Fundamental Accounting Concepts, a Tutorial for Software Engineers

By Charles Hoffman, CPA (July 1, 2021)

The purpose of this document is to help software engineers understand high-level fundamental accounting concepts, the relations between those high-level financial reporting concepts, and how the high-level fundamental accounting concepts and relations can be organized into different reporting styles for the purpose of creating financial reports.

The focus here will be financial reporting by public or listed companies that use US GAAP or IFRS when creating their financial reports.

I will try and keep this explanation as brief and succinct as possible and provide references to additional detailed information.

Double Entry Accounting Model

To understand how financial reporting fundamentally works you need to understand the double entry accounting mathematical model. Succinctly, the double entry accounting mathematical model is this:

DEBITS = CREDITS

Mathematics Magazine published an article written by David Ellerman, *The Mathematics of Double Entry Bookkeeping*[1], where Ellerman points out that double entry accounting is based on well-known mathematics construction from undergraduate algebra and explains this model. Ellerman breaks the model down into scalers[2] and vectors[3].

To turn this mathematical model into something more approachable to business professionals we turn the DEBITS and CREDITS into terms more understandable to those business professionals which is done using the fundamental accounting equation which is explained next.

[1] Mathematics Magazine, David Ellerman, *The Mathematics of Double Entry Bookkeeping*, https://ellerman.org/wp-content/uploads/2012/12/DEB-Math-Mag.CV_.pdf

[2] David Ellerman, *The Math of Double-Entry Bookkeeping: Part I (scalars)*, https://www.ellerman.org/the-math-of-double-entry-bookkeeping-part-i-scalars/

[3] David Ellerman, The Math of Double-Entry Bookkeeping: Part II (vectors), https://www.ellerman.org/the-math-of-double-entry-bookkeeping-part-ii-vectors/

Fundamental Accounting Equation

The double entry accounting mathematical model is instantiated in business terms by the fundamental accounting equation which is[4]:

ASSETS = LIABILITIES + EQUITY

Another very good way of representing this fundamental accounting equation is provided James Hearle in a popular YouTube video, *The Accounting Equation for Beginners*[5]:

Stuff the Business OWNS = Stuff the Business OWES

Effectively, assets is what stuff a business owns and liabilities and equity describe who owns the stuff. This still might be too abstract, so let's expand the model just a little bit further by actually implementing the fundamental accounting equation by defining a financial reporting scheme.

Implementing Financial Reporting Using Reporting Scheme

There are numerous financial reporting schemes defined around the world[6]. By definition, every financial reporting scheme follows the double entry accounting model and the fundamental accounting equation. After all, the accounting model is fundamentally a mathematical model.

Standards setters such as the Financial Accounting Standards Board (FASB), International Accounting Standards Board (IASB), Financial Reporting Council (FRC), International Public Sector Accounting Standards Board (IPSASB), and so forth, define a conceptual framework for their specific financial reporting scheme. In that financial reporting scheme they define the building blocks and rules pertaining to how financial reports are to be constructed.

You might think that these standards setters might use a common modeling tool such as UML to model their financial reporting schemes. Well, they don't. They describe these models in books. They all do a decent job, but sometimes things are ambiguous and inconsistent. But they all have to follow the double entry accounting mathematical model and the fundamental accounting equation in some form or another.

Let's look at one implementation of a financial reporting scheme to help us understand financial reporting scheme implementations more generally. We are going to use US GAAP to explore the next level of financial reporting.

SFAC 6 Elements of Financial Statements

I am an accountant by profession. In every intermediate accounting class, you are introduced to the "elements of financial statements", the building blocks of financial statements. In my case we used US

[4] Wikipedia, Accounting Equation, https://en.wikipedia.org/wiki/Accounting_equation
[5] YouTube, Accounting Stuff, *Accounting Equation for Beginners*, https://www.youtube.com/watch?v=56xscQ4viWE
[6] Comparison of Elements of Financial Statements, http://xbrlsite.azurewebsites.net/2021/library/ElementsOfFinancialStatements.pdf

GAAP and I will explain the elements of financial statements for US GAAP specifically. But the ideas are the same for most comprehensive financial reporting schemes such as IFRS, UK GAAP, IPSAS, and other such financial reporting schemes.

Elements

The Financial Accounting Standards Board (FASB), in SFAC 6 *Elements of Financial Statements*[7], which is part of the conceptual framework for US GAAP, they define 10 core interrelated elements of financial statements:

Elements	**Description**
Assets	Probably future economic benefits obtained or controlled by a particular entity as a result of past transactions or events.
Liabilities	Probably future sacrifices of economy benefits arising from present obligations of a particular entity to transfer assets or provide services to other entities in the future as a result of past transactions
Equity (or net assets)	Called shareholders' equity or stockholders' equity for a corporation, it is the residual interest in the assets of an entity that remains after deducting its liabilities.
Investments by Owners	Increases in equity of a particular business enterprise resulting from transactions to it from other entities or something of value to obtain or increase ownership interests in it.
Distributions to Owners	Decreases in equity of a particular enterprise resulting from transfers to owners.
Comprehensive Income	The change in equity of a business enterprise during a period from transactions and other events and circumstances from nonowner sources. It includes all changes in equity during a period except those resulting from investments by owners and distributions to owners.
Revenues	Inflows or other enhancements of assets of an entity or settlements of its liabilities during a period from delivering or producing goods, rendering services, or other activities that **constitute the entity's ongoing major or central operations**.
Expenses	Outflows or other using up of assets or incurrences of liabilities during a period from delivering or producing goods, rendering services, or other activities that **constitute the entities ongoing major or central operations**.
Gains	Increases in equity from **peripheral or incidental transactions** of an entity.
Losses	Decreases in equity arising from **peripheral or incidental transactions** of an entity.

Rules (Interrelationships between Elements)

Explicitly stated or implied rules exist between the elements that are defined. Note the term "interrelated" that is used to describe the elements that are defined. Rules define the interrelationships between the elements.

[7] FASB, SFAC 6 *Elements of Financial Statements*, https://www.fasb.org/pdf/con6.pdf

We have already spoke about the rule which is used to define the relationship between the elements reported on a statement of financial position (a.k.a. balance sheet):

$$\text{Assets} = \text{Liabilities} + \text{Equity}$$

which was defined by the fundamental accounting equation. The FASB did not explicitly articulate that rule in SFAC 6. However, that fundamental rule is implied and no one really would, or can, dispute that fundamental rule.

The FASB explicitly defines the relationship between these elements in SFAC 6, page 21, paragraph 20 this is the relation between the elements of the statement of income:

$$\text{Comprehensive Income} = \text{Revenues} - \text{Expenses} + \text{Gains} - \text{Losses}$$

The equation below defines the relations between the other concepts and uses the term "Comprehensive Income" as defined above. While this rule is not clearly and explicitly defined by the FASB, it is explained in SFAC 6, page 21, paragraph 21, well understood by professional accountants, and not disputed:

$$\text{Equity}^{T1} = (\text{Equity}^{T0} + \text{Revenue}^{P1} - \text{Expenses}^{P1} + \text{Gains}^{P1} - \text{Losses}^{P1} + \text{InvestmentsByOwners}^{P1} - \text{DistributionsToOwners}^{P1})$$

A similar equation can be derived from the above equation by substituting "Comprehensive Income" for the concepts Revenues, Expenses, Gains, and Losses which amounts to the relation of concepts within the statement of changes in equity:

$$\text{Equity}^{T1} = (\text{Equity}^{T0} + \text{Comprehensive Income}^{P1} + \text{InvestmentsByOwners}^{P1} - \text{DistributionsToOwners}^{P1})$$

Another equation which is not defined but is described in the descriptions of the terms is the following relationship:

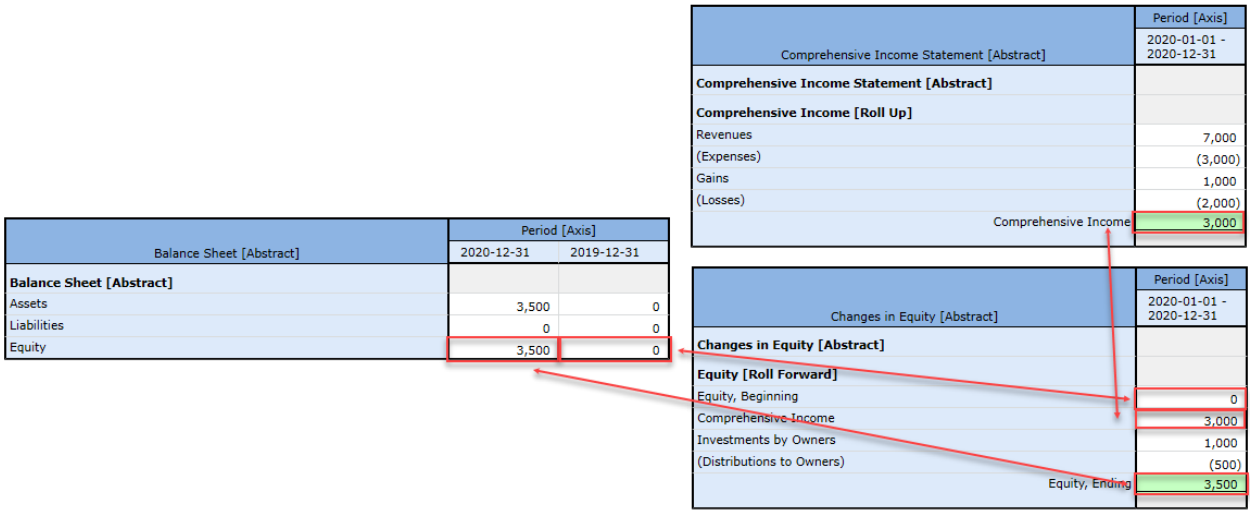
$$\text{Comprehensive income} = \text{Comprehensive income from ongoing major or central operations} + \text{Comprehensive income from peripheral or incidental transactions}$$

When you combine these rules, you see that, and how, these 10 elements are fundamentally interrelated. This brings us to the important notion or articulation.

Articulation

The FASB uses the term "articulation" to describe the notion that financial statements are fundamentally interrelated[8]. Articulation is the intentional result in financial statements that are fundamentally interrelated and connected mathematically. Graphically, the interrelationship looks like the following:

[8] FASB, SFAC 6, page 21 and 22, paragraph 21



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

Balance Sheet [Abstract]	Period [Axis] 2020-12-31	2019-12-31
Balance Sheet [Abstract]		
Assets	3,500	0
Liabilities	0	0
Equity	3,500	0

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

Intermediate Components (a.k.a. subtotals)

While financial reports must fit within the elements of a financial report defined by a financial reporting scheme; financial reports are not forms. Specific variability is anticipated and allowed by financial reporting schemes such as US GAAP, IFRS, IPSAS, GAS, FAS, etc.

By far, the most variability that exists within a set of financial statements exists on the income statement. SFAC 6 discusses the notion of intermediate components[9] of comprehensive income:

> "Examples of intermediate components in business enterprises are gross margin, income from continuing operations before taxes, income from continuing operations, and operating income. Those intermediate components are, in effect, subtotals of comprehensive income and often of one another in the sense that they can be combined with each other or with the basic components to obtain other intermediate measures of comprehensive income."

Basically, variability can be caused by choosing to report different common subtotals or by choosing to report specific line items rather than others. I refer to these different subtotals and specific line items as the notion of reporting styles[10]. This variability is not random or arbitrary. There are common reporting style patterns.

Of the four concepts "revenues", "expenses", "gains", and "losses" there are themes in the definitions of the terms. One theme is the notion of something related to an "entity's ongoing major or central operations" and "from peripheral or incidental transactions".

[9] FASB, SFAC 6, page 47, paragraph 77.
[10] Open Framework for Implementing XBRL-based Financial Reporting, *Reporting Styles*, http://xbrlsite.azurewebsites.net/2019/Framework/Details/ReportingStyle.html

You never really see the specific terms “expenses”, “gains”, or “losses” reported within an income statement. Sometimes you do see the term “Revenues” but the term is being used differently from how that element is defined in SFAC 6.

Here are the most common financial report line items and intermediate subtotals that are provided within a financial report of a commercial and industrial company:

Intermediate Subtotal	**Description**
Revenues, Net	Implies operating revenues only. For example, does not include nonoperating revenue derived from peripheral activities.
Cost of Revenues	Implies direct operating expenses only. For example, does not include Income tax expense (benefit) which is an expense.
Gross Profit (Loss)	Subtotal derived, Revenues, Net less Cost of Revenues
Operating Expenses	Implies indirect operating expenses only. For example, never includes Cost of Revenues (which are direct expenses).
Other Operating Income (Loss)	Implies operating related gains and losses which would not be included within Revenues, Net.
Operating Income (Loss)	Subtotal derived, Gross Profit (Loss) - Operating Expenses + Operating Income (Loss)
Nonoperating Income (Loss)	Implies nonoperating related gains and losses. For example, Interest Expense is generally a nonoperating expense. (However, interest expense is an operating expense for a financial institution.)
Income (Loss) from Continuing Operations Before Taxes	Subtotal derived, Operating Income (Loss) - Nonoperating Income (Loss)
Income Tax Expense (Benefit), Net	Implies expenses or income related to federal income taxes.
Income (Loss) from Continuing Operations After Tax	Subtotal Derived, Income (Loss) from Continuing Operations Before Tax - Income Tax Expense (Benefit), Net
Income (Loss) from Discontinued Operations, Net	Implies income or loss from the portion of net income (loss) that is derived from operations that have been discontinued.
Net Income (Loss)	Subtotal
Net Income (Loss) Attributable to Parent	Implies the portion of net income (loss) that is related to the controlling interest of the economic entity.
Net Income (loss) Attributable to Noncontrolling Interest	Implies the portion of net income (loss) that is related to the noncontrolling interests of the economic entity, if any.
Other Comprehensive Income (Loss)	Implies other comprehensive income (loss) which are specifically defined.
Comprehensive Income (Loss)	Subtotal, Net Income (Loss) less Other Comprehensive Income (Loss)
Comprehensive Income (Loss) Attributable to Parent	Implies the portion of comprehensive income (loss) that is related to the controlling interest of the economic entity.

Comprehensive Income (Loss) Attributable to Noncontrolling Interest	Implies the portion of comprehensive income (loss) that is related to the noncontrolling interests of the economic entity, if any.
Preferred Stock Dividends and Other Adjustments	Preferred stock dividends and other such adjustments specifically related to preferred stock.
Net Income (Loss) Available to Common Stockholders, Basic	Subtotal, net income (loss) that is available for distribution to common stock holders, basic

Note that specific industries such as depository institutions, insurance companies, broker-dealers of securities, and other economic entities with specific types of industry activities would use different intermediate subtotals and line items to represent their financial reports.

Common Elements of Financial Statement (Four Statement Model)

SFAC 6 only talks about three of the four primary financial statements: balance sheet, income statement, changes in equity. But actually, there are four statements when you add the statement of cash flows.

In addition, SFAC 6 does not differentiate between the statement of income and the statement of comprehensive income which could be two different statements.

Finally, SFAC 6 does not discuss "current" versus "noncurrent" assets and liabilities. Nor does SFAC 6 discuss controlling interests and noncontrolling interests. As such, we need to add the following line items and subtotals to or set of fundamental accounting concepts:

Intermediate Subtotal	**Description**
Current Assets	Assets which are classified as being current.
Noncurrent Assets	Assets which are classified as being noncurrent.
Current Liabilities	Liabilities which are classified as being current.
Noncurrent Liabilities	Liabilities which are classified as being noncurrent.
Equity Attributable to Parent	Equity related to controlling interests of the economic entity.
Equity Attributable to Noncontrolling Interests	Equity related to noncontrolling interests of the economic entity.
Temporary Equity	Special category of reporting line items.
Net Cash Flow	Net cash flow reported per the statement of cash flows.
Net Cash Flow from Operating Activities	Operating related cash flows. (Continuing and discontinued)
Net Cash Flow from Investing Activities	Investing related cash flows. (Continuing and discontinued)
Net Cash Flow from Financing Activities	Financing related cash flows. (Continuing and discontinued)

Net Cash Flow, Continuing	Net Cash Flow from continuing operations only.
Net Cash Flow, Discontinued	Net Cash Flow from discontinued operations only.
Net Cash Flow from Operating Activities, Continuing	Net cash flow from operating activities, continuing operations.
Net Cash Flow from Investing Activities, Continuing	Net cash flow from investing activities, continuing operations.
Net Cash Flow from Financing Activities, Continuing	Net cash flow from financing activities, continuing operations.
Net Cash Flow from Operating Activities, Discontinued	Net cash flow from operating activities, discontinued operations.
Net Cash Flow from Investing Activities, Discontinued	Net cash flow from investing activities, discontinued operations.
Net Cash Flow from Financing Activities, Discontinued	Net cash flow from financing activities, discontinued operations.
Exchange Gains (Losses)	Exchange gains or losses from foreign currency related transactions.

Again, note that we are not including additional line items that might be used by financial institutions, insurance companies, brokers and dealers of securities, and other such industry specific line items and subtotals.

Mappings

Because of the way the SEC and ESMA allow or require XBRL-based financial reports to be created it could be the case that different economic entity use different XBRL concepts to report the same line item or the same XBRL concept could be used to report a specific line item.

For example, consider the concepts that could be used to report US GAAP line items[11]:

[11] US GAAP Mappings, http://accounting.auditchain.finance/reporting-scheme/us-gaap/fac/Rules_Mapping/ConceptMap_General-mapping.html

Line	From Fundamental Accounting Concept	Type of Relation (Arcrole)	To IFRS XBRL Taxonomy Concept	Try Order
1	fac:Assets	class-equivalentClass	us-gaap:Assets	1
2	fac:Assets	class-equivalentClass	us-gaap:AssetsCurrent	2
3	fac:BalanceSheetDate	class-equivalentClass	dei:DocumentPeriodEndDate	1
4	fac:BenefitsCostsExpenses	class-equivalentClass	us-gaap:BenefitsLossesAndExpenses	1
5	fac:CommitmentsAndContingencies	class-equivalentClass	us-gaap:CommitmentsAndContingencies	1
6	fac:ComprehensiveIncomeLoss	class-equivalentClass	us-gaap:ComprehensiveIncomeNetOfTaxIncludingPortionAttributableToNoncontrollingInterest	1
7	fac:ComprehensiveIncomeLossAttributableToNoncontrollingInterest	class-equivalentClass	us-gaap:ComprehensiveIncomeNetOfTaxAttributableToNoncontrollingInterest	1
8	fac:ComprehensiveIncomeLossAttributableToParent	class-equivalentClass	us-gaap:ComprehensiveIncomeNetOfTax	1
9	fac:CostOfRevenue	class-equivalentClass	us-gaap:CostOfRevenue	1
10	fac:CostOfRevenue	class-equivalentClass	us-gaap:CostOfGoodsAndServicesSold	2
11	fac:CostOfRevenue	class-equivalentClass	us-gaap:CostOfServices	3
12	fac:CostOfRevenue	class-equivalentClass	us-gaap:CostOfGoodsSold	4
13	fac:CostOfRevenue	class-equivalentClass	us-gaap:CostOfGoodsSoldExcludingDepreciationDepletionAndAmortization	5
14	fac:CostOfRevenue	class-equivalentClass	us-gaap:CostOfGoodsSoldElectric	6
15	fac:CostOfRevenue	class-equivalentClass	us-gaap:DirectOperatingCosts	7
16	fac:CostOfRevenue	class-equivalentClass	us-gaap:CostOfGoodsSoldOilAndGas	8
17	fac:CostOfRevenue	class-equivalentClass	us-gaap:CostOfGoodsSoldElectric	9
18	fac:CostOfRevenue	class-equivalentClass	us-gaap:FinancialServicesCosts	10
19	fac:CostOfRevenue	class-equivalentClass	us-gaap:ContractRevenueCost	11
20	fac:CostOfRevenue	class-equivalentClass	us-gaap:CostOfRealEstateRevenue	12
21	fac:CostOfRevenue	class-equivalentClass	us-gaap:RefiningAndMarketingCosts	13
22	fac:CostOfRevenue	class-equivalentClass	us-gaap:CostOfNaturalGasPurchases	14
23	fac:CostOfRevenue	class-equivalentClass	us-gaap:CostOfGoldProductsAndServices	15
24	fac:CostOfRevenue	class-equivalentClass	us-gaap:CostOfRealEstateSales	16
25	fac:CostOfRevenue	class-equivalentClass	us-gaap:CostOfMerchandiseSalesBuyingAndOccupancyCosts	17
26	fac:CostOfRevenue	class-equivalentClass	us-gaap:CostOfServicesExcludingDepreciationDepletionAndAmortization	18
27	fac:CostOfRevenue	class-equivalentClass	us-gaap:CostOfServicesOilAndGas	19
28	fac:CostOfRevenue	class-equivalentClass	us-gaap:CostOfGoodsSoldDirectMaterials	20
29	fac:CostOfRevenue	class-equivalentClass	us-gaap:ExplorationExpenseMining	21
30	fac:CostOfRevenue	class-equivalentClass	us-gaap:DirectCostsOfHotels	22
31	fac:CostOfRevenue	class-equivalentClass	us-gaap:TechnologyServicesCosts	23
32	fac:CostOfRevenueGoods	class-equivalentClass	us-gaap:CostOfGoodsSold	1
33	fac:CostOfRevenueServices	class-equivalentClass	us-gaap:CostOfServices	1
34	fac:CostsAndExpenses	class-equivalentClass	us-gaap:CostsAndExpenses	1
35	fac:CostsAndExpenses	class-equivalentClass	us-gaap:BenefitsLossesAndExpenses	2
36	fac:CurrentAssets	class-equivalentClass	us-gaap:AssetsCurrent	1
37	fac:CurrentLiabilities	class-equivalentClass	us-gaap:LiabilitiesCurrent	1
38	fac:DocumentType	class-equivalentClass	dei:DocumentType	1
39	fac:EntityCentralIndexKey	class-equivalentClass	dei:EntityCentralIndexKey	1
40	fac:EntityFilerCategory	class-equivalentClass	dei:EntityFilerCategory	1
41	fac:EntityRegistrantName	class-equivalentClass	dei:EntityRegistrantName	1
42	fac:Equity	class-equivalentClass	us-gaap:StockholdersEquityIncludingPortionAttributableToNoncontrollingInterest	1
43	fac:Equity	class-equivalentClass	us-gaap:PartnersCapitalIncludingPortionAttributableToNoncontrollingInterest	2
44	fac:Equity	class-equivalentClass	us-gaap:LimitedLiabilityCompanyLlcMembersEquityIncludingPortionAttributableToNoncontrollingInterest	3
45	fac:EquityAttributableToNoncontrollingInterest	class-equivalentClass	us-gaap:MinorityInterest	1
46	fac:EquityAttributableToNoncontrollingInterest	class-equivalentClass	us-gaap:PartnersCapitalAttributableToNoncontrollingInterest	2

Getting into any more details is beyond the scope of this document which is simply providing a solid overview of fundamental accounting concepts and the relations between those concepts.

Reporting Styles

The elements defined and the rules related to the interrelation between the elements can be organized into a set of reporting styles. Effectively, reporting styles are simply different sets of such organization.

Different reporting schemes have different sets of reporting styles. The two most comprehensive examples of reporting styles that are currently provided are for:

- US GAAP: http://accounting.auditchain.finance/reporting-scheme/us-gaap/documentation/ReportingStyles.html
- IFRS: http://accounting.auditchain.finance/reporting-scheme/ifrs-full/documentation/ReportingStyles.html

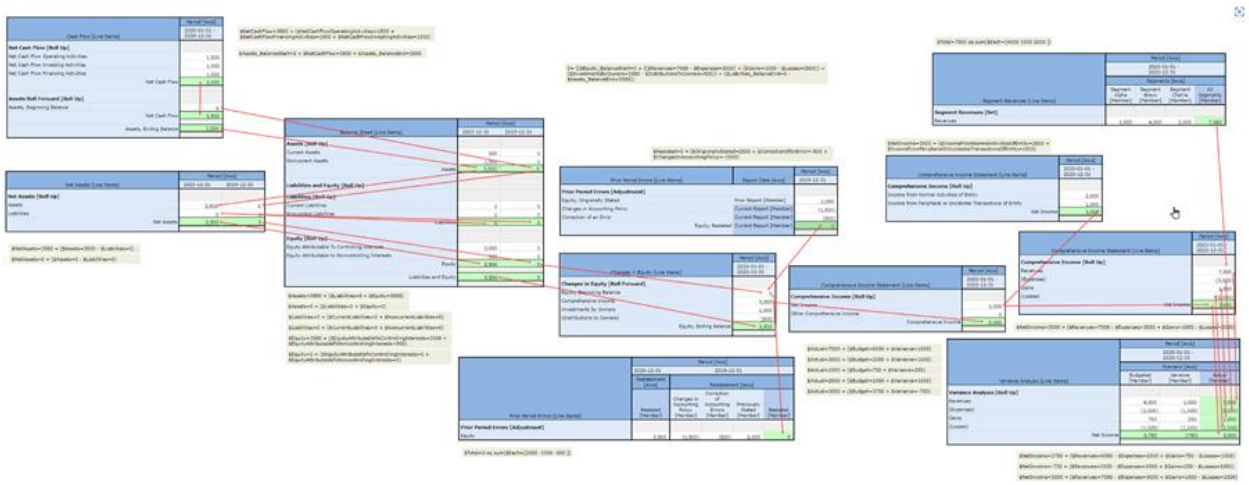
Types

The fundamental accounting concepts defined are high level types or categories of things. Some of those types have more specialized types that are more detailed descriptions or "narrower" versions of the more general types. Types and subtypes or "general-special" or "wider-narrower" relations are defined using associations[12].

[12] Charles Hoffman, CPA, *Associations*, http://www.xbrlsite.com/mastering/Part02_Chapter05.D_Associations.pdf

Articulation

Articulation[13] is the important notion that the primary financial statements are intentionally mathematically interconnected.



More Information

For more information on fundamental accounting concepts and reporting styles I would invite you to have a look at *Fundamental Accounting Concepts and Reporting Styles*[14].

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

[14] Charles Hoffman, CPA, *Fundamental Accounting Concepts and Reporting Styles*, http://www.xbrlsite.com/mastering/Part02_Chapter05.L_FundamentalAccountingConceptAndReportingStyles.pdf