Distributed Ledgers + Smart Contracts + XBRL

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XBRL can serve as a "payload" for an entry into a distributed ledger. People are already talking about that. But it seems like XBRL can provide much, much more.

- XBRL is a database (XBRL instance).
- XBRL is a declarative approach to representing business meaning/logic/semantics/rules (XBRL taxonomy schema, XBRL linkbases, and XBRL formula).
- XBRL has a run-time system[1] (XBRL processor, XBRL Formula processor).
- XBRL supports the multidimensional model[2] via XBRL Dimensions.
- XBRL supports very complex information structures.
- XBRL provides prescriptive extensibility. XML's greatest strength is also its greatest weakness. XML is extensible everywhere, in every direction. XBRL is extensible in a specific, prescriptive, and therefore predictable manner.

Basically, XBRL offers an entire global standard ecosystem for working within a digital distributed ledger to represent information and smart contracts to execute processes and workflow. Within XBRL one can represent complex information such as an entire financial report.

Perhaps not every implementation of a smart contract in a distributed ledger needs all of this robust functionality; but if you do need it, the global standard XBRL can provide it.

There might be a need for something like an XBRL Generic Linkbase for "Smart Contracts; I really don't know, more exploration is necessary. Perhaps existing linkbases can provide all the necessary functionally or it might be the case that only some arcroles need to be created and put into the XBRL International Link Role Registry (LRR). Time will tell.

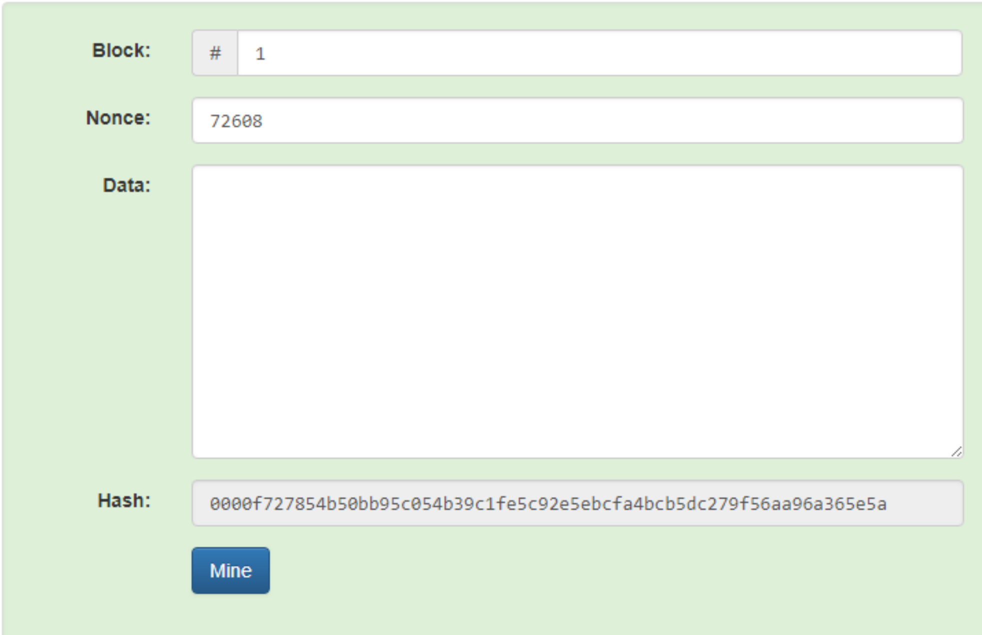
So here is how this might work.

Imagine an easy to use human interface for entering information into a blockchain based distributed ledger. This example provided by MIT is a good basic interface:

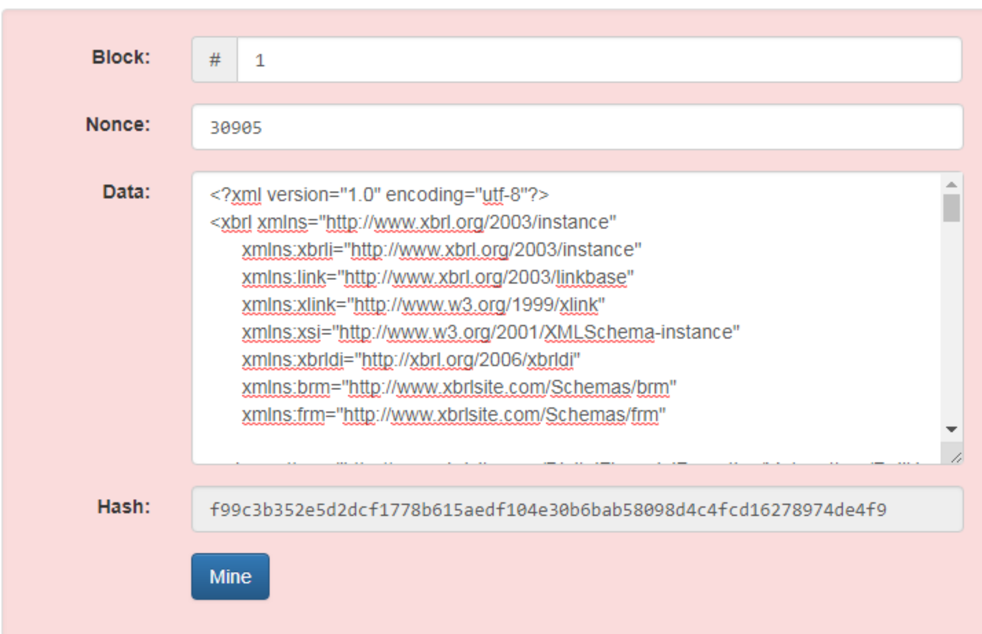
http://blockchain.mit.edu/block/

1 Wikipedia, Runtime System, https://en.wikipedia.org/wiki/Runtime_system

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

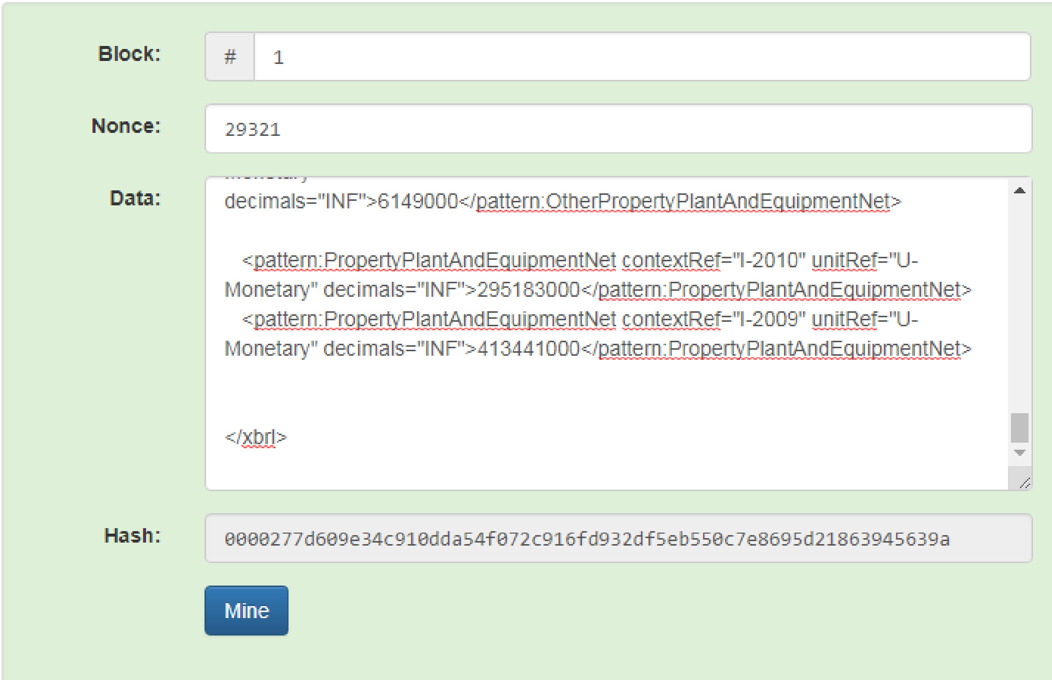


The user pastes an XBRL instance document and supporting XBRL taxonomies into the "Data" section of the block[3]:



[3] I don't know if ZIP files can be put into a block as data, that is probably possible. If so, an XBRL Taxonomy Package could be used, https://www.xbrl.org/Specification/taxonomy-package/REC-2016-04-19/taxonomy-package-REC-2016-04-19.html

The “Mine” button is pressed and then the “Hash” is computed and stored with the block:



Once the “Hash” is computed, the “Data” can never be changed for that block of information and that block will always exist; it cannot be removed. If the information is tampered with, the network will become aware of the change and the block will be disputed by the network.

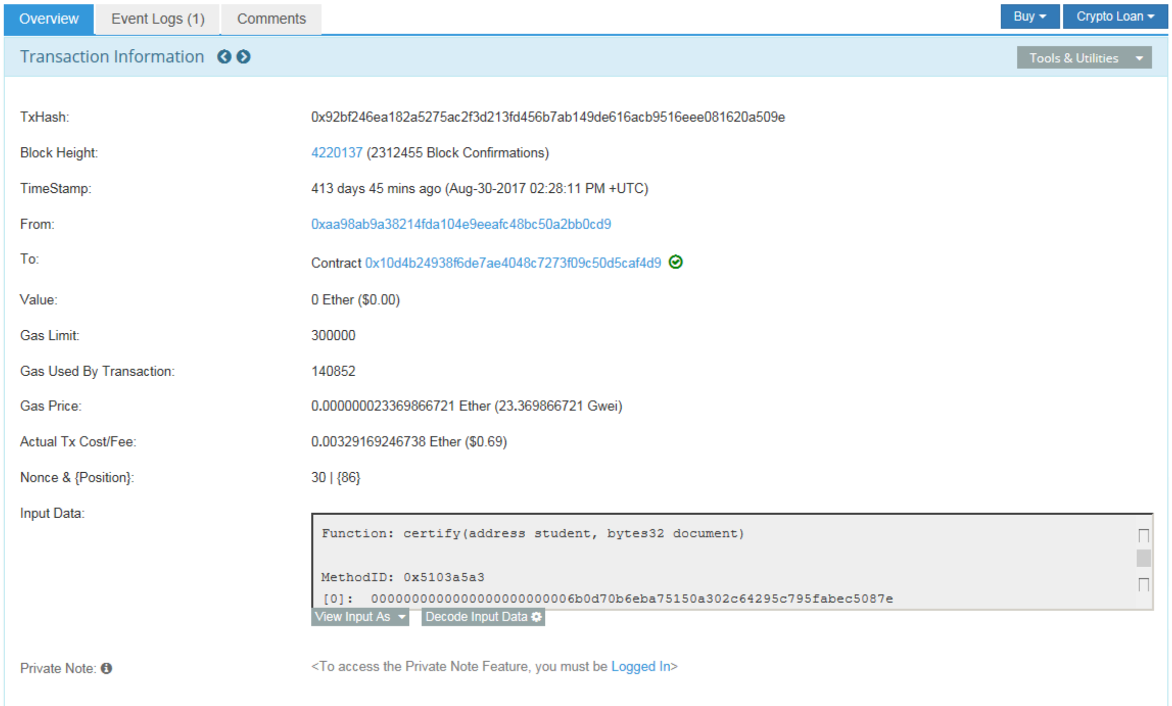
And so the block is stored in the blockchain. The information can be made available publically, to a private network across a group of entities in a supply chain, within a department in an organization, whatever. The security of the network addresses who has access to the information.

See this very basic demonstration of a blockchain which requires the Google Chrome browser, https://blockchaindemo.io/

Peers can be added to the set of authorized users of the distributed ledger.

Here is a more robust example of block of a blockchain:

https://etherscan.io/tx/0x92bf246ea182a5275ac2f3d213fd456b7ab149de616acb9516eee081620a509e

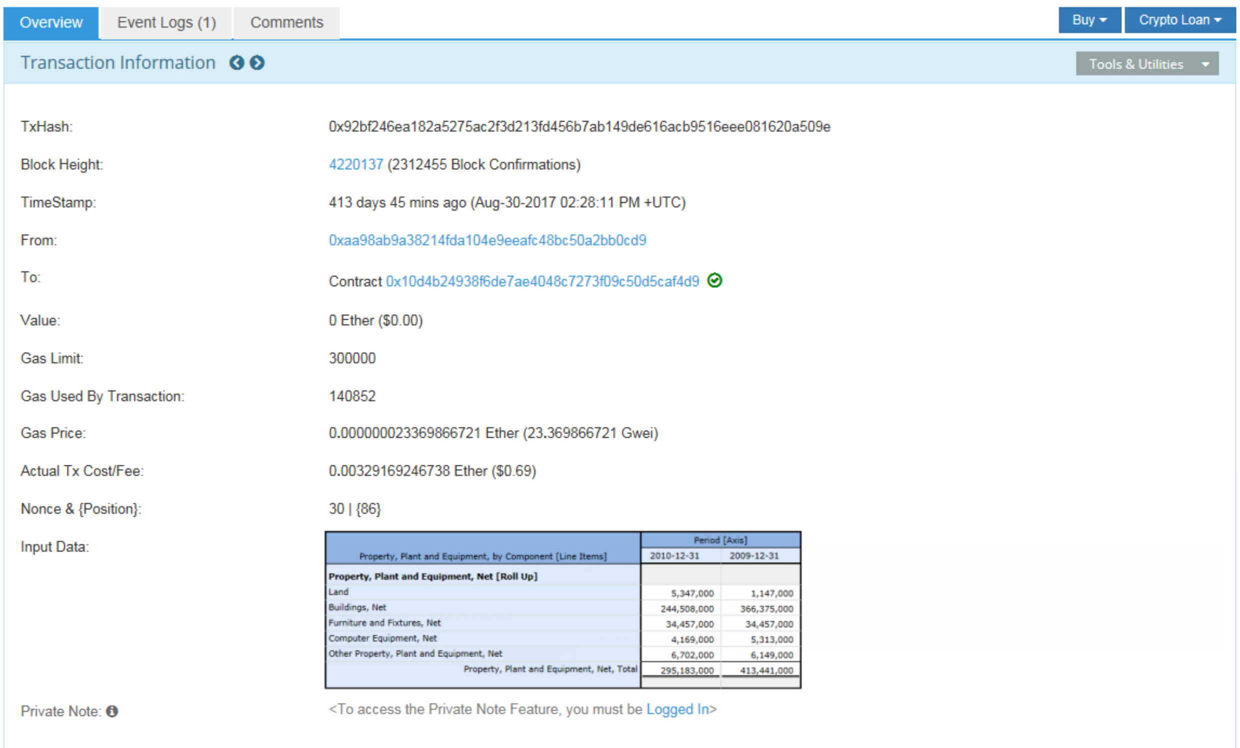


The block represents some sort of transaction. One transaction might be a company filing a financial report. Below is an example of a transaction were someone received a "Certificate of Accomplishment". You can go from the certificate to the transaction on the distributed ledger by clicking the number in the red circle:

http://certificates.b9lab.com/certificate.html?uuid=1d7c2be5-f9f3-45ed-aeb1-b397f2651136

But having humans look at the information stored in a distributed ledger is only one way of using that information. Another way of using the information is to have a machine-based process use the information in the distributed ledger. Imagine a machine interacting with a block in the blockchain to extract the XBRL instance information using a REST API web service and then using that information within a software application.

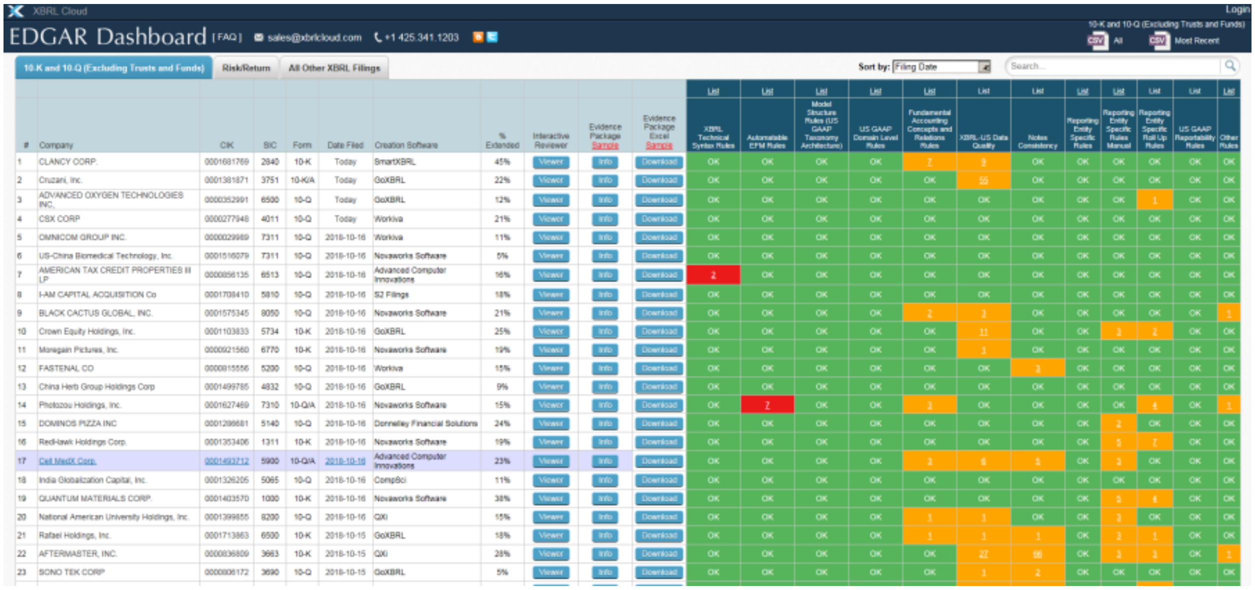
And so, the information in a block within some distributed ledger might be accessible by human-based processes or machine-based processes. Below is a mockup of a block in a blockchain where I put a screen shot of an XBRL instance after it had been rendered by a software application that understands XBRL instances, XBRL taxonomies, and how to render that information in human-readable form.



But now imagine a set of reports. For example, imagine that all the financial reports of public companies that are submitted to the SEC's EDGAR system were really stored in a distributed ledger. When a new report is added to the EDGAR system, a new entry is made to the distributed ledger. When a report is amended, then a smart contract executes and marks the previously submitted information as being superseded by the amended report. The distributed ledger system understands what information would be used if someone was to query information from the distributed ledger and use that information.

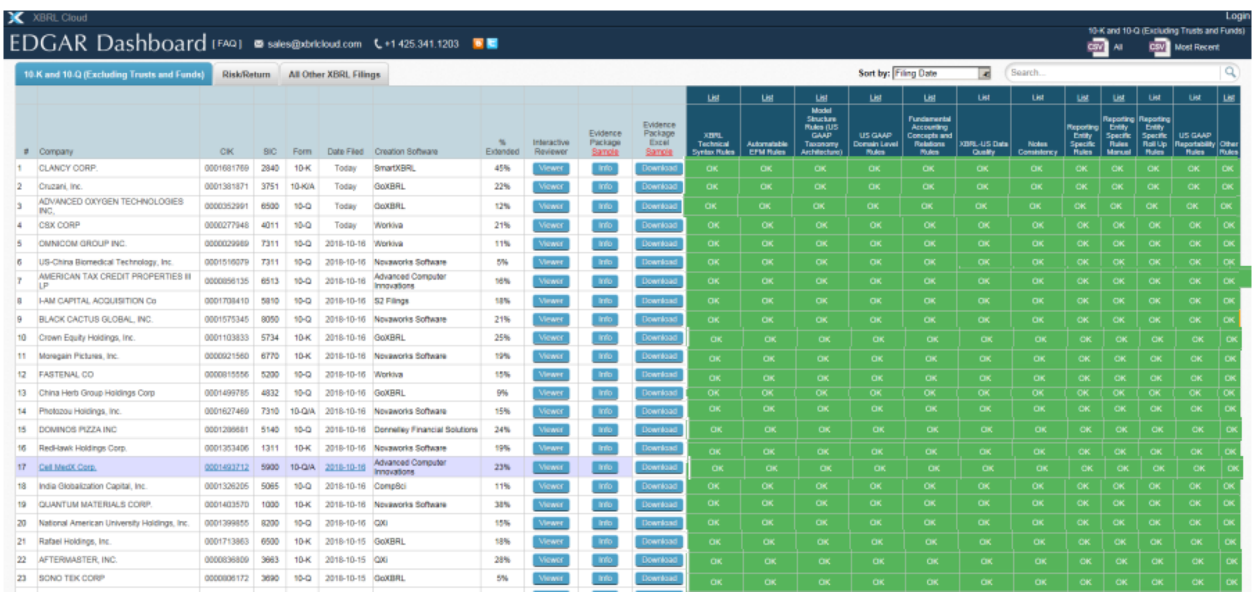
Imagine a "dashboard" that allowed you to search, filter, sort the complete set of the most current information in the blockchain so that you could get the information that you wanted to work with. An example of that is the XBRL Cloud Edgar Dashboard:

https://edgardashboard.xbrlcloud.com/edgar-dashboard/



But note the RED and ORANGE cells on that dashboard. What causes the cells to be RED or ORANGE and not GREEN? The RED and ORANGE colored cells are caused by errors in the submitted report.

But imagine that, unlike the SEC EDGAR system which contains XBRL-based information that contains errors; the first "smart contract" that is run is inbound quality validation performed prior to accepting the information by the distributed ledger system and therefore could be no errors in the distributed ledger of reported information to the extent the machine-readable business rules enforced information integrity and quality. And so, the dashboard would always look like this (i.e. no syntax, business logic, structural, mathematical, or other errors):



For some styles of XBRL implementations inbound validation is very easy. For example, the XBRL implementation by the Federal Deposit Insurance Corporation (FDIC) is very straight forward to verify prior to submission of information. Why? Validation is easy because the set of information is basically a form or a closed taxonomy. The FDIC, as I understood it at the time, used approximately 1,500 business rules to test the mathematical relations of information. Structural changes were not allowed, chances to mathematical relations were not allowed, financial institutions cannot add new information to their reports, etc.

However, the SEC's EDGAR system and the XBRL-based financial reports of public companies work a little bit differently. Essentially, more than one information structure is allowed. Mathematical relations in reports can be different for different organizations depending on the reporting style a public company chooses to use. Additional entity-specific information can be disclosed. Some subtotals are not required to be reported by all companies and so might not be provided in some reports. And so how can the SEC make sure information is represented consistently with expectations and does not contain any errors given that all these modifications are allowed?

The answer is rules. Rules prevent anarchy[4].

Information can only be guaranteed to be correct to the extent that machine-readable business rules are provided to assure that information is correct. For every dimension of flexibility, rules must be provided by the system to control that dimension of flexibility. Stepping through the system of XBRL-based financial reports will show you how to control flexibility:

- **XBRL technical syntax**: While the XBRL-based financial reports of public companies have some latitude as to how to represent information using the XBRL technical syntax; all companies must conform to the XBRL technical syntax. XBRL International provides a conformance suite that indicates what is allowed and what is not allowed. Software vendors are expected to be consistent with that XBRL conformance suite. When XBRL-based reports of public companies are submitted to the SEC EDGAR system, inbound testing prior to accepting the reported information checks to make sure submitted information is consistent with expectation. This works well and 99.99% of all XBRL-based reports are consistent with the expected XBRL technical syntax.
- **Model structure**: While the XBRL-based financial reports of public companies have some latitude as to how to represent information related to XBRL presentation relations; there are clear guideline in most cases. Note that I am saying "most cases". Why is this not clear in "all cases"? Well, it can be clear…however, the SEC neglected to provide clear rules as to the relationships between the categories of report elements that make up an XBRL-based financial report: Networks, Tables, Axis, Members, Line Items, Concepts, and Abstracts. To resolve these issues all that needs to happen is the allowed and disallowed relationships must be made clear.
- **Reporting styles**: While all financial reports of public companies are required to be consistent with US GAAP; there are different ways, or styles of reporting, that are consistent with US GAAP. Reporting styles are basically patterns. Approximately 80% of public companies us one of 29

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

specific reporting styles[5]. The remaining 20% of companies use somewhere between 27 and possibly 172 additional reporting styles. The errors caused by not having clearly defined reporting styles is easy to solve; the solution is simply provide the complete set of reporting styles.

- **Continuity cross-checks**: Information reported within financial reports must be internally consistent and logical. Information reported in on part of a report cannot contradict information reported in another part of a report. Related to the notion of reporting styles is the notion of continuity cross-checks. Continuity cross-checks are simply high-level relationships between financial concepts that are universally consistent within a reporting style. For example, "Assets = Liabilities and Equity", the accounting equation, is a continuity cross-check. The way to make sure that the continuity of the information within a report is logically consistent is to provide continuity cross-check rules.
- **Types**: Information reported within financial reports must be internally consistent and logical as we stated above. Another way information can be inconsistent is that detailed items can be used in an incorrect manner. For example, the concept "general and administrative expenses" is always part of "operating expenses"; "operating expenses would never be part of "general and administrative expenses". To prevent information from being used in an incorrect manner in a report type or class relations are used to define the appropriate use of a concept. If this is done in machine-readable form then automated validation processes can be used to detect misuses of concepts.

What I am pointing out is that flexibility can be provided and effectively controlled. There are additional control mechanisms that can be used. It is to the extent that these control mechanisms are provided that (a) flexibility can be provided and (b) quality of information can be maintained. Not providing these mechanisms means that quality issues will inevitably exist. Additional discussions of these mechanisms are beyond the scope of this document[6].

And so, imagine that you do provide all of the necessary mechanisms for controlling quality and you provide the flexibility you desire and you do realize the quality you anticipated as a result of these measures and all information is verified prior to the information being submitted into the distributed ledger.

That means you have high-quality information, available publically or privately or somewhere in between, the information can never be changed, it is immutable; so the provenance or origin of the information is clear and there is a clear audit trail. Information can be provided at any level of granularity that you might choose.

Imagine business analytics software that could interact with either the machine readable information or the human readable information to create analysis of the information within the distributed ledger. Information could be accessed using automated machine-based processes or by humans using business

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[5] Making the Case for Reporting Styles, http://xbrlsite.azurewebsites.net/2017/library/MakingTheCaseForReportingStyles.pdf

[6] If you desire more information please see, *Blueprint for Creating Zero-Defect XBRL-based Digital Financial Reports*, http://xbrlsite.azurewebsites.net/2017/Library/BlueprintForZeroDefectDigitalFinancialReports.pdf

analytics software that allows information to be worked with dynamically. Think "pivot tables" type functionality.

Here is a normalized entity comparison that uses business rules associated with the information in the blockchain to create a comparison across the periods for one economic entity. The same business rules that were used to verify that a report was created correctly is used by business analytics software to help the software understand the reported information:

Rendering | Model Structure | Fact Table | Business Rules Structure | Business Rules Validation Results | Elements

Component: (Network and Table)

Network	001 - Unknown - **General Information**
Table	General Information [Table]

Reporting Entity [Axis]: 0000789019 http://www.sec.gov/CIK

Unit [Axis]:

Period [Axis]

General Information [Line Items]	2016-07-01/2016-12-31	2016-07-01/2016-09-30	2015-07-01/2016-06-30	2015-07-01/2016-03-31	2015-07-01/2015-12-31
General Information [Hierarchy]					
Entity Registrant Name	MICROSOFT CORPORATION	MICROSOFT CORPORATION	MICROSOFT CORPORATION	MICROSOFT CORPORATION	MICROSOFT CORPORATION
Entity Central Index Key	0000789019	0000789019	0000789019	0000789019	0000789019
Entity Filer Category	Large Accelerated Filer	Large Accelerated Filer	Large Accelerated Filer	Large Accelerated Filer	Large Accelerated Filer
Trading Symbol	MSFT	MSFT	MSFT	MSFT	MSFT
Fiscal Year End	--06-30	--06-30	--06-30	--06-30	--06-30
Fiscal Year Focus	2017	2017	2016	2016	2016
Fiscal Period Focus	Q2	Q1	FY	Q3	Q2
Document Type	10-Q	10-Q	10-K	10-Q	10-Q
Balance Sheet Date	2016-12-31	2016-09-30	2016-06-30	2016-03-31	2015-12-31

Component: (Network and Table)

Network	101 - Unknown - **Balance Sheet, Classified**
Table	Balance Sheet, Classified [Table]

Reporting Entity [Axis]: 0000789019 http://www.sec.gov/CIK

Unit [Axis]: USD

Period [Axis]

Balance Sheet [Line Items]	2016-12-31	2016-09-30	2016-06-30	2016-03-31	2015-12-31
Assets [Roll Up]					
Current Assets	144,949,000,000	157,909,000,000	139,660,000,000	128,421,000,000	127,812,000,000
Noncurrent Assets	79,661,000,000	54,615,000,000	54,034,000,000	53,448,000,000	52,286,000,000
Assets	224,610,000,000	212,524,000,000	193,694,000,000	181,869,000,000	180,098,000,000
Liabilities and Equity [Roll Up]					
Liabilities [Roll Up]					
Current Liabilities	70,787,000,000	58,810,000,000	59,357,000,000	44,354,000,000	42,643,000,000
Noncurrent Liabilities	85,014,000,000	83,342,000,000	62,340,000,000	62,709,000,000	60,675,000,000
Liabilities	155,801,000,000	142,152,000,000	121,697,000,000	107,063,000,000	103,318,000,000
Commitments and Contingencies	xsi:nil	xsi:nil	xsi:nil	xsi:nil	xsi:nil
Temporary Equity	0	0	0	0	0
Equity [Roll Up]					
Equity Attributable to Parent	68,809,000,000	70,372,000,000	71,997,000,000	74,806,000,000	76,780,000,000
Equity Attributable to Noncontrolling Interest	0	0	0	0	0
Equity	68,809,000,000	70,372,000,000	71,997,000,000	74,806,000,000	76,780,000,000
Liabilities and Equity	224,610,000,000	212,524,000,000	193,694,000,000	181,869,000,000	180,098,000,000

Component: (Network and Table)

Network	401 - Unknown - **Cash Flow Statement**
Table	Cash Flow Statement [Table]

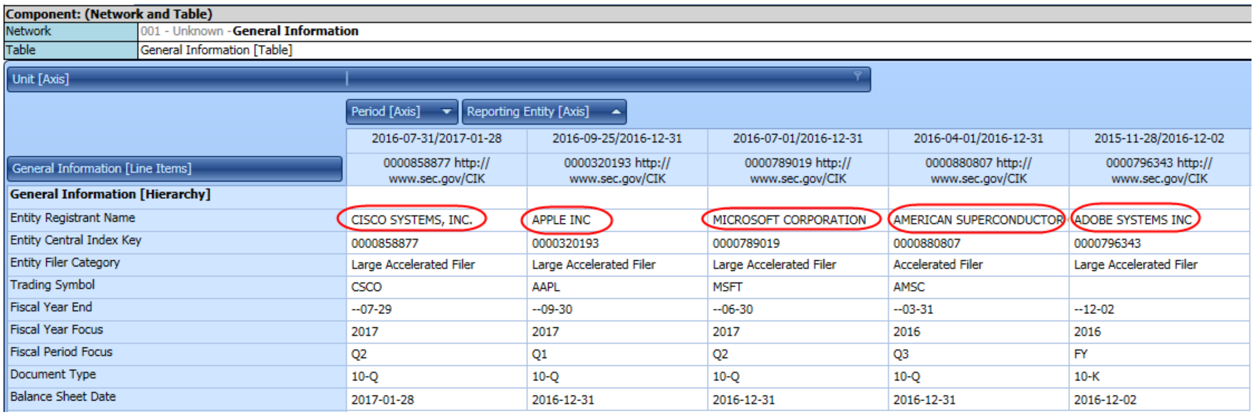
Reporting Entity [Axis]: 0000789019 http://www.sec.gov/CIK

Unit [Axis]: USD

Period [Axis]

Cash Flow Statement [Line Items]	2016-07-01/2016-12-31	2016-07-01/2016-09-30	2015-07-01/2016-06-30	2015-07-01/2016-03-31	2015-07-01/2015-12-31
Net Cash Flow [Roll Up]					
Net Cash Flow from Operating Activities [Roll Up]					
Net Cash Flow from Operating Activities, Continuing	17,842,000,000	11,549,000,000	33,325,000,000	24,861,000,000	14,192,000,000
Net Cash Flow from Operating Activities, Discontinued	0	0	0	0	0
Net Cash Flow from Operating Activities	17,842,000,000	11,549,000,000	33,325,000,000	24,861,000,000	14,192,000,000
Net Cash Flow from Investing Activities [Roll Up]					
Net Cash Flow from Investing Activities, Continuing	(33,221,000,000)	(18,470,000,000)	(23,950,000,000)	(13,877,000,000)	(8,394,000,000)
Net Cash Flow from Investing Activities, Discontinued	0	0	0	0	0
Net Cash Flow from Investing Activities	(33,221,000,000)	(18,470,000,000)	(23,950,000,000)	(13,877,000,000)	(8,394,000,000)
Net Cash Flow from Financing Activities [Roll Up]					
Net Cash Flow from Financing Activities, Continuing	17,345,000,000	14,329,000,000	(8,393,000,000)	(9,364,000,000)	(4,146,000,000)
Net Cash Flow from Financing Activities, Discontinued	0	0	0	0	0
Net Cash Flow from Financing Activities	17,345,000,000	14,329,000,000	(8,393,000,000)	(9,364,000,000)	(4,146,000,000)
Exchange Gains (Losses)	(8,000,000)	10,000,000	(67,000,000)	(45,000,000)	(62,000,000)
Net Cash Flow	1,958,000,000	7,418,000,000	915,000,000	1,575,000,000	1,590,000,000

Here is a comparison across entities for a specific period:



Component: (Network and Table)

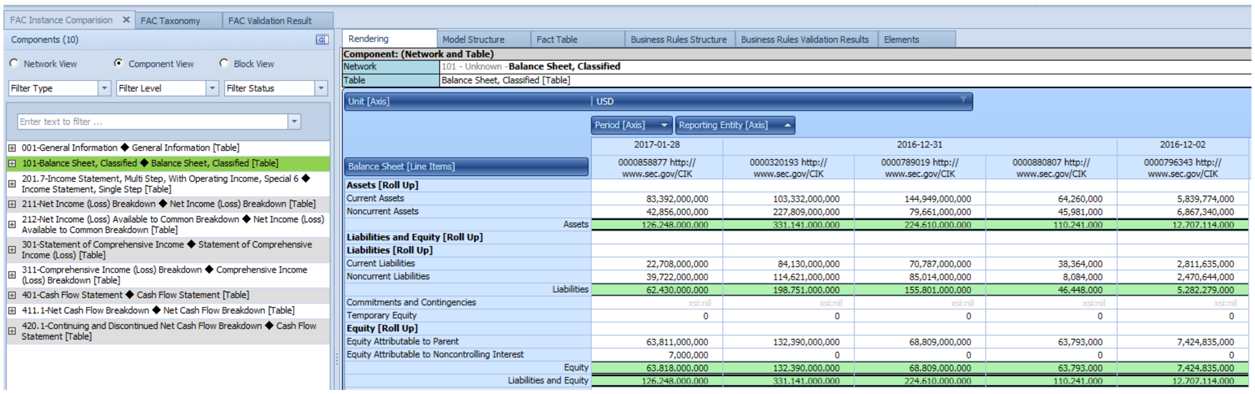
Network	001 - Unknown - **General Information**
Table	General Information [Table]

Unit [Axis]

Period [Axis] / Reporting Entity [Axis]

General Information [Line Items]	2016-07-31/2017-01-28 0000858877 http://www.sec.gov/CIK	2016-09-25/2016-12-31 0000320193 http://www.sec.gov/CIK	2016-07-01/2016-12-31 0000789019 http://www.sec.gov/CIK	2016-04-01/2016-12-31 0000880807 http://www.sec.gov/CIK	2015-11-28/2016-12-02 0000796343 http://www.sec.gov/CIK
General Information [Hierarchy]					
Entity Registrant Name	CISCO SYSTEMS, INC.	APPLE INC	MICROSOFT CORPORATION	AMERICAN SUPERCONDUCTOR	ADOBE SYSTEMS INC
Entity Central Index Key	0000858877	0000320193	0000789019	0000880807	0000796343
Entity Filer Category	Large Accelerated Filer	Large Accelerated Filer	Large Accelerated Filer	Accelerated Filer	Large Accelerated Filer
Trading Symbol	CSCO	AAPL	MSFT	AMSC	
Fiscal Year End	--07-29	--09-30	--06-30	--03-31	--12-02
Fiscal Year Focus	2017	2017	2017	2016	2016
Fiscal Period Focus	Q2	Q1	Q2	Q3	FY
Document Type	10-Q	10-Q	10-Q	10-Q	10-K
Balance Sheet Date	2017-01-28	2016-12-31	2016-12-31	2016-12-31	2016-12-02

Imagine a pivot table-type interface that was not OLAP (which has constrains that need to be avoided), but rather was a multidimensional modeling tool. Imagine a global standard query mechanism that allowed dynamic interfaces to be generated and populated with facts from the distributed ledger:



Component: (Network and Table)

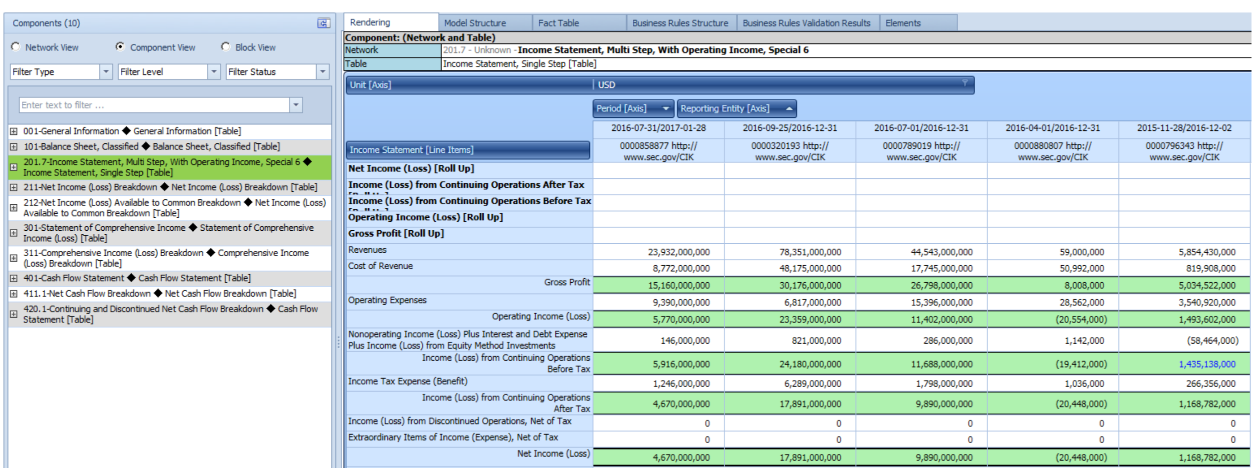
Network	101 - Unknown - **Balance Sheet, Classified**
Table	Balance Sheet, Classified [Table]

Unit [Axis]: USD

Period [Axis] / Reporting Entity [Axis]

Balance Sheet [Line Items]	2017-01-28 0000858877 http://www.sec.gov/CIK	2016-12-31 0000320193 http://www.sec.gov/CIK	2016-12-31 0000789019 http://www.sec.gov/CIK	2016-12-31 0000880807 http://www.sec.gov/CIK	2016-12-02 0000796343 http://www.sec.gov/CIK
Assets [Roll Up]					
Current Assets	83,392,000,000	103,332,000,000	144,949,000,000	64,260,000	5,839,774,000
Noncurrent Assets	42,856,000,000	227,809,000,000	79,661,000,000	45,981,000	6,867,340,000
Assets	126,248,000,000	331,141,000,000	224,610,000,000	110,241,000	12,707,114,000
Liabilities and Equity [Roll Up]					
Liabilities [Roll Up]					
Current Liabilities	22,708,000,000	84,130,000,000	70,787,000,000	38,364,000	2,811,635,000
Noncurrent Liabilities	39,722,000,000	114,621,000,000	85,014,000,000	8,084,000	2,470,644,000
Liabilities	62,430,000,000	198,751,000,000	155,801,000,000	46,448,000	5,282,279,000
Commitments and Contingencies	xsi:nil	xsi:nil	xsi:nil	xsi:nil	xsi:nil
Temporary Equity	0	0	0	0	0
Equity [Roll Up]					
Equity Attributable to Parent	63,811,000,000	132,390,000,000	68,809,000,000	63,793,000	7,424,835,000
Equity Attributable to Noncontrolling Interest	7,000,000	0	0	0	0
Equity	63,818,000,000	132,390,000,000	68,809,000,000	63,793,000	7,424,835,000
Liabilities and Equity	126,248,000,000	331,141,000,000	224,610,000,000	110,241,000	12,707,114,000

Users could slice and dice information from the distributed ledger, can "drill down" or "drill up" to any information that is organized using the semantics of the information. The information can be traversed all the way back to the original "transaction" that caused the information to exist.



Component: (Network and Table)

Network	201.7 - Unknown - **Income Statement, Multi Step, With Operating Income, Special 6**
Table	Income Statement, Single Step [Table]

Unit [Axis]: USD

Period [Axis] / Reporting Entity [Axis]

Income Statement [Line Items]	2016-07-31/2017-01-28 0000858877 http://www.sec.gov/CIK	2016-09-25/2016-12-31 0000320193 http://www.sec.gov/CIK	2016-07-01/2016-12-31 0000789019 http://www.sec.gov/CIK	2016-04-01/2016-12-31 0000880807 http://www.sec.gov/CIK	2015-11-28/2016-12-02 0000796343 http://www.sec.gov/CIK
Net Income (Loss) [Roll Up]					
Income (Loss) from Continuing Operations After Tax					
Income (Loss) from Continuing Operations Before Tax					
Operating Income (Loss) [Roll Up]					
Gross Profit [Roll Up]					
Revenues	23,932,000,000	78,351,000,000	44,543,000,000	59,000,000	5,854,430,000
Cost of Revenue	8,772,000,000	48,175,000,000	17,745,000,000	50,992,000	819,908,000
Gross Profit	15,160,000,000	30,176,000,000	26,798,000,000	8,008,000	5,034,522,000
Operating Expenses	9,390,000,000	6,817,000,000	15,396,000,000	28,562,000	3,540,920,000
Operating Income (Loss)	5,770,000,000	23,359,000,000	11,402,000,000	(20,554,000)	1,493,602,000
Nonoperating Income (Loss) Plus Interest and Debt Expense Plus Income (Loss) from Equity Method Investments	146,000,000	821,000,000	286,000,000	1,142,000	(58,464,000)
Income (Loss) from Continuing Operations Before Tax	5,916,000,000	24,180,000,000	11,688,000,000	(19,412,000)	1,435,138,000
Income Tax Expense (Benefit)	1,246,000,000	6,289,000,000	1,798,000,000	1,036,000	266,356,000
Income (Loss) from Continuing Operations After Tax	4,670,000,000	17,891,000,000	9,890,000,000	(20,448,000)	1,168,782,000
Income (Loss) from Discontinued Operations, Net of Tax	0	0	0	0	0
Extraordinary Items of Income (Expense), Net of Tax	0	0	0	0	0
Net Income (Loss)	4,670,000,000	17,891,000,000	9,890,000,000	(20,448,000)	1,168,782,000

Essentially, the information in the blockchain that makes up the distributed ledger is a "fact database". As new facts are added, old facts are marked "revised" but not removed from the blockchain. For example, an SEC financial report can be "amended". The prior information should no longer be used in queries; rather the most currently reported information should be used. The older information still exists, but the query mechanism is smart enough to get the correct information for queries.

To make all this work, there needs to be manual and/or automated workflows for creating the reports that might go into a distributed ledger type system such as shown above.

While there are, today, numerous software vendors and filing agents that can create XBRL-based reports such as those reports that are submitted to the U.S. SEC and that will be reported to the ESMA; many of those software tools and processes do not yield the necessary quality because of errors that exist within those reports[7].

There are exactly two causes for these easy to understand errors[8]:

- The SEC neglects to provide the necessary, proper, complete set of inbound validation rules and therefore lets reports that contain errors into the EDGAR system.
- While many of these rules do exist (i.e. note that XBRL Cloud shows that it can detect errors in reports, remember the RED and ORANGE cells?) the rules are not used by all software vendors.

Solving this problem is simple: (a) require all documents that will be submitted into the system to be evaluated using the same set of rules and (b) require software vendors and other processes that will ultimately lead to a completed report to use those rules. This can be easily enforced by simply having the distributed ledger re-check reports upon submission to the system and rejecting reports that are not consistent with required rules.

And so, existing software tools and processes can easily be corrected.

Further, new types of tools will be developed. One example of a tool that will ultimately exist is *Pesseract*[9] which is will be an expert system for creating financial reports and other business reports. *Pesseract* is engineered to enable accounting, reporting, auditing, and analysis processes to work in a digital environment. The current old-school financial report creation process will eventually be disrupted[10] and replaced by new processes that leverage things such as the structured nature of XBRL[11]. Leveraging XBRL's structured nature will not be driven by regulatory mandates. While regulatory

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

[8] Blueprint for Creating Zero-Defect XBRL-based Digital Financial Reports, http://xbrlsite.azurewebsites.net/2017/Library/BlueprintForZeroDefectDigitalFinancialReports.pdf

[9] Understanding Digital Financial Reporting using Pesseract, http://xbrl.squarespace.com/journal/2018/10/14/understanding-digital-financial-reporting-using-pesseract.html

[10] Seba Technology Disruption Framework, http://xbrl.squarespace.com/journal/2018/10/10/seba-technology-disruption-framework.html

[11] YouTube.com, *How XBRL Works*, https://www.youtube.com/watch?v=nATJBPOiTxM

mandates certainly primed the pump and created a small market for public or listed companies that must report to regulators; it will be improved processes, lower overall cost, reduced time and effort, and increased quality that will drive the much larger private company market to digital financial reporting.

Another class of tools that will likely ultimately exist and will contribute to the disruption of the process of creating financial reports can be exemplified by looking at Blackline's *Finance Controls and Automation Platform*[12]. Blackline pushes ideas such as "continuous accounting[13]" and "smart close[14]" and "accounting process automation[15]" which are all part of the "the modern finance platform[16]".

Financial analysis will also benefit from improved accounting and reporting processes[17]. Analysis is simple another step in the supply chain. Supplying analysts or machines that do analysis with reliable high-quality information will significantly reduce if not totally eliminate the rekeying of information.

And then there is auditing. In their *paper Imagineering Audit 4.0*[18], Jun Dai and Miklos Vasarhelyi of Rutgers University use the term "mirror world" to describe the use of technology to create a virtual copy of the real world. Distributed ledgers, smart contracts, and XBRL help to build that virtual copy.

Finally, a financial report is a type of business report. Financial reports are rather complex business reports. And so the changes that you can see happening today are likely to also transform business reporting in general. These same financial reporting tools or other similar tools can be used to create general business reports.

All of this will likely evolve over time. As the technologies that make the transformation to digital converge, at the convergence points large leaps in better functionality will likely occur.

I am not the only one that sees this transformation to digital. Alastria[19], Auditchain[20], GovernanceChain[21], Pacio[22], and others[23] have some version of this same idea of accounting, reporting, auditing, and analysis in a digital environment.

Will someone pull this off? Perhaps.

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12 Blackline, *Finance Controls and Automation Platform*, https://www.blackline.com/finance-controls-and-automation

13 Blackline, *Continuous Accounting*, https://www.blackline.com/continuous-accounting

14 Blackline, *Smart Close*, https://www.blackline.com/smart-close

15 Blackline, *Accounting Process Automation*, https://www.blackline.com/accounting-process-automation

16 The Modern Finance Platform, http://xbrl.squarespace.com/journal/2018/7/15/the-modern-finance-platform.html

17 Representing Unlevered Discounted Cash Flow Model Using XBRL, http://xbrl.squarespace.com/journal/2018/9/4/representing-unlevered-discounted-cash-flow-model-using-xbrl.html

18 Jun Dai and Miklos Vasarhelyi, *Imagineering Audit 4.0*, http://aaajournals.org/doi/abs/10.2308/jeta-10494

19 Alastria, https://alastria.io/index_en.html

20 Auditchain, *Auditchain Whitepaper*, https://auditchain.com/Auditchain-Whitepaper.pdf

21 GovernanceChain, Track.Capital, https://track.capital/

22 Pacio, *Pacio overview*, https://www.pacio.io/wp-content/uploads/2018/08/stack-grid.pdf

23 Reengineering Accounting, http://xbrl.squarespace.com/journal/2018/10/5/reengineering-accounting.html