1. Structure (a.k.a. Fragment) Arrangement Patterns

The purpose of this section is to explain the notion of structure arrangement patterns. Essentially, the structures or fragments that exist within an XBRL-based financial report are sequenced or ordered in a specific way.

Flow is the notion of relations between Networks and/or [Table]s for the purpose of ordering or sequencing information contained in a digital financial report. Creating schemes for generating the desired flow of information contained by a digital financial report can be impacted by metadata available. Fragment arrangement patterns[1] explain different approaches to representing the flow of a digital financial report.

A structure is a type of report fragment.

1.1. XBRL-based financial reports to SEC report fragment ordering scheme

One example of using networks to order or sequence the contents of an XBRL-based digital financial report can be seen in how the SEC achieves sequencing. Consider the following example:

The above is a fragment of a model financial report rendered within the SEC interactive data previewer. The XBRL extension taxonomy created by the public company drives the SEC interactive data viewer.

Networks drive the rendering of the table of contents on the left. Each network can be broken into three components which drive the sequencing of the rendering framework:

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[1] Fragment arrangement pattern examples,
http://xbrlsite.azurewebsites.net/DigitalFinancialReporting/FragmentArrangementPatterns/2017-05-07/

- **Number** such as "101000" within the first network.
- **Sort Category** such as "Document", "Statement" or "Disclosure"
- **Title** or other part of the networks definition.

The category is used to put the different networks into one of the yellow categories in the SEC example, the number determines the order within the category, and the balance of the description is the label that a user sees.

This approach is workable, but it means that all information must be broken out by network and anything smaller than the network itself cannot be broken out any further. For example, table information is not used for rendering information at all.

You can examine this in more detail by examining the reference or model implementation of an SEC XBRL financial filing.

1.2. Metadata provided impacts ordering

Certain metadata is required by the XBRL technical syntax. Other metadata is determined by how a taxonomy is expressed. The following is a summary of the constraints imposed by approaches used to express metadata within a taxonomy and how those constraints impact ordering.

- **Networks** – Networks are always required to be unique so as such, networks can always be used to order a taxonomy. However, if networks alone are used many times not enough granularity is achievable. Also networks cannot be articulated within a hierarchy.
- **Networks plus Non-unique Tables** – Tables can be used with networks to order information. However, depending on whether the tables are expressed are unique governs the role a network must play in allowing a table to be specifically identified.
- **Unique Tables** – If every table within a taxonomy is unique, then networks no longer need to be relied upon to uniquely identify and locate a table, the table alone will allow such identification.

1.3. Tables organized into a list

Another approach to articulating sequencing information can be seen by comparing the *Pivot Table* business use case with the *Flow* business use case.

Consider the screen shot below of the Pivot Table business use case:
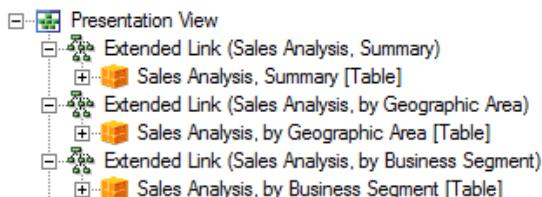
There are three networks with three tables. Each network and table is unique. Suppose you wanted to articulate the ordering you would prefer for working with this information, how would you do that? You could request the information in the physical order in which it exists within the XBRL taxonomy or you could request the information in alphabetical order, that is about all the options you might have.

Now consider the *Flow* business use case below. The taxonomy has a network called "Report Flow". Within that network, a hierarchy of the [Table]s which exist in the taxonomy for this financial report is provided.
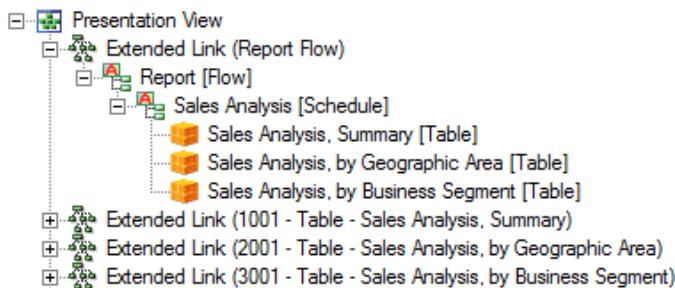
As such, a software application can read that hierarchy and use it within the application to show the summary first, the geographic table second, and the business segment third.

Alternatively, the numbering of the network could be used to achieve the same goal as with the SEC example.

The [Table]s alone can be used, and the networks totally ignored, because each table is unique. By contrast, if each table were called "Sales Analysis, Summary [Table]", then to identify which [Table] you were looking for, you would also need to rely on the network.

1.4. Notion of the "Implied [Table]"

In the section which discusses the report elements which make up a digital financial report we explain that everything within a digital financial report exists within a [Table], be that [Table] explicitly articulated using the "[Table]" report element, or the table is implied.

Basically, everything expressed within a network which is not contained within some explicit [Table] can be thought of existing within a pseudo or implicit table called "No Table [Table]". Because you might have more than one "No Table [Table]", you must rely on the network to uniquely identify which "No Table [Table]" you would like to work with. As such, using implicit tables requires you to work with tables just as though you created non-unique tables.

1.5. The "Statement [Table]"

Another approach to defining [Table]s can be seen by examining the "Statement [Table]" within the US GAAP Taxonomy or even better, the "Hypercube [Table]" of the FINREP taxonomy.

The FINREP taxonomy took the most extreme route using one [Table] and one [Table] only throughout their entire taxonomy. They did this to specifically push all semantics of the meaning of a group of information onto the network which contains the hypercube. One can be sure that the network describes the information 100% of the time because (a) each [Table] is called exactly the same thing and (b) because each network could only possibly contain one [Table] because using the same [Table] name within a network would cause modelling conflicts (and remember, all [Table]s have the same name). The bottom line here is that the network carries all semantics for describing the information, there is no confusion.

By contrast, the US GAAP Taxonomy has the "Statement [Table]" which is used on the balance sheet, the income statement, the cash flow statement, and the statement of changes in equity. As such, one can only know which "Statement [Table]" you are working with by using the network.

Further, most but not all other [Table]s in the US GAAP Taxonomy are unique. What is more, not everything is modelled as an explicit [Table] and therefore there are many "No Table [Table]s" (see the preceding section).

1.6. Examples Explaining Approaches to Creating Hypercubes

The following four examples show four difference approaches or strategies to creating hypercubes.

Approach #1: XBRL-based Financial Reports Submitted to the SEC.

The first approach is exemplified by XBRL-based financial reports submitted to the SEC. Here is information about that approach: Human readable[2]. Machine readable[3]. SEC Filing Page[4].

When this approach is used, hypercubes may or may not explicitly exist and those hypercubes may or may not be unique. For example,

Component: (Network and Table)				
Network	100000 - Document - **Document and Entity Information** (http://www.microsoft.com/20170630/taxonomy/role/DocumentDocumentAndEntityInformation)			
Table	Statement [Table]			

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

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

	Period [Axis]		
Statement [Line Items]	2016-07-01 - 2017-06-30	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		

Notice that in the screen shot shown, the explicit hypercube "us-gaap:StatementTable" is used on the fact set shown; but that same hypercube is

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[2] Approach #1: Human readable, http://xbrlsite.azurewebsites.net/2017/Prototypes/Microsoft2017/evidence-package/#Rendering-DocumentDocumentAndEntityInformation-us_gaap_StatementTable.html

[3] Approach #1: Machine Readable, https://www.sec.gov/Archives/edgar/data/789019/000156459017014900/msft-20170630.xml

[4] Approach #1, SEC Filing Page, https://www.sec.gov/Archives/edgar/data/789019/000156459017014900/0001564590-17-014900-index.htm

used on numerous other fact sets. As such, the fact sets cannot be identified using only the hypercube.

Approach #2: XASB reference implementation, unique hypercubes.

The second approach is exemplified using my XASB reference implementation. Here is information which shows examples of this approach: Human readable[5]. Machine readable[6].

When this approach is used, every hypercube is unique and all information is reported within an explicitly provided hypercube. For example,

Component: (Network and Table)					
Network	**AA: Statement: Financial Highlights** (http://xasb.org/gaap/role/schedule/level4/FinancialHighlightsSchedule)				
Table	Financial Highlights [Table]				

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

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

	Period [Axis]				
Financial Highlights [Line Items]	2010-01-01 - 2010-12-31	2009-01-01 - 2009-12-31	2008-01-01 - 2008-12-31	2007-01-01 - 2007-12-31	2006-01-01 - 2006-12-31
Financial Highlights [Hierarchy]					
Revenues, Net	4,000	5,000	4,000	4,000	4,000
Income (Loss) from Continuing Operations	500	(4,000)	(4,000)	(4,000)	(4,000)
Net Income (Loss)	500	(4,000)	(4,000)	(4,000)	(4,000)
Cash Flow Provided by (used in) Operating Activities, Net	(1,000)	4,000	0	0	0
Capital Additions	1,000	650	550	450	350
Average Number of Employees	300	250	250	240	220

Above you see that the fragment shown is represented explicitly with the hypercube "gaap:FinancialHighlightsTable" and that same hypercube is never used again to represent any other fact set. As such, you can reliably get all of the information related to the disclosure "gaap:FinancialHighlightsTable" by referencing that unique hypercube.

Approach #3: XASB reference implementation, one hypercube.

The third approach is exemplified by the XASB reference implementation which has been modified so that ever fact set is represented by exactly the same hypercube. Here is information which shows examples of this approach: Human readable[7]. Machine readable[8].

When this approach is use, all information is reported within an explicitly defined hypercube, but that hypercube always has exactly the same name. For example,

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[5] Approach #2: Human readable, http://xbrlsite.azurewebsites.net/2020/Prototype/hypercubes/xasb-reference-normal/evidence-package/contents/index.html#Rendering-FinancialHighlightsSchedule-gaap_FinancialHighlightsTable.html

[6] Approach #2: Machine readable,
http://xbrlsite.azurewebsites.net/2020/Prototype/hypercubes/xasb/xasb-reference-normal/company-instance.xml

[7] Approach #3: Human readable, http://xbrlsite.azurewebsites.net/2020/Prototype/hypercubes/xasb-reference-one-hypercube/evidence-package/contents/index.html#Rendering-FinancialHighlightsSchedule-gaap_HypercubeTable.html

[8] Approach #3: Machine readable, http://xbrlsite.azurewebsites.net/2020/Prototype/hypercubes/xasb-reference-one-hypercube/company-instance.xml

Component: (Network and Table)						
Network	**AA, Part 1: Financial Highlights** (http://xasb.org/gaap/role/schedule/FinancialHighlightsSchedule)					
Table	Hypercube [Table]					

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

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

	Period [Axis]				
Financial Highlights [Line Items]	2010-01-01 - 2010-12-31	2009-01-01 - 2009-12-31	2008-01-01 - 2008-12-31	2007-01-01 - 2007-12-31	2006-01-01 - 2006-12-31
Financial Highlights [Hierarchy]					
Revenues, Net	4,000	5,000	4,000	4,000	4,000
Income (Loss) from Continuing Operations	500	(4,000)	(4,000)	(4,000)	(4,000)
Net Income (Loss)	500	(4,000)	(4,000)	(4,000)	(4,000)
Cash Flow Provided by (used in) Operating Activities, Net	(1,000)	4,000	0	0	0
Capital Additions	1,000	650	550	450	350
Average Number of Employees	300	250	250	240	220

Above you see that the fragment shown is represented explicitly with the hypercube "gaap:HypercubeTable" and that every other hypercube used has exactly the same name. What this means is that the identification of the information is "pushed" to the Network identifier.

This approach has some interesting characteristics. It forces that only one hypercube be placed within any Network because if two hypercubes were put into the same Network and they had the same name, association conflicts would occur. And so, this forces consistency with respect to how hypercubes are represented.

Approach #4: XASB reference implementation, one hypercube, one [Line Items].

The fourth approach is exemplified by the XASB reference implementation which has been modified so that every fact set is represented by exactly the same hypercube just like Approach #3; but in addition, the [Line Items] element is also the same for every hypercube, "Hypercube [Line Items]". Here is information which shows examples of this approach: Human readable[9]. Machine readable[10].

When this approach is used, every hypercube is unique (just like approach #3) and all information is reported within an explicitly provided hypercube (just like approach #2 and approach #3); but then every hypercube also uses "Hypercube [Line Items]" to identify the primary items container of the hypercube. For example,

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[9] Approach #4: Human readable, http://xbrlsite.azurewebsites.net/2020/Prototype/hypercubes/xasb-reference-one-hypercube-one-lineitems/evidence-package/contents/index.html#Rendering-FinancialHighlightsSchedule-gaap_HypercubeTable.html

[10] Approach #4: Machine readable, http://xbrlsite.azurewebsites.net/2020/Prototype/hypercubes/xasb-reference-one-hypercube-one-lineitems/company-instance.xml

Component: (Network and Table)						
Network	**AA, Part 1: Financial Highlights** (http://xasb.org/gaap/role/schedule/FinancialHighlightsSchedule)					
Table	Hypercube [Table]					

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

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

	Period [Axis]				
Hypercube [Line Items]	2010-01-01 - 2010-12-31	2009-01-01 - 2009-12-31	2008-01-01 - 2008-12-31	2007-01-01 - 2007-12-31	2006-01-01 - 2006-12-31
Financial Highlights [Hierarchy]					
Revenues, Net	4,000	5,000	4,000	4,000	4,000
Income (Loss) from Continuing Operations	500	(4,000)	(4,000)	(4,000)	(4,000)
Net Income (Loss)	500	(4,000)	(4,000)	(4,000)	(4,000)
Cash Flow Provided by (used in) Operating Activities, Net	(1,000)	4,000	0	0	0
Capital Additions	1,000	650	550	450	350
Average Number of Employees	300	250	250	240	220

Above you see that the fragment shown is represented explicitly with the hypercube "gaap:HypercubeTable" and that every other hypercube used has exactly the same name. What this means is that the identification of the information is "pushed" to the Network identifier. But in addition, the primary items are within the concept "Hypercube [Line Items]" (gaap:HypercubeLineItems).

This approach has some interesting characteristics. It forces that only one hypercube be placed within any Network because if two hypercubes were put into the same Network and they had the same name, association conflicts would occur. And so, this forces consistency with respect to how hypercubes are represented. Further, business users don't have to concern themselves with naming the [Line Items] report element.

1.7. Which Approach is Best?

All this distils down into three possible options:

- **Use explicit unique [Tables]**. This option works well, and in fact it is the option which I believe is the most reasonable. By taking this approach you can ignore networks altogether, relegating networks to the role of syntax needed only for avoiding modelling conflicts. And because you can ignore the network, you can be sure the [Table] describes the information set and each [Table] being unique, each information set is unique. (Approach #2)

- **Use explicit but only one [Table] for everything**. This option works well also because it is clear that the network carries all semantics for describing a set of information. The down side is that you have to create metadata such as the "number" and "category" used by the SEC to help organize those networks. You can then use unique line item names (Approach #3) or make all the line item names the same (Approach #4)

- **Mixed model**. If [Tables] are not unique and if [Table]s are not explicit (i.e. you have "No Table [Table]"s), you have to rely on both networks and tables to identify which information you need to work with. This can be both cumbersome for software and for users. A mixed model such as this does not appear to make much sense and should be avoided, all things considered.

Further, XBRL International explicitly states that using a mixed dimensional model is not a good idea or a best practice[11]. (Approach #1)

There are no real benefits of having [Table]s names which can be used in more than one place, yet there are significant benefits of unique [Table] names.

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