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

Proven, reliable, best practice method for implementing XBRL-based financial reporting following the forthcoming OMG Standard Business Report Model (SBRM)

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ABSTRACT: This document outlines a proven standard method of implementing a standard digital financial report using the XBRL technical syntax leveraging the extensibility features of XBRL which follow the forthcoming OMG *Standard Business Report Model* (SBRM)[1]. This document itself is not a methodology, rather this document will be used to back into a methodology which can be used to implementing a digital financial report in the syntax of one's choice. The intent of this document is to summarize know-how. This know-how, when documented in the form of a useful method, eliminates the need for others to re-invent the wheel. Rather than re-inventing the wheel; others can simply leverage a well-thought-through, world-class approach that has been designed, created, rigorously tested, and carefully engineered leveraging approaches that have been proven to work results. These best practice approaches and techniques that has been generally demonstrated as superior to any known alternatives because the techniques produce results that are superior to those achieved by other means or because it has become a standard way of doing things are documented in this resource. It is anticipated that others will improve upon this method over time.

[1] OMG, Standard Business Report Model (SBRM), https://omgwiki.org/SBRM/doku.php

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One type of practical knowledge is **know-how**; how to accomplish something. This document explains how to accomplish something. Things can be explained formally such as in a formal academic paper by trained scholars or specialists with deep expertise. This is not a formal academic paper. Things can also be explained informally, in more practical terms based on experimentation of a practitioner trying to figure something out. That is what we are doing in this paper. Our hope is that an academic or scholar who has deep knowledge in accounting, math, and knowledge engineering will see what we are trying to explain here and do a better job than we have been able to do. This is our best shot.

Per Wikipedia, a **methodology**[2] is defined as the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methodology and principles associated with a branch of knowledge. Typically, it encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques.

A methodology does not set out to provide a solution. A methodology is, therefore, not the same as a method. Instead, a methodology offers the theoretical underpinnings for understanding which method, or set of methods, or so called "best practices" can be applied to a specific case, for example, to calculating a specific result. A **best practice** is a method or technique that has been generally accepted as superior to any 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, e.g., a standard way of complying with legal or ethical requirements. A **good practice** is similar to a best practice although perhaps less formal.

A meta model and documented method will help those attempting to implement XBRL-based financial reporting to not have to “re-invent the wheel”.

This document explains a proven, best practices based, open source method for creating a high-fidelity, high-resolution, with verifiably high-quality XBRL-based digital financial report when the extensibility features of XBRL are leveraged and maximizing capabilities for verifying the quality of the financial report using automated machine-based processes. It is intended that this specifically defined method will contribute to the creation of an implementation independent methodology for creating such financial reports.

Automation is about removing friction, driving costs down, speeding processes up, and improving efficiency. Automation is about improving processes in order to deliver goods and services that are better for less cost. This method can be used to automate accounting, reporting, auditing, and analysis tasks and processes.

If a process cannot be controlled then the process simply cannot repeatedly and reliably output high-quality. If process output is not high-quality, automation cannot possibly be effective.

[2] Wikipedia, *Methodology*, https://en.wikipedia.org/wiki/Methodology

So, control of a process is necessary in order for the process to be effective. How do you control a process? You control a process using rules. Manual processes are controlled by rules that are read by humans. Automated processes are controlled by rules that are readable by both machines (i.e., to execute the process) and humans (i.e., to make sure the rules are right).

Who creates these machine-readable rules that are used to control processes that yield effective automation? Accountants must create these rules because the rules tend to be accounting oriented. Technical rules tend to relate to syntax and such technical rules can be hidden from business professionals. What is left is the business logic and accounting rules that are used to control information and control process workflow. As such, the creation of machine-readable rules must be "self-service". Business professionals must be empowered to create, adjust, maintain, and otherwise manage the rules that are used to control and therefor effectively automate processes. Once you have the machine-readable rules, you need software that can process the rules; this is sometimes called a rules engine or reasoning engine or a semantic reasoner. We will get to that in a bit, but first let's be sure you have some critically important background understanding.

Deriving this Method

The creation of this method is an engineering design process exercise, not a philosophical exercise, political discussion, or religious debate. This method was consciously and deliberately derived by taking the best practices of many implementations of XBRL related to financial reporting[3], take the practices that are proven to be superior to other practices, avoiding practices that are found to cause undesirable results or other issues, and combining all known, proven, and tested best practices into this one implementation method. This method can be effectively used for XBRL-based reporting using the US GAAP and IFRS reporting schemes to the SEC or IFRS reporting to the ESMA. Most importantly, this method is safe and reliable for implementation within individual economic entities for accounting process automation and the automation of reporting tasks and processes. This includes the necessary process control mechanisms[4] that assure the high-quality output necessary.

An objective of this method to have high precision and high coverage as defined by C. Maria Keet, PhD, in her textbook *An Introduction to Ontology Engineering*[5]. Another objective of this method is to be consistent with the forthcoming OMG Standard Business Report Model

[3] Mastering XBRL-based Digital Financial Reporting, http://xbrlsite.azurewebsites.net/2020/master/
[4] Controlling of a System, http://xbrl.squarespace.com/journal/2020/5/21/control-of-a-system.html
[5] *Distinguishing Between Good, Less Good, Bad, and Worse Ontology-like things*, http://xbrl.squarespace.com/journal/2019/9/6/distinguishing-between-good-less-good-bad-and-worse-ontology.html

(SBRM)[6]. The problem statement summary in section 6.1 Problem Statement, page 19 of the *Standard Business Report Model (SBRM) Request for Proposal*[7] is very helpful in understanding both the problem and the solution to the problem.

Complexity and Order

Difference systems have different levels of complexity. Systems can also be ordered or disordered. The *Cynefin Framework*[8] is a conceptual framework that helps you understand the dynamics that are at work within different types of systems.

The following graphic helps one understand the different levels of complexity: simple, complicated, complex, and chaotic. The graphic also helps one understand the difference between disorder and order.

[6] OMG, *Standard Business Report Model* (SBRM), https://omgwiki.org/SBRM/doku.php
[7] OMG, *Standard Business Report Model (SBRM) Request For Proposal*, page 19, https://www.omg.org/cgi-bin/doc?bmi/2019-06-04
[8] Cynefin Framework, http://xbrl.squarespace.com/journal/2021/3/21/cynefin-framework.html

The video *Using Cynefin to Prioritize and Analyze Features, User Stories, and Functional Requirements*[9] provides an excellent walk through of these ideas. Another video, *Complexity, Cynefin, and Agile*[10]; provides additional useful insights related to understanding how to deal with complexity.

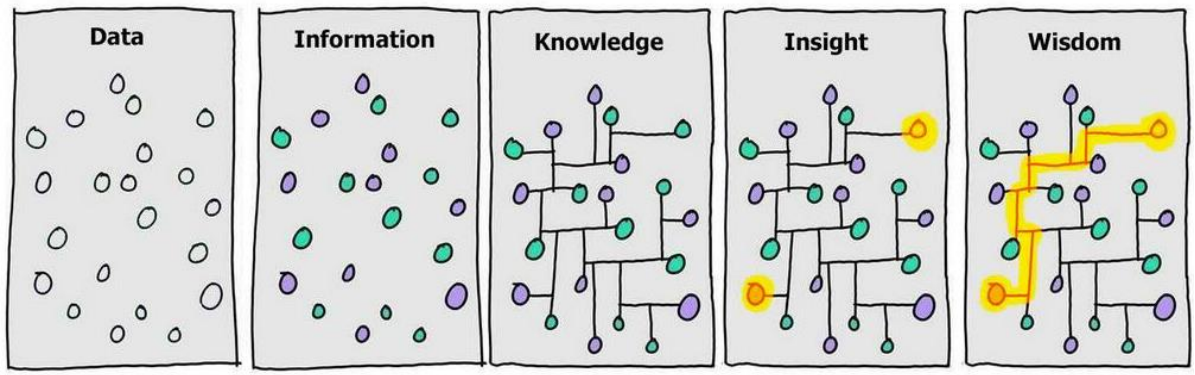
This method leverages "safe to fail" experimentation to understand complexity and to create the necessary control mechanisms necessary to create XBRL-based digital financial reports that are also provably properly functioning logical systems.

Different skill sets are necessary to be able to create simple, complicated, and complex systems that work effectively.

Data vs Information vs Knowledge

We are working with information, not data. The difference between data and information is that data is the raw facts and numbers where information is data in context. This is important to understand as most problems faced by accountants are an information problem, rather than a data problem. Getting data is easy. Knowing what that data represents and how the data fits together is more challenging. Representing information in the form that a machine such as a computer can understand and use that information is difficult and takes a skilled professional.

Knowledge is a set of data and information and a combination of skill, know-how, experience which can be used to improve the capacity to take action or support a decision making process by categorizing, collating, associating the data and information[11].



[9] YouTube.com, *Using Cynefin to Prioritize and Analyze Features, User Stories, and Functional Requirements*, https://www.youtube.com/watch?v=L5fnxahydXM
[10] YouTube.com, *Complexity, Cynefin, and Agile*, https://youtu.be/-F4enP8oBFM
[11] YouTube.com; *Data, Information, Knowledge*; https://youtu.be/3NxN0OgVN2k

Knowing what that data represents and how the data fits together is difficult. Representing information in the form that a machine such as a computer can understand and use that information is difficult.

Logical Conceptualization of a Financial Report[12]

A financial report is an allowed interpretation of an expression of the financial position and financial performance of an economic entity per some set of statutory and regulatory rules. Here-to-for, that expression has been in a form that is only readable by humans. However, XBRL and other machine-readable formats change that, making those expressions readable by both humans and by machine-based processes.

Single-entry accounting is how 'everyone' would do accounting. In fact, that is how accounting was done before double-entry accounting was invented. Double-entry accounting was the invention of medieval merchants and was first documented by the Italian mathematician and Franciscan Friar Luca Pacioli.

Double-entry accounting adds an additional important property to the accounting system, that of a clear strategy to identify errors and to remove the errors from the system. Even better, double-entry accounting has a side effect of clearly firewalling errors as either accident or fraud[13]. This then leads to an **audit strategy**. Double-entry accounting is how professional accountants do accounting.

An XBRL-based financial report[14] is not only a machine-readable format; it also is a machine-readable logical system and has the potential to be a well-defined and fully expressed logical system. A well-defined logical system, when fully expressed, will be properly functioning and demonstrably consistent, valid, sound, and complete. These properties can be leveraged to offer a systematic **audit strategy for XBRL-based financial reports**[15].

Essentially, an XBRL-based financial report is a set of declarative statements provided in global standard XBRL format. Logic programming software applications such as Prolog, Datalog, Clips, and Answer Set Programming can provide feedback as to whether these statements are consistent, precise, valid, sound, complete and otherwise properly functioning. Even XBRL processors and XBRL formula processors can effectively prove that XBRL-based financial reports

[12] Logical Theory Describing Financial Report, http://xbrl.squarespace.com/logical-theory-financial-rep/
[13] Ian Grigg, *Triple Entry Accounting*, https://iang.org/papers/triple_entry.html
[14] Charles Hoffman, CPA, *Narrative Explaining Logical Conceptualization of a Financial Report*, http://xbrlsite.azurewebsites.net/2019/Framework/NarrativeConceptualization.pdf
[15] Charles Hoffman, CPA, *Auditing XBRL-based Financial Reports*, http://xbrlsite.azurewebsites.net/2019/Library/AudtingXBRLBasedFinancialReports.pdf

are properly functioning to a large degree. When you distill accounting down to its essence[16] and separate the tasks and processes from how those tasks and processes are completed it becomes obvious that augmenting human-based processes with machine-based processes is not only possible, but desirable.

Understanding the Problem and the Solution

In promoting XBRL-based digital financial reporting specifically; and more generally new modern approaches to accounting, reporting, auditing, and analysis in a digital environment in general; we first have to make a case that some sort of problem exists, show that a solution to that problem is available, and show that the solution brings overwhelming benefits beyond the cost of change and cost of ongoing use and maintenance of the new solution.

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[17]: US GAAP, IFRS, IPSAS, GAS, FAS, FRF for SMEs, 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 allowed 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 this scenario:

> Two public companies, A and B, each have knowledge about their financial position and financial performance. They must communicate their knowledge 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 are using a common set of basic logical principles (facts known to be true, deductive reasoning, inductive reasoning, etc.) and

[16] Essence of Accounting, http://xbrl.squarespace.com/journal/2020/5/12/essence-of-accounting.html
[17] *Comparison of Financial Reporting Schemes High Level Concepts*, http://xbrlsite.azurewebsites.net/2018/Library/ReportingSchemes-2018-12-30.pdf

common financial reporting standards (i.e. US GAAP, IFRS, etc.), so they should be able to communicate this information fully, so that any inferences which, say, the investor draws from public company A's input should also be derivable by public company A using basic logical principles and common financial reporting standards, and vice versa; and similarly for the investor and public company B.

This method uses machine-readable business rules to "channel" and therefore control variability, keeping the variability within standard limits and permissible alternatives. That keeps 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. 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.

Thinking of this scenario it is easy to begin to see the “sweet spot” of XBRL’s capabilities which are:

- **Exchange of rich, complex, high-fidelity information**: The information exchange transaction type for which XBRL was designed is rich, complex, and high-fidelity information as contrast to a simple information transaction of low fidelity.
- **Zero to very low tolerance for error**: As accountants say, information must “tick and tie” and “cross cast and foot.” There should be no mathematical or logical inconsistencies, contradictions, or other such anomalies within a financial report. XBRL has a lot of expressive power.
- **Information variability, flexibility, reconfigurability**: XBRL was intentionally designed to handle the variability of financial reporting. A financial report is not a rigid form. Information reported might not be uniform. But that is not to say the information does not follow patterns and is arbitrary and random. For example, various intermediate concepts (subtotals) might be used to summarize basic concepts. XBRL offers flexibility where flexibility is necessary. But this variability must be controlled and managed to keep reports within permissible boundaries.
- **Process control mechanisms**[18]: XBRL offers robust capabilities necessary for process control.

Let’s be clear about the terms we are using and the need for low to zero tolerance for error. Specifically, let’s be clear about the following definitions:

- **Reliability** is about getting consistent results each time an activity is repeated.

[18] The Hidden Data Factory that Masks Errors, http://xbrl.squarespace.com/journal/2020/6/1/the-hidden-data-factory-that-masks-process-problems.html

- **Accuracy** is about identifying the correct target. Accuracy relates to correctness in all details; conformity or correspondence to fact or given quality, condition; deviating within acceptable limits from a standard. Accuracy means with no loss of resolution or fidelity of what the sender wishes to communicate and no introduction of false knowledge or misinterpretation of communicated information.
- **Precision** is the closeness of repeated measurements to one another. Precision involves choosing the right equipment and using that equipment properly. Precise readings are not necessarily accurate. A faulty piece of equipment or incorrectly used equipment may give precise readings (all repeated values are close together) but inaccurate (not correct) results.
- **Fidelity** relates to the exactness or loyal adherence of facts and details with which something is copied or reproduced. Fidelity relates to the faithful representation of the facts and circumstances represented within a financial report properly reflect, without distortion, reality. High fidelity is when the reproduction (a financial report) with little distortion, provides a result very similar to the original (reality of economic entity and environment in which the economic entity operates).
- **Integrity** is the quality or condition of being whole or undivided; completeness, entireness, unbroken state, uncorrupt. Integrity means that not only is each piece of a financial report correct but all the pieces of the financial report fit together correctly, all things considered.
- **Resolution** relates to the amount of detail that you can see. The greater the resolution, the greater the clarity.
- **Completeness** relates to having all necessary or normal parts, components, elements, or steps; entire.
- **Correctness** relates to freedom from error; in accordance with fact or truth; right, proper.
- **Consistency** relates to being compatible or in agreement with itself or with some group; coherent, uniform, steady. Holding true in a group, compatible, not contradictory.

Consider the notion of XBRL as a high-fidelity knowledge media[19]. Just like word-of-mouth, a book, or a video; XBRL enables some knowledge bearer to impart knowledge on some knowledge receiver using some knowledge media. **XBRL is a high-fidelity knowledge media[20]**.

[19] Understanding that XBRL is a Knowledge Media, http://xbrl.squarespace.com/journal/2017/1/16/understanding-that-xbrl-is-a-knowledge-media.html
[20] *Special Theory of Machine-based Automated Communication of Semantic Information of Financial Statements*, http://xbrlsite.azurewebsites.net/2019/Library/SpecialTheoryOfSemanticCommunicationOfFinancialInformation.pdf

In their book *Blown to Bits*[21], Philip Evans and Thomas S. Wurster point out the new economics of information. In the past, you could have reach or richness, but typically not both at the same time. The internet completely changed this economic equation. **Reach** is access to information. **Richness** relates to quantity, timeliness, accuracy and variety (fidelity, resolution) of information. Word of mouth tends to be the richest information, but the reach can be lower. Books have excellent reach, but less richness. With XBRL you can have excellent reach and richness.

Considering all of the above, there are two key ideas here to highlight:

- First, as applied to financial reporting, the task is to communicate a rich set of financial information of an economic entity with high-fidelity, high-resolution, and near perfect accuracy and reliability.
- Second, each knowledge media has advantages and disadvantages so the choice of medium matters.

Let us borrow an idea from the philosopher Albert Borgman[22]. Suppose that what we are trying to communicate is a symphony. To communicate that symphony; we can choose to use sheet music of the symphony, a recording of the symphony put onto a CD, an MPEG4 file which has an audio and video recording of the symphony performance, or a music critic's review of a performance of the symphony.

It takes specific and different skills to communicate the symphony in each medium and consequently to ingest the symphony represented in a particular medium. The easiest digestion is to drop a CD into a CD player and then simply listening to the music of the symphony. Reading the sheet music of the symphony requires more skill.

Which media has perfect fidelity? Which has the least loss of resolution? Is it the sheet music? Maybe a recorded performance of an elementary school orchestra? Well, that depends.

Thankfully, with regard to financial reports we have an easier situation. Society has spent hundreds of years working through the details and have reached general agreement on standard concepts to describe the financial position and financial performance of an economic entity. Particularly over the past hundred years with the rise of standard reporting schemes such as US GAAP, UK GAAP, and International Financial Reporting Standards (IFRS). Almost every economic entity has a staff of persons dedicated to producing financial reports based on such standards. There are also persons who wish to receive and utilize these reports who

[21] Philip Evans and Thomas S. Wurster, *Blown to Bits*, https://www.amazon.com/Blown-Bits-Economics-Information-Transforms/dp/087584877X
[22] Albert Borgman, *Holding on to Reality*, https://www.press.uchicago.edu/ucp/books/book/chicago/H/bo3640475.html

understand those standards and therefore the meaning of the information conveyed by the financial reports.

We now have a "new media" that is better suited in this digital age to the task than the "old media" of paper-based reports or what amounts to e-paper such as PDF or HTML files. With structured formats such as XBRL it is easier for machine-based processes to work with reported financial information effectively.

XBRL is an information encoding language, a new media, well-suited to the task of transferring financial information between people and systems in a digital environment.

In a perfect world, computers would perform the translation of a financial report from the human-readable representation into a machine-readable and more importantly a machine-understandable representation. Likewise, computers on the receiving end would ingest this reported information in a way that brings desired value to the people who wish to understand and use that information. In this perfect world, neither creator nor consumer of the information should need to get involved in this translation process from human-readable to machine-readable information and back again. Therefore, to them, the choice of syntax and the complexity or simplicity of the information model shouldn't really matter. It should just work.

From the point of view of these stakeholders, their fundamental interests, perceptions, positions, and risks are straight forward and rather easy to describe:

- Will the medium allow me to express the information that I wish to express?
- Can I find the information that I am looking for at the level of detail that I need in the financial report?
- Can I compare information between periods of an economic entity or between economic entities as of some period?
- Can I do all this safely, reliably, predictably, over and over again without error?

How all this works should be left to technical specialists who are skilled in engineering processes and can, in fact, make such a system work reliably. After all, we have put man on the moon. Clearly there are many technologies that have been made to work, expressing information within a financial report is rather easy by comparison.

Yet we do need professional accountants, financial analysts, regulators, investors, and other less technical stakeholders of a domain to communicate what they might need from such a system.

But we don't want financial people reviewing a technical architecture of a taxonomy or ontology to determine if that architecture is best suited to meet the needs of the domain. They simply are not qualified to have an opinion.

We want financial professionals to review how the system performs and to provide an opinion as to whether a system meets their needs or not. So, there does need to be an ability for business domain professionals that have a problem and the technical professionals that understand how to solve that problem to communicate. Both groups of business and technical stakeholders tend to have an innate understanding of logic. Logic is the basis for communications between these two groups of stakeholders.

Sadly, software today which is used in such a system is not yet good enough so financial professionals cannot understand, or even believe or comprehend how such a system could possibly even work. And the reasons software is not good enough yet are not a mystery. One of the primary reasons that no such software yet exists is the lack of a well-suited information model that can be represented in XBRL. And so, it is difficult to have software that utilizes such a model when the model does not yet even exist.

Another reason such software does not exist is that XBRL is under-utilized generally because XBRL is poorly understood. A third reason such software does not exist is that the metadata that would drive such software and make it work appropriately has not been created yet because people tend to not understand XBRL and that it actually provides the means to represent that needed metadata.

XBRL is an ontology-like thing[23] that has capabilities far beyond the belief or comprehension of most business professionals and technical professionals. There exists a "which came first, the chicken or the egg" type of a situation.

Now we begin to see the need for some sort of methodology. A methodology can help illuminate the structure of a financial report. With that methodology, some method for making the promise of XBRL-based digital financial reporting a reality can be created, tested, and it can be determined if the system is meeting the needs of system stakeholders.

Once you read the method, you can decide if the method might work. Even better, if you use software that employs this method and you are happy with how the software works; that will help you understand why the method might be rather useful.

[23] *Enhanced Description of an Ontology-like Thing*, http://xbrl.squarespace.com/journal/2019/7/19/enhanced-description-of-ontology-like-thing.html

In deciding, be sure to have the appropriate background knowledge[24], understand that the model does exist[25], and that the metadata exists[26]. Also, make sure you use software that leverages these resources and ideas[27].

Financial Report Levels

To clearly and precisely understand XBRL-based digital financial reporting and the target level of this method, it helps to think of the spectrum of financial reports in terms of levels similar to how levels are helpful in understanding the capabilities of self-driving cars[28]. The term "self-driving" means different things to different people so it makes it difficult to have a precise conversation about that topic. But breaking the description into a spectrum of descriptions is very helpful to the communication process.

This is similarly true for the levels of an XBRL-based digital financial report. Below we will break down a financial report into helpful levels that will enable a precise and clear discussion. We will provide a very brief description, a little bit of information, and a link to specific examples that instantiate a report per each specific level. The marginal difference between each level is very helpful in providing the reader with a solid understanding of the different levels. Here is an overview of the levels related to financial reporting as I see them beginning with the least functional in terms of both human and machine use of the information from with a financial report.

- **Level 0**: Not machine readable. *An example of Level 0 is a clay tablet, papyrus, or paper as the report medium*.
- **Level 1**[29]: Machine readable, nonstandard, structured for presentation. *PDF, HTML, or XHTML are examples of Level 1*.
- **Level 2**[30]: Machine readable, nonstandard, structured for meaning, no taxonomy (a.k.a. dictionary), no rules, no report model. *An XBRL-based report without an XBRL taxonomy schema, without XBRL relations and resources, and without XBRL Formulas is an example of Level 2*.

[24] Artificial Intelligence and Knowledge Engineering in a Nutshell, http://xbrlsite.azurewebsites.net/2019/Library/KnowledgeEngineeringInNutShell.pdf
[25] Logical Theory Describing Financial Report, http://xbrl.squarespace.com/logical-theory-financial-rep/
[26] Mastering XBRL-based Digital Financial Reporting, http://xbrlsite.azurewebsites.net/2020/master/
[27] Pesseract, http://pesseract.azurewebsites.net/#menu3
[28] Truecar, The 5 Levels of Autonomous Vehicles, https://www.truecar.com/blog/5-levels-autonomous-vehicles/
[29] Level 1 financial report example, http://xbrlsite.azurewebsites.net/2021/reporting-scheme/proof/reference-level1/
[30] Level 2 financial report example, http://xbrlsite.azurewebsites.net/2021/reporting-scheme/proof/reference-level2/

- **Level 3**[31]: Machine readable, global standard syntax, structured for meaning, with taxonomy (a.k.a. dictionary), incomplete rules, incomplete high-level report model. *An XBRL-based report with a XBRL taxonomy schema, with XBRL relations and resources, but without XBRL Formulas is an example of Level 3.*

- **Level 4**[32]: Machine readable, global standard syntax, structured for meaning, with taxonomy (a.k.a. dictionary), complete set of rules provided, incomplete high-level report model. *An XBRL-based report with a XBRL taxonomy schema, with XBRL relations and resources, and with XBRL Formulas that completely describes the report is an example of Level 4*.

- **Level 5**[33]: Machine readable, global standard syntax, structured for meaning, with taxonomy (a.k.a. dictionary), complete set of rules provided, complete global standard high-level report model, yields PROVEN properly functioning system and UNDERSTANDABLE report information. *An XBRL-based report with all the characteristics of Level 4, plus consistency cross checks, type-subtype relations, consistent modeling of XBRL presentation relations, information that describes the correct representation of every disclosure within the report, and a reporting checklist that describes all required disclosures is an example Level 5*.

- **Level 6**: All of Level 5 PLUS blockchain-anchored XBRL to increase trust. *An XBRL-based report with all the characteristics of Level 5, plus information within a digital distributed ledger that assures no one has tampered with the report is an example of Level 6*.

- **Level 7**: All of Level 6 PLUS blockchain-anchored transactions and events. *An XBRL-based report with all the characteristics of Level 6, plus information that indicates that assures no one has tampered with transactions is an example of Level 7*.

The target of this method is Level 5 and above. Below Level 5 the functionality what we generally need from such reports in terms of quality and effective use of reported information in automated machine-based processes is not good enough. It is possible to create a Level 4 XBRL-based report that is properly functioning. Level 5 provides a guarantee that the financial report is properly functioning within a provides specification articulated with a complete set of rules.

[31] Level 3 financial report example, http://xbrlsite.azurewebsites.net/2021/reporting-scheme/proof/reference-level3/
[32] Level 4 financial report example, http://xbrlsite.azurewebsites.net/2021/reporting-scheme/proof/reference-level4/
[33] Level 5 financial report example, http://xbrlsite.azurewebsites.net/2021/reporting-scheme/proof/reference-level5/

Objective of this Method

The objective of the method for creating XBRL-based digital financial reports when the extensibility features of XBRL are leveraged is to be able to create a financial report maximizing the use of automated machine-based processes, maximize the ability to analyze reported information reliably and safely using machine-based processes, and maximize the verifiable quality of reported information such that the knowledge bearer and the knowledge receiver derive maximum benefit using machine-base processes. This method is about the structural, mechanical, mathematical, and logical dynamics of the report. This method is not about things like verifying whether the amount reported for, say, the report line item "Cash and cash equivalents" are correct.

This method is intended to produce Level 5 financial reports or higher.

It is the intent that this method will be used to create a syntax independent and implementation independent methodology in the future.

While the primary focus of this method is for a financial report; it has also been determined that it provides benefit for automation of accounting, auditing, and analysis tasks and processes also.

Intended Scope of this Method

To reiterate in more detail to be sure it is clear, this method is about controlling and verifying the structural, mechanical, mathematical, and logical dynamics of a financial report. Structure, mechanics, mathematics, and logic are all objective in nature and relate to the financial report itself and not what goes into the financial report.

What information goes into a financial report and where that information is presented many times can be subjective; open to interpretation and judgement of the professional accountants creating the report. Facts reported can never be verified as being free from error or fraud simply by using this method. Should financial reports be true and fair representations of information, free from errors and/or fraud? Absolutely. However, this is not the intended purpose of this method.

The functionality of XBRL-based financial reports should enable professional accountants and auditors reviewing reports to do so thoroughly and completely and using this method will contribute to that end. However, while this method is helpful and perhaps you can even say necessary to meet that objective, it is not necessarily proven to be sufficient to meet that objective.

Restating once again, it is intended that this method will contribute to the creation of an implementation independent methodology. But this specific method employs the XBRL technical syntax.

Principles

Principles help you think about something thoroughly and consistently. Overcoming disagreements between stakeholders and even within groups of stakeholders is important. Agreement between stakeholder groups and within stakeholder groups contributes to harmony. Lack of agreement contributes to dissonance. Principles help in the communications process.

A “stakeholder" is anyone that has a vested interest. Another term for stakeholder is "constituent". A "constituent" is a component part of something.

Foundational to arriving at harmony is having a common conceptual framework including a set of consistent principles or assumptions or world view for thinking about the system.

This “framework for agreeing” helps the communications process which increases harmony and decreases dissonance. This is about bringing the system into balance, consciously creating the appropriate equilibrium/balance.

The following is a set of principles which those stakeholders creating this method agree to use to understand their perceptions, positions, and risks when it comes to creating this method.

1. Prudence dictates that using information from an XBRL-based financial report should not be a guessing game.
2. A near zero defect report is useful; a defective financial report is not trustworthy and therefore not useful. The goal is to achieve the quality level of Six Sigma[34].
3. Rules prevent anarchy. Business rules guide, control, suggest, or influence behavior. Business 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.
4. The only way to achieve a meaningful exchange of information without disputes is with the prior existence of and agreement as to a standard set of technical syntax rules, business logic rules, and workflow rules.
5. Explicitly stated information or reliably derived information is preferable to implicit information. Forcing software engineers to imply information is to be avoided. Derived and implied are not the same thing.
6. Many, but not all, aspects of financial reports can be guaranteed to be defect free using automated machine-based processes to the extent that machine-readable rules exist which software can leverage.

[34] Wikipedia, *Six Sigma*, Sigma Levels, https://en.wikipedia.org/wiki/Six_Sigma#Sigma_levels

7. When possible to effectively create, machine-based automated processes tend to be more desirable than human-based manual processes because machine processes tend to be more reliable, faster, and cost less. However, it is impossible to completely eliminate human involvement from the process of creating a financial report. Financial report creation processes will be a collaboration of machine-based processes and human-based processes. Machines should perform tasks that machines do best; humans should perform tasks that humans do best.
8. Complexity cannot be removed from a system, but complexity can be moved.
9. Maximize consistency. Only allow inconsistency of approach when there is a justifiable reason for allowing such an inconsistency.

Comparison of Reporting Schemes

To help the reader understand that financial reporting schemes have patterns, we put together a comparison of six different financial reporting schemes[35]. The side-by-side comparison allows you to compare and contrast different reporting schemes to see the similarities and differences between the high-level concepts of these reporting schemes. Some of these reporting schemes have been represented using XBRL[36], others have not.

Reporting Scheme:	US GAAP issued by FASB	IFRS issued by IASB	UK GAAP Issued by FCR	IPSAS issued by IPSASB	GAS issued by GASB	FAS issued by FASAB
URL	https://www.fasb.org	https://www.ifrs.org/	https://www.frc.org.uk	https://www.ipsasb.org	https://www.gasb.org	http://www.fasab.gov
Reporting Scheme description	United States Generally Accepted Accounting Standards	International Financial Reporting Standards	UK Accounting Standards	International Public Sector Accounting Standards	General purpose financial reporting by private companies; general business reporting	Federal Accounting Standards (United States)
Location of Standards	https://asc.fasb.org/ (free access, but you have to register)	https://www.ifrs.org/issued-standards/list-of-standards/	https://www.gov.uk/government/publications/corporation-tax-technical-specifications-xbrl-and-ixbrl	http://www.ifac.org/publications-resources/2018-handbook-international-public-sector-accounting-pronouncements	https://gars.gasb.org/ (free access, but you have to register) https://www.gasb.org/jsp/GASB/Page/GASBSectionPage&cid=1176160042391	http://www.fasab.gov/document-by-chapter
Conceptual Framework	https://www.fasb.org/pdf/con6.pdf	https://www.iasplus.com/en/standards/ias/ias1	https://www.frc.org.uk/getattachment/69f7d814-c806-4ccc-b451-aba50d6e8de2/FRS-102-FRS-applicable-in-the-UK-and-Republic-of-Ireland-(March-2018).pdf	https://www.ifac.org/system/files/publications/files/A10-IPSAS-01_1.pdf	https://www.gasb.org/cs/ContentServer?c=GASBContent_C&cid=1176156649588&d=&pagename=GASB%2FGASBContent_C%2FProjectPage	http://files.fasab.gov/pdffiles/handbook_sffac_1.pdf
Approximate number of reporting entities	About 10,000 public entities; About 27.9 million private companies in US; 18,500 private companies with 500 employees or more; 320,000 not-for-profit entities.	Estimated to be about 10,000 listed companies in Europe perhaps 30,000 globally; probably 25 mission private small and medium (SME) entities globally or more	5.7 million private sector businesses	Unknown, estimate at least 100,000 based on state and local government numbers in US.	Estimated 90,000 state and local governmental entities in the US.	The Federal Register indicates there are over 430 departments, agencies, and sub-agencies in the federal government.
Semantics						
Economic entity	Economic entity	Economic entity; reporting entity	Economic entity; reporting entity	Economic entity	Financial reporting entity	Reporting entity
Balance sheet	Statement of Financial Position	Statement of financial position	Statement of financial position (balance sheet)	Statement of financial position	Statement of Net Position; Statement of net assets	Statement of financial position (or balance sheet)
Income statement	Statement of Income	Statement of profit or loss	Statement of profit or loss	Statement of financial performance	Statement of activities; Statement of revenues, expenditures, and changes	Statement of operations (or income statement)
Cash flow statement	Statement of Cash Flows	Statement of cash flows	Statement of cash flows	Cash flow statement	Statement of cash flows	Statement of cash flows
Statement of Changes in Equity	Statement of Changes in Equity	Statement of changes in equity	Statement of changes in equity	Statement of changes in net assets/equity	Statement of changes in net position	Statement of changes in net position
Statement of Comprehensive	Statement of Comprehensive Income	Statement of comprehensive income	Statement of comprehensive			

What might seem striking to non-accountants, maybe even to accountants, is the similarity between the reporting schemes at a high level. Clearly all reporting schemes have the

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

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

accounting equation at the highest level: Assets = Liabilities and Equity. The high-level concepts provide the breakdowns of Assets, Liabilities, and Equity used by that reporting scheme[37].

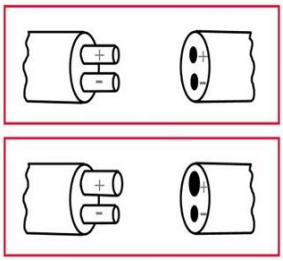
What one recognizes if they understand the leverage that patterns provide and they understand how computers work is the leverage that would be provided by a meta model of a financial report[38]. Such a meta-model of a financial report enables the efficient creation of software that is approachable and easy for professional accountants to use.

A reality of today's world is that different reporting schemes that leverage XBRL have slightly different implementations of XBRL. The good news is that the implementations are only slightly different. But even these minor differences need to be addressed.

Poka-yoke (Mistake proofing)

Poka-yoke is a technique used to prevent mistakes through smarter design. Poka-yoke[39] is a Japanese term that means "mistake-proofing". A poka-yoke is any mechanism consciously added to a process that helps an equipment operator avoid mistakes. Its purpose is to eliminate defects by preventing, correcting, or drawing attention to human errors as the errors occur.

For example, consider the graphic[40] below. You want someone to plug the plug into the receptacle such that positive and negative match up; inadvertently reversing this would have catastrophic consequences. In the top graphic, notice that it is possible to make a mistake but in the bottom a mistake would be impossible because of the size differences in the positive and negative receptacle and plug.



Smart design means less user errors. Fact sets are a mechanism for implementing poka-yoke, or mistake proofing XBRL-based information. Primitive object structure, mechanical relations, mathematical relations, logical relations, and even some accounting relations must make sense relative to other primitive objects. Fact sets and the structured nature of XBRL make

[37] Charles Hoffman, CPA, *Toward a Formal Machine Readable Financial Reporting Scheme Model*, http://xbrl.squarespace.com/journal/2019/9/5/toward-a-formal-machine-readable-financial-reporting-scheme.html
[38] Charles Hoffman, CPA, *Understanding the Meta-Model of a Financial Report*, http://xbrl.squarespace.com/journal/2018/12/20/understanding-the-meta-model-of-a-financial-report.html
[39] Wikipedia, *Poka-yoke*, https://en.wikipedia.org/wiki/Poka-yoke
[40] Process Exam, *Six Sigma Tools - Poka Yoke*, http://www.processexam.com/six-sigma-tools-poka-yoke

implementing these mistake proofing techniques possible with financial report creation software.

Double-entry accounting is a type of poka-yoke mechanism used by professional accountants. The first recorded use of double-entry accounting was in 1211 AD by a bank in Florence[41]. The foundational basis of double-entry accounting is straightforward. Quoting David Ellerman from his paper *The Math of Double-Entry Bookkeeping: Part I (scalars)*[42]:

> "Given an equation w + … + x = y + … + z, it is not possible to change just one term in the equation and have it still hold. Two or more terms must be changed."

And so, the left hand side of the equation "w + … + x" (the DEBIT side) must always equal the right hand side of the equation "y + … + z" (the CREDIT side) in double-entry accounting. The reason that double-entry accounting is used, as contrast to single-entry accounting, is double-entry accounting's capability to detect errors and to distinguish an error from fraud. Double-entry accounting is smart design.

Poka-yoke is one of many Lean Six Sigma techniques and philosophies which could be employed to control processes[43].

Cost of Quality

George Labovitz and Yu Sang Chang came up with in 1992 called the "1-10-100 Rule" and is widely used as a tool to describe efficiency. In summary:

- $1: Verifying and correcting information at the start is the least expensive way to make sure your information is clean and accurate. This is **prevention cost**.
- $10: Identifying and cleaning information after the fact is time consuming and resource intensive. This is **correction cost**.
- $100: Bad information may flow between sources, creating a waste of time and resources. This is **failure cost**.

[41] Geoffrky Alan Lee, *The Development of Italian Bookkeeping 1211–1300, Wiley*, https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1467-6281.1973.tb00183.x
[42] David Ellerman, *The Math of Double-Entry Bookkeeping: Part I (scalars)*, http://www.ellerman.org/the-math-of-double-entry-bookkeeping-part-i-scalars/
[43] Comprehensive Introduction to Lean Six Sigma, http://xbrlsite.azurewebsites.net/2017/IntelligentDigitalFinancialReporting/Part01_Chapter02.72_LeanSixSigma.pdf

Understanding Ontology

The following definition of ontology is taken from the textbook *Ontology Engineering*[44] by Elisa Kendall and Deborah McGuinness:

Ontology - a model that specifies a rich description of the

- terminology, concepts, nomenclature;
- relationships among and between concepts and individuals; and
- sentences distinguishing concepts, refining definitions and relationships (constraints, restrictions, regular expressions)

relevant to a particular domain or area of interest.

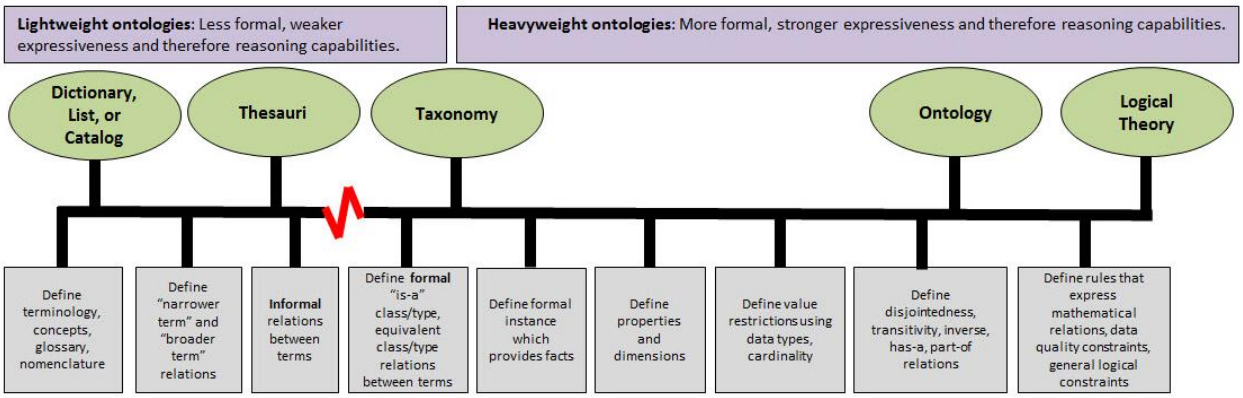
But as I pointed out, there are many different approaches to representing the information found in what many people call an ontology[45]. Further, there are many different ontology-like things.

Most business professionals probably have a vague understanding of what an ontology actually is or may not have ever heard the term at all. Those familiar with XBRL might be familiar with the term 'XBRL taxonomy'. Fundamentally, an ontology is an artifact that a software application can refer to and manipulate. The artifact can exist in any number of physical formats. But the essence is that an ontology is a logic-based classification system representation of information that a computer can process.

Ontology-Like Things

The different types of classification systems form a spectrum. Some knowledge engineering textbooks refer to this as the *ontology spectrum*[46]. Michael Uschold's insightful explanation of an ontologies his presentation *Ontologies and Semantics for Industry*[47] uses the term **ontology-like thing** to describe this spectrum. Here is a graphic of the ontology spectrum or ontology-like things:

[44] Elisa Kendall and Deborah McGuinness, *Ontology Engineering*, https://www.amazon.com/Ontology-Engineering-Synthesis-Lectures-Semantic/dp/1681733080
[45] Chris Irwin Davis, PhD, *Ontologies, Taxonomies, and Bears—Oh, My!*, https://www.linkedin.com/pulse/ontologies-taxonomies-bearsoh-my-chris-irwin-davis-phd/
[46] *Ontology Spectrum*, http://xbrl.squarespace.com/journal/2019/4/27/ontology-spectrum.html
[47] Michael Uschold, *Ontology-like Things for Industry*, http://xbrl.squarespace.com/journal/2019/7/13/ontology-like-things-for-industry.html



The following is an enhanced description of an ontology-like thing that is approachable to business professionals. This definition is inspired and synthesized from the basic textbook definition of an ontology provided in *Ontology Engineering* by Elisa Kendall and Deborah McGuinness; Michael Uschold's insightful description of an ontology-like things in his presentation *Ontologies and Semantics for Industry*; and Shawn Riley's description of an ontology's common components in *Good Old-Fashioned Expert Systems (With or Without Machine Learning)*[48]. Adding a few other odds and ends, I came up with the following definition:

An **ontology or ontology-like thing** is a model that specifies a rich and *flexible* description of the *important relevant*

- **terms** (terminology, concepts, nomenclature; includes primitive terms and functional terms);
- **relations** (relationships or associations among and between concepts and individuals; is-a relations, has-a relations; other properties); and
- **assertions**: (sentences distinguishing concepts, refining definitions and relationships including constraints, restrictions; axioms, theorems, restrictions); and
- **world view**: (reasoning assumptions, identity assumptions)

relevant to a particular domain or area of interest, which generally allows for some certain specific variability, and as consciously unambiguously and completely as is necessary and practical in order to achieve a specific goal or objective or a range of goals/objectives. It enables a community to agree on important common terms for capturing meaning or representing a shared understanding of and knowledge in some domain where flexibility/variability is necessary.

[48] Shawn Riley, *Good Old-Fashioned Expert Systems (With or Without Machine Learning)*, https://www.linkedin.com/pulse/good-old-fashioned-ai-expert-systems-shawn-riley/

And so, the reason for creating an "ontology-like thing" is to make the meaning of a set of terms, relations, and assertions explicit, so that both humans and machines can have a common understanding of what those terms, relations, and assertions mean. "Instances" or "sets of facts" (a.k.a. individuals) can be evaluated as being consistent with or inconsistent with some defined ontology-like thing created by some community. The level of accuracy, precision, fidelity, and resolution expressively encoded within some ontology-like thing depends on the application or applications being created that leverage that ontology-like thing.

Describing a Logical System in Simple Terms

A **system**[49] is a cohesive conglomeration of interrelated and interdependent parts that is either natural or man-made.

A **logical system** can be explained by a logical theory. A logical theory is an abstract conceptualization[50] of specific details of some domain. The logical theory provides a way of thinking about a domain by means of deductive reasoning to derive logical consequences of the theory.

A **logical theory** enables a community of stakeholders trying to achieve a specific goal or objective or a range of goals/objectives to agree on important statements used for capturing meaning or representing a shared understanding of and knowledge in some universe of discourse.

A logical theory is made up of a set of *models*, *structures*, *terms*, *associations*, *rules*, and *facts*. 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*[51] is a set of structures that are consistent with and permissible interpretations of that model.
- **Structure**: A *structure* is a set of statements which describe the structure.
- **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”, “equity”, and “balance sheet”.

[49] Wikipedia, *Systems Theory*, https://en.wikipedia.org/wiki/Systems_theory
[50] Wikipedia, *Conceptual Model*, https://en.wikipedia.org/wiki/Conceptual_model
[51] Wikipedia, *Model Theory*, https://en.wikipedia.org/wiki/Model_theory

- **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".
- **Rules**: Rules are statements that describe what 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 a business report. For example, the financial report, a type of business report, might state "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.

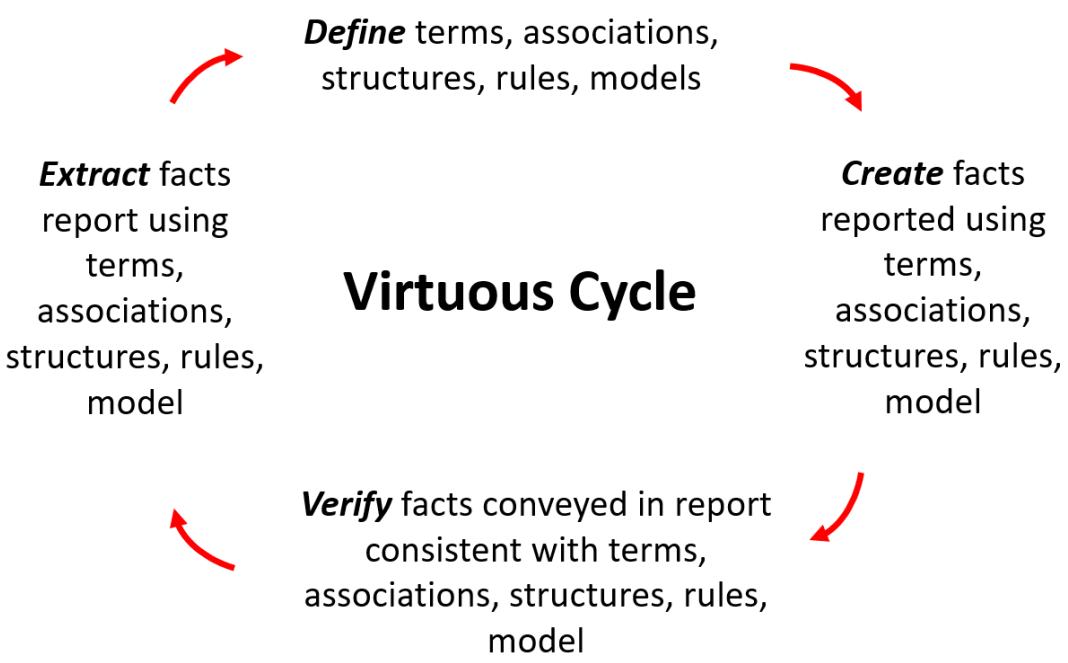
Fundamentally, a logical theory is a set of statements. Those statements can be represented in machine-readable form. Once in machine-readable form, those statements can be interrogated using software applications. To the extent that this can be done effectively; software tools can assist professional accountants and others working with those statements.

A logical theory is said to be **consistent** if there are no contradictions with respect to the statements made by the logical theory that describes the logical system (i.e. reality).

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

When a logical system is consistent and it has high precision and high coverage the logical system can be considered a properly functioning logical system. When a system is working right, it creates a virtuous cycle[52].

[52] Charles Hoffman, CPA, *Virtuous Cycle*, http://xbrl.squarespace.com/journal/2020/4/29/virtuous-cycle.html



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)

Precision and Coverage of Ontology-like things

In her book *An Introduction to Ontology Engineering*[53], C. Maria Keet, PhD, provides discussion about what constitutes a good and perhaps a not-so-good ontology. She discusses the notion that a syntax error in an ontology is similar to computer code not being able to compile. She discusses the notion of logical errors within an ontology-like thing which cause the ontology to not work as expected.

Finally, Keet discusses the notions of *precision* and *coverage* when it comes to judging whether an ontology or ontology-like thing is good or bad and provides a set of four graphics that drive this point. Precision can be low or high; coverage can likewise be low or high.

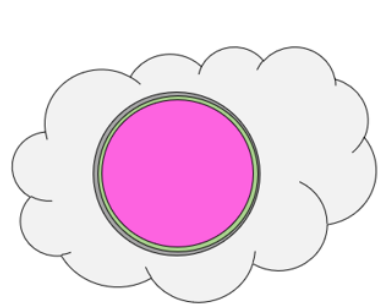
You get a good ontology when the precision of the ontology is high and the coverage of the ontology is high. *Precision* is a measure of how precisely you do or can represent the

[53] C. Maria Keet, *An Introduction to Ontology Engineering*, pages 8-9, https://people.cs.uct.ac.za/~mkeet/files/OEbook.pdf

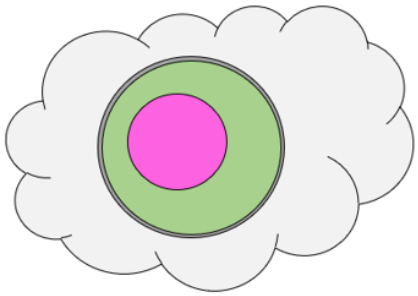
information of a domain within an ontology-like thing as contrast to reality. *Coverage* is a measure of how well you do or can represent a domain of information within an ontology-like thing.

If you represent the things that you should represent (i.e. your coverage is good) and you do so such that the ontology-like thing accurately represents reality, then you get a good ontology-like thing. But if an ontology-like thing cannot do what it should be able to do then it is a bad ontology-like thing. And things can go wrong when you have high precision but not enough coverage or if you have low precision with high coverage or things can become really bad if neither your precision nor coverage are what you should have created given the goal you are trying to achieve.

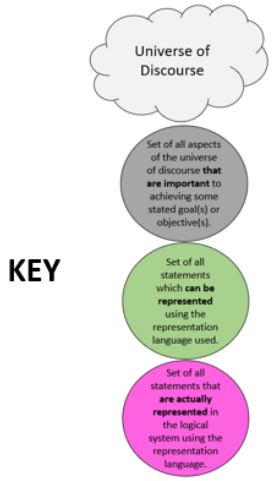
The following graphics are inspired by the graphics provided by C. Maria Keet:

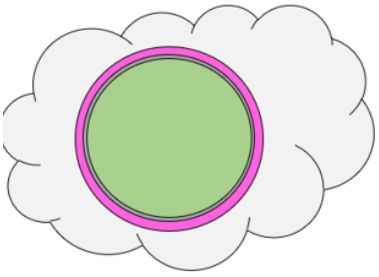


High precision, High coverage (Very good)
All important aspects of reality related to some universe of discourse necessarily to achieve some goal or objective or a set of goals/objectives have been effectively and properly represented.

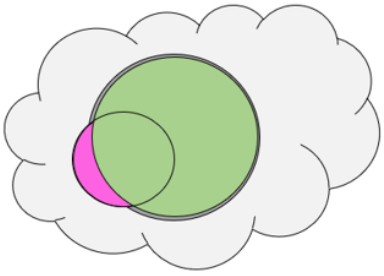


High precision, Low coverage (Less Good)
While all important information represented could be represented is precisely represented; other important information with respect to a universe of discourse which could be represented has not been represented.

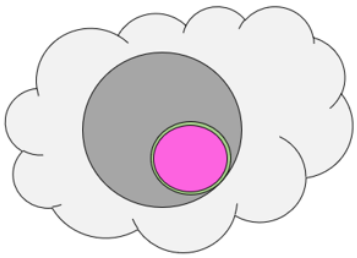




Low precision, High coverage (Bad)
Information that does not exist in reality from the domain of discourse or information that is unimportant from the domain of discourse (i.e. pink) is represented (i.e. green).



Low precision, Low coverage (Worse)
Information that does not exist in reality (i.e. pink) is represented (i.e. green) and significant important information has not been represented related to some universe of discourse.



Low precision, Low coverage (Inadequate language)
The representation language used does not have the expressive power to represent the information important to the universe of discourse necessary to meet the goal(s) and objective(s) of the system.

And so, precision and coverage matter when it comes to creating an ontology-like thing.

Ontological Commitment

An **ontological commitment** is an agreement by the stakeholders of a community to use some ontology-like thing in a manner that is consistent with the theory of how some domain operates represented by the ontology-like thing. The commitment is made in order to achieve some specific goal or goals established by the stakeholders in a community sharing the ontology-like thing.

The ontology-like thing is a lot like the conductor of an orchestra.

Testable and Provable Logical System

Testing is used to be sure an ontology-like thing has good precision and good coverage. The ontology-like thing and instances (values) created per that ontology-like thing form a sharable conceptualization or logical system[54] that can be tested and proven to be:

- **Consistent** (no assertions of the system contradict another assertion)
- **Valid** (no false inference from a true premise is possible)
- **Complete** (if an assertion is true, then it can be proven; i.e. all assertions exists in the system)
- **Sound** (if any assertion is a theorem of the system; then the theorem is true)
- **Fully expressed** (if an important term exists in the real world; then the term can be represented within the system)

Think of a logical system that is consistent, valid, complete, sound, and fully expressed. Now, imagine removing one assertion from the system. Removing that one assertion could let incorrect information into the system which would cause information quality issues.

Ontology-like things for accounting, reporting, auditing, and analysis require high-quality and therefore they require highly expressive ontology-like things.

Overview of Method

The following is an overview of this particular method for creating XBRL-based digital financial reports. The purpose of this overview is to provide a big picture view of this method. Details of this method will be provided within subsequent sections of this document. First, a brief description of the pieces and functions of the theoretical model are provided in the form of a bulleted list. Second, a narrative is provided which explains how the pieces of the theoretical model fit together and further explains the function of each piece.

[54] Wikipedia, *Logical System*, https://en.wikipedia.org/wiki/Logic#Logical_systems

- **XBRL technical syntax**: Explicitly use the global standard XBRL technical syntax without deviation.
- **Profiles**: Explicitly and consciously restrict XBRL technical syntax by define profiles to handle the inconsistent implementation detail differences.
- **Business report meta-meta model**: Explicitly and consciously abide by the financial report meta-meta model which abides by the business report meta-meta model.
- **Categories of report elements**: Explicitly categories of report elements: Network, Table, Axis, Member, Line Items, Abstract, Concept.
- **Model structure relations rules**: Explicitly and strictly enforce relations between categories of report elements using model structure rules.
- **Reporting styles**: Explicitly define all allowed variability within reporting styles in advance.
- **Concept arrangement patterns**: Explicitly define allowed concept arrangement patterns in advance.
- **Member arrangement patterns**: Explicitly define allowed member arrangement patterns in advance.
- **Disclosures**: Explicitly define all disclosures in advance.
- **Topics**: Explicitly define all topic which are used to organize disclosures in advance.
- **Disclosure mechanics rules**: Explicitly define the integrity, resolution and fidelity of disclosure mechanical, structural, mathematical, logical, and accounting relationships in advance for all disclosures.
- **Reporting checklist rules**: Explicitly define reporting checklist. Reporting checklist rules enforce statutory and regulatory reporting requirements to the extent that these reporting requirements can be automated. Other compliance and governance rules can be included in this checklist or provided within a separate checklist. Rules which cannot be checked using automated processes are to be checked using manual processes.
- **Mathematical relations rules**: Explicitly define all mathematical relations which exist within a report.
- **Class/subclass relations rules**: Explicitly define all class/subclass relations in advance.
- **Continuity crosscheck rules**: Explicitly define all continuity cross checks for each reporting style in advance.
- **Report integrity**: Explicitly test integrity, resolution, and fidelity of relations between disclosures within a report for overall report integrity and fidelity.
- **Consistency with prior reports**: Explicitly test each report against all prior reports for consistency of between financial reports.
- **Consistency with peers**: Explicitly test each report against a set of peer reports for consistency between your financial report and the reports of your peers.
- **Templates**: Explicitly define templates which can be leveraged when creating disclosures within a report.
- **Exemplars**: Explicitly identify exemplars from other existing reports which can be leveraged when creating disclosures within a report.

This logical conceptualization is described in additional detail in the *Narrative Explaining Logical Conceptualization of a Financial Report*[55].

To physically represent information, you need some sort of syntax. It is not necessary to use the **XBRL technical syntax**, but that is the syntax used by this method. But the XBRL technical syntax is general. No one ever uses the complete XBRL technical syntax, implementations use parts of that syntax. **Profiles** are used to partition the implementation details. A profile is a restricted set of the XBRL technical syntax used for an implementation.

The **business report meta-model**[56] is used for two things. First, it is used to map the logic of a business report to the technical implementation of that report. Second, it is used to make the implementation of a business report consistent across all profiles.

The **categories of report elements** are used to achieve the mapping between the logical model (business report meta-model) and the physical implementation. The **model structure relations** assist in this task.

Because there is variability allowed in the representation of financial information but because that variability can be captured in the form of patterns, the notion of **reporting styles** is used to capture that variability.

Each model structure has an information model that documents the pattern of how information is arranged within a representation. This information model can be broken down into a known set of **member arrangement patterns** and **concept arrangement patterns**.

The patterns of the set of information models of a model structure for the fragments of a report can be identified and named. These patterns can be given names, uniquely identified, and mapped to the **disclosures** required by statutory and regulatory reporting requirements. Each of these disclosures has a set of **disclosure mechanics** which describes the structure, mechanics, logical, mathematical, and some accounting relations of the disclosure.

Further, which disclosures are required to be provided and when per statutory and regulatory reporting rules and other compliance and governance rules are documented by a set of rules which represent the **reporting checklist** which act as the universally applicable meta rules for creation of a financial report. Any such rules that cannot be automated must be checked using manual processes.

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[55] Charles Hoffman, CPA, *Narrative Explaining Logical Conceptualization of a Financial Report*, http://xbrlsite.azurewebsites.net/2019/Framework/NarrativeConceptualization.pdf

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

When a report is created, the logical, mathematical, and some accounting relationships within and between the fragments which make up a report must be intact. **Mathematical relations** are rather obvious; describing and enabling the verification of basic mathematical computations within a report. **Type/subtype associations** and **continuity cross checks** enforce these rules both describing and enabling the verification of report integrity between and within report fragments.

Finally, a report is compared and contrasted with prior reports to make sure there is **consistency with prior reports** and the current report and likewise check the **consistency with peers** to make sure your report is consistent with other relevant financial reports.

Templates and **exemplars** can be leveraged as examples when representing a **disclosure** within a new report that is being created.

A report can be proven to be 100% consistent with the specified rules used to describe and verify a report against that description. This is not to say that a report can be verified to be a 100% true and fair representation using this method. These structural, mechanical, mathematical, logical, and accounting rules are all necessary to prove that a report is true and fair. However, these rules must be supplemented by human testing and perhaps even additional automatable machine-based processes to be sure that a financial report is a 100% true and fair representation of all quantitative and qualitative aspects of the financial position and financial performance of an economic entity.

Logical Model

The following is a detailed explanation of the logical model that will be implemented via the physical model. All sections of the "Overview of Method" section are included for completeness and to make cross referencing information easier. The logical model follows the *Financial Report Semantics and Dynamics Theory*[57] and the *Logical Theory Describing a Business Report*[58].

XBRL Technical Syntax

The XBRL technical syntax is not part of the logical model. The XBRL technical syntax will be discussed in the physical implementation model.

[57] Charles Hoffman, CPA and Rene van Egmond, *Financial Report Semantics and Dynamics Theory*, http://xbrlsite.azurewebsites.net/2016/Library/Theory-2017-06-26.pdf

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

Profiles

Profiles are not part of the logical model. Profiles will be discussed in the physical implementation model.

Business Report Meta-Meta Model

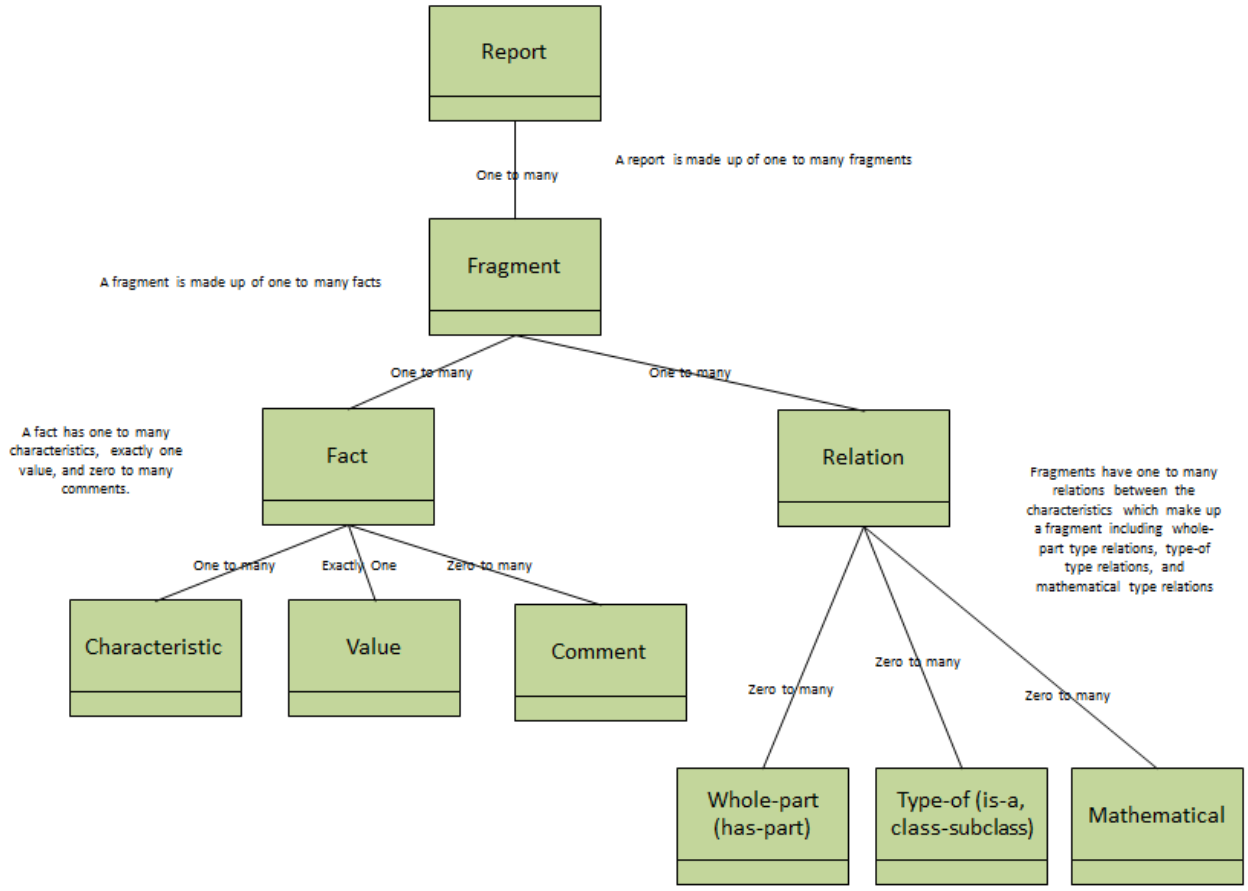
The following are the details of the business report meta-meta model. This is considered a meta-meta model because all reports (models) of all profiles (meta-model) follow this specific meta-meta model.

- **Report**: A report is a set of identifiable facts distinguished from one another by one or many characteristics plus information that can be used to describe and verify the logical, mechanical, mathematical, structural, and other such relations between facts.
- **Fragment**: A fragment is a part of a report. A report is made up of one or many fragments. A fragment is a set of facts.
- **Fact**: A fact defines a single, observable, piece of information contained within a report, or fact value, conceptualized for unambiguous interpretation or analysis by one or more distinguishing characteristics. Facts can be a single numbers, a phrase of text, or prose (a set of numbers and/or text formatted generally for human consumption).
- **Characteristic**: A characteristic describes a fact (a characteristic is a property of a fact). A characteristic provides information necessary to describe a fact and distinguish one fact from another fact. A fact may have one or many distinguishing characteristics.
- **Relation**: A relation is how one thing in a report is or can be related to some other thing in a report. These relations, often referred to as business rules, describe logical, mechanical, mathematical, structural, and other such constraints. There are three primary types of relations (others can exist):
    - **Whole-part**: something composed exactly of their parts and nothing else; the sum of the parts is equal to the whole (roll up).
    - **Is-a**: 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.
    - **Computational business rule**: Other types of computational business rules can exist such as "Beginning balance + changes = Ending Balance" (roll forward) or "Net income (loss) / Weighted average shares = Earnings per share".
- **Model structure**: The model structure is a type of relation that describes and can be used to verify fragments of a report. The model structure describes the structure of the report fragment.
- **Fact Table**: A fact table is a set of facts which go together for some specific reason. All the facts in a fact table share the same characteristics. The facts which are included

within the set of facts that make up the fact table are determined by the model structure.

- **Grain**: Grain is the level of depth of information or granularity. The lowest level of granularity is the actual transaction, event, circumstance, or other phenomenon represented in a financial report.

The following is a visual summary of the relationships between the entities that make up a business report:



Categories of Report Elements

The categories of report elements are not part of the logical model. The categories of report elements will be discussed in the physical implementation model.

Model Structure Relations

Model structure relations are not part of the logical model. Model structure relations will be discussed in the physical implementation model.

Reporting Styles

Reporting styles are used to adjust for the variability allowed by a financial report. A financial report is not a ridged form. Information reported might not be completely uniform. But that is not to say the information does not follow patterns and is arbitrary and random. FASB CON 6[59] points out that various intermediate concepts (subtotals) might be used to summarize basic concepts. Reporting styles are used to group variability.

For example, a balance sheet or statement of financial position is a required primary financial statement. However, there is a variety of forms the statement of financial position might take:

- Balance sheet that distinguishes current and noncurrent assets and liabilities.
- Balance sheet that does not distinguish current and noncurrent assets and liabilities.
- Statement of financial position provided on a liquidation basis which reports net assets.
- Balance sheet of a regulated public utility that reports capitalization.

Reporting styles exist for US GAAP[60] and IFRS[61]. A finite number of reporting styles can be defined which accounts for 100% of reports. If a new reporting style is observed which does not fit into existing styles; a new reporting style is simply added to the list. Below is a summary of balance sheet reporting styles for US GAAP:

Code	Count of Reports Using this Style	Percent of Reports Using this Style	Percent of Reports Consistent with Style
BSC	4,637	81%	98%
BSU	883	15%	99%
BSN	111	2%	99%
BSR	15	1%	99%
BSL	?	?%	?%
BSB	3	0%	100%
Unknown/Other	88	1%	??%
Total	5,734	100%	

For more information on reporting styles, please see Making the Case for Reporting Styles[62].

[59] FASB, *Statement of Financial Reporting Concepts No. 6*, page 47, paragraph 77, https://www.fasb.org/jsp/FASB/Document_C/DocumentPage?cid=1218220132802&acceptedDisclaimer=true
[60] US GAAP Reporting Styles, http://www.xbrlsite.com/2018/10K/US-GAAP-Reporting-Styles.pdf
[61] IFRS Reporting Styles, http://www.xbrlsite.com/2018/IFRS/IFRS-Reporting-Styles.pdf
[62] Charles Hoffman, CPA, *Making the Case for Reporting Styles*, http://xbrlsite.azurewebsites.net/2017/library/MakingTheCaseForReportingStyles.pdf

Reporting styles should be defined in advance of creating reports. Alternatively, reporting styles can be detected using software algorithms by probing the report model structure.

Concept Arrangement Patterns

Concept arrangement pattern is the organization of concepts within a fragment of a report. Concepts can be related mathematically or non-mathematically. These relationship patterns can be organized into groups which are referred to as concept arrangement patterns. The following is a summary of the more common concept arrangement patterns:

- **Set**: Facts are related non-mathematically.
- **Roll up**: Fact A + Fact B + Fact C = Fact D (a total)
- **Roll forward**: Beginning balance (stock) + changes (flow) = Ending balance (stock)
- **Variance**: Amount (actual scenario) – Amount (projected scenario) = variance
- **Adjustment**: Originally stated balance + adjustments = restated balance
- **Complex computation**: Total oil produced / Number of wells = Total production per well
- **Text block**: A single fact is reported so that there are no relations.

The following is an example of a concept 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

The concept arrangement pattern shown above is a roll up. All fragments of a financial report can be broken down into a finite set of concept arrangement patterns. If a new concept arrangement pattern that does not exist is discovered, that new pattern can simply be added to the list of such patterns.

For more information on concept arrangement patterns see the document *Understanding Concept Arrangement Patterns, Member Arrangement Patterns, and Report Fragment Arrangement Patterns*[63].

[63] *Understanding Concept Arrangement Patterns, Member Arrangement Patterns, and Report Fragment Arrangement Patterns*, http://xbrlsite.azurewebsites.net/2017/IntelligentDigitalFinancialReporting/Part02_Chapter05.7_UnderstandingConceptArrangementPatternsMemberArrangementPatterns.pdf

Member Arrangement Patterns

Mereology[64] is the theory of parthood relations: of the relations of part to whole and the relations of part to part within a whole. Similar to concept arrangement patterns, member arrangement patterns define mathematical and non-mathematical relations. Logically, concept arrangement patterns and member arrangement patterns are identical.

Member arrangement patterns will be discussed further in the physical implementation model.

All allowed member arrangement patterns should be defined in advance of creating a model for a financial report.

Disclosures

A **disclosure** is a fragment of a financial report which represents something that is being disclosed within that report. The following is an example of a disclosure for the components of inventory.

BOEING CO | 2013 | FY | ★★★★★

Inventories at December 31 consisted of the following:

	2013	2012
Long-term contracts in progress	**$12,608**	$15,130
Commercial aircraft programs	**48,065**	40,389
Commercial spare parts, used aircraft, general stock materials and other	**7,793**	7,206
Inventory before advances and progress billings	**68,466**	62,725
Less advances and progress billings	**(25,554)**	(24,974)
Total	**$42,912**	$37,751

Disclosures can be directly mapped to accounting standards or other statutory or regulatory reporting requirements, the accounting practices of an industry, or the policies of a specific economic entity which creates a financial report.

Every fragment of a financial report is made up of one or more disclosures[65]. All disclosures should be defined and given a unique identifier prior to creating a model for a financial report. Alternatively, if disclosures are not defined in advance and not given unique identifiers then disclosures can be identified using prototype theory and disclosure mechanics rules.

Topics

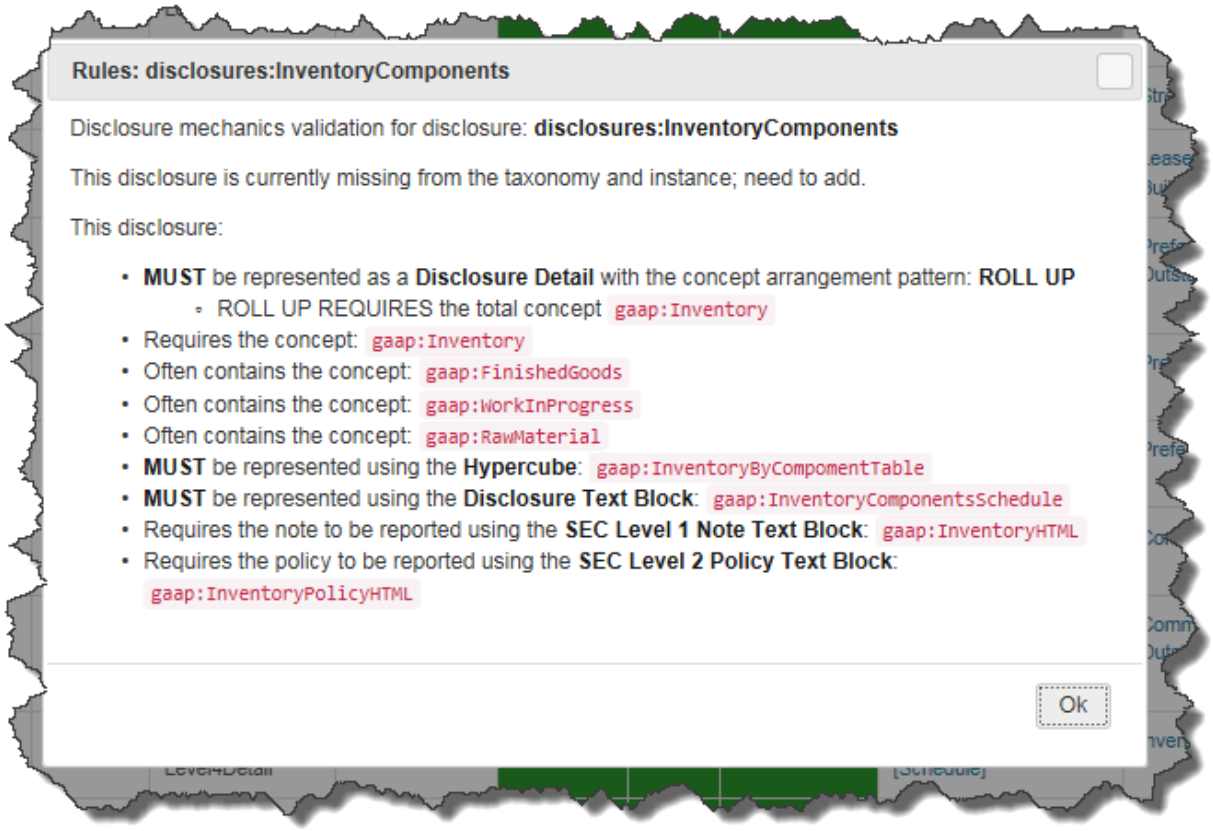
Because the volume of disclosure can be rather high, it is helpful to organize sets of disclosures into topics. A **Topic** is a name under which a set of Disclosures that are grouped together for some specific reason can be organized.

[64] Stanford Encyclopedia of Philosophy, *Mereology*, https://plato.stanford.edu/entries/mereology/
[65] Disclosure Best Practices Prototype, http://xbrlsite-app.azurewebsites.net/DisclosureBestPractices/DisclosureBestPractices.aspx?DisclosureName=BalanceSheet

Disclosure Mechanics Rules

Disclosure mechanics rules define the mechanical, structural, mathematical, logical, and some accounting relationships of a disclosure. The disclosure mechanics rules is not a complete description of a disclosure, rather it is a description of the key stone or skeleton or wire frame of the characteristics of a disclosure.

The following is an example of disclosure mechanics rules provided for the “Inventory Components” disclosure:



Disclosure mechanics rules should be provided during the process of representing disclosure information within a model for a financial report.

Reporting Checklist Rules

Reporting checklist rules enforce statutory, regulatory, compliance, and governance reporting requirements to the extent that such reporting requirements can be represented in machine readable form. Such rules which cannot be checked using automated processes are to be provided in human-readable form and checked by human-based processes.

The following is an example of a reporting checklist[66]:

#	Disclosure	Category	Level	Pattern	Applicable	Found	Disclosure Consistent	Representation Concept [TEXT BLOCK]	Representation Concept [DETAIL]	Checklist Category	Reason
1	Entity Information		Level4Detail	HIERARCHY	True	True	CONSISTENT	NOT-EXPECTED	Economic Entity Name	Required disclosure	Disclosure always required
2	Document Information		Level4Detail	HIERARCHY	True	True	CONSISTENT	NOT-EXPECTED	Document Title	Required disclosure	Disclosure always required
3	Financial Highlights		Level3TextBlock / Level4Detail	HIERARCHY	True	True	CONSISTENT	Financial Highlights [HTML]	Revenues, Net	Required disclosure	Disclosure always required
4	Balance Sheet		Level4Detail	COMPONENT	True	True	CONSISTENT	NOT-EXPECTED	NOT-EXPECTED	Required disclosure	Disclosure always required, satisfied by Assets [Roll Up] and Liabilities and Equity [Roll Up]
5	Assets [Roll Up]		Level4Detail	ROLL UP	True	True	CONSISTENT	NOT-EXPECTED	Assets	Part of disclosure	Disclosure always required
6	Liabilities and Equity [Roll Up]		Level4Detail	ROLL UP	True	True	CONSISTENT	NOT-EXPECTED	Liabilities and Equity	Part of disclosure	Disclosure always required
7	Income Statement		Level4Detail	ROLL UP	True	True	CONSISTENT	NOT-EXPECTED	Net Income (Loss)	Required disclosure	Disclosure always required
8	Cash Flow Statement, Direct Method		Level4Detail	ROLL UP	True	True	CONSISTENT	NOT-EXPECTED	Cash Flow, Net	Required disclosure	Disclosure always required
9	Statement of Changes in Equity		Level4Detail	ROLL FORWARD	True	True	CONSISTENT	NOT-EXPECTED	Equity	Required disclosure	Disclosure always required
10	Significant Accounting Policies		Level1TextBlock	LEVEL 1 TEXT BLOCK	True	True	CONSISTENT	Significant Accounting Policies [Note]	NOT-EXPECTED	Required disclosure	Disclosure always required
11	Basis of Reporting		Level1TextBlock	LEVEL 1 TEXT BLOCK	True	True	CONSISTENT	Overall Financial Report Presentation and Display [HTML]	NOT-EXPECTED	Required disclosure	Disclosure always required
12	Nature of Operations		Level1TextBlock	LEVEL 1 TEXT BLOCK	True	True	CONSISTENT	Nature of Business [HTML]	NOT-EXPECTED	Required disclosure	Disclosure always required
13	Cash and Cash Equivalents Components		Level3TextBlock / Level4Detail	ROLL UP	True	True	CONSISTENT	Cash and Cash Equivalents	Cash and Cash Equivalents	Line item exists, then disclosure required	Required because line item gaap:CashAndCashEquivalentsAt...

All reporting checklist rules should be defined in advance to the extent that such rules can be represented in machine-readable form.

Mathematical Relations Rules

While mathematical relations are implicitly included within the concept arrangement pattern relations; this method explicitly points out the need to provide information that both describes and can be used to verify basic mathematical relations within a report. More information is provided in the physical implementation model.

Type/subtype Relations Rules

Type/subtype[67] or type or "is-a" rules relate to the proper use of a concept relative to another concept. When the creator of a model can adjust the model, such rules enforce proper use of one concept relative to another concept or can be used to define the type of some new concept added by an economic entity creating a report.

For example, consider the balance sheet fragment below. The concept "Inventories" is clearly a current asset per the balance sheet that is shown below. Suppose an economic entity creating

[66] Combined disclosure mechanics and reporting checklist implemented by XBRL Cloud, http://xbrlsite.azurewebsites.net/2017/Prototypes/XASB/Disclosure%20Mechanics%20and%20Reporting%20Checklist.html

[67] Class/subclass relations is related to mereology which is the theory of parthood relations: of the relations of part to whole and the relations of part to part within a whole. Stanford Encyclopedia of Philosophy, https://plato.stanford.edu/entries/mereology/

a report inadvertently used the concept “Inventories” to represent a fact that was included within the set of Noncurrent assets.

That would be an improper use of the concept “Inventories” which is clearly a current asset to represent a noncurrent asset. Class/subclass relations prevent this sort of error from occurring by providing information about the allowed and perhaps disallowed relations between totals and the line items contributing to that subtotal.

Balance Sheet [Abstract]	Period [Axis]	
	2018-12-31	2017-12-31
Balance Sheet [Abstract]		
Assets [Roll Up]		
Current Assets [Roll Up]		
Cash and Cash Equivalents	4,000	3,000
Accounts Receivable	2,000	1,000
Inventories	1,000	1,000
Current Assets	7,000	5,000
Noncurrent Assets [Roll Up]		
Property, Plant, and Equpment, Net	6,000	1,000
Noncurrent Assets	6,000	1,000
Assets	13,000	6,000

All type/subtype kind of relations should be represented within a representation of the model of the financial report.

Continuity Crosscheck Rules

Continuity cross check rules are defined generally for each reporting style and are used to avoid inconsistencies, contradictions, and other such mistakes within the set of facts that make up a financial report[68]. There are common patterns of errors. The following are some examples which show the types of errors that can occur[69]. For example,

- If no concept was explicitly reported for the line item “noncurrent assets” on the balance sheet, but then in a disclosure that fact was explicitly reported; but the fact

[68] High Quality Examples of Errors in XBRL-based Financial Reports, http://xbrl.squarespace.com/journal/2017/4/29/high-quality-examples-of-errors-in-xbrl-based-financial-repo.html
[69] Quarterly XBRL-based Public Company Financial Report Quality Measurement (December 2018), http://xbrl.squarespace.com/journal/2018/12/31/quarterly-xbrl-based-public-company-financial-report-quality.html

reported in the disclosure contradicted the derived balance sheet total for noncurrent asset using the rule “Assets = Current assets + Noncurrent assets”.

- If a fact was reported as negative but the fact should have been reported as positive.
- If two concepts were reversed, for example “Equity” (meaning total equity) and “Equity attributable to parent”.
- If the facts reported for “Net income (loss)”, “Net income (loss) attributable to parent”, and “Net income (loss) attributable to noncontrolling interest” do not properly reconcile to one another.

This screen shot provides a specific example. In the screen shot below you can see that the same value is reported for the line items “Net income (Loss) Attributable to Parent” and “Net Income (Loss)”. But this is logically impossible because a value was also reported for “Net Income (Loss) Attributable to Noncontrolling Interest”:

Net Income (Loss) Breakdown [Line Items]	Value
Net Income (Loss) [Roll Up]	
Net Income (Loss) Attributable to Parent	(22,792,952)
Net Income (Loss) Attributable to Noncontrolling Interest	6,813
Net Income (Loss)	(22,792,952)
Validation Results [Hierarchy]	
IS7	(6,813)

A complete set of consistency cross check rules should be provided for all possible models of all possible financial reports for all possible reporting styles of such reports.

Report Integrity

In addition to the importance of the integrity of each disclosure being correct; it is likewise important that the integrity of the report is correct across all disclosures. There should be no inconsistencies or contradictions or other such anomalies in reported information. Report integrity is the term used to express this notion.

A good example of report integrity is the summary information provided within a primary financial statement and the detailed information provided for that line item within the disclosure notes.

Consistency with Prior Reports

Prior to considering a report complete and correct, a report should be compared with prior reports prepared for an entity to make certain that the current report is created consistently with prior reports.

Below you see five reports of Microsoft with a comparison of the income statement of the five reports. You can see that each report is consistent with all other prior reports used to check the consistency of the current report to prior reports:

Component: (Network and Table)	
Network	001 - Unknown - **General Information**
Table	General Information [Table]

Reporting Entity [Axis]	0000789019 http://www.sec.gov/CIK				
	Period [Axis]				
General Information [Line Items]	2016-07-01/2016-12-31	2016-07-01/2016-09-30	2015-07-01/2016-06-30	2015-07-01/2016-03-31	2015-07-01/2015-12-31
General Information [Hierarchy]					
Entity Registrant Name	MICROSOFT CORPORATION	MICROSOFT CORPORATION	MICROSOFT CORPORATION	MICROSOFT CORPORATION	MICROSOFT CORPORATION
Entity Central Index Key	0000789019	0000789019	0000789019	0000789019	0000789019
Entity Filer Category	Large Accelerated Filer	Large Accelerated Filer	Large Accelerated Filer	Large Accelerated Filer	Large Accelerated Filer
Trading Symbol	MSFT	MSFT	MSFT	MSFT	MSFT
Fiscal Year End	--06-30	--06-30	--06-30	--06-30	--06-30
Fiscal Year Focus	2017	2017	2016	2016	2016
Fiscal Period Focus	Q2	Q1	FY	Q3	Q2
Document Type	10-Q	10-Q	10-K	10-Q	10-Q
Balance Sheet Date	2016-12-31	2016-09-30	2016-06-30	2016-03-31	2015-12-31

Component: (Network and Table)	
Network	701.7 - Unknown - **Income Statement, Multi Step, With Operating Income, Special 6**
Table	Income Statement, Single Step [Table]

Reporting Entity [Axis]	0000789019 http://www.sec.gov/CIK				
	Period [Axis]				
Income Statement [Line Items]	2016-07-01/2016-12-31	2016-07-01/2016-09-30	2015-07-01/2016-06-30	2015-07-01/2016-03-31	2015-07-01/2015-12-31
Net Income (Loss) [Roll Up]					
Income (Loss) from Continuing Operations After Tax					
Income (Loss) from Continuing Operations Before Tax					
Operating Income (Loss) [Roll Up]					
Gross Profit [Roll Up]					
Revenues	44,543,000,000	20,453,000,000	85,320,000,000	64,706,000,000	44,175,000,000
Cost of Revenue	17,745,000,000	7,844,000,000	32,780,000,000	24,801,000,000	17,079,000,000
Gross Profit	26,798,000,000	12,609,000,000	52,540,000,000	39,905,000,000	27,096,000,000
Operating Expenses	15,396,000,000	7,384,000,000	32,358,000,000	22,803,000,000	15,277,000,000
Operating Income (Loss)	11,402,000,000	5,225,000,000	20,182,000,000	17,102,000,000	11,819,000,000
Nonoperating Income (Loss) Plus Interest and Debt Expense Plus Income (Loss) from Equity Method Investments	286,000,000	100,000,000	(431,000,000)	(698,000,000)	(451,000,000)
Income (Loss) from Continuing Operations Before Tax	11,688,000,000	5,325,000,000	19,751,000,000	16,404,000,000	11,368,000,000
Income Tax Expense (Benefit)	1,798,000,000	635,000,000	2,953,000,000	2,728,000,000	1,750,000,000
Income (Loss) from Continuing Operations After Tax	9,890,000,000	4,690,000,000	16,798,000,000	13,676,000,000	9,618,000,000
Income (Loss) from Discontinued Operations, Net of Tax	0	0	0	0	0
Extraordinary Items of Income (Expense), Net of Tax	0	0	0	0	0
Net Income (Loss)	9,890,000,000	4,690,000,000	16,798,000,000	13,676,000,000	9,618,000,000

Consistency with Peer Reports

Prior to considering a report complete and correct, a report should be compared with the reports of peers to make certain that the current report is created consistently with peers with similar reports.

Below you see five reports of Microsoft and four of Microsoft's peers with a comparison of the income statement of the five reports. You can see that each report is consistent with all other peer reports used to check the consistency of the current report to peer reports:

Component: (Network and Table)					
Network	001 - Unknown - **General Information**				
Table	General Information [Table]				
Drop Filter Fields Here	Period [Axis]	Reporting Entity [Axis]			
	2016-07-31/2017-01-28	2016-09-25/2016-12-31	2016-07-01/2016-12-31	2016-04-01/2016-12-31	2015-11-28/2016-12-02
General Information [Line Items]	0000858877 http://www.sec.gov/CIK	0000320193 http://www.sec.gov/CIK	0000789019 http://www.sec.gov/CIK	0000880807 http://www.sec.gov/CIK	0000796343 http://www.sec.gov/CIK
General Information [Hierarchy]					
Entity Registrant Name	CISCO SYSTEMS, INC.	APPLE INC	MICROSOFT CORPORATION	AMERICAN SUPERCONDUC...	ADOBE SYSTEMS INC
Entity Central Index Key	0000858877	0000320193	0000789019	0000880807	0000796343
Entity Filer Category	Large Accelerated Filer	Large Accelerated Filer	Large Accelerated Filer	Accelerated Filer	Large Accelerated Filer
Trading Symbol	CSCO	AAPL	MSFT	AMSC	0
Fiscal Year End	--07-29	--09-30	--06-30	--03-31	--12-02
Fiscal Year Focus	2017	2017	2017	2016	2016
Fiscal Period Focus	Q2	Q1	Q2	Q3	FY
Document Type	10-Q	10-Q	10-Q	10-Q	10-K
Balance Sheet Date	2017-01-28	2016-12-31	2016-12-31	2016-12-31	2016-12-02

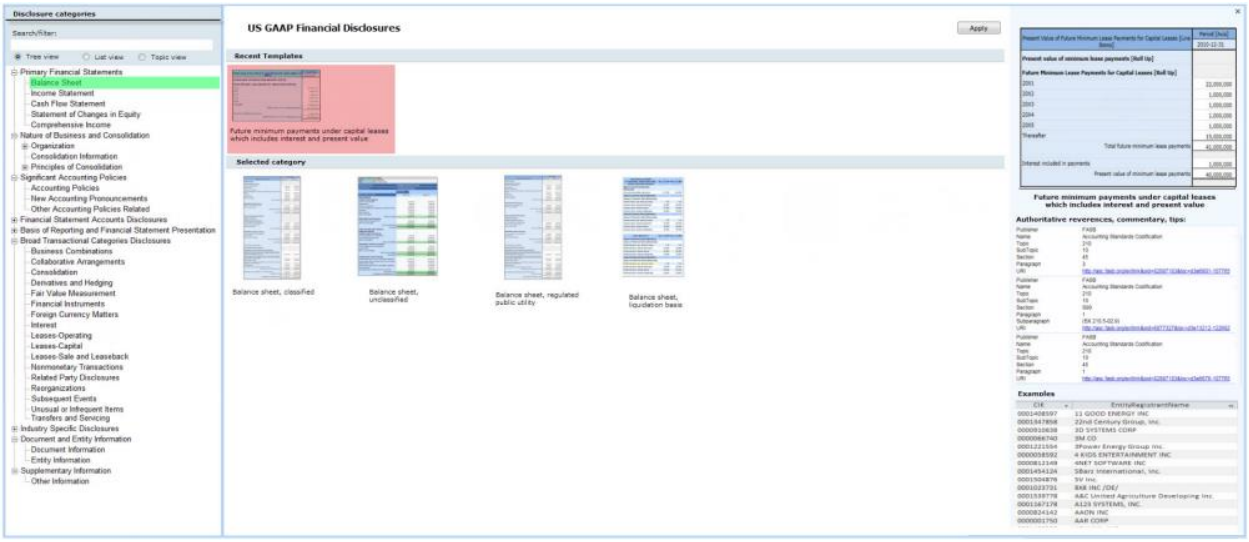
Component: (Network and Table)					
Network	201.7 - Unknown - **Income Statement, Multi Step, With Operating Income, Special 6**				
Table	Income Statement, Single Step [Table]				
Drop Filter Fields Here	Period [Axis]	Reporting Entity [Axis]			
	2016-07-31/2017-01-28	2016-09-25/2016-12-31	2016-07-01/2016-12-31	2016-04-01/2016-12-31	2015-11-28/2016-12-02
Income Statement [Line Items]	0000858877 http://www.sec.gov/CIK	0000320193 http://www.sec.gov/CIK	0000789019 http://www.sec.gov/CIK	0000880807 http://www.sec.gov/CIK	0000796343 http://www.sec.gov/CIK
Net Income (Loss) [Roll Up]					
Income (Loss) from Continuing Operations After Tax [Roll Up]					
Income (Loss) from Continuing Operations Before Tax [Roll Up]					
Operating Income (Loss) [Roll Up]					
Gross Profit [Roll Up]					
Revenues	23,932,000,000	78,351,000,000	44,543,000,000	59,000,000	5,854,430,000
Cost of Revenue	8,772,000,000	48,175,000,000	17,745,000,000	50,992,000	819,908,000
Gross Profit	15,160,000,000	30,176,000,000	26,798,000,000	8,008,000	5,034,522,000
Operating Expenses	9,390,000,000	6,817,000,000	15,396,000,000	28,562,000	3,540,920,000
Operating Income (Loss)	5,770,000,000	23,359,000,000	11,402,000,000	(20,554,000)	1,493,602,000
Nonoperating Income (Loss) Plus Interest and Debt Expense Plus Income (Loss) from Equity Method Investments	146,000,000	821,000,000	286,000,000	1,142,000	(58,464,000)
Income (Loss) from Continuing Operations Before Tax	5,916,000,000	24,180,000,000	11,688,000,000	(19,412,000)	1,435,138,000
Income Tax Expense (Benefit)	1,246,000,000	6,289,000,000	1,798,000,000	1,036,000	266,356,000
Income (Loss) from Continuing Operations After Tax	4,670,000,000	17,891,000,000	9,890,000,000	(20,448,000)	1,168,782,000
Income (Loss) from Discontinued Operations, Net of Tax	0	0	0	0	0
Extraordinary Items of Income (Expense), Net of Tax	0	0	0	0	0
Net Income (Loss)	4,670,000,000	17,891,000,000	9,890,000,000	(20,448,000)	1,168,782,000

Templates

A Template is an example of what a disclosure might look like when that disclosure is created within a financial report. Templates are useful when creating a disclosure which is new to a report.

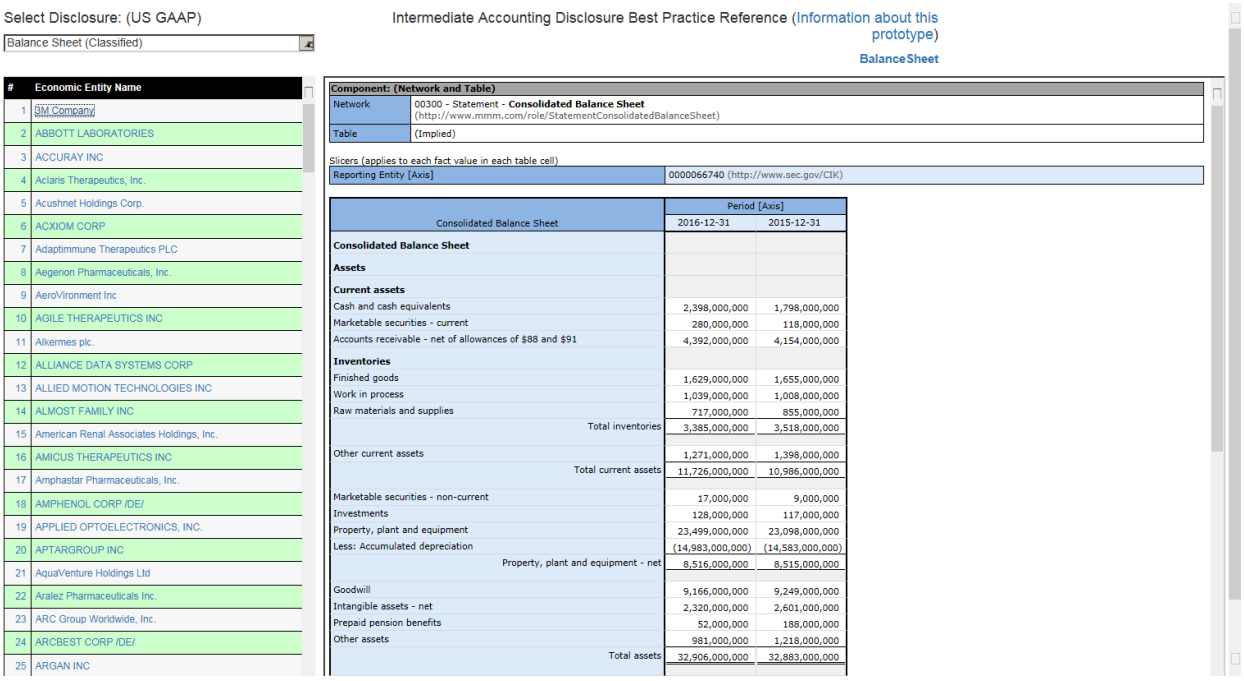
The following is a proof of concept template selector that provides an idea of the functionality of templates[70].

[70] Working Proof of Concept Template Selector, http://xbrl.squarespace.com/journal/2018/12/1/working-proof-of-concept-template-selector.html



Exemplars

An Exemplar is very similar to a Template except that an Exemplar is taken from some existing financial report that already contains that disclosure. Here is an example of Exemplars for Disclosures[71]:



Select Disclosure: (US GAAP)

Balance Sheet (Classified)

Intermediate Accounting Disclosure Best Practice Reference (Information about this prototype)

BalanceSheet

#	Economic Entity Name
1	3M Company
2	ABBOTT LABORATORIES
3	ACCURAY INC
4	Aclaris Therapeutics, Inc.
5	Acushnet Holdings Corp.
6	ACXIOM CORP
7	Adaptimmune Therapeutics PLC
8	Aegerion Pharmaceuticals, Inc.
9	AeroVironment Inc
10	AGILE THERAPEUTICS INC
11	Alkermes plc.
12	ALLIANCE DATA SYSTEMS CORP
13	ALLIED MOTION TECHNOLOGIES INC
14	ALMOST FAMILY INC
15	American Renal Associates Holdings, Inc.
16	AMICUS THERAPEUTICS INC
17	Amphastar Pharmaceuticals, Inc.
18	AMPHENOL CORP /DE/
19	APPLIED OPTOELECTRONICS, INC.
20	APTARGROUP INC
21	AquaVenture Holdings Ltd
22	Aralez Pharmaceuticals Inc.
23	ARC Group Worldwide, Inc.
24	ARCBEST CORP /DE/
25	ARGAN INC

Component: (Network and Table)

Network	00300 - Statement - **Consolidated Balance Sheet** (http://www.mmm.com/role/StatementConsolidatedBalanceSheet)
Table	(Implied)

Slicers (applies to each fact value in each table cell)

Reporting Entity [Axis]	0000066740 (http://www.sec.gov/CIK)

Consolidated Balance Sheet	Period [Axis] 2016-12-31	2015-12-31
Consolidated Balance Sheet		
Assets		
Current assets		
Cash and cash equivalents	2,398,000,000	1,798,000,000
Marketable securities - current	280,000,000	118,000,000
Accounts receivable - net of allowances of $88 and $91	4,392,000,000	4,154,000,000
Inventories		
Finished goods	1,629,000,000	1,655,000,000
Work in process	1,039,000,000	1,008,000,000
Raw materials and supplies	717,000,000	855,000,000
Total inventories	3,385,000,000	3,518,000,000
Other current assets	1,271,000,000	1,398,000,000
Total current assets	11,726,000,000	10,986,000,000
Marketable securities - non-current	17,000,000	9,000,000
Investments	128,000,000	117,000,000
Property, plant and equipment	23,499,000,000	23,098,000,000
Less: Accumulated depreciation	(14,983,000,000)	(14,583,000,000)
Property, plant and equipment - net	8,516,000,000	8,515,000,000
Goodwill	9,166,000,000	9,249,000,000
Intangible assets - net	2,320,000,000	2,601,000,000
Prepaid pension benefits	52,000,000	188,000,000
Other assets	981,000,000	1,218,000,000
Total assets	32,906,000,000	32,883,000,000

[71] Disclosure Best Practices, http://xbrlsite-app.azurewebsites.net/DisclosureBestPractices/DisclosureBestPractices.aspx?DisclosureName=BalanceSheet

Physical Implementation Model

This section of the document explains how the logical model is implemented using the XBRL technical syntax. This section provides those details and points to specific examples which can be used to learn this method. The following two resources provide very detailed information related to this physical implementation and is supported by two different software vendors. A web-based version of files is provided as well as a ZIP archive which can be downloaded and examined.

Web-based files:

http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/xasb/taxonomy/company-instance.xml

All files local:

http://xbrlsite.azurewebsites.net/2018/Library/XASB-DynamicRulesLoading-AllFilesLocal-2018-10-19.zip

XBRL Technical Syntax

This method is physically implemented using the XBRL technical syntax. The method is compliant with the XBRL 2.1[72], Inline XBRL[73], XBRL Dimensions 1.0[74], XBRL Formula 1.0[75], and Generic Links 1.0[76] specifications. The method follows the spirit of the XBRL Abstract Model 2.0[77] public working draft and the Open Information Model 1.0[78] candidate recommendation.

Profiles

This method of implementing the XBRL technical syntax uses the *Accounting Process Automation XBRL Application Profile*[79] and the *Open Source Framework for Implementing XBRL-*

[72] XBRL International, *Extensible Business Reporting Language (XBRL)*, http://www.xbrl.org/Specification/XBRL-2.1/REC-2003-12-31/XBRL-2.1-REC-2003-12-31+corrected-errata-2013-02-20.html
[73] XBRL International, *Inline XBRL*, https://specifications.xbrl.org/spec-group-index-inline-xbrl.html
[74] XBRL International, *XBRL Dimensions 1.0*, http://www.xbrl.org/specification/dimensions/rec-2012-01-25/dimensions-rec-2006-09-18+corrected-errata-2012-01-25-clean.html
[75] XBRL International, *XBRL Formula 1.0*, https://specifications.xbrl.org/work-product-index-formula-formula-1.0.html
[76] XBRL International, *Generic Links*, https://specifications.xbrl.org/spec-group-index-generic-links.html
[77] XBRL International, *XBRL Abstract Model 2.0*, Public Working Draft 06 June 2012, http://www.xbrl.org/specification/abstractmodel-primary/pwd-2012-06-06/abstractmodel-primary-pwd-2012-06-06.html
[78] XBRL International, *Open Information Model 1.0*, Candidate Recommendation 02 May 2017, http://www.xbrl.org/Specification/oim/CR-2017-05-02/oim-CR-2017-05-02.html
[79] Charles Hoffman, CPA, et. al., *Accounting Process Automation XBRL Application Profile*, http://xbrlsite.azurewebsites.net/2018/AccountingProcessAutomation/AccountingProcessAutomationProfile-2018-10-30.pdf

based Digital Financial Reporting[80]. The intension is to make this method of implementing XBRL consistent with the U.S. Securities and Exchange Commission, the European Single Market Authority, and other implementations of XBRL related to financial reporting but still use best practice methods. The intent is to leverage the best practices of other financial reporting profiles[81] and avoid problem areas of such implementations.

Any **system specific restrictions** of the XBRL technical syntax are implemented using profiles to segregate such system specific restrictions. Examples of system specific restrictions include the *Edgar Filer Manual* (EFM) used for submission of XBRL-based financial reports to the U.S. Securities and Exchange Commission and the *European Single Electronic Format* (ESEF) which is used for XBRL-based financial reports submitted to the European Single Market Authority (ESMA).

Business Report Meta-Meta Model

The business report meta-meta model is defined in the logical model section of this document. The physical implementation of this model is mapped to this business report meta-meta model which is the same for any implementation.

Categories of Report Elements

The following are the terms used by this method of when implementing this physical model within software:

- **Network/Group**: 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. Other terms used to describe a network are "group" and "base set". A Network/Group essentially breaks a report into fragments.
- **Hypercube/Table**: A Table is the same thing that XBRL calls a hypercube. A Table/Hypercube simply groups some set of Axes, Members, Line Items, Abstracts, and Concepts together into a logical structure. Again, because Table's are used inconsistently by creating XBRL taxonomies, they really have no meaning by themselves. Tables/Hypercubes are essentially another way to break a report into smaller fragments.
- **Dimension/Axis**: An Axis, or what XBRL calls a dimension and XBRL Formula calls an aspect, is one approach to representing a Characteristic. Entity and period core dimensions that are always required. Those creating XBRL taxonomies can create additional non-core dimensions.

[80] Charles Hoffman, CPA, et. al., *Open Source Framework for Implementing XBRL-based Digital Financial Reporting*, http://xbrlsite.azurewebsites.net/2018/Library/OpenSourceFrameworkForImplementingXBRLBasedFinancialReporting-2018-12-05.pdf

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

- **Member**: A Member is a possible value of a Characteristic.
- **Primary Items/Line Items**: A Line Items, or Primary Items as called by the XBRL Dimensions specification, is in essence a special type of Dimension/Axis which specifies a data type, period type, and optionally a balance type. Line Items/Primary Items are Characteristics.
- **Abstract**: An Abstract is simply used to organize Line Items/Primary Items; they provide no real meaning. When used, Abstracts can make a model easier to understand.
- **Concept**: A Concept is in essence a type of Member. You can think of a Concept as a value for the Line Items Characteristic. A Concept is special in that it can be used to represent a Fact Value.
- **Fact**: A Fact is a fact value plus all supporting Characteristics which describes the fact. Numeric facts have the additional properties of rounding and units. Optionally, a fact can be associated with one to many parenthetical explanations.
- **Parenthetical explanation**: A parenthetical explanation (implementation of an XBRL Footnote) is a property of a fact which provides additional descriptive information about the fact. Basically, a parenthetical explanation is a comment that you add to a Fact.
- **Report**: A report is the combination of an XBRL instance plus the XBRL taxonomy schema and all linkbases which describe and can be used to verify the logic, mathematics, structure, mechanics, and other such information within the report.
- **Block**: A block[82] is a part of a fragment that participates in the same concept arrangement pattern. A Block 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. Simply think about a block as a useful fragment used for referencing a fragment of a financial report.

Model Structure Relations

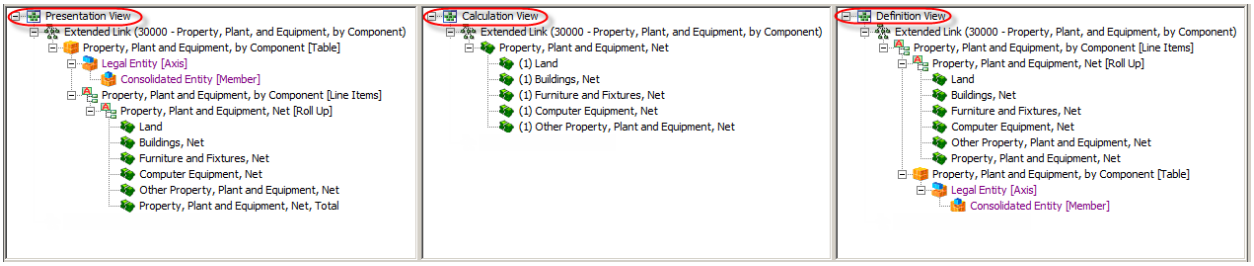
Report element categories MUST be related in specific ways. One report element category can only be related to another report element category in very specific ways when represented in XBRL presentation relations. Note that XBRL definition relations are more restrictive than XBRL presentation relations. The same is true with XBRL calculation relations. The intent of this rule is to minimize ambiguity and maximize consistency with XBRL definition relations; particularly XBRL Dimensions relations expressed using XBRL definition relations.

The following matrix articulates the allowed and disallowed relations between the different categories of report elements. This is a restrictive relations model, this model is encouraged.

[82] *Understanding Block Semantics*, http://xbrlsite.azurewebsites.net/2017/IntelligentDigitalFinancialReporting/UnderstandingBlockSemantics.pdf

		Restrictive model (Meets EFM filing rules, but less ambigous)						
		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	Disallowed	Disallowed
	Concept	Disallowed	Disallowed	Disallowed	Disallowed	OK	OK	Disallowed

These relations rules can be implemented using XBRL definition relations[83]. Model structure relations have to do with XBRL presentation relations.



Reporting Styles

Reporting styles are used to adjust for the variability allowed by a financial report. The example implementation provides only one reporting style[84]. The XBRL-based reporting for US GAAP to the SEC provides a better example of reporting styles[85].

While the US GAAP and XASB implementations of reporting styles uses a set of codes which identify the reporting style of a report, an automated process for using reporting styles is possible.

The US GAAP implementation of reporting styles[86] provides a web service[87] which provides the reporting style for a specific economic entity. Each reporting style provides:

[83] Model structure rules, machine readable, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/xasb/model-structure/ModelStructure-rules-xasb-def.xml
[84] XASB reporting styles, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/xasb/fac/Documentation/rss.xml
[85] US GAAP reporting styles, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/us-gaap/fac/Documentation/rss.xml
[86] US GAAP reporting styles, http://xbrlsite-app.azurewebsites.net/ReportFrameCodeService/ListCIKToReportFrameCodeMapping.aspx?ReportFrameCode=COMID-BSC-CF1-ISM-IEMIB-OILY-SPEC6
[87] US GAAP reporting styles web service, http://xbrlsite-app.azurewebsites.net/ReportFrameCodeService/GetReportFrameCodeForCIK.aspx?CIK=0001084869

- An XBRL taxonomy schema which is used to provide the list of fundamental accounting concepts and link information for a reporting style together.
- Mapping relations which indicates which base taxonomy concept could be used to represent a fundamental accounting concept.
- Presentation, calculation, and definition relations that define human-readable relations for a reporting style and rendering information when software generates human-readable output.
- XBRL Formulas impute rules for deriving fundamental accounting concept information when such a concept is not explicitly reported.
- XBRL Formula consistency check rules that actually perform the testing of the fundamental accounting concept relations for a reporting style.

A number of working proof of concept Excel-based extraction tools can be helpful in understanding how reporting styles are used[88].

Concept Arrangement Patterns

Each XBRL-based report can be broken down into some set of fragments. Each fragment can be further broken down into Blocks which is a set of [Line Items] that share the same concept arrangement pattern within the same Network and Table. The following is a summary of common concept arrangement patterns.

Text Block[89]

The most common form of Block is the Text Block which makes up over half of the reported facts within an XBRL instance. This is a Text Block:

Statement [Line Items]	Period [Axis]: 2016-07-01 - 2017-06-30
Components of Inventories	The components of inventories were as follows: (In millions)

June 30,	2017	2016
Raw materials	$ 797	$ 612
Work in process	145	158
Finished goods	1,239	1,481
Total	$ 2,181	$ 2,251

There are three categories of Text Blocks: Level 1 Note Text Block, Level 2 Policy Text Block, and Level 3 Disclosure Text Block. All Text Blocks are similar in that they contain prose, essentially formatted text[90].

[88] Further Updated and Expanded XBRL-based Financial Report Extraction Tools, http://xbrl.squarespace.com/journal/2018/1/11/further-updated-and-expanded-xbrl-based-financial-report-ext.html

[89] Level 3 Disclosure Text Block, Microsoft, http://www.xbrlsite.com/2017/Prototypes/Microsoft/evidence-package/#Rendering-DisclosureINVENTORIESTables-us_gaap_StatementTable.html

Essentially, a Text Block or any kind is a Block that has exactly one concept, the Text Block concept.

Hierarchy or Set[91]

The Hierarchy[92] or Set is simply some set of one to many concepts, other than Text Blocks, that conveys information that goes together for some reason or other.

Statement [Line Items]	Period [Axis]		
	2016-07-01 - 2017-06-30	2017-07-31	2016-12-31
Document Type	10-K		
Amendment Flag	false		
Document Period End Date	2017-06-30		
Document Fiscal Year Focus	2017		
Document Fiscal Period Focus	FY		
Trading Symbol	MSFT		
Entity Registrant Name	MICROSOFT CORPORATION		
Entity Central Index Key	0000789019		
Current Fiscal Year End Date	--06-30		
Entity Well-known Seasoned Issuer	Yes		
Entity Current Reporting Status	Yes		
Entity Voluntary Filers	No		
Entity Filer Category	Large Accelerated Filer		
Entity Common Stock, Par Value Per Share	0.00000625		
Entity Common Stock, Shares Outstanding		7,702,243,979	
Entity Public Float			466,500,000,000
I.R.S. Employer Identification No.	911144442		

Roll Up[93]

The Roll Up is similar to a Set in that it is a set of concepts. What makes a roll up different is that the Set of concepts participates within a roll up relation that is represented by XBRL calculations relations.

Inventory [Line Items]	Period [Axis]	
	2017-06-30	2016-06-30
Raw materials	797,000,000	612,000,000
Work in process	145,000,000	158,000,000
Finished goods	1,239,000,000	1,481,000,000
Total	2,181,000,000	2,251,000,000

[90] Text Blocks in reports submitted to the SEC are a specifically prescribed form of escaped HTML.

[91] Hierarchy or Set, Microsoft, http://www.xbrlsite.com/2017/Prototypes/Microsoft/evidence-package/#Rendering-DocumentDocumentAndEntityInformation-us_gaap_StatementTable.html

[92] I don't like the term "Hierarchy", because essentially all of the Block patterns are hierarchies of some sort. The term "Set" is a better term. But, there is a lot of legacy information that uses the term Hierarchy. So, the term Set and Hierarchy are basically interchangeable and mean the same thing.

[93] Roll up, Microsoft, http://www.xbrlsite.com/2017/Prototypes/Microsoft/evidence-package/#Rendering-DisclosureComponentsOfInventoriesDetail-us_gaap_InventoryCurrentTable.html

A roll up always has exactly one total. A roll up always has XBRL calculation relations. A roll up always has numeric concepts that are of the same period type (i.e. either all instant or all duration). A roll up could aggregate a set of stocks (i.e. balance sheet accounts) or a set of flows (i.e. income statement, net cash flow, etc.).

Roll Up, Nested[94]

A nested roll up is exactly the same as a roll up except that the roll up includes one or more subtotals.

Property, Plant and Equipment [Line Items]	Period [Axis]	
	2016-06-30	2015-06-30
Land	824,000,000	769,000,000
Buildings and improvements	12,393,000,000	10,800,000,000
Leasehold improvements	3,659,000,000	3,577,000,000
Computer equipment and software	17,391,000,000	13,612,000,000
Furniture and equipment	3,889,000,000	3,579,000,000
Total, at cost	38,156,000,000	32,337,000,000
Accumulated depreciation	(19,800,000,000)	(17,606,000,000)
Total, net	18,356,000,000	14,731,000,000

Roll Forward[95]

A roll forward seems similar to a roll up, however they are not the same. A roll forward represents the flows between a stock at two different calendar periods in time. The formula is: Beginning balance + Changes = Ending Balance.

Income Tax Contingency [Line Items]	Period [Axis]		
	2016-07-01 - 2017-06-30	2015-07-01 - 2016-06-30	2014-07-01 - 2015-06-30
Balance, beginning of year	10,164,000,000	9,599,000,000	8,714,000,000
Decreases related to settlements	(4,000,000)	(201,000,000)	(50,000,000)
Increases for tax positions related to the current year	1,277,000,000	1,086,000,000	1,091,000,000
Increases for tax positions related to prior years	397,000,000	115,000,000	94,000,000
Decreases for tax positions related to prior years	(49,000,000)	(317,000,000)	(144,000,000)
Decreases due to lapsed statutes of limitations	(48,000,000)	(118,000,000)	(106,000,000)
Balance, end of year	11,737,000,000	10,164,000,000	9,599,000,000

[94] Roll up, Nested, Microsoft, http://www.xbrlsite.com/2017/Prototypes/Microsoft/evidence-package/#Rendering-DisclosureComponentsOfPropertyAndEquipmentDetail-us_gaap_ScheduleOfPropertyPlantAndEquipmentTable.html

[95] Roll Forward, Microsoft, http://www.xbrlsite.com/2017/Prototypes/Microsoft/evidence-package/#Rendering-DisclosureChangesInUnrecognizedTaxBenefitsDetail-us_gaap_IncomeTaxContingencyTable.html

Roll forwards always have an instant concept with a period start preferred label role, the same instant concept at some future point in time with a period end preferred label role, and then some set of one to many changes. Another term for roll forward is “movements” or “movements analysis”.

Roll Forward Info[96]

A roll forward info might look similar to a roll forward, but there is a difference. A roll forward actually has a roll forward computation. A roll forward info has no roll forward computation, it only conveys information about a roll forward. A good example is the roll forward of shares for a share based payment award with supplemental information provided for the weighted average stock price for each flow.

Reporting Entity [Axis]	SAMP http://www.SampleCompany.com
Legal Entity [Axis]	Consolidated Entity [Member]
	Period [Axis]
Weighted Average Grant Date Fair Value [Line Items]	2010-01-01/2010-12-31
Weighted Average Grant Date Fair Value [Roll Forward Info]	
Nonvested Fair Value, Beginning Balance	32.72
Granted	41.51
Vested	30.92
Forfeited	35.93
Nonvested Failr Value, Ending Balance	36.92

Other Block Patterns

As mentioned, testing of the approximately 754,430 Blocks in the set of 5,734 public company financial reports that have been submitted to the SEC, 100% of those Blocks fit into this model. However, errors could exist in the model. The error that could be occurring is that there is some other identifiable pattern or patterns which are not listed in this set of identified Block patterns. The resolution to this error would simply be to add a new Block pattern or patterns.

This is not a matter of opinion, this is 100% provable using the evidence of the financial reports themselves. When the new Block patterns are added, then the model becomes 100% correct once again.

Member Arrangement Patterns

As stated, each XBRL-based report can be broken down into some set of fragments. Each fragment can be further broken down into Blocks which is a set of [Member]s of a [Dimension]

[96] Roll forward info, Microsoft, http://www.xbrlsite.com/2017/Prototypes/Microsoft/evidence-package/#Rendering-DisclosureStockPlanActivityDetail-us_gaap_ScheduleOfShareBasedCompensationArrangementsByShareBasedPaymentAwardTable.html

that share the same member arrangement pattern within the same Network and Table. The following is a summary of common member arrangement patterns.

Note that the logic of some member arrangement patterns are equivalent to that of concept arrangement patterns. For example, a member aggregation is logically equivalent to a roll up; only the syntax is different.

Member Aggregation[97]

A member aggregation is exactly the same logically as a roll up. However, a member aggregation is different than a roll up in that the syntax used to represent the roll up is different. In a roll up, the line items being rolled up are a set of concepts. In a member aggregation, however, there is one concept that is used to represent all of the members and members are differentiated from one another using an Axis.

	Period [Axis]									
	2017-06-30					2016-06-30				
	Statement, Geographical					Statement, Geographical				
Certain Long-Lived Assets by Geography [Line Items]	United States	Ireland	Luxembourg	Other Countries	Geographical [Domain]	United States	Ireland	Luxembourg	Other Countries	Geographical [Domain]
Long-lived assets	39,118,000,000	12,876,000,000	6,845,000,000	10,123,000,000	68,962,000,000	22,819,000,000	2,078,000,000	6,854,000,000	8,210,000,000	39,961,000,000

Roll Up + Member Aggregation[98]

A roll up can be combined with a member aggregation which then has the roll up + member aggregation pattern as is shown here:

	Period [Axis]									
	2016-12-31					2015-12-31				
	Property, Plant and Equipment, Type [Axis]					Property, Plant and Equipment, Type [Axis]				
Property, Plant and Equipment [Line Items]	Computer equipment	Technical equipment	Facilities	Capital projects in progress	Property, Plant and Equipment, Type [Domain]	Computer equipment	Technical equipment	Facilities	Capital projects in progress	Property, Plant and Equipment, Type [Domain]
Total property and equipment	2,270,000	2,427,000	3,387,000	1,010,000	9,094,000	1,877,000	1,806,000	1,772,000	2,183,000	7,638,000
Accumulated depreciation - other					(4,836,000)					(2,622,000)
Net property and equipment					4,258,000					5,016,000

Roll Forward + Member Aggregation[99]

A roll forward can likewise be combined with a member aggregation which then has a roll forward + member aggregation pattern which is shown here:

---

[97] Member aggregation, Microsoft, http://www.xbrlsite.com/2017/Prototypes/Microsoft/evidence-package/#Rendering-DisclosureLongLivedAssetsExcludingFinancialInstrumentsAndTaxAssetsClassifiedByLocationOfControllingStatutoryCompanyDetail-msft_CertainLongLivedAssetsByGeographyTable.html

[98] Roll up + Member aggregation, comparison, http://www.xbrlsite.com/site1/2017/Prototypes/DisclosureAnalysis/All/Index_1271_Consistent.html

[99] Roll forward + member aggregation, comparison, http://www.xbrlsite.com/site1/2017/Prototypes/DisclosureAnalysis/All/Index_225_Consistent.html

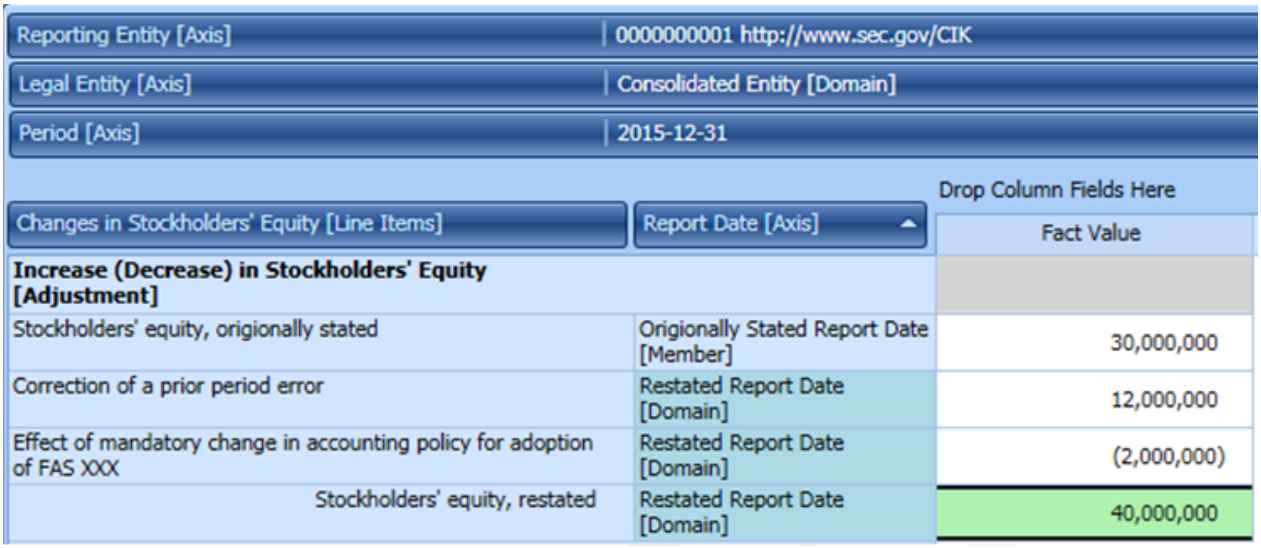
Component: (Network and Table)

Network	100800 - Disclosure - **Carrying Amount of Goodwill (Detail)**
Table	Schedule of Goodwill [Table]
Reporting Entity [Axis]	0000789019 http://www.sec.gov/CIK
Legal Entity [Axis]	Entity [Domain]
Period [Axis]	Statement Business Segmen...

Goodwill [Line Items]	2016-07-01/2017-06-30				2015-07-01/2016-06-30			
	Productivity and Business Processes	Intelligent Cloud	More Personal Computing	Segments [Domain]	Productivity and Business Processes	Intelligent Cloud	More Personal Computing	Segments [Domain]
Beginning Balance	6,678,000,000	5,467,000,000	5,727,000,000	17,872,000,000	6,309,000,000	4,917,000,000	5,713,000,000	16,939,000,000
Acquisitions	17,072,000,000 [1]	49,000,000	115,000,000	17,236,000,000	443,000,000	549,000,000	100,000,000	1,092,000,000
Other	(11,000,000)	39,000,000	(14,000,000)	14,000,000	(74,000,000)	1,000,000	(86,000,000)	(159,000,000)
Ending Balance	23,739,000,000	5,555,000,000	5,828,000,000	35,122,000,000	6,678,000,000	5,467,000,000	5,727,000,000	17,872,000,000

Adjustment + Member Aggregation[100]

An adjustment looks similar to a roll up or a roll forward, however, the logic of the mathematical computation is completely different. An adjustment has the formula logic: Originally stated balance + changes = Restated balance. The following shows an example.



Reporting Entity [Axis]	0000000001 http://www.sec.gov/CIK
Legal Entity [Axis]	Consolidated Entity [Domain]
Period [Axis]	2015-12-31

Changes in Stockholders' Equity [Line Items]	Report Date [Axis]	Drop Column Fields Here Fact Value
Increase (Decrease) in Stockholders' Equity [Adjustment]		
Stockholders' equity, origionally stated	Origionally Stated Report Date [Member]	30,000,000
Correction of a prior period error	Restated Report Date [Domain]	12,000,000
Effect of mandatory change in accounting policy for adoption of FAS XXX	Restated Report Date [Domain]	(2,000,000)
Stockholders' equity, restated	Restated Report Date [Domain]	40,000,000

Adjustments are relatively rare in financial reports. They can typically occur when there is a correction of an error or a change in equity related to an accounting policy change.

Set or Hierarchy + Variance[101]

A variance looks similar to a member aggregation, however the business logic is different. The formula logic for a variance is: Budgeted amount + Variance = Actual. There can be other members used besides budgeted; what is common is the use of a reporting scheme.

[100] Adjustment, XASB reference implementation, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/xasb/taxonomy/evidence-package/contents/index.html#Rendering-PriorPeriodAdjustments-gaap_StatementChangesInEquityPriorPeriodAdjustmentsTable.html

[101] Variance, XASB reference implementation, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/xasb/taxonomy/evidence-package/contents/index.html#Rendering-VarianceAnalysis-company_VarianceAnalysisGrossProfitTable.html

Reporting Entity [Axis]	SAMP http://www.SampleCompany.com		
Legal Entity [Axis]	Consolidated Entity [Member]		
Period [Axis]	2010-01-01/2010-12-31		
	Reporting Scenario [Axis]		
Variance Analysis [Line Items]	Budgeted [Member]	Variance [Member]	Actual [Member]
Variance Analysis [Hierarchy]			
Sales	5,000	1,000	6,000
Cost of Goods Sold	3,000	1,000	4,000
Contribution Margin	2,000	(1,000)	1,000
Distribution Costs	1,000	0	1,000

Hierarchy + Members But Without Aggregation[102]

Below you see a disclosure of payments to benefit plans. Members are used to distinguish one category of plans from another however there is no aggregation involved in the representation.

	Period [Axis]		
	2016-08-31		
	Defined Benefit Plans and Other Postretirement Benefit Plans [Axis]		
Defined Benefit Plan Disclosure [Line Items]	U.S. Plans	Non-U.S. Plans	Other Postretirement Benefit Plan [Member]
2017	46,881,000 [1]	44,537,000	10,259,000
2018	49,865,000 [1]	50,094,000	11,469,000
2019	53,277,000 [1]	55,964,000	12,598,000
2020	56,950,000 [1]	66,225,000	13,942,000
2021	61,361,000 [1]	75,166,000	15,830,000
2022-2026	373,921,000 [1]	416,507,000	110,756,000

Disclosures

A Disclosure is a set of financial or nonfinancial facts that is disclosed. Each fragment of a financial report represents some disclosure. Each Disclosure can be named and provided within an XBRL taxonomy schema which defines each named Disclosure. Naming each disclosure provides benefits in that a disclosure can be referenced in an XBRL taxonomy, when querying information from within an XBRL instance, etc. If names are not provided for each Disclosure, than Disclosures cannot be directly referred to.

A Disclosure is defined using an XBRL taxonomy schema and is defined by having a type attribute with the value set to “disclosures:disclosureItemType”.

Machine readable example[103]:

[102] Hierarchy + Members but without aggregation, comparison, http://www.xbrlsite.com/site1/2017/Prototypes/DisclosureAnalysis/All/Index_285_Consistent.html

[103] Disclosures, machine readable, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/xasb/disclosures/disclosures.xsd

```
<element id="disclosures_AdditionalPaidInCapitalChanges"
    type="disclosures:disclosureItemType" name="AdditionalPaidInCapitalChanges"
    abstract="true" xbrli:periodType="duration" substitutionGroup="xbrli:item"/>
<element id="disclosures_AssetsRollUp" type="disclosures:disclosureItemType"
```

Human readable example[104]:

5	Assets [Roll Up]	Abstract			disclosures:AssetsRollUp
6	Balance Sheet	Abstract			disclosures:BalanceSheet
7	Liabilities and Equity [Roll Up]	Abstract			disclosures:LiabilitiesAndEquityRollUp

Topics

Topics are used to organize or sequence disclosures which could be numerous in volume, sometimes in the hundreds or even thousands.A Topic is a name under which a set of Disclosures that are grouped together for some specific reason can be organized. A topic is defined using an XBRL taxonomy schema and is defined by having a type attribute with the value set to “topics:topicItemType”.

Machine readable example[105]:

```
<element id="topics_AccountingPolicies" type="topics:topicItemType"
    name="AccountingPolicies" abstract="true" xbrli:periodType="duration"
    substitutionGroup="xbrli:item"/>
```

Human readable example[106]:

Topics

Line	Label	Object Class	Period Type	Balance	Report ElementName
1	Topics	Network			http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-schemes/xasb/topics/role/Topics
2	Financial Report	Abstract			topics:FinancialReport
3	Primary Financial Statements	Abstract			topics:PrimaryFinancialStatements
4	Balance Sheet	Abstract			topics:BalanceSheet
5	Income Statement	Abstract			topics:IncomeStatement

[104] Disclosures, human readable, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/xasb/disclosures/disclosures_ModelStructure.html

[105] Topics, machine readable, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/xasb/disclosures/topics.xsd

[106] Topics, human readable, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/xasb/disclosures/topics_modelstructure.html

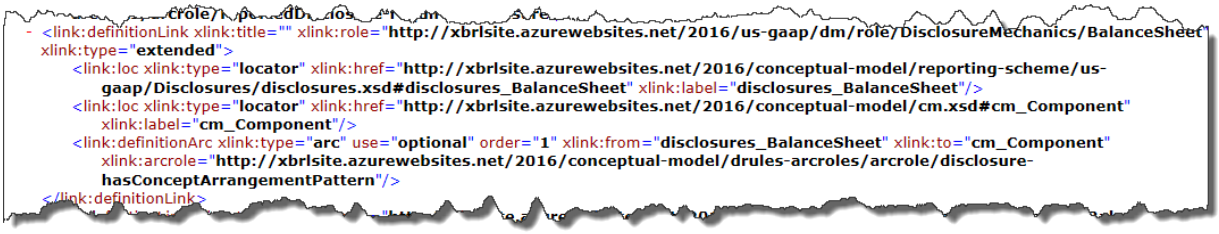
Disclosure Mechanics Rules

Disclosure mechanics rules enforce structural, mechanical, mathematical, logical, and some accounting type relations within a specific reported disclosure[107]. The disclosure mechanics rules is not a complete description of a disclosure, rather it is a description of the key stone or skeleton or wire frame of the characteristics of a disclosure.

For example, the disclosure “Inventory components” is always required to be a roll up, the total concept of the roll up is always to be “us-gaap:InventoryNet” or some alternative concept; if the inventory components is provided then an inventory policy is also expected to be found, etc.

A set of arcrole[108] is used to represent the relations which are used to represent the disclosure mechanics rules.

Machine readable example[109]:



```
- <link:definitionLink xlink:title="" xlink:role="http://xbrlsite.azurewebsites.net/2016/us-gaap/dm/role/DisclosureMechanics/BalanceSheet"
  xlink:type="extended">
      <link:loc xlink:type="locator" xlink:href="http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/us-
          gaap/Disclosures/disclosures.xsd#disclosures_BalanceSheet" xlink:label="disclosures_BalanceSheet"/>
      <link:loc xlink:type="locator" xlink:href="http://xbrlsite.azurewebsites.net/2016/conceptual-model/cm.xsd#cm_Component"
          xlink:label="cm_Component"/>
      <link:definitionArc xlink:type="arc" use="optional" order="1" xlink:from="disclosures_BalanceSheet" xlink:to="cm_Component"
          xlink:arcrole="http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/disclosure-
          hasConceptArrangementPattern"/>
  </link:definitionLink>
```

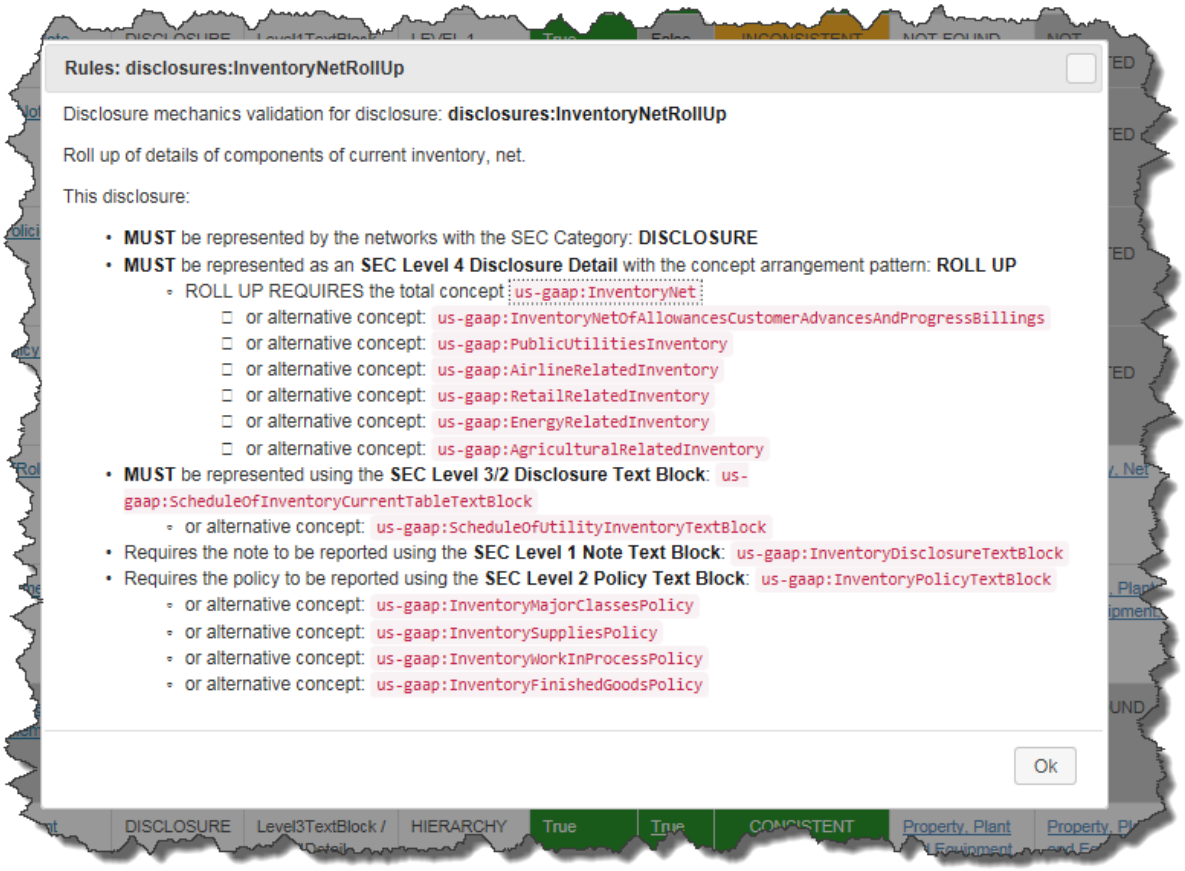

Human readable example[110]:

[107] Understanding Disclosure Mechanics, http://xbrlsite.azurewebsites.net/2016/Analysis/UnderstandingDisclosureMechanics.pdf

[108] Disclosure mechanics arcroles, http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles.xsd

[109] Disclosure mechanics, machine readable example, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/us-gaap/disclosure-mechanics/1-rules-def.xml

[110] Disclosure mechanics, human readable example, http://xbrlsite.azurewebsites.net/2017/Prototypes/Microsoft2017/Disclosure%20Mechanics%20and%20Reporting%20Checklist.html



Reporting Checklist Rules

Reporting checklist rules enforce statutory and regulatory reporting requirements as well as compliance and governance requirements to the extent that these reporting requirements can be automated.

A set of supported arcrole[111] is used to represent the relations which are used to represent the disclosure mechanics rules.

Machine readable example[112]:

[111] Disclosure mechanics arcroles, http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles.xsd

[112] Reporting checklist, machine readable, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/us-gaap/reporting-checklist/ReportingChecklist-us-gaap-strict-rules-def.xml

```
</link:definitionLink>
- <link:definitionLink xlink:title="Document information ALLOWS an alternative representation, document and
entity information." xlink:role="http://xbrlsite.azurewebsites.net/2016/us-gaap/rc/role/ReportingChecklist"
xlink:type="extended">
    <link:loc xlink:href="http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/us-
        gaap/Disclosures/disclosures.xsd#disclosures_DocumentInformation" xlink:type="locator"
        xlink:label="disclosures_DocumentInformation"/>
    <link:loc xlink:href="http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/us-
        gaap/Disclosures/disclosures.xsd#disclosures_DocumentAndEntityInformation" xlink:type="locator"
        xlink:label="disclosures_DocumentAndEntityInformation"/>
    <link:definitionArc xlink:type="arc" use="optional" order="3" xlink:from="disclosures_DocumentInformation"
        xlink:to="disclosures_DocumentAndEntityInformation"
        xlink:arcrole="http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-
        arcroles/arcrole/disclosure-allowedAlternativeDisclosure"/>
</link:definitionLink>
```

Human readable example[113]:

#	Disclosure	Category	Level	Pattern	Applicable	Found	Disclosure Consistent	Representation Concept [TEXT BLOCK]	Representation Concept [DETAIL]	Checklist Category	Reason
1	Document Information [Hierarchy]	DOCUMENT	Level4Detail	HIERARCHY	True	True	CONSISTENT	NOT-EXPECTED	Document Fiscal Period Focus	Required disclosure	Disclosure always required
2	Document and Entity Information [Hierarchy]	DOCUMENT	Level4Detail	HIERARCHY	False	True	CONSISTENT	NOT-EXPECTED	Entity Registrant Name	Alternative representation	Not necessary, satisfied by Document Information [Hierarchy] disclosure
3	Entity Information, by Legal Entity [Hierarchy]	DOCUMENT	Level4Detail	HIERARCHY	True	True	CONSISTENT	NOT-EXPECTED	Entity Registrant Name	Required disclosure	Disclosure always required
4	Document and Entity Information [Hierarchy]	DOCUMENT	Level4Detail	HIERARCHY	False	True	CONSISTENT	NOT-EXPECTED	Entity Registrant Name	Alternative representation	Not necessary, satisfied by Entity Information, by Legal Entity [Hierarchy] disclosure
5	Balance Sheet	STATEMENT	Level4Detail	COMPONENT	True	True	CONSISTENT	NOT-EXPECTED	NOT-EXPECTED	Required disclosure	Disclosure always required, satisfied by Assets [Roll Up] and Liabilities and Equity [Roll Up]

Mathematical Relations Rules

Mathematical relations rules relate to the correct computations of roll ups, roll forwards, adjustments, variances, member aggregations (a type of roll up), and other such mathematical computations.

Many regulators do not allow the submission of XBRL Formula relations within their allowed formats and not all regulators enforce the existence of XBRL calculation relations when roll ups are present. As such, this method requires that all mathematical relations to be supported by a set of machine-readable rules that describe and which can be used to verify such mathematical relations using XBRL calculation relations and XBRL Formula to the extent necessary to express all such relations.

Machine readable example[114]:

[113] Reporting checklist, human readable example, http://xbrlsite.azurewebsites.net/2017/Prototypes/Microsoft2017/Disclosure%20Mechanics%20and%20Reporting%20Checklist.html

[114] Mathematical relations, machine readable, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/xasb/taxonomy/gaap-formula.xml

```
- <generic:link xlink:role="http://xasb.org/gaap/role/schedule/level4/IncomeStatementSchedule"
  xlink:type="extended">
      <!-- Value ASSERTION -->
    <va:valueAssertion xlink:label="ASSERTION_IncomeStatementSchedule" xlink:type="resource"
      test="$VARIABLE_Total = ($VARIABLE_A - $VARIABLE_B - $VARIABLE_C - $VARIABLE_D +
      $VARIABLE_E - $VARIABLE_F - $VARIABLE_G - $VARIABLE_H + $VARIABLE_I)"
      implicitFiltering="true" aspectModel="dimensional" id="ASSERTION_GAAP_Complex_BB-
      Part-1_IncomeStatementSchedule"/>
      <!-- Arc from Assertion to Label -->
    <generic:arc xlink:type="arc" order="1.0" xlink:to="ASSERTION_Label"
      xlink:from="ASSERTION_IncomeStatementSchedule"
```

Human readable example[115]:

Income Tax Contingency [Line Items]	Period [Axis]		
	2016-07-01 - 2017-06-30	2015-07-01 - 2016-06-30	2014-07-01 - 2015-06-30
Balance, beginning of year	10,164,000,000	9,599,000,000	8,714,000,000
Decreases related to settlements	(4,000,000)	(201,000,000)	(50,000,000)
Increases for tax positions related to the current year	1,277,000,000	1,086,000,000	1,091,000,000
Increases for tax positions related to prior years	397,000,000	115,000,000	94,000,000
Decreases for tax positions related to prior years	(49,000,000)	(317,000,000)	(144,000,000)
Decreases due to lapsed statutes of limitations	(48,000,000)	(118,000,000)	(106,000,000)
Balance, end of year	11,737,000,000	10,164,000,000	9,599,000,000

Type/subtype Relations Rules

Class/subclass or type/subtype relations rules enforce explicitly allowed and explicitly disallowed relations between reported concepts. Type/class relations rules are not explicitly provided by most, if any, financial reporting taxonomies. However, calculation relations provide some capability to define classes or types of concepts in a hierarchy of relations. Because extension is allowed, these rules are used to detect the incorrect use of a concept relative to other concepts within a report. For example, a common error is the reporting of an indirect operating expense within a set of direct operating expenses. Type/class relations rules prevent and detect these common errors. Further, if financial reporting taxonomies do provide type/class relations; this framework requires the enforcement of these relations.

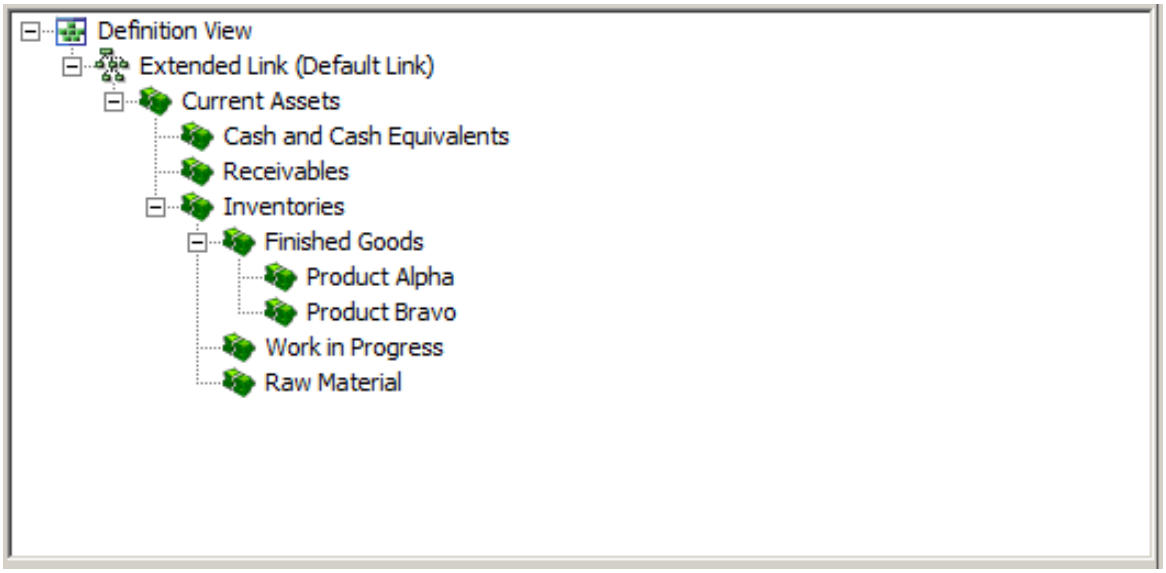
Machine readable example[116]:

[115] Mathematical relations, human readable, http://www.xbrlsite.com/2017/Prototypes/Microsoft/evidence-package/#Rendering-DisclosureChangesInUnrecognizedTaxBenefitsDetail-us_gaap_IncomeTaxContingencyTable.html

[116] Type/class relations rules, machine readable, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/xasb/type-class/TypeOrClassRelations-DisallowedRollUpRelations-xasb-rules-def.xml

```
<link:definitionLink xlink:title="Total Operating expenses DOES NOT INCLUDE Cost of Revenues"
xlink:role="http://www.xbrlsite.com/2016/Prototype/elr/TypeOrClassRelations/role/DisallowedRollUpRelations"
xlink:type="extended">
    <link:loc xlink:href="http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/xasb/fac/fac-
        xasb.xsd#fac-xasb_OperatingExpenses" xlink:type="locator" xlink:label="fac-xasb_OperatingExpenses"/>
    <link:loc xlink:href="http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/xasb/fac/fac-
        xasb.xsd#fac-xasb_CostOfRevenue" xlink:type="locator" xlink:label="fac-xasb_CostOfRevenue"/>
    <link:definitionArc xlink:arcrole="http://www.xbrlsite.com/2015/fro/us-
        gaap/xbrl/Ontology/rules/arcrole/summationConcept-disallowedItemConcept" xlink:type="arc" use="optional"
        order="1" xlink:from="fac-xasb_OperatingExpenses" xlink:to="fac-xasb_CostOfRevenue"/>
</link:definitionLink>
</link:linkbase>
```

Human readable example:



Consistency Crosscheck Rules

Consistency cross check rules are used to make sure there are no logical conflicts, contradictions, or other such anomalies exist within high-level reported facts in a financial report[117].

Common errors[118] include reversing the concepts equity attributable to parent and total equity; contradictory net income (loss), net income (loss) attributable to parent, and net income (loss) attributable to noncontrolling interest; reversing the polarity of a fact entering a positive as a negative or a negative as a positive fact.

If a reported fact in one area of a report contradicts, conflicts with, or is otherwise inconsistent with other reported fact then the financial report is illogical. For example, "Assets = Current assets + Noncurrent assets" is a universally applicable rule for a classified balance sheet.

[117] Quarterly XBRL-based Public Company Financial Report Quality Measurement (September 2018), http://xbrl.squarespace.com/journal/2018/9/29/quarterly-xbrl-based-public-company-financial-report-quality.html

[118] High Quality Examples of Errors in XBRL-based Financial Reports, http://xbrl.squarespace.com/journal/2017/4/29/high-quality-examples-of-errors-in-xbrl-based-financial-repo.html

Machine readable example[119]:

```
</link:documentation>
- <generic:link xlink:role="http://www.xbrl.org/2003/role/link" xlink:type="extended">
    <va:valueAssertion xlink:type="resource" xlink:label="ASSERTION" test="$Equity = ($EquityAttributableToParent +
      $EquityAttributableToNoncontrollingInterest)" implicitFiltering="true" aspectModel="dimensional"
      id="FAC_CONSISTENCY_1"/>
    <generic:arc xlink:type="arc" order="1.0" xlink:to="ASSERTION_Label" xlink:from="ASSERTION"
      xlink:arcrole="http://xbrl.org/arcrole/2008/element-label"/>
    <label:label xlink:role="http://www.xbrl.org/2008/role/label" xml:lang="en" xlink:type="resource"
```

Human readable example[120]:

Comprehensive Income (Loss) [Roll Up]		
Net Income (Loss) Attributable to Parent	97,905,000	fac:NetIncomeLossAttributableToParent[us-gaap:NetIncomeLoss [97,905,000]]
Other Comprehensive Income (Loss)	79,000	fac:OtherComprehensiveIncomeLoss[us-gaap:OtherComprehensiveIncomeLossNetOfTax[79,000]]
Comprehensive Income (Loss)	97,826,000	fac:ComprehensiveIncomeLoss[97,826,000] = fac:ComprehensiveIncomeLossAttributableToParent[us-gaap:ComprehensiveIncomeNetOfTax[97,826,000]]
Validation Results [Hierarchy]		
IS10	(158,000)	fac:ComprehensiveIncomeLoss[97,826,000] = (fac:NetIncomeLossAttributableToParent[us-gaap:NetIncomeLoss [97,905,000]] + fac:OtherComprehensiveIncomeLoss[us-gaap:OtherComprehensiveIncomeLossNetOfTax[79,000]])

Report Integrity

Not only does each disclosure within a report need to be correct; each disclosure relative to other disclosures within a report likewise needs to be correct. Consider this inventory disclosure which should tie to the balance sheet:

Component: (Network and Table)

Network	JG - Schedule - **Inventory, by Component**
Table	Inventory, by Component [Table]

Reporting Entity [Axis]	1234567890 http://regulator.gov/id
Reporting Scenario [Axis]	Actual [Member]
Report Date [Axis]	Reported as of March 18, 2011 [Member]
Legal Entity [Axis]	Consolidated Entity [Member]
Unit [Axis]	USD

Period [Axis]

Inventory, by Component [Line Items]	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

Report Element Properties

Properties | Labels | References | Occurrences | To Do

Fragments containing: Inventory

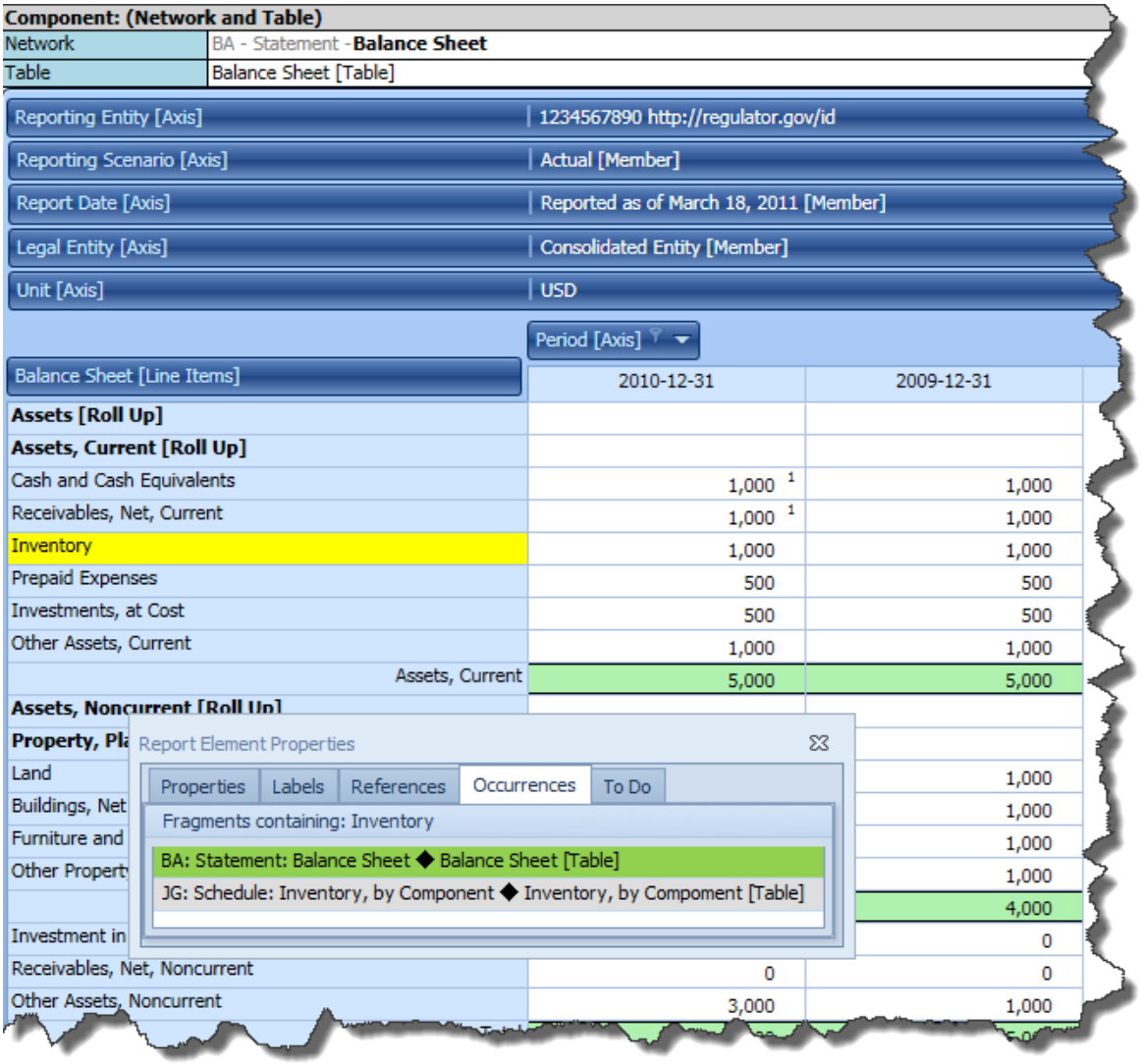
BA: Statement: Balance Sheet ◆ Balance Sheet [Table]

JG: Schedule: Inventory, by Component ◆ Inventory, by Component [Table]

[119] Consistency cross check rules, machine readable, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/us-gaap/fac/ReportingStyles/COMID-BSC-CF1-ISM-IEMIB-OILY-SPEC6_schema.xsd

[120] In this example the fact value for the line item "Other Comprehensive Income (Loss)" was entered as a positive but should have been entered as a negative as can be seen by the fact that the amount of the error is exactly twice the amount of the reported fact value.

And here is the balance sheet. You can see by the two entries in the "Occurrences" window of the application that somehow those two disclosures are connected.



Component: (Network and Table)	
Network	BA - Statement - **Balance Sheet**
Table	Balance Sheet [Table]

Reporting Entity [Axis]	1234567890 http://regulator.gov/id
Reporting Scenario [Axis]	Actual [Member]
Report Date [Axis]	Reported as of March 18, 2011 [Member]
Legal Entity [Axis]	Consolidated Entity [Member]
Unit [Axis]	USD

Balance Sheet [Line Items]	Period [Axis] 2010-12-31	2009-12-31
Assets [Roll Up]		
Assets, Current [Roll Up]		
Cash and Cash Equivalents	1,000 [1]	1,000
Receivables, Net, Current	1,000 [1]	1,000
Inventory	1,000	1,000
Prepaid Expenses	500	500
Investments, at Cost	500	500
Other Assets, Current	1,000	1,000
Assets, Current	5,000	5,000
Assets, Noncurrent [Roll Up]		
Property, Pl		
Land		1,000
Buildings, Net		1,000
Furniture and		1,000
Other Propert		1,000
		4,000
Investment in		0
Receivables, Net, Noncurrent	0	0
Other Assets, Noncurrent	3,000	1,000

Report Element Properties

Properties | Labels | References | Occurrences | To Do

Fragments containing: Inventory

BA: Statement: Balance Sheet ◆ Balance Sheet [Table]

JG: Schedule: Inventory, by Component ◆ Inventory, by Compoment [Table]

The connection is the fact with the concept "Inventory". The functionality of the application helps determine whether disclosures which should be connected together are in fact connected together properly.

Consistency with Prior Reports

The reporting styles rules and continuity cross checks are used to test the consistency between prior reports.

Below you see five reports of Microsoft with a comparison of the income statement of the five reports driven by the reporting style and continuity cross checks. You can see that each report

is consistent with all other prior reports used to check the consistency of the current report to prior reports:

Component: (Network and Table)	
Network	001 - Unknown - **General Information**
Table	General Information [Table]

Reporting Entity [Axis]	0000789019 http://www.sec.gov/CIK				
	Period [Axis]				
General Information [Line Items]	2016-07-01/2016-12-31	2016-07-01/2016-09-30	2015-07-01/2016-06-30	2015-07-01/2016-03-31	2015-07-01/2015-12-31
General Information [Hierarchy]					
Entity Registrant Name	MICROSOFT CORPORATION	MICROSOFT CORPORATION	MICROSOFT CORPORATION	MICROSOFT CORPORATION	MICROSOFT CORPORATION
Entity Central Index Key	0000789019	0000789019	0000789019	0000789019	0000789019
Entity Filer Category	Large Accelerated Filer	Large Accelerated Filer	Large Accelerated Filer	Large Accelerated Filer	Large Accelerated Filer
Trading Symbol	MSFT	MSFT	MSFT	MSFT	MSFT
Fiscal Year End	--06-30	--06-30	--06-30	--06-30	--06-30
Fiscal Year Focus	2017	2017	2016	2016	2016
Fiscal Period Focus	Q2	Q1	FY	Q3	Q2
Document Type	10-Q	10-Q	10-K	10-Q	10-Q
Balance Sheet Date	2016-12-31	2016-09-30	2016-06-30	2016-03-31	2015-12-31

Component: (Network and Table)	
Network	201.7 - Unknown - **Income Statement, Multi Step, With Operating Income, Special 6**
Table	Income Statement, Single Step [Table]

Reporting Entity [Axis]	0000789019 http://www.sec.gov/CIK				
	Period [Axis]				
Income Statement [Line Items]	2016-07-01/2016-12-31	2016-07-01/2016-09-30	2015-07-01/2016-06-30	2015-07-01/2016-03-31	2015-07-01/2015-12-31
Net Income (Loss) [Roll Up]					
Income (Loss) from Continuing Operations After Tax					
Income (Loss) from Continuing Operations Before Tax					
Operating Income (Loss) [Roll Up]					
Gross Profit [Roll Up]					
Revenues	44,543,000,000	20,453,000,000	85,320,000,000	64,706,000,000	44,175,000,000
Cost of Revenue	17,745,000,000	7,844,000,000	32,780,000,000	24,801,000,000	17,079,000,000
Gross Profit	26,798,000,000	12,609,000,000	52,540,000,000	39,905,000,000	27,096,000,000
Operating Expenses	15,396,000,000	7,384,000,000	32,358,000,000	22,803,000,000	15,277,000,000
Operating Income (Loss)	11,402,000,000	5,225,000,000	20,182,000,000	17,102,000,000	11,819,000,000
Nonoperating Income (Loss) Plus Interest and Debt Expense Plus Income (Loss) from Equity Method Investments	286,000,000	100,000,000	(431,000,000)	(698,000,000)	(451,000,000)
Income (Loss) from Continuing Operations Before Tax	11,688,000,000	5,325,000,000	19,751,000,000	16,404,000,000	11,368,000,000
Income Tax Expense (Benefit)	1,798,000,000	635,000,000	2,953,000,000	2,728,000,000	1,750,000,000
Income (Loss) from Continuing Operations After Tax	9,890,000,000	4,690,000,000	16,798,000,000	13,676,000,000	9,618,000,000
Income (Loss) from Discontinued Operations, Net of Tax	0	0	0	0	0
Extraordinary Items of Income (Expense), Net of Tax	0	0	0	0	0
Net Income (Loss)	9,890,000,000	4,690,000,000	16,798,000,000	13,676,000,000	9,618,000,000

Consistency with Peer Reports

The reporting styles rules and continuity cross checks are used to test the consistency between peer reports.

Below you see five reports of Microsoft and four of Microsoft's peers with a comparison of the income statement of the five reports. You can see that each report is consistent with all other peer reports driven by the reporting style and continuity cross checks used to check the consistency of the current report to peer reports:

Component: (Network and Table)	
Network	201 - Unknown - **General Information**
Table	General Information [Table]

Drop Filter Fields Here

	Period [Axis]				
	2016-07-31/2017-01-28	2016-09-25/2016-12-31	2016-07-01/2016-12-31	2016-04-01/2016-12-31	2015-11-28/2016-12-02
General Information [Line Items]	0000858877 http://www.sec.gov/CIK	0000320193 http://www.sec.gov/CIK	0000789019 http://www.sec.gov/CIK	0000880807 http://www.sec.gov/CIK	0000796343 http://www.sec.gov/CIK
General Information [Hierarchy]					
Entity Registrant Name	CISCO SYSTEMS, INC.	APPLE INC	MICROSOFT CORPORATION	AMERICAN SUPERCONDUC...	ADOBE SYSTEMS INC
Entity Central Index Key	0000858877	0000320193	0000789019	0000880807	0000796343
Entity Filer Category	Large Accelerated Filer	Large Accelerated Filer	Large Accelerated Filer	Accelerated Filer	Large Accelerated Filer
Trading Symbol	CSCO	AAPL	MSFT	AMSC	0
Fiscal Year End	--07-29	--09-30	--06-30	--03-31	--12-02
Fiscal Year Focus	2017	2017	2017	2016	2016
Fiscal Period Focus	Q2	Q1	Q2	Q3	FY
Document Type	10-Q	10-Q	10-Q	10-Q	10-K
Balance Sheet Date	2017-01-28	2016-12-31	2016-12-31	2016-12-31	2016-12-02

Component: (Network and Table)	
Network	201.7 - Unknown - **Income Statement, Multi Step, With Operating Income, Special 6**
Table	Income Statement, Single Step [Table]

Drop Filter Fields Here

	Period [Axis]				
	2016-07-31/2017-01-28	2016-09-25/2016-12-31	2016-07-01/2016-12-31	2016-04-01/2016-12-31	2015-11-28/2016-12-02
Income Statement [Line Items]	0000858877 http://www.sec.gov/CIK	0000320193 http://www.sec.gov/CIK	0000789019 http://www.sec.gov/CIK	0000880807 http://www.sec.gov/CIK	0000796343 http://www.sec.gov/CIK
Net Income (Loss) [Roll Up]					
Income (Loss) from Continuing Operations After Tax [Roll Up]					
Income (Loss) from Continuing Operations Before Tax [Roll Up]					
Operating Income (Loss) [Roll Up]					
Gross Profit [Roll Up]					
Revenues	23,932,000,000	78,351,000,000	44,543,000,000	59,000,000	5,854,430,000
Cost of Revenue	8,772,000,000	48,175,000,000	17,745,000,000	50,992,000	819,908,000
Gross Profit	15,160,000,000	30,176,000,000	26,798,000,000	8,008,000	5,034,522,000
Operating Expenses	9,390,000,000	6,817,000,000	15,396,000,000	28,562,000	3,540,920,000
Operating Income (Loss)	5,770,000,000	23,359,000,000	11,402,000,000	(20,554,000)	1,493,602,000
Nonoperating Income (Loss) Plus Interest and Debt Expense Plus Income (Loss) from Equity Method Investments	146,000,000	821,000,000	286,000,000	1,142,000	(58,464,000)
Income (Loss) from Continuing Operations Before Tax	5,916,000,000	24,180,000,000	11,688,000,000	(19,412,000)	1,435,138,000
Income Tax Expense (Benefit)	1,246,000,000	6,289,000,000	1,798,000,000	1,036,000	266,356,000
Income (Loss) from Continuing Operations After Tax	4,670,000,000	17,891,000,000	9,890,000,000	(20,448,000)	1,168,782,000
Income (Loss) from Discontinued Operations, Net of Tax	0	0	0	0	0
Extraordinary Items of Income (Expense), Net of Tax	0	0	0	0	0
Net Income (Loss)	4,670,000,000	17,891,000,000	9,890,000,000	(20,448,000)	1,168,782,000

Templates

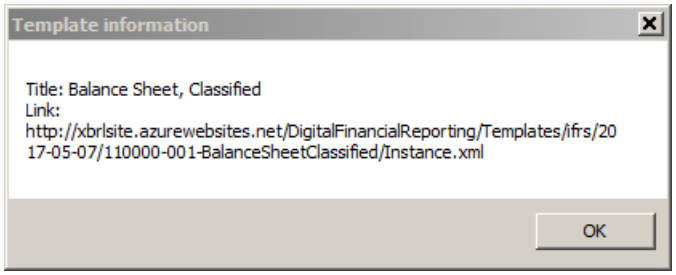
A Template is a starting point or sample that can be used to create a complete Disclosure which will be provided within a report.

Machine readable example[121]:

[121] Template, machine readable, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/ifrs/disclosures/disclosures-templates-ref.xml

```
- <referenceLink xlink:role="http://www.xbrl.org/2003/role/link" xlink:type="extended">
    <loc xlink:href="disclosures.xsd#disclosures_BalanceSheetClassified" xlink:type="locator"
      xlink:label="disclosures_BalanceSheetClassified"/>
    <referenceArc xlink:type="arc" xlink:to="disclosures_BalanceSheetClassified_lbl"
      xlink:from="disclosures_BalanceSheetClassified"
      xlink:arcrole="http://www.xbrl.org/2003/arcrole/concept-reference"/>
   - <reference xlink:role="http://xbrlsite.azurewebsites.net/2016/conceptual-model/cm-
    roles/roles/template" xlink:type="resource"
    xlink:label="disclosures_BalanceSheetClassified_lbl">
      <rpart:Title>Balance Sheet, Classified</rpart:Title>
      <rpart:Description>Basic classified balance sheet</rpart:Description>
      <rpart:Level>4</rpart:Level>
      <rpart:TemplateForDisclosure>http://xbrlsite.azurewebsites.net/DigitalFinancialReporting/Templ
        05-07/110000-001-BalanceSheetClassified/Instance.xml</rpart:TemplateForDisclosure>
    </reference>
  </referenceLink>
- <referenceLink xlink:role="http://www.xbrl.org/2003/role/link" xlink:type="extended">
```

Human readable example:



A list of available Templates can be provided with a base taxonomy or the list could be provided separately.

Exemplars

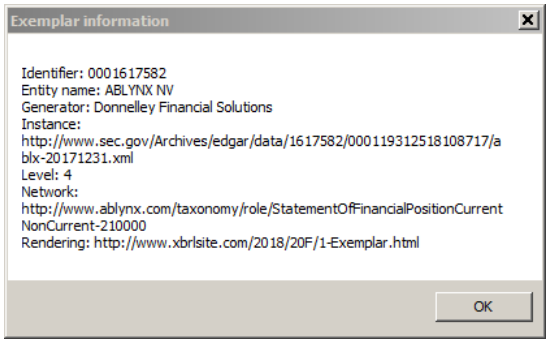
An Exemplar is an example of a Disclosure from some other existing financial report. The notion of an exemplar is very similar to that of a template; the only difference is that the source of the template is some other existing financial report which contains the disclosure which the professional accountant is representing.

Machine readable example[122]:

[122] Exemplar, machine readable, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/ifrs/disclosures/exemplars-forDisclosure-1361-ref.xml

```
- <referenceLink xlink:role="http://www.xbrl.org/2003/role/link" xlink:type="extended">
    <loc xlink:href="disclosures.xsd#disclosures_BalanceSheetClassified" xlink:type="locator"
      xlink:label="disclosures_BalanceSheetClassified"/>
    <referenceArc xlink:type="arc" xlink:to="disclosures_BalanceSheetClassified_lbl"
      xlink:from="disclosures_BalanceSheetClassified"
      xlink:arcrole="http://www.xbrl.org/2003/arcrole/concept-reference"/>
   - <reference xlink:role="http://xbrlsite.azurewebsites.net/2016/conceptual-model/cm-
    roles/roles/exemplar" xlink:type="resource" xlink:label="disclosures_BalanceSheetClassified_lbl">
      <rpart:LEI>0001172494</rpart:LEI>
      <rpart:EntityRegistrantName>AU OPTRONICS CORP</rpart:EntityRegistrantName>
      <rpart:AccessionNumber>0000950103-18-003972</rpart:AccessionNumber>
      <rpart:Generator>DataTracks</rpart:Generator>
      <rpart:Instance>http://www.sec.gov/Archives/edgar/data/1172494/000095010318003972/auo-
        20171231.xml</rpart:Instance>
      <rpart:Level>4</rpart:Level>
      <rpart:Network>http://auo.com/role/ConsolidatedStatementsOfFinancialPosition</rpart:Network>
      <rpart:Table/>
      <rpart:Rendering>http://www.xbrlsite.com/2018/20F/10-Exemplar.html</rpart:Rendering>
      <rpart:Confidence>80%</rpart:Confidence>
      <rpart:Likes>1</rpart:Likes>
      <rpart:Dislikes>0</rpart:Dislikes>
      <rpart:Rating>5</rpart:Rating>
    </reference>
  </referenceLink>
- <referenceLink xlink:role="http://www.xbrl.org/2003/role/link" xlink:type="extended">
```

Human readable example:



A list of available Exemplars can be provided with a base taxonomy or the list could be provided separately.

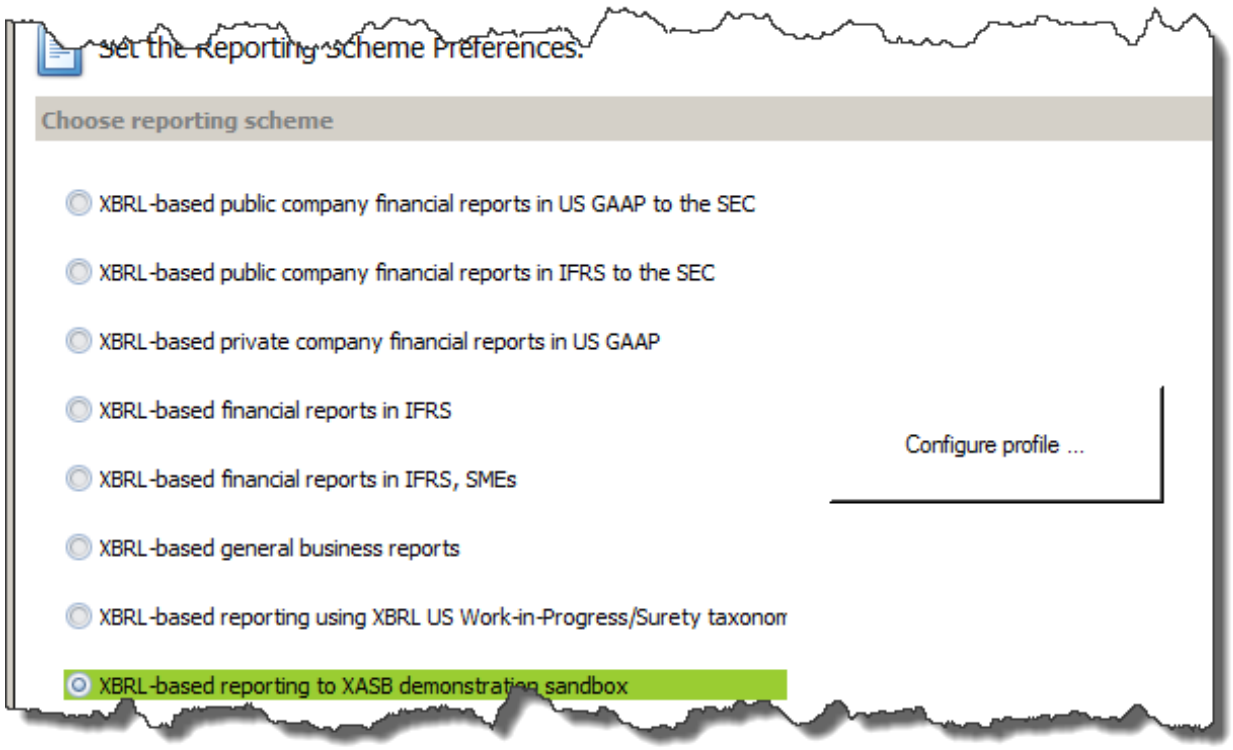
Processing Model

The following is a model of the processing used when a digital financial report and/or its related model is created or edited using this method.

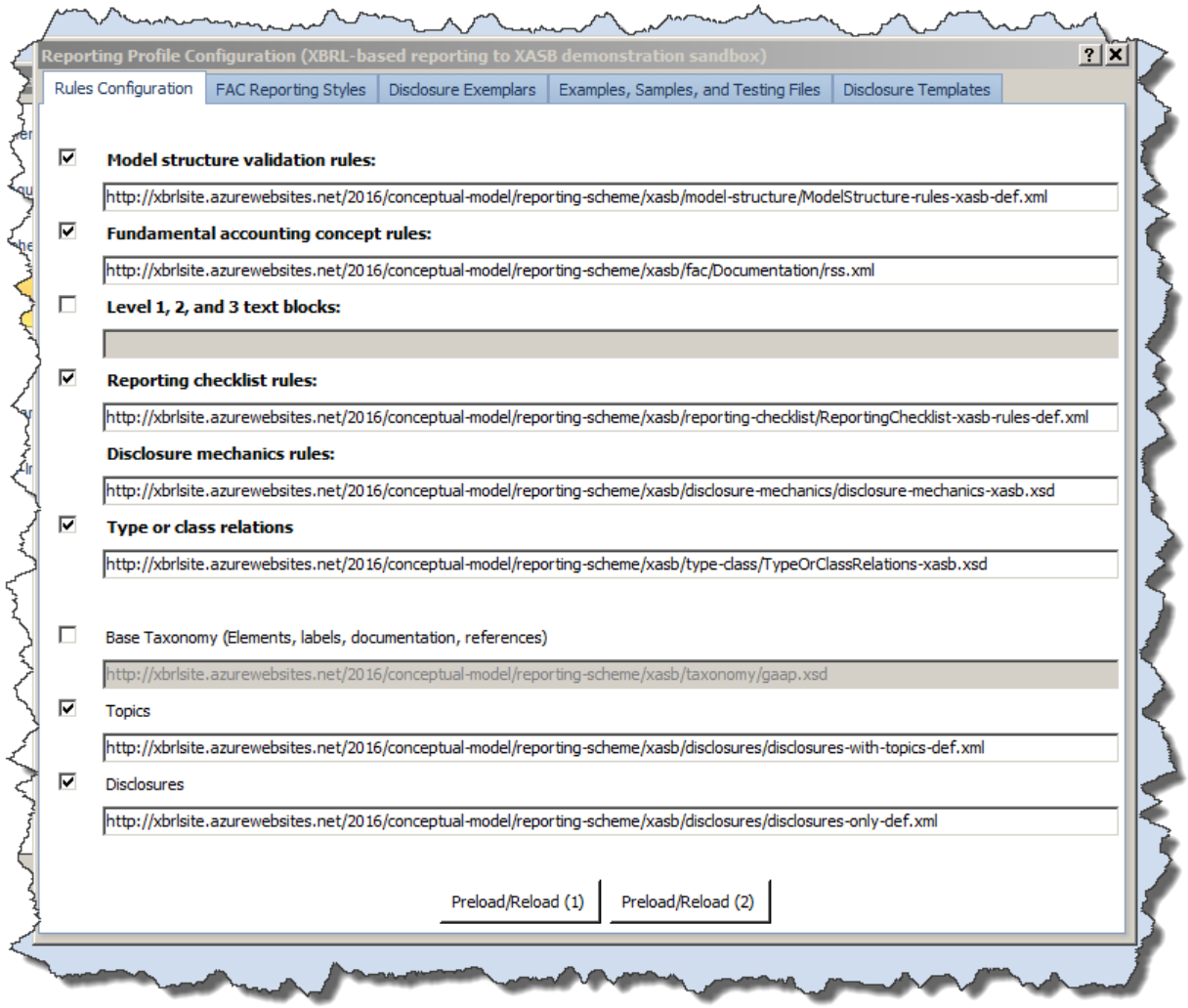
Profiles

A software application can dynamically detect which application profile or implementation model has been used to create an XBRL instance by probing the XBRL instance for the reporting scheme which was used to create the report.

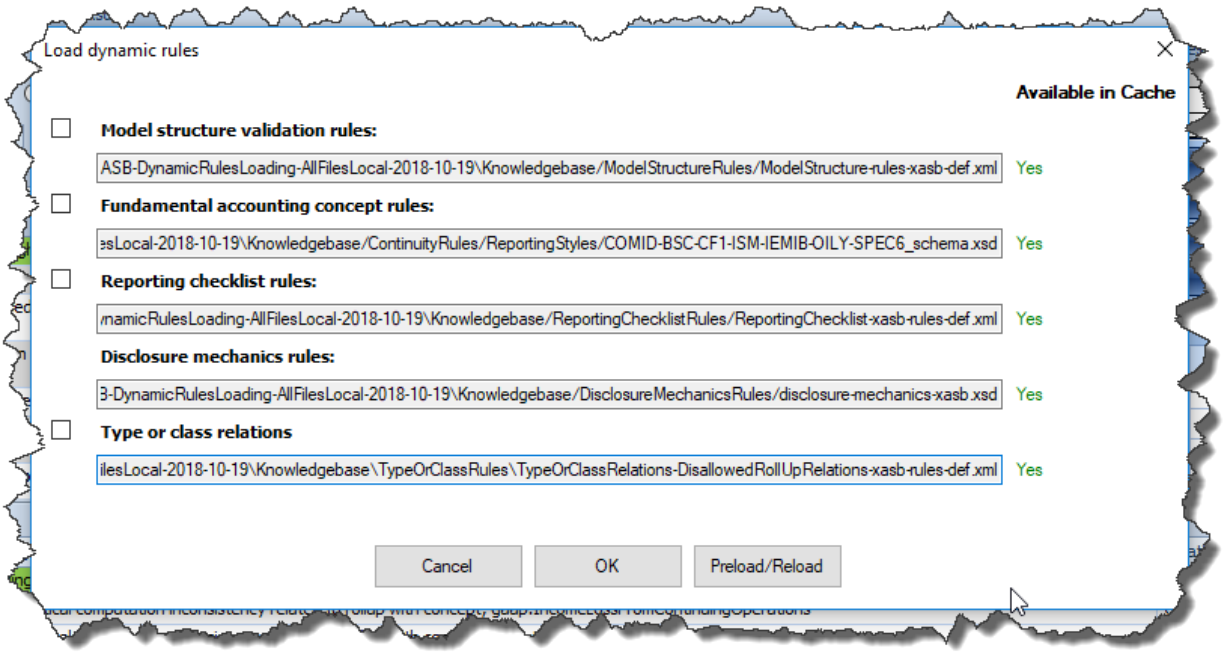
Also, profiles are used to differentiate any system specific restrictions placed on the XBRL technical syntax used.



Explicitly selecting a profile sets the rules used to verify a business report to the proper set of rules per the implementation profile used to create the report:



Alternatively, the implementation model rules which are used can be used to dynamically configure the application creating, in essence, a dynamic reporting scheme, by directly referencing sets of rules within the XBRL instance which has been created:



So, either the more hard coded profile selection approach or the dynamic profile selection choice results in a configuring a business report for the profile that was used in the creation of the report.

Business Report Meta-Meta Model

The business report meta-meta model is identical for every profile.

Category of Report Elements

The category of report element are identical for every profile. The label used by a profile can be different. For example, using the term "[Table]" rather than "Hypercube" or "[Axis]" as contrast to "Dimension" are common differences in the labeling of the report element categories. However, the logical meaning of the categories of report elements does not change between physical implementation models.

Model Structure Relations

Some model structure relations allowed and disallowed preferences can be changed per profile. For example, whether an "[Abstract]" concept is required to be the root of a Network or whether a "Hypercube" is used as the Network root has no impact on the meaning of information conveyed by a report.

Reporting Styles

Reporting styles differ by reporting scheme used and therefore by the profile used to represent the reporting scheme. The reporting style code used to identify a reporting style can be (a) assigned by a mapping between the economic entities reporting or (b) dynamically determined based on probing the different primary financial statements of the report.

It is also possible to require the reporting style code to be reported with a report or requiring a reporting style XBRL taxonomy scheme to be directly connected to a reporting entity's XBRL taxonomy or XBRL instance.

Concept Arrangement Patterns

Concept arrangement patterns tend to be the same for each physical implementation profile.

Member Arrangement Patterns

Member arrangement patterns tend to be the same for each physical implementation profile.

Disclosures

The list of Disclosures could be explicitly provided for a reporting scheme with the base taxonomy of that reporting scheme or it might not be provided at all. If the Disclosures are not provided, then the list Disclosures must be created in order to leverage this physical implementation method.

Topics

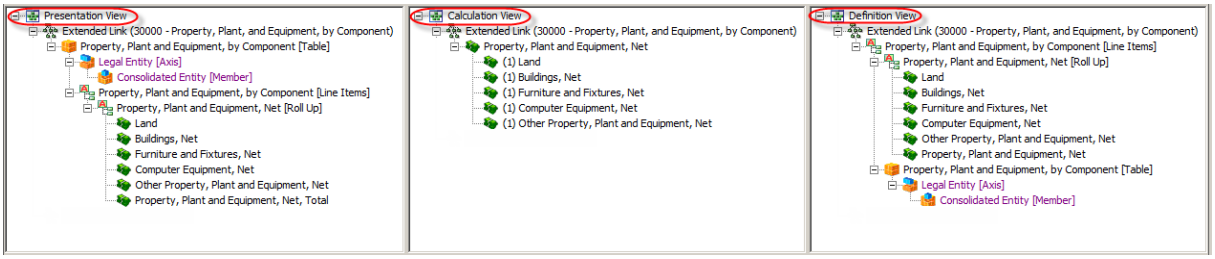
Similar to the list of Disclosures, the list of Topics into which Disclosures can be organized may or may not be provided. If not provided, the list of Topics must be created in order to leverage Topics within this physical implementation method.

Leveraging Rules and Other Aspects of the Logical Model

To an accountant using the model of a financial report; there is no "XBRL presentation view" or "XBRL calculation view" or "XBRL definition view". There is only the financial report model. The accountant interacts with the financial report model, not with anything related to XBRL. Behind the scenes, software handles the complex and technical details of generating the XBRL related artifacts. This allows two things. First, it allows for perfect XBRL technical syntax to be generated by the software. Second, it allows for other technical syntax serialization options to be easily added.

The application keeps all the XBRL relations perfectly synchronized, the user does not have an option to determine where things go in the XBRL presentation relations in the default mode of the software application. The arbitrary personal preferences of the software user are not considered.

There are some settings that the software user can adjust in the application preferences and options to determine how the XBRL presentation relations are organized by the software application. Software may expose an option, "Manage XBRL presentation relations manually." That option allows the software user to do additional work and manually manage the XBRL presentation relations organization themselves; but that is not the default functionality of the software.



What the accountant using the software works with is something similar to the screen shot shown below (best alternative) or something similar which exposes some graph of the financial report model that the user can manipulate (less appealing) that helps the user understand and interact with the model. Perhaps alternatively, software users can view the XBRL presentation, XBRL calculation, XBRL definition relations but they cannot edit those relations. Thus, the user cannot un-synchronize the XBRL presentation, calculation, definition, and formula relations.

Component: (Network and Table)	
Network	30000 - Unknown - **Property, Plant, and Equipment, by Component**
Table	Property, Plant and Equipment, by Component [Table]

Reporting Entity [Axis]	XXXX http://XXX	
Legal Entity [Axis]	Consolidated Entity [Member]	
Unit [Axis]	XXX	
	Period [Axis]	
Property, Plant and Equipment, by Component [Line Items]	YYYY-MM-DD	YYYY-MM-DD
Property, Plant and Equipment, Net [Roll Up]		
Land	XXX,XXX	XXX,XXX
Buildings, Net	XXX,XXX	XXX,XXX
Furniture and Fixtures, Net	XXX,XXX	XXX,XXX
Computer Equipment, Net	XXX,XXX	XXX,XXX
Other Property, Plant and Equipment, Net	XXX,XXX	XXX,XXX
Property, Plant and Equipment, Net, Total	XXX,XXX	XXX,XXX

The software application knows that the fragment the user is working on is a “ROLL UP” because (a) the software user was asked the question, “What is the concept arrangement pattern of this Block you wish to add?” and given a combo box of allowed values to select from, and they selected “Roll Up” from the combo box when creating the Block for this Hypercube and (b) because of the GREEN in the total cells of the roll up that provide a visual clue that the Block is a roll up.

But all the XBRL presentation, calculation, definition, and formula are created behind the scenes. The software user might even have a radio button to switch between using XBRL formula base business rules as contrast to XBRL calculation relations to describe and verify mathematical computations.

When the XBRL instance information is “filled in”, by the creator of the financial report or by an application that extracts information from a database or application thus auto-generating the XBRL instance information; the rendering of the XBRL instance information looks like this:

Component: (Network and Table)	
Network	30000 - Unknown - **Property, Plant, and Equipment, by Component**
Table	Property, Plant and Equipment, by Component [Table]

Reporting Entity [Axis]	SAMP http://www.SampleCompany.com
Legal Entity [Axis]	Consolidated Entity [Member]
Unit [Axis]	USD

Property, Plant and Equipment, by Component [Line Items]	Period [Axis] 2010-12-31	2009-12-31
Property, Plant and Equipment, Net [Roll Up]		
Land	5,347,000	1,147,000
Buildings, Net	244,508,000	366,375,000
Furniture and Fixtures, Net	34,457,000	34,457,000
Computer Equipment, Net	4,169,000	5,313,000
Other Property, Plant and Equipment, Net	6,702,000	6,149,000
Property, Plant and Equipment, Net, Total	295,183,000	413,441,000

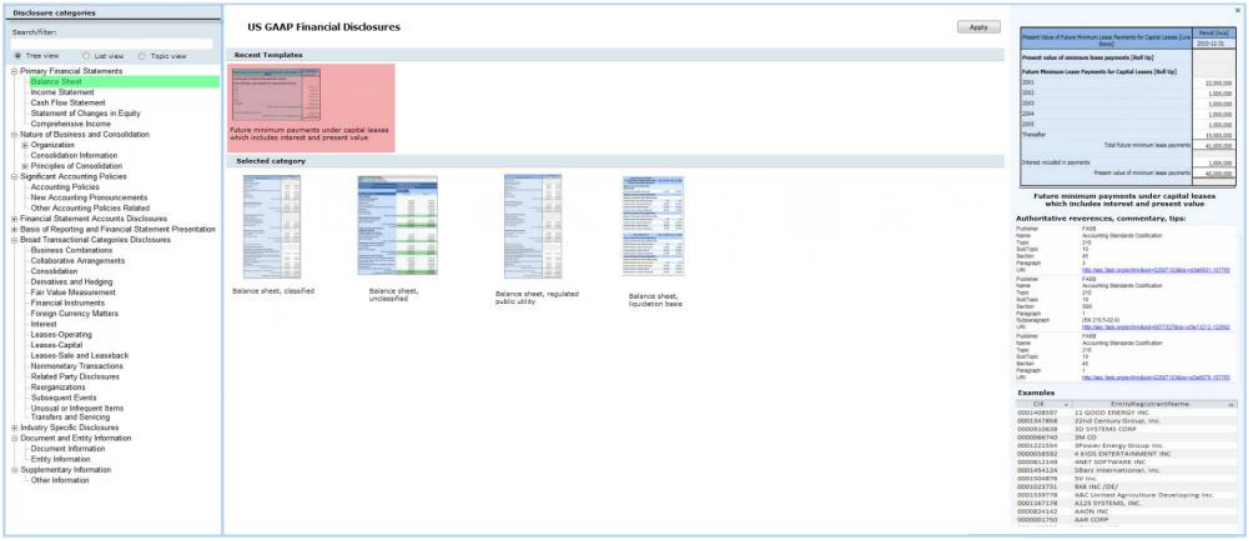
The following are things that the software user is not bothered with:

- The user is never asked if the fragment they are creating is “dimensional” or “non-dimensional”; all fragments are dimensional. If the software user does not want to explicitly create a hypercube they don’t need to. But if an explicit hypercube is not created, then an implied hypercube is used by the application but not serialized when the XBRL technical syntax is generated.
- The user is never asked about XBRL “presentation relations” or “calculation relations” or “definition relations”. They can perhaps look at those relations but they cannot edit them by default. But if the user decides, for some reason, that they want to do additional work and manually manage the presentation relations, that functionality could be exposed to the software user.
- The user is never asked about technical details of XBRL artifacts such as the “substituionGroup” or “abstract” or whether a hypercube should be open or closed. All these details are managed by the software application.
- The user is never asked if something is a “primary item” or “dimension”; this is determined by where they are editing information in the financial report graph model (that screen shot of the rendering above is a graph of information).

The software application proactively guides the software user through the process of creating a perfect roll up, or roll forward, or the other concept arrangement patterns or member arrangement patterns. The application is retrospectively looking at the business rules that exist (continuity cross checks, disclosure mechanics, reporting checklist, mathematical relations, class/subclass relations, report integrity, etc.) probably using a separate processing thread periodically checking the report against all the rules to make sure the user is not breaking any rules.

During the creation process the software uses the rules retrospectively to assist the software user during financial report creation process. For example, if the user is creating the "Inventory components" disclosure because the application has either been told that is what the user is working on (using the named disclosure) or the application senses that that is what they are working on using the rules (disclosure mechanics rules); the application can present new concepts to the user that are related to that specific disclosure as contrast to providing thousands of concepts that have nothing to do with the disclosure they are working on.

Templates and exemplars can assist in the disclosure creation process. Templates and exemplars can be associated with a specific disclosure, are covered by the same disclosure mechanics rules, consistency cross check rules, mathematical relations rules, class/subclass relations rules, and reporting checklist rules.



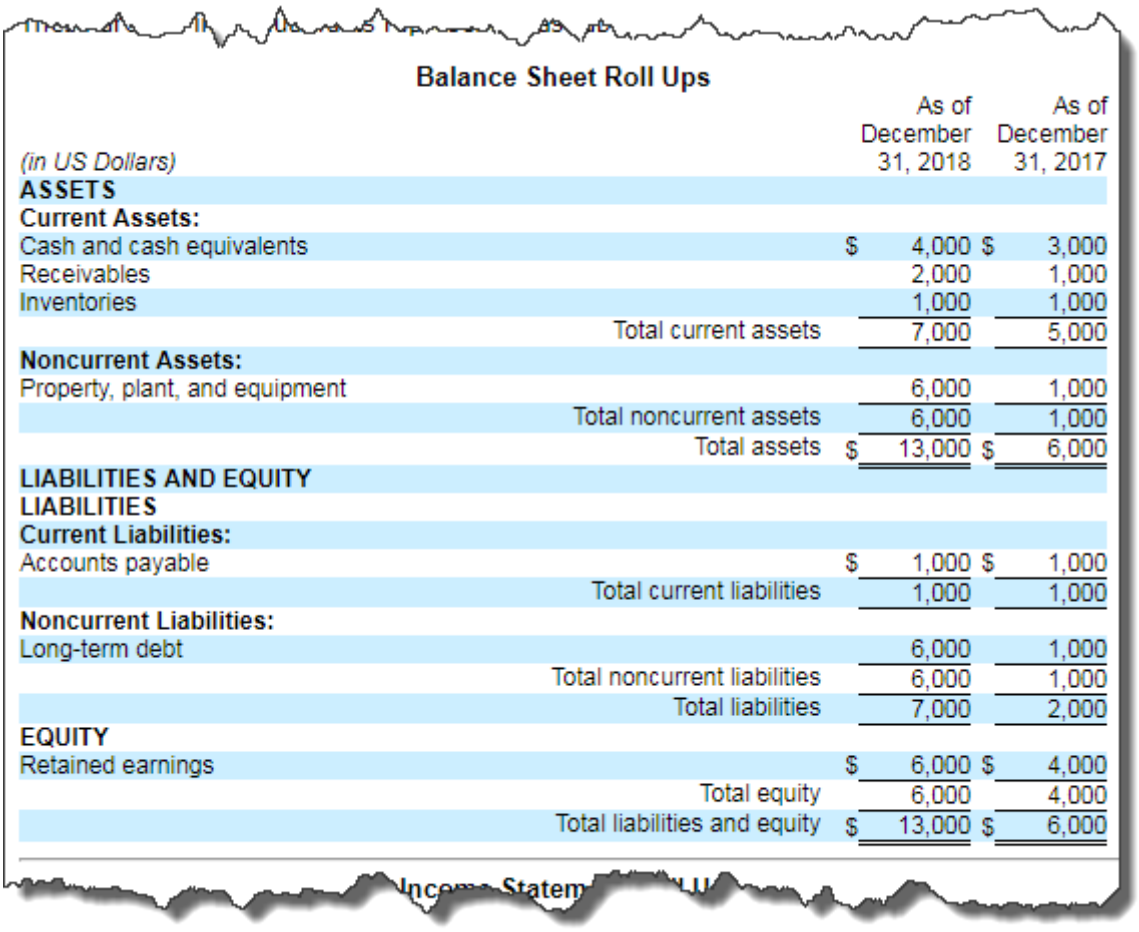
Human-readable and Machine-readable

XBRL is not "e-paper" but rather XBRL is a new way of representing information, as stated earlier a new media. Raw XBRL is both machine-readable and human-readable when a proper rendering engine is employed to convert the machine-readable information into a human-readable form. While such a conversion process cannot every achieve a "pixel perfect"

presentation of human-readable information; such rendering engine results are very readable by humans.

Should a "pixel perfect" presentation of information be desired and if the software user is willing to perform an additional task of mapping raw XBRL-based information into an XHTML format using available tools, then Inline XBRL[123] can be employed to create such "pixel perfect" presentations of information.

Alternatively, raw XBRL can auto-generate Inline XBRL. For example, the following is inline XBRL that was auto-generated from raw XBRL[124]:



Balance Sheet Roll Ups

(in US Dollars)	As of December 31, 2018	As of December 31, 2017
ASSETS		
Current Assets:		
Cash and cash equivalents	$ 4,000	$ 3,000
Receivables	2,000	1,000
Inventories	1,000	1,000
Total current assets	7,000	5,000
Noncurrent Assets:		
Property, plant, and equipment	6,000	1,000
Total noncurrent assets	6,000	1,000
Total assets	$ 13,000	$ 6,000
LIABILITIES AND EQUITY		
LIABILITIES		
Current Liabilities:		
Accounts payable	$ 1,000	$ 1,000
Total current liabilities	1,000	1,000
Noncurrent Liabilities:		
Long-term debt	6,000	1,000
Total noncurrent liabilities	6,000	1,000
Total liabilities	7,000	2,000
EQUITY		
Retained earnings	$ 6,000	$ 4,000
Total equity	6,000	4,000
Total liabilities and equity	$ 13,000	$ 6,000

And so there are numerous alternatives to achieving a very human-readable presentation of XBRL-based information. Regardless of whether Inline XBRL is or is not used, the financial report model is the same for Inline and raw XBRL.

[123] XBRL International, Inline XBRL, https://specifications.xbrl.org/spec-group-index-inline-xbrl.html
[124] Inline XBRL auto-generated from raw XBRL, http://xbrlsite.azurewebsites.net/2018/RoboticFinance/basic-SampleInstance-InlineXBRL2b_FormattedTables.html

Comprehensive Rigorous testing of Complete Report

A report can be broken down into fragments. Each report fragment must be thoroughly tested. Further, conflicts and contradictions between report fragments must be detected and resolved.

Imagine a financial report that has 11 fact sets. Each fact set represents something that is disclosed, a disclosure. Statements are made in the form of machine-readable rules which describe each disclosure. Those same machine-readable descriptions can be leveraged by automated machine-based processes to verify that each disclosure is consistent with that description.

Primary Information

#	Disclosure	Category	Level	Pattern	Disclosure Found	Disclosure Consi…	Applicable	Representation Concept [TEXT BLOCK]	Representation Concept DETAIL
1	Assets Roll Up	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Assets
2	Cash and Cash Equivalents Roll Forward	Unknown	Level4Detail	RollForward	True	CONSISTENT	True	NOT-EXPECTED	Cash and Cash Equivalents
3	Cash Flow Statement, Indirect Method	Statement	UNKNOWN	Component	True	CONSISTENT	True	-	-
4	Document Information	Unknown	Level4Detail	Hierarchy	True	CONSISTENT	True	NOT-EXPECTED	Document Title
5	Entity Information	Unknown	Level4Detail	Hierarchy	True	CONSISTENT	True	NOT-EXPECTED	Economic Entity Name
6	Liabilities and Equity Roll Up	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Liabilities and Equity
7	Net Cash Flow Roll Up	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Net Cash Flow
8	Property, Plant, and Equipment, Net Subclassifications (Alternati…	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Property, Plant and Equipment, Net
9	Share Capital by Class	Unknown	Level4Detail	Hierarchy	True	CONSISTENT	True	NOT-EXPECTED	Common Stock
10	Statement of Financial Performance, by Function	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Net Income (Loss)
11	Statement of Financial Position, Classified	Statement	UNKNOWN	Component	True	CONSISTENT	True	-	-

While every disclosure in a report might be correct; every statutory or regulatory disclosure that is reported to be provided must be confirmed to exist within a report. A machine-readable reporting checklist can be used to specify which disclosures are required and to verify that a report does, in fact, contain each required disclosure.

#	Disclosure	Checklist Category	Reason Disclosure Must Exist	Discovered	Expectation Met	Link to Disclosure Mechanics
0	Reporting Checklist					
1	Document Information	Required disclosure	Disclosure always required	True	CONSISTENT	Document Information
2	Entity Information	Required disclosure	Disclosure always required	True	CONSISTENT	Entity Information
3	Statement of Financial Position, Classified	Required disclosure	Disclosure always required, satisfied by Assets Roll Up and Liabilities and Equity…	True	CONSISTENT	Statement of Financial Position, Classified
4	Assets Roll Up	Part of disclosure	Satisfies Statement of Financial Position, Classified disclosure	True	CONSISTENT	Assets Roll Up
5	Liabilities and Equity Roll Up	Part of disclosure	Satisfies Statement of Financial Position, Classified disclosure	True	CONSISTENT	Liabilities and Equity Roll Up
6	Statement of Financial Performance, by Function	Required disclosure	Disclosure always required	True	CONSISTENT	Statement of Financial Performance, by Function
7	Cash Flow Statement, Indirect Method	Required disclosure	Disclosure always required, satisfied by Net Cash Flow Roll Up and Cash and C…	True	CONSISTENT	Cash Flow Statement, Indirect Method
8	Net Cash Flow Roll Up	Part of disclosure	Satisfies Cash Flow Statement, Indirect Method disclosure	True	CONSISTENT	Net Cash Flow Roll Up
9	Cash and Cash Equivalents Roll Forward	Part of disclosure	Satisfies Cash Flow Statement, Indirect Method disclosure	True	CONSISTENT	Cash and Cash Equivalents Roll Forward
10	Share Capital by Class	Line item exists, then disclosure requi…	Required because line item frf-sme:CommonStock was reported	True	CONSISTENT	Share Capital by Class
11	Property, Plant, and Equipment, Net Subclassifications (Alternative)	Line item exists, then disclosure requi…	Required because line item frf-sme:PropertyPlantAndEquipmentNet was reported	True	CONSISTENT	Property, Plant, and Equipment, Net Subclassifications (Alternative)

Prototype Ontology-like Thing

There is no standard presentation of an ontology. The FRF for SMEs Ontology[125] is a working prototype of how an XBRL-based ontology-like thing can be organized. This ontology includes a reference implantation which exercises the ontology functionality in achieving its objective. See the bottom of the HOME page to obtain the reference implementation XBRL instance.

[125] *FRF for SMEs Ontology*, http://xbrlsite.azurewebsites.net/2016/conceptual-model/reporting-scheme/frf-sme/documentation/Home.html

Conclusion

One type of practical knowledge is **know-how**; how to accomplish something. This document explains a best practices, proven, open source method for representing a high-fidelity, high-resolution financial report using the XBRL technical syntax that can be proven to be of high quality in specific important areas where machine-readable rules are provided. This reduces the cost and time of human-based approaches to verifying the quality of such financial reports.

This method is of particular importance when XBRL's extensibility features are leveraged in the creation of a financial report.

This method is useful to regulators collecting information as well as by individual economic entities reporting to regulators who choose to implement digital financial reporting internally within their organization.

This method is a proven, best practices approach to creating a modern finance platform[126] leveraging the global standard XBRL technical syntax. This method is useful when implementing accounting process automation and automating financial reporting creation processes[127].

The next step is to use this specific XBRL-based implementation method to create a syntax independent methodology for creating such financial reports and business reports.

Other Helpful Resources

The following is a set of additional resources that are likely helpful to those endeavoring to better understand this method. These resources provide helpful background information, additional details, samples, examples, and so forth:

- ***Artificial Intelligence and Knowledge Engineering Basics in a Nutshell***[128]: Critical background information that helps the reader understand the information in this document.
- ***Accounting Process Automation Using XBRL***[129]: Background information related to using XBRL for accounting process automation.

[126] *Financial Transformation and the Modern Finance Platform*, http://xbrl.squarespace.com/journal/2018/11/2/financial-transformation-and-the-modern-finance-platform.html
[127] YouTube, *Financial Transformation and the Modern Finance Platform*, Video playlist, https://www.youtube.com/playlist?list=PLqMZRUzQ64B70NDzYu1-3YyNVJwuhtjSE
[128] *Artificial Intelligence and Knowledge Engineering Basics in a Nutshell*, http://xbrlsite.azurewebsites.net/2019/Library/KnowledgeEngineeringInNutShell.pdf
[129] *Accounting Process Automation Using XBRL*, http://xbrlsite.azurewebsites.net/2018/Library/AccountingProcessAutomationUsingXBRL.pdf

- ***General Ledger Trial Balance to External Financial Report***[130]: Step-by-step guide to creating a modern financial statement creation platform for internal and external financial reporting.
- ***Introduction to the Fact Ledger***[131]: General purpose ledger for use in accounting process automation and automation of financial report creation.
- ***Theoretical and Mathematical Underpinnings of a Financial Report***[132]: Points out how I have been able to leverage the theoretical and mathematical underpinnings of a financial report to detect and leverage patterns that exist in financial reports that might not be apparent to most software engineers.
- ***Blueprint for Creating Zero-Defect XBRL-based Digital Financial Reports***[133]: Explains how to use automated and manual processes professional accountants need to evaluate and measure the quality of an XBRL-based financial report.
- ***Guide to Building an Expert System for Creating Financial Reports***[134]: Detailed description of a software implementation that leverages the method articulated in this document.
- ***Intelligent XBRL-based Digital Financial Reporting***[135]: Everything you would ever want to know about intelligent XBRL-based digital financial reporting in one place.

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[130] *General Ledger Trial Balance to External Financial Report*, http://xbrlsite.azurewebsites.net/2018/RoboticFinance/TrialBalanceToReport.pdf
[131] *Introduction to the Fact Ledger*, http://xbrlsite.azurewebsites.net/2018/Library/IntroductionToTheFactLedger.pdf
[132] *Theoretical and Mathematical Underpinnings of a Financial Report*, http://xbrlsite.azurewebsites.net/2018/Library/TheoreticalAndMathematicalUnderpinningsOfFinancialReport.pdf
[133] *Blueprint for Creating Zero-Defect XBRL-based Digital Financial Reports*, http://xbrlsite.azurewebsites.net/2017/Library/BlueprintForZeroDefectDigitalFinancialReports.pdf
[134] *Guide to Building an Expert System for Creating Financial Reports*, http://xbrlsite.azurewebsites.net/2018/Library/GuideToBuildingAnExpertSystemForCreatingFinancialReports.pdf
[135] *Intelligent XBRL-based Digital Financial Reporting*, http://xbrl.squarespace.com/intelligent-xbrl/