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Blockchain Technology
UNDERSTANDING THE NEXT BIG THING
BUSINESS NETWORKS, MARKETS & WEALTH

Wealth is generated by the flow of goods & services across business network.

Markets are central to this process.

Business Networks benefit from connectivity.
LEDGERS ARE IMPORTANT

Ledger is THE system of record for a business

Businesses have multiple ledgers for multiple business networks in which they participate
PARTICIPANTS, TRANSACTIONS, & CONTRACTS

**Participants**

Members of a business network

**Transaction**

An asset transfer

Ex.) John gives a car to Anthony (simple)

**Contract**

Conditions for transaction to occur

Ex.) If Anthony pays John money, then car passes from John to Anthony (simple)
INTRODUCING BLOCKCHAIN

A shared ledger technology allowing any participant in the business network to see THE system of record

<table>
<thead>
<tr>
<th>ACCOUNT NUMBER</th>
<th>BALANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1G8bnej6etY…</td>
<td>12.5</td>
</tr>
<tr>
<td>1K7A6wyxj6…</td>
<td>323</td>
</tr>
<tr>
<td>16pIcrGi51nr…</td>
<td>26  +25</td>
</tr>
<tr>
<td>1MVbHlcuJr…</td>
<td>15.2</td>
</tr>
<tr>
<td>1G4HyHp1oa…</td>
<td>100</td>
</tr>
<tr>
<td>17UP3moev2…</td>
<td>.00000001</td>
</tr>
<tr>
<td>1Eq4FM2Ts…</td>
<td>45</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

Money Creation

Ledger

Winning maintainer

0.0001 (fee)
Problem:

Difficult to monitor asset ownership and transfers in a trusted business network
Solution:
A permissioned, replicated, shared ledger
BLOCKCHAIN FOR BUSINESS

Shared ledger | Smart Contracts | Privacy | Validation

Append-only distributed system of record shared across business network

Ensuring appropriate visibility: transactions are secure, authenticated & verifiable

Business terms embedded in transaction database & executed with transactions

All parties agree to network verified transaction

Broader participation, lower cost, increased efficiency
• Records all transactions
• Shared
• Replication
• Permissibility
• THE shared system of record
SMART CONTRACTS

- Business rules implied by the contract embedded in the Blockchain
- Verifiable, signed
- Encoded in programming language

Ex.) Defines contractual conditions under which corporate bond transfer occurs
• Ledger is shared, but participants require privacy
• Participants need:
  • Transactions to be private
  • Identity not linked to a transaction
• Transactions must be authenticated
• Cryptography central to these processes
• Transaction verification & commitment
• When participants are anonymous
  • Commitment is expensive
  • Bitcoin cryptographic mining provides verification for anonymous participants but at significant compute cost (proof of work)
• When participants are known & trusted
  • Commitment possible at low cost
• Multiple alternatives
  • Proof of stake where fraudulent transactions
• Validators (e.g. transaction bond)
  • Multi-signature (e.g. 3/5 participants agree)
• Industrial Blockchain needs “pluggable” consensus
THE BITCOIN MINING SAGA - PART I
By Patricia Batavio

What is Bitcoin Mining?
It's a decentralized computational process that serves 2 purposes:

1. Verify a transaction
2. Aggregate transactions into a block

- Confirm transactions in a trustful manner when enough computational power (effort) is devoted to a block
- Creates (issues) new bitcoins in each block
- Bundle transactions in a block
- Verify if transactions are valid
- Select the header of the most recent block and insert it into the new block as a hash
- When the solution is found, the new block is added to the local blockchain and propagated to the network

Mining Blocks
- Verify a transaction
- Aggregate transactions into a block
- Mine the new block
- Validate the new block
- Assemble the new block to blockchain
10 BENEFITS OF BLOCKCHAIN

1. **Cost savings**: direct or indirect.
2. **Speed**: removing time delays.
3. **Transparency**: providing the right information to the right people.
4. **Better privacy**: protecting consumers, businesses via more granular controls.
5. **Lower risk**: better visibility, less exposure, less fraud, less tampering.
6. **Access**: more equitable access.
7. **Productivity**: more work output.
8. **Efficiency**: faster processing or reporting.
9. **Quality**: less errors or more satisfaction.
10. **Outcomes**: profits and growth
WHAT ARE BLOCKCHAIN’S DRAWBACKS?

- Scalability
- Adaptability
- Regulation: where does financial reporting authorities come in?
- Relatively immature technology
- Privacy: Anonymity and untraceable communication
FACTORS TO CONSIDER IN EVALUATING A BLOCKCHAIN PLATFORM

What is the track record of the developers for delivering enhancements and upgrades to the blockchain?

What specific programming languages are available?

How many nodes can the blockchain grow? Will there be upper limits?

What is the cost of deploying that technology?

Do you have a full view on the blockchain activity?

Is there real-time transparency for all transactions?

Programmability

Affordability

Scalability

Blockchain Evaluation

Upgradability

Manageability

Visibility

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FACTORS TO CONSIDER IN EVALUATING A BLOCKCHAIN PLATFORM

- **Security**: What is the documented confidence level in blockchain security?
- **Open Source**: What is the level of collaboration and contributions from a variety of developers?
- **Speed/Performance**: What are the upper limits for speed in validating transactions?
- **Blockchain Evaluation**: Does it inter-operate well with other blockchains or related technologies?
- **High Availability**: What is the uptime's?
- **Extensibility**: Can you extend the basic blockchain functionality with a variety of add-ons?
Gartner Hype Cycle for Emerging Technologies, 2017

gartner.com/SmarterWithGartner

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### Types of Blockchains

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permissioned ledger</td>
<td>All participants of the network are known and already trusted. An agreement protocol can be used to maintain a shared version of truth about the state of the records on the blockchain. There is also no requirement for a permissioned blockchain to be private as it can be a public blockchain but with regulated access control.</td>
</tr>
<tr>
<td>Distributed ledger</td>
<td>Distributed among its participants and spread across multiple sites or organizations. This type can either be private or public. The records are stored contiguously instead of sorted into blocks. This concept is used in Ripple.</td>
</tr>
<tr>
<td>Shared ledger</td>
<td>Generic term that is used to describe any application or database that is shared by the public or a consortium.</td>
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<tr>
<td>TYPES OF BLOCKCHAINDS</td>
<td></td>
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<tr>
<td>-----------------------</td>
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<tr>
<td><strong>Fully private &amp; proprietary blockchains</strong></td>
<td></td>
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<tr>
<td>Perhaps have no mainstream application as they deviate from the core idea of decentralization in blockchain technology. Nonetheless in specific private settings within an organization-shares data and provides some level of guarantee of the authenticity of the data. These blockchains may be useful in such a scenario.</td>
<td></td>
</tr>
<tr>
<td><strong>Fully private &amp; proprietary blockchains</strong></td>
<td></td>
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<tr>
<td>Example: may be used for collaboration and sharing data between various government departments</td>
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<td><strong>Tokenized blockchains</strong></td>
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<td>These blockchains are standard blockchains that generate cryptocurrency as a result of a consensus process via mining or via initial distribution.</td>
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