Distributed Ledger Technologies

What are they and How could we use them?

Prepared by

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Distributed Ledger Technologies (DLT)

← → C Secure | https://globalpetroleumshow.com/conference/

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Global Petroleum Show prides itself in being the **most important energy event** in North America attracting thousands of global thought leaders and influencers from countries around the world – **this year GPS celebrates its 50th anniversary.**

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The GPS Conference has been developed to answer three topical theme questions:

- How are traditional oil & gas companies forging ahead in a transformed global energy landscape?
- How are companies in all energy sectors diversifying their portfolios to support future sustainability and environmental implications?

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How are digital systems, such as Blockchain, changing the way companies and countries do business?



North America's Leading Energy Event June 12 - 14, 2018 Stampede Park Calgary, Canada

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Distributed Ledger Technologies (DLT)

- DLT refers to a novel and fast-evolving approach to recording and sharing data across multiple data stores (or ledgers).
- This technology allows for transactions and data to be recorded, shared, and synchronized across a distributed network of different network participants.
 - Blockchains
 - Smart contracts
 - Chainless technologies
 - IoT: Directed Acyclic Graphs (DAG)







Distributed ledger

 An asset database that can be shared across a network of multiple sites, geographies or institutions.



- Properties
 - Cryptography is used to manage the ledger in a secure way
 - Immutable: once an entry is recorded in the database it is extremely difficult to be altered.
 - Tamper evident: if a record is changed the network can detect it immediately.
 - Decentralized: No need for a central authority to enforce the rules ("In code we trust")

By having a large distributed network of independent users, data integrity can be maintained without the need for a central authority





- "Cryptographically secured" data structure consisting of blocks, time stamps and transaction data linked in a chain.
- A record cannot be altered retroactively without the alteration of all subsequent blocks and the collusion of the network.
- The use of a blockchain removes the characteristic of infinite reproducibility from a digital asset.





Blockchain

- Blocks hold batches of valid data that are hashed and encoded into a Merkle tree.
- Each block includes the cryptographic hash of the prior block in the blockchain, linking the two. The linked blocksform a chain.
- This iterative process secures the integrity of the previous block, all the way back to the original genesis block.



Figure adapted from: "The Great Chain of Being Sure About Things" by The Economist







Hash functions

A function that takes an input of any size and returns an output with a fixed size.

• SHA256 outputs strings that are 256 bits long.

Properties:

- Collision free: <u>No body can find</u> x and y such that for x!=y we obtain H(x) = H(y).
- Hiding: Given H(r|x), with r chosen from a very spread out distribution, it is infeasible to find x.
- Puzzle-friendly: Given H(id|x) ∈ Y, no solving strategy for x is much better than trying random values of x.

SHA256('CREWES')= 85f0e143ecf66a98c2a01173df36c02e3d27940a120974a6dca52e9df02e5bb8





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 Blockchain-based smart contracts are contracts that can be partially or fully executed or enforced without human interaction.

e.g. creating invoices that pay themselves when a shipment arrives or share certificates which automatically send their owners dividends if profits reach a certain level.

• Smart contracts go beyond transactions and enable exchange of value or information without powerful intermediaries acting as arbiters.







Trading and tracking oil shipments

- Problem: Title transfers and post trades are heavy on paperwork.
- Even though each party could keep digital records of their operations, using a distributed ledger will force buyers and seller to use the same record book.
- Using a blockchain provides a secure way of recording deal histories that can be accessible to the network users.
- Disclosing asset custody within a blockchain, makes clear to everyone who owns what and where the assets came from.







Certifying academic records

- The Digital Certificates Project at MIT has been developing an ecosystem for creating, sharing and verifying blockchain-based educational records.
- Make tamper-proof academic records available to anyone at any time.



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Figures from: https://medium.com/learning-machine-blog/why-the-blockchain-will-revolutionize-academic-credentialing-9950c9c4928d





Notarizing CREWES reports

Just for fun!

Compute hash of the document, time-stamp it and broadcast it to the bitcoin network



REWES



Copies of the document can be verified now against the record in the blockchain

Home / Document Proof

Document Details 🤣

d610775619ccd1378480d7104f8a67d7409addebc8eebb354c0b0ef1fa232762

2762

Document Hash	d610775619ccd1378480d7104f8a67d7409addebc8eebb354c0b0ef1fa2
Server Timestamp	2018-02-28 17:43:38 UTC
Blockchain Broadcast	2018-02-28 18:18:53 UTC
Blockchain Confirmation	2018-02-28 18:33:51 UTC

Document Proof Confirmed

The document's proof hash has been included in the blockchain in the transaction with txid

be4cae3e67707f6ad0cc535e98ce33abcc62b86ec5f7e4d5f6421022cbc24da

You may verify this transaction through public block explorers:

Bitcoin.com Explorer BlockTrail BlockCha

Details about the transaction, like cryptographic signatures, can be seen on any public blockchain explorer

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Transaction			
Transaction bbo4caw3e67707f6ad0cc535e9fcca33abcc67bd8ac6f7b4d5f6	121022cbc2	6da	
Summary			
Size			240 (byta
Fee Rate		0.000	0999999559999395599 DTC per k
Received Time			Feb 23, 2018 11:33:51 A
Mined Time Included in Block Details		00000000000000002455c7041fc5a2a9ba4	Feb 25, 2018 11:33:33 A
Mined Time Included in Block Details ©tookackes77075460c335690c838bccK2054cc577e4c9544315022d	c24da	000000000000000000000000000000000000000	Feb 25, 2018 11:33:31 A Jes 311 wild 540009 3cs / 0172 do //
Minded Im Black Dettails Otoeksa:Nest710176480x335490x3360x628564cffreid5M43102cb > 1580x6AnwapEruFH10pDEWUgtapExineL 0.0005 BTC	(24d) >	00000000000000000000000000000000000000	Feb 25, 2018 11:3531 A Id: 311w64/5900093c6/01/2d5/0 Intend Feb 20, 2018 11:33:31 Au 6 8TC (M)
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	244	00000000000000000000000000000000000000	Pop 25, 2018 11:3331 A ex 111-eta/Second Sci 70 17:45:7 noved Pop 28, 2018 11:3331 A 6 BTC (b) ex 21-esheosylectoreta 0.0004376 BTC (b)

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- Problem: validating the source of a .segy or .las file
 - A secured record of acquired well logs and seismic data and their metadata could be maintained.
 - Data do not need to be shared with the network. Only their hashes and a hash table with pointers to a private database are needed to maintain the records. Metadata can be included in the blockchain to facilitate search and data validation.
 - A public permissioned blockchain may achieve this goal.





Auditing processing jobs

- Problem: validating processing flows applied on seismic data
 - The hash of the output of a processing step along with the parameters used in the processing can be registered in a distributed ledger facilitating audits through the processing sequence.
 - An smart contract could be set up such that invoices are automatically generated at every processing step.
 - Companies could include a set of required processing parameters within the smart contract. Invoices will only be produced if the required parameters were used in the processing sequence.





Thanks !



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