
SPE
International
Society of Petroleum Engineers
Blockchain & Smart Contracts
in Oil & Gas industry
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SPE International®

Society of Petroleum Engineers

BLOCKCHAIN TECHNOLOGY

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Context

Business Impact and Blockchain Potential

About blockchain meaning and its impact in business

- As an early definition, we can say Blockchain is a system of recording information in a way that makes it very difficult or almost impossible to change, hack, or crack.
- Is a digital book of transactions that is shared by all the computers of a network, creating a decentralized way of store information.
- Based on previous definitions, and taking into account that the world surrounding us is full of transactions in our daily basis (contracts, exchange, and all kinds of operations of our economic, legal, social and political systems), we can assume that an almost inviolable information system can act as a “source of true”, that can create a revolution in our society, impacting in the interactions between governments, organizations, communities and individuals.
- For many years we’ve heard that blockchain has the potential to change companies and economies, and even we are aware of its potential, there are some practical considerations about blockchain itself, that we need to know to leverage its potential.
- Oil & Gas industry offer a wide range of opportunities in Smart Contracts brings economics efficiencies and agile recognition system for performance. It also provides unique technology for open information sharing with trust and trace tools.

Blockchain in numbers

- Blockchain became famous when it was released to be the ledger implementation for Bitcoin crypto in 2008
- The number of **registered blockchain wallets** in the second quarter of 2021 was more than **70 million**.
- The global blockchain market will be worth **$1,431.54 billion by 2030**, growing at a CAGR of approximately **85.9%** between 2022 and 2030.
- Blockchain could **boost global GDP by $1.76** trillion by 2030.
- **96%** of financial service experts believe blockchain has achieved mainstream adoption.
- Blockchain in manufacturing is growing at a rate of **73%**, between the years of 2022 and 2026.
- The first NFT was created in 2014. **NFT market was worth $41 billion in 2021**

Blockchain Concepts

What is Blockchain?

- The **technology** behind Bitcoin and other cryptocurrencies
- Distributed, **peer-to-peer network**
- Requires **no central authority**
- A ledger of transactions, grouped in blocks that are chained each other, and **replicated** to all servers
- Digital cryptography ensures
  - Transactions are **verifiable**
  - System is **tamper-proof**
- Ledger updates are applied through automated network **consensus**

Internet of Information

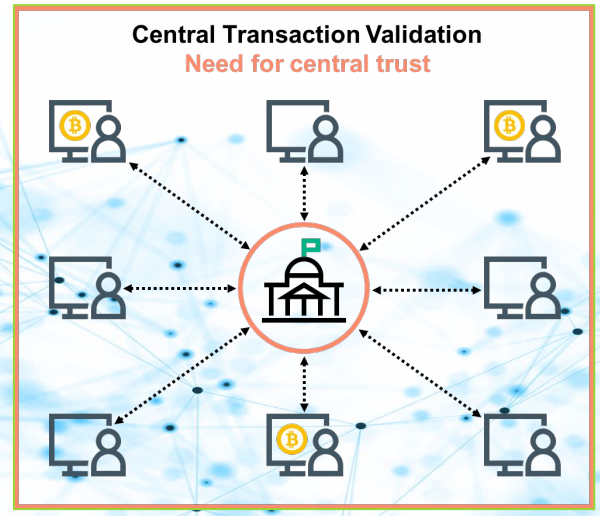
TCP/IP → *WWW*
e-mail → *Social Networks*
Cloud
E-commerce….

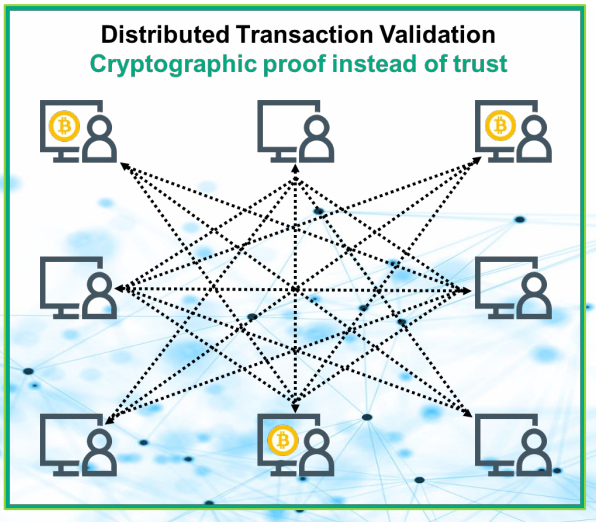
Internet of Value

Blockchain → *Bitcoin* → *Other Applications*

Why was it invented?

Because “… no mechanism exists to make payments over a communications channel without a trusted party”





What Makes Blockchain Different?

Decentralized – Enables peer to peer exchange with no central authority, no central controller

Distributed – Each independent node contains a complete copy of the database making the network highly resilient

Proof of ownership – Cryptographic keys ensure ownership of assets

Proof of authorship – Digital signatures provide proof of a transaction's origin

Tamper proof – Digital cryptography binds each block of transactions to its predecessor making any changes instantly detectable

Network-based Consensus - Entire network agrees on validity of updates through software based consensus models

Transactions and Blocks

Transactions

Transactions are like lines in a double-entry bookkeeping ledger. Nodes creates transactions and miners groups them in blocks to add to the blockchain and perform verification and add security

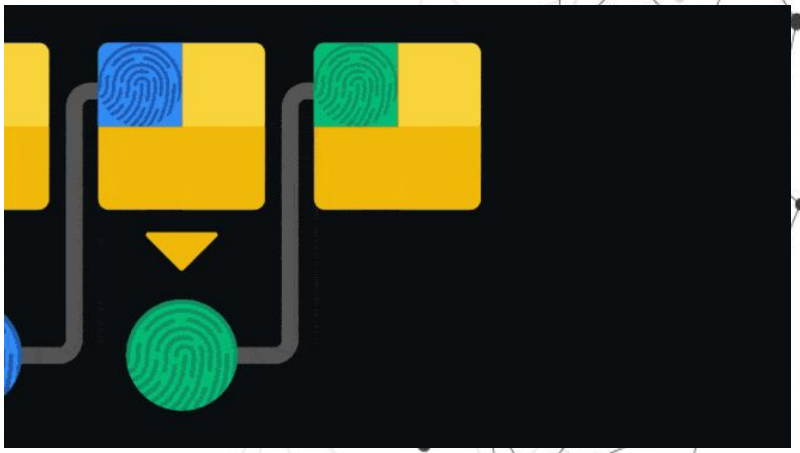
Blocks

Is a group of transactions that starts as candidate block and as it is validated, the block is added to the chain. Each block is chained with the digest of the previous block.

Transaction as Double-Entry Bookkeeping

Inputs	Value	Outputs	Value
Input 1	0.10 BTC	Output 1	0.10 BTC
Input 2	0.20 BTC	Output 2	0.20 BTC
Input 3	0.10 BTC	Output 3	0.20 BTC
Input 4	0.15 BTC		
Total Inputs:	0.55 BTC	Total Outputs:	0.50 BTC

	Inputs	*0.55 BTC*
-	*Outputs*	*0.50 BTC*
	Difference	*0.05 BTC (implied transaction fee)*



https://www.blockchain.com/es/explorer

Consensus Mechanisms

Blockchain Consensus algorithms ensure each new block added to the network is the **only version of the truth**, which is **agreed by all** the nodes in a distributed/decentralized computing **network**. The 2 main consensus mechanisms are:

Miners / Validators

These are **nodes** that are part of the network and perform **validation of the blocks** and keep the network safe. For that, they get **rewards** by "mining" **new tokens** (i.e. new issued Bitcoins) and getting the **fees** of the transactions.

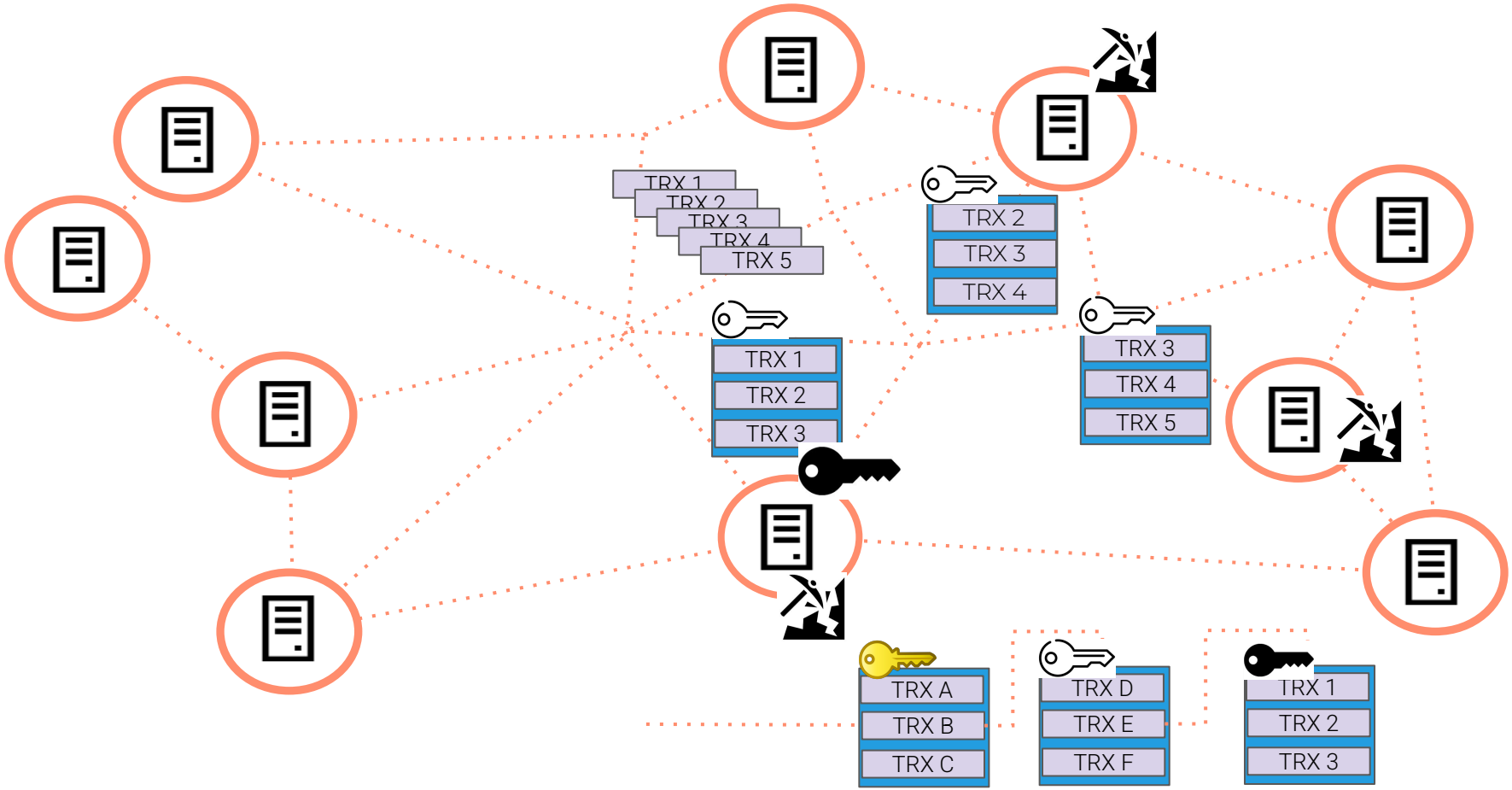
Proof of Work

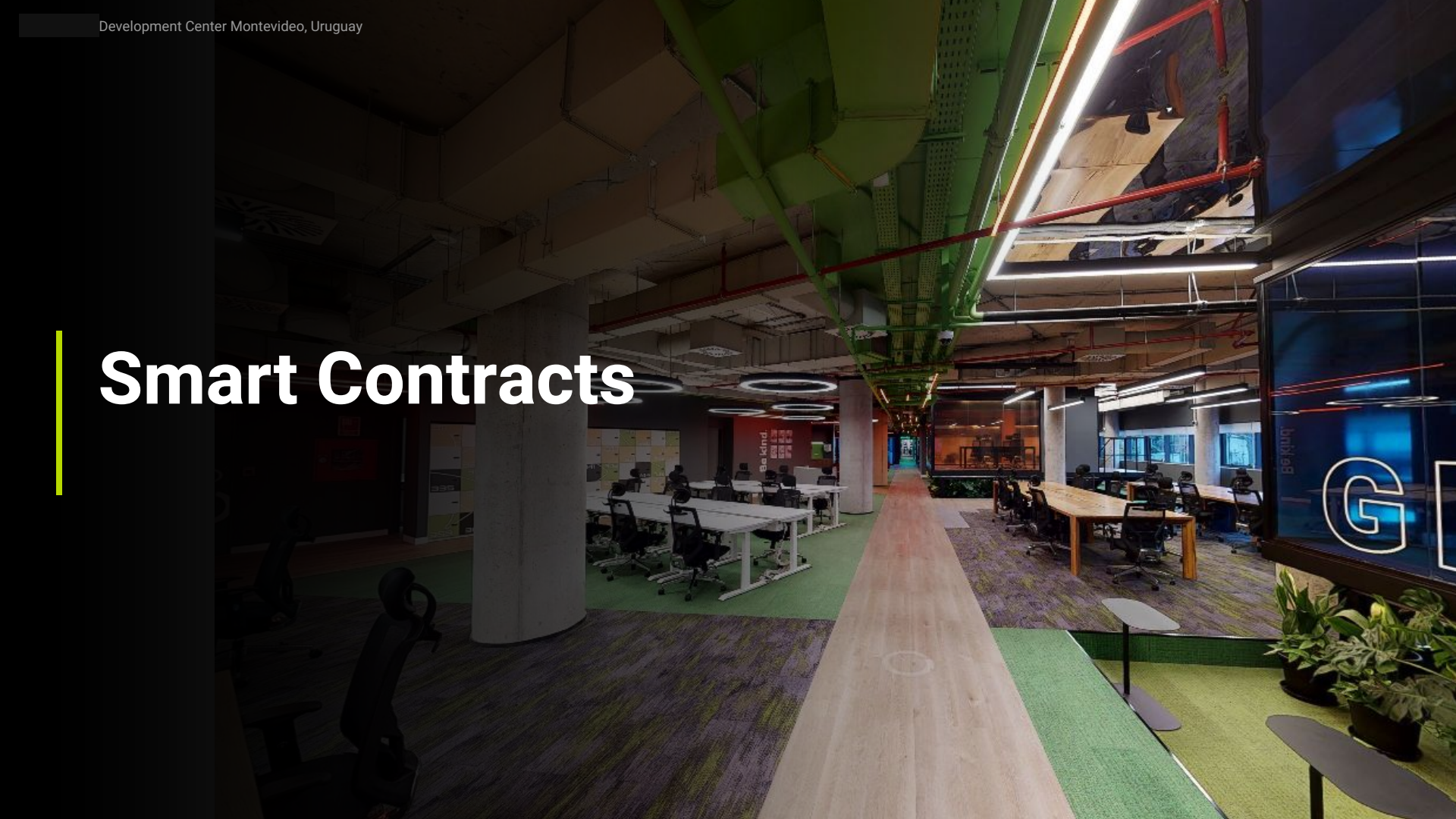
Solve a **highly complex maths problem** in a race, where the first "miner" that finds the result wins the race and the block is **added to the chain**

Proof of Stake

Validators nodes deposit a **stake as warranty**, and validate blocks and **adds them to the chain**. If the network **detects a fraudulent** validation, the validator node **lose the stake**.

Transactions and Blocks





Smart Contracts

Blockchains Generations

Bitcoin

2009

1st generation blockchain is based on coins with proof of work

Key Features
- Secure and tamper proof transactions
- No intermediary (P2P)

Applications:
- Digital currency

Throughput:
- 7 TPS

Ethereum

2015

2nd generation blockchain is based on smart contracts and proof of work

Key Features
- Smart Contracts
- Digital Ecosystem to write new cryptocurrencies

Applications: Gen 1 +:
- Distributed Apps (DApps)
- DeFi, Gaming, Id Mgmnt, etc...

Throughput:
- 15 TPS

today

3rd generation blockchain cryptocurrencies are Proof of Anything

Key Features
- Increased Scalability
- Interoperability
- Public / Private Permissioned / Permissionless

Application: Gen 2 +
- Off-chain scaling solutions
- Innovation and the future....

Throughput:
- N x 100,000 TPS

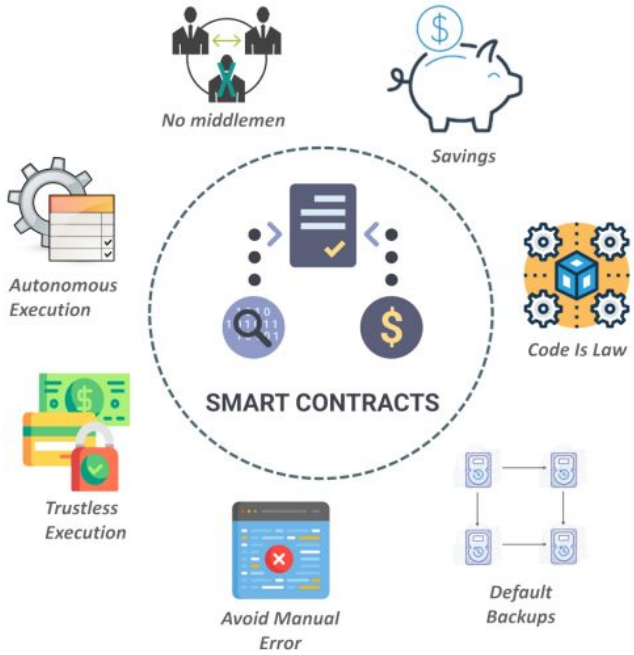
Ethereum Smart Contracts

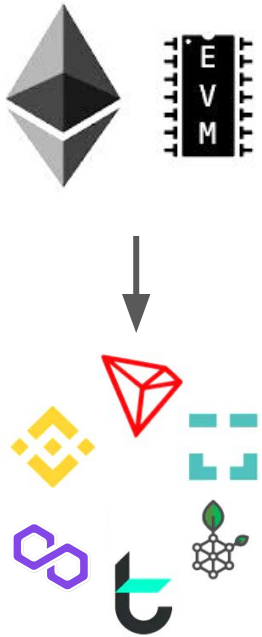
Programs stored on a blockchain that run when predetermined conditions are met.

solidity

SMART CONTRACTS

- Cryptocurrencies
- Utility Tokens
- NFTs
- ...

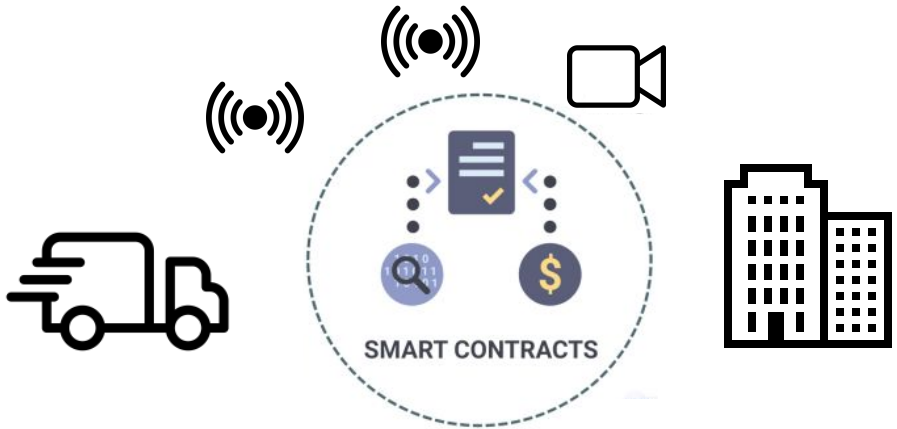




Smart contracts are a reliable way to carry out transactions requiring trust, transparency, and anonymity among stakeholders.

Ethereum Smart Contracts - Example

Illustrative Example: Smart Contract in a Supply Chain:
Pay the fee to the provider based on delivery time SLA compliance.



Blockchain Transactions

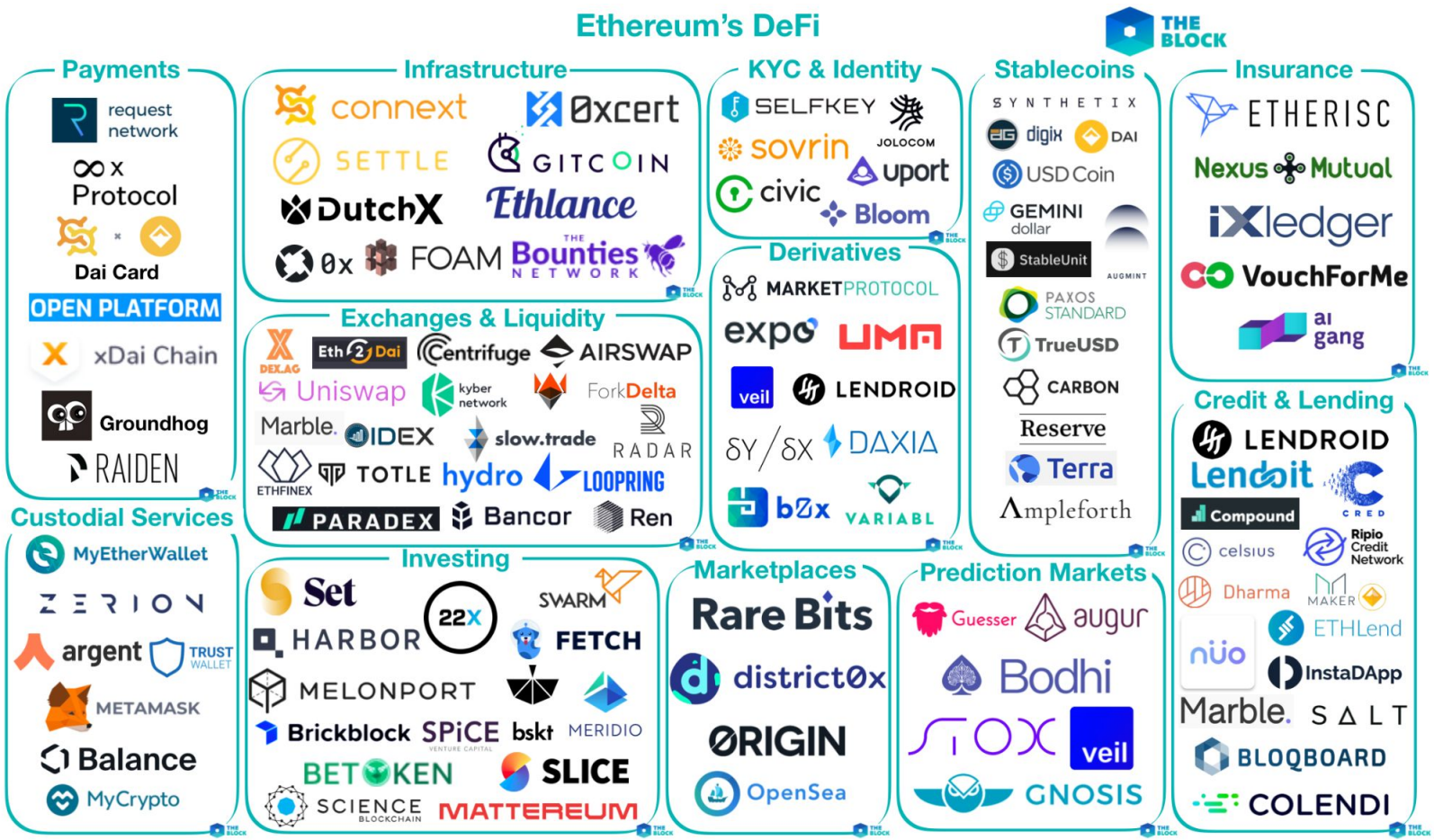
```
TRX1-SHIP20220302-01:02:14
TRX2-MOVE20220303-12:03:12
TRX3-MOVE20220304-15:01:24
TRX4-DELI20220305-06:08:36
TRX5-PAYM20220305-06:08:36
```

Smart Contract

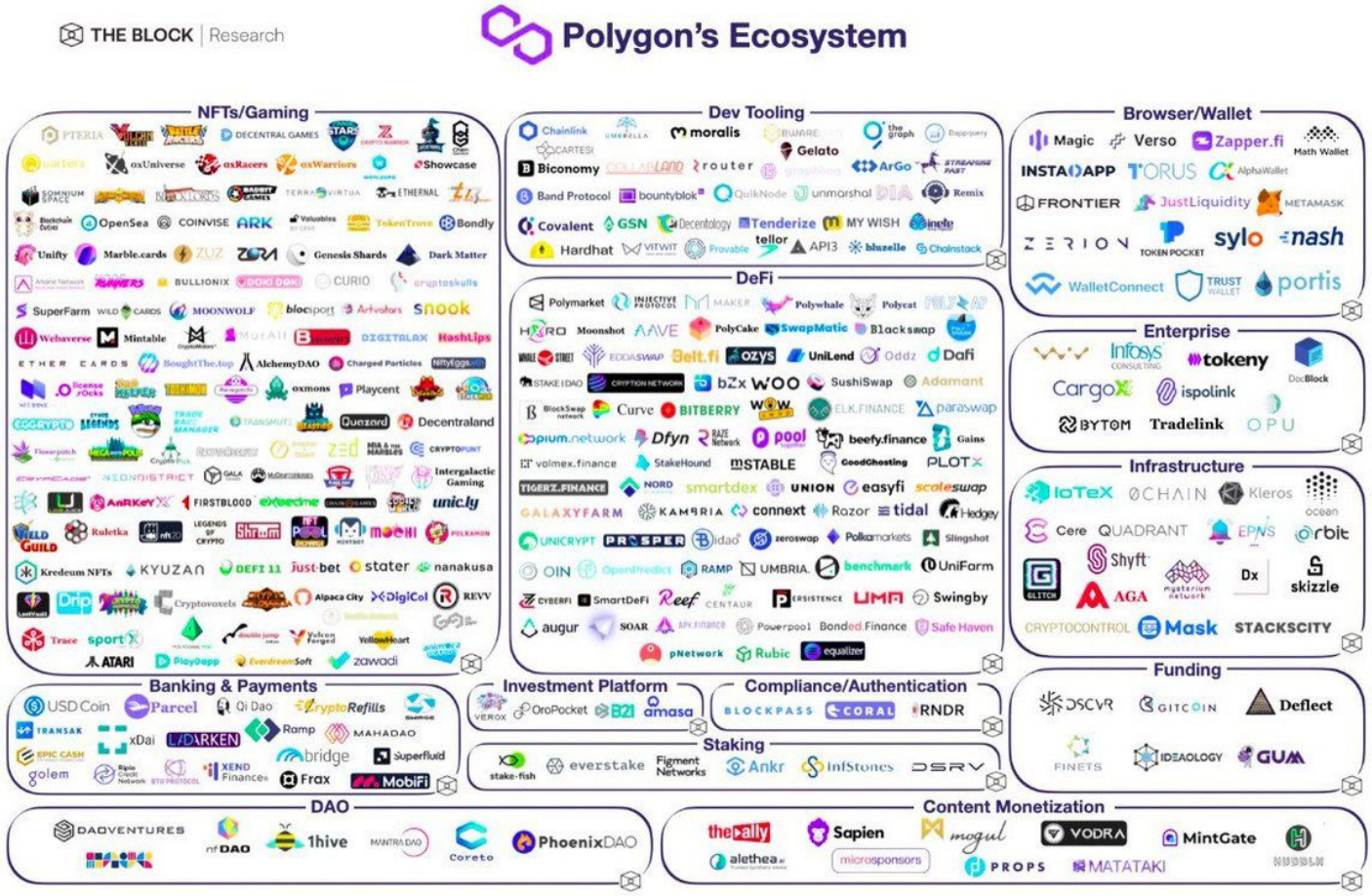
```
Trigger Smart Contract When Status is Delivered {
      DeliveryTime = calculateDeliveryTime();
      Fee = calculateFee(DeliveryTime);
      payFee(Fee); //TRX5
}
```

Use Cases

Use cases


Ethereum's DeFi
THE BLOCK
Payments
request network
0x Protocol
Dai Card
OPEN PLATFORM
xDai Chain
Groundhog
RAIDEN
Infrastructure
connext
0xcert
SETTLE
GITCOIN
DutchX
Ethlance
0x
FOAM
THE Bounties NETWORK
KYC & Identity
SELFKEY
JOLOCOM
sovrin
uport
civic
Bloom
Stablecoins
SYNTHETIX
digix
DAI
USD Coin
GEMINI dollar
StableUnit
AUGMINT
PAXOS STANDARD
TrueUSD
CARBON
Reserve
Terra
Ampleforth
Insurance
ETHERISC
Nexus Mutual
iXledger
VouchForMe
ai gang
Derivatives
MARKETPROTOCOL
expo
UMA
veil
LENDROID
δY/δX
DAXIA
bZx
VARIABL
Exchanges & Liquidity
DEX.AG
Eth2Dai
Centrifuge
AIRSWAP
Uniswap
kyber network
ForkDelta
Marble.
IDEX
slow.trade
RADAR
ETHFINEX
TOTLE
hydro
LOOPRING
PARADEX
Bancor
Ren
Credit & Lending
LENDROID
Lendoit
CRED
Compound
celsius
Ripio Credit Network
Dharma
MAKER
nüo
ETHLend
InstaDApp
Marble.
SALT
BLOQBOARD
COLENDI
Custodial Services
MyEtherWallet
ZERION
argent
TRUST WALLET
METAMASK
Balance
MyCrypto
Investing
Set
22X
SWARM
HARBOR
FETCH
MELONPORT
Brickblock
SPiCE VENTURE CAPITAL
bskt
MERIDIO
BETOKEN
SLICE
SCIENCE BLOCKCHAIN
MATTEREUM
Marketplaces
Rare Bits
district0x
ORIGIN
OpenSea
Prediction Markets
Guesser
augur
Bodhi
STOX
veil
GNOSIS

Use cases


THE BLOCK | Research
Polygon's Ecosystem
NFTs/Gaming
Dev Tooling
Browser/Wallet
DeFi
Enterprise
Infrastructure
Funding
Banking & Payments
Investment Platform
Compliance/Authentication
Staking
DAO
Content Monetization

Use cases

ledger that **Ripple** uses has been latched onto by a group of Japanese banks, who will be using it for quick mobile payments.

ripple

INSURANCE

A smart contract-based blockchain is being used by Insurer **American International Group Inc** as a means of saving costs and increasing transparency.

AIG

ENDANGERED SPECIES PROTECTION

The protection of endangered species is being facilitated via a blockchain project that records the activities of these rare animals.

CARBON OFFSETS

IBM is using the Hyperledger Fabric blockchain in China to monitor carbon offset trading.

IBM

HYPERLEDGER

ENTERPRISE

Ethereum's blockchain can be accessed as a cloud-based service courtesy of **Microsoft Azure.**

Microsoft Azure

BORDER CONTROL

Essentia has devised a border control system that would use blockchain to store passenger data in the Netherlands.

essentia.one

SUPPLY CHAINS

IBM and **Walmart** have partnered in China to create a blockchain project that will monitor food safety.

IBM

Walmart

HEALTHCARE

A number of healthcare systems that store data on the blockchain have been pioneered including **MedRec.**

MEDREC

SHIPPING

Shipping is a natural fit for blockchain, and **Maersk** have been trialling a blockchainbased project within the maritime logistics industry.

MÆRSK

REAL ESTATE

Blockchain is now being used to complete real estate deals, the first of which was conducted in Kiev by **Propy.**

PROPY

ENERGY

Essentia is developing a test project that will help energy suppliers track the distribution of their resources in real time, whilst maintaining data confidentiality.

essentia.one

LAND REGISTRY

Land registry titles are now being stored on the blockchain in Georgia in a project developed by the **National Agency of Public Registry.**

NATIONAL AGENCY of PUBLIC REGISTRY

COMPUTATION

Digital Currency Group are helping Amazon Web Services examine ways in which the distributed ledger technology can help improve database security.

DIGITAL CURRENCY GROUP

ADVERTISING

New York Interactive Advertising Exchange has been experimen- ting with blockchain as a means of providing an ads marketplace for publishers.

NYIAX

BORDER CONTROL

Essentia is developing a blockchain project for border control that will allow customs agents to record passenger data from an array of inputs and safely store it.

essentia.one

JOURNALISM

Decentralized journalism, as enabled by blockchain technology, has the potential to prevent censorship and increase transparency, as **Civil** has shown.

CIVIL

WASTE MANAGEMENT

Waltonchain is using **RFID** technology to store waste management data on the blockchain in China.

ENERGY

Food importation is another industry where blockchain is proving its worth, with **Louis Dreyfus Co** trialling a soybean importation operation using this technology.

LDC.

Louis Dreyfus Company

DIAMONDS

The **De Beers Group** is using blockchain to track the importation and sale of diamonds.

De Beers Group of Companies

FINE ART

By storing **certificates** of authenticity on the blockchain, it's possible to dramatically reduce art forgeries, as one blockchain project is proving.

NATIONAL SECURITY

For the past two years, the **US Department of Homeland Security** has been using blockchain to record and safely store data captured from its security cameras.

TOURISM

In a bid to boost its tourism economy, **Hawaii** is examining ways in which blockchain-based cryptocurrencies can be adopted throughout the US state.

RAILWAYS

Russian rail operator **Novotrans** is storing inventory data on a blockchain pertaining to repair requests and rolling stock

ENTERPRISE

Google is building its own blockchain which will be integrated into its cloud-based services, enabling businesses to store data on it, and to request their own white label version developed by **Alphabet Inc**

Google

Alphabet

MUSIC

Arbit is a blockchain-based project led by former Guns N Roses drummer Matt Sorum seeking a fairer way to reward musicians for their creative efforts.

arbit

FISHING

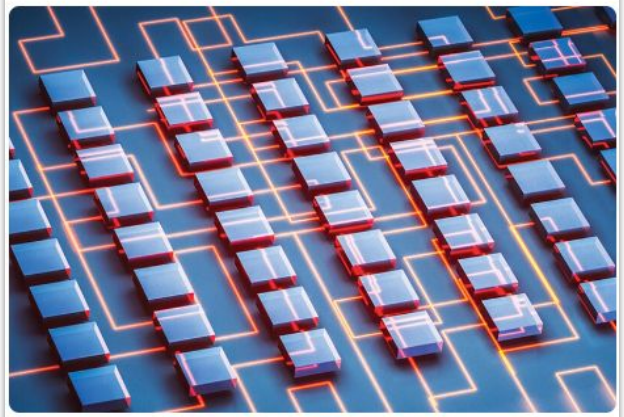
Blockchain technology has been used to provide a transparent record of where fish was caught, as a means of ensuring it was legally landed.

JPT JOURNAL OF PETROLEUM TECHNOLOGY

Building a Defensible Digital Network Business

Digital data startups face many hazards, from potential customers unwilling to share data to buyers who just do not see the payoff in what they are selling.

February 17, 2021 By Stephen Rassenfoss
Journal of Petroleum Technology



A section of computing nodes on a circuit board shows computing power adn intelligence *Credit: Jonathan Kitchen/Getty Images.*

Testing a System Where Machines Decide How Much to Pay a Trucker, and Send a Check

Ten big names in the oil and gas business created a group to try out ways to use blockchain in the oil business, and test if the record keeping and automatic data collection software can track water shipments more efficiently.

September 22, 2019 By Stephen Rassenfoss
Journal of Petroleum Technology

The Ultimate Breakthrough for Drilling Automation May Be Simply Finding a Business Case

Drilling automation champions met to identify where this emerging technology needs to be by the end of the decade. What they ended up agreeing on most was that the business models used today are largely incompatible with the technology of the future.

May 1, 2022 By Trent Jacobs
Journal of Petroleum Technology

Final Thoughts

Final Thoughts

Takeaways:

- **Blockchain** is **not just** a technology for **Cryptocurrencies**
- **Blockchain** is a cutting edge technology **already present** in Energy industry as part as revolution 4.0
- **Open data sharing** with **quality** and **tracing** assurance is feasible with **decentralized tokenization**
- **Smart contracts** are unlocking new **efficiency** rate in services and **open B2B** environment
- **Energy industry** could **benefit** from **others industries** that are bringing **new players** based in **Blockchain solutions**


Thank you.
Globant