1. Blocks

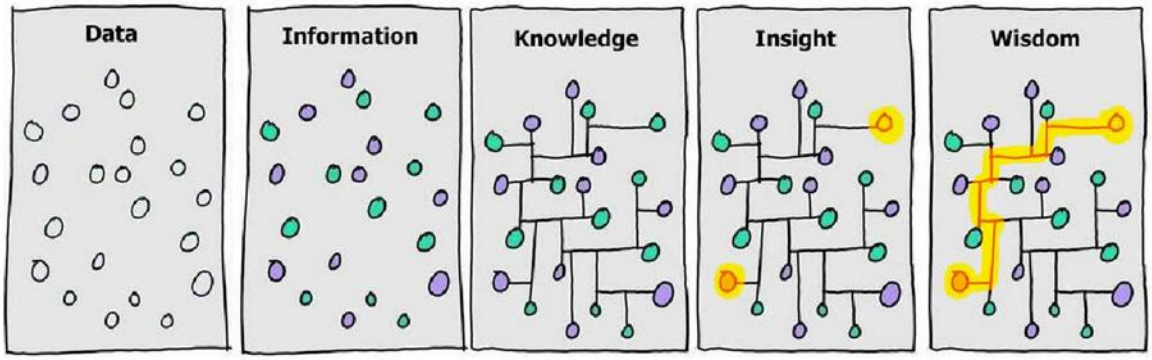
The purpose of this section is to explain the notion of the block (a.k.a. information block).

The term **block**[1] was used to describe a specific type of fragment in XBRL-based digital financial reports. The terms Block and Fact Set as I use them are synonyms. This chapter explains what a Block (or Fact Set, I will use the term Block for the rest of the document) is and how that notion can be leveraged when working with an XBRL-based digital financial report.

Networks and hypercubes were discussed in the document Structures[2]. Networks and hypercubes are technical artifacts as contrast to logical artifacts.

1.1. Difference Between Data and Information

Data and information are not the same thing. To understand the difference, it helps to understand two things. First is the DIKW[3] pyramid or spectrum:



Data is raw and unprocessed and tends to be understandable only in one, usually local, context. **Information** is data that has been processed, classified, organized, and put into context, therefore understandable globally by anyone. **Knowledge** is refined and actionable information that has been further processed, organized, and/or structured in some way making the information super-useful and therefore valuable. **Insight** and **wisdom** are even more valuable and come from applying knowledge to some specific situation such as making a decision.

The point here is that data and information are not the same thing. Information is data that is self-aware. You can take information out of one application and put that information into another application and the information has all the pieces necessary to be understandable by that second application. There are other issues related to semantics that using standard semantics solves.

Second is the data product pyramid[4]. The data product pyramid helps you to also understand the differences between data and information. A **data product** is generally

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

[2] Structures, http://www.xbrlsite.com/mastering/Part02_Chapter05.E_Structures.pdf

[3] Wikipedia, *DIKW pyramid*, https://en.wikipedia.org/wiki/DIKW_pyramid

[4] Dataception, *Data Product Pyramid*, https://www.dataception.com/Data-Product-Pyramid.html

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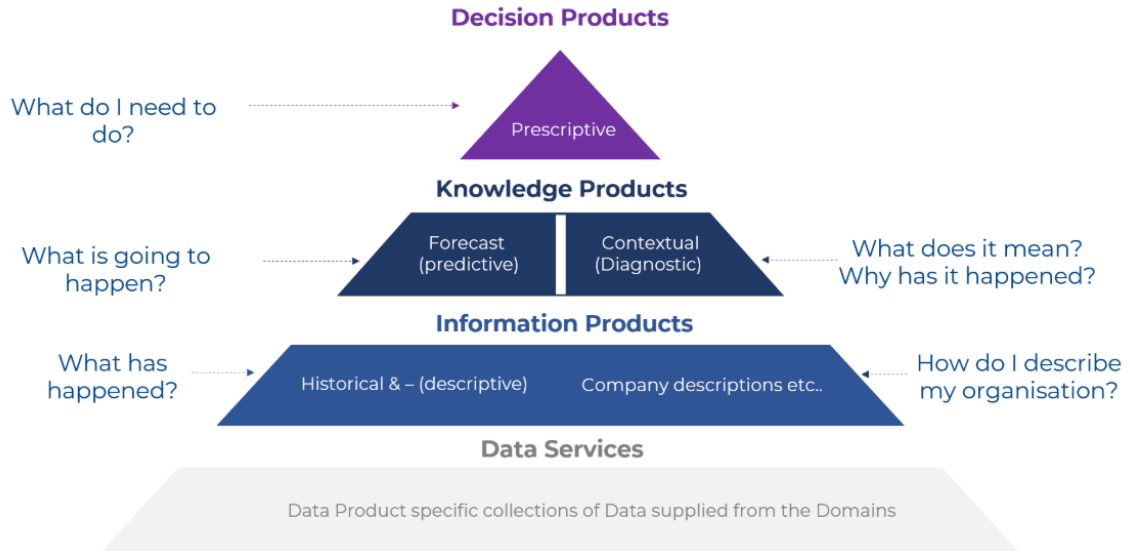
a reusable raw and unprocessed data asset, engineered to deliver a trusted dataset to a user for a specific purpose. It integrates data from relevant source systems, processes the data, ensures that it is compliant, and makes the data accessible to those with the right credentials. The focus of a data product is raw, unprocessed data which can be numbers, text, or some sort of measurement. Examples of a data product are stock market data, website traffic lots, social media posts. The data might be delivered in the form of a CSV file, spreadsheets, an API, an XML file, RDF, JSON.



Again, information is data that is self-aware. An **information product** tends to provide processed information to the information product's user. Information products are often used to monetize knowledge. Information products are organized and interpreted data which provides context and meaning. Information is generally provided in a way that the information can be consumed such as reports, dashboards of information, articles, and in the future very likely machine-readable knowledge graphs of high-quality information. Information products help their users do things like understand trends, patterns, relationships within the information. An example of an information product might be the analysis of stock market data for a specific company or companies within a specific industry. A financial report of a company can be considered an information product.

A **knowledge product** is refined and actionable information that has been processed, organized, and/or structured in some way or put into practice in some way making the information super-useful. The information is ready to use. The knowledge is derived from expertise, research, lessons learned. Knowledge products allow the user of the knowledge product to make informed decisions or better decisions. Knowledge products provide insights, best practices, good practices, expertise which was derived from information, skills and experience. Knowledge products tend to answer "why" and "how" types of questions. Knowledge products can be delivered in a wide variety of forms such as training material, templates, guides, checklists, tutorials, artificial intelligence models, spreadsheet models. In the future knowledge products will, I believe, include machine-readable knowledge graphs that, preferably, use a global standard format and are proven to be of high quality per a logical schema.

A **decision product** is a model, algorithm, or some sort of decision-making tool that either provide actionable recommendations or execute some action or actions based

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on a decision or decisions made from a set of information or knowledge. For example, a recommendation engine in an investment management platform might automatically purchase a specific stock when a user of that platform when a user of the platform clicks "yes" to a specific suggestion.

1.2. Information Model

And so, we are interested in processing information, not data. Yes, it is true that information is constructed from data; but that is a lower-level task that a user need not be involved with. A software platform can take care of those details without the involvement of the user.

Realize that there are two perspectives of information[5]: software deals with information but humans also need to deal with information.

The right articulation of that information can be both machine-interpretable and also interpretable by humans at the same time.

1.3. Understandability vs Interpretability

Machines and humans interact with information in different ways. Being able to distinguish between the two effectively will help you understand artificial intelligence capabilities more precisely[6].

Machines interpret information according to predefined rules. Those rules are defined by things like schemas, ontologies, theories, and rules that have been represented in some sort of machine-readable form. Machines interpret, they don't actually understand what they are doing.

Humans understand information based on context, skills, experience, research, observation, and reasoning. Humans actually know the meaning of something. Humans may even comprehend something which is to understand something completely. Humans bring meaning to their ability to understand beyond information that is actually provided in the form of intuition and common knowledge that machines simply don't have. Humans can understand implications, "deeper meaning" from context, experience, skills, and knowledge that goes beyond the actual information itself.

1.4. Information "Nuggets"

The Data Foundation paper, *Implementing the FDTA*[7], makes mention of the "infon" which is defined as a discrete, identifiable piece of meaningful information. They go on to describe the infon as a "nugget" of information. The term "infon" is defined by Situation Theory[8].

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[5] Understandability, https://digitalfinancialreporting.blogspot.com/2024/04/understandability.html

[6] Understandability vs Interpretability, https://digitalfinancialreporting.blogspot.com/2025/02/understanding-vs-interpretation.html

[7] Data Foundation, *Implementing the FDTA*, https://static1.squarespace.com/static/56534df0e4b0c2babdb6644d/t/65099fc452736817404c52e0/1695129542125/2023-Implementing-FDTA_DRAFT7.pdf

[8] ScienceDirect, *Situation Theory*, https://www.sciencedirect.com/topics/mathematics/situation-theory

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What that paper refers to as an "infon" and sometimes refers to as a "nugget" of information is the similar logical artifact which I refer to as the "Block" or a block of information.

1.5. Block

A Block, a.k.a. Information Block, is a unit of information that follows a logical pattern which the information fits into. A Block is an assembly of report elements, facts, associations, and rules. Those Block artifacts are bonded together by the logic of the logical pattern of information. That Block make up a portion of a report model and the facts which make up that portion of the full report.

A Block is a logical artifact, a logical abstraction, that makes working with a report easier.

1.6. Basic Example of a Block

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

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

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

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

1.7. Slightly more Complex Block

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

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

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

To accountants the notions I am explaining are commonsense. But imagine articulating all the things that are going on unconsciously in the mind of a professional accountant to a machine such as a computer in a manner that is explicitly understandable to the computer. Computers need to be lead through all this; computers are like infants that don't understand any of these details.

1.8. Pathological Representations of Information

An excellent way to understand blocks is to look at bad or pathological representations of structures and compare them with good structures.

What you see below is four logical information blocks that have been represented as one physical structure within an XBRL-based report[9]:

[9] Pathological structure, http://xbrlsite.azurewebsites.net/2020/introduction/pathological/evidence-package/

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Structure [Line Items]	Period [Axis] 2020-01-01 - 2020-12-31
Revenues	7,000
(Expenses)	(3,000)
Gains	1,000
(Losses)	(2,000)
Comprehensive Income	3,000
Net Cash Flow Operating Activities	1,500
Net Cash Flow Investing Activities	1,000
Net Cash Flow Financing Activities	1,000
Net Cash Flow	3,500
Assets, Beginning Balance	0
Net Cash Flow	3,500
Assets, Ending Balance	3,500
Revenues	7,000
Comprehensive Income	3,000
Distributions to Owners	500

The best way to understand why the pathological representation is not elegant, let's look at a minor improvement to that pathological example which separates the information block better, making them easier to distinguish from each other[10]:

Reporting Entity [Axis]	GH259400TOMPUOLS65II http:/
	Period [Axis]
Implied [Line Items]	2020-01-01/2020-12-31
Block 1 [Abstract]	
Revenues	7,000
(Expenses)	(3,000)
Gains	1,000
(Losses)	(2,000)
Comprehensive Income	3,000
Block 2 [Abstract]	
Net Cash Flow Operating Activities	1,500
Net Cash Flow Investing Activities	1,000
Net Cash Flow Financing Activities	1,000
Net Cash Flow	3,500
Block 3 [Abstract]	
Assets, Beginning Balance	0
Net Cash Flow	3,500
Assets, Ending Balance	3,500
Block 4 [Abstract]	
Revenues	7,000
Comprehensive Income	3,000
Distributions to Owners	500

[10] Improved pathological representation, http://xbrlsite.azurewebsites.net/2020/introduction/patho-better/evidence-package/

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While the above is a bit easier to read and understand because of the addition of four [Abstract] report elements which are used to separate the four structures; however, there is still room for improvement.

An even better representation of exactly the same blocks of information makes the information much clearer to get your head around[11]:

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

Cash Flow Statement [Abstract]	Period [Axis] 2020-01-01 - 2020-12-31
Cash Flow Statement [Abstract]	
Net Cash Flow [Roll Up]	
Net Cash Flow Operating Activities	1,500
Net Cash Flow Investing Activities	1,000
Net Cash Flow Financing Activities	1,000
Net Cash Flow	3,500
Assets [Roll Forward]	
Assets, Beginning Balance	0
Net Cash Flow	3,500
Assets, Ending Balance	3,500

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

Notice how the four structures (i.e. income statement which is a roll up, net cash flow roll up and assets roll forward which makes up the cash flow statement, and the unrelated set of facts which make up the financial highlights set) are significantly more understandable.

While it is true that all three versions of this same example convey exactly the same meaning and all drive the same Inline XBRL representation (see next page); it is

[11] Best pathological representation, http://xbrlsite.azurewebsites.net/2020/introduction/patho-best/evidence-package/

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likewise true that all things considered the third representation that you see above is more explicit and tends to be easier to understand. Here is the same information represented using Inline XBRL[12]:

Statement of Comprehensive Income

ABC Company, Inc.

(See accompanying notes to the financial statements.)

(in US Dollars)	For period ended December 31, 2020
Comprehensive income:	
Revenue	$7,000
Expenses	(3,000)
Gains	1,000
Losses	(2,000)
Comprehensive income	$3,000

Cash Flow Statement

ABC Company, Inc.

(See accompanying notes to the financial statements.)

(in US Dollars)	For period ended December 31, 2020
Net cash flow:	
Net cash flow from operating activities	$1,500
Net cash flow from investing activities	1,000
Net cash flow from financing activities	1,000
Net cash flow	3,500
Assets, beginning balance	0
Assets,ending balance	$3,500

Financial Highlights

ABC Company, Inc.

(in US Dollars)	For period ended December 31, 2020
Financial highlights:	
Revenues	$7,000
Comprehensive income	3,000
Distributions to owners	500

[12] Inline XBRL of pathological representation, http://xbrlsite.azurewebsites.net/2020/introduction/pathological/instance-RENDERED.html

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Notice how the third representation is the most consistent with the Inline XBRL representation and note how a better model tends to yield a better automated rendering of information without the need for taking the time to create the Inline XBRL.

1.9. Types of Blocks

The following is a list of commonly occurring Block patterns.

1.9.1. Text Block[13]

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

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

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

There are three categories of Text Blocks: Level 1 Note Text Block, Level 2 Policy Text Block, and Level 3 Disclosure Text Block. All Text Blocks are similar in that they contain prose, essentially formatted text[14].

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

1.9.2. Set (a.k.a. Hierarchy)[15]

The Hierarchy[16] or Set is simply some set of one to many concepts, other than Text Blocks, that conveys information that goes together for some reason or other.

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

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

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

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

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

1.9.3.Roll Up[17]

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

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

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

1.9.4.Roll Up, Nested[18]

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

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

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

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

1.9.5.Roll Forward[19]

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

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

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

1.9.6.Member Aggregation[20]

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

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

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

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

1.9.7.Roll Up + Member Aggregation[21]

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

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

1.9.8.Roll Forward + Member Aggregation[22]

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

Component: (Network and Table)									
Network	100800 - Disclosure - Carrying Amount of Goodwill (Detail)								
Table	Schedule of Goodwill [Table]								
Reporting Entity [Axis]	0000789019 http://www.sec.gov/CIK				Legal Entity [Axis]	Entity [Domain]			
	Period [Axis]	Statement Business Segmen...							
	2016-07-01/2017-06-30				2015-07-01/2016-06-30				
Goodwill [Line Items]	Productivity and Business Processes	Intelligent Cloud	More Personal Computing	Segments [Domain]	Productivity and Business Processes	Intelligent Cloud	More Personal Computing	Segments [Domain]	
Beginning Balance	6,678,000,000	5,467,000,000	5,727,000,000	17,872,000,000	6,309,000,000	4,917,000,000	5,713,000,000	16,939,000,000	
Acquisitions	17,072,000,000 [1]	49,000,000	115,000,000	17,236,000,000	443,000,000	549,000,000	100,000,000	1,092,000,000	
Other	(11,000,000)	39,000,000	(14,000,000)	14,000,000	(74,000,000)	1,000,000	(86,000,000)	(159,000,000)	
Ending Balance	23,739,000,000	5,555,000,000	5,828,000,000	35,122,000,000	6,678,000,000	5,467,000,000	5,727,000,000	17,872,000,000	

1.9.9.Adjustment[23]*(a.k.a. Restatement)*

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

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

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

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

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Reporting Entity [Axis]	0000000001 http://www.sec.gov/CIK	
Legal Entity [Axis]	Consolidated Entity [Domain]	
Period [Axis]	2015-12-31	
		Drop Column Fields Here
Changes in Stockholders' Equity [Line Items]	Report Date [Axis]	Fact Value
Increase (Decrease) in Stockholders' Equity [Adjustment]		
Stockholders' equity, origionally stated	Origionally Stated Report Date [Member]	30,000,000
Correction of a prior period error	Restated Report Date [Domain]	12,000,000
Effect of mandatory change in accounting policy for adoption of FAS XXX	Restated Report Date [Domain]	(2,000,000)
Stockholders' equity, restated	Restated Report Date [Domain]	40,000,000

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

1.9.10. Variance[24]

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

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

1.9.11. Set + Members but Without Aggregation[25]

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

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

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

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

1.9.12. Roll Forward Info[26]

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

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

1.9.13. Other Block Patterns

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

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

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

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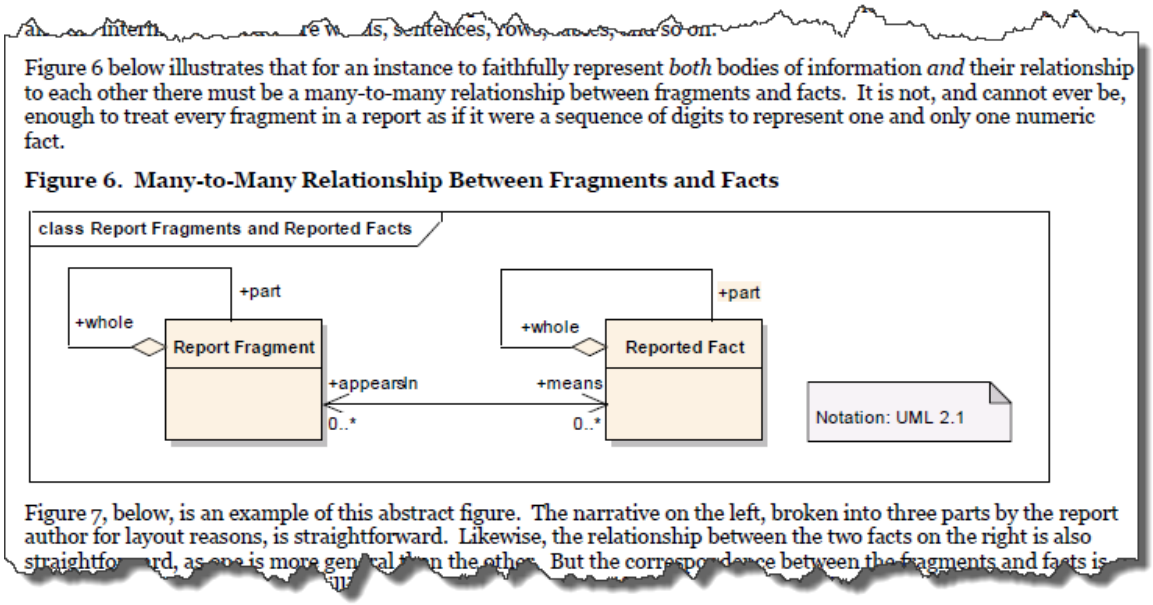
1.10. Decomposing a Financial Report

A full financial **report** is made up of **fragments**, or report fragments as the *US GAAP Financial Reporting Taxonomy Architecture* calls them[27]. The *US GAAP Financial Reporting Taxonomy Architecture* goes on to explain the notion of a **schedule**. The architecture document says, "A 'Schedule' appears as a set of concepts within a relationship group and the root concept of a schedule is a text block.[28]" And then the architecture discusses **facts** and relations between fragments and facts even providing a UML diagram to explain the relationship[29].



So, the descriptions of these terms and the relations between the terms is not necessarily clear as provided by the *US GAAP Financial Reporting Taxonomy Architecture*; however, the architecture is trying to articulate the pieces of a financial report, what those pieces do, and how the pieces interact with one another.

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 Term**

[27] FASB, *US GAAP Financial Reporting Taxonomy Architecture Version 2014*, page 4, https://www.fasb.org/cs/ContentServer?c=Document_C&cid=1176163689810&d=&pagename=FASB%2FDocument_C%2FDocumentPage

[28] FASB, *US GAAP Financial Reporting Taxonomy Architecture Version 2014*, page 15, Section 3.2.2 Schedules, https://www.fasb.org/cs/ContentServer?c=Document_C&cid=1176163689810&d=&pagename=FASB%2FDocument_C%2FDocumentPage

[29] FASB, *US GAAP Financial Reporting Taxonomy Architecture Version 2014*, page 13, Figure 6, https://www.fasb.org/Page/ShowPdf?path=US-GAAP-Taxonomies-Architecture-FINAL-2014-01-31.pdf&title=2014%20US%20GAAP%20Financial%20Reporting%20Taxonomy%20Architecture

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A **report** is information published by a reporting entity at some point in time for some purpose.	Report	Financial Report
A **fragment** is a set of one to many blocks which go together for some specific purpose within a report.	Fragment	Report Fragment
A **block** (a.k.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.	Block (a.k.a. Fact Set)	Schedule
A **fact** is reported. 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
A **disclosure** is a set of one to many logical blocks of information.	Disclosure	*<no such artifact>*
A **bundle** (a.k.a. component) is a set of two or more disclosures or a complex disclosure. For example, an "Assets [Roll Up]" disclosure and a "Liabilities and Equity [Roll Up] disclosure form a bundle which makes up a Balance Sheet disclosure.	Bundle, a.k.a. Component	*<no such artifact>*

All the terms correlate pretty well with the possible exception of "block" and "schedule". The way the US GAAP Financial Reporting Taxonomy Architecture uses the term schedule is not as clear as it needs to be. While I did not provide the complete logical model of a financial repot above, understanding that complete model is helpful. You can find the *Logical Theory Describing a Business Report*[30].

1.11. Things you May Not Realize about Representing Information using XBRL

This section gets a little bit technical because I have to explain a few things about how XBRL is employed to represent information. If you want to understand this section, please read through the basic *XBRL Technical Primer*[31].

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

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

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

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those Tables. Alternatively, you might not explicitly define a Table within a Network. And so if you do not explicitly provide a Table and put any report elements within a Network; essentially what you are doing is creating a single implied table that contains each report element that is not represented within a Table within a Network.

And so, Networks and Tables (explicitly defined or implied) are used to represent the information model description of a report.

Sometimes you MUST separate things using Networks to avoid conflicts; other times you get too choose whether to separate things using Networks. Tables work the same way; sometimes you MUST use a Table to separate blocks and other times you get to choose whether you want to (a) use an existing Table or (b) create a new Table to represent some piece of a report.

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

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

States #3 and #4 are incorrect by definition. Information that is defined illogically is simply wrong.

State #2 is not incorrect, but neither is it a best practice. State #1 is the only best practice, information that is logically represented and as easy to read as possible. A **best practice** is a method or technique that has been generally accepted as superior to any other known alternatives because it produces results that are superior to those results achieved by other means or because it has become a standard way of doing something.

And so, let's have another look at the report rendering that I showed earlier where property, plant, and equipment components roll up and the inventory components roll up are combined into one report fragment:

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Reporting Entity [Axis]	SAMP http://www.SampleCompany.com	
Legal Entity [Axis]	Consolidated Entity [Member]	
Unit [Axis]	USD	
	Period [Axis]	
Assets, by Component [Line Items]	2020-12-31	2019-12-31
Land	5,347,000	1,147,000
Buildings, Net	244,508,000	366,375,000
Furniture and Fixtures, Net	34,457,000	34,457,000
Computer Equipment, Net	4,169,000	5,313,000
Other Property, Plant and Equipment, Net	6,702,000	6,149,000
Property, Plant and Equipment, Net, Total	295,183,000	413,441,000
Finished Goods	7,000	7,000
Work in Progress	9,000	9,000
Raw Materials	2,000	2,000
Inventory, Total	18,000	18,000

Now, look at this almost identical representation of the same information and note the slight difference. In the report above, a root presentation relation which is an [Abstract] concept that holds all of the other concepts from the property, plant, and equipment [Roll up] and distinguishes those concepts from the inventory [Roll Up].

Reporting Entity [Axis]	SAMP http://www.SampleCompany.com	
Legal Entity [Axis]	Consolidated Entity [Member]	
Unit [Axis]	USD	
	Period [Axis]	
Assets, by Component [Line Items]	2020-12-31	2019-12-31
Property, Plant and Equipment [Roll Up]		
Land	5,347,000	1,147,000
Buildings, Net	244,508,000	366,375,000
Furniture and Fixtures, Net	34,457,000	34,457,000
Computer Equipment, Net	4,169,000	5,313,000
Other Property, Plant and Equipment, Net	6,702,000	6,149,000
Property, Plant and Equipment, Net, Total	295,183,000	413,441,000
Inventory [Roll Up]		
Finished Goods	7,000	7,000
Work in Progress	9,000	9,000
Raw Materials	2,000	2,000
Inventory, Total	18,000	18,000

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So, is the first rendering at the top of the page without those two [Abstract] concepts wrong and the second rendering at the bottom right? No, that is not what I am saying. Both the top and the bottom representations are logically correct. But at the same time, I point out that if the second representation is easier to read than the first, then the second is a better practice that the first.

You might think that this discussion is silly and that as long as the representation is logical, you can represent XBRL-based information however you want. And yes, it is true that you can do that, represent information however you want as long as the information is not illogical.

However, if you are a software engineer that is constructing software that helps business professionals do things right or to automatically follow best practices or to not let software users to things wrong; this is incredibly helpful information.

Further, have a look at this fragment from an XBRL-based financial report of a public company submitted to the SEC:

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Commitments (Details) (USD $) In Millions, unless otherwise specified	12 Months Ended		
	Oct. 31, 2012	Oct. 31, 2011	Oct. 31, 2010
Commitments			
Rent expense	$ 1,012	$ 1,042	$ 1,062
Sublease rental income	37	38	46
Property under capital lease	882	577	
Accumulated depreciation on property under capital lease	453	454	
Minimum lease payments, sublease rental income			
Minimum lease payments, 2013	780		
Minimum lease payments, 2014	665		
Minimum lease payments, 2015	517		
Minimum lease payments, 2016	351		
Minimum lease payments, 2017	218		
Minimum lease payments, thereafter	805		
Minimum lease payments, total	3,336		
Less: Sublease rental income, 2013	(28)		
Less: Sublease rental income, 2014	(23)		
Less: Sublease rental income, 2015	(18)		
Less: Sublease rental income, 2016	(9)		
Less: Sublease rental income, 2017	(4)		
Less: Sublease rental income, thereafter	(12)		
Sublease rental income, total	(94)		
Minimum lease payments net of sublease rental income, 2013	752		
Minimum lease payments net of sublease rental income, 2014	642		
Minimum lease payments net of sublease rental income, 2015	499		
Minimum lease payments net of sublease rental income, 2016	342		
Minimum lease payments net of sublease rental income, 2017	214		
Minimum lease payments net of sublease rental income, thereafter	793		
Minimum lease payments net of sublease rental income, total	3,242		
Capital lease commitments			
Capital lease commitments, 2013	59		
Capital lease commitments, 2014	240		
Capital lease commitments, 2015	11		
Capital lease commitments, 2016	7		
Capital lease commitments, 2017	4		
Capital lease commitments, thereafter	33		
Capital lease commitments, total	354		
Less: Interest payments, 2013	(8)		
Less: Interest payments, 2014	(6)		
Less: Interest payments, 2015	(3)		
Less: Interest payments, 2016	(2)		
Less: Interest payments, 2017	(2)		
Less Interest payments, thereafter	(12)		
Interest payments, total	(33)		

That representation you see above is from an actual XBRL-based report created by a public company to the U.S. Securities and Exchange Commission. While logically, the information is 100% correct, the rendering of the information is hideous and downright ugly.

I have provided you with one simple, basic use of blocks. This basic explanation is useful in that it helps you get a true sense of what a block really is. But it is only a basic example; there are many other uses for the notion of blocks.

So, one use of blocks is to avoid hideous, ugly, and unreadable information representations such as these two examples:

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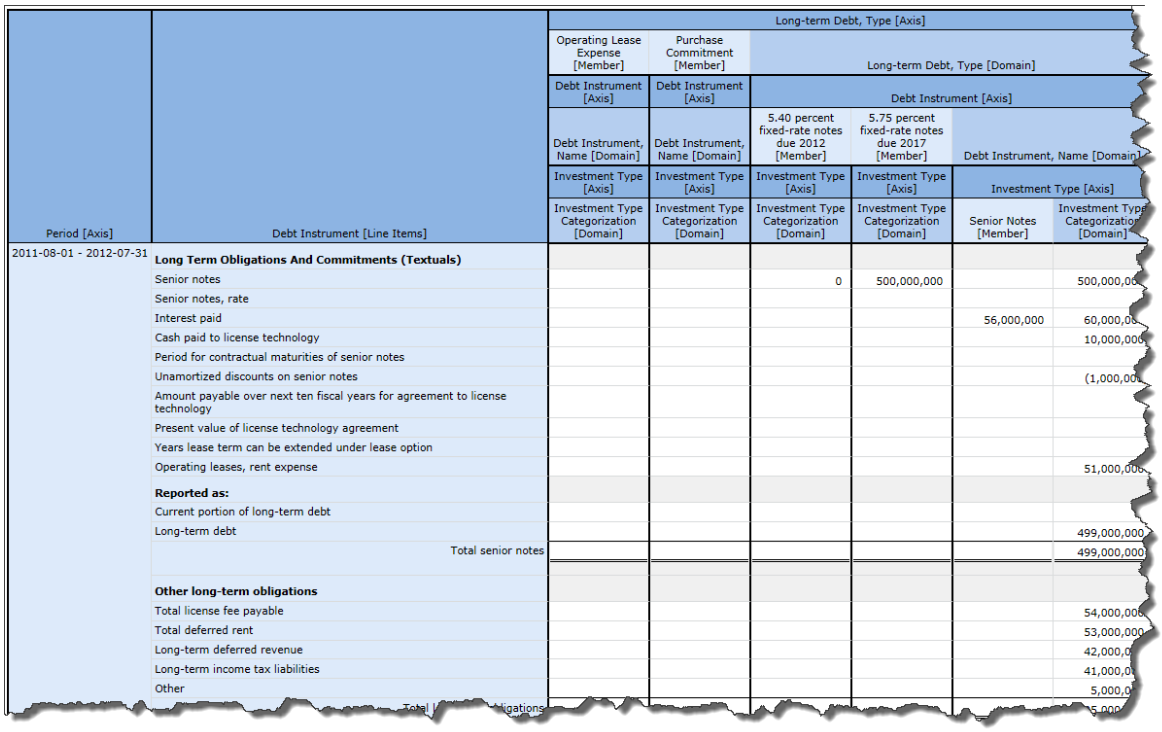
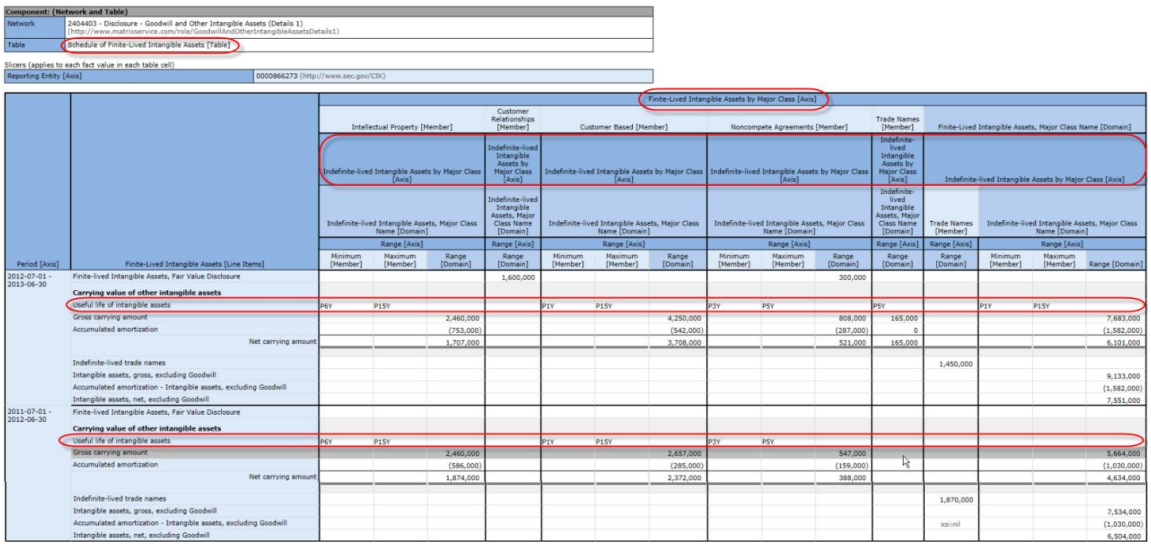


Period [Axis]	Debt Instrument [Line Items]	Long-term Debt, Type [Axis]: Operating Lease Expense [Member] / Debt Instrument [Axis] / Debt Instrument, Name [Domain] / Investment Type [Axis] / Investment Type Categorization [Domain]	Long-term Debt, Type [Axis]: Purchase Commitment [Member] / Debt Instrument [Axis] / Debt Instrument, Name [Domain] / Investment Type [Axis] / Investment Type Categorization [Domain]	Long-term Debt, Type [Domain]: Debt Instrument [Axis]: 5.40 percent fixed-rate notes due 2012 [Member] / Investment Type [Axis] / Investment Type Categorization [Domain]	Long-term Debt, Type [Domain]: Debt Instrument [Axis]: 5.75 percent fixed-rate notes due 2017 [Member] / Investment Type [Axis] / Investment Type Categorization [Domain]	Long-term Debt, Type [Domain]: Debt Instrument [Axis]: Debt Instrument, Name [Domain] / Investment Type [Axis]: Senior Notes [Member]	Long-term Debt, Type [Domain]: Debt Instrument [Axis]: Debt Instrument, Name [Domain] / Investment Type [Axis]: Investment Type Categorization [Domain]
2011-08-01 - 2012-07-31	**Long Term Obligations And Commitments (Textuals)**						
	Senior notes			0	500,000,000		500,000,00
	Senior notes, rate						
	Interest paid					56,000,000	60,000,00
	Cash paid to license technology						10,000,00
	Period for contractual maturities of senior notes						
	Unamortized discounts on senior notes						(1,000,00
	Amount payable over next ten fiscal years for agreement to license technology						
	Present value of license technology agreement						
	Years lease term can be extended under lease option						
	Operating leases, rent expense						51,000,00
	Reported as:						
	Current portion of long-term debt						
	Long-term debt						499,000,000
	Total senior notes						499,000,000
	Other long-term obligations						
	Total license fee payable						54,000,00
	Total deferred rent						53,000,00
	Long-term deferred revenue						42,000,0
	Long-term income tax liabilities						41,000,0
	Other						5,000,0
	Total [illegible] obligations						5,000



Component: (Network and Table)

Network	2404403 - Disclosure - Goodwill and Other Intangible Assets (Details 1) (http://www.matrixservice.com/role/GoodwillAndOtherIntangibleAssetsDetails1)
Table	Schedule of Finite-Lived Intangible Assets [Table]

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

Reporting Entity [Axis]	0000866273 (http://www.sec.gov/CIK)

Period [Axis]	Finite-Lived Intangible Assets [Line Items]	Finite-Lived Intangible Assets by Major Class [Axis]: Intellectual Property [Member] / Indefinite-lived Intangible Assets by Major Class [Axis] / Indefinite-Lived Intangible Assets, Major Class Name [Domain] / Range [Axis]: Minimum [Member]	Maximum [Member]	Range [Domain]	Customer Relationships [Member] / Indefinite-lived Intangible Assets by Major Class [Axis] / Indefinite-Lived Intangible Assets, Major Class Name [Domain] / Range [Axis]: Range [Domain]	Customer Based [Member] / Indefinite-lived Intangible Assets by Major Class [Axis] / Indefinite-Lived Intangible Assets, Major Class Name [Domain] / Range [Axis]: Minimum [Member]	Maximum [Member]	Range [Domain]	Noncompete Agreements [Member] / Indefinite-lived Intangible Assets by Major Class [Axis] / Indefinite-Lived Intangible Assets, Major Class Name [Domain] / Range [Axis]: Minimum [Member]	Maximum [Member]	Range [Domain]	Trade Names [Member] / Indefinite-lived Intangible Assets by Major Class [Axis] / Indefinite-Lived Intangible Assets, Major Class Name [Domain] / Range [Axis]: Range [Domain]	Finite-Lived Intangible Assets, Major Class Name [Domain]: Trade Names [Member] / Range [Axis]: Range [Domain]	Indefinite-lived Intangible Assets by Major Class [Axis] / Indefinite-Lived Intangible Assets, Major Class Name [Domain] / Range [Axis]: Minimum [Member]	Maximum [Member]	Range [Domain]
2012-07-01 - 2013-06-30	Finite-lived Intangible Assets, Fair Value Disclosure				1,600,000							300,000							
	Carrying value of other intangible assets																		
	Useful life of intangible assets	P6Y	P15Y			P1Y	P15Y		P3Y	P5Y		P5Y				P1Y	P15Y		
	Gross carrying amount			2,460,000				4,250,000			808,000	165,000						7,683,000	
	Accumulated amortization			(753,000)				(542,000)			(287,000)	0						(1,582,000)	
	Net carrying amount			1,707,000				3,708,000			521,000	165,000						6,101,000	
	Indefinite-lived trade names													1,450,000					
	Intangible assets, gross, excluding Goodwill																	9,133,000	
	Accumulated amortization - Intangible assets, excluding Goodwill																	(1,582,000)	
	Intangible assets, net, excluding Goodwill																	7,551,000	
2011-07-01 - 2012-06-30	Finite-lived Intangible Assets, Fair Value Disclosure																		
	Carrying value of other intangible assets																		
	Useful life of intangible assets	P6Y	P15Y			P1Y	P15Y		P3Y	P5Y									
	Gross carrying amount			2,460,000				2,657,000			547,000							5,664,000	
	Accumulated amortization			(586,000)				(285,000)			(159,000)							(1,030,000)	
	Net carrying amount			1,874,000				2,372,000			388,000							4,634,000	
	Indefinite-lived trade names													1,870,000					
	Intangible assets, gross, excluding Goodwill																	7,534,000	
	Accumulated amortization - Intangible assets, excluding Goodwill													xsi:nil				(1,030,000)	
	Intangible assets, net, excluding Goodwill																	6,504,000	

There are two strong arguments for not creating ugly, hideous renderings. First, for every one bad example of a rendering, there are 50 or 100 or good examples. The good examples are best practices, the bad examples are not. Second, if you can help software engineers the problems you are having representing information using XBRL and making it right; the software engineers can help you be more successful.

1.12. Better Understanding the Utility of a Block and a Slot

It is pretty clear that a financial report is made up of lots of smaller pieces and those pieces interact with one another in specific ways. If you give those pieces names, you can use the pieces to perform useful work.

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A **block** (a.k.a. fact set) is a part of a fragment that participates in the same *concept arrangement pattern*[32]. By definition, all the concepts participate in the same Member Arrangement Pattern of a component (Network + Table) simply because they exist in the same Table. A roll up, roll forward, adjustment, and set (hierarchy) are all types of concept arrangement patterns. Every XBRL-based public company financial report is essentially a set of blocks. I estimate that there are about 754,430 blocks in the set of approximately 6,000 public company reports that I analyzed. 16% are roll ups, 5% are roll forwards, 24% are sets (hierarchies), and 54% are text blocks[33]. I know this because I measured the reports that I analyzed to figure out that blocks exist.

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

Blocks have something called a "slot"[34]. A **slot** is simply the idea of an allotted place where something can be logically and sensibly placed in a block. For example, a roll up has exactly *one* total and so *a second total* could never logically be added to a roll up.

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

2. Understanding Block Semantics

Irreducible complexity[35] is explained as follows: a single system which is composed of several interacting parts that contribute to the basic function, and where the removal of any one of the parts causes the system to effectively cease functioning.

So, for example, consider a simple mechanism such as a mousetrap. That mousetrap is composed of several different parts each of which is essential to the proper functioning of the mousetrap: a flat wooden base, a spring, a horizontal bar, a catch bar, the catch, and staples that hold the parts to the wooden base. If you have all the parts and the parts are assembled together properly, the mousetrap works as it was designed to work.

But say you remove one of the parts of the mousetrap. The mousetrap will no longer function as it was designed; it simply will not work. That is irreducible complexity: the complexity of the design requires that it can't be reduced any farther without losing functionality.

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

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

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

[35] Understanding the Law of Conservation of Complexity, http://xbrl.squarespace.com/journal/2015/5/24/understanding-the-law-of-conservation-of-complexity.html

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Similarly, an XBRL-based digital financial report has irreducible complexity, certain pieces that if missing cause errors, problems using the information, and other quality issues. Errors and quality issues in financial reports causes the entire report to be considered untrustworthy.

2.1. Understanding Blocks

A Block[36] is a unit of a report that was created in order to make interacting with and otherwise working with a report easier. Individual facts are many times too small working sets to be useful. Networks tend to be too large to work with. A Block is a useful unit of a report that makes doing certain things significantly easier and other things which were simply impossible; possible.

Essentially, a Block is a fragment of a report that has the same *concept arrangement pattern*[37]. For example, there is a simple basic Block[38]:

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

The Block above has the concept arrangement pattern "roll up". I will explain more of the traits of a Block as we go along. Blocks are very consistent structures and makes working with an XBRL-based report at a logical level possible as contrast to working at the XBRL technical syntax level. Blocks make many, many things possible.

Blocks are driven by the information represented by a Disclosure itself, not by how someone might choose to present that Disclosure information. For example, if you look at a set of 339[39] Disclosures of the components of property, plant, and equipment there are similarities between each of those Disclosures.

A Block is a part of a Component whose line items all participates in the same *concept arrangement pattern*[40]. A roll up, roll forward, adjustment, and hierarchy are all types of concept arrangement patterns. Every XBRL-based public company financial report is essentially a set of Blocks. I estimate that there are about 754,430 blocks in the set

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[36] Charles Hoffman and Hamed Mousavi, *Putting the Expertise into an XBRL-based Knowledge Based System for Creating Financial Reports*, http://pesseract.azurewebsites.net/PuttingTheExpertiseIntoKnowledgeBasedSystem.pdf

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

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

[39] Disclosure Best Practices, Property, plant and equipment components, http://xbrlsite-app.azurewebsites.net/DisclosureBestPractices/DisclosureBestPractices.aspx?DisclosureName=PropertyPlantAndEquipmentNetByTypeRollUp

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

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of 5,734 public company reports that I analyzed. Of that total, 16% are roll ups, 5% are roll forwards, 24% are hierarchies, and 54% are text blocks[41].

2.2. Blocks and Extensibility

XBRL has a predictable shape. What you put into that predictable shape is up to you. However, what you represent using that predictable shape must be logical by some definition. But how do you define what is logical per your definition of logical? How do you explain to creators of XBRL-based reports what is allowed and what is not allowed via an extension XBRL taxonomy so that reports based on that extension and its base XBRL taxonomy are logical?

Here is a simple case to help you understand the issue. The accounting equation establishes that "Assets = Liabilities and Equity"[42]. That rule is nowhere to be found in either the US GAAP XBRL Taxonomy. Per my last measurement, there were 53 economic entities out of about 5,734 where their reported assets did not equal liabilities and equity. Per investigation, all 53 inconsistences with the accounting equation were verified to be errors in the XBRL-based report of the economic entity.

As was pointed out in the document *Leveraging XBRL Extensibility Effectively*[43], when XBRL's extensibility feature is employed, the flexibility introduced in terms of extensibility means responsibility to control that extensibility using rules. Rules prevent anarchy[44]. The judicious use of rules is necessary to control the structure, mechanics, mathematical relations, logical relations, and general consistency of the information provided within a report.

Blocks help you control mechanisms that assure that extensibility is used how the extensibility is intended to be used. Things like the US GAAP and IFRS XBRL Taxonomy architecture guidelines provide some guidance as does the Edger Filer Manual or the European Single Electronic Format. But, while this guidance is necessary, it is not sufficient. Proof that the guidance is not sufficient is the clearly identifiable filer errors in the XBRL-based reports of public companies[45] financial reports. Again, rules prevent anarchy. But exactly what rules?

2.3. Complex Structures are Really Groups of Simple Structures

Consider the set of three Blocks below which make up an income statement[46]:

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

[42] Wikipedia, *Accounting Equation*, https://en.wikipedia.org/wiki/Accounting_equation

[43] *Leveraging XBRL Extensibility Effectively*, http://xbrlsite.azurewebsites.net/2018/Library/LeveragingXBRLExtensibilityEffectively.pdf

[44] *Comprehensive Introduction to Business Rules*, http://xbrlsite.azurewebsites.net/2017/IntelligentDigitalFinancialReporting/Part01_Chapter02.4_ComprehensiveIntroductionToBusinessRules.pdf

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

[46] Microsoft, Income statement, http://www.xbrlsite.com/2017/Prototypes/Microsoft/evidence-package/#Rendering-StatementINCOMESTATEMENTS-us_gaap_StatementTable.html

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Statement [Line Items]	Period [Axis]		
	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

There are three Blocks. The first Block is a roll up of "Net income". The second Block is a hierarchy (or set) that represents a summary of earnings per share. The third Block is a hierarchy (or set) that represents a summary of weighted average shares outstanding.

Could have this information been presented in different manners? Sure. Could this information been represented in a different manner? Could the meaning of the information have been different simply based on the preferences of the creator of the representation? Certainly not.

Blocks are about the objective representation of information, not about subjective and perhaps even arbitrary presentation choices which are consciously or sometimes even unconsciously made by accountants. Blocks are about structural rules, mechanical rules, mathematical rules, logical rules, and certain accounting rules that are all objective and not open for debate. That leaves the judgement to the professional accountants, hiding the technical details that they do not care about and should not have to concern themselves with to the software application to deal with.

If these ideas are discussed with a professional accountant, care needs to be taken to be sure that you are having the right discussion. The typical professional account will make the statement that everything within a financial report is subject to professional judgement which is simply not true. Professional accountants get no latitude as to whether a roll up should roll up, if a roll forward should roll forward or if a balance sheet balances. This logic is universal and to which all domains, even the domain of accounting, must subscribe. If explained to professional accountants correctly, the vast majority will concur with these ideas. Proof of this is that the vast majority of information reported within an XBRL-based report subscribes to these ideas.

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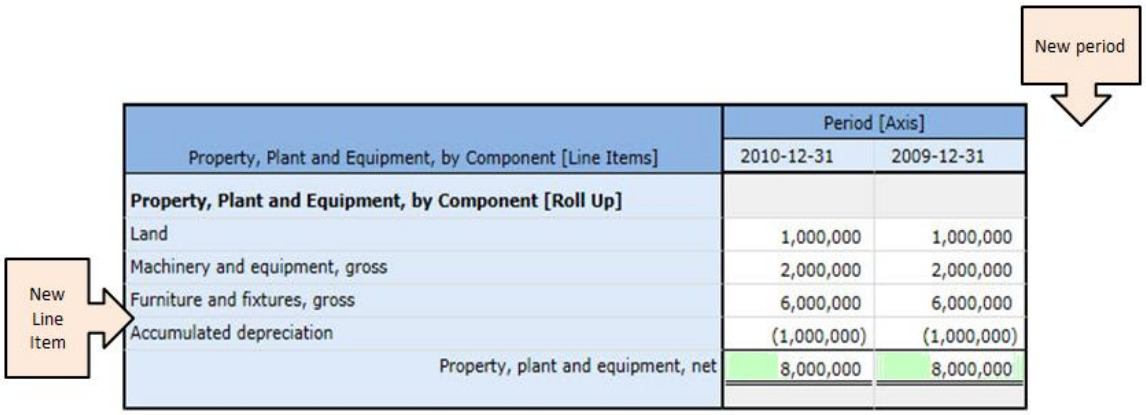
2.4. Blocks have Slots

Blocks have "slots". A Slot is simply a place in a Block where it makes logical sense for new objects to be added to the Block. Different types of Blocks have different slots. Below you can see one Block, showing two Slots for that Block. One Slot is that a new Line Item can be added within the roll up total. Or, a second Slot is that a new period can be added to the Block.



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

This is not a comprehensive discussion of Slots, it only provides the general ideas of what a Slot is, and that a financial report can be broken down into a set of Blocks each of which has specific Slots.

2.5. Disclosures

A disclosure is simply some set of information that is disclosed within a report. A disclosure is made up of one or many Blocks.

For example, a balance sheet is made up of two blocks:

1. A roll up of "Assets"
2. A roll up of "Liabilities and Equity"

Similarly, every other disclosure can be explained using that idea that disclosures are made up of sets of Blocks. The document *Disclosure Best Practices*[47] provides detailed information related to about 65 disclosures.

Note that an important idea here is that each Disclosure is given a name[48]. Providing names allows for specific disclosures to be referred to, things to be connected to disclosures, and other such benefits.

[47] Disclosure Best Practices, http://www.xbrlsite.com/site1/2017/Prototypes/DisclosureAnalysis/DisclosureBestPractices.pdf

[48] Understanding the Power of Naming Disclosures, http://xbrl.squarespace.com/journal/2018/11/26/understanding-the-power-of-naming-disclosures.html

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3. Recognizing and Identifying Blocks

An XBRL-based report, such as a financial report, is composed of many fragments which make up the structure of the report. Each structural piece, or fragment, category has pros and cons depending on the nature of the structural piece.

The lowest level category of report fragment is the **Fact**. Facts provide individual pieces of information. As explained by the multidimensional model of an XBRL-based report[49], one Fact is differentiated from another Fact by the Characteristics of the Fact. Individual Facts is generally the most detailed level of interaction with the information that makes up a report.

The highest level category of a report fragment is the **Network**. Networks provide individual fragments of the technical structure of a report. The Network tends to be a technical oriented structure that are quite large and that have some business meaning but generally not enough precision in terms of meaning to be useful. Further, Networks often offer information in terms of the personal preference of how someone tends to want to organize information which could be well organize or poorly organized.

The second-highest level category of a report fragment is the **Hypercube** or often times called the [Table] in US GAAP or IFRS based financial reports. The Hypercube tends to be correlated to the Network on a one-to-one basis in the vast majority of US GAAP and IFRS based financial reports because each Network tends to contain only one explicitly defined Hypercube or one implied Hypercube (i.e. while no Hypercube is defined, all Concepts in the Network are grouped into one dynamically defined implied Hypercube). And so, the utility of the Hypercube tends to be comparable to the utility of the Network.

If there is more than one Hypercube in a Network, then that report fragment can be identified by combining the Network plus each Hypercube into what I refer to as a **Component**. But again, Components tend to have the same utility as a Network.

Enter the notion of what I call the **Block**. The Block is a fragment of a report that was created in order to make it possible to enable software applications to interact with the fragments of an XBRL-based report at a level that enables software engineers to create functionality that is useful to the professional accountants interacting with such reports.

This document explains what Blocks are and why they are so useful in solving two significant problems when working with an XBRL-based report: (2) working at a logical as contrast to a technical level and (2) identifying the fragment that you are working with.

3.1. Networks are Not Logical Artifacts

Why are Networks necessary? There are exactly two answers to that question: (1) because you WANT to represent a report fragment in separate Networks or (2) because you HAVE to represent a report fragment in a different Network.

So the "WANT to" is easy to understand. For example, you choose to put two fragments of information into two different Networks. Why would you do that?

[49] *Introduction to the Multidimensional Model for Professional Accountants*, http://xbrl.squarespace.com/journal/2016/3/18/introduction-to-the-multidimensional-model-for-professional.html

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Because you can. Not much of a discussion is necessary here, this is simply a matter of preference. But what about the "HAVE to". Why would you have to construct two different report fragments within different Networks? The answer is conflicts.

Say, for example, that you wanted to represent the three computations[50] below within an XBRL-based report:

	2010	2009
TRADE AND OTHER RECEIVABLES		
Trade and Other Receivables, Net, by Component		
Trade Receivables, Net	8,790	6,431
Financing Lease Receivables, Net	2,498	1,263
Other Receivables, Net	1,305	1,096
Trade and Other Receivables, Net	12,593	8,790
Trade and Other Receivables, Net, by Net/Gross		
Trade and Other Receivables, Gross	18,280	13,472
Allowance for Doubtfull Accounts	-5,687	-4,682
Trade and Other Receivables, Net	12,593	8,790
Trade and Other Receivables, Net, by Current/Noncurrent		
Trade Receivables, Net, Current	6,340	5,701
Trade Receivables, Net, Noncurrent	6,253	3,089
Trade and Other Receivables, Net	12,593	8,790

To do that, you would need to use three different Networks. Why? Because there are three different sets of roll up computations and if you represented all three roll ups within one Network the three sets of computations would conflict with one another. And so, to avoid conflicts such as this (i.e. there are other types of conflicts) you use Networks.

The point here is to highlight the difference between a preference where you could do something and a requirement where you must do something. It is important to be able to distinguish between what is a preference and something that is required.

Next, the following might not be familiar to you. What you see is a list of the Blocks within a straight forward XBRL document[51]:

[50] Business Use Case: Multiple Rollups, http://xbrlsite.azurewebsites.net/DigitalFinancialReporting/BusinessUseCases/2017-05-07/BUC06-MultipleRollUps/Index.html

[51] You can grab the ZIP archive with the XBRL instance and XBRL taxonomy here, http://xbrlsite.azurewebsites.net/2018/Pesseract/Basic.zip

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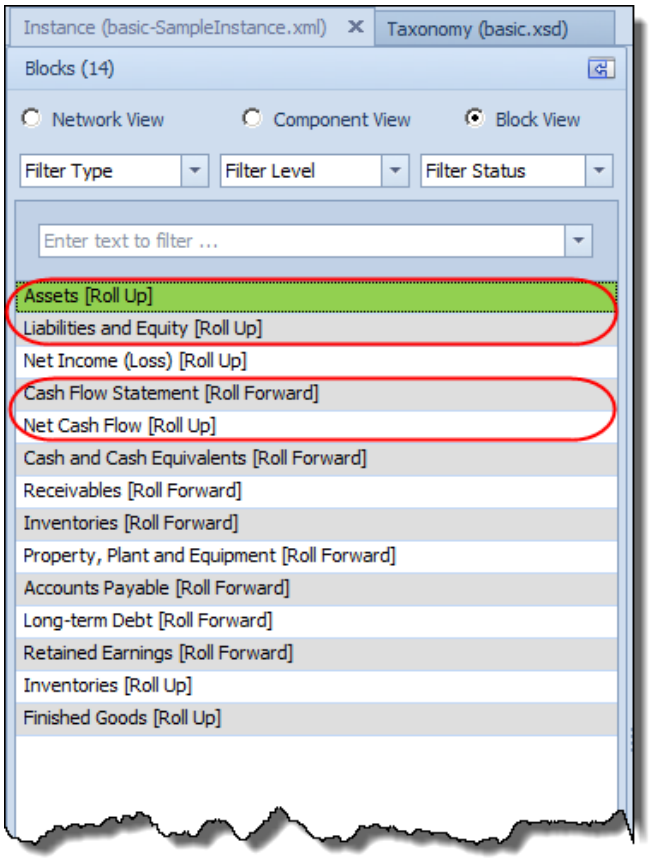

In that report there are 12 Networks, there are 12 Hypercubes, there are 12 Components because there is one Hypercube per Network, and there are 14 Blocks. Why are there 14 Blocks? The reason there are 14 Blocks is because there are two Components that contain two Blocks, all the other Components have only one Block.

In this representation the balance sheet is in one Network, but that Network contains two Blocks; "Assets [Roll Up]" and "Liabilities and Equity [Roll Up]". And that makes sense; that is exactly what a balance sheet is: two roll ups and the totals for the roll ups are the same amount, the balance sheet balances.

In this representation the cash flow statement is likewise in one Network, but again there are two Blocks: "Net Cash Flow [Roll Up]" and the "Cash Flow Statement [Roll Forward]". That likewise makes sense, a cash flow statement is a roll up of the net cash flows from operating, financing, and investing activities to the total net cash flow. Then, the beginning balance is rolled forward to the ending balance using that total net cash flow and perhaps some other reconciling items.

So why couldn't this report be represented so that there is a one-to-one correlation between Networks and Blocks? There is no reason that could not be done. How this information is represented is purely a matter of preference.

Where information occurs in the report is a matter of preference, habit, norms in many cases, best practices, and other such reasons. The meaning of the information contained in the report would not change if Blocks were represented in different Network combinations. The only imitation that you have is that you cannot create

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relations where you have physical conflicts between things like the different totals of receivables which we showed earlier in this section.

3.2. Block Detection and Identification

There are two distinct phases in the process of detecting and identifying a Block within a report:

1. Determining that some fragment of a report is an identifiable Block.
2. Determining the information that is being represented, the disclosure being provided, by that Block.

The first phase where you simply identify THAT some fragment of a report is a Block is straight forward and are applied Network by Network until all the Blocks in a Network are identified; and then all the Networks within a report have been identifies meaning that all the Blocks of a report have been identified.

The second phase, understanding the information that is being conveyed by a Block of information, requires that additional metadata be created which is then used in that process of understanding what the Block represents.

Remember that we are discussing machine-based processes here. A professional accountant would generally have no problem identifying what information is being conveyed by a Block of information. We are trying to get a machine to understand the nature of the Block of information so that the machine can perform work for its human operator.

3.3. Reports are Blocks of Information

So, a report can be broken down to some set of Blocks. That complete set of Blocks is the report. For example, the Microsoft 2017 10-K financial report can be broken down into 192 distinct Blocks. Each of the 192 Blocks must be verified to be correct. If you go look at the validation results of the Microsoft report[52]; you will notice that there are 70 lines in the validation results report.

Why are there only 70 lines and not 192, one report line per Block? There are four specific reasons:

1. Information is conveyed three times generally in a report: (1) the Level 1 Note Text Block which contains an HTML representation for an entire disclosure; (2) the Level 3 Disclosure Text Block which contains an HTML representation for a specific disclosure; and (3) the Level 4 Disclosure Detail which provided individual Facts for a disclosure or statement. Level 1 Note Text Blocks other than the one for the significant accounting policies is not considered in the validation process because where disclosures are presented is a matter of preference and is subjective therefore the validation process ignores the vast majority of Blocks that are Level 1 Note Text Blocks.
2. The validation report puts the Level 3 Disclosure Text Block and the Level 4 Disclosure Detail side-by-side on the report; and therefore many lines show

[52] Microsoft Disclosure Mechanics Validation Results, http://xbrlsite.azurewebsites.net/2017/Prototypes/Microsoft2017/Disclosure%20Mechanics%20and%20Reporting%20Checklist.html

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two Blocks that make up both the Level 3 and Level 4 versions of the same disclosure.

3. The validation report lines that are completely gray in color are disclosures for which there are rules provided but the economic entity does not report that disclosure; so those lines can be ignored. (It is possible to turn those disclosures that are not applicable to the economic entity off using the radio buttons on the top of the report).
4. Rules do not exist for 100% of the Blocks that are provided in the report. If rules are not provided, then the second phase of determining what information the Block is conveying cannot be performed. Missing rules means parts of the report are not being verified as being correct.

This is a critically important point to understand. The prototype reporting checklist and disclosure mechanics rules that I provide number about 65 or 70 disclosures depending upon how you count them (i.e. how disclosure alternatives are counted). There is not 100% coverage of US GAAP currently provided. What I am showing is a prototype.

But what if you did provide 100% coverage for a reporting scheme and what if 100% of the Blocks were covered by rules? That is exactly what is done with the XASB reporting scheme prototype[53].

The XASB report has 133 Blocks and the verification report has 133 blocks that are being verified to be correct. This is important to understand because it means that there is 100% coverage of the XBRL-based report by the verification rules.

Further, the XASB report prototype exercises all concept arrangement patterns found in US GAAP or IFRS based reports. That proves the capabilities of the system.

An easier report where 100% coverage can be better seen is to use what I call the basic example[54]. There are no text blocks used and the representation of the report is straight forward. Here is the Block view of the report where you see that there are 12 Blocks shown with the Pesseract software application:

[53] XASB reporting schema, Disclosure Mechanics Results, http://xbrlsite.azurewebsites.net/2017/Prototypes/XASB/Disclosure%20Mechanics%20and%20Reporting%20Checklist.html

[54] Basic example, XBRL instance, http://xbrlsite.azurewebsites.net/2018/Prototypes/Basic/Basic-XASB-ConsistentRF/basic-SampleInstance.xml

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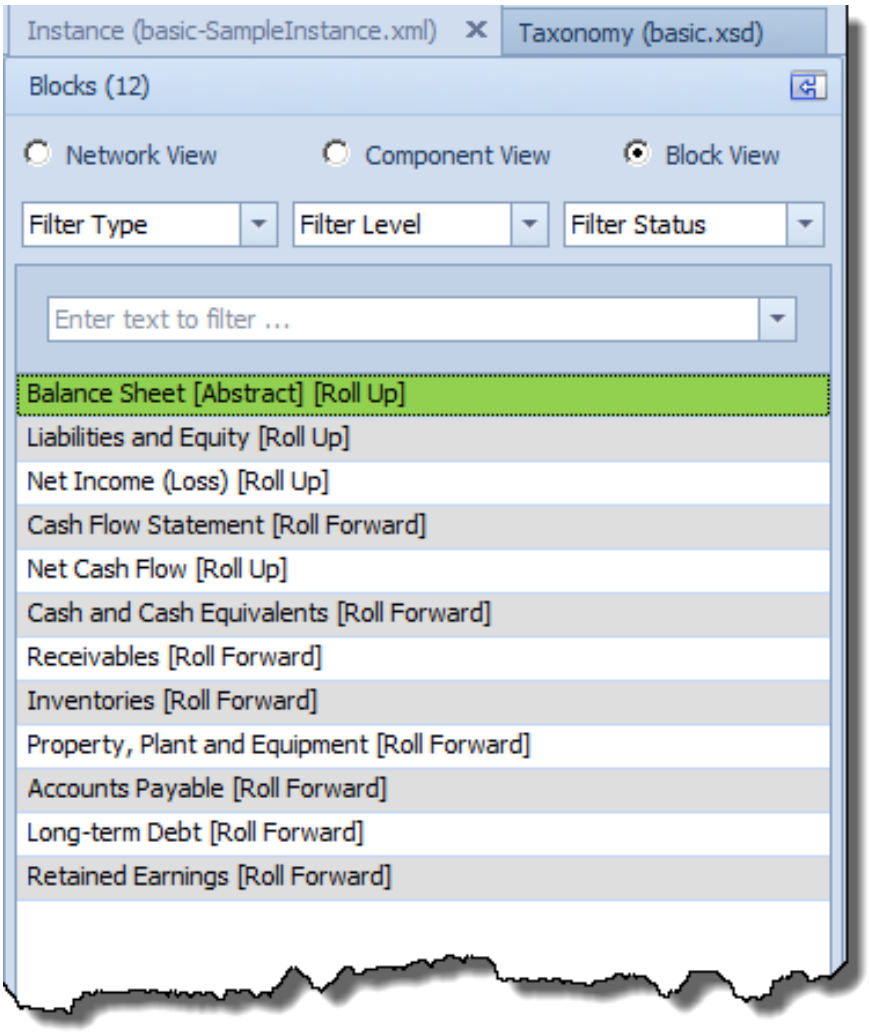

Here is the XBRL Cloud evidence package that helps you see the Blocks in the report[55] if you don't have software where you can load the report:

[55] Basic example, XBRL Cloud Evidence Package, http://xbrlsite.azurewebsites.net/2018/Prototypes/Basic/Basic-XASB-ConsistentRF/evidence-package/contents/index.html#Rendering-N0-Implied.html

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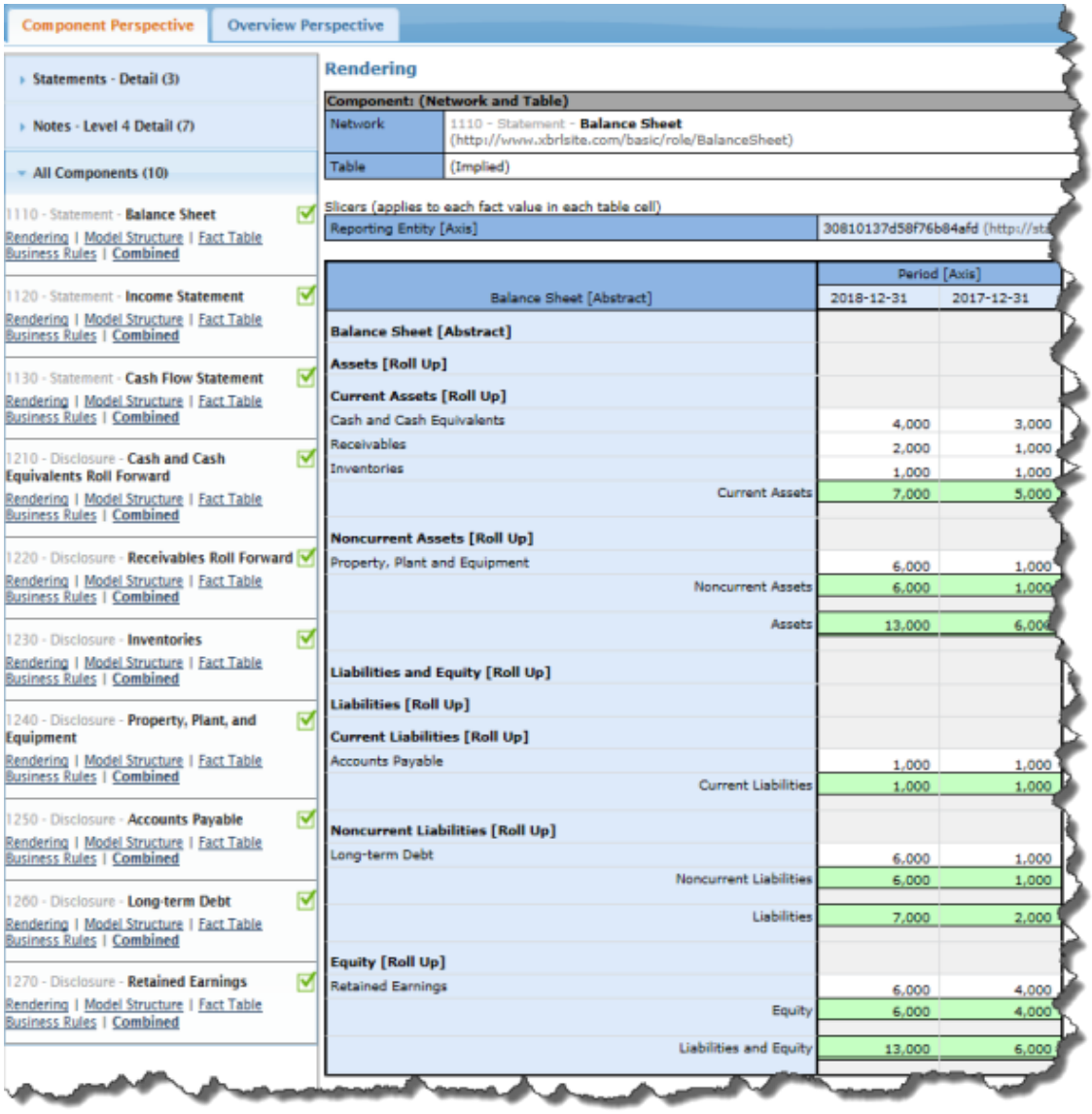

The XBRL Cloud view of this information shows 10 Components, that software understands Blocks, but does not provide a separate listing for Blocks in this interface. Two of the Components have two Blocks (balance sheet and cash flow statement) while all the Components have one Block so there are a total of 12 Blocks the same as the Pesseract software's count of Blocks.

Here is the XBRL Cloud reporting checklist and disclosure mechanics validation report[56]. You can see a list of 12 Blocks here. Note that 100% of the Blocks are represented correctly per the rules used to evaluate the report:

[56] Basic example, reporting checklist and disclosure mechanics, http://xbrlsite.azurewebsites.net/2018/Prototypes/Basic/Basic-XASB-ConsistentRF/ReportingChecklistResults/Disclosure%20Mechanics%20and%20Reporting%20Checklist.html

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#	Disclosure	Category	Level	Pattern	Applicable	Found	Disclosure Consistent	Representation Concept [TEXT BLOCK]	Representation Concept [DETAIL]	Checklist Category	Reason
1	Balance Sheet		Level4Detail	COMPONENT	True	True	CONSISTENT	NOT-EXPECTED	NOT-EXPECTED	Required disclosure	Disclosure always required, satisfied by Assets [Roll Up] and Liabilities and Equity [Roll Up]
2	Assets [Roll Up]		Level4Detail	ROLL UP	True	True	CONSISTENT	NOT-EXPECTED	Assets	Part of disclosure	Disclosure always required
3	Liabilities and Equity [Roll Up]		Level4Detail	ROLL UP	True	True	CONSISTENT	NOT-EXPECTED	Liabilities and Equity	Part of disclosure	Disclosure always required
4	Income Statement		Level4Detail	ROLL UP	True	True	CONSISTENT	NOT-EXPECTED	Net Income (Loss)	Required disclosure	Disclosure always required
5	Cash Flow Statement, Direct Method		Level4Detail	ROLL UP	True	True	CONSISTENT	NOT-EXPECTED	Net Cash Flow	Required disclosure	Disclosure always required
6	Receivables [Roll Forward]		Level4Detail	ROLL FORWARD	True	True	CONSISTENT	NOT-EXPECTED	Receivables	Required disclosure	Disclosure always required
7	Cash and Cash Equivalents [Roll Forward]		Level4Detail	ROLL FORWARD	True	True	CONSISTENT	NOT-EXPECTED	Cash and Cash Equivalents	Line item exists, then disclosure required	Required because line item basic:CashAndCashEquivalents was reported
8	Inventories [Roll Forward]		Level4Detail	ROLL FORWARD	True	True	CONSISTENT	NOT-EXPECTED	Inventories	Line item exists, then disclosure required	Required because line item basic:Inventories was reported
9	Accounts Payable [Roll Forward]		Level4Detail	ROLL FORWARD	True	True	CONSISTENT	NOT-EXPECTED	Accounts Payable	Line item exists, then disclosure required	Required because line item basic:AccountsPayable was reported
10	Property, Plant, and Equipment [Roll Forward]		Level4Detail	ROLL FORWARD	True	True	CONSISTENT	NOT-EXPECTED	Property, Plant and Equipment	Line item exists, then disclosure required	Required because line item basic:PropertyPlantAndEquipment was reported
11	Long-Term Debt [Roll Forward]		Level4Detail	ROLL FORWARD	True	True	CONSISTENT	NOT-EXPECTED	Long-term Debt	Line item exists, then disclosure required	Required because line item basic:LongtermDebt was reported
12	Retained Earnings [Roll Forward]		Level4Detail	ROLL FORWARD	True	True	CONSISTENT	NOT-EXPECTED	Retained Earnings	Line item exists, then disclosure required	Required because line item basic:RetainedEarnings was reported

The Pesseract application provides the same results, again using a slightly different interface. Note the count of 12 Blocks:

Primary Information

#	Disclosure	Category	Level	Pattern	Disclosure Found	Disclosure Consis…	Applicable	Representation Concept [TEXT BLOCK]	Representation Concept DETAIL
1	Accounts Payable [Roll For…	Unknown	Level4Detail	RollForward	True	CONSISTENT	True	NOT-EXPECTED	Accounts Payable
2	Assets [Roll Up]	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Assets
3	Balance Sheet	Statement	UNKNOWN	Component	True	CONSISTENT	True	-	-
4	Cash and Cash Equivalents…	Unknown	Level4Detail	RollForward	True	CONSISTENT	True	NOT-EXPECTED	NOT-FOUND
5	Cash Flow Statement, Dire…	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Net Cash Flow
6	Income Statement	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Net Income (Loss)
7	Inventories [Roll Forward]	Unknown	Level4Detail	RollForward	True	CONSISTENT	True	NOT-EXPECTED	Inventories
8	Liabilities and Equity [Roll Up]	Unknown	Level4Detail	RollUp	True	CONSISTENT	True	NOT-EXPECTED	Liabilities and Equity
9	Long-Term Debt [Roll Forw…	Unknown	Level4Detail	RollForward	True	CONSISTENT	True	NOT-EXPECTED	Long-term Debt
10	Property, Plant, and Equip…	Unknown	Level4Detail	RollForward	True	CONSISTENT	True	NOT-EXPECTED	Property, Plant and Equipment
11	Receivables [Roll Forward]	Unknown	Level4Detail	RollForward	True	CONSISTENT	True	NOT-EXPECTED	Receivables
12	Retained Earnings [Roll For…	Unknown	Level4Detail	RollForward	True	CONSISTENT	True	NOT-EXPECTED	Retained Earnings

In summary, what is being shown is that if a complete set of rules is provided the covers 100% of the Blocks being represented; then 100% of the report can be verified to be consistent with the expectations which are articulated within the machine-readable rules.

All this is enabled by the ability to break down an XBRL-based report into fragments that you can work with; we call these fragments Blocks.

3.4. Study this to Better Understand

To better understand networks, hypercubes, blocks, and disclosures study the PROOF representation of a report[57]:

Line		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

[57] Proof, http://www.xbrlsite.com/seattlemethod/golden/proof/base-taxonomy/proof_ModelStructure.html

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Start with the report model, examine the report that was created, notice the organization of the networks, hypercubes, blocks, and disclosures[58].

#	Network	Hypercube	Block	Pattern	Disclosures
1	01-Balance Sheet	Balance Sheet [Hypercube]	Assets	RollUp	disclosures:AssetsRollUp, disclosures:BalanceSheet
2	01-Balance Sheet	Balance Sheet [Hypercube]	Liabilities and Equity	RollUp	disclosures:BalanceSheet, disclosures:LiabilitiesAndEquityRollUp
3	02-Net Assets	Net Assets [Hypercube]	Net Assets	RollUp	disclosures:NetAssetsRollUp
4	03-Income Statement	Comprehensive Income Statement [Hypercube]	Net Income	RollUp	disclosures:IncomeStatement
5	04-Income Statement (Alternative)	Comprehensive Income Statement [Hypercube]	Net Income	RollUp	disclosures:IncomeStatementAlternative
6	05-Comprehensive Income	Comprehensive Income Statement [Hypercube]	Comprehensive Income	RollUp	disclosures:ComprehensiveIncome
7	06-Cash Flow	Cash Flow [Hypercube]	Net Cash Flow	RollUp	disclosures:CashFlowStatement, disclosures:NetCashFlowRollUp
8	06-Cash Flow	Cash Flow [Hypercube]	Assets, Beginning Balance	RollForward	disclosures:AssetsRollForward, disclosures:CashFlowStatement
9	07-Prior Period Errors	Prior Period Errors [Hypercube]	Equity, Origionally Stated	Adjustment	disclosures:PriorPeriodError
10	08-Prior Period Errors (Alternative)	Prior Period Errors [Hypercube]	Prior Period Errors [Adjustment]	Set	disclosures:PriorPeriodErrorAlternative
11	09-Changes in Equity	Changes in Equity [Hypercube]	Equity, Beginning Balance	RollForward	disclosures:ChangesInEquity
12	10-Policies	Policies [Hypercube]	Basis of Reporting [Text Block]	Level1TextBlock	disclosures:BasisOfReporting
13	10-Policies	Policies [Hypercube]	Nature of Operations [Text Block]	Level1TextBlock	disclosures:NatureOfOperations
14	10-Policies	Policies [Hypercube]	Revenue Recognition Policy [Text Block]	Level1TextBlock	disclosures:RevenueRecognitionPolicy
15	11-Variance Analysis	Variance Analysis [Hypercube]	Net Income	RollUp	disclosures:VarianceAnalysis
16	12-Segment Revenues	Segment Revenues [Hypercube]	Segment Revenues [Set]	Set	disclosures:SegmentRevenues
17	13-Stock Plan Activity	Weighted Average Grant Date Fair Value [Hypercube]	Nonvested Fair Value, Beginning Balance	RollForwardInfo	disclosures:StockPlanActivity
18	14-Financial Highlights	Financial Highlights [Hypercube]	Financial Highlights [Set]	Set	disclosures:FinancialHighlights

The tools are not perfect yet, but of you invest the time you can master the understanding of networks, hypercubes, blocks, and disclosures and know how to use XBRL to represent financial reports.

3.5. Master Class in Representing Financial Statement Logic Using XBRL

The blog post, *Master Class in Representing Financial Statement Logic Using XBRL*[59], provides 10 different approaches to representing the exact same information using XBRL. The point is to be able to compare and contrast the different approaches and understand the pros and cons of the different approaches.

The blocks of information of each approach are logically identical. Further, the disclosures represented by each approach are identical.

4. Understanding Model-driven

In this section we want to explain the connection between model-driven and information blocks. By model-driven, I really mean model-driven, global open

[58] Blocks, https://auditchain.infura-ipfs.io/ipfs/QmNUY15G1dhTXYCpyUyvqYWZ33Nc6mKRUDz7GDgLFonaPs/blocks.html

[59] Master Class in Representing Financial Statement Logic Using XBRL, https://digitalfinancialreporting.blogspot.com/2024/12/master-class-in-representing-financial.html

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standards based, semantic oriented, intelligent software agent powered, and customizable.

Intuit's TurboTax is model-driven. The idea of model-based reporting is not new. For example, the Quantrix Modeler[60] has been around for quite some time. The whitepaper, *Whitepaper: Quantrix and Excel: 3 Key Differences*[61], explains key conceptual and practical differences between Quantrix and Microsoft Excel.

So, while TurboTax and Quantrix Modeler are model-driven, neither is global open standards based. I am not certain that you could consider either TurboTax or Quantrix Modeler semantic-oriented and they are certainly not semantic oriented how something like the Semantic Web Stack (i.e. RDF + OWL + SHACL + SPARQL) is semantic oriented. And I am not sure to what extent you could consider either "intelligent software agent powered. TurboTax is not customizable at all, but I am not sure to what extent you can consider Quantrix customizable.

A forth coming book, *Real-time Financial Accounting the Data Centric Way (which has been renamed to The Future of Accounting)*, also mentions model driven financial reporting.

While Quantrix Modeler and TurboTax can be considered a "model-driven" approach to financial modeling, I want to explain what I mean by:

- Model-driven
- Global open industry standards-based
- Semantic-oriented
- Intelligent software agent powered
- Customizable

Key to all this is the core pattern[62] which drives all of this, the information block or simply the block.

4.1. Model-driven

Quantrix is a model-driven tool. Microsoft Word and Excel are document-based tools. Technically, a more accurate description is that Word and Excel are model-driven tools; but the model they use are how things are put into a document or onto a spreadsheet, not a financial report.

For example, when working with Word; pieces of a report go into a paragraph, a list, a table and then there is some sort of sequencing of those document-based artifacts into what looks like a report that was typed on a piece of paper. Excel is similar, but the artifacts involved are workbooks, worksheets, rows, columns, and cells.

A model-driven report constructs disclosures, organizes those disclosures into some sort of flow, the disclosures have financial report line items and facts in them. The model of the report is based on the meaning conveyed by the report, not structures used to organize information in the form of a spreadsheet or document so a human can then read the spreadsheet/document.

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[60] Quantrix, Quantrix Platform, https://discovery.quantrix.com/financial-modeling-software/

[61] Quantrix, *Whitepaper: Quantrix and Excel: 3 Key Differences*, https://quantrix.com/quantrix-whitepapers/quantrix-and-excel/

[62] Seattle Method, *Core Pattern*, https://seattlemethod.blogspot.com/2025/11/core-pattern.html

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The model of a report is based on XBRL International's *Open Information Model* (OIM) and OMG's *Standard Business Report Model* (SBRM). OIM is the basis for the Seattle Method and SBRM is effectively based on the Seattle Method model of a business report. So, OIM, SBRM, and the Seattle Method are well aligned.

Another thing about the Quantrix model is that the model is limited to OLAP (Online Analytical Processing)[63]. By contrast, the model-driven approach that a financial report model uses is based on the multidimensional model provided by XBRL Dimensions[64]. Both the Seattle Method and XBRL International *Open Information Model* (OIM) leverage that global standard technical specification of a multidimensional model. At this point it is unclear what physical implementation of a multidimensional model the OMG *Standard Business Report Model* (SBRM) will leverage.

4.2. Global Open Industry Standards-based

Quantrix is not standards-based, that tool uses a proprietary oriented technical format. The form of model-driven financial reporting that I am describing leverages a global standard-based technical format for getting information into and out of software. Because of the global standard-based technical format, software vendors cannot lock you into their specific software.

To understand the traction that the global open standard XBRL is getting, have a look at what the Financial Accounting Standards Board (FASB) has published (is publishing) on their website using that global standard XBRL technical format:

- US GAAP Reporting Taxonomy[65], machine-readable information related to US GAAP financial reporting provided using the global standard XBRL
- SEC Reporting Taxonomy[66], used by public companies who are required to report to the U.S. Securities and Exchange Commission (SEC) using the XBRL format
- GAAP Employee Benefit Plans Taxonomy[67], machine-readable information related to financial reporting by retirement plans and welfare plans which leverages the XBRL technical format
- GAAP Meta Model Relationships Taxonomy[68], explains fundamental relationship between financial reporting concepts in machine readable terms using XBRL
- DQC Rules Taxonomy[69], Data Quality Committee rules published in machine-readable form

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[63] Wikipedia, *Online Analytical Processing*, https://en.wikipedia.org/wiki/Online_analytical_processing

[64] XBRL International, *XBRL Dimensions*, https://specifications.xbrl.org/work-product-index-group-dimensions-dimensions.html

[65] FASB, *2025 GAAP Reporting Taxonomy*, https://www.fasb.org/page/detail?pageId=/projects/FASB-Taxonomies/2025-gaap-financial-reporting-taxonomy.html

[66] FASB, *2025 SEC Reporting Taxonomy*, https://www.fasb.org/page/detail?pageId=/projects/FASB-Taxonomies/2025-sec-reporting-taxonomy.html

[67] FASB, *GAAP Employee Benefit Plan Taxonomy Website Terms and Conditions*, https://fasb.org/page/detail?pageId=/projects/FASB-Taxonomies/2025-disclaimer-gaap-employee-benefit-plan-taxonomy.html

[68] FASB, *GAAP Meta Model Relationships Taxonomy*, https://www.fasb.org/page/detail?pageId=/projects/FASB-Taxonomies/gaap-meta-model-relationships-taxonomy.html

[69] FASB, *DQC Rules Taxonomy*, https://www.fasb.org/projects/fasb-taxonomies/dqc-rules-taxonomy

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The IFRS Foundation has not yet progressed as much as the FASB, but they have published IFRS XBRL Taxonomies for financial reporting and they do mention digital financial reporting[70].

Effectively, financial reporting is being digitized. And the machine readable technical format of choice tends to be the global open industry standard XBRL technical format. In addition to this machine readable information; infrastructure for creating more XBRL-based machine readable information has been created. XBRL International published, *Accounting Semantics Arcroles 1.0*[71], which are part of the building blocks that are used to represent financial report information using the XBRL global open industry standard technical format.

In addition, a new version of the XBRL Open Information Model is being created and *XBRL Rules and Query Language 3.0*[72] is being created.

Two key things to take away from this section. First, "digital" works differently than representing things in a physical format such as paper. While accounting, reporting, auditing, and analysis has been performed via paper or electronic versions of paper or "e-paper" like word processing documents and presentation oriented electronic spreadsheets in the past; this is undergoing a very significant change as you can see by what the FASB is doing. Second, if you don't understand "digital"; you really might want to up your digital proficiency[73] to better understand what is going on. The change is a big one. A paradigm shift is occurring and old mental maps will not be helpful in understanding the new paradigm.

4.3. Semantic-oriented

Quantrix provides the ability to create a model-driven report using semantics, basically meaning and logic, that the user of Quantrix specifies. It is unclear whether such models can be shared between financial reports, but the models are OLAP models and they are not global open industry standards-based semantic-oriented models. In this regard Quantrix is again proprietary.

The model of a financial report is semantic, that meaning and logic is sharable across report models, and the financial report model is based on the logical model of the global open industry standard XBRL. The Seattle Method, OIM, and SBRM further enhance that logical model of a financial report enabling additional capabilities.

There are multiple levels of the semantic model of a financial report, the meaning and logic which can then be interpreted by software applications. A report itself has a logical model. What goes into that logical report model is separate and therefore different reporting schemes still share the same report model logic.

All of these semantics can be represented in machine readable form and exchanged between different software implementations using the global standards based physical format used to represent the standard semantics published by, say, the FASB as pointed out above, or by the IFRS Foundation for International Financial Reporting

[70] IFRS Foundation, Digital Financial Reporting, https://www.ifrs.org/digital-financial-reporting/

[71] XBRL International, Accounting semantics arcroles 1.0, https://www.xbrl.org/REQ/accounting-semantics-req/REQ-2023-01-04/accounting-semantics-req-2023-01-04.html

[72] XBRL International, *XBRL Rules and Query Language 3.0,* https://specifications.xbrl.org/work-product-index-formula-rules-and-query.html

[73] Charles Hoffman, *Digital Proficiency*, https://digitalfinancialreporting.blogspot.com/2024/05/digital-proficiency.html

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Standards or EFRAG for sustainability reporting, ESG, CSRD, or whatever you might call it.

To the extent that this machine-readable and therefore machine-interpretable semantics is made available to software applications, software can supercharge the skills of skilled and experienced accountants working with those financial reports.

4.4. Intelligent Software Agent Powered

Quantrix does have some intelligence, but it does not provide a complete first order logic rules engine. Model-driven financial reporting does provide a powerful yet safe implementation of first order logic using DATALOG[74] which is a safe subset of declarative logic programming language PROLOG[75]. Those rule and rule-based logic can be supplemented by probability-based logic and large language models (LLMs) for even more information processing capabilities.

A model-driven report is effectively a knowledge graph. That knowledge graph can be the basis for a knowledge based system[76] (a.k.a. mindful machine, deductive apparatus, expert system).

To understand the type of intelligence a software agent would have, look at the logic implemented for the Seattle Method related to financial reporting:

- Theory of Mathematical Integrity
- Theory of Model Structure
- Theory of Information Blocks
- Theory of Fundamental Accounting Concepts and Reporting Styles
- Theory of Types and Parts
- Theory of Disclosures and Disclosure Mechanics
- Theory of Reportability

Other intelligence can be added, for example something like Theory of Normalization which would convert as reported financial report information into a normalization model.

While TurboTax is a true model-driven software application and while TurboTax can be considered semantic-oriented; there is a big difference between the intelligence of TurboTax and model-driven financial reports. TurboTax is basically a standard form based intelligent software agent, whereas model-driven intelligence enables those creating financial reports to customize their report model because, unlike tax forms, financial statements are not forms.

Further, because customizations of financial reports must be kept within permitted boundaries or customizations of the report model logic as well as financial reporting scheme logic; model-driven intelligent software also provides "guardrails" to control the wild behaviour of accounts creating model-driven reports; keeping them within those permitted boundaries.

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[74] Wikipedia, *Datalog*, https://en.wikipedia.org/wiki/Datalog

[75] Wikipedia, Prolog, https://en.wikipedia.org/wiki/Prolog

[76] Seattle Method, *Knowledge Based System*, https://seattlemethod.blogspot.com/2025/09/knowledge-based-systems.html

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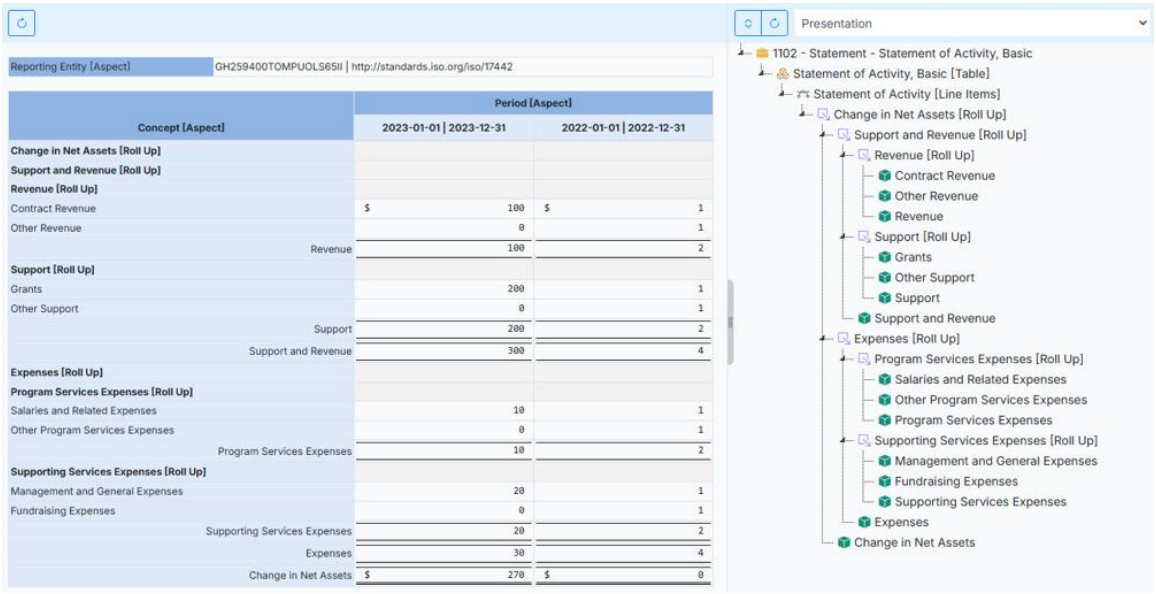
4.5. Customizable

A financial statement is not standardized form. While the model of a financial report is fixed; what a reporting economic entity puts into that financial report model is specific to that reporting economic entity, but it does follow logical patterns of the financial report model. And every financial report model follows the logic of a business report model because a financial report is a specialization of the more general business report.

As such, creators of model-driven financial reports need to be able to work within that fixed business report model and be able to configure their custom report model within the boundaries of what is permitted. Customizations are controlled and kept within permitted boundaries.

TurboTax is a form editor. Intuit has to create each of the forms generated by TurboTax. Users of TurboTax cannot change forms.

Model-driven financial reporting works differently. There are a number of layers which should not be confused. A complete discussion of this is beyond the scope of this document.



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

Concept [Aspect]	Period [Aspect] 2023-01-01 | 2023-12-31	2022-01-01 | 2022-12-31
Change in Net Assets [Roll Up]		
Support and Revenue [Roll Up]		
Revenue [Roll Up]		
Contract Revenue	$ 100	$ 1
Other Revenue	0	1
Revenue	100	2
Support [Roll Up]		
Grants	200	1
Other Support	0	1
Support	200	2
Support and Revenue	300	4
Expenses [Roll Up]		
Program Services Expenses [Roll Up]		
Salaries and Related Expenses	10	1
Other Program Services Expenses	0	1
Program Services Expenses	10	2
Supporting Services Expenses [Roll Up]		
Management and General Expenses	20	1
Fundraising Expenses	0	1
Supporting Services Expenses	20	2
Expenses	30	4
Change in Net Assets	$ 270	$ 0

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