

Proof + Common + Rendering

Understanding essence of representations of financial information represented using the XBRL technical syntax

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Last Revised – May 19, 2020 (DRAFT)

“The things that we should do are: the things that need to be done, the things you see that need to be done, and the things no one else thinks need to be done.” *Richard Buckminster Fuller*¹

Executive summary:

- This document explains and proves another layer of conceptual meaning of XBRL-based financial information, building on the accounting equation example representation², the SFA6 *Elements of Financial Statements* example representation³, and the Common Elements of Financial Statements example representation⁴, and the Proof example representation⁵.
- This Proof + Common + Rendering example adds disclosure mechanics rules⁶, disclosure rules (i.e. reporting checklist rules)⁷, and a pixel perfect Inline XBRL representation of a financial statement⁸.
- These examples explain impediments to creating a true and fair financial report representation using the XBRL technical syntax and how to overcome those impediments within a process for creating such machine-readable financial reports.
- This example helps a reader understand the essence of an XBRL-based financial report.

¹ WikiQuotes, Richard Buckminster Fuller, https://simple.wikiquote.org/wiki/Richard_Buckminster_Fuller

² Accounting Equation, <http://xbrlsite.azurewebsites.net/2020/master/ae/index.html>

³ FASB's SFAC 6 Elements of Financial Statement, <http://xbrlsite.azurewebsites.net/2020/master/sfac6/index.html>

⁴ Common Elements of Financial Statements, <http://xbrlsite.azurewebsites.net/2020/master/common/index.html>

⁵ Proof, <http://xbrlsite.azurewebsites.net/2020/master/proof/index.html>

⁶ Disclosure mechanics rules, <http://xbrlsite.azurewebsites.net/2020/master/proof-common-render/dm.xsd>

⁷ Disclosure rules (i.e. reporting checklist), <http://xbrlsite.azurewebsites.net/2020/master/proof-common-render/dr-rules-def.xml>

⁸ Pixel Perfect Inline XBRL representation, <http://xbrlsite.azurewebsites.net/2020/master/proof-common-render/instance-RENDERED.html>

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This document builds on the base created by the accounting equation represented in XBRL⁹, the FASB’s SFAC 6 *Elements of Financial Statements* represented in XBRL¹⁰, the Common Elements of Financial Reports example represented in XBRL, and the Proof example represented in XBRL. It is strongly recommended that you carefully examine those examples before moving on to this example representation of an XBRL-based financial report.

This example which I am referring to as the **Proof + Common + Rendering** example expands the significantly simpler logical systems represented by the prior examples adding disclosure mechanics rules, disclosure rules (i.e. reporting checklist), and a pixel-perfect Inline XBRL rendering of this fairly simple example financial report.

You can download a zip file that contains all of the XBRL examples or the human-readable representation of the example from the home page of this example¹¹.

Concept Arrangement Patterns

The *US GAAP Financial Reporting Taxonomy Architecture*¹² decomposes a report into “fragments” and “schedules” and finally into “facts”. I have similarly decomposed the objects of a financial report. The following is a comparison of the terms that I use reconciled to the terms the *US GAAP Financial Reporting Taxonomy Architecture* uses as best as possible:

Definition	My Term	US GAAP Financial Reporting Taxonomy Architecture Term	XBRL Term
A report is information published by a reporting entity at some point in time for some purpose.	Report	Financial Report	XBRL instance
A fragment is a set of one to many fact sets which go together for some specific purpose within a report.	Fragment	Report Fragment; Group and Table;	Network and Hypercube
A fact set is a set of facts which go together (tend to be cohesive and share a certain common nature) for some specific purpose within a report.	Fact Set or “Block”	Schedule	
A fact defines a single, observable, reportable piece of information contained within a report contextualized for unambiguous interpretation or analysis by one or more distinguishing aspects.	Fact	Fact	Fact

⁹ Accounting Equation represented in XBRL, <http://xbrlsite.azurewebsites.net/2020/core/master-ae/>

¹⁰ FASB’s SFAC 6 *Elements of Financial Statements* represented in XBRL, <http://xbrlsite.azurewebsites.net/2020/core/master-sfac6/>

¹¹ Proof+Common+Rendering example representation, <http://xbrlsite.azurewebsites.net/2020/master/proof-common-render/index.html>

¹² FASB, *US GAAP Financial Reporting Taxonomy Architecture*, Figure 6. Many-to-Many Relationship Between Fragments and Facts, page 13, https://www.fasb.org/cs/ContentServer?c=Document_C&cid=1176163689810&d=&pagename=FASB%2FDocument_C%2FDocumentPage

An analysis of a set of 6,023 XBRL-based financial reports submitted to the SEC by public companies revealed:

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

So, the actual average size of the pieces of a report are quite small. Information is skewed a bit by the relatively large number of Level 1, Level 2, and Level 3 text blocks.

Networks are too big to work with because they can contain multiple hypercubes (a.k.a. [Table]s). Even hypercubes are too big to work with because those creating reports tend to construct the hypercubes in arbitrary ways. Facts themselves are too small to work with.

But there is a magical fragment unit that is just right. I call this magical unit of a financial report the “Block” or the “Fact Set”. I will use the term Fact Set and Block interchangeably to mean exactly the same thing in this document. Each **Fact Set** or **Block** can be described by what I call a concept arrangement pattern¹³. A concept arrangement pattern is literally a pattern of the arrangement of Concepts that are represented as a part of [Line Items].

Of the **754,430** Fact Sets found in the 6,023 reports that I interrogated using automated machine-based processes, there were:

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

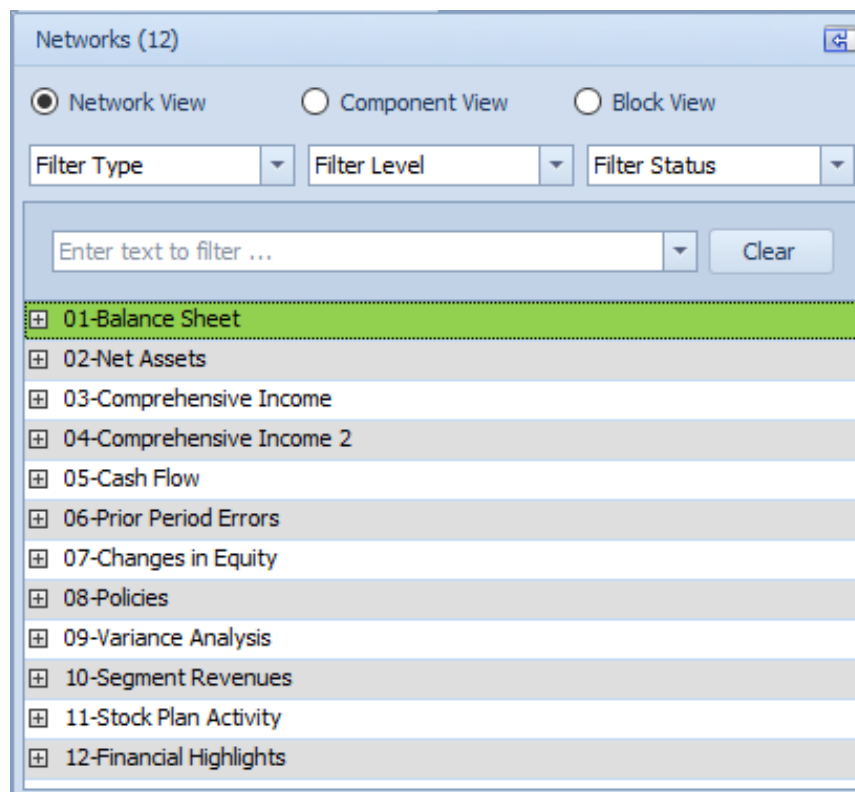
¹³ *Concept Arrangement Patterns*,
http://xbrlsite.azurewebsites.net/2017/IntelligentDigitalFinancialReporting/Part02_Chapter05.7a_ConceptArrangementPatterns.pdf

But every fragment of every XBRL-based financial report can be described by its concept arrangement pattern of the Fact Set which makes up the fragment. The concept arrangement pattern is simply the pattern of the arrangement of the contents of the [Line Items] (a.k.a. primary items) of the report. Only Concepts or [Abstract]s can exist within a set of [Line Items].

The **Proof** example representation puts all of those possible concept arrangement patterns into one XBRL taxonomy schema, set of XBRL linkbases, set of XBRL formulas, and XBRL instance and constructs a provably properly functioning logical system. The purpose of that representation is to verify that each of the concept arrangement patterns have been created logically and interact with all other concept arrangement patterns within an XBRL-based digital financial report.

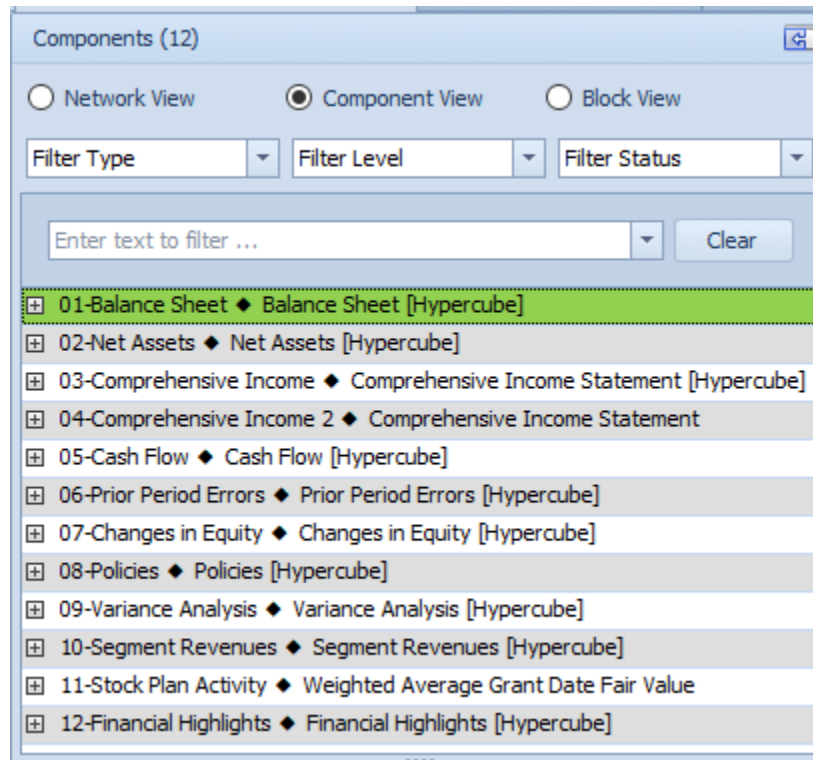
Networks, Components, and Blocks

The following is the set of XBRL **networks** that you will find in this example representation:



If you load the XBRL instance into any off-the-shelf XBRL software application you will see 12 networks as can be seen above and as can be seen if you use the XBRL Cloud Evidence Package which provides a human-readable representation of an XBRL-based report¹⁴.

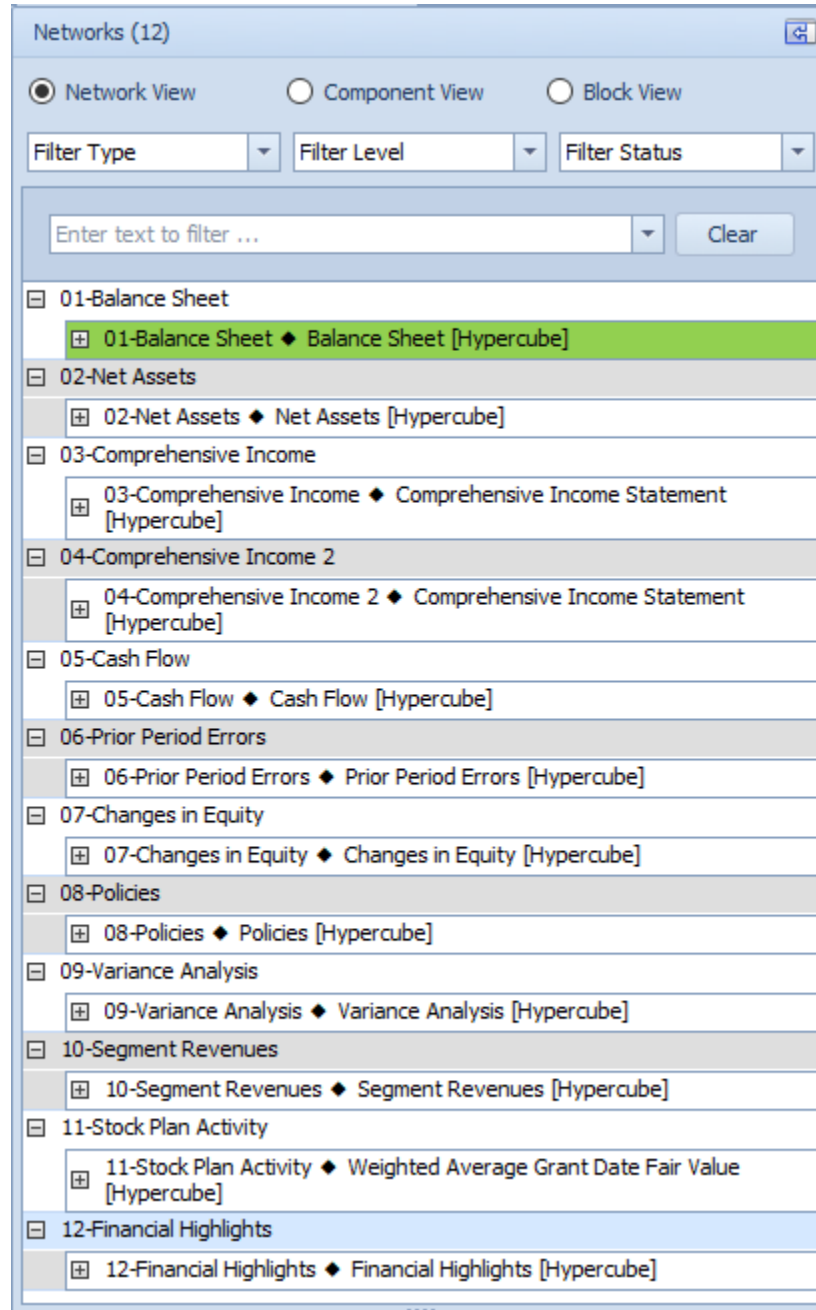
Each network could contain (a) no hypercubes or (b) one to many hypercubes. The notion of a component breaks a network into separate hypercubes; so a component is a network plus one hypercube. Here are the components of the Proof + Common + Rendering example:



Note that there are 12 components for this example representation. That means that there exists either 1 explicit hypercube within each network. In our case, explicit hypercubes were defined for each component. It could be the case that an implied hypercube is used to represent a component. Logically, there is no difference between an explicitly defined hypercube and an implied hypercube other than explicit hypercubes have names (i.e. the name of the hypercube) and implied hypercubes have no name that can be used to identify the fragment of a report that the hypercube is representing.

Below you see another screenshot of the networks but this time each network is expanded to show the hypercubes that are used to represent a component within each network:

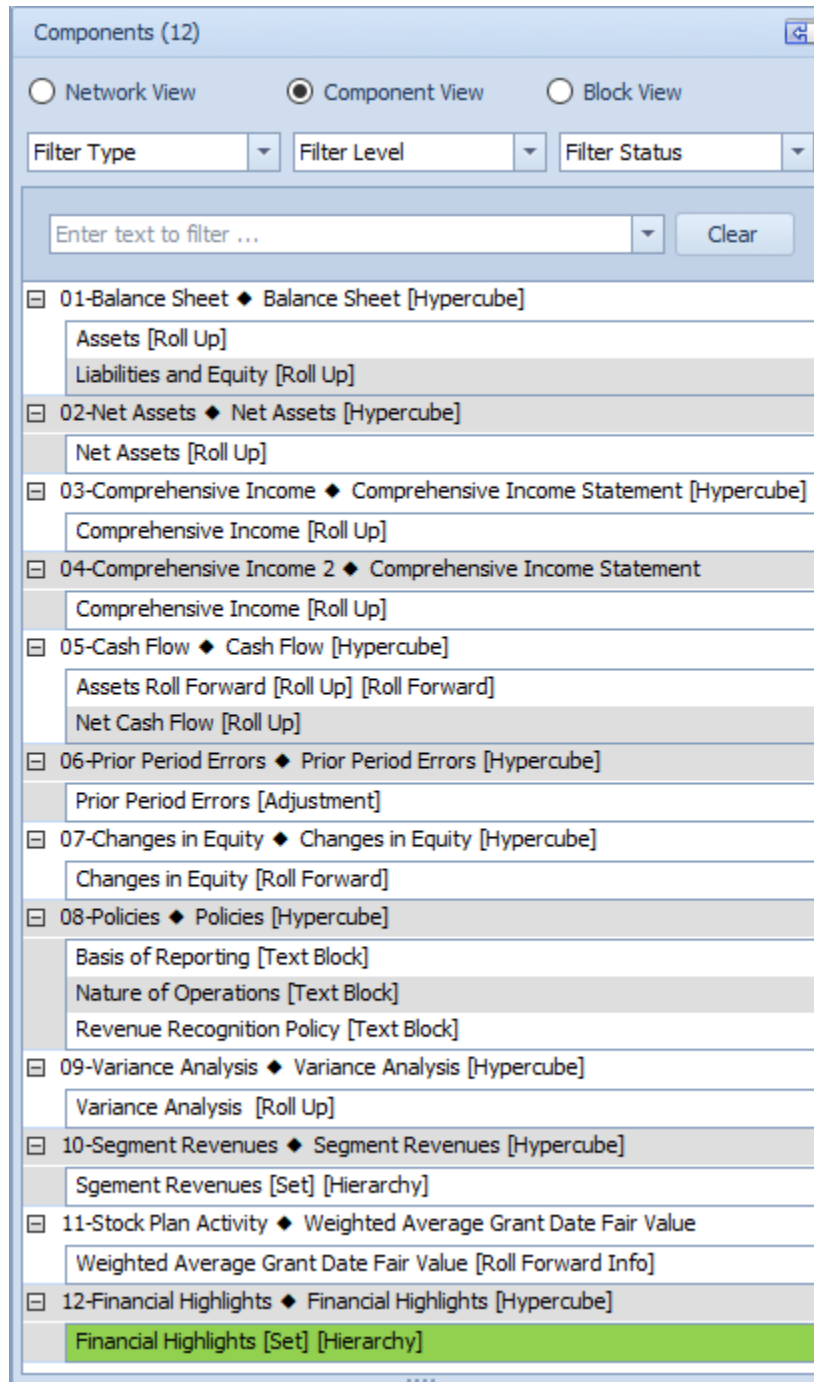
¹⁴ XBRL Cloud Evidence Package for Proof+Common+Rendering Example, http://xbrl.azurewebsites.net/2020/master/proof-common-render/evidence-package/contents/index.html#Rendering-BalanceSheet-proof_BalanceSheetHypercube.html



If you count the networks you see that there are 12; and if you count the hypercubes you see that there are also 12; and that there is exactly 1 hypercube included within each network.

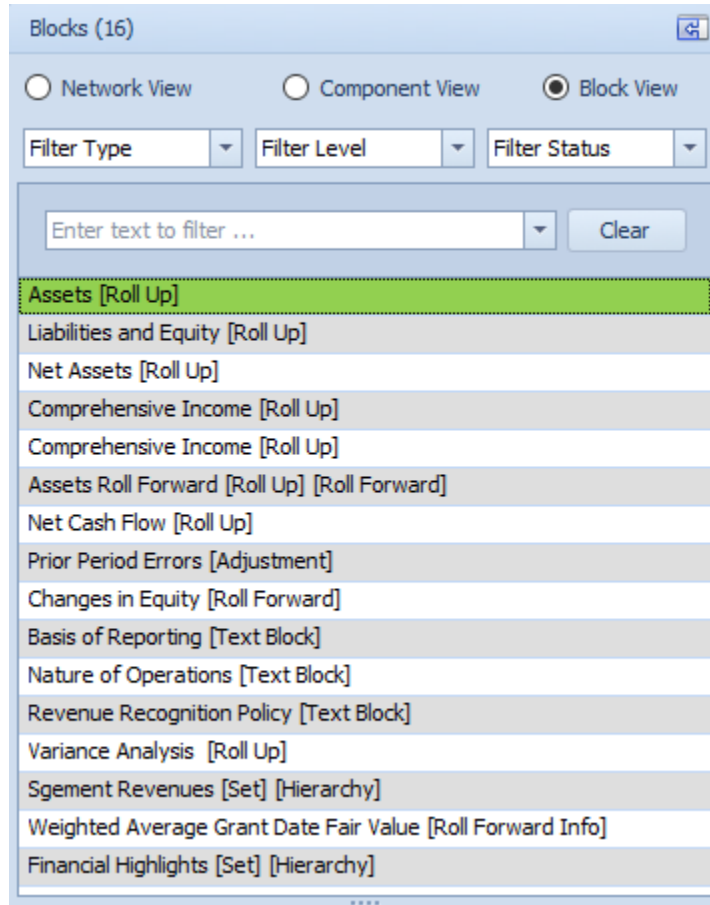
Similarly, components contain **fact sets** or blocks¹⁵. Below you see a screen shot of the components of this example expanded to also show the blocks or fact sets that are included within the component:

¹⁵ The software application that I use to show fact sets uses the term “Blocks”. The more current term is Fact Set which has been adopted by the OMG Standard Business Report Model.



If you count the components you see that there are 12. If you count the blocks you will note that there are 16. Several components have only one block, but a couple of others have two blocks (#1 and #5) and one component has three blocks (#8).

Below you see a screenshot of each of the 16 blocks that make up the example we are working with:



Note that each of the blocks or fact sets have names. This is because when the XBRL taxonomy was created, it was carefully configured in order to have explicitly identifiable names for each block.

Disclosures

Each block or fact set provides a representation of a piece of a report. I refer to each such piece of a report as a disclosure. This includes all report fragments whether the block is part of the primary financial statements, the policies, or the disclosure notes; everything disclosed is referred to as a disclosure.

Disclosure Rules (Reporting Checklist)

What disclosures are required to exist in a report can be represented in machine-readable form using what I call disclosure rules (this is the new term used by SBRM) or have referred to as reporting checklist (older term, means the same thing as the SBRM term). The following is a screen shot of the disclosure rules of this example representation:

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#	Disclosure	Checklist Category	Reason Disclosure Must Exist	Discovered	Expectation Met	Link to Disclosure Mechanics
0	Reporting Checklist					
1	Balance Sheet	Required disclosure	Disclosure always required, satisfied by Assets Roll Up and Liabilities and Equity Roll Up disclosures	True	CONSISTENT	Balance Sheet
2	Assets Roll Up	Part of disclosure	Satisfies Balance Sheet disclosure	True	CONSISTENT	Assets Roll Up
3	Liabilities and Equity Roll Up	Part of disclosure	Satisfies Balance Sheet disclosure	True	CONSISTENT	Liabilities and Equity Roll Up
4	Income Statement	Required disclosure	Disclosure always required	True	CONSISTENT	Income Statement
5	Cash Flow Statement	Required disclosure	Disclosure always required, satisfied by Assets Roll Forward and Net Cash Flow Roll Up disclosures	True	CONSISTENT	Cash Flow Statement
6	Assets Roll Forward	Part of disclosure	Satisfies Cash Flow Statement disclosure	True	CONSISTENT	Assets Roll Forward
7	Net Cash Flow Roll Up	Part of disclosure	Satisfies Cash Flow Statement disclosure	True	CONSISTENT	Net Cash Flow Roll Up
8	Changes in Equity	Required disclosure	Disclosure always required	True	CONSISTENT	Changes in Equity
9	Financial Highlights	Possible disclosure	Disclosure is present	True	CONSISTENT	Financial Highlights
10	Prior Period Errors	Possible disclosure	Disclosure is present	True	CONSISTENT	Prior Period Errors
11	Variance Analysis	Possible disclosure	Disclosure is present	True	CONSISTENT	Variance Analysis
12	Segment Revenues	Possible disclosure	Disclosure is present	True	CONSISTENT	Segment Revenues
13	Stock Plan Activity	Possible disclosure	Disclosure is present	True	CONSISTENT	Stock Plan Activity
14	Basis of Reporting	Required disclosure	Disclosure always required	True	CONSISTENT	Basis of Reporting
15	Nature of Operations	Required disclosure	Disclosure always required	True	CONSISTENT	Nature of Operations
16	Revenue Recognition Policy	Required disclosure	Disclosure always required	True	CONSISTENT	Revenue Recognition Policy
17	Net Assets Roll Up	Possible disclosure	Disclosure is present	True	CONSISTENT	Net Assets Roll Up
18	Income Statement Alternative	Possible disclosure	Disclosure is present	True	CONSISTENT	Income Statement Alternative

The disclosure rules are represented within an XBRL definition relations linkbase¹⁶. Because the disclosure rules are simply an XBRL definition linkbase, those rules can be loaded into any standard off-the-shelf XBRL software application. For example,

	Arcrole	Order
Definition View		
http://www.xbrl.org/2003/role/link		
[Disclosure]		0
Reporting Checklist		
[Thing]		0
[FinancialReport]	http://xbrlsite.azurewebsites.net/2016/conceptual-model/arcrole/class-equivalentClass	1
Balance Sheet	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-requiresDisclosure	2
Income Statement	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-requiresDisclosure	3
Cash Flow Statement	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-requiresDisclosure	3, 1
Changes in Equity	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-requiresDisclosure	4
Financial Highlights	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-possibleDisclosure	5
Prior Period Errors	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-possibleDisclosure	6
Variance Analysis	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-possibleDisclosure	7
Segment Revenues	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-possibleDisclosure	8
Stock Plan Activity	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-possibleDisclosure	9
Basis of Reporting	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-requiresDisclosure	10
Nature of Operations	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-requiresDisclosure	11
Revenue Recognition Policy	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-requiresDisclosure	12
Assets Roll Up	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-possibleDisclosure	21
Liabilities and Equity Roll Up	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-possibleDisclosure	21
Net Assets Roll Up	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-possibleDisclosure	22
Assets Roll Forward	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-possibleDisclosure	23
Income Statement Alternative	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-possibleDisclosure	24
Net Cash Flow Roll Up	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/financialReport-possibleDisclosure	25

Explaining the disclosure rules (reporting checklist) in detail is beyond the scope of this document but in summary; disclosures can always be required, be required when a specific line item is reported, be required when another disclosure is required, and other such alternatives. The logical scheme that I use now is rather basic, but it (a) is better than anything else that I am aware of and (b) it gets the point across that a reporting checklist can be made to be machine-readable.

¹⁶ Disclosure rules (a.k.a. reporting checklist), <http://xbrlsite.azurewebsites.net/2020/master/proof-common-render/dr-rules-def.xml>

Disclosure Mechanics

The disclosure rules work together with what I call the disclosure mechanics rules. Disclosure mechanics rules document a specification for the permissible configuration of a disclosure using the XBRL technical syntax. Consider this very basic example:

Rules	Line of Reasoning
	This disclosure: disclosures:IncomeStatement
	- MUST be represented using the Hypercube/[Table] named: proof:ComprehensiveIncomeStatementHypercube
	- MUST be represented as a Level 4 Disclosure Detail with the concept arrangement pattern: cm:RollUp
	- cm:RollUp REQUIRES total: proof:ComprehensiveIncome

The disclosure rule is for the disclosure with the name “IncomeStatement”. The human-readable information that you see is a rendering of the actual rules that are represented within an XBRL definitions relations linkbase¹⁷. This machine-readable rule specifies that:

1. Every “IncomeStatement” disclosure MUST be represented using the hypercube with the name “proof:ComprehensiveIncomeStatementHypercube”.
2. Every “IncomeStatement” disclosure MUST be a “Roll Up” concept arrangement pattern.
3. Every “IncomeStatement” disclosure MUST have the concept “proof:ComprehensiveIncome” as the total of the Roll Up.

In addition to specifying permissible configurations for a disclosure, the same information is used to identify and extract information from that disclosure that is contained in a financial report. Again, this information is represented using an XBRL definition relations linkbase which can be loaded into any XBRL software application:

	Arcrole	Order
Definition View		
Income Statement		
Income Statement		0
Comprehensive Income Statement [Hypercube]	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/disclosure-requiresHypercube	1
[RollUp]	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/disclosure-hasConceptArrangementPattern	2
Comprehensive Income	http://xbrlsite.azurewebsites.net/2016/conceptual-model/drules-arcroles/arcrole/conceptArrangementPattern-requiresConcept	3

Below you see the line of reasoning used by a software algorithm which uses the disclosure mechanics rules to (a) identify the disclosure within an XBRL-based financial report and (b) determine if the identified disclosure is consistent with the permissible specification and (c) determine if the disclosure is consistent with that specification and finally (d) extract information from the report:

¹⁷ XBRL definition relations for disclosure mechanics rule for the disclosure “IncomeStatement”, <http://xbrlsite.azurewebsites.net/2020/master/proof-common-render/dm-ComprehensiveIncome-rules-def.xml>

Rules	Line of Reasoning
####Disclosure mechanics validation explanation for disclosure: disclosures:IncomeStatement####	...
Level 4 Disclosure Detail	
Looking for blocks with concept arrangement pattern: RollUp	
Looking for Hypercube/[Table]: proof:ComprehensiveIncomeStatementHypercube	
*FOUND Hypercube/[Table]: proof:ComprehensiveIncomeStatementHypercube in network:	
Looking for Concept: proof:ComprehensiveIncome	
*FOUND Concept: proof:ComprehensiveIncome in network:	
Concept located in multiple networks (2).	
Concept located in network: 03-Comprehensive Income	
CONCLUSION	
Disclosure found in report: True	
Disclosure mechanics are CONSISTENT because the Level 4 Disclosure Detail concept was FOUND.	
#### END of disclosure mechanics validation explanation for this disclosure ####	

This same scheme is used for every disclosure that might exist within an XBRL-based financial report. For example, here are the 18 disclosures that might exist within the Proof + Common + Rendering example XBRL instance:

Primary Information									
#	Disclosure	Category	Level	Pattern	Disclosure Found	Disclosure Consistent	Applicable	Representation Concept [TEXT BLOCK]	Representation Concept DETAIL
1	Assets Roll Forward	Unknown	Level4Detail	RollForward	True	CONSISTENT	True	NOT-EXPECTED	Assets
2	Assets Roll Up	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Assets
3	Balance Sheet	Unknown	UNKNOWN	Component	True	CONSISTENT	True	-	-
4	Basis of Reporting	Unknown	Level1TextBlock	TextBlock	True	CONSISTENT	True	Basis of Reporting [Text Block]	NOT-EXPECTED
5	Cash Flow Statement	Unknown	UNKNOWN	Component	True	CONSISTENT	True	-	-
6	Changes in Equity	Unknown	Level4Detail	RollForward	True	CONSISTENT	True	NOT-EXPECTED	Equity
7	Financial Highlights	Unknown	Level4Detail	Hierarchy	True	CONSISTENT	True	NOT-EXPECTED	Revenues
8	Income Statement	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Comprehensive Income
9	Income Statement Alternative	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Comprehensive Income
10	Liabilities and Equity Roll Up	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Liabilities and Equity
11	Nature of Operations	Unknown	Level1TextBlock	TextBlock	True	CONSISTENT	True	Nature of Operations [Text Block]	NOT-EXPECTED
12	Net Assets Roll Up	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Net Assets
13	Net Cash Flow Roll Up	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Net Cash Flow
14	Prior Period Errors	Unknown	Level4Detail	Adjustment	True	CONSISTENT	True	NOT-EXPECTED	Equity
15	Revenue Recognition Policy	Unknown	Level1TextBlock	TextBlock	True	CONSISTENT	True	Revenue Recognition Policy [Text Block]	NOT-EXPECTED
16	Segment Revenues	Unknown	Level4Detail	Hierarchy	True	CONSISTENT	True	NOT-EXPECTED	Revenues
17	Stock Plan Activity	Unknown	Level4Detail	RollForwardInfo	True	CONSISTENT	True	NOT-EXPECTED	Nonvested Fair Value
18	Variance Analysis	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Comprehensive Income

If you look closely you will note that there are 18 disclosures but the report had only 16 blocks. Why would the block count and the number of disclosures not be the same? The reason is that there are two disclosures that would never be instantiated as a block. Those two disclosures are the BalanceSheet which is made up of TWO blocks; the “AssetsRollUp” and the “LiabilitiesAndEquityRollUp” and the “CashFlowStatement” disclosure which is made up of the “NetCashFlowRollUp” disclosure and the “AssetsRollForward”. (Normally, this would be the “Cash and cash equivalents” roll forward but since we are not down to that level of detail in our examples yet so we are rolling the assets line item forward.)

Properly Functioning Logical System

And so, the point of this detailed explanation is to show that 100% of a report is controlled by disclosure mechanics rules to make certain that each of the possible disclosures is represented consistently with permissible specifications for each disclosure.

If the facts in a report are consistent with the rules specified and the rules are complete and precise then machine-based processes can be used to determine if the XBRL-based financial report is a properly functioning logical system.

We have already explained that each mathematical association that exists within the Proof and the Common Elements of a Financial Statement example. For example,

Shell of a **balance sheet** which measures status:

Component: (Network and Table)	
Network	01-Balance Sheet (http://www.xbrlsite.com/sfac6/role/BalanceSheet)
Table	Balance Sheet [Hypercube]

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

Reporting Entity [Axis]	GH259400TOMPUOLS65II (http://standards.iso.org/iso/17442)
-------------------------	--

Balance Sheet [Line Items]	Period [Axis]	
	2020-12-31	2019-12-31
Balance Sheet [Arithmetic Expression]		
Assets	3,500	0
Liabilities	0	0
Equity	3,500	0

Shell of a **comprehensive income** statement which measures performance:

Component: (Network and Table)	
Network	02-Comprehensive Income (http://www.xbrlsite.com/sfac6/role/ComprehensiveIncome)
Table	Comprehensive Income Statement [Hypercube]

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

Reporting Entity [Axis]	GH259400TOMPUOLS65II (http://standards.iso.org/iso/17442)
-------------------------	--

Comprehensive Income Statement [Line Items]	Period [Axis]
	2020-01-01 - 2020-12-31
Comprehensive Income [Roll Up]	
Revenues	7,000
(Expenses)	(3,000)
Gains	1,000
(Losses)	(2,000)
Comprehensive Income	3,000

Shell of **changes in equity** which connects the income statement to the balance sheet:

Component: (Network and Table)	
Network	03-Changes in Equity (http://www.xbrlsite.com/sfac6/role/ChangesInEquity)
Table	Changes in Equity [Hypercube]

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

Reporting Entity [Axis]	GH259400TOMPUOLS65II (http://standards.iso.org/iso/17442)
-------------------------	--

Changes in Equity [Line Items]	Period [Axis]
	2020-01-01 - 2020-12-31
Changes in Equity [Roll Forward]	
Equity, Beginning Balance	0
Comprehensive Income	3,000
Investments by Owners	1,000
(Distributions to Owners)	(500)
Equity, Ending Balance	3,500

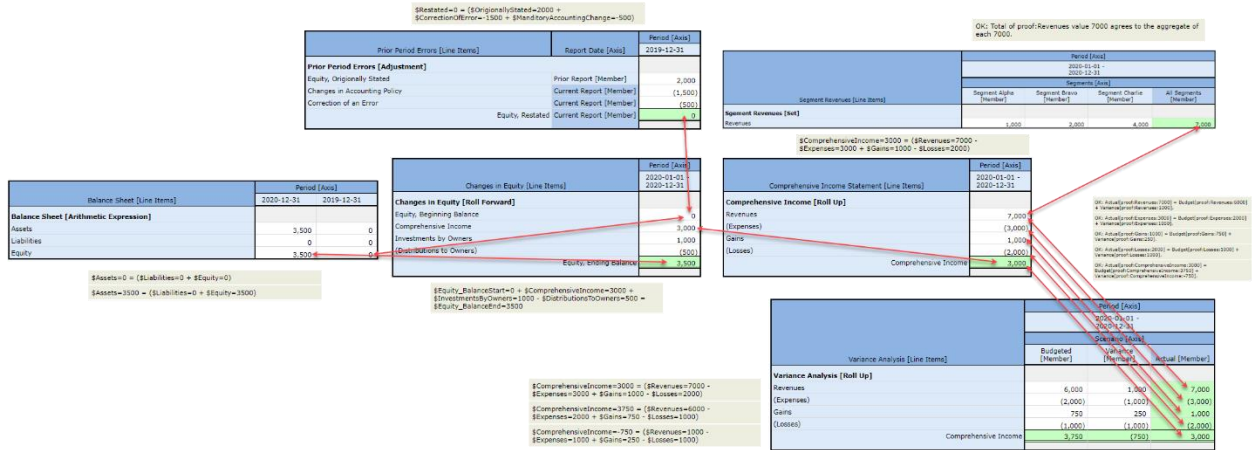
The rules (a.k.a. assertions) that show that everything ticks and ties numerically per the four rules represented. (Note that the balance sheet rule is executed twice, once for the beginning and again for the ending balance.)

id	satisfied	message
CONSISTENCY_5 (evaluation 1)	satisfied	$\$Assets=3500 = (\$Liabilities=0 + \$Equity=3500)$
CONSISTENCY_5 (evaluation 2)	satisfied	$\$Assets=0 = (\$Liabilities=0 + \$Equity=0)$
CONSISTENCY_6 (evaluation 1)	satisfied	$\$ComprehensiveIncome=3000 = (\$Revenues=7000 - \$Expenses=3000 + \$Gains=1000 - \$Losses=2000)$
RollForward_1 (evaluation 1)	satisfied	$\$Equity_BalanceStart=0 + \$ComprehensiveIncome=3000 + \$InvestmentsByOwners=1000 - \$DistributionsToOwners=500 = \$Equity_BalanceEnd=3500$
ASSERTION_SFAC6_CONCEPTUAL_FRAMEWORK_RECONCILIATION (evaluation 1)	satisfied	$0 = ((\$Equity_BalanceStart=0 + ((\$Revenues=7000 - \$Expenses=3000) + (\$Gains=1000 - \$Losses=2000)) + (\$InvestmentsByOwners=1000 - \$DistributionsToOwners=500)) + (\$Liabilities_BalanceEnd=0 - \$Assets_BalanceEnd=3500))$

The four statement model shows the explicitly created **articulation** or the interrelationships between the three primary financial statements defined by the FASB in SFAC 6. Common elements of financial statements add the cash flow statement so we have our four statement model. The Proof example adds additional possible dimensions that a fact might be disaggregated by or forms some other sort of mathematical computation such as an “adjustment” or a “variance” or a “roll forward”. The proof example ultimately shows that the rich set of such mathematical associations are consistent with expectation as is demonstrated in the graphic below and the detailed validation reports provided by XBRL software applications that test the logic of information provided in the report against the expectations documented by the rules:

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Those results are summarized below:

UBmatrix XPE 4.0:

Thu Feb 27 15:49:50 PST 2020
XBRL Processor Version:4.0.0.2125
Report name: Detailed Output

Summary

Formulas Compiled	Formula Fired	Assertions Compiled	Assertions Fired	Assertions Satisfied	Assertions Not Satisfied
0	0	11	14	14	0

Assertion Report

Value Assertions

id	satisfied	message
CONSISTENCY_AccountingEquation (evaluation 1)	satisfied	$\$Assets=0 = (\$Liabilities=0 + \$Equity=0)$
CONSISTENCY_AccountingEquation (evaluation 2)	satisfied	$\$Assets=3500 = (\$Liabilities=0 + \$Equity=3500)$
CONSISTENCY_ComprehensiveIncome (evaluation 1)	satisfied	$\$ComprehensiveIncome=3000 = (\$Revenues=7000 - \$Expenses=3000 + \$Gains=1000 - \$Losses=2000)$
CONSISTENCY_ComprehensiveIncome (evaluation 2)	satisfied	$\$ComprehensiveIncome=3750 = (\$Revenues=6000 - \$Expenses=2000 + \$Gains=750 - \$Losses=1000)$
CONSISTENCY_ComprehensiveIncome (evaluation 3)	satisfied	$\$ComprehensiveIncome=-750 = (\$Revenues=1000 - \$Expenses=1000 + \$Gains=250 - \$Losses=1000)$
RollForward_Equity (evaluation 1)	satisfied	$\$Equity_BalanceStart=0 + \$ComprehensiveIncome=3000 + \$InvestmentsByOwners=1000 - \$DistributionsToOwners=500 = \$Equity_BalanceEnd=3500$
CONSISTENCY_SFAC6_Conceptual_Framework_Reconciliation (evaluation 1)	satisfied	$0 = ((\$Equity_BalanceStart=0 + ((\$Revenues=7000 - \$Expenses=3000) + (\$Gains=1000 - \$Losses=2000)) + (\$InvestmentsByOwners=1000 - \$DistributionsToOwners=500)) + (\$Liabilities_BalanceEnd=0 - \$Assets_BalanceEnd=3500))$
VARIANCE_Revenues (evaluation 1)	satisfied	$\$Actual=7000 = (\$Budget=6000 + \$Variance=1000)$
VARIANCE_Expenses (evaluation 1)	satisfied	$\$Actual=3000 = (\$Budget=2000 + \$Variance=1000)$
VARIANCE_Gains (evaluation 1)	satisfied	$\$Actual=1000 = (\$Budget=750 + \$Variance=250)$
VARIANCE_Losses (evaluation 1)	satisfied	$\$Actual=2000 = (\$Budget=1000 + \$Variance=1000)$
VARIANCE_ComprehensiveIncome (evaluation 1)	satisfied	$\$Actual=3000 = (\$Budget=3750 + \$Variance=-750)$
MemberAggregation_SegmentRevenues (evaluation 1)	satisfied	SATISFIED: (OK) The reported total 7000 for the concept proof: Revenues agrees to the aggregate of each reported member.
Adjustment_Reconciles_EquityPriorPeriodAdjustments (evaluation 1)	satisfied	$\$Restated=0 = (\$OriginallyStated=2000 + \$CorrectionOfError=-1500 + \$MandatoryAccountingChange=-500)$

XBRL Cloud Evidence Package:

Assertions Summary

	Defined	Executed	Pass	Fail
Existence assertions	0	0	0	0
Value assertions	11	14	14	0
Consistency assertions	0	0	0	0
Total all assertions	11	14	14	0

#	Label	Result	Rule
1	$\$ComprehensiveIncome = (\$Revenues - \$Expenses + \$Gains - \$Losses)$ (CONSISTENCY_ComprehensiveIncome)	Pass	$\$ComprehensiveIncome = (\$Revenues - \$Expenses + \$Gains - \$Losses)$
2	$\$ComprehensiveIncome = (\$Revenues - \$Expenses + \$Gains - \$Losses)$ (CONSISTENCY_ComprehensiveIncome)	Pass	$\$ComprehensiveIncome = (\$Revenues - \$Expenses + \$Gains - \$Losses)$
3	$\$ComprehensiveIncome = (\$Revenues - \$Expenses + \$Gains - \$Losses)$ (CONSISTENCY_ComprehensiveIncome)	Pass	$\$ComprehensiveIncome = (\$Revenues - \$Expenses + \$Gains - \$Losses)$
4	$\$Actual = (\$Budget + \$Variance)$ (VARIANCE_Expenses)	Pass	$\$Actual = (\$Budget + \$Variance)$
5	$\$Actual = (\$Budget + \$Variance)$ (VARIANCE_ComprehensiveIncome)	Pass	$\$Actual = (\$Budget + \$Variance)$
6	$\$Actual = (\$Budget + \$Variance)$ (VARIANCE_Revenues)	Pass	$\$Actual = (\$Budget + \$Variance)$
7	Adjustment reconciles: originally stated balance + adjustments restated balance across the Report Date [Axis] (Adjustment_Reconciles_EquityPriorPeriodAdjustments)	Pass	$\$Restated = (\$OriginallyStated + \$CorrectionOfError + \$MandatoryAccountingChange)$
8	$\$Equity_BalanceStart + \$ComprehensiveIncome + \$InvestmentsByOwners - \$DistributionsToOwners = \$Equity_BalanceEnd$ (RollForward_Equity)	Pass	$\$Equity_BalanceStart + \$ComprehensiveIncome + \$InvestmentsByOwners - \$DistributionsToOwners = \$Equity_BalanceEnd$
9	$\$Assets = (\$Liabilities + \$Equity)$ (CONSISTENCY_AccountingEquation)	Pass	$\$Assets = (\$Liabilities + \$Equity)$
10	$\$Assets = (\$Liabilities + \$Equity)$ (CONSISTENCY_AccountingEquation)	Pass	$\$Assets = (\$Liabilities + \$Equity)$
11	SATISFIED: (OK) The reported total 7000 for the concept proof:Revenues agrees to the aggregate of each reported member. (MemberAggregation_SegmentRevenues)	Pass	\$Total eq sum(\$Each)
12	$0 = (Equity\{T0\} + (Revenue\{P1\} - Expenses\{P1\} + Gains\{P1\} - Losses\{P1\}) + (InvestmentsByOwners\{P1\} - DistributionsToOwners\{P1\})) + Liabilities\{T1\} - Assets\{T1\})$ (CONSISTENCY_SFAC6_Conceptual_Framework_Reconciliation)	Pass	$0 = ((\$Equity_BalanceStart + ((\$Revenues - \$Expenses) + (\$Gains - \$Losses)) + (\$InvestmentsByOwners - \$DistributionsToOwners)) + (\$Liabilities_BalanceEnd - \$Assets_BalanceEnd))$
13	$\$Actual = (\$Budget + \$Variance)$ (VARIANCE_Gains)	Pass	$\$Actual = (\$Budget + \$Variance)$
14	$\$Actual = (\$Budget + \$Variance)$ (VARIANCE_Losses)	Pass	$\$Actual = (\$Budget + \$Variance)$

Fujitsu XWand:

No.	ID	Type	Expression	Element	Context	Unit	Value
1	CONSISTENCY_AccountingEquation	Value Assertion	$\$Assets = (\$Liabilities + \$Equity)$	-	-	-	true
2	CONSISTENCY_AccountingEquation	Value Assertion	$\$Assets = (\$Liabilities + \$Equity)$	-	-	-	true
3	CONSISTENCY_ComprehensiveIncome	Value Assertion	$\$ComprehensiveIncome = (\$Revenues - \$Expenses + \$Gains - \$Losses)$	-	-	-	true
4	CONSISTENCY_ComprehensiveIncome	Value Assertion	$\$ComprehensiveIncome = (\$Revenues - \$Expenses + \$Gains - \$Losses)$	-	-	-	true
5	CONSISTENCY_ComprehensiveIncome	Value Assertion	$\$ComprehensiveIncome = (\$Revenues - \$Expenses + \$Gains - \$Losses)$	-	-	-	true
6	RollForward_Equity	Value Assertion	$\$Equity_BalanceStart + \$ComprehensiveIncome + \$InvestmentsByOwners - \$DistributionsToOwners = \$Equity_BalanceEnd$	-	-	-	true
7	CONSISTENCY_SFAC6_Conceptual_Framework_Reconciliation	Value Assertion	$0 = ((\$Equity_BalanceStart + ((\$Revenues - \$Expenses) + (\$Gains - \$Losses)) + (\$InvestmentsByOwners - \$DistributionsToOwners)) + (\$Liabilities_BalanceEnd - \$Assets_BalanceEnd))$	-	-	-	true
8	VARIANCE_Revenues	Value Assertion	$\$Actual = (\$Budget + \$Variance)$	-	-	-	true
9	VARIANCE_Expenses	Value Assertion	$\$Actual = (\$Budget + \$Variance)$	-	-	-	true
10	VARIANCE_Gains	Value Assertion	$\$Actual = (\$Budget + \$Variance)$	-	-	-	true
11	VARIANCE_Losses	Value Assertion	$\$Actual = (\$Budget + \$Variance)$	-	-	-	true
12	VARIANCE_ComprehensiveIncome	Value Assertion	$\$Actual = (\$Budget + \$Variance)$	-	-	-	true
13	MemberAggregation_SegmentRevenues	Value Assertion	\$Total eq sum(\$Each)	-	-	-	true
14	Adjustment_Reconciles_EquityPriorPeriodAdjustments	Value Assertion	$\$Restated = (\$OriginallyStated + \$CorrectionOfError + \$MandatoryAccountingChange)$	-	-	-	true

Arelle:

```

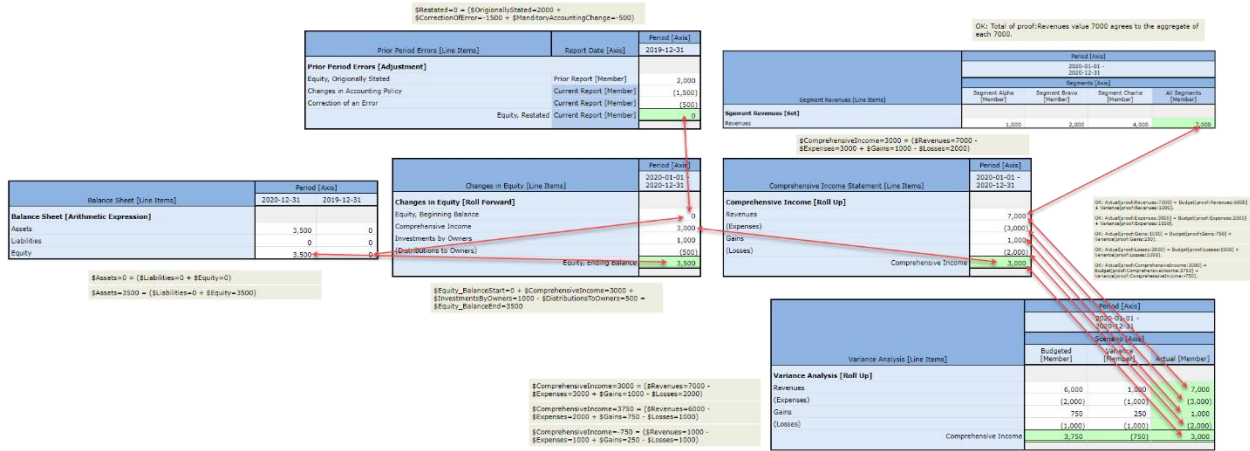
messages Concepts
[formula:assertionSatisfied] Actual = ($Budget + $Variance), $Actual: proof:ComprehensiveIncome context D-E2B5-4642-81CA-A478, $Budget: proof:ComprehensiveIncome context D-E2B5-4642-81CA-A478-Budget, $Variance: proof:ComprehensiveIncome context D-E2B5-4642-81CA-A478-Variance
[formula:assertionSatisfied] Actual = ($Budget + $Variance), $Actual: proof:Expenses context D-E2B5-4642-81CA-A478, $Budget: proof:Expenses context D-E2B5-4642-81CA-A478-Budget, $Variance: proof:Expenses context D-E2B5-4642-81CA-A478-Variance - Rule-Variance-VA01-formula.xml
[formula:assertionSatisfied] ComprehensiveIncome = ($Revenues - $Expenses + $Gains - $Losses), $ComprehensiveIncome: proof:ComprehensiveIncome context D-E2B5-4642-81CA-A478-Budget, $Expenses: proof:Expenses context D-E2B5-4642-81CA-A478-Budget, $Gains: proof:Gains context D-E2B5-4642-81CA-A478-Variance, $Losses: proof:Losses context D-E2B5-4642-81CA-A478-Variance
[formula:assertionSatisfied] ComprehensiveIncome = ($Revenues - $Expenses + $Gains - $Losses), $ComprehensiveIncome: proof:ComprehensiveIncome context D-E2B5-4642-81CA-A478-Budget, $Expenses: proof:Expenses context D-E2B5-4642-81CA-A478-Budget, $Gains: proof:Gains context D-E2B5-4642-81CA-A478-Variance, $Losses: proof:Losses context D-E2B5-4642-81CA-A478-Variance
[formula:assertionSatisfied] Assets = ($Liabilities + $Equity), $Assets: proof:Assets context I-99F9-4C9C-8C6C-BE7C, $Equity: proof:Equity context I-99F9-4C9C-8C6C-BE7C, $Liabilities: proof:Liabilities context I-99F9-4C9C-8C6C-BE7C - Rule-Consistency-B501-formula.xml 77, instance.xml
[formula:assertionSatisfied] Assets = ($Liabilities + $Equity), $Assets: proof:Assets context I-5251-4725-9160-E873, $Equity: proof:Equity context I-5251-4725-9160-E873, $Liabilities: proof:Liabilities context I-5251-4725-9160-E873 - Rule-Consistency-B501-formula.xml 77, instance.xml 142
[formula:assertionSatisfied] Actual = ($Budget + $Variance), $Actual: proof:Revenues context D-E2B5-4642-81CA-A478, $Budget: proof:Revenues context D-E2B5-4642-81CA-A478-Budget, $Variance: proof:Revenues context D-E2B5-4642-81CA-A478-Variance - Rule-Variance-VA01-formula.xml 382
[formula:assertionSatisfied] Actual = ($Budget + $Variance), $Actual: proof:Losses context D-E2B5-4642-81CA-A478, $Budget: proof:Losses context D-E2B5-4642-81CA-A478-Budget, $Variance: proof:Losses context D-E2B5-4642-81CA-A478-Variance - Rule-Variance-VA01-formula.xml 382
[message:MemberAggregation_SegmentRevenues] SATISFIED: (OK) The reported total 7000 for the concept proof:Revenues agrees to the aggregate of each reported member. - Rule-MemberAggregation-formula.xml 73
[formula:assertionSatisfied] Revenues for each segment member foots to total, $Each: proof:Revenues context D-E2B5-4642-81CA-A478-Alpha, $Total: proof:Revenues context D-E2B5-4642-81CA-A478 - Rule-MemberAggregation-formula.xml 73, instance.xml 154, 174, 175, 178
[formula:assertionSatisfied] Equity_BalanceStart + $ComprehensiveIncome + $InvestmentsByOwners - $DistributionsToOwners = $Equity_BalanceEnd, $ComprehensiveIncome: proof:ComprehensiveIncome context D-E2B5-4642-81CA-A478, $DistributionsToOwners: proof:DistributionsToOwners context D-E2B5-4642-81CA-A478, $InvestmentsByOwners: proof:InvestmentsByOwners context D-E2B5-4642-81CA-A478
[formula:assertionSatisfied] Actual = ($Budget + $Variance), $Actual: proof:Gains context D-E2B5-4642-81CA-A478, $Budget: proof:Gains context D-E2B5-4642-81CA-A478-Budget, $Variance: proof:Gains context D-E2B5-4642-81CA-A478-Variance - Rule-Variance-VA01-formula.xml 281, instance.xml
[formula:assertionSatisfied] Adjustment reconciles: originally stated balance + adjustments restated balance across the Report Date [Axis], $CorrectionOfError: proof:ChangesInAccountingPolicy context I-5251-4725-9160-E873, $MandatoryAccountingChange: proof:CorrectionOfAnError context I-5251-4725-9160-E873
validated in 0.10 secs

```


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Here you see the interconnections between the facts that have all been verified to be consistent with expectation and mapped to the XBRL Formula validation results that are shown above¹⁸:



And so, this shows that the proof logical system is consistent, complete, and precise and therefore properly functioning. It contains each possible concept arrangement pattern that could ever exist in an XBRL-based financial report. Each of the disclosures are checked to be sure that specific disclosure is permissible against disclosure mechanics rules that define what is permissible. Report checklist rules determine if everything that should be reported has been reported.

Not covered in this specific example representation is model structure rules, consistency cross checks, and type-subtype associations. Each of these are discussed in other examples.

Roll Up

One common mathematical association between numeric facts within a financial statement is the roll up. A Roll Up concept arrangement pattern is exemplified by the Comprehensive Income statement structure which looks as follows¹⁹:

¹⁸ Proof mathematical computations, <http://xbrlsite.azurewebsites.net/2020/core/master-proof/ProofMathematicalComputations.jpg>

¹⁹ Comprehensive Income, http://xbrlsite.azurewebsites.net/2020/core/master-proof/evidence-package/contents/index.html#Rendering-ComprehensiveIncome-proof_ComprehensiveIncomeStatementHypercube.html

Comprehensive Income Statement [Line Items]	Period [Axis]
	2020-01-01 - 2020-12-31
Comprehensive Income [Roll Up]	
Revenues	7,000
(Expenses)	(3,000)
Gains	1,000
(Losses)	(2,000)
Comprehensive Income	3,000

A Roll Up is some set of items that aggregates to a total. Above, the items are Revenues, Expenses, Gains, and Losses and the total is Comprehensive Income. Items can be added to the total or subtracted from the total. All Roll Ups follow this pattern. Roll Ups can be nested within other Roll Ups to form subtotals that ultimately aggregate into a grand total. Every Roll Up is explained by machine-readable rules represented in the form of either XBRL calculation relations²⁰ or XBRL Formulas²¹ that articulate the mathematical relation in machine-readable form.

Roll Forward

A second very common mathematical oriented pattern of relations between numeric concepts is the Roll Forward which reconciles changes between the values of a line item for two points in time. Accounting students learn this fundamental relation by the acronym BASE which means **B**eginning balance + **A**dditions - **S**ubtractions = **E**nding balance. A Roll Forward is exemplified by the Changes in Equity structure:

Changes in Equity [Line Items]	Period [Axis]
	2020-01-01 - 2020-12-31
Changes in Equity [Roll Forward]	
Equity, Beginning Balance	0
Comprehensive Income	3,000
Investments by Owners	1,000
(Distributions to Owners)	(500)
Equity, Ending Balance	3,500

Every Roll Forward can be represented in machine-readable form using XBRL Formulas.

²⁰ Comprehensive Income XBRL calculation rules for Roll Up, <http://xbrlsite.azurewebsites.net/2020/core/master-proof/proof-cal.xml>

²¹ Comprehensive Income XBRL Formula rules for Roll Up, <http://xbrlsite.azurewebsites.net/2020/core/master-proof/Rule-Arithmetic-IS01-formula.xml>

Arithmetic Expression

All other mathematical relations can be represented by the Arithmetic Expression concept arrangement pattern. This mathematical pattern can simply think of as containing two parts. The first part is a set of facts. The second set of the pattern is the mathematical relations between the set of facts represented as some XBRL Formula. The Arithmetic Expression concept arrangement pattern can be exemplified by the Balance Sheet structure:

Balance Sheet [Line Items]	Period [Axis]	
	2020-12-31	2019-12-31
Balance Sheet [Arithmetic Expression]		
Assets	3,500	0
Liabilities	0	0
Equity	3,500	0

As with the Roll Forward and Roll Up, the Arithmetic Expression machine-readable rules can be represented using XBRL Formula.

Adjustment (i.e. Correcting an Error or Change in Accounting Policy)

Financial statements can be adjusted for accounting changes and/or prior period errors that are discovered and must be corrected in future reports. Generally, all such changes are run through equity in order to adjust a current financial report for a prior period change in accounting policy and/or a correction of an error.

The concept arrangement pattern created for this purpose is called an “Adjustment” and the pattern is described as a reconciliation of an originally stated balance to a restated balance by adding or subtracting specific adjustments to the originally stated balance to the restated balance. You see that example here in the Prior Period Error structure:

Prior Period Errors [Line Items]	Report Date [Axis]	Period [Axis]
		2019-12-31
Prior Period Errors [Adjustment]		
Equity, Originally Stated	Prior Report [Member]	2,000
Changes in Accounting Policy	Current Report [Member]	(1,500)
Correction of an Error	Current Report [Member]	(500)
	Equity, Restated	0

What can be tricky to understand about this representation is that the above restated balance is the exact same fact as the beginning balance of equity in the changes in equity fact set:

Changes in Equity [Line Items]	Period [Axis]
	2020-01-01 - 2020-12-31
Changes in Equity [Roll Forward]	
Equity, Beginning Balance	0
Comprehensive Income	3,000
Investments by Owners	1,000
(Distributions to Owners)	(500)
Equity, Ending Balance	3,500

Note that in the *Prior Period Errors* structure has the dimension “Report Date [Axis]” and that the *Changes in Equity* structure does not have that dimension. And so, you might ask the question, “How can a fact exist only once but have a dimension in one structure and not have that dimension in a different structure?”

The answer to that question is the XBRL notion of a “dimension-default”. The “Current Report [Member]” is established as the dimension-default within the Prior Period Error structure:

#	Label	Report Element Class	Period Type	Balance	Name
1	Prior Period Errors [Hypercube]	[Table]			proof:PriorPeriodErrorsHypercube
2	Report Date [Axis]	[Axis]			proof:ReportDateAxis
3	Current Report [Member]	[Member]			proof:CurrentReportMember
4	Prior Report [Member]	[Member]			proof:PriorReportMember
5	Prior Period Errors [Line Items]	[Line Items]			proof:PriorPeriodErrorsLineItems
6	Prior Period Errors [Adjustment]	[Abstract]			proof:PriorPeriodErrorsAdjustment
7	Equity, Originally Stated	[Concept] Monetary	As Of	Credit	proof:Equity
8	Changes in Accounting Policy	[Concept] Monetary	As Of	Credit	proof:ChangesInAccountingPolicy
9	Correction of an Error	[Concept] Monetary	As Of	Credit	proof:CorrectionOfAnError
10	Equity, Restated	[Concept] Monetary	As Of	Credit	proof:Equity

A detailed discussion about the “dimension-default” is beyond the scope of this document. If you are familiar with the notion of a dimension-default, you can see this represented in the XBRL definition relations of the Proof XBRL taxonomy schema and its related XBRL linkbases.

-	Order	Arcrole
Definition View		
01-Balance Sheet		
02-Comprehensive Income		
03-Changes in Equity		
04-Prior Period Errors		
Prior Period Errors [Line Items]	0	
Equity	67	http://xbrl.org/int/dim/arcrole/domain-member
Changes in Accounting Policy	68	http://xbrl.org/int/dim/arcrole/domain-member
Correction of an Error	69	http://xbrl.org/int/dim/arcrole/domain-member
Prior Period Errors [Hypercube]	70	http://xbrl.org/int/dim/arcrole/all
Report Date [Axis]	71	http://xbrl.org/int/dim/arcrole/hypercube-dimension
Current Report [Member]	72	http://xbrl.org/int/dim/arcrole/dimension-domain
Prior Report [Member]	74	http://xbrl.org/int/dim/arcrole/domain-member
Current Report [Member]	73	http://xbrl.org/int/dim/arcrole/dimension-default

Finally, an XBRL formula is added to verify that the Adjustment concept arrangement pattern is operating correctly per the logic expected from the XBRL Formula processor.

Adjustment_Reconciles_EquityPriorPeriodAdjustments (evaluation 1)	satisfied	\$Restated=0 = (\$OriginallyStated=2000 + \$CorrectionOfError=-1500 + \$MandatoryAccountingChange=-500)
---	-----------	---

Variance (i.e. Actual to Budget Comparison)

Financial statements can include an “Actual” to “Budget” comparison with the difference between actual and budget represented by a “Variance”. This can be achieved within an XBRL-based report using the Variance concept arrangement pattern.

A Variance concept arrangement pattern is described as a representation of one or more line items which are differentiated by using a “Scenario [Axis]” dimension. Actual and budget reporting scenarios can be achieved using an Actual [Member], a Budgeted [Member], and a Variance [Member] and is exemplified below:

Variance Analysis [Line Items]	Period [Axis]		
	2020-01-01 - 2020-12-31		
	Scenario [Axis]		
	Budgeted [Member]	Variance [Member]	Actual [Member]
Variance Analysis [Roll Up]			
Revenues	6,000	1,000	7,000
(Expenses)	(2,000)	(1,000)	(3,000)
Gains	750	250	1,000
(Losses)	(1,000)	(1,000)	(2,000)
Comprehensive Income	3,750	(750)	3,000

Again, note that similar to the Prior Period Error representation; the “Actual [Member]” values in the Variance Analysis structure directly tie to the Comprehensive Income structure:

Comprehensive Income Statement [Line Items]	Period [Axis]
	2020-01-01 - 2020-12-31
Comprehensive Income [Roll Up]	
Revenues	7,000
(Expenses)	(3,000)
Gains	1,000
(Losses)	(2,000)
Comprehensive Income	3,000

Once again, the connection between the Variance Analysis structure and the Comprehensive Income structure is achieved by representing the Actual [Member] as the dimension-default.

#	Label	Report Element Class	Period Type	Balance	Name
1	Variance Analysis [Hypercube]	[Table]			proof:VarianceAnalysisHypercube
2	Scenario [Axis]	[Axis]			proof:ScenarioAxis
3	Actual [Member]	[Member]			proof:ActualMember
4	Budgeted [Member]	[Member]			proof:BudgetedMember
5	Variance [Member]	[Member]			proof:VarianceMember
6	Variance Analysis [Line Items]	[Line Items]			proof:VarianceAnalysisLineItems
7	<i>Variance Analysis [Roll Up]</i>	[Abstract]			proof:VarianceAnalysisRollUp
8	Revenues	[Concept] Monetary	For Period	Credit	proof:Revenues
9	(Expenses)	[Concept] Monetary	For Period	Debit	proof:Expenses
10	Gains	[Concept] Monetary	For Period	Credit	proof:Gains
11	(Losses)	[Concept] Monetary	For Period	Debit	proof:Losses
12	Comprehensive Income	[Concept] Monetary	For Period	Credit	proof:ComprehensiveIncome

Again, this can be seen in the XBRL definition relations.

Finally, the mathematical computation to verify the relationship between actual, budgeted, and variance values are represented using XBRL Formula and are consistent:

VARIANCE_Revenues (evaluation 1)	satisfied	$\$Actual=7000 = (\$Budget=6000 + \$Variance=1000)$
VARIANCE_Expenses (evaluation 1)	satisfied	$\$Actual=3000 = (\$Budget=2000 + \$Variance=1000)$
VARIANCE_Gains (evaluation 1)	satisfied	$\$Actual=1000 = (\$Budget=750 + \$Variance=250)$
VARIANCE_Losses (evaluation 1)	satisfied	$\$Actual=2000 = (\$Budget=1000 + \$Variance=1000)$
VARIANCE_ComprehensiveIncome (evaluation 1)	satisfied	$\$Actual=3000 = (\$Budget=3750 + \$Variance=-750)$

Roll Forward Info

Financial statements can include what at first glance appears to be a Roll Forward but is actually a different concept arrangement pattern referred to as a Roll Forward Info. A Roll Forward Info has a “beginning” and “ending” balance similar to a Roll Forward, but unlike a Roll Forward, there is no mathematical computation. The Roll Forward Info is exemplified by the Stock Activity Plan structure:

Weighted Average Grant Date Fair Value [Line Items]	Period [Axis]
	2020-01-01 - 2020-12-31
Weighted Average Grant Date Fair Value [Roll Forward Info]	
Nonvested Fair Value, Beginning Balance	32.72
Granted	41.51
Vested	30.92
Forfeited	35.93
Nonvested Fair Value, Ending Balance	36.92

While a Roll Forward Info is commonly represented in human-readable presentations with the single underline and double underline similar to a Roll Forward; the Roll Forward Info does not actually foot. Rather, a Roll Forward Info tends to always be provided with a Roll Forward which it explains in additional detail. Finally, the Roll Forward Info while necessary does not

logically connect or mathematically connect to any other reported facts within the financial report.

Set (a.k.a. Hierarchy)

A Set concept arrangement pattern is simply some set of numeric or nonnumeric or a combination of numeric and nonnumeric concepts that have no mathematical relations between the concepts. A Set is exemplified by the Financial Highlights structure:

Financial Highlights [Line Items]	Period [Axis]
	2020-01-01 - 2020-12-31
Financial Highlights [Set]	
Revenues	7,000
Comprehensive Income	3,000
Distributions to Owners	500

Again, while the structure shown above provides three numeric facts described by numeric concepts; there are no mathematical relations between these facts within the context of this structure. As such, there are no mathematical rules needed to explain this structure. Further, this structure does not tie mathematically to any other structure in the report. Rather, each fact ties individually to some structure.

Text Blocks

A financial report can contain words that do not connect mathematically to other facts represented within a financial report. At times the words are more than simply text, rather they contain structures within the words. For example, the words could include a table, an ordered list, an unordered list, or other sorts of prose. This information is represented within a financial report using the Text Block concept arrangement pattern.

While only one is necessary, three Text Blocks have been created and are exemplified using the Policies structure:

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Public Domain Dedication**

CC0 1.0 Universal (CC0 1.0) Public Domain Dedication <https://creativecommons.org/publicdomain/zero/1.0/>

Policies [Line Items]	Period [Axis]																			
	2020-01-01 - 2020-12-31																			
Basis of Reporting [Text Block]	<p>Duis fermentum. Nullam dui orci, scelerisque porttitor, volutpat a, porttitor a, enim. Sed lobortis. Maecenas scelerisque ullamcorper libero. Aliquam porta leo imperdiet pede. In semper, elit vel elementum auctor, lectus purus rhoncus arcu, lacinia sollicitudin justo odio et nunc. Phasellus sagittis fringilla risus. Curabitur iaculis sagittis orci. Ut malesuada libero nec nulla molestie vestibulum. Suspendisse lectus massa, ullamcorper at, tincidunt eget, bibendum vel, risus. Curabitur imperdiet. Suspendisse accumsan, arcu vel ornare interdum, magna tellus porta mauris, in porta mi lacus sodales felis. Pellentesque dapibus, leo non sollicitudin consequat, lectus orci fringilla felis, non interdum leo libero sed augue. Sed magna. Maecenas ante ipsum, congue ut, sodales a, pulvinar ut, dui. Suspendisse mauris massa, sollicitudin et, hendrerit eget, placerat id, orci. Donec molestie magna.</p> <p>Sed mauris. Nulla facilisi. Fusce tristique posuere ipsum. Nulla facilisi. Aliquam viverra risus vitae ante. Sed rhoncus mi in wisi. Nullam nibh dui, molestie vitae, imperdiet non, ornare at, elit. Aenean nec justo. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Duis sodales.</p>																			
Nature of Operations [Text Block]	<p>Sed justo: Nibh, placerat</p> <table border="1"> <thead> <tr> <th></th> <th>20XX</th> <th>20XX</th> </tr> </thead> <tbody> <tr> <td>Sed dapibus dui quis lectus; Donec id sem. Integer sit amet 2% diam ac nibh consequat vestibulum; Sed eget augue malesuada quam adipiscing mattis</td> <td>XX,XXX</td> <td>XX,XXX</td> </tr> <tr> <td>Sed lobortis, Maecenas scelerisque ullamcorper libero, Aliquam porta \$880 leo imperdiet pede</td> <td>XX,XXX</td> <td>-</td> </tr> <tr> <td>Nunc congue. Fusce venenatis. Maecenas tincidunt, ipsum in fringilla hendrerit, dolor metus eleifend neque, vel tincidunt mi nunc a purus</td> <td>-</td> <td>XX,XXX</td> </tr> <tr> <td>Fusce venenatis. Maecenas tincidunt, ipsum in fringilla \$1,200 hendrerit, dolor metus eleifend neque, vel tincidunt mi nunc a purus</td> <td>XX,XXX</td> <td>XX,XXX</td> </tr> <tr> <td>Pellentesque</td> <td>XXX,XXX</td> <td>XXX,XXX</td> </tr> </tbody> </table>			20XX	20XX	Sed dapibus dui quis lectus; Donec id sem. Integer sit amet 2% diam ac nibh consequat vestibulum; Sed eget augue malesuada quam adipiscing mattis	XX,XXX	XX,XXX	Sed lobortis, Maecenas scelerisque ullamcorper libero, Aliquam porta \$880 leo imperdiet pede	XX,XXX	-	Nunc congue. Fusce venenatis. Maecenas tincidunt, ipsum in fringilla hendrerit, dolor metus eleifend neque, vel tincidunt mi nunc a purus	-	XX,XXX	Fusce venenatis. Maecenas tincidunt, ipsum in fringilla \$1,200 hendrerit, dolor metus eleifend neque, vel tincidunt mi nunc a purus	XX,XXX	XX,XXX	Pellentesque	XXX,XXX	XXX,XXX
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Pellentesque	XXX,XXX	XXX,XXX																		
Revenue Recognition Policy [Text Block]	<p>Nature of business</p> <p>Sed mauris. Nulla facilisi. Fusce tristique posuere ipsum. Nulla facilisi. Aliquam viverra risus vitae ante. Sed rhoncus mi in wisi. Nullam nibh dui, molestie vitae, imperdiet non, ornare at, elit.</p> <ul style="list-style-type: none"> Suspendisse accumsan, arcu vel ornare interdum, magna tellus porta mauris, in porta mi lacus sodales felis. Phasellus eleifend, diam vitae dapibus pulvinar, erat ligula auctor dui, eget congue justo lorem hendrerit tellus. Fusce gravida, ligula a placerat placerat, leo erat euismod lectus, et lacinia justo libero non pede. <p>Fusce gravida, ligula a placerat placerat, leo erat euismod lectus, et lacinia justo libero non pede. Vivamus ac velit vel magna nonummy pretium.</p> <ol style="list-style-type: none"> Etiam ut augue Aliquam erat volutpat 																			

Member Aggregation

Finally, not really a concept arrangement pattern itself; (a) the [Member]s of a dimension can be related to one another mathematically and (b) any other concept arrangement pattern might be supplemented with a Member Arrangement Pattern. This is exemplified by the Segment Revenues structure shown below

Segment Revenues [Line Items]	Period [Axis]			
	2020-01-01 - 2020-12-31			
	Segments [Axis]			
	Segment Alpha [Member]	Segment Bravo [Member]	Segment Charlie [Member]	All Segments [Member]
Segment Revenues [Set]				
Revenues	1,000	2,000	4,000	7,000

What you see above is a Member Aggregation of the segment revenues. This Member Aggregation is 100% consistent with the logic of a Roll Up concept arrangement pattern. The Segment Revenues [Set] contains exactly one concept “Revenues” for which four Facts are provided; one each for segments Alpha, Bravo, and Charlie and in addition the total of all segments. The mathematical relation is represented using an XBRL Formula.

Note that the Revenues of “All Segments” ties to the structure Comprehensive Income and to the structure Variance Analysis as well.

Pixel Perfect Renderings

While all of the information in the XBRL-based financial report for this example can be understood by humans reading auto-generated renderings of each disclosure there are many times when such an auto-generated rendering is not desirable.

With just a bit of additional work, more information can be provided to a software application which would enable that software application to generate a “pixel perfect rendering”. For example, here is the auto-generated rendering of the variance from budget disclosure²²:

Variance Analysis [Line Items]	Period [Axis]		
	2020-01-01 - 2020-12-31		
	Scenario [Axis]		
	Budgeted [Member]	Variance [Member]	Actual [Member]
Variance Analysis [Roll Up]			
Revenues	6,000	1,000	7,000
(Expenses)	(2,000)	(1,000)	(3,000)
Gains	750	250	1,000
(Losses)	(1,000)	(1,000)	(2,000)
Comprehensive Income	3,750	(750)	3,000

It should be pretty easy to imagine that the above rendering could be changed such that the rendering below could be automatically generated as HTML or Inline HTML as is shown below²³:

²² Variance from budget auto-generated rendering, http://xbrlsite.azurewebsites.net/2020/master/proof-common-render/evidence-package/contents/index.html#Rendering-VarianceAnalysis-proof_VarianceAnalysisHypercube.html

²³ Inline XBRL pixel perfect rendering, <http://xbrlsite.azurewebsites.net/2020/master/proof-common-render/instance-RENDERED.html>

Variance from Budget

ABC Company, Inc.

(in US Dollars) As of December 31, 2020	Budgeted	Variance	Actual
VARIANCE FROM BUDGET			
Revenues	\$6,000	\$1,000	\$7,000
Expenses	(2,000)	(1,000)	(3,000)
Gains	750	250	1,000
Losses	(1,000)	(1,000)	(2,000)
Comprehensive income	\$3,750	\$(750)	\$3,000

Alternatively, rather than generating HTML or Inline XBRL, a PDF rendering could be generated which might look something like below²⁴:

Variance from Budget

ABC Company, Inc.

(US Dollars) As of December 31, 2020	Budgeted	Variance	Actual
VARIANCE FROM BUDGET			
Revenue	\$6,000	\$1,000	\$7,000
Expenses	-2,000	-1,000	-3,000
Gains	750	250	1,000
Losses	-1,000	-1,000	-2,000
Comprehensive income	\$3,750	-\$750	\$3,000

The above PDF rendering was generated by first generating XSL-FO²⁵ and then running that XSL-FO through a freely available open source XSL-FO processor or FOP²⁶.

Further, while the above renderings are clearly easy to read, others might desire some alternative formatting choices. This is not a problem to the extent that XHTML 4.0 and CSS 3.0 support such renderings. However, XHTML 4.0 and CSS 3.0 do not support page sequencing or page flow.

As such, it becomes more complicated to represent such functionality. However, other rendering alternatives exist and can be employed. To some extent, renderings can be auto-generated with no need to add additional rendering information. But regardless, other alternatives exist for creating pixel perfect renderings including:

²⁴ PDF pixel perfect rendering, <http://xbrlsite.azurewebsites.net/2020/master/proof-common-render/instance.pdf>

²⁵ XSL-FO used to generate PDF rendering, <http://xbrlsite.azurewebsites.net/2020/master/proof-common-render/instance.fo.xml>

²⁶ Apache.org, FOP, <https://xmlgraphics.apache.org/fop/>

- XSL-FO²⁷
- DocBook²⁸
- OpenDocument²⁹
- DITA³⁰
- Quark³¹

Another alternative is to have some sort of format that can be used to generate any of the formats above or any other desired rendering format.

Applying Same Ideas to Microsoft 2017 10-K

It may seem inconceivable that all XBRL-based financial reports can be explained by approximately 10 concept arrangement patterns. But, when you think about it, a larger report is comprised of numerous structures that are of the same fundamental patterns. For example, consider a 10-K of a public company that reports to the SEC. Well, I analyzed the Microsoft 10-K for 2017³². That Microsoft 2017 10-K has precisely 194 structures³³. This is a breakdown of those structures by concept arrangement pattern and by SEC reporting level:

By Concept Arrangement Patterns:	By SEC Reporting Level:																						
<table border="1"> <thead> <tr> <th>Concept Arrangement Pattern</th> <th>Count</th> </tr> </thead> <tbody> <tr> <td>Text Block</td> <td>89</td> </tr> <tr> <td>Set</td> <td>64</td> </tr> <tr> <td>Roll Up</td> <td>31</td> </tr> <tr> <td>Roll Forward</td> <td>9</td> </tr> <tr> <td>Roll Forward Info</td> <td>1</td> </tr> </tbody> </table>	Concept Arrangement Pattern	Count	Text Block	89	Set	64	Roll Up	31	Roll Forward	9	Roll Forward Info	1	<table border="1"> <thead> <tr> <th>SEC Level</th> <th>Count</th> </tr> </thead> <tbody> <tr> <td>Level 4 Disclosure Detail</td> <td>102</td> </tr> <tr> <td>Level 3 Disclosure Text Block</td> <td>47</td> </tr> <tr> <td>Level 2 Policy Text Block</td> <td>23</td> </tr> <tr> <td>Level 1 Note Text Block</td> <td>22</td> </tr> </tbody> </table>	SEC Level	Count	Level 4 Disclosure Detail	102	Level 3 Disclosure Text Block	47	Level 2 Policy Text Block	23	Level 1 Note Text Block	22
Concept Arrangement Pattern	Count																						
Text Block	89																						
Set	64																						
Roll Up	31																						
Roll Forward	9																						
Roll Forward Info	1																						
SEC Level	Count																						
Level 4 Disclosure Detail	102																						
Level 3 Disclosure Text Block	47																						
Level 2 Policy Text Block	23																						
Level 1 Note Text Block	22																						
Total: 194	Total: 194																						

²⁷ Wikipedia, XSL-FO, https://en.wikipedia.org/wiki/XSL_Formatting_Objects

²⁸ DocBook, <https://docbook.org/whatis>

²⁹ Wikipedia, OpenDocument, <https://en.wikipedia.org/wiki/OpenDocument>

³⁰ Wikipedia, DITA, https://en.wikipedia.org/wiki/Darwin_Information_Typing_Architecture

³¹ Quark, <http://www.quark.com/>

³² Microsoft XBRL-based Report Analysis, <http://xbrl.squarespace.com/journal/2020/4/13/microsoft-xbrl-based-report-analysis.html>

³³ Microsoft 10-K for 2017, http://xbrl.azurewebsites.net/2017/Prototypes/Microsoft2017/evidence-package/#Rendering-DocumentsAndEntityInformation-us_gaap_StatementTable.html

What all this shows is how rules are used to specify permissible manipulations of a logical system and how rules, terms, structures, and associations all work together to represent a financial report logical system. Those same rules that specify the appropriate associations can be used for extracting information from a report also.

Similar to the summary provided in the Disclosure Mechanics section of this document, a summary of Microsoft's disclosures can likewise be created. XBRL Cloud can generate a report using the XBRL-based machine-readable information. That report analyzes approximately 68 disclosures of any public company. Here is that report for the Microsoft 2017 10-K³⁴ which is viewable online in any browser.

I took that base of 68 rules, deleted rules that were not applicable to Microsoft, added disclosure mechanics rules for each disclosure that had no rule provided, and was able to test 94.8% of the entire Microsoft 10-K. You can see those results which were generated using a working proof of concept which we call Pesseract³⁵:

³⁴ XBRL Cloud Reporting Checklist and Disclosure Mechanics validation results,
<http://xbrlsite.azurewebsites.net/2017/Prototypes/Microsoft2017/Disclosure%20Mechanics%20and%20Reporting%20Checklist.html>

³⁵ Pesseract Disclosure Mechanics validation results,
http://xbrlsite.azurewebsites.net/2020/Prototype/Microsoft/Microsoft2017_Discovery.jpg

Further, I did not create mathematical rules for the complete Microsoft 10-K, but clearly, I could. Here are validation results for all tested mathematical computations³⁶. Microsoft is consistent with the fundamental accounting concept relations continuity cross checks³⁷.

Applying Same Ideas to Other Entities

Similar to Microsoft, I applied these same ideas to Apple, Amazon, Salesforce, Facebook, and Google/Alphabet³⁸. Each works exactly the same way as can be observed by having a look at the analysis.

Conclusion

A **system** is defined as “a cohesive conglomeration of interrelated and interdependent parts that is either natural or man-made.” A **pattern** is defined as “any form of correlation between the states of elements within a system.”

If you look at an XBRL-based financial report through the lens of system theory³⁹ you can distill such reports down to their essence. This exercise helps you understand that essence.

For more information, I would invite you to take a look at the *Essence of Accounting*⁴⁰ which provides additional information.

³⁶ XBRL Cloud Evidence Package, Business Rules Summary, <http://xbrl.azurewebsites.net/2017/Prototypes/Microsoft2017/evidence-package/BusinessRulesSummary.html>

³⁷ XBRL Cloud Evidence Package, Fundamental Accounting Concept Relations, <http://xbrl.azurewebsites.net/2017/Prototypes/Microsoft2017/evidence-package/USFACRenderingSummary.html>

³⁸ Software Companies Prototype, <http://xbrl.squarespace.com/journal/2020/4/2/software-companies-prototype.html>

³⁹ Systems Theory: Method to my Madness, <http://xbrl.squarespace.com/journal/2019/12/29/systems-theory-method-to-my-madness.html>

⁴⁰ Charles Hoffman, CPA, *Essence of Accounting*, <http://xbrl.azurewebsites.net/2020/Library/EssenceOfAccounting.pdf>