1. Representing Structures

The purpose of this section is to dive into the details related to the structures within an XBRL-based digital financial report. Networks and hypercubes are XBRL technical artifacts that are used when creating structures. Blocks are logical artifacts and have identifiable patterns that can be leveraged. Disclosures are what blocks represent and are organized within the technical artifacts networks and hypercubes.

2. Networks

A network is a technical artifact that lets you separate associations into distinct structures because you want to or because you have to. Networks are discussed in more detail in the Very Basic XBRL Primer[1]. Basically, every association must be represented within an XBRL network. Hypercubes may be used, but are not required and also offer certain specific advantages.

Fundamentally, the function of a network is to separate associations into distinct structures. If you use a network without one or more explicitly defined hypercubes then associations within the network are deemed to exist within one implied hypercube. So, all the associations within a network act the same whether they are also defined within an explicit hypercube or there is no explicit hypercube and therefore are governed by an implied hypercube.

The relationship between networks and hypercubes might seem a bit odd or even confusing. This is because networks are defined by the XBRL technical specification and hypercubes are defined later by the XBRL Dimensions specification and the two specifications need to work together.

Properly created software applications should automate the interaction between networks and hypercubes behind the scenes so business professionals do not need to concern themselves with these details. Just understand that networks are used to separate associations because (a) you want to or (b) you have to.

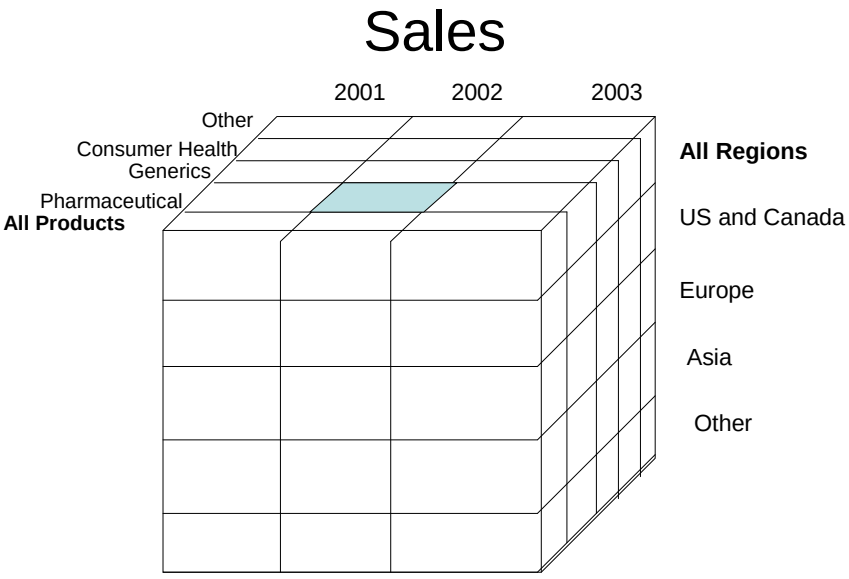
3. Hypercubes

Hypercubes always exist within a network. To understand what a hypercube is, lets first look at the notion of a table. Below you see a table which shows sales information for four products over a period of three years which fits nicely into an easy to read and understand table or spreadsheet:

Product	2001	2002	2003
Widgets	3000	6500	8200
Gadgets	1200	1450	3000
Doohickeys	2500	3400	2000
Whatzits	500	670	1300

[1] *Very Basic XBRL Primer*, http://www.xbrlsite.com/mastering/Part00_Chapter01.B_XBRLPrimer.pdf

So, a table is information that has two dimensions. Above we see products in the rows and period in the columns. But what if you have more than two dimensions of information. A cube adds a third dimension to the table. Below you see that we have added a region dimension with the values of "US and Canada", "Europe", "Asia", and "Other" to the table which results in a three dimensional object or cube.



A **hypercube** is the notion of a set of related information that tends to go together and that has multiple dimensions that are used to describe that information. A hypercube can have two, three, four, or even more dimensions potentially. For example, imagine the above cube which has the dimensions of period, product category, and region; but now we add an additional dimension of reporting scenario (i.e. actual sales, budgeted sales, and/or variance between actual and budgeted sales. So how can you possibly visualize more than two dimensions of information?

The answer is the notion of a slicer. A **slicer** enables a three dimensional, four dimensional, or even more dimensions to be represented on in a two dimensional (i.e. rows and columns) space. A good way to understand the notion of a slicer is to think of a pivot table. You put a slicer into the top portion of a pivot table in order to filter information so that you get a human-readable two dimensional row and column view of information. For example,

Analysis (With Breakdown)

Entity	Sample Company
Units	Euros
Concept	Sales

Sum of Value		Period		
Product	Region	2001	2002	2003
Consumer Health	Asia	1,025	1,263	1,457
	Europe	2,462	2,592	2,834
	Other Regions	1,365	1,340	767
	US and Canada	2,570	3,074	2,765
Consumer Health Total		7,421	8,270	7,823
Generics	Asia	503	634	807
	Europe	1,359	1,383	1,616
	Other Regions	918	890	489
	US and Canada	1,378	1,660	1,508
Generics Total		4,158	4,567	4,420
Other	Asia	1,315	1,398	895
	Europe	2,826	2,746	1,790
	Other Regions	1,200	1,154	540
	US and Canada	3,038	3,225	1,673
Other Total		8,379	8,523	4,899
Pharmaceuticals	Asia	2,009	2,471	2,864
	Europe	4,233	4,732	5,317
	Other Regions	1,690	1,715	1,147
	US and Canada	4,576	5,527	5,568
Pharmaceuticals Total		12,507	14,446	14,896
Grand Total		32,465	35,805	32,038

A hypercube is a logical scheme that is used to be able to represent sets of information that tends to go together. Reported facts don't simply float freely in space. Every fact that is provided with in a report is associated with at least one hypercube.

The notion of a hypercube comes from a common model used when working with information, the multidimensional model[2].

Below you see two hypercubes that represent two versions of the same information, sales by business segment and by geographic area. The first hypercube holds the geographic area at all geographic areas and then shows a breakdown of sales by business segment. The second holds the business segment constant at the total for all business segments and then shows a breakdown of sales by geographic area:

Sales by business segment:

[2] Wikipedia, *Dimensional Modeling*, https://en.wikipedia.org/wiki/Dimensional_modeling

Component: (Network and Table)	
Network	**Sales Analysis, by Business Segment**
Table	Sales Analysis, by Business Segment [Table]

Reporting Entity [Axis]	SAMP http://www.SampleCompany.com
Legal Entity [Axis]	Consolidated Entity [Member]
Geographic Area [Axis]	Geographic Areas, All [Member]
Unit [Axis]	USD

Sales Analysis, by Business Segment [Line Items]	Business Segment [Ax...	Period [Axis]: 2010-01-01/2010-12-31	2009-01-01/2009-12-31	2008-01-01/2008-12-31
Sales Analysis, by Business Segment [Hierarchy]				
Sales	Business Segments, All [Member]	32,038,000	35,805,000	32,465,000
	Pharmaceuticals Segment [Member]	20,181,000	18,150,000	15,275,000
	Generics Segment [Member]	2,433,000	1,973,000	1,823,000
	Consumer Health Segment [Member]	6,675,000	6,514,000	5,752,000
	Other Segments [Member]	2,749,000	9,168,000	9,615,000

Sales by geographic area:

Component: (Network and Table)	
Network	**Sales Analysis, by Geographic Area**
Table	Sales Analysis, by Geographic Area [Table]

Reporting Entity [Axis]	SAMP http://www.SampleCompany.com
Business Segment [Axis]	Business Segments, All [Member]
Legal Entity [Axis]	Consolidated Entity [Member]
Unit [Axis]	USD

Sales Analysis, by Geographic Area [Line Items]	Geographic Area [Ax...	Period [Axis]: 2010-01-01/2010-12-31	2009-01-01/2009-12-31	2008-01-01/2008-12-31
Sales Analysis, by Geographic Area [Hierarchy]				
Sales	Geographic Areas, All [Member]	32,038,000	35,805,000	32,465,000
	North America Region [Member]	10,214,000	12,649,000	10,137,000
	Europe Region [Member]	11,901,000	10,374,000	10,396,000
	Asia Region [Member]	5,639,000	4,371,000	3,210,000
	Other Regions [Member]	4,284,000	8,411,000	8,722,000

By "pivoting" the information by different combinations of business segments and geographic areas you can see different versions of information. This is somewhat like serializing each version of the information onto a printed report that shows all the different versions of the pivot table.

The multidimensional model was explained in the chapter, *Introduction to Conceptual Model of a Digital Financial Report*[3], so we will not repeat that here. We do want to remind you of a couple of things however.

3.1. Difference between Signal and Noise

Constructing hypercubes effectively is a learned skill. There is a big difference between providing "signal" which is more information and "noise" which is unimportant stuff that just gets in the way[4]. Contrast these two hypercube dimensions:

[3] *Introduction to Conceptual Model of a Digital Financial Report*, http://xbrlsite.azurewebsites.net/2017/IntelligentDigitalFinancialReporting/Part02_Chapter05.1_IntroductionToTheConceptualModelOfDigitalFinancialReport.pdf

[4] Representing Information Logically, http://xbrl.squarespace.com/journal/2020/12/30/representing-information-logically.html

Four dimensions[5]

Component: (Network and Table)	
Network	**AA: Statement: Financial Highlights** (http://www.ABCCompany.com/company/role/level4/FinancialHighlightsSchedule)
Table	Financial Highlights [Table]

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

Reporting Entity [Axis]	10810137d58f76b84aaa (http://standards.iso.org/iso/17442)
Legal Entity [Axis]	Consolidated Entity [Member]
Report Date [Axis]	Reported as of March 18, 2021 [Member]
Reporting Scenario [Axis]	Actual [Member]

Financial Highlights [Line Items]	Period [Axis]				
	2020-01-01 - 2020-12-31	2019-01-01 - 2019-12-31	2018-01-01 - 2018-12-31	2017-01-01 - 2017-12-31	2016-01-01 - 2016-12-31
Financial Highlights [Hierarchy]					
Revenues, Net	4,000,000	5,000,000	4,000,000	4,000,000	4,000,000
Income (Loss) from Continuing Operations	500,000	(4,000,000)	(4,000,000)	(4,000,000)	(4,000,000)
Net Income (Loss)	500,000	(4,000,000)	(4,000,000)	(4,000,000)	(4,000,000)
Cash Flow Provided by (used in) Operating Activities, Net	(1,000,000)	4,000,000	0	0	0
Capital Additions		650,000	550,000	450,000	350,000
Average Number of Employees	300	250	250	240	220

Eight dimensions[6]

Component: (Network and Table)	
Network	**AA: Statement: Financial Highlights** (http://www.ABCCompany.com/company/role/level4/FinancialHighlightsSchedule)
Table	Financial Highlights [Table]

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

Reporting Entity [Axis]	10810137d58f76b84aaa (http://standards.iso.org/iso/17442)
Legal Entity [Axis]	Consolidated Entity [Member]
Report Date [Axis]	Reported as of March 18, 2021 [Member]
Reporting Scenario [Axis]	Actual [Member]
Property, Plant and Equipment, Description of Major Class [Axis]	Property, Plant and Equipment, All Major Classes [Member]
Customer [Axis]	All Customers [Member]
Debt Instrument, Identifier [Axis]	All Debt Instruments [Member]
Business Segment [Axis]	Business Segments, All [Member]
Related Party, Name [Axis]	All Related Parties [Member]
Director Name [Axis]	All Directors [Member]
Share Ownership Plan, Identifier [Axis]	All Share Ownership Plans [Member]
Reconciling Item, Type [Axis]	All Reconciling Items of Cash and Cash Equivalents [Member]

Financial Highlights [Line Items]	Period [Axis]				
	2020-01-01 - 2020-12-31	2019-01-01 - 2019-12-31	2018-01-01 - 2018-12-31	2017-01-01 - 2017-12-31	2016-01-01 - 2016-12-31
Financial Highlights [Hierarchy]					
Revenues, Net	4,000,000	5,000,000	4,000,000	4,000,000	4,000,000
Income (Loss) from Continuing Operations	500,000	(4,000,000)	(4,000,000)	(4,000,000)	(4,000,000)
Net Income (Loss)	500,000	(4,000,000)	(4,000,000)	(4,000,000)	(4,000,000)
Cash Flow Provided by (used in) Operating Activities, Net	(1,000,000)	4,000,000	0	0	0
Capital Additions		650,000	550,000	450,000	350,000
Average Number of Employees	300	250	250	240	220

Logically, the two representations are identical. Running each through an XBRL Formula processor shows this. Balancing the needs of humans and the needs of computers reading information is a learned skill.

---

[5] Financial highlights, four dimensions, http://xbrlsite.azurewebsites.net/2020/reporting-scheme/xasb/reference-implementation/evidence-package/contents/index.html#Rendering-FinancialHighlightsSchedule-gaap_FinancialHighlightsTable.html

[6] Financial highlights, eight dimensions, http://xbrlsite.azurewebsites.net/2020/reporting-scheme/xasb/reference-implementation-many-dim/evidence-package/contents/index.html#Rendering-FinancialHighlightsSchedule-gaap_FinancialHighlightsTable.html

3.2. Important Information to Keep in Mind

Note that the term hypercube and the term [Table] are synonyms. Likewise, the term dimension, aspect, and [Axis] are synonyms.

A hypercube is an abstract notion which was invented to communicate an idea. Hypercubes can be explicitly defined within the XBRL technical syntax, but an implied hypercube exists when an explicitly defined hypercube is not provided.

In XBRL, there are three core aspects that exist that are always used to describe a fact: entity, period, and concept. Additional noncore aspects can be added to the three core aspects by defining the noncore aspect you need to use within an XBRL taxonomy.

When you represent information within an explicitly defined hypercube, that hypercube has a name and because of that, the hypercube can be used to identify and extract information from within a report. When you define information without an explicit hypercube, i.e. an implied hypercube, you cannot use the name of the hypercube to identify and work with information from a report because there is no physical hypercube that exists, it is only implied therefore it does not have a name.

When the same hypercube is used to represent two different fragments of a report, because each of the two fragments have the same name, you cannot distinguish one fragment from another using the hypercube name (i.e. because it is the same); so you have to also use the network in which the hypercube exists in order to effectively differentiate one hypercube from the other. You can never use a hypercube twice within one network.

XBRL International encourages not mixing dimensional and nondimensional models[7], i.e. use only explicit hypercubes or use no hypercubes at all. Note that both the US GAAP and IFRS XBRL taxonomies both mix dimensional models.

There tend to be two sound strategies for naming hypercubes. The first strategy is to give every hypercube the same name, say "my:Hypercube". That approach forces some good modeling practices such as one hypercube per network and also forces software to use one single identifier, the network, to identify a set of information. The other approach is to always use unique, or isomorphic, hypercubes meaning that each named hypercube represents one single set of information.

4. Contrasting Hypercube Structures

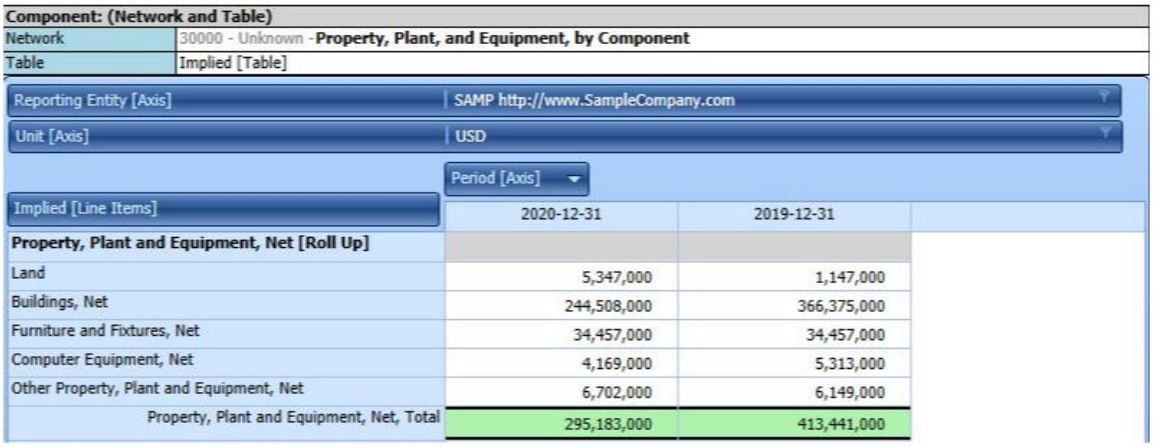
In this section I will help you understand hypercubes by comparing and contrasting a number of different hypercubes. All of these hypercubes are 100% the same in terms of the meaning conveyed by the information. The only difference is the approach used to represent the hypercube. The objective is to make the differences between each of these approaches clear. You can download the XBRL files and examine them[8].

[7] XBRL International, *XBRL International Guidance Clarifies XBRL Dimensions Semantics*, http://xbrl.squarespace.com/journal/2015/3/31/xbrl-international-guidance-clarifies-xbrl-dimensions-semant.html

[8] Download XBRL files, http://xbrlsite.azurewebsites.net/2020/Examples/Hypercubes/ComparisonOfHypercubes.zip

4.1. Implied Hypercube (i.e. no explicit hypercube defined)

To start, consider a fragment of a financial report that is represented without using a hypercube at all. When no hypercube is explicitly defined there exists one implied hypercube[9].



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

Reporting Entity [Axis]	SAMP http://www.SampleCompany.com	
Unit [Axis]	USD	
	Period [Axis]	
Implied [Line Items]	2020-12-31	2019-12-31
Property, Plant and Equipment, Net [Roll Up]		
Land	5,347,000	1,147,000
Buildings, Net	244,508,000	366,375,000
Furniture and Fixtures, Net	34,457,000	34,457,000
Computer Equipment, Net	4,169,000	5,313,000
Other Property, Plant and Equipment, Net	6,702,000	6,149,000
Property, Plant and Equipment, Net, Total	295,183,000	413,441,000

Notice at the top of the image where the name of "Table" is indicated to be "Implied [Table]". Essentially, if a set of facts that exist within one network does not have an explicitly defined hypercube; then you can assume that each of those facts exists in one single implied hypercube which we have simply given the name "ImpliedTable".

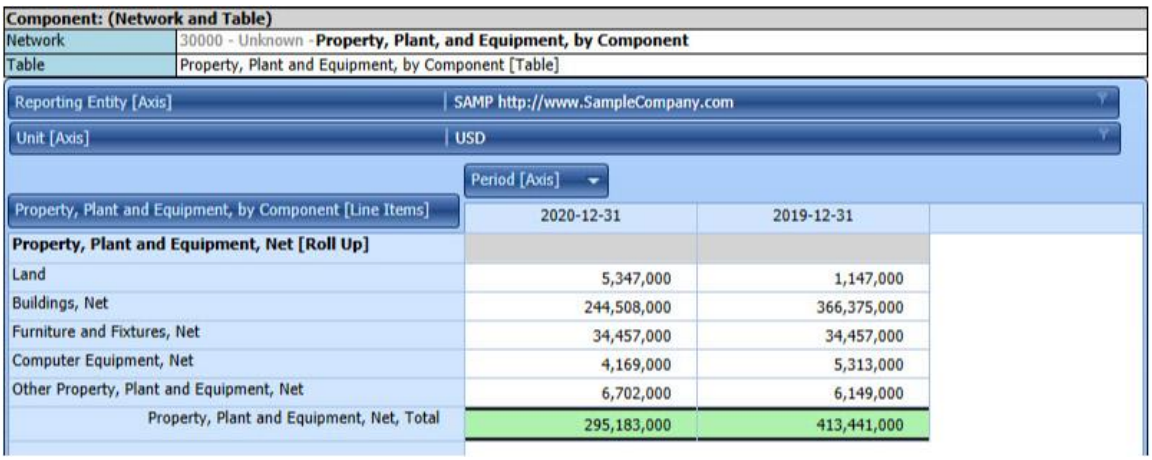
Representing information without an explicit hypercube within a financial report is not considered a best practice. Explicit hypercubes are the best way to go. A disadvantage of not using an explicit hypercube is that only core dimensions can be used; no noncore dimensions can be added because that requires the use of an explicitly defined hypercube.

4.2. Explicit Hypercube with no Dimensions

In this example we have a fragment of a report that has been represented using an explicit hypercube labeled "Property, Plant and Equipment, by Component [Table]". However, no additional noncore dimensions were defined[10].

[9] Implied hypercube example, http://xbrlsite.azurewebsites.net/2020/Examples/Hypercubes/01-ImpliedHypercube/RollUp-SampleInstance.xml

[10] Explicit hypercube with no dimensions example, http://xbrlsite.azurewebsites.net/2020/Examples/Hypercubes/02-ExplicitHypercubeNoAxis/RollUp-SampleInstance.xml



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

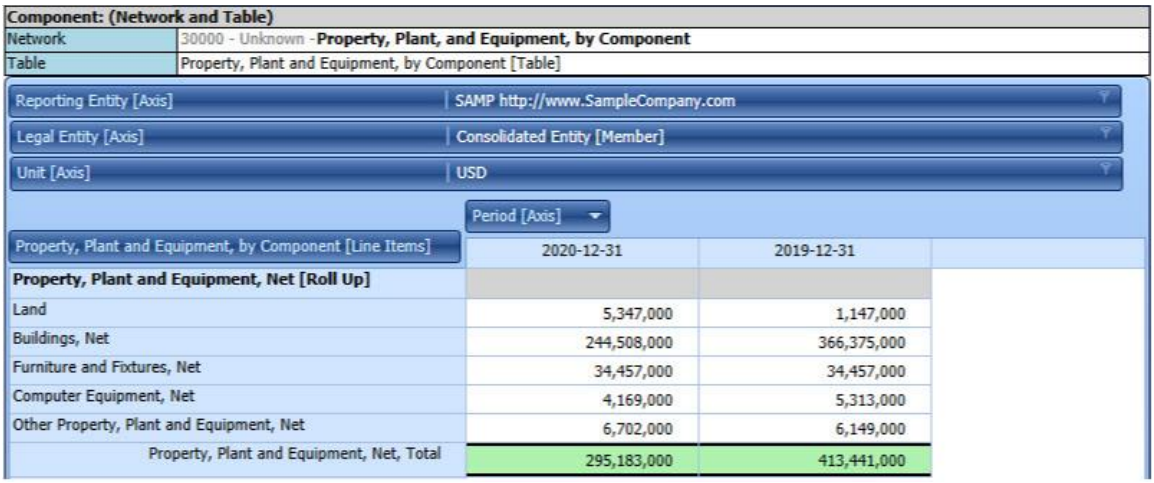
Reporting Entity [Axis]	SAMP http://www.SampleCompany.com
Unit [Axis]	USD

Property, Plant and Equipment, by Component [Line Items]	Period [Axis] 2020-12-31	2019-12-31
Property, Plant and Equipment, Net [Roll Up]		
Land	5,347,000	1,147,000
Buildings, Net	244,508,000	366,375,000
Furniture and Fixtures, Net	34,457,000	34,457,000
Computer Equipment, Net	4,169,000	5,313,000
Other Property, Plant and Equipment, Net	6,702,000	6,149,000
Property, Plant and Equipment, Net, Total	295,183,000	413,441,000

You can see that in the first example what was called "Implied [Table]" is now called "Property, Plant and Equipment, by Component [Table]". As such, you can now identify the set of facts using the hypercube that contains the set of facts by it's name. Further, there is nothing wrong with representing a set of information using a hypercube but not associating any additional noncore dimensions with that hypercube. That is perfectly legitimate per the XBRL technical specification.

4.3. Explicit Hypercube, One Noncore Dimension, no Dimension Default

In this example we have a fragment of a report that has been represented using an explicit hypercube labeled "Property, Plant and Equipment, by Component [Table]". In addition, we added the dimension "Legal Entity [Axis]" and one member of that dimensions domain, "Consolidated Entity [Member]"[11].



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

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

Property, Plant and Equipment, by Component [Line Items]	Period [Axis] 2020-12-31	2019-12-31
Property, Plant and Equipment, Net [Roll Up]		
Land	5,347,000	1,147,000
Buildings, Net	244,508,000	366,375,000
Furniture and Fixtures, Net	34,457,000	34,457,000
Computer Equipment, Net	4,169,000	5,313,000
Other Property, Plant and Equipment, Net	6,702,000	6,149,000
Property, Plant and Equipment, Net, Total	295,183,000	413,441,000

In this representation approach, the legal entity is explicitly identified as being the consolidated reporting entity. Whereas in the first and second representations the

[11] Explicit hypercube, one noncore dimension, no default dimension example, http://xbrlsite.azurewebsites.net/2020/Examples/Hypercubes/03-ExplicitHypercubeWithAxisNoDefault/RollUp-SampleInstance.xml

reader of the information and software would have to imply that the information is related to the consolidated entity.

One important point being made by this representation is that the notion of a dimension default is not used to represent the "Consolidated Entity [Member]". As such, the dimensional information physically exists within the XBRL instance which you can see if you examine the XBRL of the XBRL instance:

```
 - &lt;segment&gt;
     &lt;xbrldi:explicitMember dimension="pattern:LegalEntityAxis"&gt;pattern:ConsolidatedEntityMember&lt;/xbrldi:explicitMember&gt;
   &lt;/segment&gt;
 &lt;/entity&gt;
```

The next example will make the notion of a dimension default and its purpose clear.

4.4. Explicit Hypercube, One Noncore Dimension, With a Dimension Default

In this example the only thing that has changed is that we added a dimension default to the noncore dimension that has been provided "Legal Entity [Axis]". What adding the dimension default achieves is making the representation more flexible[12].

Component: (Network and Table)	
Network	30000 - Unknown - **Property, Plant, and Equipment, by Component**
Table	Property, Plant and Equipment, by Component [Table]
Reporting Entity [Axis]	SAMP http://www.SampleCompany.com
Legal Entity [Axis]	Consolidated Entity [Member]
Unit [Axis]	USD

Property, Plant and Equipment, by Component [Line Items]	Period [Axis] 2020-12-31	2019-12-31
Property, Plant and Equipment, Net [Roll Up]		
Land	5,347,000	1,147,000
Buildings, Net	244,508,000	366,375,000
Furniture and Fixtures, Net	34,457,000	34,457,000
Computer Equipment, Net	4,169,000	5,313,000
Other Property, Plant and Equipment, Net	6,702,000	6,149,000
Property, Plant and Equipment, Net, Total	295,183,000	413,441,000

Suppose that you also wanted to represent the line item "Property, Plant and Equipment, Net" on the balance sheet. If you look at the XBRL instance of the example above, the dimension information is explicitly provided within the context of the fact as we have pointed out. However, in the XBRL instance of this example, the dimensional information does not explicitly appear within the XBRL instance context.

You might be asking yourself, why does this matter? It matters because many times one fact appears in two different fragments of a report. For example, you see the breakdown of the subcomponents of property, plant, and equipment provided in this fragment. You can imagine that the total of this breakdown of subcomponents would also appear, say, as a line item on the balance sheet.

What a dimension default does is make it possible to use the same fact in two different fragments of a report rather than having to provide duplicate facts, one for each

[12] Explicit hypercube, one noncore dimension, with a dimension default, http://xbrlsite.azurewebsites.net/2020/Examples/Hypercubes/04-ExplicitHypercubeWithAxisWithDefault/RollUp-SampleInstance.xml

fragment, when in reality you only have one fact. That is the role of a dimension default, to enable the interconnections between hypercubes of information.

4.5. Explicit Hypercube, Adding Additional Members, Including Dimensional Aggregation

In this example we add two additional members to the single noncore dimension "Legal Entity [Axis]". The members added are "Business Unit Alpha [Member]" and "Business Unit Bravo [Member]. Further, the sum of each business unit aggregates to the consolidated entity. That aggregation across members of the dimension need to be validated using an XBRL Formula as XBRL calculations cannot validate information across the members of a dimension. What adding this information achieves is provide additional details for the reported facts which disaggregates the information by business unit[13].

Component: (Network and Table)

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

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

Period [Axis] | Legal Entity [Axis]

Property, Plant and Equipment, by Component [Line Items]	2020-12-31			2019-12-31		
	Business Unit Alpha [Member]	Business Unit Bravo [Member]	Consolidated Entity [Member]	Business Unit Alpha [Member]	Business Unit Bravo [Member]	Consolidated Entity [Member]
Property, Plant and Equipment, Net [Roll Up]						
Land	5,300,000	47,000	5,347,000	1,100,000	47,000	1,147,000
Buildings, Net	244,000,000	508,000	244,508,000	366,000,000	375,000	366,375,000
Furniture and Fixtures, Net	34,400,000	57,000	34,457,000	34,400,000	57,000	34,457,000
Computer Equipment, Net	4,000,000	169,000	4,169,000	5,000,000	313,000	5,313,000
Other Property, Plant and Equipment, Net	6,000,000	702,000	6,702,000	6,000,000	149,000	6,149,000
Property, Plant and Equipment, Net, Total	293,700,000	1,483,000	295,183,000	412,500,000	941,000	413,441,000

4.6. Explicit Hypercube, Adding Second Noncore Dimension

In this example we have add a second noncore dimension "Scenario [Axis]" that has a single member "Actual [Member]". What adding this information achieves is that it makes explicit that the information provide within this fragment is "actual" as contrast to "forecasted" information[14].

Component: (Network and Table)

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

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

Period [Axis] | Legal Entity [Axis] | Scenario [Axis]

Property, Plant and Equipment, by Component [Line Items]	2020-12-31			2019-12-31		
	Business Unit Alpha [Member]	Business Unit Bravo [Member]	Consolidated Entity [Member]	Business Unit Alpha [Member]	Business Unit Bravo [Member]	Consolidated Entity [Member]
	Actual [Member]	Actual [Member]	Actual [Member]	Actual [Member]	Actual [Member]	Actual [Member]
Property, Plant and Equipment, Net [Roll Up]						
Land	5,300,000	47,000	5,347,000	1,100,000	47,000	1,147,000
Buildings, Net	244,000,000	508,000	244,508,000	366,000,000	375,000	366,375,000
Furniture and Fixtures, Net	34,400,000	57,000	34,457,000	34,400,000	57,000	34,457,000
Computer Equipment, Net	4,000,000	169,000	4,169,000	5,000,000	313,000	5,313,000
Other Property, Plant and Equipment, Net	6,000,000	702,000	6,702,000	6,000,000	149,000	6,149,000
Property, Plant and Equipment, Net, Total	293,700,000	1,483,000	295,183,000	412,500,000	941,000	413,441,000

[13] Explicit hypercube, adding additional members, including dimensional aggregation example, http://xbrlsite.azurewebsites.net/2020/Examples/Hypercubes/05-ExplicitHypercubeWithAggregation/RollUp-SampleInstance.xml

[14] Explicit hypercube, adding second noncore dimension example, http://xbrlsite.azurewebsites.net/2020/Examples/Hypercubes/06-ExplicitHypercubeWithAggregationTwoAxis/RollUp-SampleInstance.xml

4.7. Summary

Logically, each and every representation shown above is the same except for the fact that the last two representations provide additional detailed facts. But the representation approaches used where each slightly different.

The number one takeaway you should have is a conscious understanding of the differences. Which representation approach to use depends on your reporting situation. All things considered, the following is always good advise and the best practice approach to representing information:

1. Always use explicit uniquely named hypercubes and have every fact reported within at least one hypercube. Both the SEC, ESMA, and XBRL international[15] suggest this approach.
2. Always provide a dimension default for every dimension.
3. Only provide noncore dimensions to the extent that they are helpful in making facts distinguishing from one another.
4. Avoid adding unnecessary, meaningless, or ambiguous hierarchy within your line items concepts or dimensions members.

Note that any additional dimensions or line items can be included within a hypercube and all of these representation patterns apply.

5. Structure Representation Strategy

In this section I help you understand the different structure representation strategies, understand the pros and cons of each, and help you pick structure representation strategy that works best for you for your situation.

There are two fundamental ways to **identify** a structure using a machine-based process:

1. **Using a unique identifier**: Pointing to some unique identifier that provides a "handle" which you can use to "grab" that thing.
2. **Prototype theory**: Looking at the specification or description of some thing and using that specification/description to examine the properties of some set of things to determine if a specific thing is what you are looking for. (i.e. undisputed example)

As an example, one can understand that something is a "chair" by (#1) seeing a label "chair" and identifying that thing as being a chair; or (#2) understanding as many properties as possible about what a "chair" is; looking at the properties of a thing until the "chair" is identified and given no other instance or indicator that there is something better that meets the specification better; you can reliably conclude that what you have found using the properties is likely the chair (or other thing) you have been looking for.

[15] XBRL International Guidance Clarifies Dimensions Semantics, http://xbrl.squarespace.com/journal/2015/3/31/xbrl-international-guidance-clarifies-xbrl-dimensions-semant.html

Using XBRL there are two technical artifacts that can be used to **represent structures**: Networks and Hypercubes. There are two things that drive whether you use a Network and/or Hypercube to define something:

1. Because you have to in order to prevent a technical conflict.
2. Because you want to in order to organize something in a particular way.

Given the two ways to *identify* structures and the two ways to *represent* structures, there seems to be essentially four approaches or strategies for representing structures effectively:

1. **Hypercube as Unique Identifier**: Explicitly define a ***unique hypercube*** to identify each structure.
2. **Network as Unique Identifier**: Explicitly define a ***unique network*** to identify each structure (with all structures using the same hypercube).
3. **Disclosure Specification of Prototype**: Explicitly define a ***specification*** to describe each structure (with neither a hypercube nor a network explicitly describing the structure).
4. **Hypercube as Unique Identifier Plus Disclosure Specification of Prototype**: Explicitly define a structure using ***a unique hypercube and also define a specification*** for each structure.
5. **Network as Unique Identifier Plus Disclosure Specification of Prototype**: Explicitly define a structure using ***a unique network and also define a specification*** for each structure.

There are other approaches that can be used, but the approaches will not work to let you identify the structure or determine if the structure is represented correctly. I will go over the first four approaches that work first; then show you several approaches that do not work in order to contrast approaches that do work and approaches that will not work.

5.1. Hypercube as Unique Identifier

Using this approach, each hypercube is given a unique name and therefore the unique name can be used to identify the structure[16]:

[16] Example of approach 1, Hypercube as Unique Identifier, http://xbrlsite.azurewebsites.net/2020/structure-representation-strategy/Approach1/

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

Unique Hypercube Name

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

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

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

Given that each hypercube is unique and can therefore be used to reliably identify the structure and given that the structure is considered to be an undisputed example of the disclosure, there is no need to provide disclosure mechanics rules because there is enough information in the structure to provide a specification for evaluating if other structures created are consistent with the provided prototype.

5.2. Network as Unique Identifier

Using this approach, every hypercube has exactly the same name and therefore it cannot be used to identify a structure; however, the network has a unique name and therefore it can be used as a unique identifier[17]:

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

Every hypercube the same

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

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

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

Note that this will only work if those creating XBRL instances are required to use the network name from the base taxonomy within their report and/or extension taxonomy. Just like the first case, no disclosure mechanics rules are necessary because the base taxonomy disclosure is a prototype specification and undisputed example and therefore can be used to evaluate reports to see if the disclosure mechanics of a report is consistent with the prototypes provided in the base taxonomy.

[17] Example of approach 2, Network as Unique Identifier, http://xbrlsite.azurewebsites.net/2020/structure-representation-strategy/Approach2/

5.3. Disclosure Specification as Prototype

Using this approach, there is no reliable unique identifier for the hypercube or the network; however, a specification is provided that indicates the characteristics of a disclosure and provides a unique name for each disclosure[18]:

Component: (Network and Table)	
Network	**02-Comprehensive Income** (http://www.xbrlsite.com/sfac6/role/ComprehensiveIncome)
Table	(Implied)

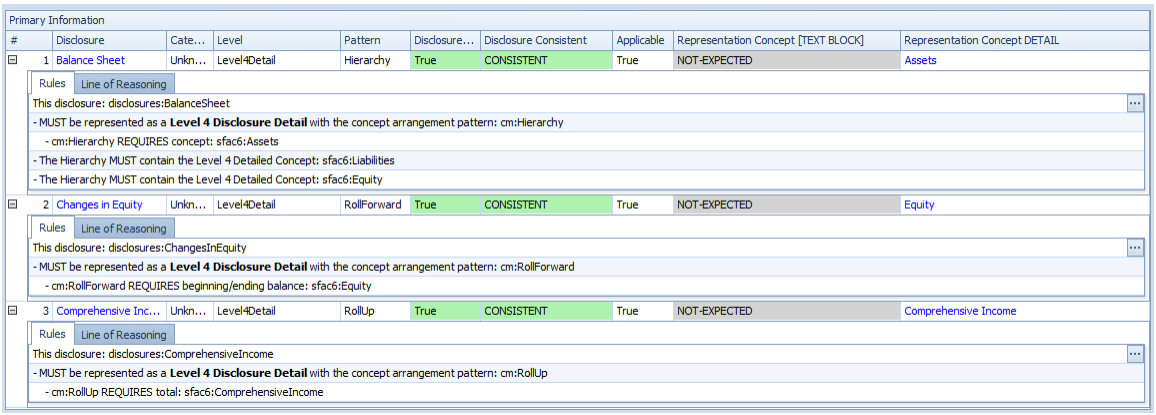
No reliable identifier

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

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

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

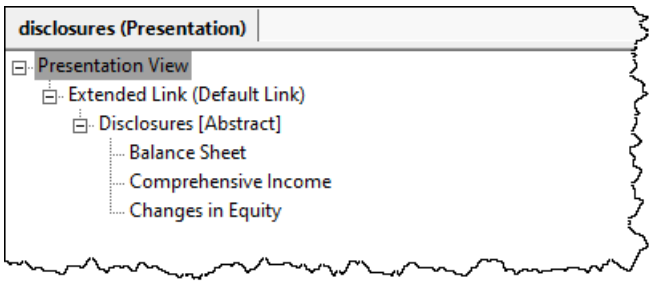
Even though there are no unique names for either hypercubes or networks, the disclosure can be identified using a specification of the disclosure mechanics rules and a list of uniquely named disclosures:



In order to uniquely identify and be able to refer to each structure, a unique disclosure name must be created otherwise there is no way to refer to a disclosure because there are no unique network names or hypercube names that can be referred to. In this case, a separate XBRL taxonomy schema[19] is created to name disclosures. This can be done as part of the creation of a base taxonomy or supplemental to the base taxonomy after it has been created:

[18] Approach 3, Disclosure Specification as Prototype, http://xbrlsite.azurewebsites.net/2020/structure-representation-strategy/Approach3/

[19] XBRL taxonomy schema with uniquely named disclosures, http://xbrlsite.azurewebsites.net/2020/structure-representation-strategy/Approach3/disclosures.xsd



5.4. Hypercube as Unique Identifier Plus Disclosure Specification of Prototype

Using this approach is essentially a combination of approach #1 and approach #3 so you have both unique hypercubes that can be used to identify structures and the disclosures they represent and specifications that describe the disclosures[20]:

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

Every hypercube is unique

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

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

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

You see above that the comprehensive income statement[21] can be reliably identified using the hypercube used to represent that structure. The same is true for the balance sheet structure[22] and changes in equity structure[23].

As can be seen per the disclosure mechanics rules, the unique hypercube name is used to help identify the disclosure in the disclosure mechanics rules. In addition, there is information such as the information model (i.e. roll up, roll forward), the total concept of the roll up or instance concept of a roll forward, or other information that is useful in specifying or identifying a structure which represents some specific disclosure.

---

[20] Approach 4, Hypercube as Unique Identifier Plus Disclosure Specification of Prototype, http://xbrlsite.azurewebsites.net/2020/structure-representation-strategy/Approach4/

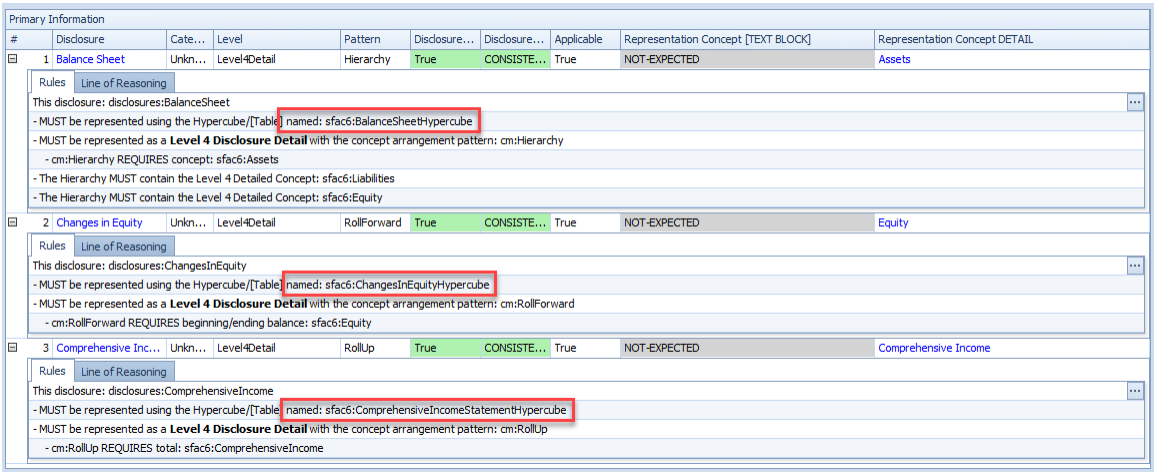
[21] Human readable, comprehensive income, http://xbrlsite.azurewebsites.net/2020/structure-representation-strategy/Approach4/evidence-package/contents/index.html#Rendering-ComprehensiveIncome-sfac6_ComprehensiveIncomeStatementHypercube.html

[22] Human readable, balance sheet, http://xbrlsite.azurewebsites.net/2020/structure-representation-strategy/Approach4/evidence-package/contents/index.html#Rendering-BalanceSheet-sfac6_BalanceSheetHypercube.html

[23] Human readable, changes in equity structure, http://xbrlsite.azurewebsites.net/2020/structure-representation-strategy/Approach4/evidence-package/contents/index.html#Rendering-ChangesInEquity-sfac6_ChangesInEquityHypercube.html

However, if you either (a) remove all information other than the name of the hypercube or (b) us only the name of the hypercube; you get the same result.

Note that in approach #3's disclosure mechanics rules hypercubes are not used.



As such, providing both a unique hypercube plus the disclosure mechanics rules seems redundant or overkill. However, this is only the case if the base taxonomy structures can be used as undisputed examples of a specification of a disclosure.

5.5. Network as Unique Identifier Plus Disclosure Specification of Prototype

Using this approach is essentially a combination of approach #2 and approach #3 so you have both unique hypercubes that can be used to identify structures and the disclosures they represent and specifications that describe the disclosures[24]:

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

Every hypercube the same

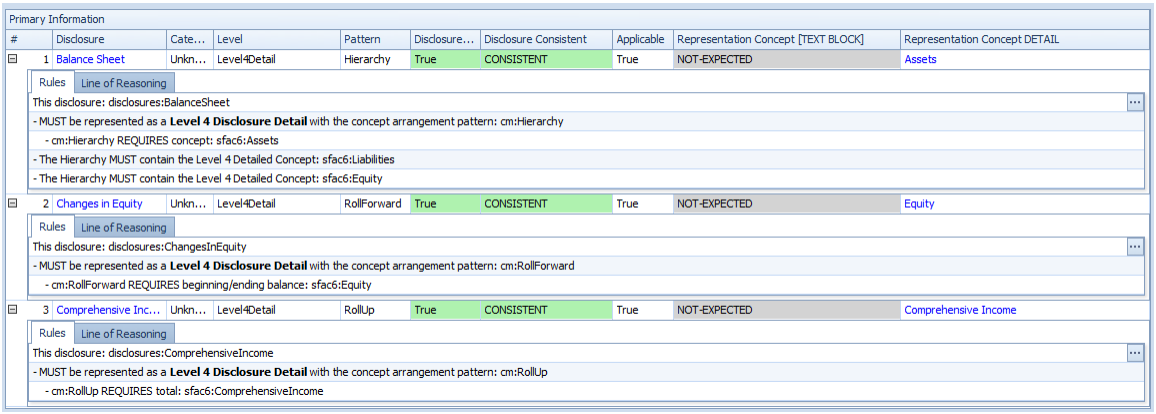
Slicers (applies to each fact value in each table cell)

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

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

[24] Approach 5, Network as Unique Identifier Plus Disclosure Specification of Prototype, http://xbrlsite.azurewebsites.net/2020/structure-representation-strategy/Approach5/

In addition to the unique network identifier, disclosure mechanics rules are provided however in this case the disclosure mechanics rules do not leverage the unique network identifier to identify the disclosure that the structure is representing[25]:



As such, providing both a uniquely identifiable structure plus the disclosure mechanics rules in order to identify the disclosure appears redundant or overkill. However, this is can only be the case if (a) networks from the base taxonomy are used in reports and (b) the base taxonomy can be views as an undisputed example of the disclosure.

5.6. Pathological Example Provided for Contrast

Note that this is a pathological example provided for contrast and not considered a viable approach to representing structures that are used to provide disclosures within an XBRL-based report. Note the following structure[26]:

Component: (Network and Table)	
Network	**02-Comprehensive Income** (http://www.xbrlsite.com/sfac6/role/ComprehensiveIncome)
Table	(Implied)

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

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

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

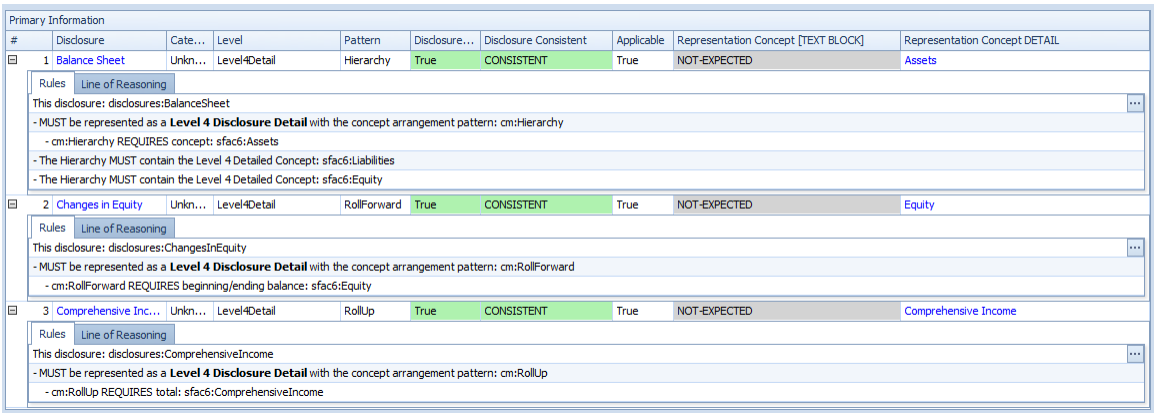
Assume that the reporting economic entity created their own network identifiers similar to XBRL-based financial statements submitted to the SEC.

[25] Disclosure mechanics rules validation result, http://xbrlsite.azurewebsites.net/2020/structure-representation-strategy/Approach5/DisclosureMechanicsRulesValidationResults.jpg

[26] Approach 6, Pathological Example Provided for Contrast, http://xbrlsite.azurewebsites.net/2020/structure-representation-strategy/Approach6/

How exactly would you refer to this structure within an XBRL-based digital financial report? Note that the network identifier would be unique for a reporting economic entity, but every economic entity would provide a different unique network identifier for this or any other structure. Further, there is no hypercube at all and so that cannot be leveraged to identify the structure. If the reporting economic entity used an extension hypercube, that would not be helpful in identifying the structure.

Suppose you wanted to write rules that specify what each of the three disclosures looked like in order to control a machine-based process; the balance sheet, comprehensive income, and changes in equity. Suppose you wanted to, say, create the rules below:



Note that the rules above refer to a disclosure: "disclosures:BalanceSheet", "disclosures:ChangesInEquity", "disclosures:ComprehensiveIncome". But you have nothing of the sort to refer to in this pathological example, it has not been defined.

6. Compare and Contrast

This document compares and contrasts ten XBRL-based financial statements which contain exactly the same financial report logic but where represented within the XBRL technical syntax using different approaches.

Each of the technical syntax approaches is completely valid, and pass XBRL technical syntax validation per any fully compliant XBRL processor. Further, the logic of the reported financial information is exactly the same in each of the ten financial statements.

What is different is the approach used to represent the financial logic within the XBRL technical syntax.

By understanding and studying the similarities and differences between these ten representations one can better understand good practices, best practices, and poor practices for representing financial logic within an XBRL-based financial statement.

To help explain the details which will be explained in this document and to keep that explanation as easy as possible; XBRL-based reports that are both very sophisticated by as small as possible are utilized. As far as the author knows, 100% of the possible logic that is representable within XBRL is covered by these examples.

6.1. Brief Overview of Examples

The following is a very brief overview of the example XBRL-based reports that will be compared and contrasted. Complete versions of each of these reports is provided in several different forms. Note that the actual names of each example are meaningless and provide only enough to be able to understand what example I am looking at.

1. **PROOF-Master**[27]: This is the baseline. This has pretty much all the logical complexity that anyone creating an XBRL-based digital financial statement would every have to get their heads around and deal with. Information is represented very consistently and with one explicit hypercube within a network.
2. **PROOF-Alternative1**[28]: This takes the baseline (the Master) and reorganizes the blocks of information differently within the XBRL networks and hypercubes. As many networks were removed as possible. This has one subtle issue; the first hypercube has many hypercubes but no "root" to organize those hypercubes.
3. **PROOF-Alternative2**[29]: This is exactly the same as Alternative1, except if you look in the first network, there is now a "root" or "container" that is used to organize the many hypercubes in the first network.
4. **PROOF-Hypercubes2**[30]: This is exactly the same as the Master or baseline, except that rather than giving hypercubes unique names, every hypercube is expressed using one standard hypercube named "Standard [Hypercube]".
5. **PROOF-Hypercubes3**[31]: This is exactly the same as Hypercube2 except that both "Standard [Hypercube]" and "Hypercube [Line Items]" are used.
6. **PROOF-Implied**[32]: This is exactly the same as the Master or baseline except that explicit hypercubes where only used when they are required because noncore dimensions must be used to represent a financial disclosure.
7. **PROOF-Dimensions**[33]: This is exactly the same as the Master or baseline except that every hypercube explicitly defines every dimension used anywhere in the financial statement.

---

[27] PROOF-Master, http://www.xbrlsite.com/seattlemethod/platinum-testcases/proof-master/index.html
[28] PROOF-Alternative1, http://www.xbrlsite.com/seattlemethod/platinum-testcases/proof-alternative1/index.html
[29] PROOF-Alternative2, http://www.xbrlsite.com/seattlemethod/platinum-testcases/proof-alternative2/index.html
[30] PROOF-Hypercube2, http://www.xbrlsite.com/site1/seattlemethod/platinum-testcases/proof-hypercubes2/index.html
[31] PROOF-Hypercube3, http://www.xbrlsite.com/site1/seattlemethod/platinum-testcases/proof-hypercubes3/index.html
[32] PROOF-Implied, http://www.xbrlsite.com/seattlemethod/platinum-testcases/proof-implied/index.html
[33] PROOF-Dimensions, http://www.xbrlsite.com/seattlemethod/platinum-testcases/proof-dimensions/index.html

8. **PROOF-Blocks**[34]: This is exactly the same as the Master or baseline except that every possible [Abstract] report element, used to organize the presentation relations, was removed.
9. **PROOF-Sparse**[35]: This is exactly the same as the Alternative2 except that a hypercube that represents a segment breakdown is intermingled with multiple other blocks of information causing a "sparse" hypercube as a result (i.e. a hypercube with a lot of blank facts because of a non-best practices use of hypercubes).
10. **PROOF-Proper**[36]: This is very similar to the Master or baseline except that duplicate hypercubes where made unique and other issues were fixed.

All the examples can be viewed online in various forms, downloaded for further inspection, loaded into the XBRL software application of your choice.

[34] PROOF-Blocks, http://www.xbrlsite.com/seattlemethod/platinum-testcases/proof-blocks/index.html
[35] PROOF-Sparse, http://www.xbrlsite.com/seattlemethod/platinum-testcases/proof-sparse/index.html
[36] PROOF-Proper, http://www.xbrlsite.com/seattlemethod/platinum-testcases/proof-proper/index.html

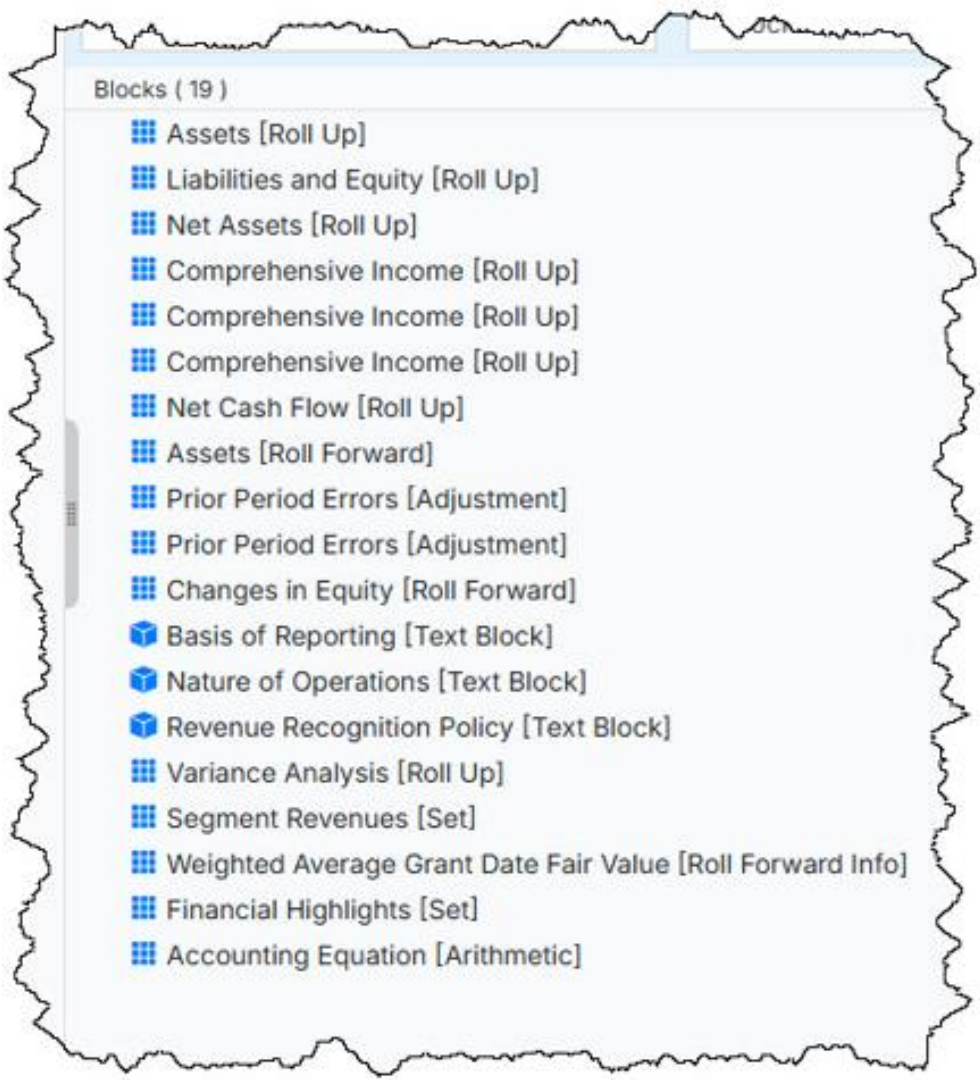
7. Comparing and Contrasting Examples

In this section, each example is explained and compared/contrasted to another example and the incremental change between the two examples is discussed.

Each of the individual representations in XBRL provides exactly the same logical information in terms of the blocks and disclosures of financial logic provided.

Within each of the ten reports there are exactly 19 identifiable[37] blocks of information. There blocks of information can be identified using software-based processes. Every piece of information conveyed by an XBRL-based report must exist within a block of information, which exists within a hypercube (explicitly defined or implied), which exists within a network.

These are the **blocks of information**, 19 of them, which exist in each of the ten XBRL-based representations:

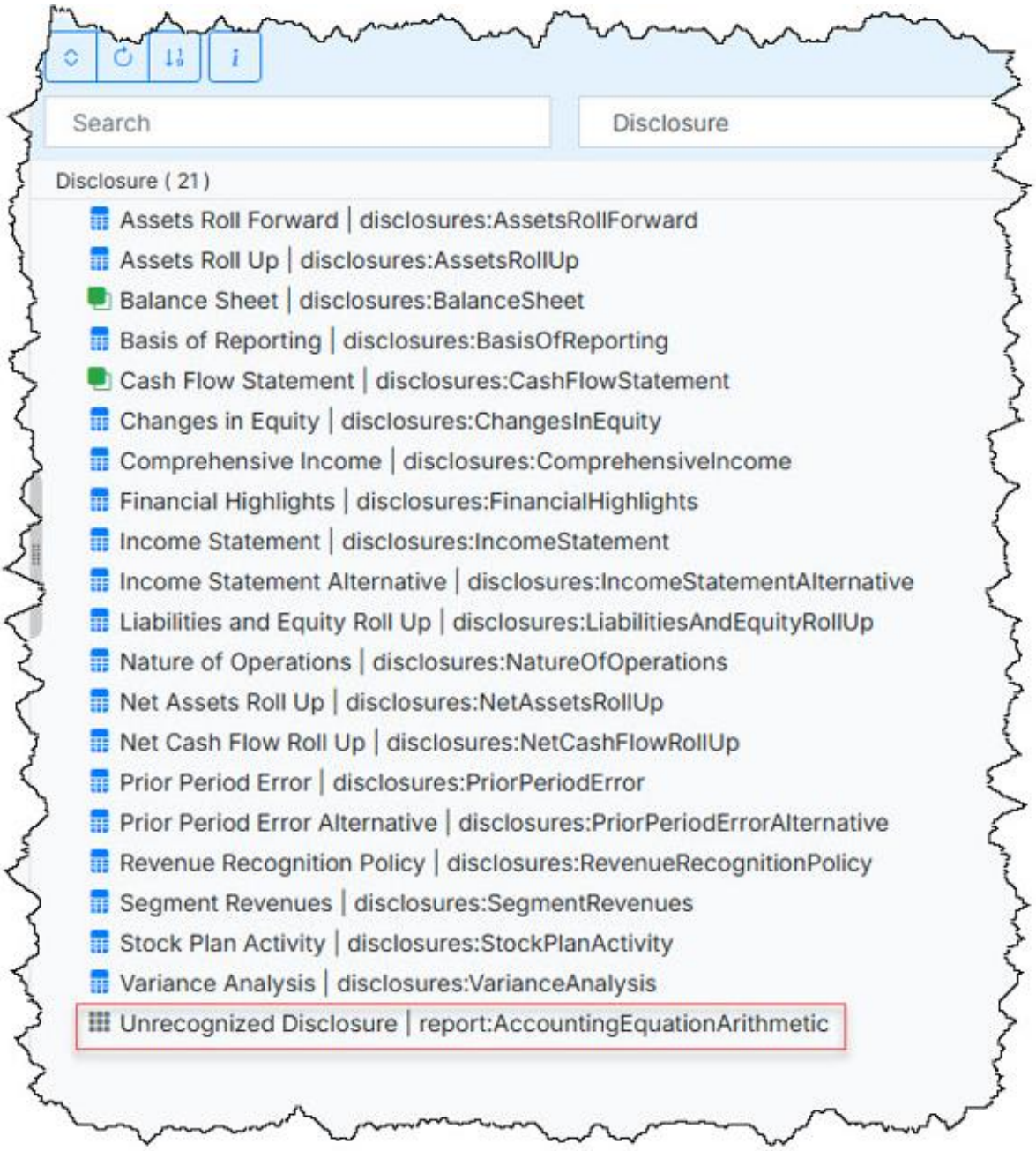


[37] *Information Model Identification*, http://www.xbrlsite.com/mastering/InformationModelIdentification.pdf

Every block of information is identifiable as one or more of the information logic patterns. The organization of members of a dimension has logic patterns and the organization of the concepts and abstracts within a set of LineItems has logic patterns.

In addition, if (a) information is provided within a base XBRL taxonomy, (b) by a supplemental XBRL taxonomy; then every block of information can be further identified as being a specific disclosure.

The following are the disclosures which are contained within each of the ten example representations:



A disclosure is defined simply as something that is disclosed within a report, be that disclosure part of the primary financial statements, part of the policies, or part of the disclosure notes of a financial statement.

Note that there are 21 disclosures but only 19 information blocks. This is because the Balance Sheet disclosure is made up of two information blocks (Assets [Roll Up] and Liabilities and Equity [Roll Up] and the Cash Flow Statement disclosure is likewise made up of two information blocks (Net Cash Flow [Roll Up] and Assets [Roll Forward]). Basically, the Balance Sheet disclosure and Cash Flow Statement Disclosure information blocks appear twice; both separately and as combined.

Effectively, those blocks of information and disclosures are organized differently within each of the ten examples. All information is organized within networks; individual representation could put the blocks of information within one network or within some other network. All information could be in one hypercube, in another hypercube, or in implied hypercubes if no noncore dimensions are used in the representation. Noncore dimensions may, or may not, be provided where they are not necessarily required to be provided. Abstract concepts used to organize the report model may, or may not be provided when there is an alternative. Names of hypercubes may be the same or be different. The name of the [Line Items] type of report elements may, or may not, be the same.

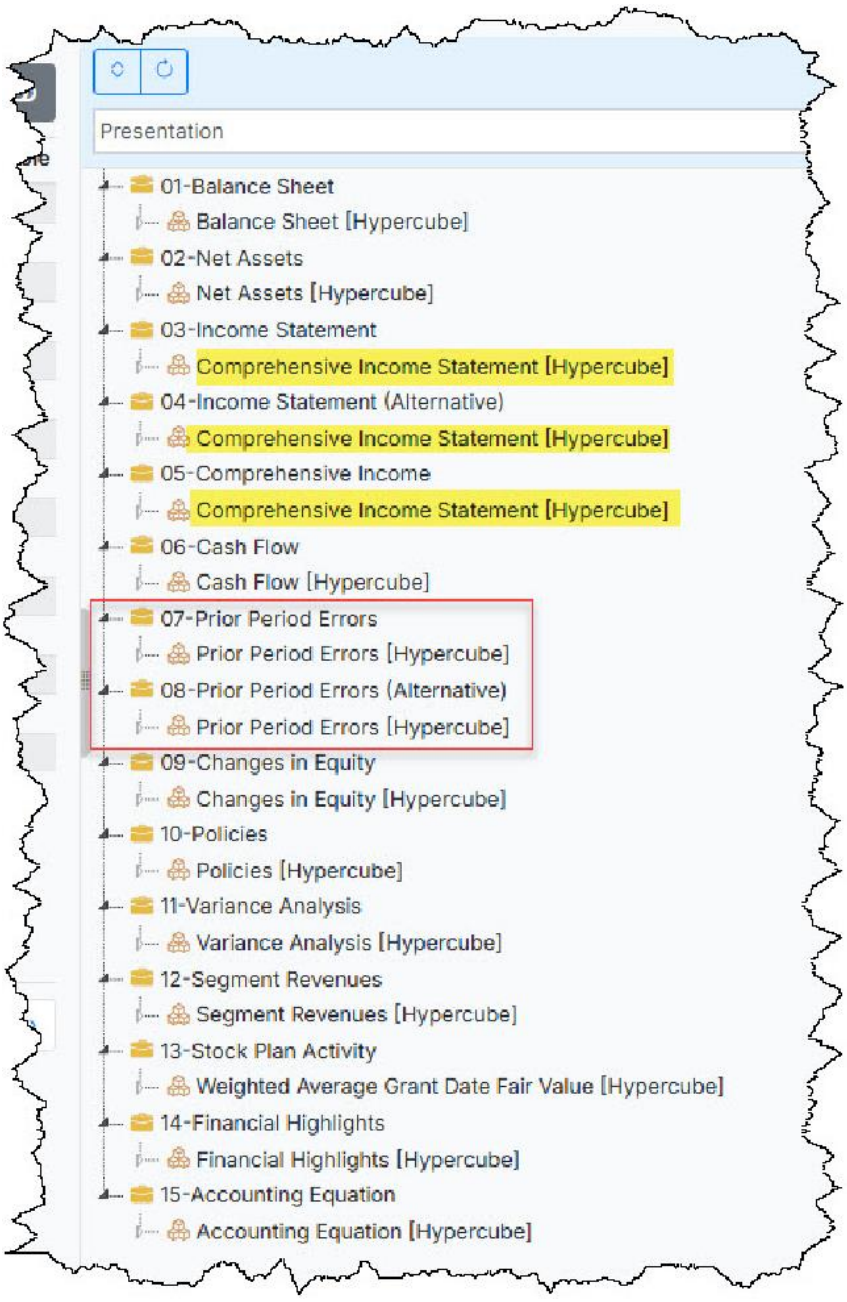
All this will be shown and explained in each of the ten examples which we will get into now.

7.1. PROOF-Master

This is the baseline. This is effectively my PROOF[38] which is used in testing software, testing and experimenting representing information within an XBRL-based report to make sure it acts correctly and interacts with other representations correctly.

This has pretty much all the logical complexity that anyone creating an XBRL-based digital financial statement would every have to get their heads around and deal with. Information is represented very consistently and with one explicit hypercube within a network. The PROOF is intentionally not perfect because it has to represent how reports are actually being created in the real world. However, the PROOF does need to be complete, consistent, and precise. The following graph provides the networks and hypercubes defined within the PROOF-Master:

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



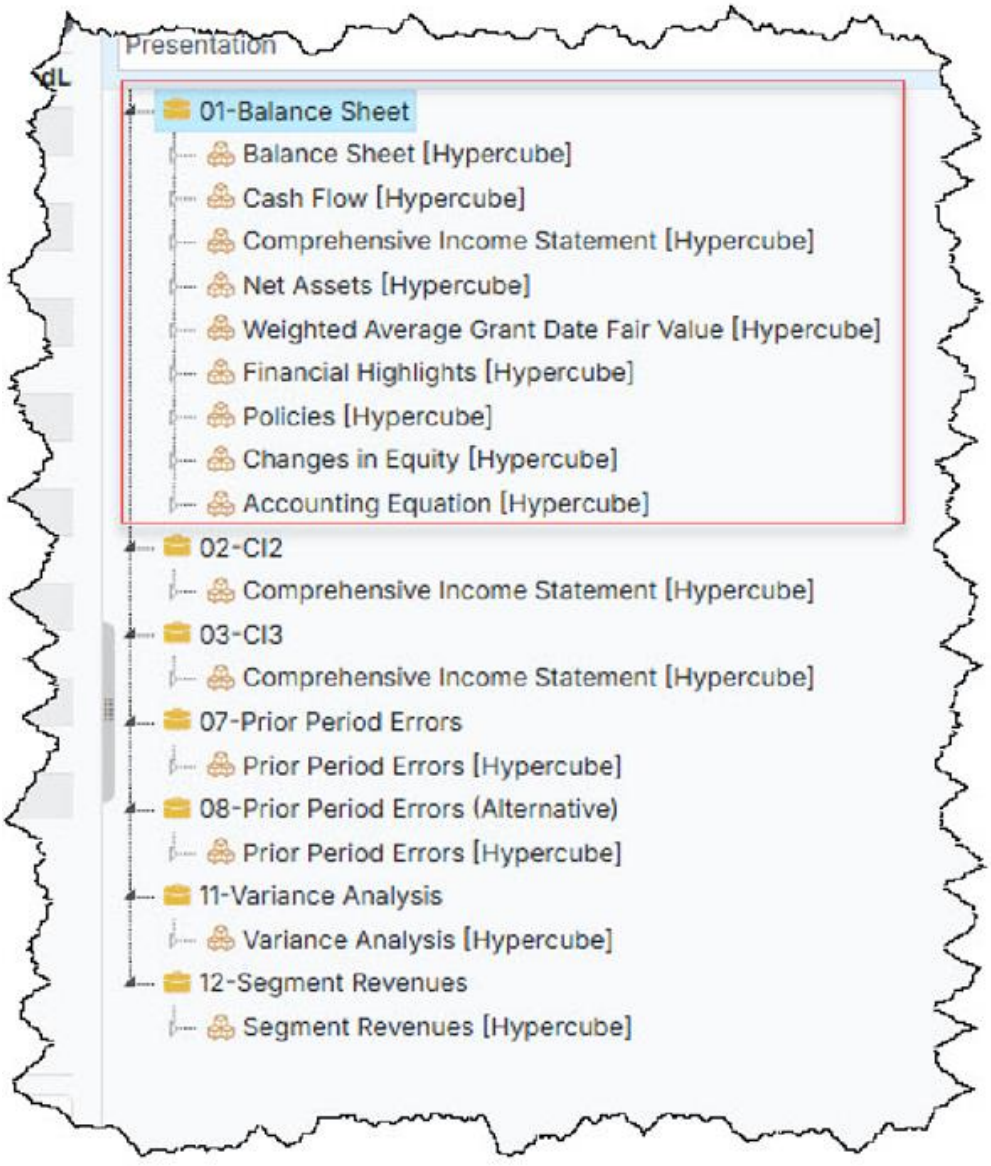
Notice that some information is being represented using the same hypercube, "Comprehensive Income Statement [Hypercube]" and "Prior Period Errors [Hypercube]". Notice that it is hard to know exactly what block of information exists within the hypercubes that have the same name. If you compare the PROOF-Master graphic with the PROOF-Proper graphic which fixes that use of the same hypercube name to represent different information blocks, you can see the pros and cons of polymorphic hypercube as contrast to isomorphic hypercubes.

Identifying specific information in a report is easier if isomorphic hypercubes are used, meaning every hypercube name is used to represent a unique information artifact.

7.2. PROOF-Alternative1

This example takes the baseline (the Master) and reorganizes the blocks of information differently within the XBRL networks and hypercubes. As many networks were removed as possible. This has one subtle issue; the first hypercube has many hypercubes but no "root" to organize those hypercubes.

Note that there are now only seven networks, rather than 15 in PROOF-Master, because a number of hypercubes were modeled within the same network as contrast to being represented in their own network.



Note that again, there are 15 hypercubes. That this example shows that it is very possible to represent some hypercubes in different networks; however, in other cases is would be impossible to combined certain specific hypercubes because conflicts would occur between hypercube information. In other cases it is impossible to combined certain specific hypercubes in the same network because things like XBRL calculation

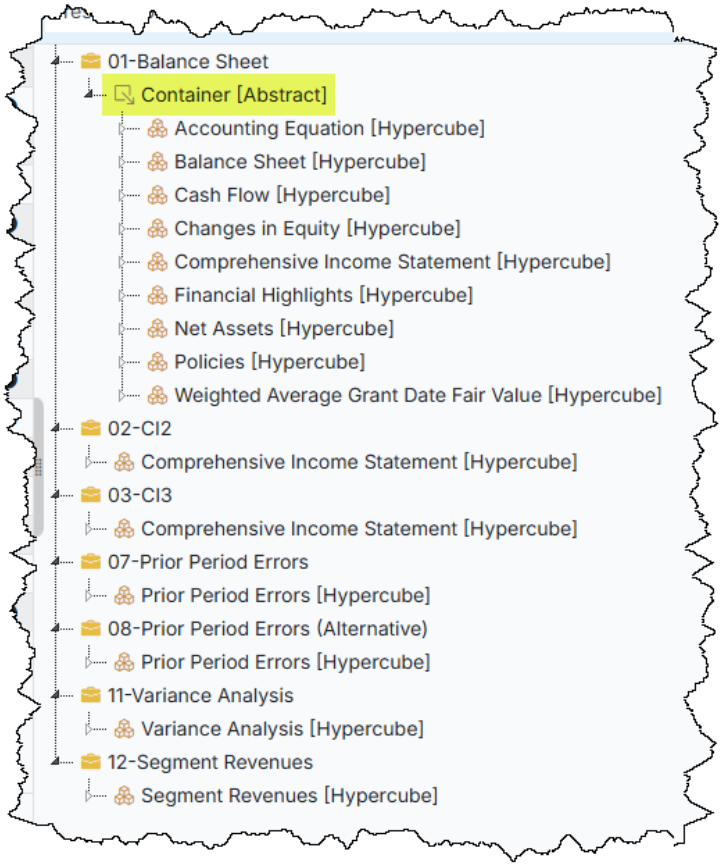
relation rules would cause conflicts even though there would be no conflict between the dimensional information.

There is one issue with the PROOF-Alternative1 representation which will be shown by using the PROOF-Alternative2 representation. Note that the first network has no way to organize the nine hypercubes that exist within that first network. The order of the hypercubes is arbitrary.

7.3. PROOF-Alternative2

This example is exactly the same as Alternative1, except that if you look in the first network in this example, there is now a "root" or "container" that is used to organize the many hypercubes in the first network.

Here you see the concept "Container [Abstract]" whose sole purpose is to enable the nine hypercubes within the "01-Balance Sheet" network to be put into a desired specific order:

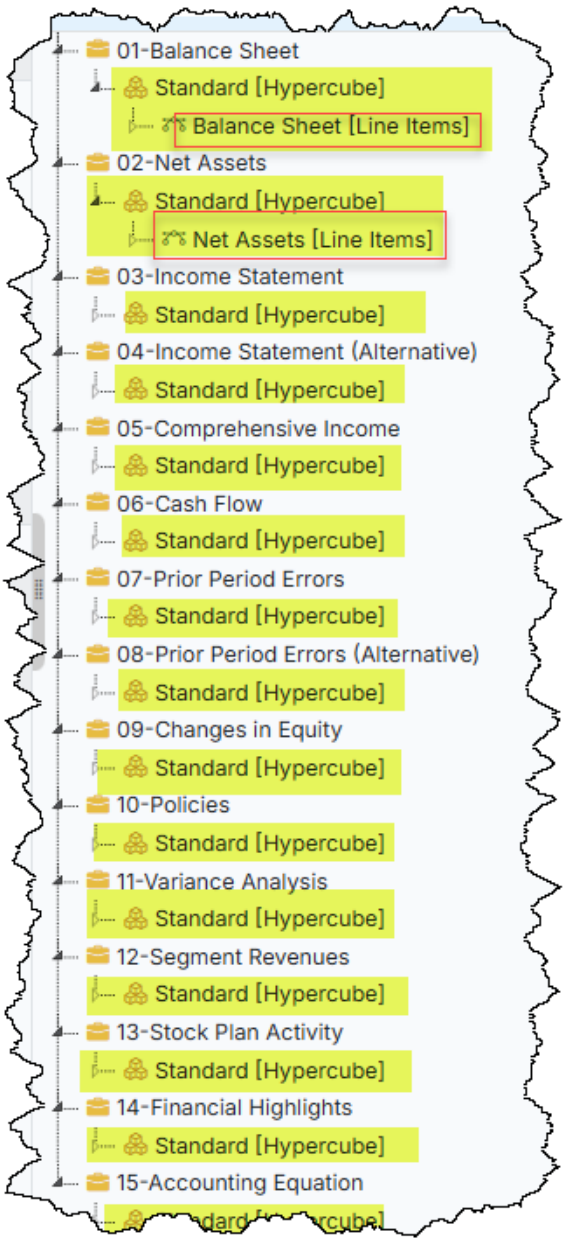


Nothing else is different. There are three key points here. First, it is very possible to put multiple hypercubes into the same network. Second, it is not possible to put any hypercube into any network; sometimes you are constrained by the type of information represented within a hypercube as to what For example, XBRL calculation relations and XBRL Dimensions work via completely different sets of rules. Hypercubes do not constrain XBRL calculation relations; networks do. Also how information is rendered for human readable consumption and how those renderings are shown within software applications is also a consideration.

This brings up a consideration: what exactly would be the reasoning behind not having one hypercube per network? What advantage is there. There is an advantage to consistently having one network contain one hypercube; consistency. With one network containing one hypercube conflicts can be avoided.

7.4. PROOF-Hypercubes2

This example is exactly the same as the Master or baseline, except that in this example rather than giving hypercubes unique names; every hypercube is expressed using one standard hypercube named "Standard [Hypercube]".



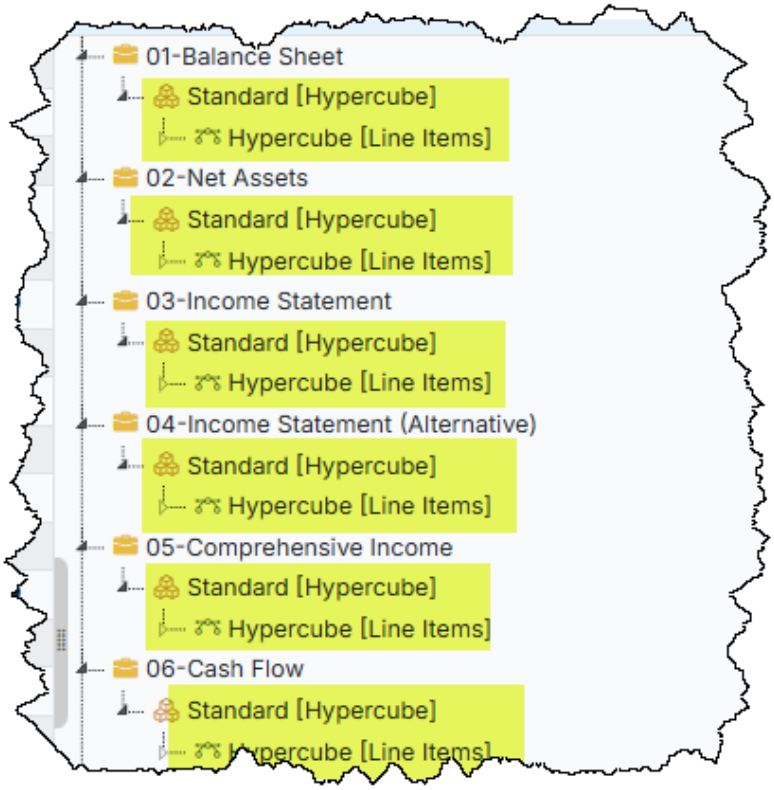
This approach has advantages and consequences. One advantage is that those creating hypercubes do not have to think of a name for the hypercube. But that brings

a disadvantage in the fact that software cannot use the hypercube name as an identifier to, say, extract information from a report. It is still possible to extract information from a report by hypercube; but an additional step is necessary to identify the information you want to extract using prototype theory.

Another advantage is that this basically requires that there be a one-to-one relationship between a network and a hypercube.

7.5. PROOF-Hypercubes3

This is exactly the same as Hypercube2 except that both "Standard [Hypercube]" and "Hypercube [Line Items]" are used.



There is really little difference between PROOF-Hypercubes2 and PROOF-Hypercubes3 except the naming/labeling of the [Line Items] report element of each hypercube. If you give each hypercube the same standard name/label "Standard [Hypercube]" then what does giving the [Line Items] different names/labels get you? Does not seem like much if anything at all.

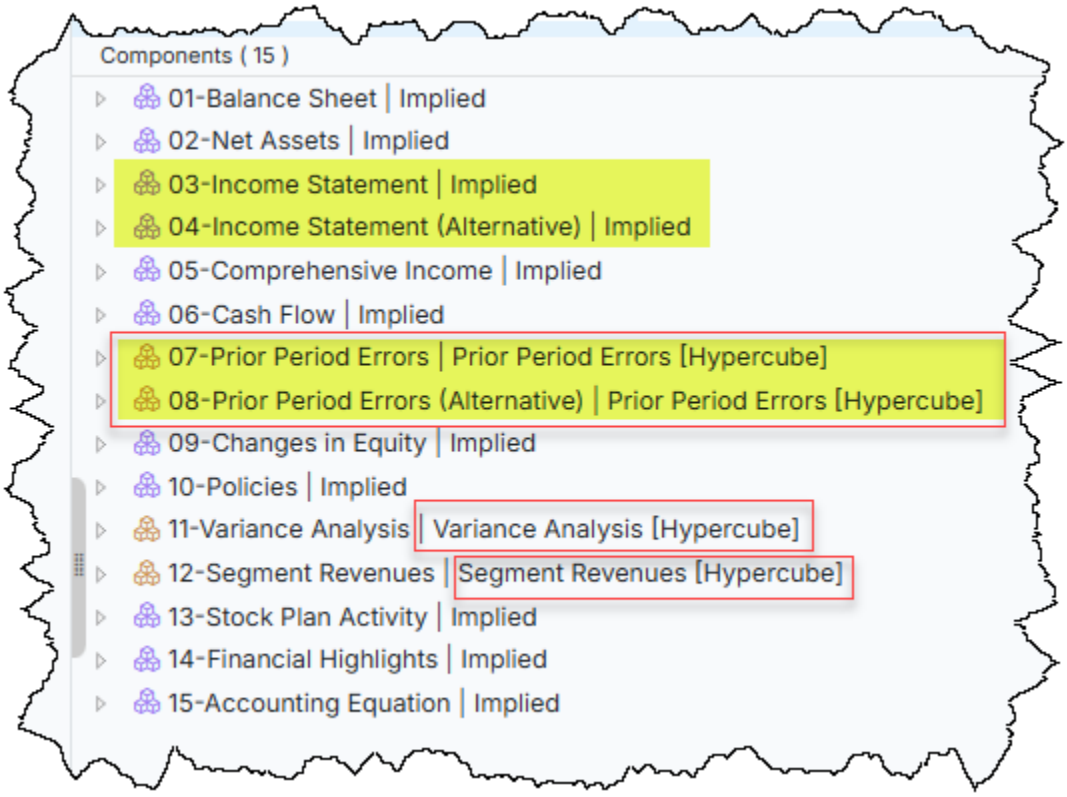
However, like naming/labeling the hypercube buys you not having to come up with those names/labels; the same reasoning can be used to conclude that using a standard identifier for the [Line Items] such as "Hypercube [Line Items]" saves work when creating an XBRL taxonomy.

Another consequence is that it is an even firmer requirement that each hypercube be within its own network because it is literally impossible to model individual hypercubes in the same network because there would be conflicts when modeling the details of each different "Hypercube [Line Items]" container.

Using "Hypercube [Line Items]" makes sense to use on uniquely named/labeled hypercubes also such as in PROOF-Master or PROOF-Alternative1 or PROOF-Alternative2. The [Line Items] of a hypercube actually act somewhat as a dimension. Also, a hypercube can only have exactly one set of [Line Items].

7.6. PROOF-Implied

This example is exactly the same as the Master or baseline example except that explicit hypercubes where only used when they are required because noncore dimensions must be used to represent the information contained in a financial disclosure.



Above you see the "Components" view of the structures of a report. Remember that a Component is a network plus a hypercube. You need the notion of a component in order to be able to distinguish hypercubes that use the same name/label as an identifier for the hypercube. For example, note "Prior Period Errors [Hypercube]" being used above in the networks with the numbers 07 and 08. You can only tell the difference between the two because of the network information provided along with the information about the hypercube.

An "implied [Hypercube]" is the idea that every network is itself a hypercube after excluding all other information from the network contained within other hypercubes within that network.

Saying this another way; a network can contain information represented within one or more hypercubes; plus, in can also contain information not represented within any hypercube. All information represented within a network that is not represented within some other explicitly defined hypercube exists in the notion of an "Implied [Hypercube]" that exists virtually (i.e. it does not physically exist).

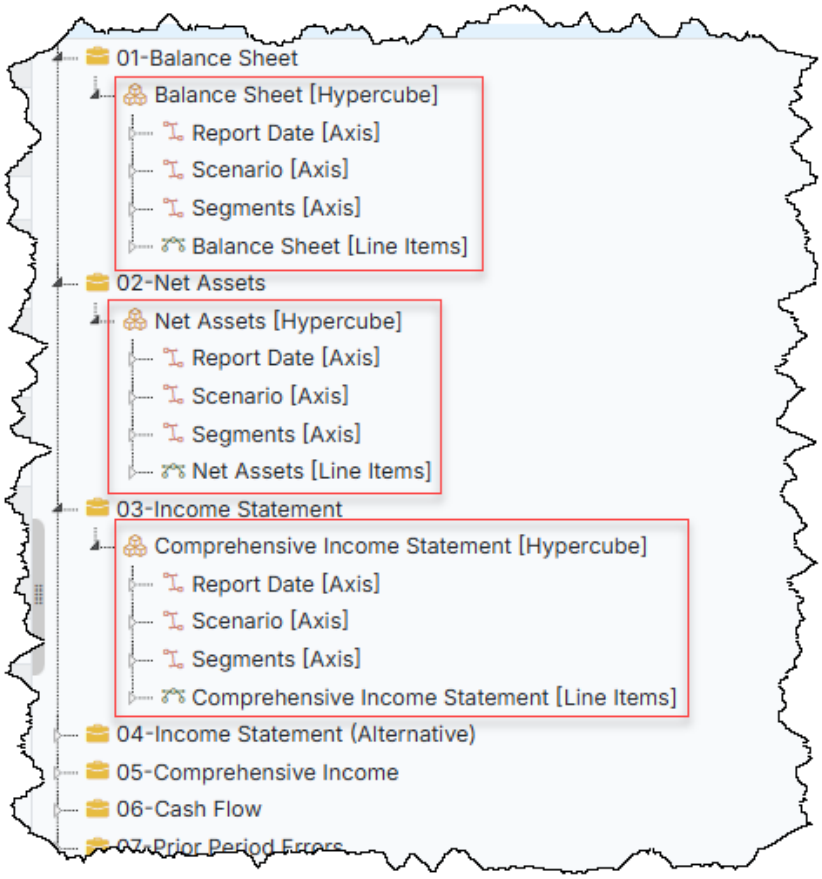
Why can't all hypercubes be implied? This is impossible because in order to add additional noncore dimensions requires that an explicitly defined hypercube be created and then used to represent the additional noncore dimensions within that hypercube.

An "Implied [Hypercube]" can only have core dimensions within that hypercube. Someone creating an XBRL taxonomy can never assign additional noncore dimensions to an "Implied [Hypercube]".

Again, the notion of a "Component" and of "Implied [Hypercube]" do not exist within the XBRL technical specification. They are useful ideas that help one discuss and work with things that are unexplained by XBRL.

7.7. PROOF-Dimensions

This example is exactly the same as the Master or baseline example except that every hypercube is explicitly defined (i.e. there are no implied hypercubes) and in addition every dimension is likewise explicitly defined (i.e. if a dimension was used anywhere, it will be explicitly shown everywhere).



There are two points being made here. First, per the rules of XBRL Dimensions; every dimension default is global in nature and exists on every fact in a report. This is true no matter which hypercube you are looking at and it also is true for facts that exist within no hypercube (i.e. within an implied hypercube).

Second, sometimes those assigning dimensions to hypercubes in a model have the belief that dimensions in a report model assign properties to facts.

Report models should not define properties for facts; base XBRL taxonomies should define properties. Why? If report models were to define properties than different report models could define different properties.

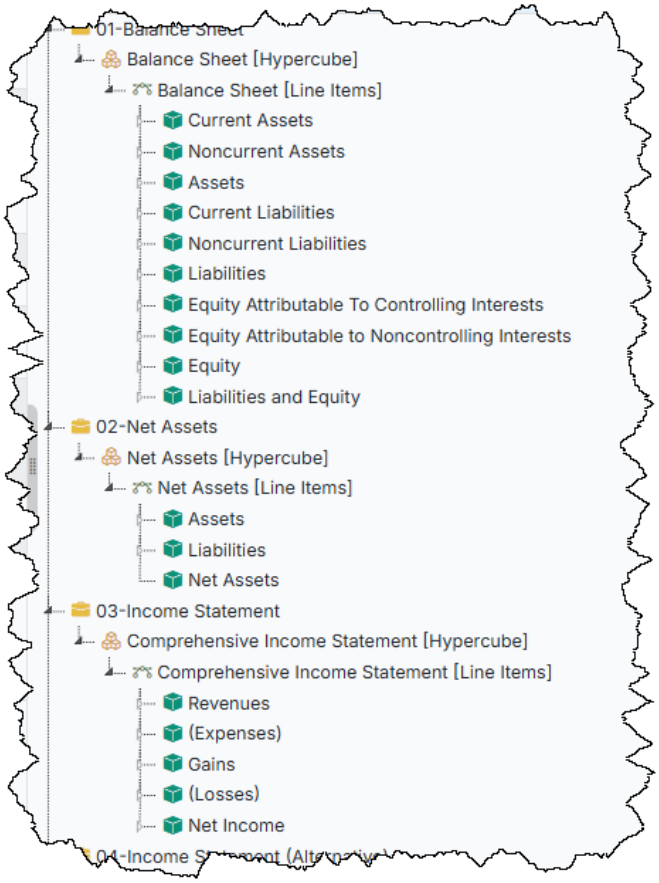
Report models should define properties for extension concepts defined for a report model. Or, report models should "anchor" extension concepts to a base taxonomy and then inherit properties from the anchor point within a base taxonomy.

When to define dimensions for a hypercube within a report model is currently unclear and ambiguous. When dimensions should be provided and exactly what is meant when dimensions are provided should be consistent for every reporting economic entity.

It would be very hard to argue that the PROOF-Dimensions representation and the PROOF-Master and even the PROOF-Implied have different meaning. If there are differences in meaning, then obviously it should be possible to precisely explain those differences.

7.8. PROOF-Blocks

This example is exactly the same as the Master or baseline example except that every possible [Abstract] report element, used to organize the XBRL presentation relations, was removed from the model.



It is easer to see the differences when looking at the human readable rendering generated from the XBRL based information provided within the report model. Here

is the human rendering of the first network and hypercube of the PROOF-Blocks example:

Concept [Aspect]	Period [Aspect]	
	2023-12-31	2022-12-31
Current Assets	500	0
Noncurrent Assets	3000	0
Assets	✓ 3500	✓ 0
Current Liabilities	0	0
Noncurrent Liabilities	0	0
Liabilities	✓ 0	✓ 0
Equity Attributable To Controlling Interests	3000	0
Equity Attributable to Noncontrolling Interests	500	0
Equity	✓ 3500	✓ 0
Liabilities and Equity	✓ 3500	✓ 0

For contrast, here is exactly the same rendering for the PROOF-Master which does contain the abstract report elements which were removed from the PROOF-Blocks representation shown above:

Concept [Aspect]	Period [Aspect]	
	2023-12-31	2022-12-31
Assets [Roll Up]		
Current Assets	500	0
Noncurrent Assets	3000	0
Assets	✓ 3500	✓ 0
Liabilities and Equity [Roll Up]		
Liabilities [Roll Up]		
Current Liabilities	0	0
Noncurrent Liabilities	0	0
Liabilities	✓ 0	✓ 0
Equity [Roll Up]		
Equity Attributable To Controlling Interests	3000	0
Equity Attributable to Noncontrolling Interests	500	0
Equity	✓ 3500	✓ 0
Liabilities and Equity	✓ 3500	✓ 0

Notice the four abstract report elements shown in bold in the second human readable rendering (PROOF-Master) that do not exist in the first human readable rendering (PROOF-Blocks).

Arguably, both human readable representations are very logical and easy to read. If you look at each of the human readable renderings of the PROOF-Blocks which have

the abstract report elements removed, you can see that each of the human readable representations are readable and understandable.

So, what is the purpose of the abstract report elements? Well, I think that one could also agree that the abstract elements in the second human readable rendering do add a bit more clarity to the representation. The abstract report elements provided certainly don't hurt anything. They serve as logical containers that make the information just a little bit easier to read.

The primary point though is that the information conveyed is exactly the same whether the abstract report elements exist or whether they do not exist. The abstract report elements do not impact the meaning of what is reported, only, perhaps, the presentation of what is presented.

7.9. PROOF-Sparse

This example is exactly the same as the Alternative2 except that in this example a hypercube that represents a segment breakdown is intermingled with multiple other blocks of information causing a "sparse" hypercube as a result (i.e. a hypercube with a lot of blank facts because of a non-best practices use of hypercubes).

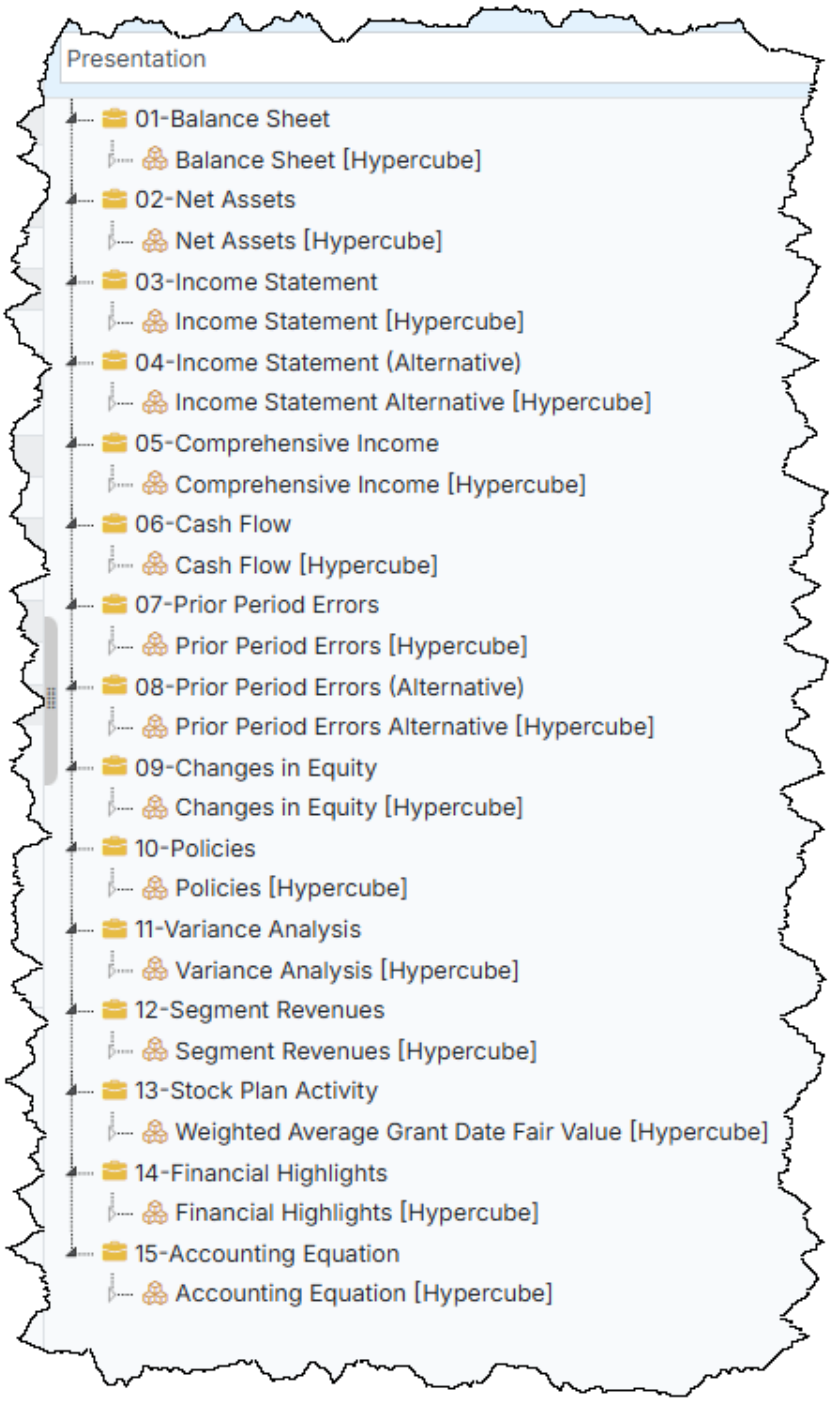
Concept [Aspect]	Units	Period [Aspect]			
		2023-01-01 | 2023-12-31			
		Segments [Axis]			
		Segment Alpha [Member]	Segment Bravo [Member]	Segment Charlie [Member]	All Segments [Member]
Assets [Roll Up]					
Current Assets	iso4217:USD				$ 500
Noncurrent Assets	iso4217:USD				3,000
Assets	iso4217:USD				3,500
Liabilities and Equity [Roll Up]					
Liabilities [Roll Up]					
Current Liabilities	iso4217:USD				$ 0
Noncurrent Liabilities	iso4217:USD				0
Liabilities	iso4217:USD				0
Equity [Roll Up]					
Equity Attributable To Controlling Interests	iso4217:USD				3,000
Equity Attributable to Noncontrolling Interests	iso4217:USD				500
Equity	iso4217:USD				3,500
Liabilities and Equity	iso4217:USD				$ 3,500
Comprehensive Income [Roll Up]					
Revenues	iso4217:USD	$ 1,000	$ 4,000	$ 2,000	$ 7,000
(Expenses)	iso4217:USD				(3,000)
Gains	iso4217:USD				1,000
(Losses)	iso4217:USD				(2,000)
Net Income	iso4217:USD				$ 3,000
Net Assets [Roll Up]					
Assets	iso4217:USD				3,500
Liabilities	iso4217:USD				0
Net Assets	iso4217:USD				$ 3,500
Net Cash Flow [Roll Up]					
Net Cash Flow Operating Activities	iso4217:USD				$ 1,500
Net Cash Flow Investing Activities	iso4217:USD				1,000
Net Cash Flow Financing Activities	iso4217:USD				1,000
Net Cash Flow	iso4217:USD				$ 3,500
Assets [Roll Forward]					
Assets, Beginning Balance	iso4217:USD				$ 0
Net Cash Flow	iso4217:USD				3,500
Assets, Ending Balance	iso4217:USD				$ 3,500
Changes in Equity [Roll Forward]					
Equity, Beginning Balance	iso4217:USD				$ 0
Comprehensive Income	iso4217:USD				3,000
Investments by Owners	iso4217:USD				1,000
(Distributions to Owners)	iso4217:USD				(500)
Equity, Ending Balance	iso4217:USD				$ 3,500
Weighted Average Grant Date Fair Value [Roll Forward Info]					
Nonvested Fair Value, Beginning Balance	iso4217:USD/shares				32.72
Granted	iso4217:USD/shares				41.51
Vested	iso4217:USD/shares				30.92
Forfeited	iso4217:USD/shares				35.93
Nonvested Fair Value, Ending Balance	iso4217:USD/shares				36.92
Financial Highlights [Set]					
Revenues	iso4217:USD	$ 1,000	$ 4,000	$ 2,000	$ 7,000
Comprehensive Income	iso4217:USD				3,000
Distributions to Owners	iso4217:USD				500
Segment Revenues [Set]					
Revenues	iso4217:USD	$ 1,000	$ 4,000	$ 2,000	$ 7,000
Accounting Equation [Arithmetic]					
Assets	iso4217:USD				3,500
Liabilities	iso4217:USD				0
Equity	iso4217:USD				3,500
Basis of Reporting [Text Block]					This is the basis of reporting.
Nature of Operations [Text Block]					This is the nature of operations.
Revenue Recognition Policy [Text Block]					This is the revenue recognition policy.

The point of this example is to show the consequences of not letting the information itself drive the representation of the information. While the representation can be considered logical, it tends to be confusing to read and make sense of.

It also can make creating software more challenging because the software needs to consider and properly process many different possible permutations and combinations.

7.10. PROOF-Proper

This example is very similar to the Master or baseline example except that duplicate hypercubes where made unique and other issues were fixed in this example. This example makes working with the information in the report the easiest it seems.



Notice how there are 15 hypercubes, just like the PROOF-Master, but in this examle every hypercube has a unique name. This enables each block of information and disclosure to be distinguished from every other block of information by either humans

or by machine-based processes. Every hypercube is effectively a uniquely named/labeled object.

8. Consequences of Specific Decisions

The information blocks of each of the ten representations of information within XBRL-based reports is exactly the same. However, working with the information is different depending on choices make. The thing to understand are the consequences of choices made. This can lead to better choices which better align to the goals and objectives one is trying to achieve.

8.1. Hypercube Use and Naming

There are three different approaches to the use and naming of hypercubes in XBRL-based reports. One alternative, not using hypercubes at all, is impossible because it is obvious that the logic used within financial reports demands the capabilities offered by XBRL Dimensions and the hypercubes that specification brings to the table. Noncore dimensions are necessary to effectively represent financial information within XBRL. As such, not using hypercubes at all is not an alternative.

XBRL International has published guidance, *Technical Considerations for the use of XBRL Dimensions 1.0*[39], that suggests against mixing dimensional and nondimensional models. Further, it is impossible to query a report for a machine readable token if there is no way to represent that machine readable token. Meaning, if a hypercube does not exist; then you cannot query information using that hypercube name.

On the other hand, it is a lot of work creating and naming/labeling hypercubes.

8.2. Supplementing using Prototype Theory

Even if hypercube names do not explicitly exist, it is still very possible to extract information using externally defined information.

There are two ways to identify something. The first is described in the section above, using an identifier or token to identify a set of information, for example a hypercube.

The second way to identify something is to examine the parts you see and use the parts to identify what you are looking at.

So, if a hypercube or other identifier does not exist; a set of rules can be defined to examine parts of something and then an identifier can be created to describe what is being identified.

This is how the disclosures and disclosure mechanics rules of the Seattle Method work.

8.3. Disclosures

Ultimately, what is of interest in an XBRL-based report is not networks or hypercubes or blocks of information; rather it is the disclosures represented within the networks and hypercubes represented as information blocks.

[39] XBRL International, *Technical Considerations for the use of XBRL Dimensions 1.0*, https://www.xbrl.org/WGN/dimensions-use/WGN-2015-03-25/dimensions-use-WGN-2015-03-25.html

There are two paths to getting to that disclosure information. The first path is using explicit identifiers to name each disclosure; the second path is to look at the information that was disclosed and figuring out what disclosure that information is providing.

In each of the 10 cases, disclosures can be identified whether or not hypercubes have been provided, it makes on difference which network the information is represented in, abstract concepts make no difference in terms of identifying the information.

1. **Master**: https://auditchain.infura-ipfs.io/ipfs/QmRvuNK8JLuTXAhCEik6uDF7N6NCiL4HvdmTjXTgvxbmYm/blocks.html
2. **Alternative1**: https://auditchain.infura-ipfs.io/ipfs/QmYVkXhnZuwstkjXjdyHCL43RacSsLVugzFurjdM9BNUK1/blocks.html
3. **Alternative2**: https://auditchain.infura-ipfs.io/ipfs/QmXdCJTL7GUzbPWNptZnN4WAbwhGFSwKoGEnePbg3Qq1By/blocks.html
4. **Hypercubes2**: https://auditchain.infura-ipfs.io/ipfs/QmeKuk7JJMpjhJXWr6KdAADruUhB6JrjrkjagRak3uWUq8/blocks.html
5. **Hypercubes3**: https://auditchain.infura-ipfs.io/ipfs/QmXVQQ9YHPkh3EnzovzbNcAFyvp36s5ivG1sKn2mG4SxCj/blocks.html
6. **Implied**: https://auditchain.infura-ipfs.io/ipfs/QmTzuW6gRGXsZjgHencMtRxzQfDY1E9NkgDQYQBRGfMj1M/blocks.html
7. **Dimensions**: https://auditchain.infura-ipfs.io/ipfs/QmeA7DeYUDrg24L2eMYGjJfKbbEJBiFMQTAaeHd9tbwHLg/blocks.html (This is a software bug related to the extra dimensions)
8. **Blocks**: https://auditchain.infura-ipfs.io/ipfs/QmQWcoiYAd4SM9FYaGrHPTSt4yaawHf4NZ7wx2ckR8EB29/blocks.html
9. **Sparse**: https://pacioli.auditchain.finance/reportAnalysis/f993e56f12bca1cd9d10330185b28cf72f148ae6.report/disclosures.html (This is a software bug related to discover of the changes in equity roll forward)
10. **Proper**: (need to create rules, report is local) https://auditchain.infura-ipfs.io/ipfs/QmYdVvfYb4NcTiXgUbccTV6us7169i3AcC9QZJ4GW2jrTF/blocks.html