Distributed Ledgers + Smart Contracts + XBRL

By Charles Hoffman, CPA

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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 system¹ (XBRL processor, XBRL Formula processor).
- XBRL supports the multidimensional model² 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, <u>https://en.wikipedia.org/wiki/Runtime_system</u>

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

Block:	# 1
Nonce:	72608
Data:	
Hash:	0000f727854b50bb95c054b39c1fe5c92e5ebcfa4bcb5dc279f56aa96a365e5a
	Mine

The user pastes an XBRL instance document and supporting XBRL taxonomies into the "Data" section of the block³:

Block:	# 1
Nonce:	30905
Data:	<pre><?xml version="1.0" encoding="utf-8"?> <xbr></xbr>xmlns="http://www.xbrl.org/2003/instance" xmlns:xbrli="http://www.xbrl.org/2003/instance" xmlns:link="http://www.xbrl.org/2003/instance" xmlns.xlink="http://www.xbrl.org/2003/inkbase" xmlns.xlink="http://www.w3.org/1999/xlink" xmlns.xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns.xbrldi="http://www.w3.org/2006/xbrldi" xmlns.brm="http://www.xbrlsite.com/Schemas/brm" xmlns.frm="http://www.xbrlsite.com/Schemas/frm"</pre>
Hash:	f99c3b352e5d2dcf1778b615aedf104e30b6bab58098d4c4fcd16278974de4f9
	Mine

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, <u>https://www.xbrl.org/Specification/taxonomy-package/REC-2016-04-19/taxonomy-package-REC-2016-04-19.html</u>

Block:	# 1
Nonce:	29321
Data:	decimals="INF">6149000 <pattern:propertyplantandequipmentnet contextref="I-2010" decimals="INF" unitref="U-
Monetary">295183000</pattern:propertyplantandequipmentnet> <pattern:propertyplantandequipmentnet contextref="I-2009" decimals="INF" unitref="U-
Monetary">413441000</pattern:propertyplantandequipmentnet>
Hash:	0000277d609e34c910dda54f072c916fd932df5eb550c7e8695d21863945639a
	Mine

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/

DATA	Welcome to Blockchain Demo 2.0!	
REVIOUS HA		
	/dc/585150//all909616624/d05dd168052652d/d066899	202610610905701
GENES	SIS BLOCK on Tue, 17 Oct 2017 19:53:20 GMT	604
	\checkmark	
DATA	xml version="1.0" encoding="utf-8"? Created by C</p	Charles Hoffman, CPA
PREVIOUS HA	1	92026148108b27of
ASH 000)8aaaa4b75ccd61e6d7da7655d5966c0795d63e88ce13cd	1795ea8f7f7fc42d
BLOCK	✓ #1 on Wed, 17 Oct 2018 15:08:59 GMT	857
	\checkmark	2
		•
DATA	xml version="1.0" encoding="utf-8"? <xbrl xmlns="htt</p>	tp://www.xbrl.org/200
REVIOUS HA	SH 0008aaaa4b75ccd61e6d7da7655d5966c0795d63e88ce13c	d795ea8f7f7fc42d
IASH 000)aabacce8283f32500d49806ffcc438e4a0afaee02f0094	9478cbc9c667fa8
	(#)	2021

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

Overview Event Logs (1) Comment	Buy + Crypto Loan +
Transaction Information 🔇 🕑	Tools & Utilities 💌
TxHash:	0x92bf246ea182a5275ac2f3d213fd456b7ab149de616acb9516eee081620a509e
Block Height:	4220137 (2312455 Block Confirmations)
TimeStamp:	413 days 45 mins ago (Aug-30-2017 02:28:11 PM +UTC)
From:	0xaa98ab9a38214fda104e9eeafc48bc50a2bb0cd9
To:	Contract 0x10d4b24938f6de7ae4048c7273f09c50d5caf4d9 🔗
Value:	0 Ether (\$0.00)
Gas Limit:	300000
Gas Used By Transaction:	140852
Gas Price:	0.00000023369866721 Ether (23.369866721 Gwei)
Actual Tx Cost/Fee:	0.00329169246738 Ether (\$0.69)
Nonce & {Position}:	30 {86}
Input Data:	Function: certify(address student, bytes32 document) MethodID: 0x5103a5a3 [0]: 0000000000000000006b0d70b6eba75150a302c64295c795fabec5087e View Input As
Private Note:	<to access="" be="" feature,="" in="" logged="" must="" note="" private="" the="" you=""></to>

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.

Overview	Event Logs (1)	Comments					Buy - Crypto Loan -
Transactio	on Information	00					Tools & Utilities 🔻
TxHash:			0x92bf246ea182a5275ac2f3d213fd456b7ab149d	e616acb9516	eee081620a	509e	
Block Height	10 10		4220137 (2312455 Block Confirmations)				
TimeStamp:			413 days 45 mins ago (Aug-30-2017 02:28:11 PM	I +UTC)			
From:			0xaa98ab9a38214fda104e9eeafc48bc50a2bb0cd	9			
To:			Contract 0x10d4b24938f6de7ae4048c7273f09c50)d5caf4d9 🥝			
Value:			0 Ether (\$0.00)				
Gas Limit:			300000				
Gas Used By	/ Transaction:		140852				
Gas Price:			0.000000023369866721 Ether (23.369866721 Gv	vei)			
Actual Tx Co	st/Fee:		0.00329169246738 Ether (\$0.69)				
Nonce & {Po	sition}:		30 {86}				
Input Data:		1		Period	[Axis]	1	
input Data.			Property, Plant and Equipment, by Component [Line Items]	2010-12-31	2009-12-31		
			Property, Plant and Equipment, Net [Roll Up]				
			Land Buildings, Net	5,347,000	1,147,000		
			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		
Private Note:	•		<to access="" be<="" feature,="" must="" note="" private="" td="" the="" you=""><td>e Logged In></td><td></td><td>1</td><td></td></to>	e Logged In>		1	

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/

х	XBRL Cloud Login																					
ED	GAR Dashboar		🖾 sak	ndx@ae	cloud.com	C +1 425.341.1203												9 8	Kand 104		g Trusts and Most Recer	d Funds) nt
10	K and 10-Q (Excluding Trusts and Fund	s) Risk/R	eturn	All Oth	er XBRL Filin	ige								Sort by: F	iling Date	-	Search					Q)
											Lis	List	List	List	Lis	List	List	List	List	UH	UR	List
	Company	СК	BIC	Form	Date Filed	Creation Software	% Extended	Interactive Reviewor	Evidence Package Sample	Evidence Package Excel Sample	XERL Technical Syntax Rules	Automatable EPM Rules	Model Structure Rules (US GAAP Taxonomy Archilecture)	US GAAP Domain Level Rules	Fundamental Accounting Concepts and Relations Rules	XDRL-US Data Quelty	Notes Consistency	Reporting Entity Specific Nales	Reporting Entity Specific Rules Manual	Reporting Entity Specific Rail Up Notes	US GAAP Reportability Notes	Other Rules
1	CLANCY CORP.	0001681769	2840	10-K	Today	SmartXBRL	45%	Viewer	info	Download	OK	ок	ок	ок	2	2	OK	ОК	ок	ОК	ОК	OK
2	Cruzani, Inc.	0001381871	3751	10-K/A	Today	GoXBRL	22%	Viewer	Info	Download	ОК				ок							OK
3	ADVANCED OXYGEN TECHNOLOGIES INC.	0000352991	6500	10-Q	Today	GoXBRL	12%	Viewer	Info	Download	ок											ок
4	CSX CORP	0000277948	4011	10-Q	Today	Workiva	21%	Viewer	info	Download	OK											OK
5	ONNICOM GROUP INC.	0000029989	7311	10-Q	2018-10-16	Workiva	11%	Viewer	Info	Download	ОК											OK
6	US-China Biomedical Technology, Inc.	0001516079	7311	10-Q	2018-10-16	Novaworks Software	5%	Viewer	Info	Download	OK											OK
7	AMERICAN TAX CREDIT PROPERTIES II LP	0000056135	6513	10-Q	2018-10-16	Advanced Computer Innovations	16%	Viewer	Info	Download	2											ox
8	HAM CAPITAL ACQUISITION Co	0001703410	5810	10-Q	2018-10-16	S2 Filings	18%	Vewer	Info	Download	OK											ok
9	BLACK CACTUS GLOBAL, INC.	0001575345	8050	10-Q	2018-10-16	Novaworks Software	21%	Vewer	Info	Download	OK											
10	Crown Equity Holdings, Inc.	0001103833	5734	10-K	2018-10-16	GoXBRL	25%	Viewer	Info	Download	OK											ок
11	Moregain Pictures, Inc.	0000921560	6770	10-K	2018-10-16	Novaworks Software	19%	Viewer	Info	Download	OK											OK
12	FASTENAL CO	0000815556	5290	10-Q	2018-10-16	Workiva	15%	Viewer	Info	Download	OK											OK
13	China Herb Group Holdings Corp	0001499785	4832	10-Q	2018-10-16	GoXBRL	9%	Viewer	Info	Download	ОК											ок
14	Photozou Holdings, Inc.	0001627469	7310	10-Q/A	2018-10-16	Novaworks Software	15%	Viewer	Info	Download	OK	2										
15	DOMINOS PIZZA INC	0001206681	5140	10-Q	2018-10-16	Donnelley Financial Solution	19 24%	Viewer	Info	Download	ОК											OK
16	RedHawk Holdings Corp.	0001353406	1311	10-K	2018-10-16	Novaworks Software	19%	Viewer	Info	Download	OK											OK
17	Cell MedX Corp.	0001493712	5900	10-Q/A	2018-10-16	Advanced Computer Innovations	23%	Viewer	Info	Download	ок											ox
18	India Globalization Capital, Inc.	0001326205	5065	10-Q	2018-10-16	CompBci	11%	Viewer	Info	Download	OK											OK
19	QUANTUM MATERIALS CORP.	0001403570	1000	10-K	2018-10-16	Novaworks Software	38%	Viewer	Info	Download	OK											OK
20	National American University Holdings, Inc.	0001399855	8200	10-Q	2018-10-16	G20	15%	Vewer	Info	Download	OK											OK
21	Rafael Holdings, Inc.	0001713863	6500	10-K	2018-10-15	GoXBRL	18%	Viewer	Info	Download	ОК											ок
22	AFTERMASTER, INC.	0000636809	3663	10-K	2018-10-15	QXI	28%	Viewer	Info	Download	ОК											
23	SONO TEK CORP	0000006172	3690	10-Q	2018-10-15	GeXBRL	5%	Viewer	Info	Download	ок											oĸ

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):

X	XBRL Cloud Login																					
EI	DGAR Dashboar	d [FAQ]	🖾 sal	es@xbr	icloud.com	C+1 425.341.1203												10 2	K and 104	D (E DUCH	g Trusts an Most Rece	d Funds) mt
	IO.K and 10-Q (Excluding Trusts and Fund	is) Risk/R	deturn	All Oth	er XBRL Filir	ngs								Sort by:	iling Date	-	Search					9
											List	List	List	List	List	List	List	List	us	UR	UR	List
	Company	СК	SIC	Form	Date Filed	Creation Software	% Extended	Interactive Reviewor	Evidence Package Sample	Evidence Package Excel Sample	XBPL Technical Syntax Rules	Automatable EPM Rules	Structure Rules (US GAAP Taxonomy Architecture)	US GAAP Domain Level Rules	Fundamental Accounting Concepts and Relations Rules	XBRL-US Data Oxelity	Notes Consistency	Reporting Entity Specific Hules	Reporting Entity Specific Rules Manuel	Reporting Entity Specific Rail Up Hules	US GAAP Reportabilit Rules	y Other Plutes
1	CLANCY CORP.	0001681769	2840	10-K	Today	SmartXBRL	45%	Viewer	info	Download	OK											OK
2	Cruzani, Inc.	0001381871	3751	10-K/A	Today	GoXBRL	22%	Viewer	info	Download	OK											OK
3	ADVANCED OXYGEN TECHNOLOGIES	0000352991	6500	10-0	Today	GoXBRL	12%	Viewer	Info	Download												OK
4	C8X CORP	0000277948	4011	10-Q	Today	Workiva	21%	Viewer	info	Download	ок											OK
5	OMNICOM GROUP INC.	0000029989	7311	10-Q	2018-10-16	Workiva	11%	Viewer	Info	Download	ОК											OK
6	US-China Biomedical Technology, Inc.	0001516079	7311	10-Q	2018-10-16	Novaworks Software	5%	Viewer	Info	Download	ОК											ox
7	AMERICAN TAX CREDIT PROPERTIES II LP	0000856135	6513	10-0	2018-10-16	Advanced Computer Innovations	16%	Viewer	Info	Download	ОК											OK
8	HAM CAPITAL ACQUISITION Co	0001703410	5810	10-Q	2018-10-16	S2 Filings	18%	Vewer	Info	Download	ОК											OK
9	BLACK CACTUS GLOBAL, INC.	0001575345	8050	10-Q	2018-10-16	Novaworks Software	21%	Viewer	Info	Download	ОК											OK
10	Crown Equity Holdings, Inc.	0001103833	5734	10-K	2018-10-16	GoXBRL	25%	Viewer	info	Download	ОК											OK
11	Moregain Pictures, Inc.	0000921560	6770	1D-K	2018-10-16	Novaworks Software	19%	Viewer	Info	Download	ок											OK
12	FASTENAL CO	0000815556	5200	10-Q	2018-10-16	Workiva	15%	Viewer	Info	Download	OK											OK
13	China Herb Group Holdings Corp	0001499785	4832	10-Q	2018-10-16	GoXBRL	9%	Viewer	info	Download	ОК											OK
14	Photozou Holdings, Inc.	0001627469	7310	10-Q/A	2018-10-16	Novaworks Software	15%	Viewer	info	Download	OK											OK
15	DOMINOS PIZZA INC	0001286681	5140	10-Q	2018-10-16	Donnelley Financial Solutions	24%	Viewer	Info	Download	ОК											OK
16	RedHawk Holdings Corp.	0001353406	1311	10-K	2018-10-16	Novaworks Software	1916	Vewer	Info	Download	OK											OK
17	Cell MedX Corp.	0001493712	5900	10-Q/A	2018-10-16	Advanced Computer Innovations	23%	Viewer	Info	Download	ОК											OK
18	India Globalization Capital, Inc.	0001326205	5065	10-Q	2018-10-16	CompBci	11%	Viewer	info	Download	ОК											OK
19	QUANTUM MATERIALS CORP.	0001403570	1000	1D-K	2018-10-16	Novaworks Software	38%	Viewer	Info	Download	ОК											OK
20	National American University Holdings, Inc.	0001399855	8200	10-Q	2018-10-16	020	15%	Viewer	Info	Download	ОК											OK
21	Rafael Holdings, Inc.	0001713863	6500	10-K	2018-10-15	GoXBRL	18%	Vewer	into	Download	ок											OK
22	AFTERMASTER, INC.	0000836809	3663	10-K	2018-10-15	QXI	28%	Viewer	info	Download	ОК											OK
23	SONO TEK CORP	0000006172	3690	10-Q	2018-10-15	GoXBRL	5%	Viewer	Info	Download	ОК											OK
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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 anarchy⁴.

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 styles⁵. 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 document⁶.

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

⁵ Making the Case for Reporting Styles, <u>http://xbrlsite.azurewebsites.net/2017/library/MakingTheCaseForReportingStyles.pdf</u>

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 Structur	e Business Rules Validation Re	sults Elements							
Component: (Netwo	rk and Table)											
Network	Vetwork 001 - Unknown - General Information											
Table	a General Information [Table]											
Reporting Entity [Axis]]	1	0000789019 http://www.sec.go	v/CIK	Ŷ							
Unit [Axis]					9							
			Period [Axis] 🛛 🔫									
General Information [I	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 2015-12-3					
General Information	n [Hierarchy]											
Entity Registrant Name	e		MICROSOFT CORPORATION	MICROSOFT CORPORATION	MICROSOFT CORPORATION	MICROSOFT CORPORATION	MICROSOFT CORPORATION					
Entity Central Index Ke	ey		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-К	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, Cla	assified									
Table Balance Sheet, Classified [Table]										
Reporting Entity [Axis]	0000789019 http://www.sec.go	000789019 http://www.sec.gov/CIK								
Unit [Axis]	USD	USD Ÿ								
	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										
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: (Netwo	rk and Table)									
Network	401 - Unknown - Cash Flow Statem	ent								
Table	Cash Flow Statement [Table]									
Reporting Entity [Axis]]	0000789019 http://www.sec.gov/CIK								
Unit [Axis]		USD		9						
		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 Op	perating 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 Op	perating Activities, Discontinued	0	0	0	0	0				
١	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 In	vesting 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 In	vesting Activities, Discontinued	0	0	0	0	0				
I	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 Fir	nancing 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 Fi	nancing Activities, Discontinued	0	0	0	0	0				
1	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 (Losse	es)	(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: (Networ	rk and Table)					
Network	001 - Unknown - General Informati	ion				
Table	General Information [Table]					
Unit [Axis]		I		٢		
		Period [Axis] Reporting	Entity [Axis]			
		2016-07-31/2017-01-28	2016-09-25/2016-12-31	2016-07-01/2016-12-31	2016-04-01/2016-12-31	2015-11-28/2016-12-02
General Information [L	ine Items]	0000858877 http:// www.sec.gov/CIK	0000320193 http:// www.sec.gov/CIK	0000789019 http:// www.sec.gov/CIK	0000880807 http:// www.sec.gov/CIK	0000796343 http:// www.sec.gov/CIK
General Information	ı [Hierarchy]					
Entity Registrant Name	• (CISCO SYSTEMS, INC.	APPLE INC	MICROSOFT CORPORATION	AMERICAN SUPERCONDUCTOR	ADOBE SYSTEMS INC
Entity Central Index Ke	εγ	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-К
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:

FAC Instance Comparision X FAC Taxonomy FAC Validation Result									
Components (10)	Rendering Model Structure Fact Table	Business Rules Structure	Business Rules Validation Resu	Its Elements					
a	Component: (Network and Table)								
C Network View C Component View C Block View	Network 101 - Unknown - Balance Sheet, Classified								
	Table Balance Sheet, Classified (Table)								
Filter Type Hiter Level Hiter Status Hiter Status	(unders)	1150		¢ .					
	Unit (Axis)	USD							
Enter text to filter	Period [Avis] - Reporting Entity [Avis] -								
⊞ 001-General Information ◆ General Information [Table]	2017-01-28 2016-12-31				2016-12-02				
101-Balance Sheet, Classified Balance Sheet, Classified [Table]	Balance Sheet [Line Items]	0000858877 http://	0000320193 http://	0000789019 http://	0000880807 http://	0000796343 http://			
201.7-Income Statement, Multi Step, With Operating Income, Special 6 ◆ Income Statement, Single Step [Table]	Assets [Roll Up]	www.acc.gov/carc	mmacagorycare	WWW.Socigov/circ	mmacigor/circ	mmacagorycan			
III 211-Net Income (Loss) Breakdown ◆ Net Income (Loss) Breakdown [Table]	Current Assets	83,392,000,000	103,332,000,000	144,949,000,000	64,260,000	5,839,774,000			
212 Net Income (Lean) Auslable to Common Recolutions A Net Jacome (Lean)	Noncurrent Assets	42,856,000,000	227,809,000,000	79,661,000,000	45,981,000	6,867,340,000			
Available to Common Breakdown [Table]	Assets	126.248.000.000	331.141.000.000	224.610.000.000	110.241.000	12.707.114.000			
201-Statement of Comprehensive Income A Statement of Comprehensive	Liabilities and Equity [Roll Up]								
Income (Loss) [Table]	Liabilities [Roll Up]								
311.Comprehensive Income (Lose) Breakdown 🔶 Comprehensive Income	Current Liabilities	22,708,000,000	84,130,000,000	70,787,000,000	38,364,000	2,811,635,000			
(Loss) Breakdown [Table]	Noncurrent Liabilities	39,722,000,000	114,621,000,000	85,014,000,000	8,084,000	2,470,644,000			
EL 401-Cash Elow Statement Cash Elow Statement [Table]	Liabilities	62,430,000,000	198,751.000.000	155,801,000,000	46,448,000	5,282,279,000			
II. 411 1 Net Cash Flaw Reading A Net Cash Flaw Reading we [Table]	Commitments and Contingencies								
[] 411.14vet Casil Flow breakdown ♥ ivet Casil Flow breakdown [rable]	Temporary Equity	0	0	0	0	0			
420.1-Continuing and Discontinued Net Cash Flow Breakdown ◆ Cash Flow	Equity [Roll Up]								
Statement (Labe)	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.

Components (10)	Rendering Model Structure Fact Table	Business Rules Structure	Business Rules Validation Resu	lits Elements						
C	Component: (Network and Table)									
C Network view C Component view C Block view	Network 201.7 - Unknown - Income Statement, Multi Step, With Operating Income, Special 6									
Filter Type - Filter Level - Filter Status -	Table Income Statement, Single Step [Table]									
	Unit [Axis] USD Y									
Enter text to filter	Period [Avis]									
001-General Information General Information [Table]		2016-07-31/2017-01-28	2016-09-25/2016-12-31	2016-07-01/2016-12-31	2016-04-01/2016-12-31	2015-11-28/2016-12-02				
☑ 101-Balance Sheet, Classified ◆ Balance Sheet, Classified [Table]	Income Statement [Line Items]	0000858877 http://	0000320193 http://	0000789019 http://	0000880807 http://	0000796343 http://				
 201.7-Income Statement, Multi Step, With Operating Income, Special 6 Income Statement, Single Step [Table] 	Net Income (Loss) [Roll Up]	in accigory care	www.socigory.carc	mmacagorycarc	www.socigotycak	mmacagovycare				
	Income (Loss) from Continuing Operations After Tax									
212-Net Income (Loss) Available to Common Breakdown Available to Common Breakdown [Tabla]	Income (Loss) from Continuing Operations Before Tax									
301-Statement of Commehansive Tocome Statement of Commehansive	Operating Income (Loss) [Roll Up]									
Income (Loss) [Table]	Gross Profit [Roll Up]									
311-Comprehensive Income (Loss) Breakdown Comprehensive Income	Revenues	23,932,000,000	78,351,000,000	44,543,000,000	59,000,000	5,854,430,000				
(LOSS) Breakdown [Table]	Cost of Revenue	8,772,000,000	48,175,000,000	17,745,000,000	50,992,000	819,908,000				
Horodan How Statement Cash How Statement [Table]	Gross Profit	15,160,000,000	30,176,000,000	26,798,000,000	8,008,000	5,034,522,000				
420 1-Continuing and Discontinued Nat Carb Flow Breakdown Carb Flow	Operating Expenses	9,390,000,000	6,817,000,000	15,396,000,000	28,562,000	3,540,920,000				
Statement [Table]	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 reports⁷.

There are exactly two causes for these easy to understand errors⁸:

- 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 disrupted¹⁰ and replaced by new processes that leverage things such as the structured nature of XBRL¹¹. Leveraging XBRL's structured nature will not be driven by regulatory mandates. While regulatory

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

⁸ Blueprint for Creating Zero-Defect XBRL-based Digital Financial Reports, <u>http://xbrlsite.azurewebsites.net/2017/Library/BlueprintForZeroDefectDigitalFinancialReports.pdf</u> 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, <u>http://xbrl.squarespace.com/journal/2018/10/10/seba-technology-disruption-framework.html</u>

¹¹ YouTube.com, *How XBRL Works*, <u>https://www.youtube.com/watch?v=nATJBPOiTxM</u>

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 Platform¹². Blackline pushes ideas such as "continuous accounting¹³" and "smart close¹⁴" and "accounting process automation¹⁵" which are all part of the "the modern finance platform¹⁶".

Financial analysis will also benefit from improved accounting and reporting processes¹⁷. 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 4.0¹⁸, 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. Alastria¹⁹, Auditchain²⁰, GovernanceChain²¹, Pacio²², and others²³ have some version of this same idea of accounting, reporting, auditing, and analysis in a digital environment.

Will someone pull this off? Perhaps.

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

¹³ Blackline, Continuous Accounting, <u>https://www.blackline.com/continuous-accounting</u>

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

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

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

¹⁷ Representing Unlevered Discounted Cash Flow Model Using XBRL, <u>http://xbrl.squarespace.com/journal/2018/9/4/representing-unlevered-</u> discounted-cash-flow-model-using-xbrl.html ¹⁸ Jun Dai and Miklos Vasarhelyi, *Imagineering Audit 4.0*, <u>http://aaajournals.org/doi/abs/10.2308/jeta-10494</u>

¹⁹ Alastria, <u>https://alastria.io/index_en.html</u>

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

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, <u>http://xbrl.squarespace.com/journal/2018/10/5/reengineering-accounting.html</u>