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Viable Applications for Blockchain in the Healthcare Community

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This material is based upon work funded and supported by the Department of Defense under Contract No. FA8702-15-D-0002 with Carnegie Mellon University for the operation of the Software Engineering Institute, a federally funded research and development center.

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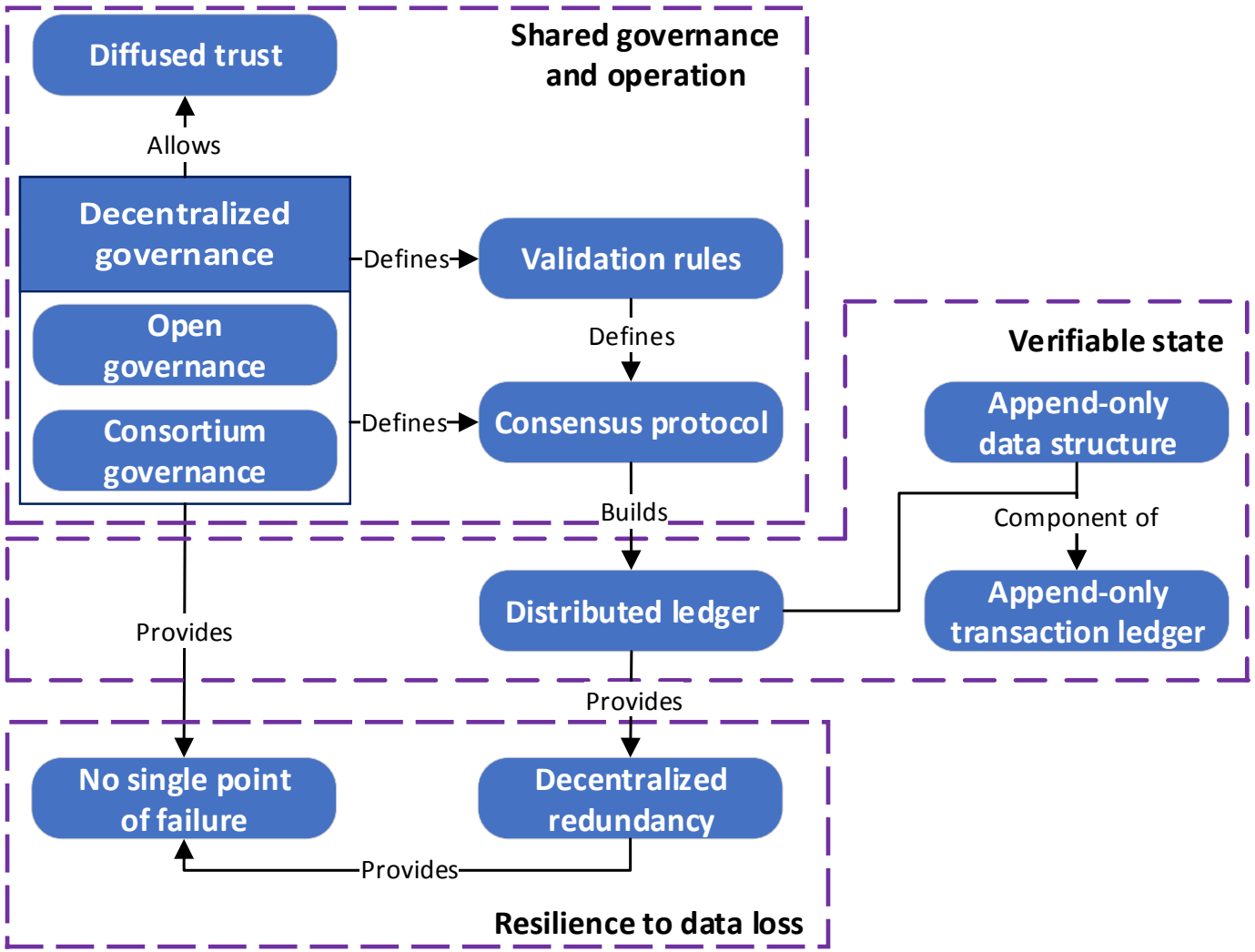
DM19-0322

Blockchain definition



Ruoti, S; et al. "SoK: Blockchain Technology and Its Potential Use Cases." In submission, 2019.

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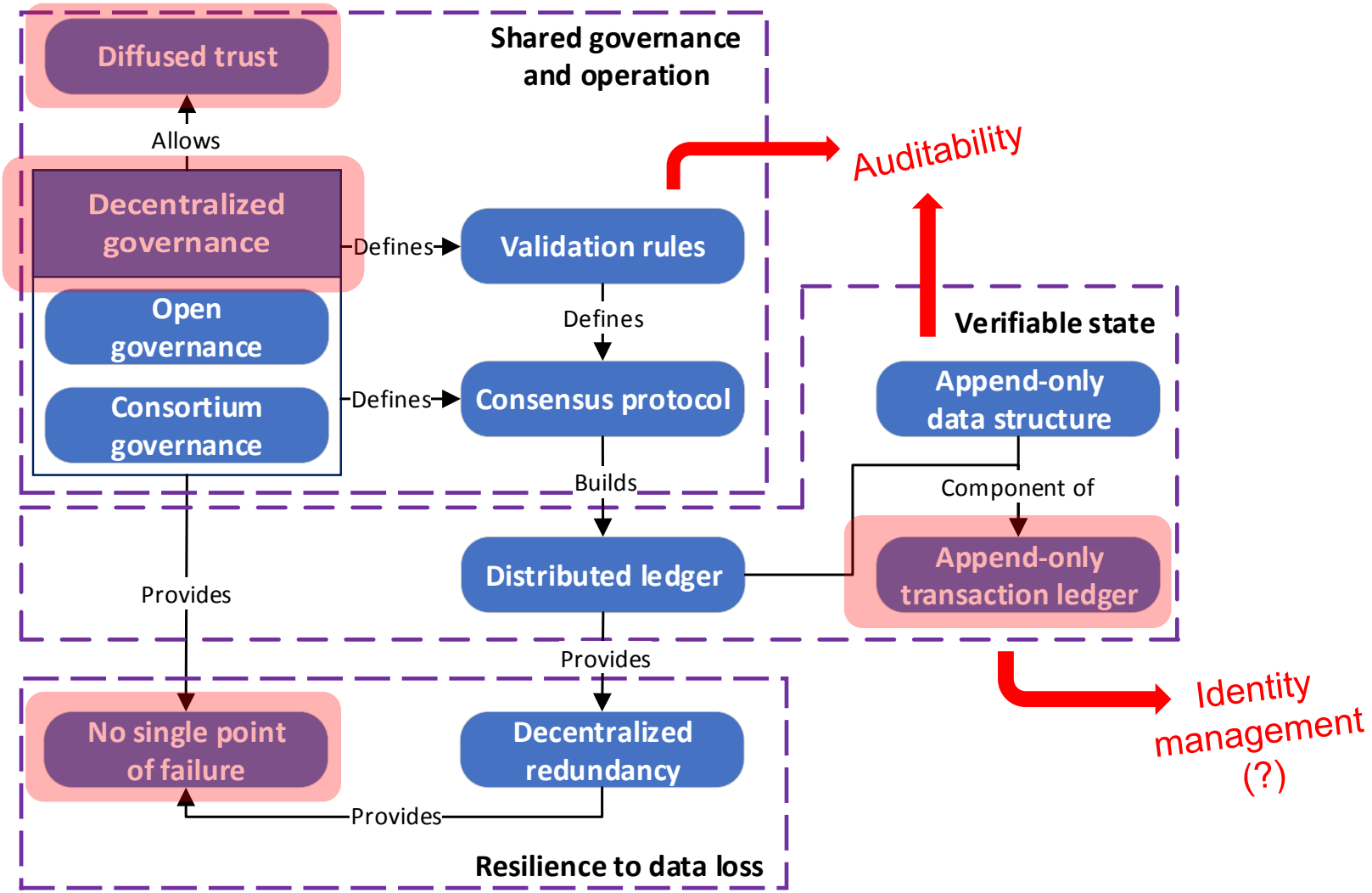

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1. **Financial Instruments, Records and Models**
    1. Currency
    2. Private equities
    3. Public equities
    4. Bonds
    5. Derivatives (futures, forwards, swaps, options and more complex variations)
    6. Voting rights associated with any of the above
    7. Commodities
    8. Spending records
    9. Trading records
    10. Mortgage / loan records
    11. Servicing records
    12. Crowd-funding
    13. Micro-finance
    14. Micro-charity
2. **Public Records**
    1. Land titles
    2. Vehicle registries
    3. Business license
    4. Business incorporation / dissolution records
    5. Business ownership records
    6. Regulatory records
    7. Criminal records
    8. Passports
    9. Birth certificates
    10. Death certificates
    11. Voter IDs
    12. Voting
    13. Health / Safety Inspections
    14. Building permits
    15. Gun permits
    16. Forensic evidence
    17. Court records
    18. Voting records
    19. Non-profit records
    20. Government/non-profit accounting/transparency
3. **Private Records**
    1. Contracts
    2. Signatures
    3. Wills
    4. Trusts
    5. Escrows
    6. GPS trails (personal)
4. **Other Semi-Public Records**
    4. Degree
    5. Certifications
    6. Learning Outcomes
    7. Grades
    8. HR records (salary, performance reviews, accomplishment)
    9. Medical records
    10. Accounting records
    11. Business transaction records
    12. Genome data
    13. GPS trails (institutional)
    14. Delivery records
    15. Arbitration
5. **Physical Asset Keys**
    1. Home / apartment keys
    2. Vacation home / timeshare keys
    3. Hotel room keys
    4. Car keys
    5. Rental car keys
    6. Leased cars keys
    7. Locker keys
    8. Safety deposit box keys
    9. Package delivery (split key between delivery firm and receiver)
    10. Betting records
    11. Fantasy sports records (!)
6. **Intangibles (?)**
    1. Coupons
    2. Vouchers
    3. Reservations (restaurants, hotels, queues, etc)
    4. Movie tickets
    5. Patents
    6. Copyrights
    7. Trademarks
    8. Software licenses
    9. Videogame licenses
    10. Music/movie/book licenses (DRM)
    11. Domain names
    12. Online identities
    13. Proof of authorship / Proof of prior art
7. **Other**
    1. Documentary records (photos, audio, video)
    2. Data records (sports scores, temperature, etc)
    3. Sim Cards
    4. GPS network identity
    5. Gun unlock codes
    6. Weapons unlock codes
    7. Nuclear launch codes (!)
    8. Spam control (micro-payments for posting)

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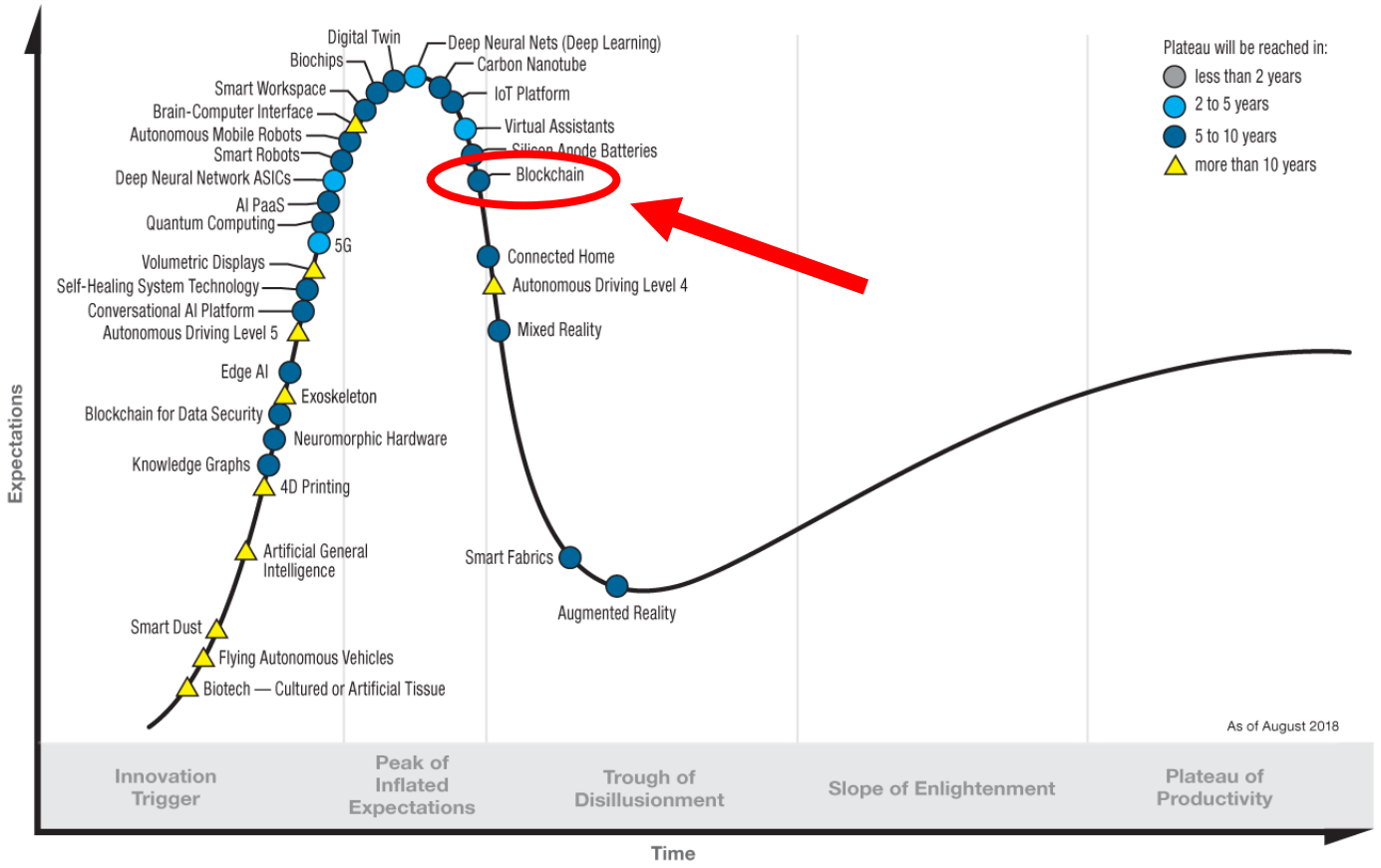
Hype Cycle for Emerging Technologies, 2018



gartner.com/SmarterWithGartner

Source: Gartner (August 2018)

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Gartner

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Blockchain platforms – “don’t blink”

Early 2015	Apr 12, 2017	Oct 16, 2018
Ethereum	BigChainDB	Cardano
Hyperledger (vaporware)	Chain Core	Icon
	Credits	Aion
	Domus Tower Blockchain	Wanchain
	Elements Blockchain Platform	Nebilo
	Eris:db	Zilliqa
	HydraChain	ArcBlock
	Hyperledger Iroha	EOS
	Hyperledger Sawtooth	
	Multichain	
	Openchain	
	Stellar	
	Symbiont Assembly	

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Major relevant use cases

Use case	Properties
Supply chain management • Medical supplies & equipment • Pharmaceuticals	Auditability, Immutability, Shared governance
Records management • EMR/EHR • Insurance • Research documentation	Auditability, Immutability, Shared governance
Asset management • Device tracking • Drug delivery	Auditability, Immutability, Identity management
Data sharing	Auditability, Decentralized governance, NSPoF

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HHS – Accelerate

GCN

HHS unveils blockchain-powered acquisition assistance

BY TROY K. SCHNEIDER | JUL 23, 2018

From the article:

> The new system gives acquisition teams detailed, real-time information on pricing and terms and conditions from across HHS for 10 categories of purchases. There are also micro-services to help automate the development of acquisition plans and marketing documents, [Jose] Arrieta said, and the beginnings of a tool to help HHS vendors pull data on their past interactions with the agency and avoid "the trouble of re-submitting all the past info over and over again."

https://gcn.com/articles/2018/07/23/hhs-blockchain.aspx

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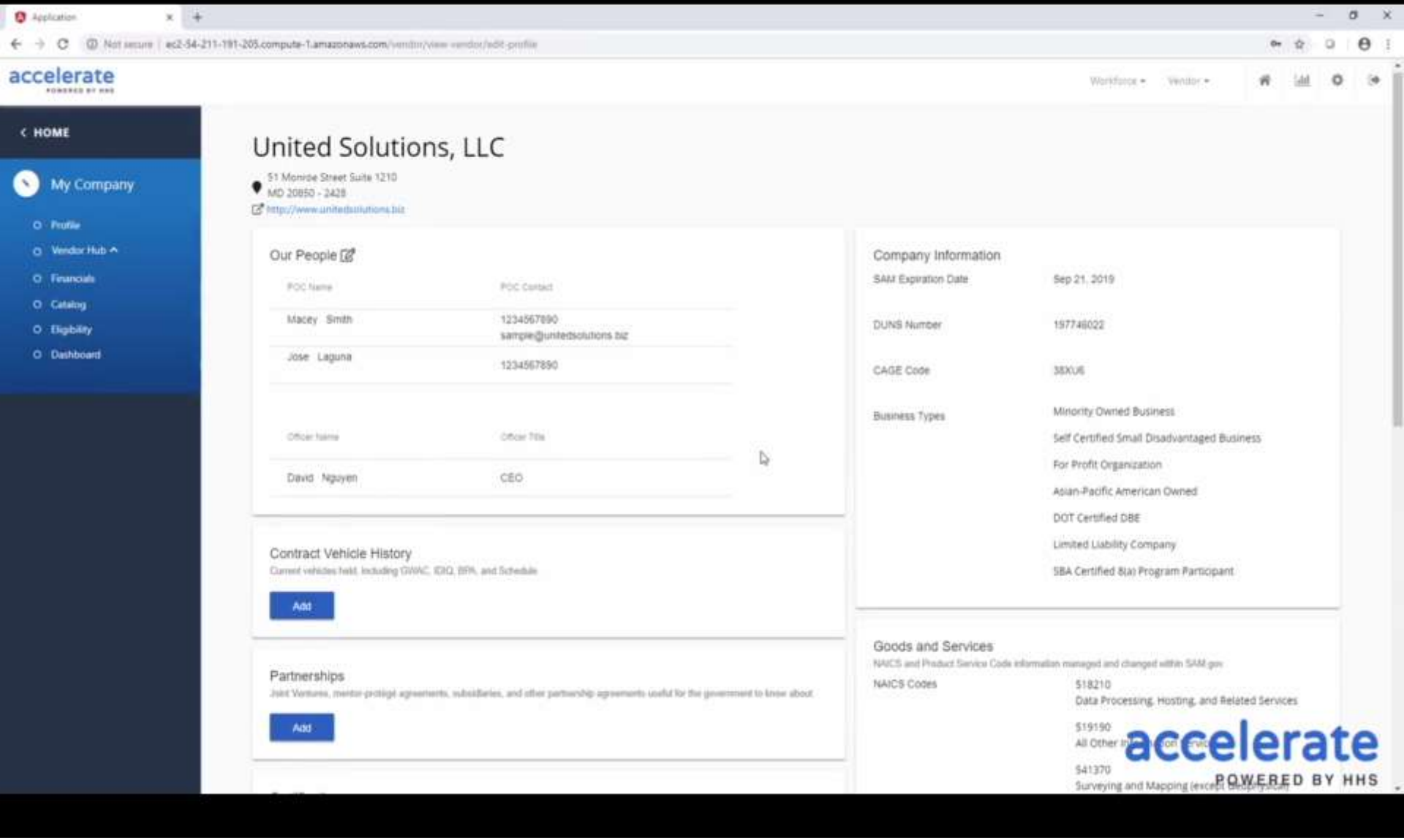

https://vimeo.com/326386037

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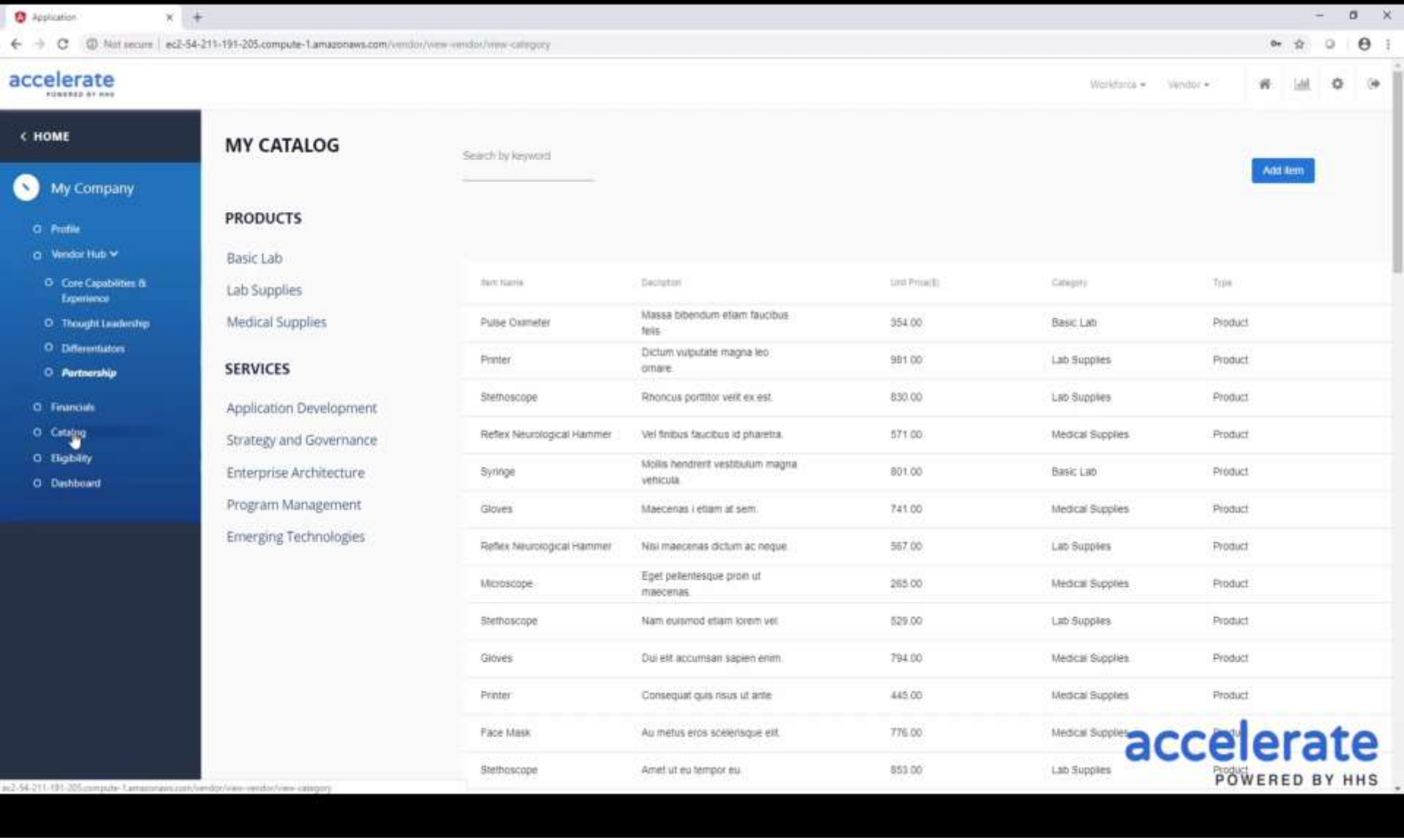

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HHS – Accelerate

- Integrates with other services, rather than replace
- Data accessible through shared API rather than database calls
- Machine learning used to clean data, other purposes

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HHS – Cybersecurity

GCN

HHS investigates blockchain for securing log files

BY SARA FRIEDMAN | MAR 18, 2019

From the article:

> […] Now, the HHS Division of Acquisition is looking to test new blockchain applications to help it meet requirements of the Department of Homeland Security's Continuous Diagnostics and Mitigation program.
>
> One potential application deals with securing the log files that HHS automatically collects on activity across its systems. CDM requires federal agencies to review all their audit/log files to check for suspicious activity.

https://gcn.com/articles/2019/03/18/hhs-blockchain-log-data.aspx

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CDC – Outbreak Response

Nextgov

CDC Wants to Use Blockchain to Get People to Crisis Zones Faster

By JACK CORRIGAN // OCTOBER 31, 2018

Blockchain to connect disparate systems

Database ➞ Blockchain for unified data view

Using Hyperledger microservices, building atop legacy systems

Live in Dec 2018 (?)

https://www.nextgov.com/emerging-tech/2018/10/cdc-wants-use-blockchain-get-people-crisis-zones-faster/152440/

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CDC – Public health tracking

FAST COMPANY

09.04.18

How IBM and the CDC are testing blockchain to track health issues like the opioid crisis

IBM and CDC experts are hopeful that using a blockchain could help streamline long-running surveys that track patient symptoms and treatments.

BY STEVEN MELENDEZ 2 MINUTE READ

CDC regularly collects lots of survey data on medical topics

Currently using simulated data

https://www.fastcompany.com/90231255/how-ibm-and-the-cdc-are-testing-blockchain-to-track-health-issues-like-the-opioid-crisis

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VA – Contracting

From the article:

> On June 7, the US Department of Veteran Affairs (VA) issued a request for information (RFI) regarding how blockchain technology could be used to simplify and streamline the department's contract procedures, specifically when contracts are closed out.
>
> This is not the first time the VA has looked to blockchain […]. In January, the VA sought proposals on how to improve health data sharing and interoperability through blockchain technology.

https://www.ethnews.com/va-looks-to-blockchain-to-streamline-contract-process

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Startups

https://arxiv.org/abs/1812.02776

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Startups

Applications of Blockchain in Healthcare: Current Landscape & Challenges

A PREPRINT

Gajendra J. Katuwal[1], Sandip Pandey[2], Mark Hennessey[3], and Bishal Lamichhane[3]

[1]Philips Research North America, Cambridge, MA, United States
[2]Blockchain Lab, Delft University of Technology, Delft, Netherlands
[3]Philips Research Europe, Eindhoven, Netherlands

December 10, 2018

https://arxiv.org/abs/1812.02776

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Table 1: Example initiatives on the use of blockchain for management of healthcare data & services

Group	Comments	Projects
EHR		Medrec [35], Patientory [36], HealthSuite Insights Philips Healthcare [37], Gem Health [41], Medshare [38], Iryo [39], FHIR Chain [42], OMNI PHR [43], Medicalchain [44], Doc.ai [45], Hearthy [46]
	Focus on developing countries	Factom [47]
Genomics		Encrypgen [48], Nebula Genomics [49], lunaDNA [50], Zenome [51], Genomes.io [52], Shivom [53]
Imaging		ETDB-Caltech [54], Patel et. al 2018 [55]
	Dermatolgoy	OPU Labs[56], MedX Protocol[57], Dermonet [58]
	Network as a service	Akiri switch [59]

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Startups

Table 2: Example initiatives on the use of blockchain for pharmaceutical supply chain solutions

Initiatives	Description
MediLedgerProject [68]	Permissioned blockchain solutions to meet the track and trace regulation in pharmaceutical supply chain.
Ambrosus [69]	AMB-net, a blockchain based IoT network for supply chain targeted for food and pharmaceutical industries.
Modsense T1 from Modum [70]	Blockchain based tracking of temperature and environment conditions along the supply chain.
Blockverify [71]	Anti-counterfeit and transparency solution for supply chain with applications to pharmaceutical sector among others.
DHL collaboration with Accenture [72]	The initiative, dubbed as prototype solution service, uses blockchain to track pharmaceutical products throughout the entire supply chain.
Imperial Logistics collaboration with One Network Enterprises [73]	The solution from this collaboration is intended to improve supply chain security using the One Blockchain platform from the One Network Enterprises.
Authentag [74]	Provide distributed ledger technology from blockchain to provide tracking and verification services for pharmaceutical supply chain.
EasySight Supply chain management/ Hejia [75]	With the motivation to enable smaller company have reduced time for receiving payments, the blockchain based solution from EasySight tracks drugs through the supply chain for complete transparency of trade records.
GFT [76] collaboration with MYTIGATE [77]	The solution from this collaboration is a proof of concept on the use of blockchain to keep track of pharmaceuticals.
SAP	SAP has combined blockchain technology with their ATTP (Advanced track and trace for pharmaceuticals) to solve supply chain issues considering new regulatory requirements.
IEEE Pharma Supply BlockChain Forum [78]	A general podium for multiple stakeholders to initiate and discuss the potential usage of blockchain for pharmaceutical supply chain solutions.

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Table 3: Companies and initiatives that use/plan to use blockchain based solution for billing and claim management.

Initiatives	Description
Gem [84]	Blockchain based on Ethereum to streamline claim management in healthcare.
Change Healthcare [85]	Solution based on HyperLedger fabric 1.0 for claims and revenue management.
HSBlox [86]	A blockchain based platform called SETU (Simplified Exchange and Transparency for Users) to provide solutions for claim management.
Pokitdok [89]	Provides Dockchain, a blockchain for financial data processing in a clinical setting, using features like smart contracts.
Solve.care [90]	Blockchain based solution from Solve.care provides decentralized administration of health mostly concerning various health benefits program, preventing misuse and fraud for example.
HealthNautica [91] collaboration with Factom [92]	This joint collaboration works on a blockchain solution for claim management and data record management in general.
Smartillions [93]	The solution from Smartillions used blockchain based system for claims management with payment from an underlying pension fund, with option of all transactions to providers also done with a digital asset.
Robomed Network [94]	Robomed in its blockchain based solution ties payment for a medical procedure to expected clinical outcome, motivating the providers for a first time right medical treatment.
Quantum Medical Transport collaboration with River Oaks Billing Associates [95]	The collaboration is using blockchain based solution for medical billing payments, mostly to make such transactions secure.

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Startups

Interesting sidenotes:

- Some companies appear to have gone out of business before even launching

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care-blockchain-startups-medicine/

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…yet all mention of blockchain has been scrubbed from their website since December

care-blockchain-startups-medicine/

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Startups

Interesting sidenotes:

- Some companies appear to have gone out of business before even launching
- Undeniable blockchain startup success story still elusive in any domain, healthcare included

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MedRec

Probably* the first effort to get Medical SomethingOrOther on blockchain

EHR management solution, based on Ethereum

Web page recently updated detailing MedRec 1.0, MedRec 2.0

* Informal usage. Please do not sue me.

https://medrec.media.mit.edu/

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Thank you!

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