBM Cognos CDM	10-Q	2015	Q1	0	0	0	0	0	0	0
0000766704	0000766704-15-000012	HEALTH CARE REIT INC /DE/	IBM Cognos CDM	10-K	2014	Q4	0	0	1	0	0	0	0
0000766704	0000766704-14-000030	HEALTH CARE REIT INC /DE/	IBM Cognos CDM	10-Q	2014	Q3	0	0	0	0	0	0	0
0000766704	0000766704-14-000019	HEALTH CARE REIT INC /DE/	IBM Cognos CDM	10-Q	2014	Q2	0	0	0	0	0	0	0
0000766704	0000766704-14-000012	HEALTH CARE REIT INC /DE/	IBM Cognos CDM	10-Q	2014	Q1	0	0	0	0	0	0	0
0000766704	0000766704-14-000006	HEALTH CARE REIT INC /DE/	IBM Cognos CDM	10-K	2013	Q4	0	0	1	0	0	0	0
0000766704	0000766704-13-000035	HEALTH CARE REIT INC /DE/	IBM Cognos CDM	10-Q	2013	Q3	0	0	0	0	0	0	0
0000766704	0000766704-13-000024	HEALTH CARE REIT INC /DE/	IBM Cognos FSR	10-Q	2013	Q2	0	0	0	0	0	0	0
0000766704	0000766704-13-000015	HEALTH CARE REIT INC /DE/	IBM Cognos FSR	10-Q	2013	Q1	0	0	1	0	0	0	0
0000766704	0000766704-13-000006	HEALTH CARE REIT INC /DE/	IBM Cognos FSR	10-K	2012	Q4	0	0	1	0	0	0	0
0000766704	0000766704-12-000034	HEALTH CARE REIT INC /DE/	IBM Cognos FSR	10-Q	2012	Q3	0	0	0	0	0	0	0
0000766704	0000766704-12-000020	HEALTH CARE REIT INC /DE/	IBM Cognos FSR	10-Q	2012	Q2	1	0	0	0	0	0	0
0000766704	0000766704-12-000009	HEALTH CARE REIT INC /DE/	IBM Cognos FSR	10-Q	2012	Q1	1	0	0	0	0	0	0
0000766704	0000950123-12-002707	HEALTH CARE REIT INC /DE/	IBM Cognos FSR	10-K	2011	Q4	1	0	0	0	0	0	0
0000766704	0001193125-11-294910	HEALTH CARE REIT INC /DE/	RR Donnelley	10-Q	2011	Q3	1	0	0	0	0	0	0
0000766704	0000950123-11-075160	HEALTH CARE REIT INC /DE/	RR Donnelley	10-Q	2011	Q2	1	0	0	0	0	0	0
0000766704	0000950123-11-048445	HEALTH CARE REIT INC /DE/	RR Donnelley	10-Q	2011	Q1	1	0	0	0	0	0	0
0000766704	0000950123-11-028671	HEALTH CARE REIT INC /DE/	RR Donnelley	10-K	2010	FY	1	0	0	0	0	0	0
0000766704	0000950123-10-102561	HEALTH CARE REIT INC /DE/	IBM Cognos FSR	10-Q	2010	Q3	0	0	0	0	0	0	0
0000766704	0000950123-10-074122	HEALTH CARE REIT INC /DE/	IBM Cognos FSR	10-Q	2010	Q2	0	0	0	0	0	0	0

1.18.3. Compare specific detail across periods

The following is an example of comparing details across periods. Here you see high-level items related to the statement of comprehensive income. Each financial report section could have this type of comparison.

Component: (Network and Table)																
Network	311-Comprehensive Income (Loss) Breakdown (http://www.xbrlsite.com/2014/Prototype/fac/ComprehensiveIncomeBreakdown)															
Table	Comprehensive Income (Loss) Breakdown [Table] (overriden)															
	Reporting Entity [Axis]															
	WELLTOWER INC. (766704)															
	Fiscal Year [Axis]															
	2012				2013				2014				2015			
Comprehensive Income (Loss) Breakdown [Line Items]	Fiscal Period [Axis]				Fiscal Period [Axis]				Fiscal Period [Axis]				Fiscal Period [Axis]			
	Q1	Q2	Q3	FY	Q1	Q2	Q3	FY	Q1	Q2	Q3	FY	Q1	Q2	Q3	FY
Comprehensive Income (Loss) [Roll Up]																
Comprehensive Income (Loss) Attributable to Parent	56,688,000	134,543,000	191,573,000	293,325,000	49,875,000	41,608,000	104,603,000	105,013,000	65,487,000	160,445,000	278,991,000	430,319,000	176,664,000	531,415,000	717,118,000	810,184,000
Comprehensive Income (Loss) Attributable to Noncontrolling Interest	-1,056,000	-1,876,000	-2,241,000	-2,415,000	139,000	-5,228,000	-9,109,000	-13,267,000	-9,187,000	-2,910,000	-10,894,000	-14,678,000	-10,285,000	-5,145,000	-19,416,000	-31,166,000
Comprehensive Income (Loss)	57,744,000	132,667,000	189,332,000	295,740,000	49,736,000	36,380,000	95,494,000	92,280,000	56,300,000	157,535,000	268,097,000	444,997,000	166,379,000	526,270,000	697,702,000	841,350,000

1.18.4. Compare specific detail across peer entities

The following is an example of comparing details across peer entities. Here you see high-level items related to the statement of comprehensive income. Each financial report section could have this type of comparison.

Component: (Network and Table)								
Network	311-Comprehensive Income (Loss) Breakdown (http://www.xbrlsite.com/2014/Prototype/fac/ComprehensiveIncomeBreakdown)							
Table	Comprehensive Income (Loss) Breakdown [Table] (overriden)							
	Reporting Entity [Axis]							
	ALEXANDRIA REAL ESTATE EQUITIES INC (1035443)	APACHE CORP (6769)	ARCHER DANIELS MIDLAND CO (7084)	Alliance Holdings GP, L.P. (1344980)	BRUKER CORP (1109354)	PILGRIMS PRIDE CORP (802481)	SNYDER'S-LANCE, INC. (57528)	WELLTOWER INC. (766704)
	Fiscal Year [Axis]	Fiscal Year [Axis]	Fiscal Year [Axis]	Fiscal Year [Axis]	Fiscal Year [Axis]	Fiscal Year [Axis]	Fiscal Year [Axis]	Fiscal Year [Axis]
	2015	2015	2015	2015	2015	2015	2015	2015
Comprehensive Income (Loss) Breakdown [Line Items]	Fiscal Period [Axis]	Fiscal Period [Axis]	Fiscal Period [Axis]	Fiscal Period [Axis]	Fiscal Period [Axis]	Fiscal Period [Axis]	Fiscal Period [Axis]	Fiscal Period [Axis]
	FY	FY	FY	FY	FY	FY	FY	FY
Comprehensive Income (Loss) [Roll Up]								
Comprehensive Income (Loss) Attributable to Parent	194,036,000	-23,119,000,000	944,000,000	211,893,000	29,200,000	649,525,000	51,062,000	810,184,000
Comprehensive Income (Loss) Attributable to Noncontrolling Interest	1,893,000	-409,000,000	-4,000,000	93,555,000	2,300,000	48,000	33,000	-31,166,000
Comprehensive Income (Loss)	195,929,000	-23,528,000,000	940,000,000	305,448,000	31,500,000	649,573,000	51,095,000	841,350,000

1.19. Method of Implementing a Standard Digital Financial Report Using the XBRL Syntax

The document *Method of Implementing a Standard Digital Financial Report Using the XBRL Syntax*[112] describes a specific method for creating a high-quality, high-resolution financial report and its related taxonomies using the XBRL technical syntax. That method demonstrated via the creation of a prototype XBRL taxonomy and report for the International Public Sector Accounting Standards (IPSAS)[113].

[112] Charles Hoffman, CPA and Rene van Egmond, Method of Implementing a Standard Digital Financial Report Using the XBRL Syntax, http://xbrlsite.azurewebsites.net/2019/Library/MethodForImplementingStandardFinancialReportUsingXBRL.pdf

[113] *International Public Sector Accounting Standards XBRL Taxonomy Prototype Project*, http://xbrl.squarespace.com/journal/2019/1/16/international-public-sector-accounting-standards-xbrl-taxono.html

1.20. Inline XBRL

Inline XBRL[114], or iXBRL. is an additional model layer on top of "raw XBRL", or XBRL that does not take advantage of the Inline XBRL layer. Inline XBRL is a method of representing facts and their contexts within an HTML document (actually XHTML). The model of the report and the information conveyed by the report is exactly the same whether Inline XBRL is used or raw XBRL is used to represent the facts and contextual information.

1.21. Universe of Discourse

A logical model of a financial report can be used to shield business users from the technical complexity of an XBRL-based report and the report's technical model.

A universe of discourse is the set of all things under consideration during a discussion, examination, or study. A universe of discourse is the set of all objects or entities that is defined by a model. **XBRL-based digital financial reporting is NOT conceptually promiscuous**; you simply cannot add new pieces to the model. The model is the *shape of the information* (the report itself) not the *specific information* (what goes into the report) that goes into that shape.

Axioms and theorems assert knowledge. Constraints are restrictions on existing knowledge. Constraints can be used to detect incomplete information. Constraints can be used to check knowledge for inconsistencies and contradictions. Axioms, theorems, constraints, and other sorts of rules all follow the rules of logic. The rules of logic are the common denominator.

Business users interact with the model using the semantic level of these "Conceptual Legos" that expose logical pieces that are understandable by the user of the system. The system is not a "black box", rather the system is transparent do that the business professional using the system understands what the system is doing.

Digital financial reporting requires that every user of the system share the same universe of discourse, the same fundamental model, and the same logical rules. The goal is that every interpretation of the model is consistent with the intended interpretation of the model. The model is formal, the model is definable, and the model has a finite set of shapes.

1.22. Importance of Logical Theory Describing a Business Report

The *Logical Theory Describing a Business Report* and the *Financial Report Semantics and Dynamics Theory* describe the same business report model. A financial report is a specialization of the more general business report.

Absence of some common standard metamodel usable by individual business domain or regulator models (structure, constraints definitions, etc.):

- forces each implementation of standard business reporting for regulatory reporting or internal reporting within an organization to specify their own individual business report model to the best of their ability and such individual models tend to be lacking in quality and inconsistencies with other specified business report models

[114] XBRL International, *Inline XBRL*, https://www.xbrl.org/the-standard/what/ixbrl/

- makes retrieval of specific sections and fact data points of a business report unreliable
- makes it impossible to assert compliance of the report with statutory, regulatory and internal reporting constraints on the reported information
- makes disambiguation of facts from multiple sources all but impossible due to the absence of such a metamodel that qualifies provenance.

Absence of the means to connect domain taxonomies and ontologies to the standard business report process:

- impedes the definition of the domain specific semantics needed to properly assert reporting compliance constraints
- prevents the reuse of information definitions across multiple business reports within a single regulatory context
- prevents the creation of an information repository that supports cross-domain analysis

Think about implementing something like Deloitte's vision of The Finance Factory[115] without common standards including a common standard business report model. Think about implementing accounting process automation or continuous accounting or other such endeavors.

Standards provide leverage[116]. If it is unclear to you why standards matter, consider reading *Computer Empathy*[117] to understand what it actually takes to make such projects work effectively.

1.23. Standard Business Report Model (SBRM)

The Object Management Group (OMG) is taking XBRL-based business reports to a new level, leveraging what has been learned from creating XBRL-based financial reports over the past 10 years. The Standard Business Report Model (SBRM)[118] is described as follows:

> "SBRM formally documents a logical conceptualization of a business report in both human-readable and machine-readable models."

SBRM goes on to explain that through the use of standard models, business experts can define the structure and content of their reports and extensions using high-level logical business report objects, possibly presented in the form of semantic spreadsheets and pivot tables rather than with lower level technical syntax.

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[115] *Deloitte's Vision: The Finance Factory*, http://xbrl.squarespace.com/journal/2019/2/20/deloittes-vision-the-finance-factory.html

[116] Standards make markets, http://xbrl.squarespace.com/journal/2018/12/22/standards-make-markets.html

[117] Charles Hoffman, CPA, *Computer Empathy*, http://xbrlsite.azurewebsites.net/2018/Library/ComputerEmpathy.pdf

[118] *Object Management Group and Standard Business Report Model (SBRM)*, http://xbrl.squarespace.com/journal/2019/6/25/object-management-group-and-the-standard-business-report-mod.html

While XBRL has mainly been employed for financial reporting, leveraging the nature of financial accounting rules[119]; digital business reporting will benefit from the capabilities pioneered by XBRL-based financial reporting. Further, business reporting will not be limited to only one syntax but rather the arbitrary preferred syntax of can be used and systems can still be consistent with one conceptual model of a business report.

Financial reporting will likewise benefit from SBRM because SBRM helps business professionals and technical professionals constructing systems where flexible reporting is a requirement to effectively control variability and still have high-quality information exchanges.

[119] Charles Hoffman, *Leveraging the Theoretical and Mathematical Underpinnings of a Financial Report*, http://xbrlsite.azurewebsites.net/2018/Library/TheoreticalAndMathematicalUnderpinningsOfFinancialReport.pdf