Professional System for Creating Financial Reports Leveraging Knowledge Graphs

Practical, nontechnical description of a professional system for creating provably high-quality financial reports where the report creator is using financial reporting schemes (such as US GAAP and IFRS) where report creator is permitted to modify the report model which leverages global standard knowledge graphs represented using XBRL

By

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January 1, 2024 (DRAFT)

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1.   Introduction

Today, general purpose financial reports tend to be created using software tools such as Microsoft Word and Excel which have no understanding of the financial reports being created within those tools. Skilled and experienced professional accountants, using their knowledge of accounting and financial reporting principles and rules, carefully craft a financial report from a blank canvas or by using examples from reference materials or existing financial reports. Once completed, the report is checked for quality using checklists, memory joggers, and other such tools and techniques by more skilled and experienced professional accountants.   Perhaps additional checking is done by independent third-party auditors to be sure the report is complete, consistent, and precise in its "true and fair" representation of the financial position and financial performance of the reporting economic entity.

This document explains a new system for creating general purpose financial reports.   In this new system, a cloud-based software application which is an expert system which does understand financial reports is used. This rules-based expert system is driven by machine-readable financial accounting and reporting rules represented in machine-readable form using the global standard XBRL technical format.   The system subscribes to a framework called the *Seattle Method*[1] which was explicitly designed and engineered for the explicit purpose of creating quality financial reports by a professional accountant.

That global standards based machine-readable information conveys the necessary information to the expert system software application; the understanding necessary to enable the software to augment the understanding of a skilled and experienced professional accountant and assist that accountant to the successful completion of their goal which is the creation of a complete, consistent, and precise general-purpose financial report.

Once completed; that report, if the creator so desires or is mandated to do so, could also be serialized as XBRL and submitted to a regulator or other party which desires to make use of the reported information.

In this document, a simple example is used in order to keep the explanation of this system as brief as possible.   The document is

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[1] Charles Hoffman, CPA, *Seattle Method*,
http://xbrlsite.com/seattlemethod/SeattleMethod.pdf

intended to communicate the general idea, not the complete set of capabilities of this software system.

Further, this system explains this approach using a general-purpose financial report. However, this system is also useful for general business reporting. The same framework is used but the machine-readable reporting scheme appropriate for some different area of knowledge is used within this framework instead of the machine-readable information we used here which is specific to financial reporting.

The intent of this specific documentation is to avoid all technical lingo and jargon and stick to a more logic-based explanation which is more approachable to business professionals which are the target for this specific explanation.

To quickly understand how my approach digital financial reporting differs from the approach of others, I would invite the reader to read *Seeing Digital Financial Reporting Differently*[2]. Basically, I am playing the long game; not trying to simple meet a regulator mandate.

This introduction will walk the reader through the conceptual details of a knowledge graph-based system. Then, in a subsequent section we will walk you through the system itself and how that system works. Finally, we will point the reader to additional resources which they can use to understand the full set of capabilities of this professional system for creating financial reports.

This brings us to the first detail which needs to be explained which is the notion of an area of knowledge which we will explain now.

1.1. Area of Knowledge

An **area of knowledge** is a highly organized socially constructed aggregation of shared knowledge for a distinct subject matter. An area of knowledge has a specialized insider vocabulary (i.e. jargon), underlying assumptions (axioms, theorems, constraints, assertions, restrictions), and perhaps some persistent open questions that have not necessarily been resolved within that area of knowledge (i.e. flexibility is necessary, change may occur within that area of knowledge).

You can think about an area of knowledge as being characterized in a spectrum with two extremes:

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[2] *Seeing Digital Financial Reporting Differently*,
https://digitalfinancialreporting.blogspot.com/2023/12/seeing-digital-financial-reporting.html

- **Kind area of knowledge**: clear information, clear rules, lots of logical patterns, lots of rules, repetitive patterns, and typically unchanging tasks.

- **Wicked area of knowledge**: obscure data, few or no rules, few logical patterns, constantly changing tasks, and abstract ideas that tend to be hard to explain.

An area of knowledge can have aspects of both extremes, but tends to lean toward one side of the spectrum or the other.

Financial accounting and reporting tend to lean more toward the "kind" end in many ways, particularly the quantitative aspects of accounting and reporting. The qualitative aspects may be more in the wicked side of the spectrum.

Other terms used to refer to an area of knowledge include a domain of discourse, area of interest, and knowledge domain.

1.2. Sensemaking

Sensemaking[3] is the process of determining the deeper meaning or significance or essence of the collective experience for those within an area of knowledge.

The *Cynefin Framework*[4] is a sensemaking model that can be leveraged for understanding an area of knowledge. Using the Cynefin Framework, the knowledge within an area of knowledge can be broken down into categories which include:
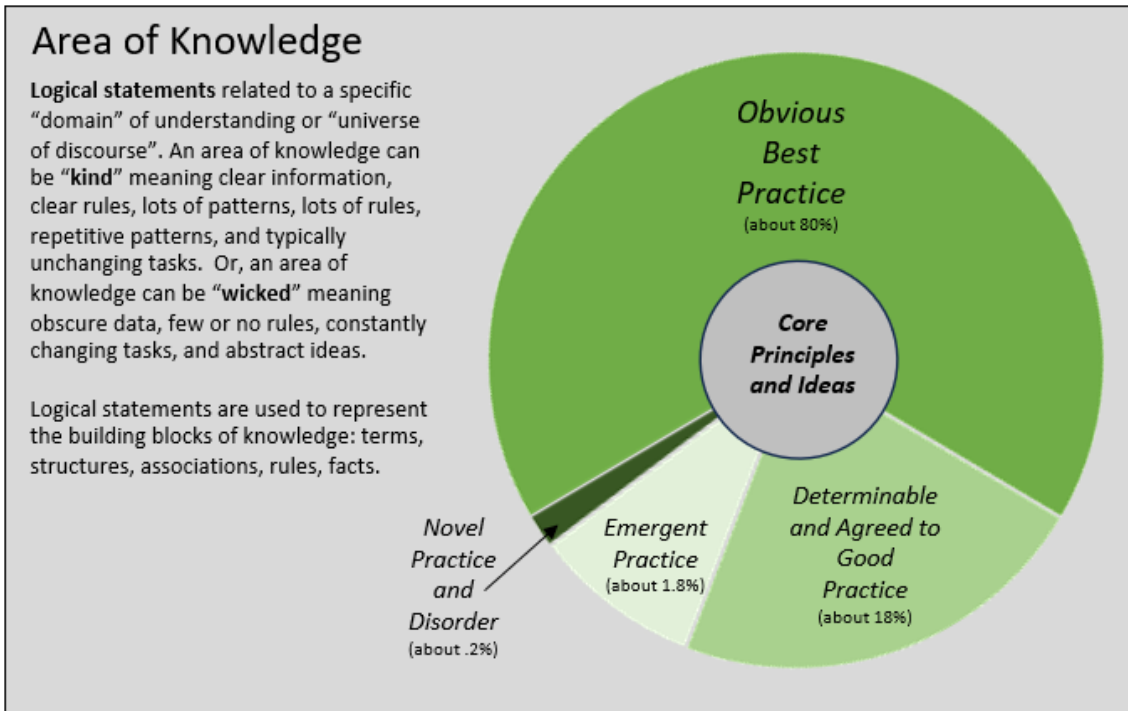
- Obvious best practice

- Determinable and agreed to good practice

- Emergent practice

- Novel practice

A full explanation of the Cynefin Framework and how to use that framework for understanding the financial accounting and reporting area of knowledge[5] is beyond the scope of this document.

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[3] *Sensemaking*, http://xbrl.squarespace.com/journal/2021/11/18/sensemaking.html

[4] YouTube.com, *The Cynfin Framework*, https://youtu.be/N7oz366X0-8?si=Bc4YTaRj5Buj3xEl

[5] YouTube.com, *Complexity, Cynefin, and Agile*, https://youtu.be/-F4enP8oBFM?si=ZFq4LKYzhegvoRU8

Area of Knowledge

Logical statements related to a specific "domain" of understanding or "universe of discourse". An area of knowledge can be "**kind**" meaning clear information, clear rules, lots of patterns, lots of rules, repetitive patterns, and typically unchanging tasks. Or, an area of knowledge can be "**wicked**" meaning obscure data, few or no rules, constantly changing tasks, and abstract ideas.

Logical statements are used to represent the building blocks of knowledge: terms, structures, associations, rules, facts.

Obvious Best Practice (about 80%)

Core Principles and Ideas

Novel Practice and Disorder (about .2%)

Emergent Practice (about 1.8%)

Determinable and Agreed to Good Practice (about 18%)

Knowledge can be represented in human-readable form, in machine-readable form, or in a machine-readable form that can be effectively converted into human-readable form.

Financial accounting and reporting is one area of knowledge. You can explain aspects of the financial accounting and reporting area of knowledge, such as the nature of a financial report, using a logical theory which explains a logical model.

1.3.   *Representing Things Digitally*

A Wardley Map[6] is a tool that can be used in the process of representing something digitally and think about something strategically[7]. You can think of a Wardly Map as a sketch or blueprint of a working system. It might be right; it might be wrong. But it is something we can discuss and refine together on paper to make sure everything we do in reality is as purposeful as it can be. These designs will inevitably be put to the test by the forces of capitalism.   No one is exempt; not even governments or non-profits. So, to help us cope, we acknowledge this fact up front by arranging our blueprint by evolutionally stage; from the

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[6] YouTube.com, *Wardly Mapping in 90 Seconds*,
https://youtu.be/9jvMiq4CZJ0?si=TVPfYO1ggM5PDh34
[7] *Skill to Representing Things Digitally*,
https://digitalfinancialreporting.blogspot.com/2023/02/skill-to-represent-things-digitally.html

uncharted where things are uncertain, high failure, and a gamble; to the industrialized where things are known, reliable, and standard practice. Awareness of these qualities helps us approach each part of the system deliberately. No "one size fits all", only careful specific intention. But the map is only the beginning. Behind Wardley Mapping is a deeper strategic thinking process. There are many patterns to learn, principles to practice, and moves to make. Take it one step at a time for even the smallest insight can change everything.

1.4.   Systems Thinking

Peter Senge explains system thinking well, "Systems thinking is a discipline for seeing wholes. It is a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static snapshots…Today systems thinking is needed more than ever because we are becoming overwhelmed by complexity."

For there to be a system, there must be two things: a describable structure or state, and a describable set of logical patterns of behavior (rules).

1.5.   System

A system is cohesive groups of interrelated, interdependent components that can naturally exist in nature (natural system) or human-made (designed system). The "solar system", the way the planets revolve around the sun, is an example of a natural system. A general-purpose financial report is an example of a designed system; created by humans to fulfil some specific purpose.

A system can be explained by a logical theory. A logical theory is an abstract conceptualization of specific important details of some area of knowledge. The logical theory provides a way of thinking about that area of knowledge by means of logical reasoning to derive logical consequences of the logical 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 logical statements used for capturing meaning or representing a shared understanding of and knowledge in some area of knowledge.

A logical conceptualization is a set of models that are consistent with and permissible per that logical conceptualization.

1.6. Atomic Design Methodology

Atomic design methodology[8] is the idea of creating high level models and creating building blocks to create something. For example, in the natural world:

- **Atoms** are the basic building blocks of all matter.
- **Molecules** are groups of two or more atoms held together by chemical bonds.
- **Organisms** are assemblies of molecules functioning together as a unit. Organisms are more complex structures built from more simple structures.
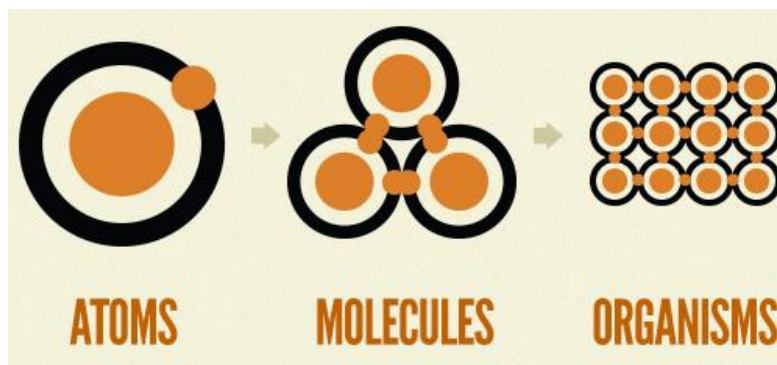
This same idea can be applied to financial reports and financial reporting but instead of using the terms "atom', "molecules", and "organisms" we use the jargon of financial accounting and reporting.

Again, a full explanation of how this is done is beyond the scope of this specific explanation. For more information, please refer to the *Essence of Accounting*[9].

1.7. Conceptual Understanding of Knowledge

Knowledge is a form of familiarity with information from some specific area. Knowledge is often understood to be awareness of facts, having

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[8] Brad Frost, *Atomic Design Methodology*, https://digitalfinancialreporting.blogspot.com/2023/12/atomic-design-methodology.html

[9] Charles Hoffman, CPA, *Essence of Accounting*, https://xbrlsite.azurewebsites.net/2020/Library/EssenceOfAccounting.pdf

learned skills, or having gained experience using the things and the state of affairs (situations[10]) within some area of knowledge.

Knowledge of facts is distinct from opinion or guesswork by virtue of justification or proof. In our case we are talking about specific knowledge, the facts and the proof, that has been put into a form readable by a machine. The machine can read that knowledge and mimic understanding of that knowledge.

We communicate using knowledge graphs all the time and tend to not realize it. When you go to a whiteboard and draw circles and squares and connect them with lines with arrows you are drawing a graph and communicating knowledge. Those circles, squares, lines, and arrows are intuitively understandable and very expressive. These informal knowledge graphs have been used by humans to communicate information for quite some time.
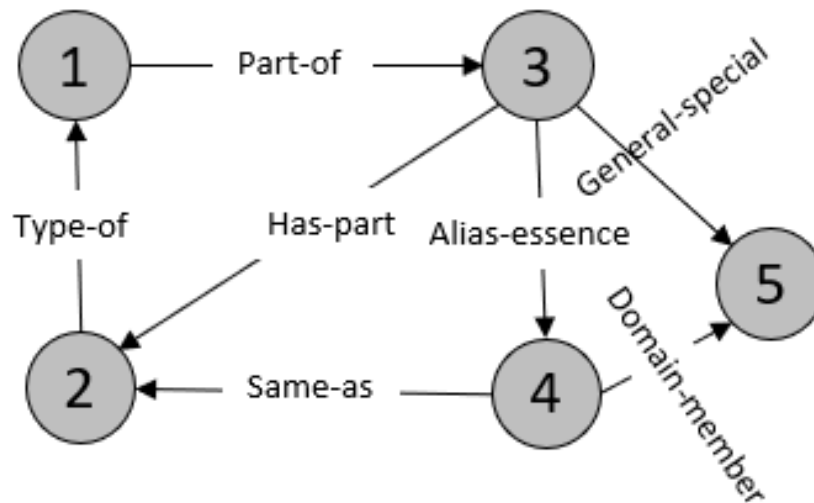
Most accountants are familiar with flowcharts. You can think of a knowledge graph as a type of flowchart that is readable by both humans and computers.

Philosophy is a formal discipline which provides tools and techniques for the systematic study of specific things including knowledge and reasoning.

One tool provided by the discipline of philosophy is logic. Logic is the study of correct reasoning. Logic uses artificial languages with a precise

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[10] *Describing Situation Semantics using Situation Theory*,
https://digitalfinancialreporting.blogspot.com/2023/10/describing-situation-semantics-using.html

symbolic representation to investigate reasoning. The tools of logic which provide the foundation for mathematics are leveraged by computers to mimic tools previously available only to humans, opening up the possibility of machines literally mimicking an understanding of knowledge.

Conceptually, a financial report is a knowledge graph[11]. Those financial report knowledge graphs have an enforceable logical schema[12] that prescribes what is permitted and what is disallowed within that knowledge graph.

General business reports are likewise knowledge graphs. One can understand general business report knowledge graphs by studying financial report knowledge graphs.

1.8. Knowledge

Knowledge is the understanding or interpretation of information. Knowledge is the understanding or interpretation of information and approach to act upon the information in the mind of the perceiver. Knowledge in the form of skills acquired by a person through education or through experience relates to the theoretical and/or practical understanding of some area of knowledge.
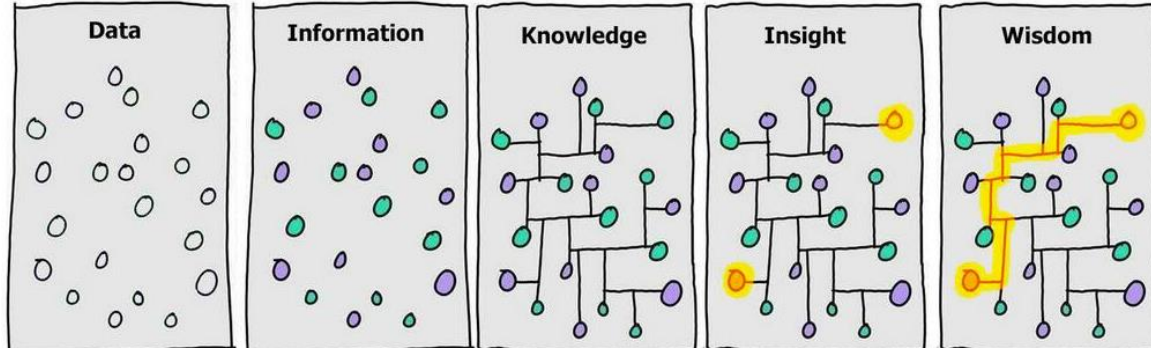

The difference between "data" and "information" is context. This graphic created by Shawn Riley[13], is helpful in understanding the difference between data and information. The key differentiator is context.

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[11] Charles Hoffman, CPA, *Financial Report Knowledge Graph*, https://xbrlsite.azurewebsites.net/2021/Library/FinancialReportKnowledgeGraphs.pdf

[12] Charles Hoffman, CPA, Logical Schema of Financial Reports, http://xbrlsite.com/seattlemethod/LogicalSchemaOfFinancialReports.pdf

[13] Shawn Riley, *Machine Learning versus Machine Understanding*, https://www.linkedin.com/pulse/machine-learning-vs-understanding-shawn-riley/
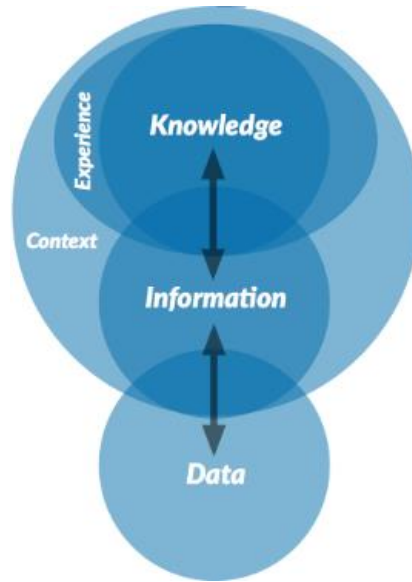
1.9. Graph

A **graph**, in formal terms using technical jargon, is a set of vertices and edges and is explained by graph theory[14] and network theory[15] which is part of graph theory.

In less intimidating language (but still too technical really), a graph is a set of nodes and the relationships that connect the nodes together. Graphs represent things as nodes and the ways in which those things relate to one another and rest of the world as relationships.

A graph is a general-purpose communications tool that allows us to model all sorts of scenarios in terms that are innately understandable to humans. One thing that can be represented in the form of a graph is knowledge.

Again, a comprehensive discussion of graphs is beyond the scope of this document. The bottom line is two important ideas. First, we want to use professional quality knowledge graphs which have the maximum amount of expressive power and are very safe to use. The type of knowledge graph that fits that bill is known as a "**strongly typed directed acyclic labeled property graph of semantic knowledge which includes a logical schema**."[16]

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[14] Wikipedia, *Graph Theory*, https://en.wikipedia.org/wiki/Graph_theory

[15] Wikipedia, *Network Theory*, https://en.wikipedia.org/wiki/Network_theory

[16] *Professional Knowledge Graph*, https://digitalfinancialreporting.blogspot.com/2023/12/professional-knowledge-graphs.html

Second, we need to discuss knowledge graphs and rather than using one of the many different technical jargons available for having those discussions; we will choose to discuss knowledge graphs using the terminology of logic.

We are interested not in the technical instantiation of the knowledge; we are interested in discussing the knowledge itself expressed by the knowledge graph; within the knowledge graph. To discuss knowledge graphs, we will use the language of philosophy and logic which has been around for hundreds of years and which is innately understandable to humans.

Knowledge graphs express logical statements. More on that in just a moment. But first let us wrap up our explanation of what a knowledge graph is.

1.10. Knowledge Graph

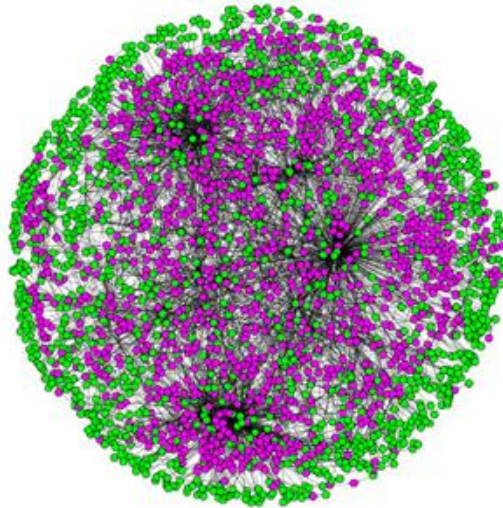This is a simple graph of knowledge, or a **knowledge graph**:
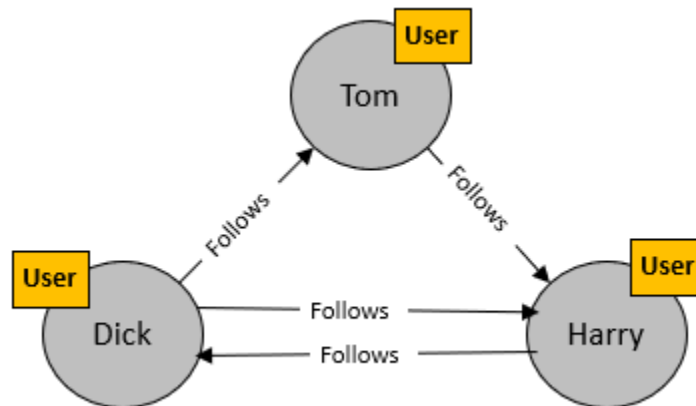
A knowledge graph[17], also known as a semantic network, represents a network of real-world things (entities)—i.e. objects, events, situations, or concepts—and illustrates the relationship between those things. This information can be visualized as a graph structure.

Here is a more complex knowledge graph. This type of general view of a knowledge graph is commonly referred to as a graph hairball[18]:

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[17] IBM, *What is a Knowledge Graph?*, https://www.ibm.com/topics/knowledge-graph

[18] *Graph Hairball*, https://digitalfinancialreporting.blogspot.com/2023/09/graph-hairball.html

The reason the knowledge graphs looks like a cluster of "stuff" which tends to be incomprehensible to humans is the general nature of the information representation which provides a tremendous amount of flexibility and the lack of a high-level model to make working with the knowledge graph easier for humans.

Saying this another way, when a high-level model is applied to a knowledge graph; then the high-level model, such as the *Logical Theory Describing Financial Report*[19], can be used to turn the hairball into something that looks like this:
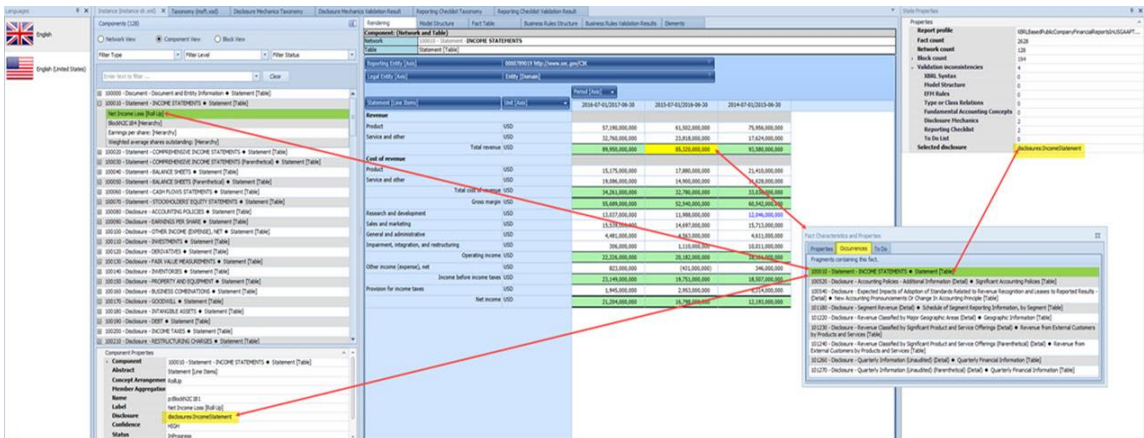
Knowledge graphs are rich in terms of expressiveness but still innately understandable by humans but knowledge graphs can also be read and understood by machines such as computers.

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[19] Charles Hoffman, *Logical Theory Describing Financial Report*,
http://xbrlsite.com/seattlemethod/LogicalTheoryDescribingFinancialReport_Terse.pdf

A general-purpose **financial report** conveys knowledge about the financial status, financial performance, and liquidity of an economic entity. For example, here is a fragment of a financial report:

Statement [Line Items]	Period [Axis]		
	2016-07-01 - 2017-06-30	2015-07-01 - 2016-06-30	2014-07-01 - 2015-06-30
Net income	21,204,000,000 [2,3]	16,798,000,000 [1]	12,193,000,000
Other comprehensive income (loss):			
Net unrealized gains (losses) on derivatives (net of tax effects of $(5), $(12), and $20)	(218,000,000)	(238,000,000)	559,000,000
Net unrealized losses on investments (net of tax effects of $(613), $(121), and $(197))	(1,116,000,000)	(228,000,000)	(362,000,000)
Translation adjustments and other (net of tax effects of $9, $(33), and $16)	228,000,000	(519,000,000)	(1,383,000,000)
Other comprehensive loss	(1,106,000,000)	(985,000,000)	(1,186,000,000)
Comprehensive income	20,098,000,000	15,813,000,000	11,007,000,000

The information contained within a financial report can also be seen as or represented as a knowledge graph that is readable by both machines and by humans.

While the formatting of the information within a financial report is different than the formal vertices and edges of a graph; I think that it is rather easy to see or perceive that a financial report is a knowledge graph.
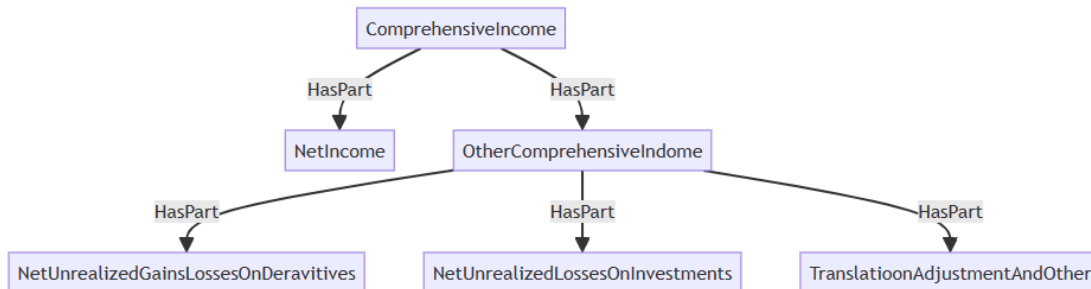
1.11. Expressing Knowledge in Knowledge Graphs, Building Blocks

The *elements of logic*[20] are the fundamental building blocks of logical theories that describe the logical conceptualization of some natural or designed man-made logical system that is represented using a knowledge graph.

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[20] Elements of Logic, https://digitalfinancialreporting.blogspot.com/2023/10/elements-of-logic-for-accountants.html

The elements of logic describe *what is in* a knowledge graph. Logical statements explain what the knowledge graph means; the information that is conveyed.

This is as contrast to the physical technical format of that information which might be XBRL, RDF+OWL+SHACL, GSQL, SQL, PROLOG, DATALOG, CSV, Excel, or some other mechanism for expressing a physical technical format. Yes, the "envelope" that contains the knowledge is important; but we are not concerning ourselves with that physical envelope; we are interested in the information provided within that envelope.

The relevant, important logic of an area of knowledge can be described using these logical building blocks; these elements of logic: (Remember, logic is about correct reasoning and not about which facts you choose to believe or choose not to believe.)

- **Logical statement**: A logical statement is a proposition, claim, assertion, belief, idea, or fact about or related to the area of knowledge to which a logical conceptualization relates. A logical statement is a declarative sentence[21]. Not all sentences are statements; for example, a question such as "What is your name?", or a command such as "Stop!", are not statements. There are five broad categories of logical statements:

    o **Terms**: Terms are relevant, important logical statements that define ideas or "things" used by a logical conceptualization. For example, "assets", "liabilities", "equity", and "balance sheet" are things or ideas used in a logical conceptualization to describe the area of knowledge referred to as financial reporting. Terms should be defined such that one term can be distinguished from some other term and that terms can be classified into clear categories.

    o **Associations**: Associations are relevant, important logical 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". Associations can be grouped into two broad categories:

        ▪ "**Is-a**" (a.k.a. general-special, association, type-subtype, class-subclass, equivalent-class)

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[21] *Business Rules Manifesto*, https://www.businessrulesgroup.org/brmanifesto.htm

- ▪ "**Has-a**" (a.k.a. part-of, has-part, part-whole, composition, aggregation)

- o **Rules**: Rules (a.k.a. assertions, restrictions, constraints) are relevant, important logical statements that describe what tend to be convertible into 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". One rule can be connected to another rule using logic gates[22] (AND, OR, NOR, NAND, XOR, XNOR, NOT) to form complex compound logical statements. Rules can assert mathematical relationships or derive mathematical relationships to form new facts.

- o **Facts**: Facts are relevant, important logical statements that are known to be true. In the context of databases and knowledge representation, facts are often used to represent known information. Facts are logical statements about the numbers and words that are provided by an economic entity within a financial report. For example, the financial 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.

- o **Properties:** Properties are relevant, important logical statements about the important qualities and traits of a model, structure, term, association, rule, or fact.

- **Axioms:** Axioms are foundational logical statements that are fundamentally accepted as being true per some logical system.

- **Theorems**: Theorems are logical statements that are determined to be true per logical steps that can be taken to arrive at a conclusion using axioms, other theorems, or facts.

- **Restriction**: Restrictions are a special type of axiom or theorem that is imposed by some authority which chooses to restrict, constrain, limit, or otherwise impose some range on some logical artifact.

- **Classification**: Classification is the grouping of logical artifacts into useful sets or groups.

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[22] *Logic Gates*, https://www.linkedin.com/pulse/logic-gates-building-blocks-digital-circuits-deekshith-kumar
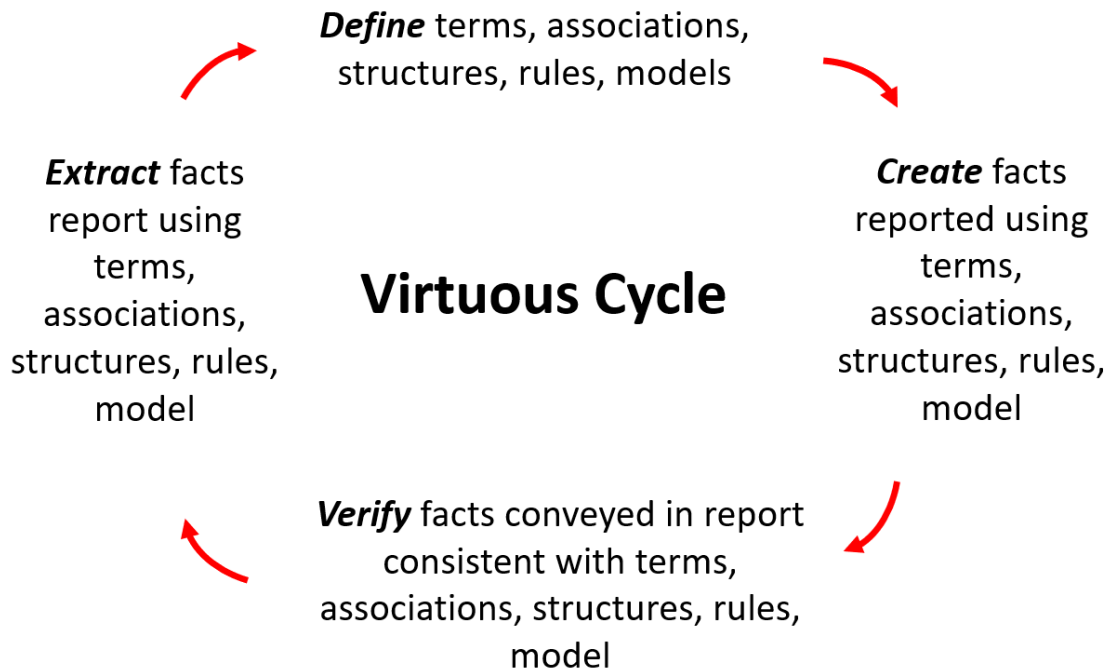
- **Logical structure**: A logical structure is as set of logical statements which describe the structure or assembly. An "infon" which is defined by Situation Theory is a unit of information. In infon is a type of logical structure. An infon is a useful, convenient unit or "set" of information.

- **Logical model**: A logical model is a set of specific structures or assemblies that are consistent with and permissible interpretations of that model. Models add flexibility to logical conceptualizations.

- **Logical conceptualization**: A logical conceptualization is a set of models that are consistent with and permissible per that logical conceptualization. A logical conceptualization is made up of a set of models, structures, terms, associations, rules, and facts.

- **Logical theory**: A logical theory is described per some logical conceptualization and forms a logical theory that explains what is permitted and what is not permitted per a logical conceptualization which is made up of a set of logical models, structures, terms, associations, rules, and facts.

- **Logical system**: A logical system can be explained by a logical theory. A logical theory is an abstract conceptualization of specific important details of some area of knowledge. The logical theory provides a way of thinking about an area of knowledge by means of deductive reasoning to derive logical consequences of the logical theory.

A logical system described by a logical theory and described by a logical conceptualization enables a community of stakeholders trying to achieve a specific goal or objective or a range of goals/objectives for an area of knowledge to agree on important logical statements used for capturing meaning or representing a shared understanding of and knowledge in some area of knowledge.

1.12. Properly Functioning Logical System

A logical system should be consistent (as opposed to inconsistent, making contradictory statements), complete (as opposed to incomplete, leaving a piece out of the theory), and precise (as opposed to imprecise, describing an area of knowledge incorrectly).

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 properly functioning, it creates a virtuous cycle.

Define terms, associations,
structures, rules, models

Extract facts
report using
terms,
associations,
structures, rules,
model

Virtuous Cycle

Create facts
reported using
terms,
associations,
structures, rules,
model

Verify facts conveyed in report
consistent with terms,
associations, structures, rules,
model

1.13. Control

A knowledge graph tells a story. That story, for say a knowledge graph that represents a financial report, is the story about the financial position and financial performance of a reporting economic entity. That story must be "true" and "fair".

The information conveyed by that story should be the same whether a traditional human readable report is used as the medium or whether a machine-readable knowledge graph is used as the medium to convey the logical information; those logical statements, conveyed by the knowledge graph.

Financial reports are not "standard forms"[23]. Report models can be modified or customized by reporting entities which can use different subtotals, different disclosure alternatives, and even report additional disclosures which the economic entity feels is important to understanding that specific economic entity.

That flexibility is a deliberate feature of financial reporting schemes such as US GAAP and IFRS. That flexibility is intentional and part of the design of those financial reporting schemes.

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[23] *Puzzle Pieces of Financial Reporting*, https://digitalfinancialreporting.blogspot.com/2023/11/puzzle-pieces-of-digital-financial.html

But while financial reports are not standard forms, they are also not random. There are logical patterns. There are good practices and "best practices.

When a report model can be modified/customized, the "wild behavior" of accountants creating reports and report models must be controlled and preferably even eliminated, keeping report models within permitted boundaries. While permitted boundaries can sometimes be defined differently by, say, different CPA firms or even different accountants within the same CPA firm; logical patterns exist and those logical patterns can be leveraged[24]. To properly differentiate "wild behavior" from acceptable behavior; one needs to properly understand the difference between ambiguity, judgement, and how to evaluate the true level of skill and experience of a professional accountant[25].

1.14. Skills and Experience

The average accountant is, well, average. The skills of professional accountants and auditors can be represented graphically as a bell-shaped curve:

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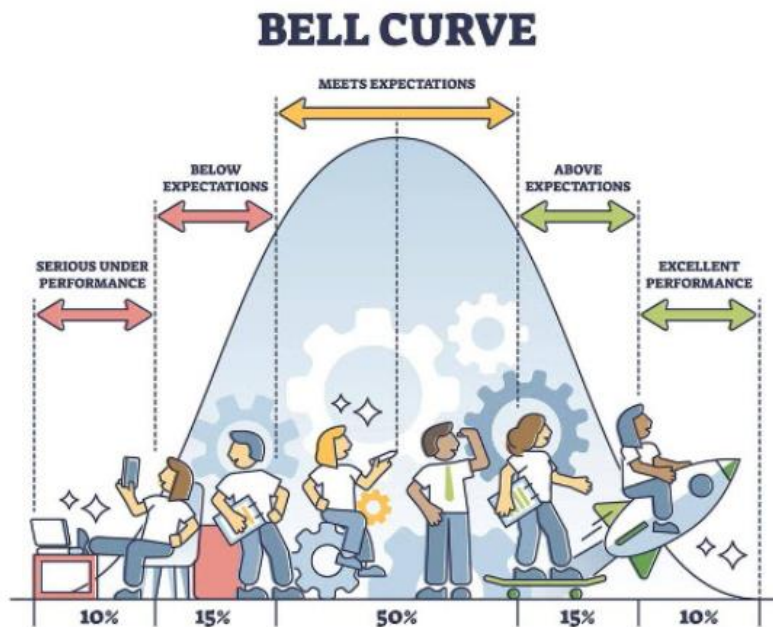
[24] *Puzzle Pieces of Digital Financial Reporting*,
https://digitalfinancialreporting.blogspot.com/2023/11/puzzle-pieces-of-digital-financial.html
[25] Value of an Expert System for Creating Financial Reports,
https://digitalfinancialreporting.blogspot.com/2023/02/value-of-expert-system-for-financial.html

An expert system shifts that bell shaped curve by augmenting the skills of accountants with the good practices and best practices of expert accountants using machine-readable rules that are available to software applications used by those accountants. That machine-readable knowledge can shift the bell-shaped curve by shifting the skills of accountants:
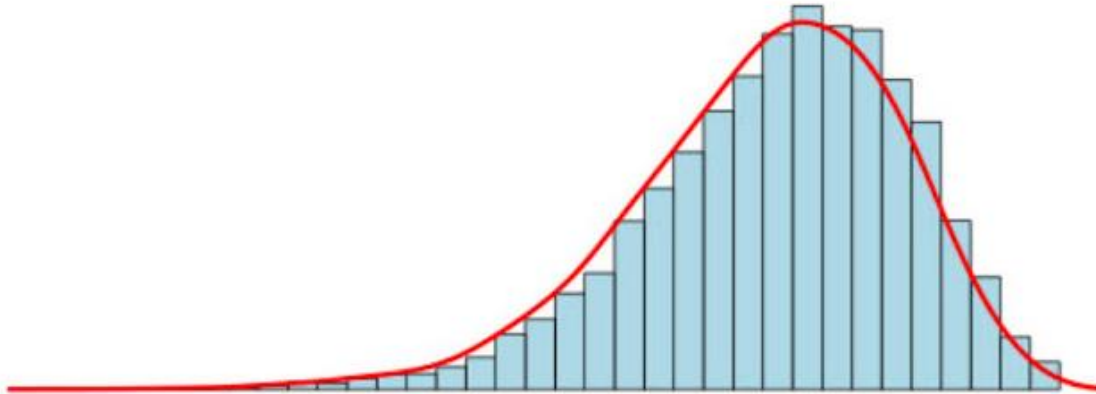
The result is better accountants and auditors and higher quality financial reports.

1.15. Describing a System

A financial reporting scheme represented using a knowledge graph in the form of an XBRL taxonomy which is then used to represent a report model for a report created by an economic entity in machine readable form serves multiple purposes:

- **Description**: It is a clear and should be complete description of a report model (specification of what is permitted); created by standards setters or regulators or anyone else specifying a report. And obviously the clear and complete description should represent accounting and reporting rules precisely and accurately.

- **Construction**: It is a guide to the creation of a report based on that permitted report model description whereby a human can be assisted by software applications utilizing that machine readable description of permitted report models.

- **Verification**: The actual report constructed can be verified against the clear, complete description assisted by software applications utilizing that machine readable description.

- **Extraction**: Information can be effectively extracted from machine readable reports and report models assisted by software utilizing that machine readable clear and complete description.

Note that the machine-readable version of the report model description and report can be automatically converted from the machine-readable format to a human readable format using automated processes.

To reiterate; a machine-readable representation of a financial reporting scheme in a knowledge graph like an XBRL taxonomy must be clear, complete, and reflect accounting and reporting rules precisely and accurately[26].

Precise but not accurate   Accurate and precise   Accurate but not precise   Not accurate or precise
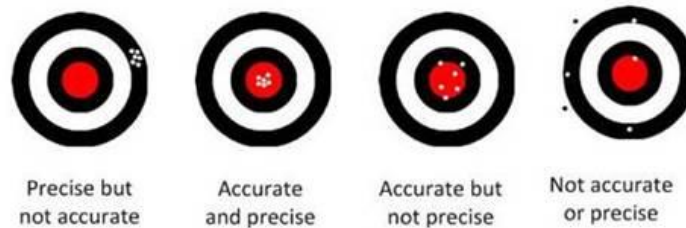
1.16. Accounting Oracle Machine

Traditionally, financial reporting schemes have been represented in books and can often be unclear. The US GAAP and IFRS XBRL taxonomies are, as they are represented today, are not clear as the really could be or need to be, they are not complete, they are missing rules.

Further, US GAAP and IFRS reporting rules are sometimes ambiguous, but that lack of clarity can be "worked around" by a skilled and experienced accountant that understands accounting and reporting principles and the existing rules well and if they have the right skill and experience, they can create "sensible" alternatives considering the ambiguous (i.e. not clear) articulation of the rules by standards setters and regulators.

In the future this knowledge which was historically communicated using books will be communicated in new ways such as, perhaps, an accounting oracle machine[27].

Whether accounting and reporting rules are in human readable form or machine-readable form; these knowledge graphs should be clear, complete, accurate, and precise. The advantage of machine-readable form is that the process can be more formalized and tasks and processes can be automated.

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[26] *What is Accuracy?*, https://www.adamequipment.com/aeblog/what-is-accuracy

[27] *Global Standards based Accounting and Reporting Oracle Machine Prototype*, https://digitalfinancialreporting.blogspot.com/2023/11/global-standards-based-accounting-and.html

1.17. Intelligent Software Agents

Imagine intelligent software agents such as ChatGPT "copilots"[28] augmenting the skills of professional accountants, auditors, and analysts. Imagine unified generative AI, machine learning, and rules-based systems[29].
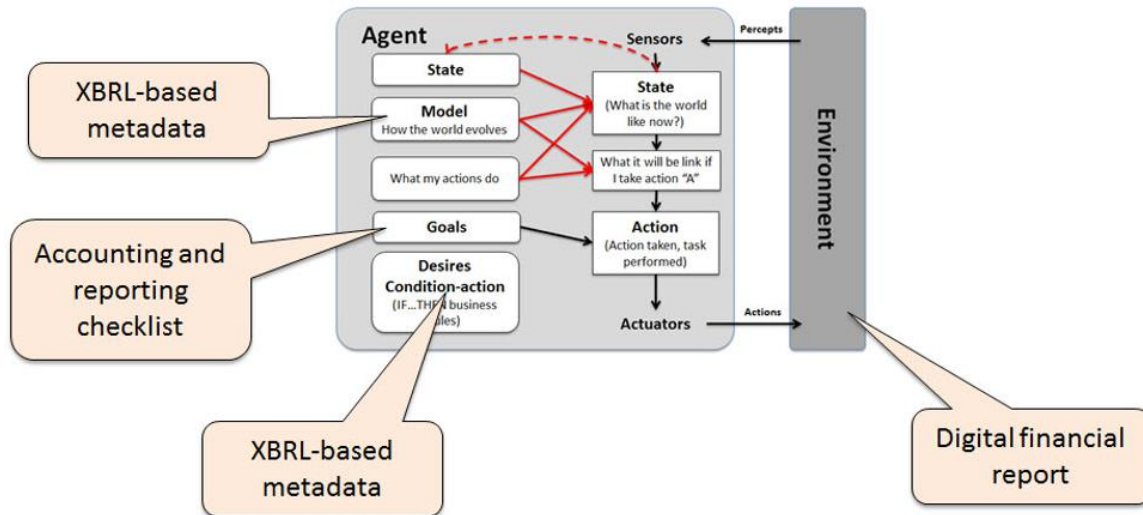

Financial reporting is not a silo, it is a chain. Today, financial reporting is treated as if it was separate silos. Tomorrow, the benefits of being a chain will be recognized and realized. Imagine an accounting oracle machine shared by the member of a financial reporting supply chain[30].

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[28] *Useful Generative AI is Coming*,
https://digitalfinancialreporting.blogspot.com/2023/11/useful-generative-ai-coming-to.html

[29] *Unifying Generative AI, Machine Learning, and Rules-based Systems*,
https://digitalfinancialreporting.blogspot.com/2023/12/unifying-generative-ai-machine-learning.html

[30] *Global Standards based Accounting and Reporting Oracle Machine Prototype*,
https://digitalfinancialreporting.blogspot.com/2023/11/global-standards-based-accounting-and.html
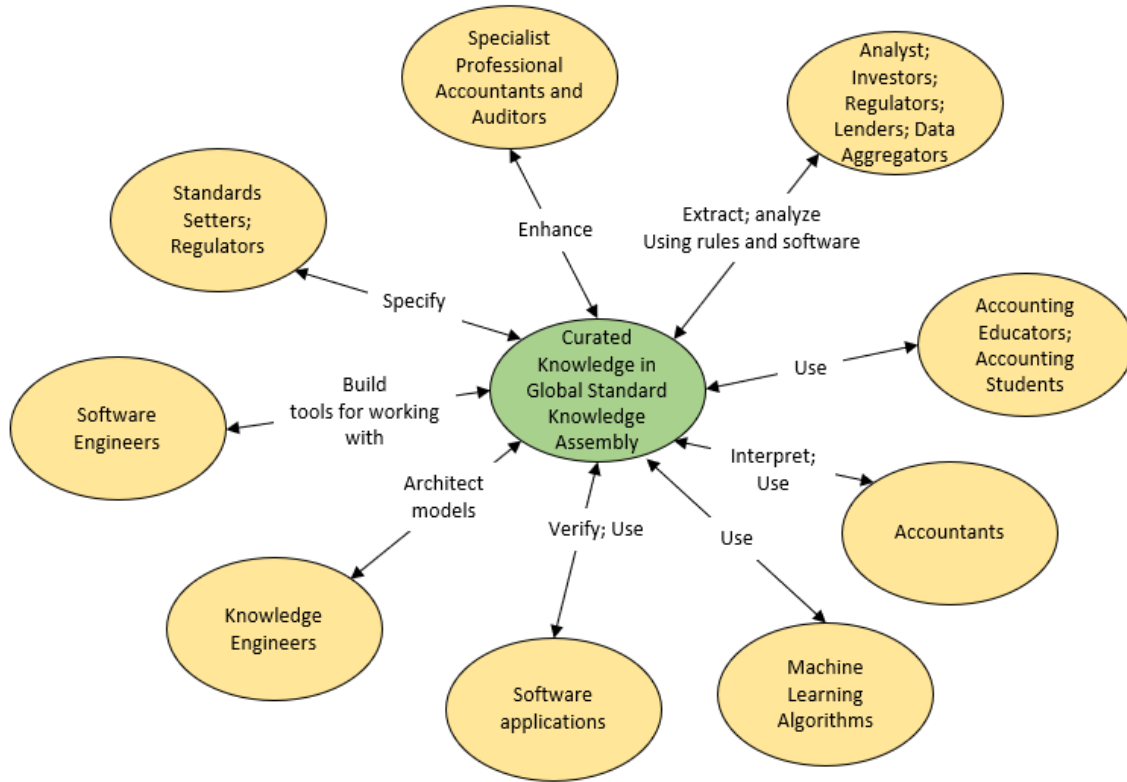
1.18. Universal Technology of Accountability

Accounting is one of the most important technologies invented in the history of human civilization and has been around about 7,000 years. Accounting was invented before writing and before the invention of numbers. The global multinational organization simply could not exist without double entry bookkeeping and accounting. This professional system is an enhancement to this universal technology for accountability[31].

1.19. Algorithmic Regulation

In the document, *The Great Transmutation*[32], I point out the idea of algorithmic regulation. While most people only talk about the idea of algorithmic regulation; this professional system for creating financial reports is an implementation of such a system.

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[31] *Universal Technology for Accountability*, https://digitalfinancialreporting.blogspot.com/2023/02/universal-technology-for-accountability.html

[32] Charles Hoffman, CPA, *The Great Transmutation*, https://xbrlsite.azurewebsites.net/2022/Library/TheGreatTransmutation.pdf

2.   Understanding the System

In this section I will explain the system for creating financial reports using machine readable knowledge graphs using a simple example that helps the reader get their heads around the complete system effectively. In a subsequent section I will enhance the explanation to provide a precise understanding of the full capabilities of this new type of system for creating financial reports.

This system will be explained using an implementation of the system within an existing cloud-based software application, Auditchain Luca[33], which is part of the Auditchain Suite.

For this particular explanation, I will be using the prototype financial reporting scheme SFAC 8[34]. This prototype can effectively be used to convey the general ideas of this professional system for creating financial reports using global standard knowledge graphs.

The PROOF[35] which is a slightly larger but more logically complete in terms of capabilities should be used if you want to get a better idea of the capabilities of such a system.

Finally, please don't make the common mistake of thinking that this system only works for financial reports. While the rich model of financial reporting does tend to enhance the capabilities of this system; this system also works with general business reports. In fact, I would consider this a system for implementing semantic spreadsheets[36].

2.1. Publish Base Financial Reporting Scheme

The first step in creating a system for creating financial reports that leverage knowledge graphs is to represent the base financial reporting scheme in the form of a knowledge graph.

For this explanation, we will use an existing small, easy to understand, yet good-enough financial reporting scheme to communicate the

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[33] Development Version of Auditchain Suite of which Auditchain Luca is a part, https://dev.auditchain.finance/

[34] *SFAC 8 Financial Reporting Scheme Prototype*, http://www.xbrlsite.com/seattlemethod/golden/sfac8/sfac8_ModelStructure.html

[35] PROOF, https://digitalfinancialreporting.blogspot.com/2023/12/proof.html

[36] *Special Purpose Logical Spreadsheets for Accountants*, http://www.xbrlsite.com/2023/Library/SpecialPurposeLogicalSpreadsheetsForAccountants.pdf

general ideas of a system for creating financial reports leveraging a global standard knowledge graph.

This specific working prototype is referred to as SFAC 8[37].

Line	Label	Report Element C	Period Type	Balance	Report Element Name
1	**11-Statement of Financial Position**	Network			http://xbrlsite.com/seattlemethod/sfac8/role/BalanceSheet
2	**Balance Sheet [Hypercube]**	Table			sfac8:BalanceSheetHypercube
3	Balance Sheet [Line Items]	LineItems			sfac8:BalanceSheetLineItems
4	Balance Sheet [Arithmetic]	Abstract			sfac8:BalanceSheetArithmetic
5	Assets	Concept (Monetary)	As Of	Debit	sfac8:Assets
6	Liabilities	Concept (Monetary)	As Of	Credit	sfac8:Liabilities
7	Equity	Concept (Monetary)	As Of	Credit	sfac8:Equity
8	**12-Statement of Net Assets**	Network			http://xbrlsite.com/seattlemethod/sfac8/role/NetAssets
9	**Fund Balance [Hypercube]**	Table			sfac8:FundBalanceHypercube
10	Fund Balance [Line Items]	LineItems			sfac8:FundBalanceLineItems
11	Net Assets [Roll Up]	Abstract			sfac8:NetAssetsRollUp
12	Assets	Concept (Monetary)	As Of	Debit	sfac8:Assets
13	(Liabilities)	Concept (Monetary)	As Of	Credit	sfac8:Liabilities
14	Net Assets	Concept (Monetary)	As Of	Debit	sfac8:NetAssets
15	Fund Balance [Roll Up]	Abstract			sfac8:FundBalanceRollUp
16	Fund Balance, With Donor Restrictions	Concept (Monetary)	As Of	Credit	sfac8:FundBalanceWithDonorRestrictions
17	Fund Balance, Without Donor Restrictions	Concept (Monetary)	As Of	Credit	sfac8:FundBalanceWithoutDonorRestrictions
18	Fund Balance	Concept (Monetary)	As Of	Credit	sfac8:FundBalance
19	**21-Statement of Comprehensive Income**	Network			http://xbrlsite.com/seattlemethod/sfac8/role/ComprehensiveIncome
20	**Comprehensive Income Statement [Hypercube]**	Table			sfac8:ComprehensiveIncomeStatementHypercube
21	Comprehensive Income Statement [Line Items]	LineItems			sfac8:ComprehensiveIncomeStatementLineItems
22	Comprehensive Income [Roll Up]	Abstract			sfac8:ComprehensiveIncomeRollUp
23	Revenues	Concept (Monetary)	For Period	Credit	sfac8:Revenues
24	(Expenses)	Concept (Monetary)	For Period	Debit	sfac8:Expenses
25	Gains	Concept (Monetary)	For Period	Credit	sfac8:Gains
26	(Losses)	Concept (Monetary)	For Period	Debit	sfac8:Losses
27	Comprehensive Income	Concept (Monetary)	For Period	Credit	sfac8:ComprehensiveIncome
28	**22-Statement of Comprehensive Income (Alternative)**	Network			http://xbrlsite.com/seattlemethod/sfac8/role/ComprehensiveIncome2
29	**Comprehensive Income Statement [Hypercube]**	Table			sfac8:ComprehensiveIncomeStatementHypercube
30	Comprehensive Income Statement [Line Items]	LineItems			sfac8:ComprehensiveIncomeStatementLineItems
31	Comprehensive Income [Roll Up]	Abstract			sfac8:ComprehensiveIncomeRollUp
32	Income from Normal Activities of Entity	Concept (Monetary)	For Period	Credit	sfac8:IncomeFromNormalActivitiesOfEntity
33	Income from Peripheral or Incidental Transactions of Entity	Concept (Monetary)	For Period	Credit	sfac8:IncomeFromPeripheralOrIncidentalTransactionsOfEntity
34	Comprehensive Income	Concept (Monetary)	For Period	Credit	sfac8:ComprehensiveIncome
35	**23-Statement of Changes in Net Assets**	Network			http://xbrlsite.com/seattlemethod/sfac8/role/ChangeInNetAssets
36	**Changes in Net Assets [Hypercube]**	Table			sfac8:ChangesInNetAssetsHypercube
37	Changes in Net Assets [Line Items]	LineItems			sfac8:ChangesInNetAssetsLineItems
38	Changes in Net Assets [Roll Up]	Abstract			sfac8:ChangesInNetAssetsRollUp
39	Revenues	Concept (Monetary)	For Period	Credit	sfac8:Revenues
40	(Expenses)	Concept (Monetary)	For Period	Debit	sfac8:Expenses
41	Gains	Concept (Monetary)	For Period	Credit	sfac8:Gains
42	(Losses)	Concept (Monetary)	For Period	Debit	sfac8:Losses
43	Change in Net Assets	Concept (Monetary)	For Period	Credit	sfac8:ChangeInNetAssets
44	**31-Statement of Changes in Equity**	Network			http://xbrlsite.com/seattlemethod/sfac8/role/ChangesInEquity
45	**Changes in Equity [Hypercube]**	Table			sfac8:ChangesInEquityHypercube
46	Changes in Equity [Line Items]	LineItems			sfac8:ChangesInEquityLineItems
47	Changes in Equity [Roll Forward]	Abstract			sfac8:ChangesInEquityRollForward
48	Equity, Beginning Balance	Concept (Monetary)	As Of	Credit	sfac8:Equity
49	Comprehensive Income	Concept (Monetary)	For Period	Credit	sfac8:ComprehensiveIncome
50	Investments by Owners	Concept (Monetary)	For Period	Credit	sfac8:InvestmentsByOwners
51	(Distributions to Owners)	Concept (Monetary)	For Period	Debit	sfac8:DistributionsToOwners
52	Equity, Ending Balance	Concept (Monetary)	As Of	Credit	sfac8:Equity
53	**32-Statement of Changes in Fund Balance**	Network			http://xbrlsite.com/seattlemethod/sfac8/role/ChangeInFundBalance
54	**Changes in Fund Balance [Hypercube]**	Table			sfac8:ChangesInFundBalanceHypercube
55	Changes in Fund Balance [Line Items]	LineItems			sfac8:ChangesInFundBalanceLineItems
56	Changes in Fund Balance [Roll Forward]	Abstract			sfac8:ChangesInFundBalanceRollForward
57	Fund Balance, Beginning Balance	Concept (Monetary)	As Of	Credit	sfac8:FundBalance
58	Change in Net Assets	Concept (Monetary)	For Period	Credit	sfac8:ChangeInNetAssets
59	Other Increases (Decreases) in Fund Balance	Concept (Monetary)	For Period	Credit	sfac8:OtherIncreasesDecreasesInFundBalance
60	Fund Balance, Ending Balance	Concept (Monetary)	As Of	Credit	sfac8:FundBalance

The following is a brief description of the important key aspects of the SFAC 8 financial reporting scheme.

1. This reporting scheme has 7 assemblies or structures indicated above by the 7 orange bars in the graphic above.

2. Of those 7 structures, there are two statements of financial position (#11 and #12), 3 statements of financial performance (#21, #22, #23), and 2 statement of changes (#31, #32).

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[37] *SFAC 8*,
http://www.xbrlsite.com/seattlemethod/golden/sfac8/sfac8_ModelStructure.html

3. Using those 7 structures (a.k.a. assemblies) a reporting entity could create a report using 3 different reporting styles. (Note that the "Reference" reporting style is used to test the full financial reporting scheme.

The following is a summary of the steps involved in publishing a base financial reporting scheme per this Seattle Method with links to each artifact created where available for this example. (Note that Auditchain Luca could conceivably be used to create a base financial reporting scheme but it is not optimized for that task.)

1. **Topics**: Generally, the first step in creating a base financial reporting scheme is to create a list of topics into which the disclosures of the base financial reporting scheme would be organized. Each topic has a unique name which is used to reference that specific topic. In the case of this base financial reporting scheme there are only 7 different disclosures so the topics are not really necessary. (Note that US GAAP and IFRS have potentially thousands of disclosures and therefore topics to organize the disclosures are quite helpful.)

2. **Disclosures**[38]: The next step in creating a base financial reporting scheme is to specifically identify and uniquely name each disclosure which might be represented within a financial report.

3. **Disclosure Mechanics Rules**[39]: The next step is to describe the essence for each disclosure in the financial reporting scheme using machine-readable rules that can be used to identify and describe each disclosure.

4. **Reporting Styles**[40]: Next, each of the permutations and combinations of disclosures which could be provided are specified within a reporting style.

   a. **Reporting Checklist Rules**[41]: The reporting checklist rules specifies when each disclosure is to be provided per the reporting style.

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[38] *Disclosures*, http://www.xbrlsite.com/seattlemethod/golden/sfac8/disclosures.xsd

[39] *Disclosure Mechanics Rules*, http://www.xbrlsite.com/seattlemethod/golden/sfac8/dm.xsd

[40] *Reporting Styles*, http://www.xbrlsite.com/seattlemethod/golden/sfac8/fac/reporting-styles-cm-ref.xml

[41] *Reporting Checklist Rules*, http://www.xbrlsite.com/seattlemethod/golden/sfac8/fac/BS1-IS1/dr-rules-def.xml

b. **Fundamental Accounting Concepts Continuity Crosschecks**[42]: The fundamental accounting concepts continuity crosscheck rules specify the specific high-level accounting concepts used and the mathematical relations between those concepts for each reporting style.

c. **Type-subtype Associations**[43]: The type-subtype associations specify the "is-a" and "has-a" type associations between the members of the set of high-level financial reporting concepts. These are the "wider-narrower" relations as many regulators refer to these types of associations.

d. **Templates**[44]: Each disclosure can have 0 to many different templates that act as prototypes for each disclosure that might be used by a financial reporting scheme.

e. **Exemplars**[45]: Each disclosure can have 0 to many different exemplars that are similar to templates but the examples come from financial reports created by other reporting economic entities that make use of this same financial reporting scheme.

5. **Model Structure Rules**[46]: Each base financial reporting scheme may specify the specific model structure rules for their specific base financial reporting scheme and all reports created per that financial reporting scheme. This gives each financial reporting scheme flexibility. Alternatively, standard model structure rules may be used.

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[42] *Fundamental Accounting Concepts Continuity Crosscheck Rules*,
http://www.xbrlsite.com/seattlemethod/golden/sfac8/fac/BS1-IS1/reportingstyle.xsd
[43] *Type-subtype Associations Rules*,
http://www.xbrlsite.com/seattlemethod/golden/sfac8/fac/BS1-IS1/types-rules-def.xml
[44] *Templates*,
http://www.xbrlsite.com/seattlemethod/golden/sfac8/templates/disclosures-templates-ref.xml
[45] *Exemplars*,
http://www.xbrlsite.com/seattlemethod/golden/sfac8/exemplars/disclosures-exemplarsList-ref.xml
[46] *Model Structure Rules (standard rules)*,
http://xbrlsite.com/seattlemethod/cm/model-structure-rules-strict-def.xml

6. **Entry Point**[47]: Finally, all the terms, labels, references, structures, associations, rules, and other artifacts used by each of the disclosures is created and provided within the base financial reporting scheme.

7. **Reference Implementation**[48]: A reference implementation is a working prototype of a report model and report created which exercises 100% of the base financial reporting scheme. The reference implementation proves that the XBRL-based knowledge graph is working as would be expected. The reference implementation is used to test and prove the base financial reporting scheme is complete, consistent, and precise.

Another cloud-based software application, Auditchain Pacioli[49], can be used to independently test the based financial reporting scheme XBRL-based knowledge graph, verifying[50] that base financial reporting scheme is operating as would be expected.

Summary

#	Verification Category	Result
1	XBRL Technical Syntax Verification	
2	Report Mathematical Computations Verification (XBRL Calculations)	
3	Report Mathematical Computations Verification (XBRL Formulas)	
4	Report Model Structure Verification	
5	Fundamental Accounting Concept Consistency Crosschecks Verification	
6	Type-subtype (wider-narrower) Associations Verification	
7	Disclosure Mechanics Verification	
8	Report Disclosure Checklist Verification	
9	Other	

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[47] *Entry Point*, http://www.xbrlsite.com/seattlemethod/golden/sfac8/sfac8-entryPoint.xsd

[48] *Reference Implementation*, http://www.xbrlsite.com/seattlemethod/golden/sfac8/index.html

[49] *Auditchain Pacioli, Power User Tool*, https://pacioli.auditchain.finance/tools/PowerUserTool.swinb

[50] *Pacioli Technical Analysis*, https://auditchain.infura-ipfs.io/ipfs/QmTH2iYTSWStdh5kXbadA1T9rPjAE7Z5qLF8L4wxgdhxig/

		TERMS		
		Mappings		
		FACTS (technical listing)		
		Type-subtype graph		
		Type-subtype table		
		Model Structure Validation		
1	11-Statement of Financial Position | Balance Sheet [Hypercube]	Structures	Facts	Pivots
2	12-Statement of Net Assets | Fund Balance [Hypercube]	Structures	Facts	Pivots
3	21-Statement of Comprehensive Income | Comprehensive Income Statement [Hypercube]	Structures	Facts	Pivots
4	22-Statement of Comprehensive Income (Alternative) | Comprehensive Income Statement [Hypercube]	Structures	Facts	Pivots
5	23-Statement of Changes in Net Assets | Changes in Net Assets [Hypercube]	Structures	Facts	Pivots
6	31-Statement of Changes in Equity | Changes in Equity [Hypercube]	Structures	Facts	Pivots
7	32-Statement of Changes in Fund Balance | Changes in Fund Balance [Hypercube]	Structures	Facts	Pivots
8	Disclosures | (implied) **Added**	Structures	Facts	Pivots
9	FAC - 101-Balance Sheet Classified | Balance Sheet Classified [Hypercube] **Added**	Structures	Facts	Pivots
		Derivations graph		
		Blocks		
		Blocks Graph		
		Metaverse (preliminary)		
		Derivation Rules		
		Calculations		
	All Rules	**Value Assertions**		
		Disclosure Mechanics rules		
		Report Checklist Rules		
		Messages		

You can also see separetely the added and reported networks

The bottom line is that the "building blocks" or the "elements" used to create a machine-readable representation of a financial reporting scheme using an XBRL-based knowledge graph; then one would expect that the machine-readable knowledge representation will be:

- Encoded formally in a declarative knowledge representation language. In our case this is XBRL; but other alternatives might be, RDF+OWL+SHACL, GSQL, SQL, PROLOG, DATALOG.

- Syntactically well-formed for the chosen language, as verified by an appropriate syntax checker or parser. In our case this is an
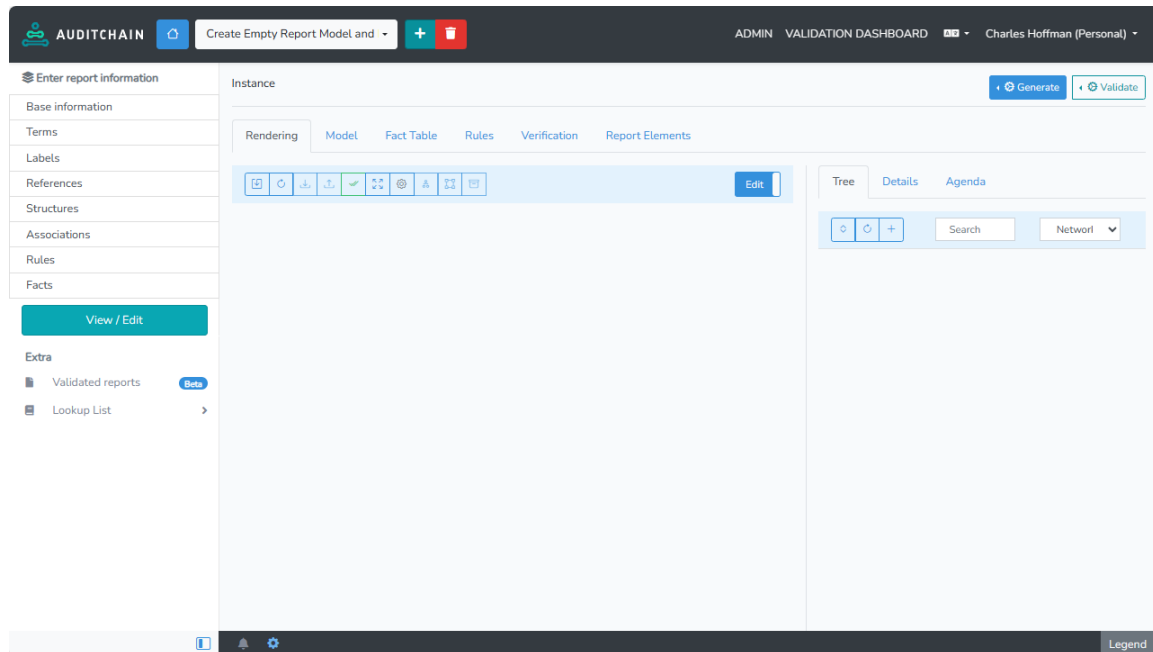
29

XBRL processor that has passed all the appropriate XBRL International Conformance Suite(s)[51].

- Logically consistent, as verified by a language appropriate reasoner or theorem prover for the language chosen. In our case we are using Auditchain Pacioli[52], which is a PROLOG based rules/logic engine to satisfy this need.

- Will meet business or appropriate application requirements as demonstrated though deliberate, extensive, rigorous testing. The reference implementation, verified using the described rules and logic engine, satisfies this need.

Having performed all of the above steps, confidence and proof that the base financial reporting scheme is worth committing to is satisfied.

2.2. *Create Empty Report*

The next step in the system is to create an empty report model and report. For all of the subsequent steps we will be using Auditchain Luca[53] except where indicated otherwise. Here is a completely empty report model and report:

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[51] XBRL International, XBRL Specification, Conformance Suite, https://specifications.xbrl.org/work-product-index-group-base-spec-base-spec.html
[52] Pacioli Logic and Rules Engine, https://docs.auditchain.finance/pacioli/pacioli-logic-and-rules-engine
[53] Auditchain Luca, https://dev.auditchain.finance/

This empty shell can be seen if one examines the state properties of the report at the moment of its creation which is shown below:
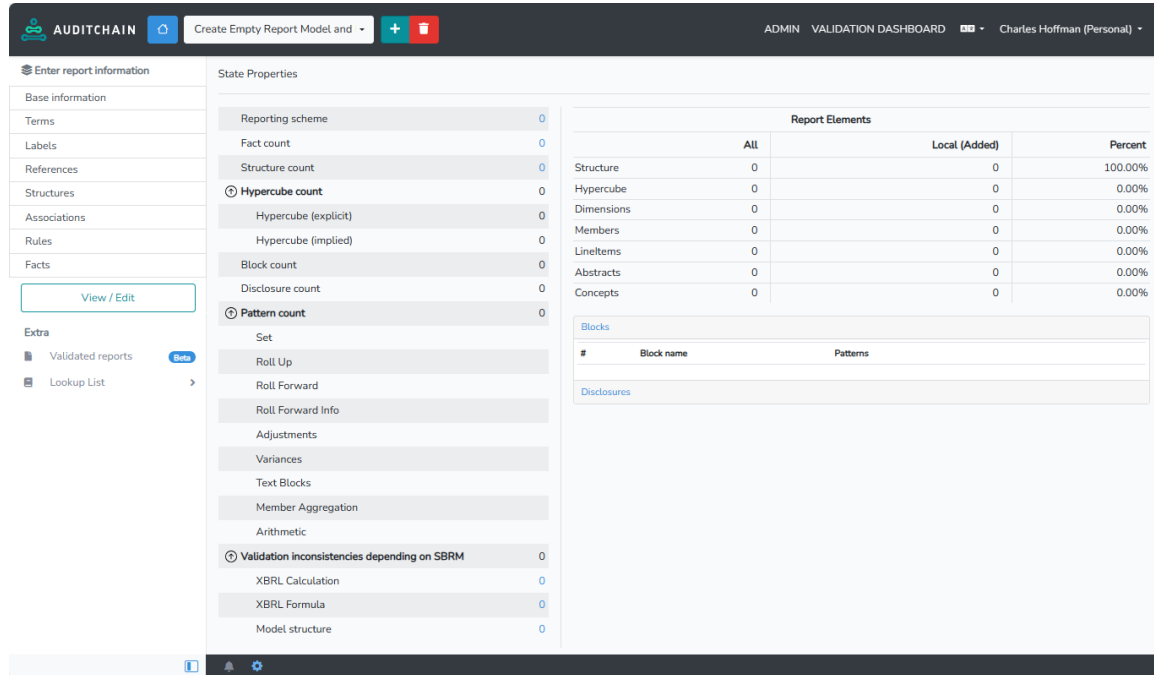
2.3. Connect Report to Published Financial Reporting Scheme

Any report model that is created when preparing a financial report using this system would generally reference some published base financial reporting scheme. Every base financial reporting scheme created and published that would be used, should be created in the manner specified by the *Seattle Method*[54].
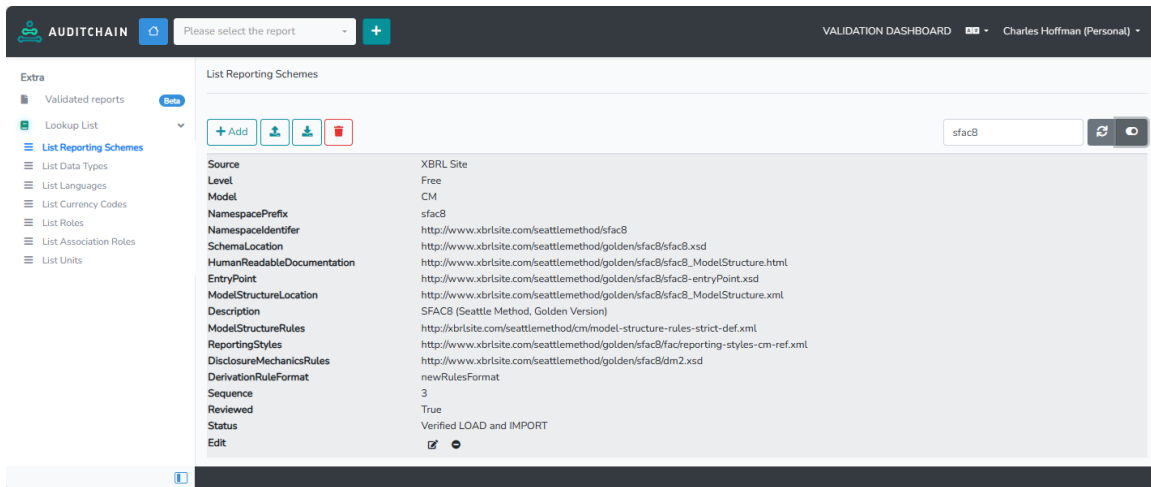
Supported financial reporting schemes are shown within the Auditchain Luca software application. Currently 35 working prototype financial reporting schemes are provided.

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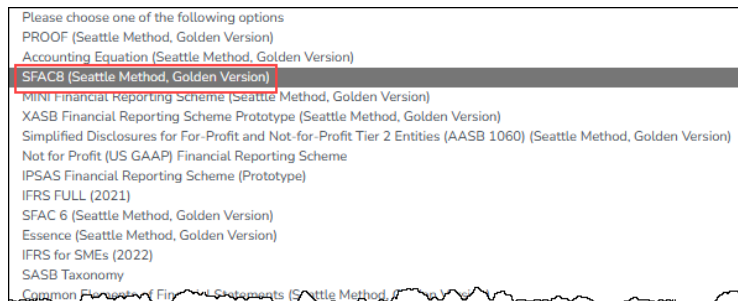
[54] Seattle Method, http://xbrlsite.com/seattlemethod/

In our case, we will use the "SFAC8(Seattle Method, Golden Version)". Once that financial reporting scheme has been selected, the Auditchain Luca automatically connects to the specified financial reporting scheme and that published financial reporting scheme (every one of the technical artifacts) is automatically imported into the "smart cache" of the Auditchain Luca software application.

To use a properly created base financial reporting scheme, all one needs to do is connect its metadata to the lookup list of financial reporting schemes in Auditchain Luca:

After the base financial reporting scheme(s) have been loaded, if you look at the report model and report you begin to see how much the software understands. Note the "Agenda" in the red rectangle below:
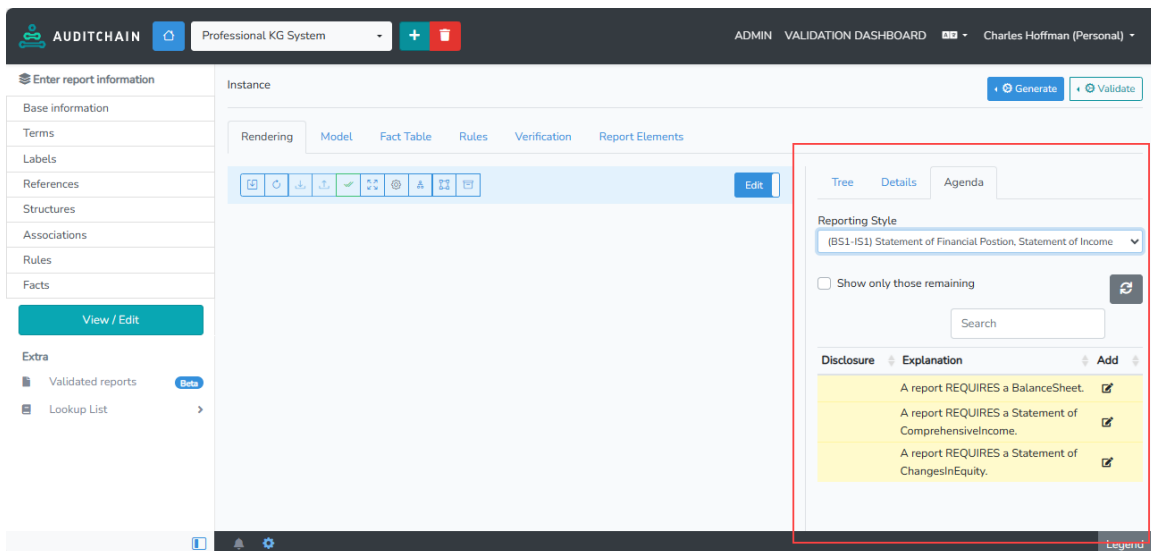
So what is going on is that Auditchain Luca has several software daemons running on the server in the background. The Auditchain

Luca software uses the rules stored in the smart cache, a daemon reads those rules, interprets the rules and then provides information to the software user dynamically. In this case, what the user sees is an "Agenda" that specifies that three disclosures are still to be added to the report model and report.
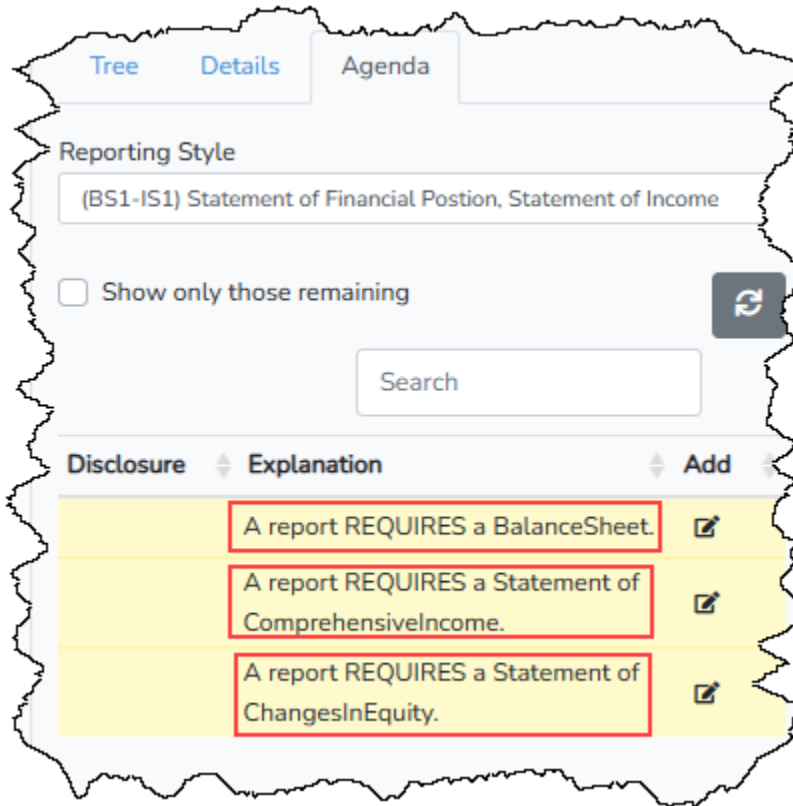
Why, and how, does the software understand that there are still three disclosures that are required to be reported? Well, the software

- Uses the disclosure names that specifies what a specific disclosure is desired to be worked with.
- Uses the disclosure mechanics rules to locate a disclosure that might satisfy the reporting checklist.
- And finally, the reporting checklist rules which uses the disclosure mechanics rules to find the disclosure or not and report back to the software using the reporting checklist rules.

2.4. Create Structures (a.k.a. assemblies)

A report is made up of structures which are filled with disclosures. In our case the Agenda reported that we needed to create three additional disclosures (within the structures) to satisfy the need of the

disclosure. To do this, we will create each different structure in the three different ways you could get a structure created. The first will use the ability of the Auditchain Luca software application to work directly with the logic of the base financial reporting scheme.

Given the fact that the entire set of logic is loaded into the smart cache; the software can present the user information about disclosures within the reporting scheme. The user can grab a structure used to represent a disclosure they want in their report from within the Auditchain Luca tool:
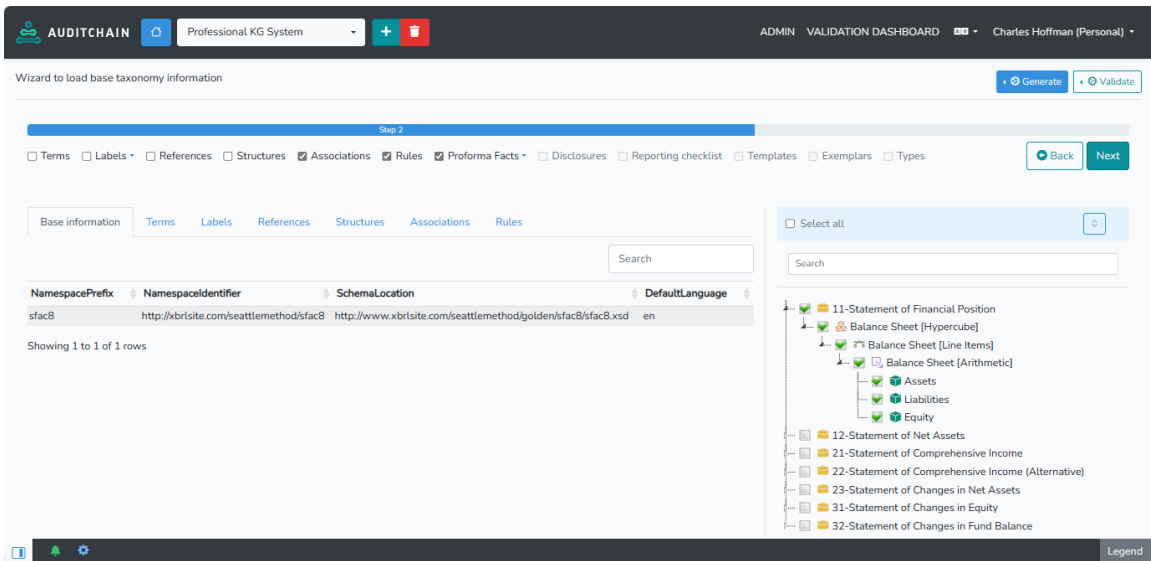

After the desired disclosure is selected, that template is loaded into the Auditchain Luca report creation software application as seen below: (note that all terms, structures, labels, associations, and rules are imported into the report being created; dummy facts are automatically generated creating a report pro forma:
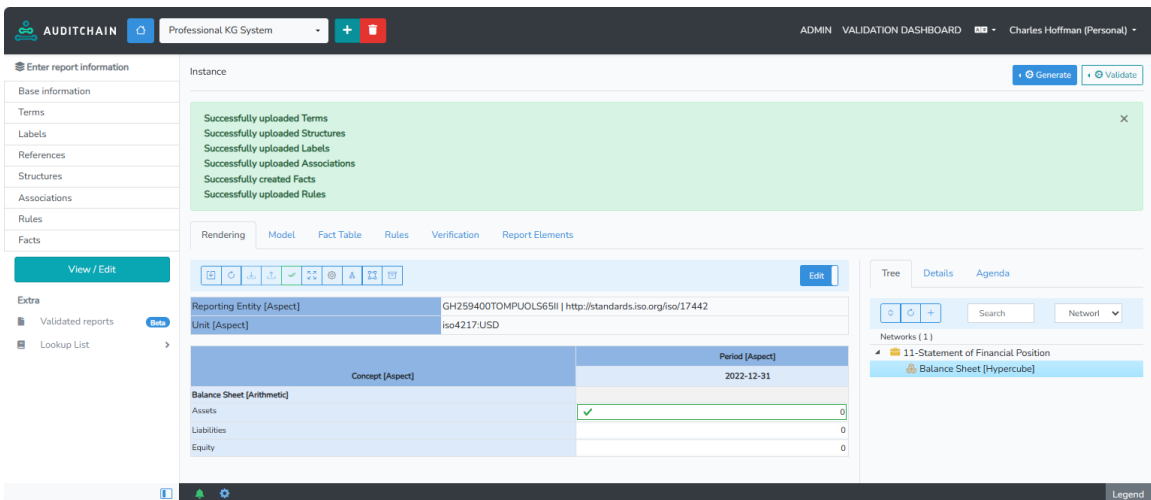
Having another look at the Agenda; notice what has happened. If the Luca software user chooses to look at the agenda, they would see that one of the Agenda items turned from yellow to green. The green color means the disclosure has been provided and there are no indications that the report is incorrect in any other way (other than the two additional disclosures that need to be included which are still indicated by the yellow in the Agenda).
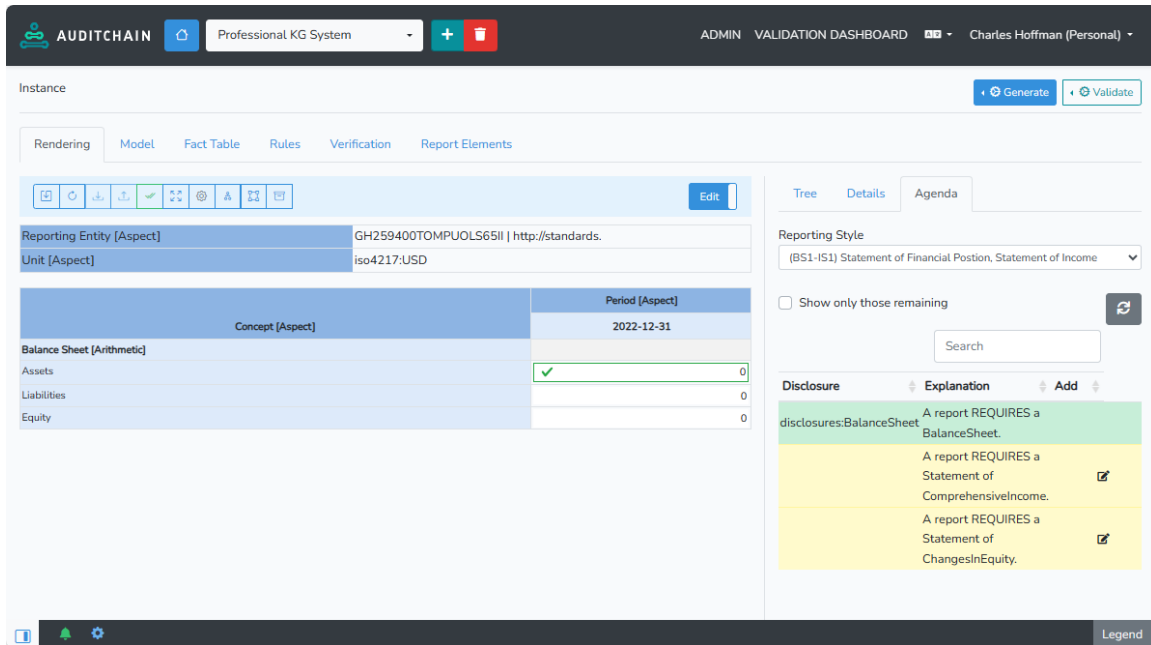

The next structure, income statement, we will create by importing information relating to that structure from an Excel spreadsheet that contains that information which you can see below.
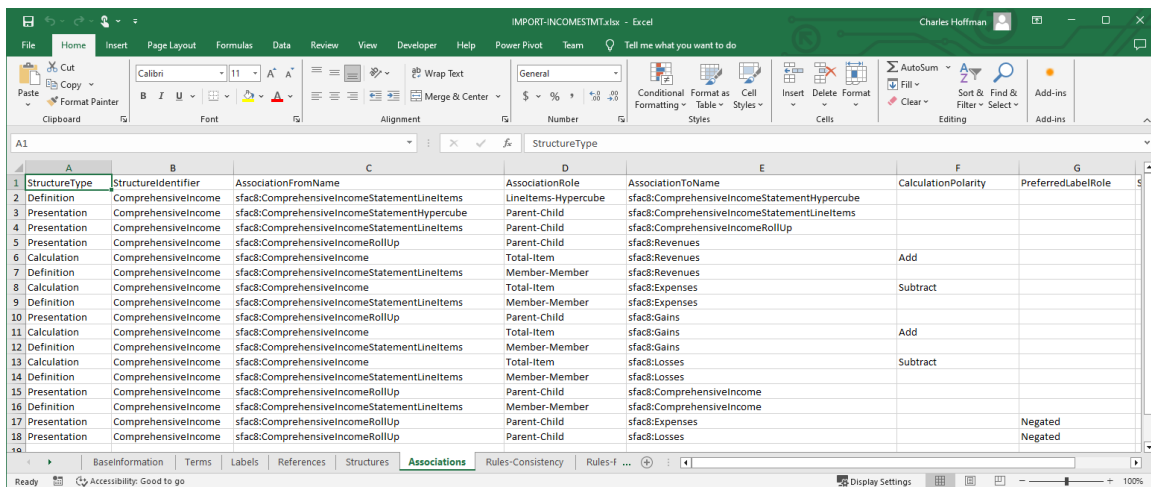

The Excel workbook contains sheets that contain the logic of the information that makes up the structure we are going to import. That

Excel based information could have been generated from another software application, exported from an accounting system, copied and pasted from another spreadsheet, or created in some other way.

The user selects the Excel spreadsheet (or this also could be JSON) from within the Luca software application:
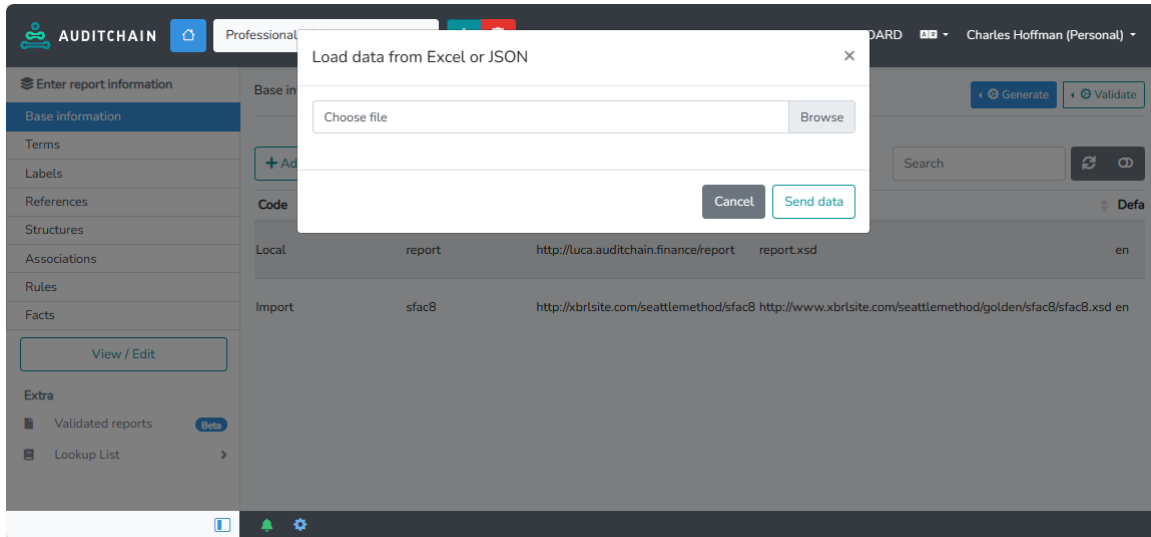

The software application converts the Excel to JSON and shows the JSON to the user. The user presses the "Send data" button and the information is loaded into the Luca software application:
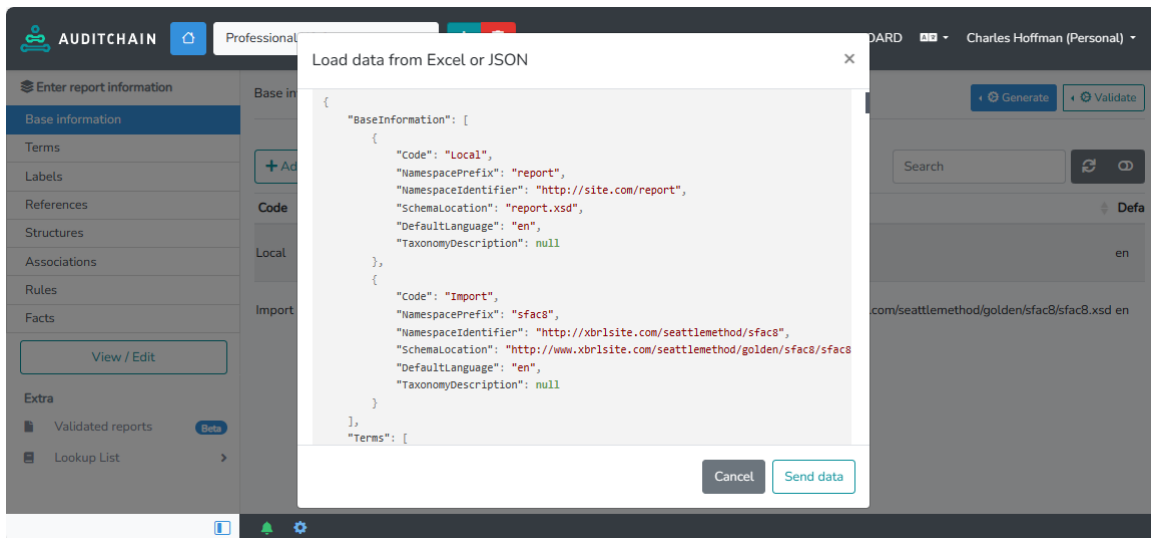

JSON is imported into the Luca software tool and now you have two disclosures instead of just one. Note that you can "see" what was imported by viewing the new structure within the software application. You can think of this as editing the report information using a set of logical patterns that the software application understands rather than

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editing the "nodes" and "edges" of a graph as you would within a graph database software application. You are editing the knowledge graph; but just in a different way, specific to this specific type of knowledge graph.
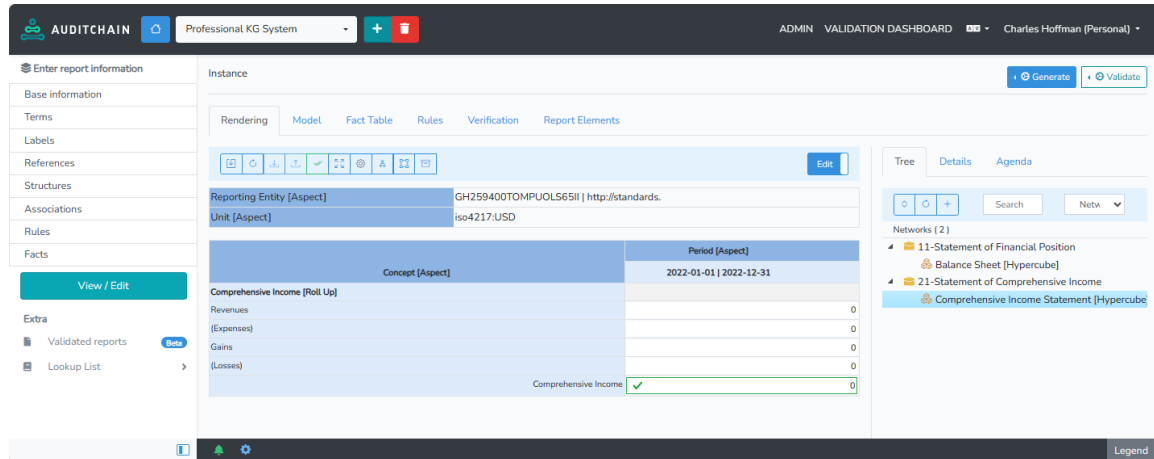

And what do you think happened to the agenda? If the user goes back to the Agenda again, they see that a second agenda item has turned from yellow to green:
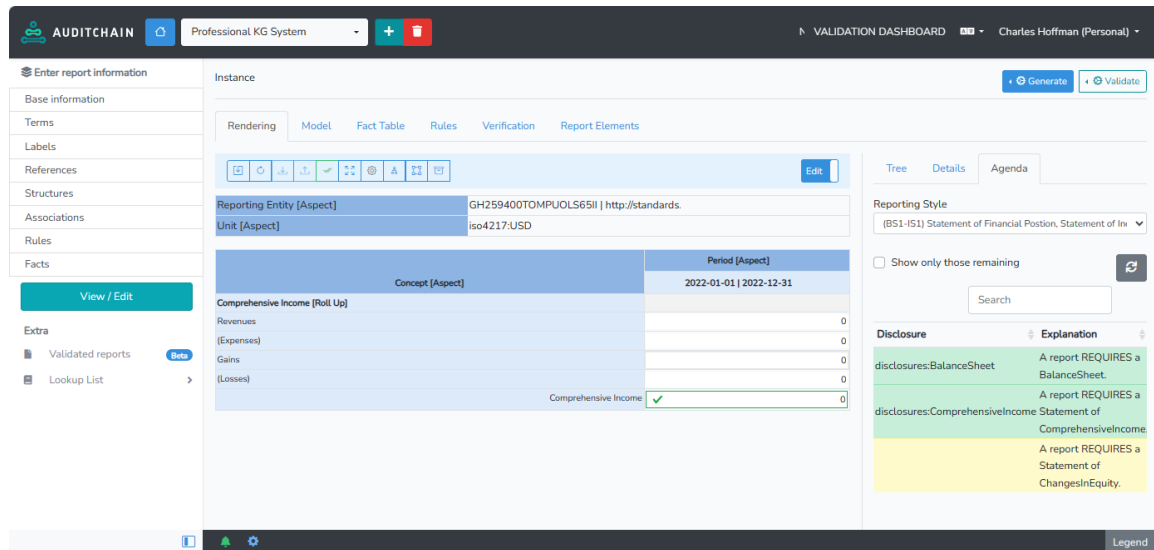

We showed you creating the first report structure by loading a template directly from the base financial reporting scheme knowledge graph. We showed you that you could also import information from Excel or JSON (you can also import XBRL, we just did not show that).

For the third structure, we will show you that you can create and edit structures manually within the Auditchain Luca software application. To see how this editing works more dynamically, please watch the

video Knowledge Graph Demo 1 (Prototype)[55]. This video shows you what we have covered thus far: loading from a base financial reporting scheme template, importing from Excel, and manually creating a structure within the Auditchain Luca software application.
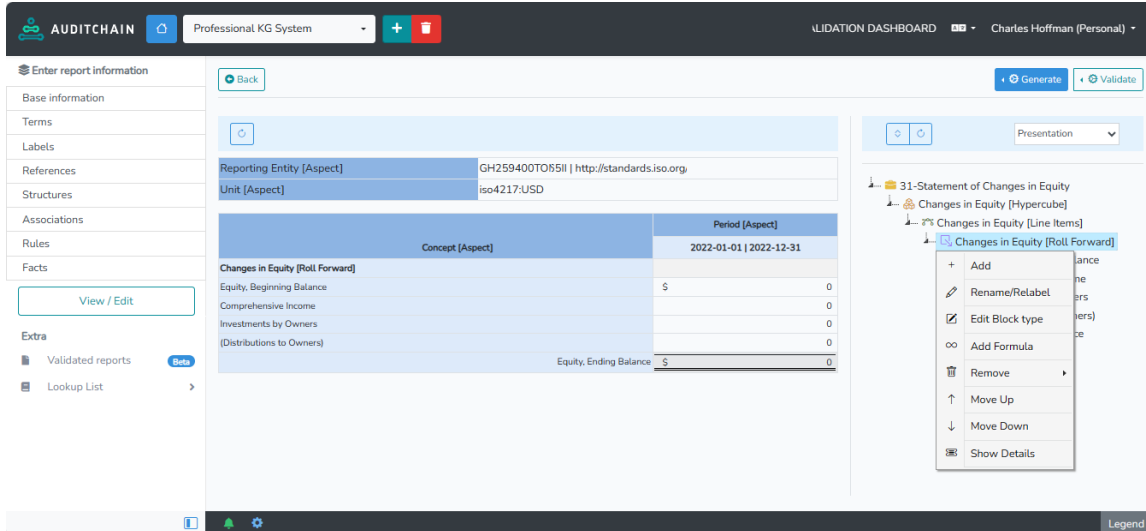
Once the structure is fully created, the software application recognizes the new structure, what type of information block was created, and what disclosure the information is representing. If you go back to the Agenda again, you will see that now the third disclosure has changed from yellow to green.

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[55] *Knowledge Graph Demo 1 (Prototype)*,
https://youtu.be/CVOatdjDRTA?si=URt3mPUoV07Fy7hg
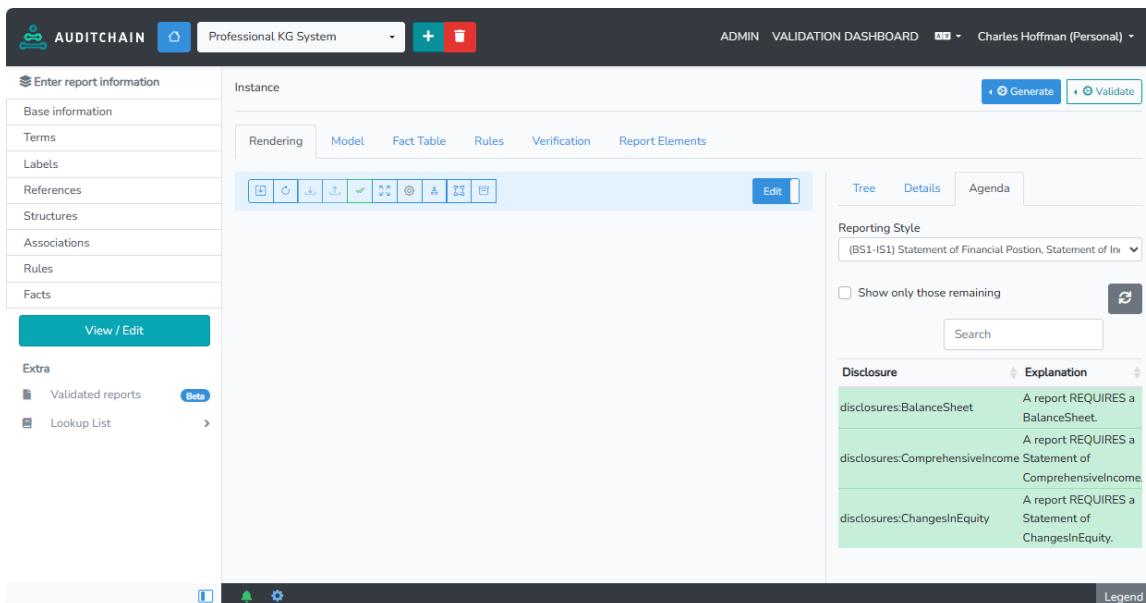
Further, if the user goes to the state properties form, you can see all the work that you have completed thus far: (you get to the state properties form by pressing the gear in the status bar)

And so, you now have a report model and a report pro forma that is completely valid per the logical schema of the knowledge graph. Software daemons work in the background dynamically as you create the report to both monitor what you are doing and also the help you were it can.

There are many subtle things that are going on within the software as you interact with the Auditchain Luca software application during the report creation process. One example is that when you are shown lists of report artifacts to use, that list is filtered based on the context of the user of the software application. When you add new report elements, the list of possible report elements to add is highly filtered based on where you say you want to add something, the existing report elements of that block of information, etc.

2.5. Completing or Tuning Report Model and Report

Thus far we only have a report model and pro forma facts that have been automatically generated by the Auditchain Luca software application.

While the value in the report are currently logical, they are not precise as the use the values created during import, loading, and creating the information manually loaded dummy facts into the report:
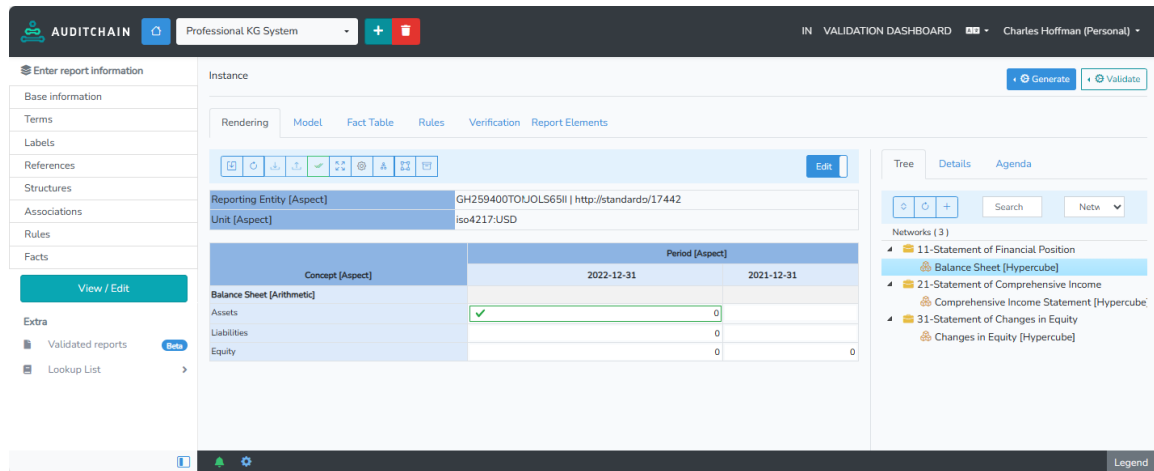
But now let's start adding values and watch what happens. If you change the value for the fact "Assets" for 2022-12-31 from "0" to "1000"; three things in the interface turn RED. The first is the cell border, the second is the icon of the structure you are working on, the third is the number next to the bell in the status bar.

This happens because (a) the software understands the rules and facts available to the report (b) it checks the consistency of the report mathematics, yes all of them, which shows that something is incorrect.
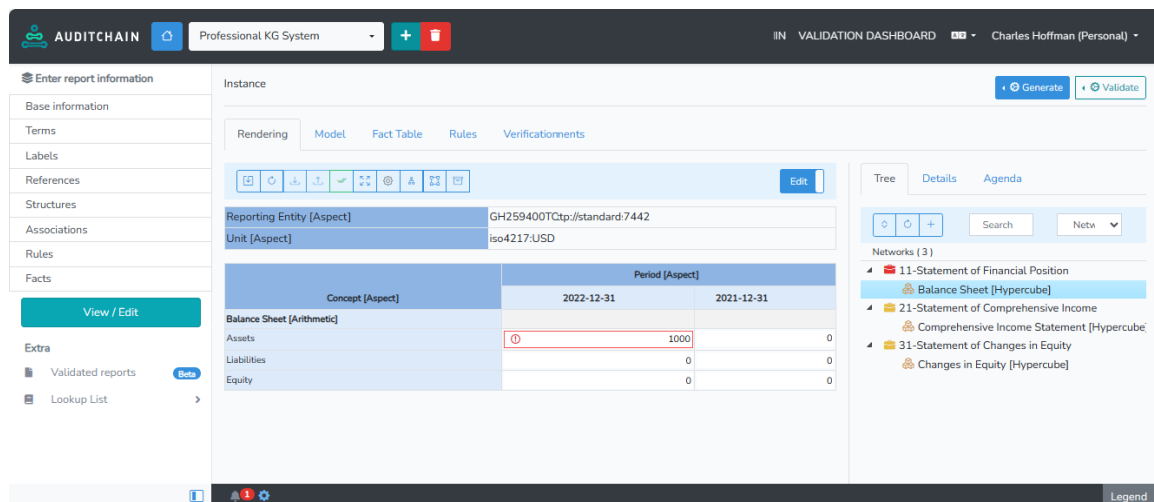
So now, lets finish entering fact values for this specific structure and you see that all the indicators within this specific structure have turned green and the icon of the structure has change from red back to its normal color; but another different structure has turned red, note the icon of the third structure:
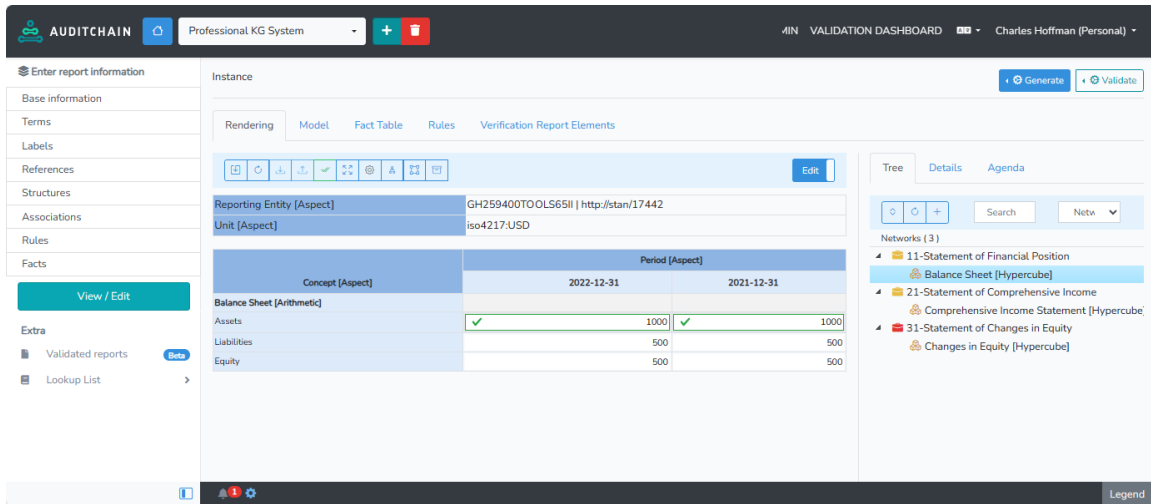
This error is occurring because the articulation[56] of the primary financial statements. The value entered for Equity on the balance sheet makes it so the statement of changes in equity has an error; basically that roll forward does not roll forward. This can be seen by pressing on the bell and looking at the verification results:
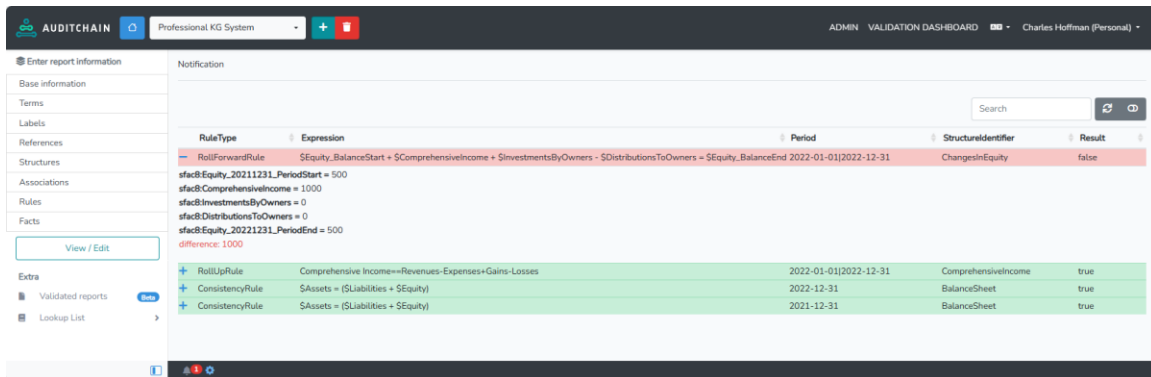
What has happened is that information related to the changes in equity is incomplete. We have not yet entered the full set of information for the changes in equity roll forward.

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[56] *Understanding Articulation*, https://digitalfinancialreporting.blogspot.com/2023/08/understanding-articulation.html

After we make the change for distributions to owners, then all of the RED coloring goes away in the Auditchain Luca software application:
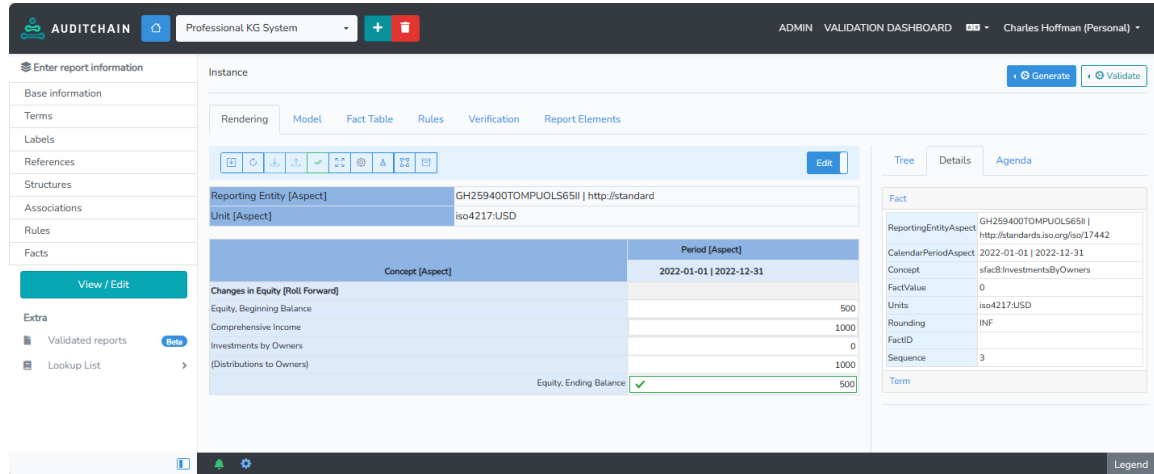
2.6. Reviewing your Work

The user of the software can manually review their work, focusing on the logic of the report model and report. Each structure can be viewed individually by selecting the structure from within the tree view on the right side of the interface.

The primary review tool is the actual rendering of the report in EDIT mode:
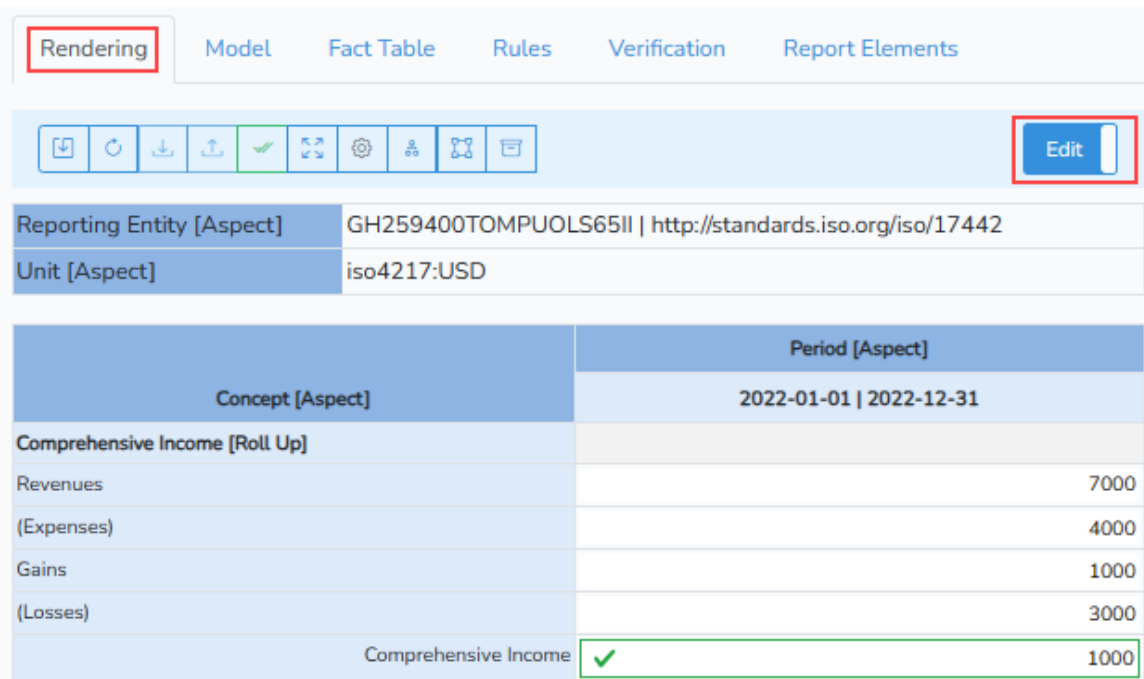
But the rendering can also be changed to VIEW mode:

Another useful view available is the report model structure:

The fact table shows the individual facts that are related to the selected structure:

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The rules related to the structure can be seen in that view:

RuleType	RuleCode	Rule	Concept	StructureIdentifier
ConsistencyRule	Arithmetic_BS01	$Assets = ($Liabilities + $Equity)	sfac8:Assets	BalanceSheet

The results of verification of the rules for that specific structure can get your focused attention in this view:

RuleType	Expression	Period	StructureIdentifier	Result
ConsistencyRule	$Assets = ($Liabilities + $Equity)	2021-12-31	BalanceSheet	true
ConsistencyRule	$Assets = ($Liabilities + $Equity)	2022-12-31	BalanceSheet	true

And finally, a focused view of the report elements of the specific selected structure can be viewed:

Label	Category	Period	Balance	Name
Comprehensive Income Statement [Hypercube]	Hypercube	-	-	sfac8:ComprehensiveIncomeStatementHypercube
Comprehensive Income Statement [Line Items]	LineItems	-	-	sfac8:ComprehensiveIncomeStatementLineItems
Comprehensive Income [Roll Up]	Abstract	-	-	sfac8:ComprehensiveIncomeRollUp
Revenues	Concept	Duration	Credit	sfac8:Revenues
(Expenses)	Concept	Duration	Debit	sfac8:Expenses
Gains	Concept	Duration	Credit	sfac8:Gains
(Losses)	Concept	Duration	Debit	sfac8:Losses
Comprehensive Income	Concept	Duration	Credit	sfac8:ComprehensiveIncome

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From the selector on the RIGHT side; a user could choose to select a from a variety of different fragments of the report including an specific Network, Hypercube, Component, Block, Fragment, or Disclosure:
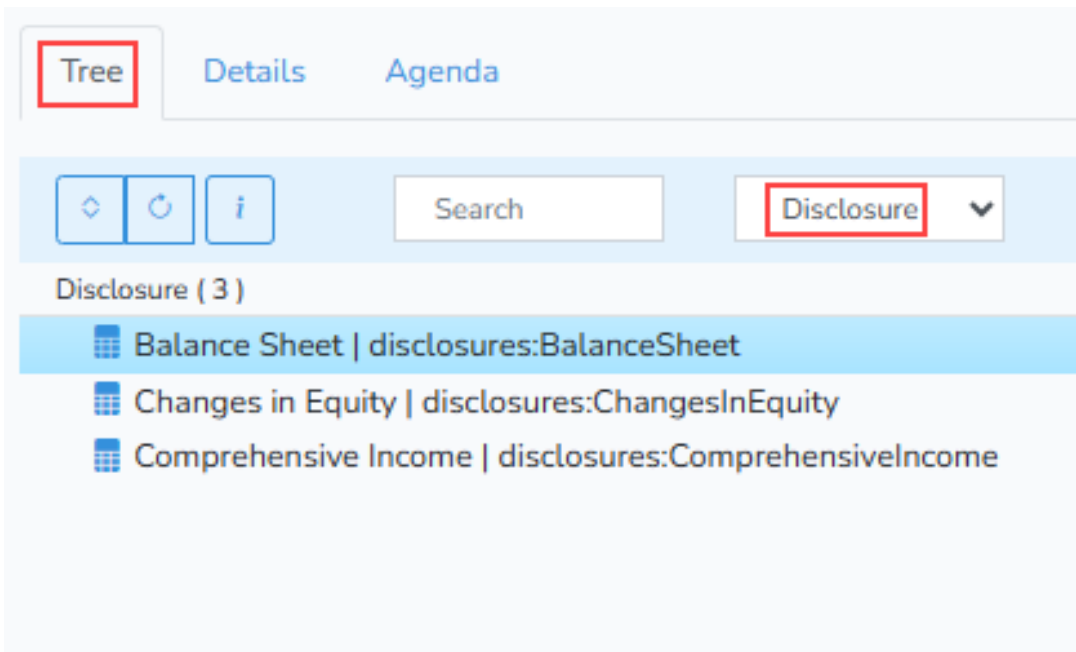
Information about the software's understanding of the disclosure information is provided: (note that the GREEN are applicable to the selected reporting style and the YELLOW are unknown to the selected reporting style)

Disclosure	Pattern	Disclosure Found
Balance Sheet	Arithmetic	true
Changes in Equity	RollForward	true
Changes in Fund Balance	RollForward	false
Changes in Net Assets	RollUp	false
Comprehensive Income	RollUp	true
Comprehensive Income Alternative	RollUp	false
Fund Balance	RollUp	false
Net Assets	RollUp	false

Details of any fact or report element are available to the software user:

Tree	**Details**	Agenda

Fact

ReportingEntityAspect	GH259400TOMPUOLS65II | http://standards.iso.org/iso/17442
CalendarPeriodAspect	2021-12-31
Concept	sfac8:Assets
FactValue	1000
Units	iso4217:USD
Rounding	INF
FactID	
Sequence	29

Term

Tree	**Details**	Agenda

Fact

Term

Prefix	sfac8
ReportElement Name	Assets
StandardLabel	Assets
DataType	Monetary
CalendarPeriodType	Instant
BalanceType	Debit

And finally, we go back to the Agenda which we have shown you before:

2.7. Report Model and Report Verification

Next, to reaffirm that everything is correct within the report model and report being created, the user can force a recalculation of all checks and some additional checking is also performed. There are two means of verification: (a) use the Pacioli verification process or (b) use the Luca verification process. Here are the results of Luca verification:

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Focusing on the validation results summary you see that everything is GREEN and check marks exist for all but row "9". Row 9 is where additional verification can be added to supplement the core *Seattle Method* verification. For example, someone might desire to add XBRL US Data Quality Committee rules[57], SEC EDGAR Manual rules[58], or ESMA ESEF validation rules[59].

#	Verification Category	Result
1	XBRL Technical Syntax Verification	✓
2	Report Mathematical Computations Verification (XBRL Calculations)	✓
3	Report Mathematical Computations Verification (XBRL Formula)	✓
4	Report Model Structure Verification	✓
5	Fundamental Accounting Concept Consistency Crosschecks Verification	✓
6	Type-subtype (wider-narrower) Associations Verification	✓
7	Disclosure Mechanics Verification	✓
8	Report Disclosure Checklist Verification	✓
9	Other	

The user can click on each category to see verification results details. In our case, all the verification results are GREEN meaning everything is OK with the report.

Results of verifying XBRL calculation rules: (roll ups)

RuleType	Expression	Period	StructureIdentifier	Result
RollUpRule	Comprehensive Income==Revenues-Expenses+Gains-Losses	2022-01-01|2022-12-31	ComprehensiveIncome	true

Results for verifying XBRL Formulas rules: (roll forwards, etc.)

| RuleType	Expression	Period	StructureIdentifier	Result
ConsistencyRule	$Assets = ($Liabilities + $Equity)	2022-12-31	BalanceSheet	true
ConsistencyRule	$Assets = ($Liabilities + $Equity)	2021-12-31	BalanceSheet	true
RollForwardRule	$Equity_BalanceStart + $ComprehensiveIncome + $InvestmentsByOwners - $DistributionsToOwners = $Equity_BalanceEnd	2022-01-01|2022-12-31	ChangesInEquity	true

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[57] XBRL US Data Quality Committee Rules, https://xbrl.us/data-quality/rules-guidance/public-review/

[58] SEC, Edgar Filer Manual, Chapter 6 Interactive Data, https://www.sec.gov/edgar/filermanual

[59] ESEF, ESEF Manual, https://www.esma.europa.eu/document/esef-reporting-manual

Results from verifying the high-level fundamental accounting concept relations continuity cross checks:

Results of verifying disclosure mechanics used by a specific reporting style:

For each disclosure, the actual rule(s) and line of reasoning are available to the software user:

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Reporting checklist rule verification results:

Disclosure	Explanation	Add
disclosures:BalanceSheet	A report REQUIRES a BalanceSheet.	
disclosures:ComprehensiveIncome	A report REQUIRES a Statement of ComprehensiveIncome.	
disclosures:ChangesInEquity	A report REQUIRES a Statement of ChangesInEquity.	

Type subtype association rules (includes "wider-narrower" or "general-special") verification results:
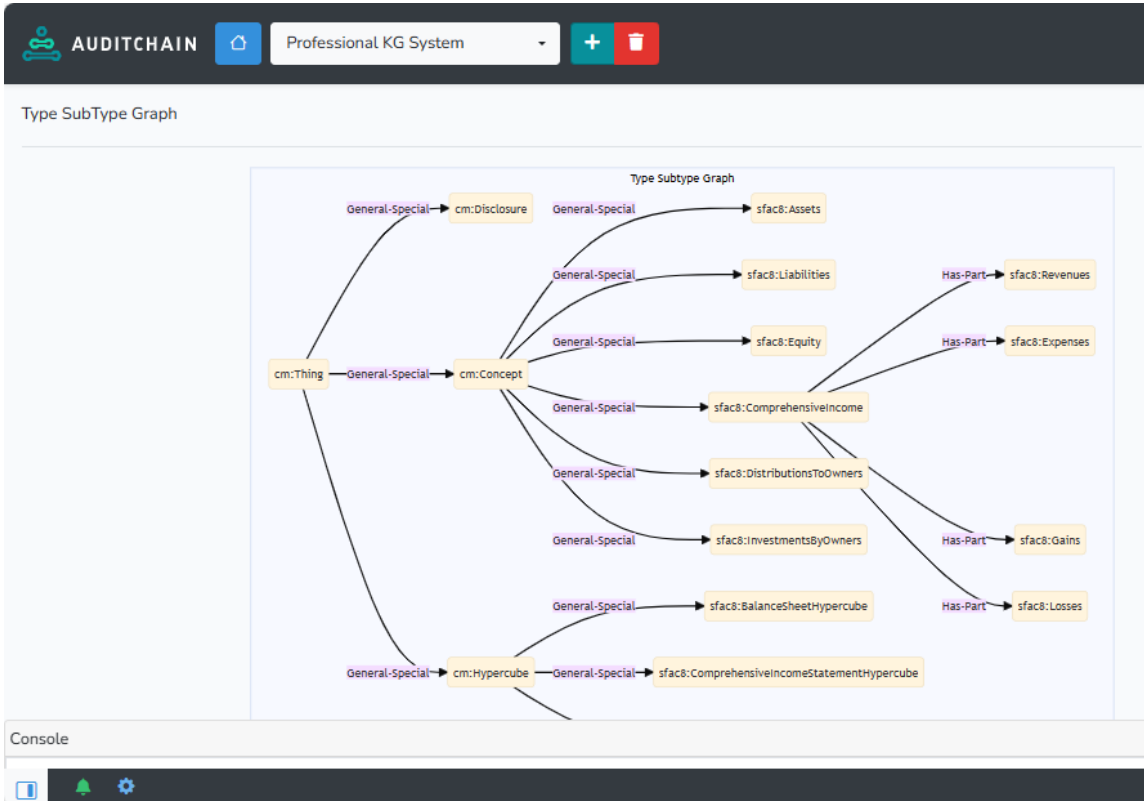
Report model structure relations verification results: (note that these check XBRL presentation relations for logical relations not enforced by XBRL technical syntax verification)

Model Structure Validation

Child	Parent						
	Networks	Hypercube (a.k.a. Table)	Dimension (a.k.a. Axis)	Member	Line Items (a.k.a. Primary Items)	Abstract	Concept
Networks	0	0	0	0	0	0	0
Hypercube (a.k.a. Table)	3	0	0	0	0	0	0
Dimension (a.k.a. Axis)	0	0	0	0	0	0	0
Member	0	0	0	0	0	0	0
Line Items (a.k.a. Primary Items)	0	3	0	0	0	0	0
Abstract	0	0	0	0	3	0	0
Concept	0	0	0	0	0	13	0

2.8. Review, Audit, and Analysis Tool

With Auditchain Luca, every detail related to the logic of the report or XBRL technical syntax is available to teams creating financial reports, internal audit teams, independent third-party audit teams, or financial analysts that are using this machine-readable information:

Technical syntax:

The complete report can be output to Excel or JSON for ad hoc query of any logical artifact of the knowledge graph.

	A	B	C	D	E	F	G
1	Prefix	ReportElementCategory	StandardLabel	ReportElementName	Datatype	CalendarPeriodType	BalanceType
2	sfac8	Hypercube	Balance Sheet [Hypercube]	BalanceSheetHypercube			
3	sfac8	LineItems	Balance Sheet [Line Items]	BalanceSheetLineItems			
4	sfac8	Abstract	Balance Sheet [Arithmetic]	BalanceSheetArithmetic			
5	sfac8	Concept	Assets	Assets	Monetary	Instant	Debit
6	sfac8	Concept	Liabilities	Liabilities	Monetary	Instant	Credit
7	sfac8	Concept	Equity	Equity	Monetary	Instant	Credit
8	sfac8	Hypercube	Comprehensive Income Statement [Hypercube]	ComprehensiveIncomeStatementHypercube			
9	sfac8	LineItems	Comprehensive Income Statement [Line Items]	ComprehensiveIncomeStatementLineItems			
10	sfac8	Abstract	Comprehensive Income [Roll Up]	ComprehensiveIncomeRollUp			
11	sfac8	Concept	Revenues	Revenues	Monetary	Duration	Credit
12	sfac8	Concept	Expenses	Expenses	Monetary	Duration	Debit
13	sfac8	Concept	Gains	Gains	Monetary	Duration	Credit
14	sfac8	Concept	Losses	Losses	Monetary	Duration	Debit
15	sfac8	Concept	Comprehensive Income	ComprehensiveIncome	Monetary	Duration	Credit
16	sfac8	Hypercube	Changes in Equity [Hypercube]	ChangesInEquityHypercube			
17	sfac8	LineItems	Changes in Equity [Line Items]	ChangesInEquityLineItems			
18	sfac8	Abstract	Changes in Equity [Roll Forward]	ChangesInEquityRollForward			
19	sfac8	Concept	Investments by Owners	InvestmentsByOwners	Monetary	Duration	Credit
20	sfac8	Concept	Distributions to Owners	DistributionsToOwners	Monetary	Duration	Debit

2.9. System Output

Numerous output options are available to the Auditchain Software application user: (not all formats are currently available)

Quality and flexibility of renderings are available and are driven by style sheets that can be modified by software users. Several default style sheets are provided:

Concept [Aspect]	Period [Aspect]	
	2022-12-31	2021-12-31
Balance Sheet [Arithmetic]		
Assets	$ 1,000	$ 1,000
Liabilities	500	500
Equity	500	500

Concept [Aspect]	Period [Aspect]
	2022-01-01 | 2022-12-31
Comprehensive Income [Roll Up]	
Revenues	$ 7,000
(Expenses)	(4,000)
Gains	1,000
(Losses)	(3,000)
Comprehensive Income	$ 1,000

Concept [Aspect]	Period [Aspect]
	2022-01-01 | 2022-12-31
Changes in Equity [Roll Forward]	
Equity, Beginning Balance	$ 500
Comprehensive Income	1,000
Investments by Owners	0
(Distributions to Owners)	(1,000)
Equity, Ending Balance	$ 500

To change colors, add or remove borders, to customize output all one needs to do is modify the style sheet: (here the color was changed from blue to gray)

Concept [Aspect]	Period [Aspect]
	2022-01-01 | 2022-12-31
Comprehensive Income [Roll Up]	
Revenues	$ 7,000
(Expenses)	(4,000)
Gains	1,000
(Losses)	(3,000)
Comprehensive Income	$ 1,000

Inline XBRL is automatically generated.

Remember, this SFAC8 example has been keep simple in order to keep the demonstration of the full process easier. Note that the best way to understand the capabilities of this system is to have a look at the *Showcase of Reports*[60]. Another good way to understand and measure capabilities is to use the Seattle Method conformance suite[61].

For this simple, basic example we are using, this is a screen shot of the complete report that was generated:

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[60] *Showcase of Reports*,
http://www.xbrlsite.com/mastering/Part04_Chapter07.1_ShowcaseOfReports.pdf
[61] *PLATINUM Business Use Cases, Test Cases, and Conformance Suite*,
https://digitalfinancialreporting.blogspot.com/2023/07/platinum-business-use-cases-test-cases.html

Component: (Network and Hypercube)	
Network	11-Statement of Financial Position (http://luca.auditchain.finance/report/role/BalanceSheet)
Hypercube	Balance Sheet [Hypercube]

Reporting Entity [Aspect]	GH259400TOMPUOLS65II | http://standards.iso.org/iso/17442
Unit [Aspect]	iso4217:USD

Concept [Aspect]	Period [Aspect]	
	2022-12-31	2021-12-31
Balance Sheet [Arithmetic]		
Assets	$ 1,000	$ 1,000
Liabilities	500	500
Equity	500	500

Component: (Network and Hypercube)	
Network	21-Statement of Comprehensive Income (http://luca.auditchain.finance/report/role/ComprehensiveIncome)
Hypercube	Comprehensive Income Statement [Hypercube]

Concept [Aspect]	Period [Aspect]
	2022-01-01 | 2022-12-31
Comprehensive Income [Roll Up]	
Revenues	$ 7,000
(Expenses)	(4,000)
Gains	1,000
(Losses)	(3,000)
Comprehensive Income	$ 1,000

Component: (Network and Hypercube)	
Network	31-Statement of Changes in Equity (http://luca.auditchain.finance/report/role/ChangesInEquity)
Hypercube	Changes in Equity [Hypercube]

Concept [Aspect]	Period [Aspect]
	2022-01-01 | 2022-12-31
Changes in Equity [Roll Forward]	
Equity, Beginning Balance	$ 500
Comprehensive Income	1,000
Investments by Owners	0
(Distributions to Owners)	(1,000)
Equity, Ending Balance	$ 500

And of course, the system can also generate XBRL-based reports that could be submitted to a regulator such as the SEC or ESMA.

2.10. More Information

For more information about using this system within software, please refer to the *World's First Expert System for Creating Financial Reports*[62].

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[62] World's First Expert System for Creating Financial Reports, https://digitalfinancialreporting.blogspot.com/2023/01/worlds-first-standards-based-expert.html

3.   Understanding System Capabilities

As we have previously stated, the prior section uses a simple, basic example in order to communicate the complete system process. The example was kept small in order to not overwhelm the person trying to understand the full, complete process.

In this section, information is provided that will enable the reader to understand the full set of capabilities of the system. Also, all data is available for public scrutiny.

3.1. PROOF

The quickest way to grasp the capabilities of this professional system is to have a look at what I refer to as my PROOF[63]. This PROOF distills thousands of XBRL-based reports submitted to the SEC and ESMA using both US GAAP and IFRS down to its logical essence.

3.2. Additional Prototype Financial Reporting Schemes

A progressively larger and larger set of financial reporting scheme prototypes, all of which are consistent with this Seattle Method framework, have been created to test and to serve as training resources. Those prototypes can help the reader trying to understand XBRL-based knowledge graphs and to get their heads around the true capabilities of this system.   Here are the progressively larger and larger financial reporting schemes that are all consistent with this system framework:

- **Accounting equation**[64]: super small, but captures the fundamental ideas and an excellent training resource

Line		Report Element Category	Period Type	Balance	Report
1	01-Balance Sheet	Network			http://xbrlsite.com/ae/role/BalanceSheet
2	Balance Sheet [Hypercube]	Table			ae:BalanceSheetHypercube
3	Balance Sheet [Line Items]	LineItems			ae:BalanceSheetLineItems
4	Balance Sheet [Arithmetic]	Abstract			ae:BalanceSheetArithmetic
5	Assets	Concept (Monetary)	As Of	Debit	ae:Assets
6	Liabilities	Concept (Monetary)	As Of	Credit	ae:Liabilities
7	Equity	Concept (Monetary)	As Of	Credit	ae:Equity

- **SFAC 6**[65]: still very small, but it adds the idea of a "structure" or "assembly" to your thinking

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[63] *PROOF*, https://digitalfinancialreporting.blogspot.com/2023/12/seeing-digital-financial-reporting.html

[64] *Accounting Equation*, http://www.xbrlsite.com/seattlemethod/platinum/ae/ae_ModelStructure.html

[65] *SFAC 6*, http://www.xbrlsite.com/seattlemethod/platinum/sfac6/sfac6_ModelStructure.html

Line		Object Class	Period Type	Balance	Report Element Name
1	11-Statement of Financial Position	Network			http://xbrlsite.com/seattlemethod/sfac6/role/BalanceSheet
2	Balance Sheet [Hypercube]	Table			sfac6:BalanceSheetHypercube
3	Balance Sheet [Line Items]	LineItems			sfac6:BalanceSheetLineItems
4	Balance Sheet [Arithmetic]	Abstract			sfac6:BalanceSheetArithmetic
5	Assets	Concept (Monetary)	As Of	Debit	sfac6:Assets
6	Liabilities	Concept (Monetary)	As Of	Credit	sfac6:Liabilities
7	Equity	Concept (Monetary)	As Of	Credit	sfac6:Equity
8	21-Statement of Comprehensive Income	Network			http://xbrlsite.com/seattlemethod/sfac6/role/ComprehensiveIncome
9	Comprehensive Income Statement [Hypercube]	Table			sfac6:ComprehensiveIncomeStatementHypercube
10	Comprehensive Income Statement [Line Items]	LineItems			sfac6:ComprehensiveIncomeStatementLineItems
11	Comprehensive Income [Roll Up]	Abstract			sfac6:ComprehensiveIncomeRollUp
12	Revenues	Concept (Monetary)	For Period	Credit	sfac6:Revenues
13	(Expenses)	Concept (Monetary)	For Period	Debit	sfac6:Expenses
14	Gains	Concept (Monetary)	For Period	Credit	sfac6:Gains
15	(Losses)	Concept (Monetary)	For Period	Debit	sfac6:Losses
16	Comprehensive Income	Concept (Monetary)	For Period	Credit	sfac6:ComprehensiveIncome
17	31-Statement of Changes in Equity	Network			http://xbrlsite.com/seattlemethod/sfac6/role/ChangesInEquity
18	Changes in Equity [Hypercube]	Table			sfac6:ChangesInEquityHypercube
19	Changes in Equity [Line Items]	LineItems			sfac6:ChangesInEquityLineItems
20	Changes in Equity [Roll Forward]	Abstract			sfac6:ChangesInEquityRollForward
21	Equity, Beginning Balance	Concept (Monetary)	As Of	Credit	sfac6:Equity
22	Comprehensive Income	Concept (Monetary)	For Period	Credit	sfac6:ComprehensiveIncome
23	Investments by Owners	Concept (Monetary)	For Period	Credit	sfac6:InvestmentsByOwners
24	(Distributions to Owners)	Concept (Monetary)	For Period	Debit	sfac6:DistributionsToOwners
25	Equity, Ending Balance	Concept (Monetary)	As Of	Credit	sfac6:Equity

- **SFAC 8**[66]: again, still small, but introduces the notion of the "reporting style" and flexibility

Line	Label	Report Element Category	Period Type	Balance	Report Element Name
1	11-Statement of Financial Position	Network			http://xbrlsite.com/seattlemethod/sfac8/role/BalanceSheet
2	Balance Sheet [Hypercube]	Table			sfac8:BalanceSheetHypercube
3	Balance Sheet [Line Items]	LineItems			sfac8:BalanceSheetLineItems
4	Balance Sheet [Arithmetic]	Abstract			sfac8:BalanceSheetArithmetic
5	Assets	Concept (Monetary)	As Of	Debit	sfac8:Assets
6	Liabilities	Concept (Monetary)	As Of	Credit	sfac8:Liabilities
7	Equity	Concept (Monetary)	As Of	Credit	sfac8:Equity
8	12-Statement of Net Assets	Network			http://xbrlsite.com/seattlemethod/sfac8/role/NetAssets
9	Fund Balance [Hypercube]	Table			sfac8:FundBalanceHypercube
10	Fund Balance [Line Items]	LineItems			sfac8:FundBalanceLineItems
11	Net Assets [Roll Up]	Abstract			sfac8:NetAssetsRollUp
12	Assets	Concept (Monetary)	As Of	Debit	sfac8:Assets
13	(Liabilities)	Concept (Monetary)	As Of	Credit	sfac8:Liabilities
14	Net Assets	Concept (Monetary)	As Of	Debit	sfac8:NetAssets
15	Fund Balance [Roll Up]	Abstract			sfac8:FundBalanceRollUp
16	Fund Balance, With Donor Restrictions	Concept (Monetary)	As Of	Credit	sfac8:FundBalanceWithDonorRestrictions
17	Fund Balance, Without Donor Restrictions	Concept (Monetary)	As Of	Credit	sfac8:FundBalanceWithoutDonorRestrictions
18	Fund Balance	Concept (Monetary)	As Of	Credit	sfac8:FundBalance
19	21-Statement of Comprehensive Income	Network			http://xbrlsite.com/seattlemethod/sfac8/role/ComprehensiveIncome
20	Comprehensive Income Statement [Hypercube]	Table			sfac8:ComprehensiveIncomeStatementHypercube
21	Comprehensive Income Statement [Line Items]	LineItems			sfac8:ComprehensiveIncomeStatementLineItems
22	Comprehensive Income [Roll Up]	Abstract			sfac8:ComprehensiveIncomeRollUp
23	Revenues	Concept (Monetary)	For Period	Credit	sfac8:Revenues
24	(Expenses)	Concept (Monetary)	For Period	Debit	sfac8:Expenses
25	Gains	Concept (Monetary)	For Period	Credit	sfac8:Gains
26	(Losses)	Concept (Monetary)	For Period	Debit	sfac8:Losses
27	Comprehensive Income	Concept (Monetary)	For Period	Credit	sfac8:ComprehensiveIncome
28	22-Statement of Comprehensive Income (Alternative)	Network			http://xbrlsite.com/seattlemethod/sfac8/role/ComprehensiveIncome2
29	Comprehensive Income Statement [Hypercube]	Table			sfac8:ComprehensiveIncomeStatementHypercube
30	Comprehensive Income Statement [Line Items]	LineItems			sfac8:ComprehensiveIncomeStatementLineItems
31	Comprehensive Income [Roll Up]	Abstract			sfac8:ComprehensiveIncomeRollUp
32	Income from Normal Activities of Entity	Concept (Monetary)	For Period	Credit	sfac8:IncomeFromNormalActivitiesOfEntity
33	Income from Peripheral or Incidental Transactions of Entity	Concept (Monetary)	For Period	Credit	sfac8:IncomeFromPeripheralOrIncidentalTransactionsOfEntity
34	Comprehensive Income	Concept (Monetary)	For Period	Credit	sfac8:ComprehensiveIncome
35	23-Statement of Changes in Net Assets	Network			http://xbrlsite.com/seattlemethod/sfac8/role/ChangeInNetAssets
36	Changes in Net Assets [Hypercube]	Table			sfac8:ChangesInNetAssetsHypercube
37	Changes in Net Assets [Line Items]	LineItems			sfac8:ChangesInNetAssetsLineItems
38	Changes in Net Assets [Roll Up]	Abstract			sfac8:ChangesInNetAssetsRollUp
39	Revenues	Concept (Monetary)	For Period	Credit	sfac8:Revenues
40	(Expenses)	Concept (Monetary)	For Period	Debit	sfac8:Expenses
41	Gains	Concept (Monetary)	For Period	Credit	sfac8:Gains
42	(Losses)	Concept (Monetary)	For Period	Debit	sfac8:Losses
43	Change in Net Assets	Concept (Monetary)	For Period	Credit	sfac8:ChangeInNetAssets
44	31-Statement of Changes in Equity	Network			http://xbrlsite.com/seattlemethod/sfac8/role/ChangesInEquity
45	Changes in Equity [Hypercube]	Table			sfac8:ChangesInEquityHypercube
46	Changes in Equity [Line Items]	LineItems			sfac8:ChangesInEquityLineItems
47	Changes in Equity [Roll Forward]	Abstract			sfac8:ChangesInEquityRollForward
48	Equity, Beginning Balance	Concept (Monetary)	As Of	Credit	sfac8:Equity
49	Comprehensive Income	Concept (Monetary)	For Period	Credit	sfac8:ComprehensiveIncome
50	Investments by Owners	Concept (Monetary)	For Period	Credit	sfac8:InvestmentsByOwners
51	(Distributions to Owners)	Concept (Monetary)	For Period	Debit	sfac8:DistributionsToOwners
52	Equity, Ending Balance	Concept (Monetary)	As Of	Credit	sfac8:Equity
53	32-Statement of Changes in Fund Balance	Network			http://xbrlsite.com/seattlemethod/sfac8/role/ChangeInFundBalance
54	Changes in Fund Balance [Hypercube]	Table			sfac8:ChangesInFundBalanceHypercube
55	Changes in Fund Balance [Line Items]	LineItems			sfac8:ChangesInFundBalanceLineItems
56	Changes in Fund Balance [Roll Forward]	Abstract			sfac8:ChangesInFundBalanceRollForward
57	Fund Balance, Beginning Balance	Concept (Monetary)	As Of	Credit	sfac8:FundBalance
58	Change in Net Assets	Concept (Monetary)	For Period	Credit	sfac8:ChangeInNetAssets
59	Other Increases (Decreases) in Fund Balance	Concept (Monetary)	For Period	Credit	sfac8:OtherIncreasesDecreasesInFundBalance

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[66] *SFAC 8*,
http://www.xbrlsite.com/seattlemethod/platinum/sfac8/sfac8_ModelStructure.html

- **Common Elements**[67]: beginning to look more like a real financial reporting scheme; introduces the notion of the four statement model, articulation, and builds on the idea of reporting styles.

Line	Label	Object Class	Period Type	Balance	Report Element Name
1	01-Balance Sheet	Network			http://www.xbrlsite.com/role/BalanceSheet
2	Balance Sheet [Hypercube]	Hypercube			common:BalanceSheetHypercube
3	Hypercube [Line Items]	LineItems			common:HypercubeLineItems
4	Assets [Roll Up]	Abstract			common:AssetsRollUp
5	Current Assets	Concept (Monetary)	As Of	Debit	common:CurrentAssets
6	Noncurrent Assets	Concept (Monetary)	As Of	Debit	common:NoncurrentAssets
7	Assets	Concept (Monetary)	As Of	Debit	common:Assets
8	Liabilities and Equity [Roll Up]	Abstract			common:LiabilitiesAndEquityRollUp
9	Liabilities [Roll Up]	Abstract			common:LiabilitiesRollUp
10	Current Liabilities	Concept (Monetary)	As Of	Credit	common:CurrentLiabilities
11	Noncurrent Liabilities	Concept (Monetary)	As Of	Credit	common:NoncurrentLiabilities
12	Liabilities	Concept (Monetary)	As Of	Credit	common:Liabilities
13	Equity [Roll Up]	Abstract			common:EquityRollUp
14	Equity Attributable To Controlling Interests	Concept (Monetary)	As Of	Credit	common:EquityAttributableToControllingInterests
15	Equity Attributable to Noncontrolling Interests	Concept (Monetary)	As Of	Credit	common:EquityAttributableToNoncontrollingInterests
16	Equity	Concept (Monetary)	As Of	Credit	common:Equity
17	Liabilities and Equity	Concept (Monetary)	As Of	Credit	common:LiabilitiesAndEquity
18	02-Net Assets	Network			http://www.xbrlsite.com/role/NetAssets
19	Net Assets [Hypercube]	Hypercube			common:NetAssetsHypercube
20	Hypercube [Line Items]	LineItems			common:HypercubeLineItems
21	Net Assets [Roll Up]	Abstract			common:NetAssetsRollUp
22	Assets	Concept (Monetary)	As Of	Debit	common:Assets
23	Liabilities	Concept (Monetary)	As Of	Credit	common:Liabilities
24	Net Assets	Concept (Monetary)	As Of	Debit	common:NetAssets
25	03-Income Statement	Network			http://www.xbrlsite.com/role/IncomeStatement
26	Income Statement [Hypercube]	Hypercube			common:IncomeStatementHypercube
27	Hypercube [Line Items]	LineItems			common:HypercubeLineItems
28	Net Income [Roll Up]	Abstract			common:NetIncomeRollUp
29	Revenues	Concept (Monetary)	For Period	Credit	common:Revenues
30	(Expenses)	Concept (Monetary)	For Period	Debit	common:Expenses
31	Gains	Concept (Monetary)	For Period	Credit	common:Gains
32	(Losses)	Concept (Monetary)	For Period	Debit	common:Losses
33	Net Income	Concept (Monetary)	For Period	Credit	common:NetIncome
34	04-Income Statement Alternative	Network			http://www.xbrlsite.com/role/IncomeStatementAlternative
35	Income Statement Alternative [Hypercube]	Hypercube			common:IncomeStatementAlternativeHypercube
36	Hypercube [Line Items]	LineItems			common:HypercubeLineItems
37	Net Income [Roll Up]	Abstract			common:NetIncomeRollUp
38	Income from Normal Activities of Entity	Concept (Monetary)	For Period	Credit	common:IncomeFromNormalActivitiesOfEntity
39	Income from Peripheral or Incidental Transactions of Entity	Concept (Monetary)	For Period	Credit	common:IncomeFromPeripheralOrIncidentalTransactionsOfEntity

- **PROOF**[68]: this rounds out the complete set of logical patterns that exist within financial reports and business reports.

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[67] *Common Elements*, http://www.xbrlsite.com/seattlemethod/platinum/common/base-taxonomy/common_ModelStructure.html

[68] *PROOF*, http://www.xbrlsite.com/seattlemethod/platinum/proof/base-taxonomy/proof_ModelStructure.html

Line	Label	Report Element Category	Period Type	Balance	Report Element Name
1	01-Balance Sheet	Network			http://www.xbrlsite.com/seattlemethod/proof/role/BalanceSheet
2	**Balance Sheet [Hypercube]**	Hypercube			proof:BalanceSheetHypercube
3	**Balance Sheet [Line Items]**	LineItems			proof:BalanceSheetLineItems
4	Assets [Roll Up]	Abstract			proof:AssetsRollUp
5	Current Assets	Concept (Monetary)	As Of	Debit	proof:CurrentAssets
6	Noncurrent Assets	Concept (Monetary)	As Of	Debit	proof:NoncurrentAssets
7	Assets	Concept (Monetary)	As Of	Debit	proof:Assets
8	Liabilities and Equity [Roll Up]	Abstract			proof:LiabilitiesAndEquityRollUp
9	Liabilities [Roll Up]	Abstract			proof:LiabilitiesRollUp
10	Current Liabilities	Concept (Monetary)	As Of	Credit	proof:CurrentLiabilities
11	Noncurrent Liabilities	Concept (Monetary)	As Of	Credit	proof:NoncurrentLiabilities
12	Liabilities	Concept (Monetary)	As Of	Credit	proof:Liabilities
13	Equity [Roll Up]	Abstract			proof:EquityRollUp
14	Equity Attributable To Controlling Interests	Concept (Monetary)	As Of	Credit	proof:EquityAttributableToControllingInterests
15	Equity Attributable to Noncontrolling Interests	Concept (Monetary)	As Of	Credit	proof:EquityAttributableToNoncontrollingInterests
16	Equity	Concept (Monetary)	As Of	Credit	proof:Equity
17	Liabilities and Equity	Concept (Monetary)	As Of	Credit	proof:LiabilitiesAndEquity
18	02-Net Assets	Network			http://www.xbrlsite.com/seattlemethod/proof/role/NetAssets
19	**Net Assets [Hypercube]**	Hypercube			proof:NetAssetsHypercube
20	**Net Assets [Line Items]**	LineItems			proof:NetAssetsLineItems
21	Net Assets [Roll Up]	Abstract			proof:NetAssetsRollUp
22	Assets	Concept (Monetary)	As Of	Debit	proof:Assets
23	Liabilities	Concept (Monetary)	As Of	Credit	proof:Liabilities
24	Net Assets	Concept (Monetary)	As Of	Debit	proof:NetAssets
25	03-Income Statement	Network			http://www.xbrlsite.com/seattlemethod/proof/role/ComprehensiveIncome
26	**Comprehensive Income Statement [Hypercube]**	Hypercube			proof:ComprehensiveIncomeStatementHypercube
27	**Comprehensive Income Statement [Line Items]**	LineItems			proof:ComprehensiveIncomeStatementLineItems
28	Comprehensive Income [Roll Up]	Abstract			proof:ComprehensiveIncomeRollUp
29	Revenues	Concept (Monetary)	For Period	Credit	proof:Revenues
30	(Expenses)	Concept (Monetary)	For Period	Debit	proof:Expenses
31	Gains	Concept (Monetary)	For Period	Credit	proof:Gains
32	(Losses)	Concept (Monetary)	For Period	Debit	proof:Losses

- **MINI Financial Reporting Scheme**[69]: this is looking like a real financial report, but some of the logical complexity is not used to keep the example as simple as possible, but still have the characteristics of a real financial reporting scheme.

Line		Object Class	Period Type	Balance	Report Element
1	1102 - Statement - Balance Sheet	Network			http://xbrlsite.com/mini/role/level4/BalanceSheet
2	**Balance Sheet [Hypercube]**	Hypercube			mini:BalanceSheetHypercube
3	**Balance Sheet [Line Items]**	LineItems			mini:BalanceSheetLineItems
4	Assets [Roll Up]	Abstract			mini:AssetsRollUp
5	Current Assets [Roll Up]	Abstract			mini:CurrentAssetsRollUp
6	Cash and Cash Equivalents	Concept (Monetary)	As Of	Debit	mini:CashAndCashEquivalents
7	Receivables	Concept (Monetary)	As Of	Debit	mini:Receivables
8	Inventories	Concept (Monetary)	As Of	Debit	mini:Inventories
9	Current Assets	Concept (Monetary)	As Of	Debit	mini:CurrentAssets
10	Noncurrent Assets [Roll Up]	Abstract			mini:NoncurrentAssetsRollUp
11	Property, Plant and Equipment	Concept (Monetary)	As Of	Debit	mini:PropertyPlantAndEquipment
12	Noncurrent Assets	Concept (Monetary)	As Of	Debit	mini:NoncurrentAssets
13	Assets	Concept (Monetary)	As Of	Debit	mini:Assets
14	Liabilities and Equity [Roll Up]	Abstract			mini:LiabilitiesAndEquityRollUp
15	Liabilities [Roll Up]	Abstract			mini:LiabilitiesRollUp
16	Current Liabilities [Roll Up]	Abstract			mini:CurrentLiabilitiesRollUp
17	Accounts Payable	Concept (Monetary)	As Of	Credit	mini:AccountsPayable
18	Accrued Expenses	Concept (Monetary)	As Of	Credit	mini:AccruedExpenses
19	Current Liabilities	Concept (Monetary)	As Of	Credit	mini:CurrentLiabilities
20	Noncurrent Liabilities [Roll Up]	Abstract			mini:NoncurrentLiabilitiesRollUp
21	Long-term Debt	Concept (Monetary)	As Of	Credit	mini:LongtermDebt
22	Noncurrent Liabilities	Concept (Monetary)	As Of	Credit	mini:NoncurrentLiabilities
23	Liabilities	Concept (Monetary)	As Of	Credit	mini:Liabilities
24	Equity [Roll Up]	Abstract			mini:EquityRollUp
25	Paid In Capital	Concept (Monetary)	As Of	Credit	mini:PaidInCapital
26	Retained Earnings	Concept (Monetary)	As Of	Credit	mini:RetainedEarnings
27	Equity	Concept (Monetary)	As Of	Credit	mini:Equity

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[69] *MINI Financial Reporting Scheme*,
http://www.xbrlsite.com/seattlemethod/platinum/mini/base-taxonomy/mini_ModelStructure.html

- **AASB 1060**[70]: this is about as real as it gets; this prototype is for a real financial reporting scheme that is somewhat equivalent to IFRS for SMEs; this is a full (complete) representation of about 20% of the full financial reporting scheme.

Line	Label	Object Class	Period Type	Balance	Report Element Name	References
1	001-Documentation-Report Information	Network			http://www.xbrlsite.com/aasb1060/role/Documentation/ReportInformation	
2	**Report Information [Hypercube]**	Hypercube			aasb1060:ReportInformationHypercube	AASB 1060 31
3	**Report Information [Line Items]**	LineItems			aasb1060:ReportInformationLineItems	AASB 1060 31
4	Report Information [Set]	Abstract			aasb1060:ReportInformationSet	
5	Reporting Period End Date	Concept (Date)	For Period		aasb1060:ReportingPeriodEndDate	AASB 1060 31 c
6	Reporting Period	Concept (Date)	For Period		aasb1060:ReportingPeriod	AASB 1060 31 c
7	Presentation Currency	Concept (Text/String)	For Period		aasb1060:PresentationCurrency	AASB 1060 31 d
8	Level of Rounding	Concept (Text/String)	For Period		aasb1060:LevelOfRounding	AASB 1060 31 e
9	002-Documentation-Reporting Entity Information	Network			http://www.xbrlsite.com/aasb1060/role/Documentation/ReportingEntityInformation	
10	**Reporting Entity Information [Hypercube]**	Hypercube			aasb1060:ReportingEntityInformationHypercube	
11	**Reporting Entity Information [Line Items]**	LineItems			aasb1060:ReportingEntityInformationLineItems	
12	Reporting Entity [Set]	Abstract			aasb1060:ReportingEntitySet	AASB 1060 32
13	Reporting Entity Name	Concept (Text/String)	For Period		aasb1060:ReportingEntityName	AASB 1060 31 a
14	Reporting Entity Name Changes Information	Concept (Text/String)	For Period		aasb1060:ReportingEntityNameChangesInformation	AASB 1060 31 a
15	Type of Reporting Entity	Concept (Text/String)	For Period		aasb1060:TypeOfReportingEntity	AASB 1060 31 b
16	Domicile of Reporting Entity	Concept (Text/String)	For Period		aasb1060:DomicileOfReportingEntity	AASB 1060 32 a
17	Legal Form of Reporting Entity	Concept (Text/String)	For Period		aasb1060:LegalFormOfReportingEntity	AASB 1060 32 a
18	Country of Incorporation of Reporting Entity	Concept (Text/String)	For Period		aasb1060:CountryOfIncorporationOfReportingEntity	AASB 1060 32 a
19	Address of Registered Office of Reporting Entity	Concept (Text/String)	For Period		aasb1060:AddressOfRegisteredOfficeOfReportingEntity	AASB 1060 32 a
20	Reporting Entity Going Concern	Concept (Yes/No)	For Period		aasb1060:ReportingEntityGoingConcern	AASB 1060 14
21	100-Statement-Statement of Financial Position, Classified (Net Assets Approach)	Network			http://www.xbrlsite.com/aasb1060/role/Statement/StatementOfFinancialPositionClassified	
22	**Statement of Financial Position, Classified [Hypercube]**	Hypercube			aasb1060:StatementOfFinancialPositionClassifiedHypercube	AASB 1060 25 a
23	**Statement of Financial Position, Classified [Line Items]**	LineItems			aasb1060:StatementOfFinancialPositionClassifiedLineItems	AASB 1060 35
24	Net Assets [Roll Up]	Abstract			aasb1060:NetAssetsRollUp	
25	Assets [Roll Up]	Abstract			aasb1060:AssetsRollUp	AASB 1060 9
26	Current Assets [Roll Up]	Abstract			aasb1060:CurrentAssetsRollUp	AASB 1060 37
27	Cash and Cash Equivalents	Concept (Monetary)	As Of	Debit	aasb1060:CashAndCashEquivalents	AASB 1060 35 a
28	Trade and Other Current Receivables	Concept (Monetary)	As Of	Debit	aasb1060:TradeAndOtherCurrentReceivables	AASB 1060 35 b
29	Current Tax Assets	Concept (Monetary)	As Of	Debit	aasb1060:CurrentTaxAssets	AASB 1060 35 m
30	Other Current Financial Assets	Concept (Monetary)	As Of	Debit	aasb1060:OtherCurrentFinancialAssets	AASB 1060 35 c
31	Current Inventories	Concept (Monetary)	As Of	Debit	aasb1060:CurrentInventories	AASB 1060 35 d
32	Current Biological Assets	Concept (Monetary)	As Of	Debit	aasb1060:CurrentBiologicalAssets	AASB 1060 35 h
33	Other Miscellaneous Current Assets	Concept (Monetary)	As Of	Debit	aasb1060:OtherMiscellaneousCurrentAssets	AASB 1060 36
34	Assets or Disposal Groups Classified as Held for Sale	Concept (Monetary)	As Of	Debit	aasb1060:AssetsOrDisposalGroupsClassifiedAsHeldForSale	AASB 1060 35 r
35	Current Assets	Concept (Monetary)	As Of	Debit	aasb1060:CurrentAssets	AASB 1060 37
36	Non-current Assets [Roll Up]	Abstract			aasb1060:NoncurrentAssetsRollUp	AASB 1060 39
37	Trade and Other Non-current Receivables	Concept (Monetary)	As Of	Debit	aasb1060:TradeAndOtherNoncurrentReceivables	AASB 1060 35 b
38	Non-current Inventories	Concept (Monetary)	As Of	Debit	aasb1060:NoncurrentInventories	
39	Deferred Tax Assets	Concept (Monetary)	As Of	Debit	aasb1060:DeferredTaxAssets	AASB 1060 35 n
40	Other Non-current Financial Assets	Concept (Monetary)	As Of	Debit	aasb1060:OtherNoncurrentFinancialAssets	AASB 1060 35 c
41	Property, Plant and Equipment, Net	Concept (Monetary)	As Of	Debit	aasb1060:PropertyPlantAndEquipmentNet	AASB 1060 35 e
42	Investment Property	Concept (Monetary)	As Of	Debit	aasb1060:InvestmentProperty	AASB 1060 35 f
43	Intangible Assets Other than Goodwill	Concept (Monetary)	As Of	Debit	aasb1060:IntangibleAssetsOtherThanGoodwill	AASB 1060 35 g
44	Goodwill	Concept (Monetary)	As Of	Debit	aasb1060:Goodwill	AASB 1060 35 g
45	Non-current Biological Assets	Concept (Monetary)	As Of	Debit	aasb1060:NoncurrentBiologicalAssets	AASB 1060 35 h
46	Investments in Associates	Concept (Monetary)	As Of	Debit	aasb1060:InvestmentsInAssociates	AASB 1060 35 i
47	Investments in Joint Ventures	Concept (Monetary)	As Of	Debit	aasb1060:InvestmentsInJointVentures	AASB 1060 35 i

3.3. Essentials of XBRL-based Digital Financial Reporting

The most information about XBRL-based reporting packed into the smallest document is available in the most current version of *Essentials of XBRL-based Digital Financial Reporting (Platinum)*[71].

3.4. Other Software Supporting System

Auditchain Pacioli and Auditchain Luca are not the only software that support this professional oriented system. They are the only software that supports the system completely.

But other software supports significant aspects of this professional system for creating financial reports and other business reports. This section points out this additional software:

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[70] *AASB 1060*, https://xbrlsite.azurewebsites.net/2021/reporting-scheme/aasb1060/base-taxonomy/aasb1060_ModelStructure2.html

[71] *Essentials of XBRL-based Digital Financial Reporting*, http://www.xbrlsite.com/seattlemethod/platinum/EssentialsOfXBRL_PLATINUM.pdf

- **XBRL Cloud**: The Evidence Package[72] is a commercial product that has been used by public companies reporting to the U.S. Securities and Exchange Commission.

Component: (Network and Table)	
Network	100010 - Statement - **INCOME STATEMENTS** (http://www.microsoft.com/20170630/taxonomy/role/StatementINCOMESTATEMENTS)
Table	Statement [Table]

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

Reporting Entity [Axis]	0000789019 (http://www.sec.gov/CIK)
Legal Entity [Axis]	Entity [Domain]

	Period [Axis]		
Statement [Line Items]	2016-07-01 - 2017-06-30	2015-07-01 - 2016-06-30	2014-07-01 - 2015-06-30
Revenue			
Product	57,190,000,000	61,502,000,000	75,956,000,000
Service and other	32,760,000,000	23,818,000,000	17,624,000,000
Total revenue	89,950,000,000 [2,3]	85,320,000,000 [1]	93,580,000,000
Cost of revenue			
Product	15,175,000,000	17,880,000,000	21,410,000,000
Service and other	19,086,000,000	14,900,000,000	11,628,000,000
Total cost of revenue	34,261,000,000	32,780,000,000	33,038,000,000
Gross margin	55,689,000,000 [2]	52,540,000,000	60,542,000,000
Research and development	13,037,000,000	11,988,000,000	12,046,000,000
Sales and marketing	15,539,000,000	14,697,000,000	15,713,000,000
General and administrative	4,481,000,000	4,563,000,000	4,611,000,000
Impairment, integration, and restructuring	306,000,000	1,110,000,000	10,011,000,000
Operating income	22,326,000,000 [2]	20,182,000,000	18,161,000,000
Other income (expense), net	823,000,000	(431,000,000)	346,000,000
Income before income taxes	23,149,000,000	19,751,000,000	18,507,000,000
Provision for income taxes	1,945,000,000	2,953,000,000	6,314,000,000
Net income	21,204,000,000 [2,5]	16,798,000,000 [4]	12,193,000,000
Earnings per share:			
Basic	2.74 [2]	2.12	1.49
Diluted	2.71 [2,5]	2.10 [4]	1.48
Weighted average shares outstanding:			
Basic	7,746,000,000	7,925,000,000	8,177,000,000
Diluted	7,832,000,000	8,013,000,000	8,254,000,000
Cash dividends declared per common share	1.56	1.44	1.24

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[72] *XBRL Cloud Evidence Package*, https://xbrlsite.azurewebsites.net/2017/Prototypes/Microsoft2017/evidence-package

- **XBRL Cloud Disclosure Mechanics and Disclosure Checklist**[73]: I don't know if this was provided commercially, but I doubt it because the rules that drive this are not of commercial quality

#	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]
6	Assets [Roll Up]	STATEMENT	Level4Detail	ROLL UP	True	True	CONSISTENT	NOT-EXPECTED	Assets	Part of disclosure	Disclosure always required
7	Liabilities and Equity [Roll Up]	STATEMENT	Level4Detail	ROLL UP	True	True	CONSISTENT	NOT-EXPECTED	Liabilities and Equity	Part of disclosure	Disclosure always required
8	Income Statement, by Legal Entity [Roll Up]	STATEMENT	Level4Detail	ROLL UP	True	True	CONSISTENT	NOT-EXPECTED	Net Income (Loss) Attributable to Parent	Required disclosure	Disclosure always required
9	Statement of Income and Comprehensive Income [...]	DISCLOSURE	Level4Detail	ROLL UP	False	True	CONSISTENT	NOT-EXPECTED	Net Income (Loss) Attributable to [...]	Alternative representation	Not necessary, satisfied by Income Statement, by Legal Entity [Roll Up] disclosure

- **Pesseract**[74]: Pesseract is a working proof of concept that was implemented as a desktop application in a world that was, at the time, transitioning to cloud-based software.

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[73] *XBRL Cloud Disclosure Mechanics and Reporting Checklist*, https://xbrlsite.azurewebsites.net/2017/Prototypes/Microsoft2017/Disclosure%20Mechanics%20and%20Reporting%20Checklist.html
[74] *Pesseract*, https://photos.app.goo.gl/cWeZYaMBEbmSSm7v8

- **99.24% of XBRL-based reporting tools that submit reports of public companies to the SEC**[75]: As of March 2019, 99.24% of public company financial reports submitted to the U.S. Securities and Exchange Commission were consistent with the business report model of this system. 89.1% of those reports were 100% consistent with the fundamental accounting concept relations continuity cross checks.

March 31, 2019 (Last 10-K or 10-Q filed)					
Generator	Filings Count	Filings With No Errors	Sum Errors (all filings)	Average Errors per Filing	Percent Without Error
Thunderdome	277	277	0	.0	100%
Electro Filings	1	1	0	.0	100%
DataTracks	180	179	1	.0	99%
DFIN (was Donnelley)	745	738	7	.0	99%
Merrill	388	377	12	.0	97%
EDGARfilings PROfile	86	83	4	.0	97%
Certent	157	150	7	.0	96%
Unknown	70	66	5	.1	94%
CompSci	55	50	11	.2	91%
Ez-XBRL	141	128	15	.1	91%
Workiva	2,165	1,919	336	.2	89%
GoXBRL	378	317	89	.2	84%
Compliance Xpressware	17	14	4	.2	82%
S2 Filings	66	54	16	.2	82%
QXi	104	84	33	.3	81%
Novaworks Software	706	537	288	.4	76%
IRIS Carbon	7	5	3	.4	71%
Advanced Computer Innovations	155	109	85	.5	70%
SAP Disclosure Management	2	1	1	.5	50%
SmartXBRL	16	4	45	2.8	25%
Other	0	0	0	.0	0%
Other	0	0	0	.0	0%
Other	0	0	0	.0	0%
Other	0	0	0	.0	0%
	5,716	5,093	962	.2	
Percent of all filings conforming to all FAC relations		89.1%			
Total filings NOT conforming	623				
Total tests	125,752	100.00%			
Total inconsistent	962	0.76%			
Total consistent	124,790	99.24%			

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[75] *Quarterly XBRL-based Public Company Financial Report Quality Measurement (March 2019),* http://xbrl.squarespace.com/journal/2019/3/29/quarterly-xbrl-based-public-company-financial-report-quality.html

#	Category	Test Number	Fundamental accounting concept consistency check description	Consistent	Consistent %	Inconsistent	Inconsistent %
1	BS	usfac:BS1	Equity = Equity Attributable to Parent + Equity Attributable to Noncontrolling Interest	5,698	100.00%	18	0.00%
2	BS	usfac:BS2	Assets = Liabilities and Equity	5,706	100.00%	10	0.00%
3	BS	usfac:BS3	Assets = Current Assets + Noncurrent Assets	5,668	99.32%	48	0.68%
4	BS	usfac:BS4	Liabilities = Current Liabilities + Noncurrent Liabilities	5,691	99.81%	25	0.19%
5	BS	usfac:BS5	Liabilities and Equity = Liabilities + Commitments and Contingencies + Temporary Equity + Equity	5,643	99.42%	73	0.58%
6	CF	usfac:CF1	Net Cash Flow = Net Cash Flows, Operating + Net Cash Flows, Investing + Net Cash Flows, Financing + Exchange Gains (Losses)	5,586	97.96%	130	2.04%
7	CF	usfac:CF2	Net Cash Flows, Continuing = Net Cash Flows, Operating, Continuing + Net Cash Flows, Investing, Continuing + Net Cash Flows, Financing, Continuing	5,690	99.71%	26	0.29%
8	CF	usfac:CF3	Net Cash Flows, Discontinued = Net Cash Flows, Operating, Discontinued + Net Cash Flows, Investing, Discontinued + Net Cash Flows, Financing, Discontinued	5,706	99.71%	10	0.29%
9	CF	usfac:CF4	Net Cash Flows, Operating = Net Cash Flows, Operating, Continuing + Net Cash Flows, Operating, Discontinued	5,705	99.81%	11	0.19%
10	CF	usfac:CF5	Net Cash Flows, Investing = Net Cash Flows, Investing, Continuing + Net Cash Flows, Investing, Discontinued	5,697	99.90%	19	0.10%
11	CF	usfac:CF6	Net Cash Flows, Financing = Net Cash Flows, Financing, Continuing + Net Cash Flows, Financing, Discontinued	5,712	99.90%	4	0.10%
12	IS	usfac:IS1	Gross Profit = Revenues - Cost Of Revenue	5,648	98.64%	68	1.36%
13	IS	usfac:IS2	Operating Income (Loss) = Gross Profit - Operating Expenses + Other Operating Income (Expenses)	5,557	98.35%	159	1.65%
14	IS	usfac:IS3	Income (Loss) from Continuing Operations Before Equity Method Investments = Operating Income (Loss) + Nonoperating Income (Loss) - Interest And Debt Expense	5,715	100.00%	1	0.00%
15	IS	usfac:IS4	Income (Loss) from Continuing Operations Before Tax = Income (Loss) from Continuing Operations Before Equity Method Investments + Income (Loss) from Equity Method Investments	5,605	99.03%	111	0.97%
16	IS	usfac:IS5	Income (Loss) from Continuing Operations after Tax = Income (Loss) from Continuing Operations Before Tax - Income Tax Expense (Benefit)	5,635	98.64%	81	1.36%
17	IS	usfac:IS6	Net Income (Loss) = Income (Loss) from Continuing Operations After Tax + Income (Loss) from Discontinued Operations, Net of Tax + Extraordinary Items, Gain (Loss)	5,628	98.54%	88	1.46%
18	IS	usfac:IS7	Net Income (Loss) = Net Income (Loss) Attributable to Parent + Net Income (Loss) Attributable to Noncontrolling Interest	5,536	96.70%	180	3.30%
19	IS	usfac:IS8	Net Income (Loss) Available to Common Stockholders, Basic = Net Income (Loss) Attributable to Parent - Preferred Stock Dividends and Other Adjustments	5,691	99.22%	25	0.78%
20	SCI	usfac:IS9	Comprehensive Income (Loss) = Comprehensive Income (Loss) Attributable to Parent + Comprehensive Income (Loss) Attributable to Noncontrolling Interest	5,672	99.32%	44	0.68%
21	SCI	usfac:IS10	Comprehensive Income (Loss) = Net Income (Loss) + Other Comprehensive Income (Loss)	5,571	97.67%	145	2.33%

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- **DOW 30**[76]: Companies that made up the DOW 30 were consistent in terms of the XBRL technical syntax, model structure, and fundamental accounting concepts; but testing of mathematical computations, disclosure mechanics, and reporting checklist rules were not tested.

Bounty Hunter Dashboard (DOW 30) Prototype

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[76] DOW 30,
http://xbrlsite.azurewebsites.net/2022/Prototypes/dow30/Dashboard.html

- **Fortune 100**[77]: Similar to the DOW 30, the entire Fortune 100 was tested in a similar manner.

- **Microsoft**[78]: Using an early version of Auditchain Pacioli, about 94% of the 2017 Microsoft 10-K was tested[79]. In addition, we were able to effectively extract 100% of the fundamental accounting concepts and test the relations between those concepts for 41 XBRL-based reports submitted to the SEC.

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[77] *Fortune 100*,
http://xbrlsite.azurewebsites.net/2022/Prototypes/fortune100/Dashboard.html
[78] *Microsoft 2017 10-K*, http://xbrl.squarespace.com/journal/2021/7/12/knowledge-graph-of-microsoft-10-k-financial-report.html
[79] *Pacioli Technical Analysis*, https://auditchain.infura-ipfs.io/ipfs/QmRbYM5cPUCauw4Ckvbysi5ktLjS5gPyrfFov4Xv2iZRtn/

- **Software Companies Testing**[80]: Testing of every 10-Q and 10-K submitted to the SEC by Microsoft, Apple, Amazon, Facebook, Alphabet/Google (name change), and SalesForce showed exactly 2 inconsistencies in the hundreds of reports submitted to the SEC over a period of 10 years.

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[80] *Software Companies Prototype*,
http://xbrl.squarespace.com/journal/2020/4/2/software-companies-prototype.html