Digital business models

Lecture 7. Blockchain-based business models

Content

- **What is the Blockchain ?**
- **What is the Blockchain Business Model ?**
- **The types of Blockchain Business Models**
- **Key characteristics of Blockchain**
- **Using blockchain in business**

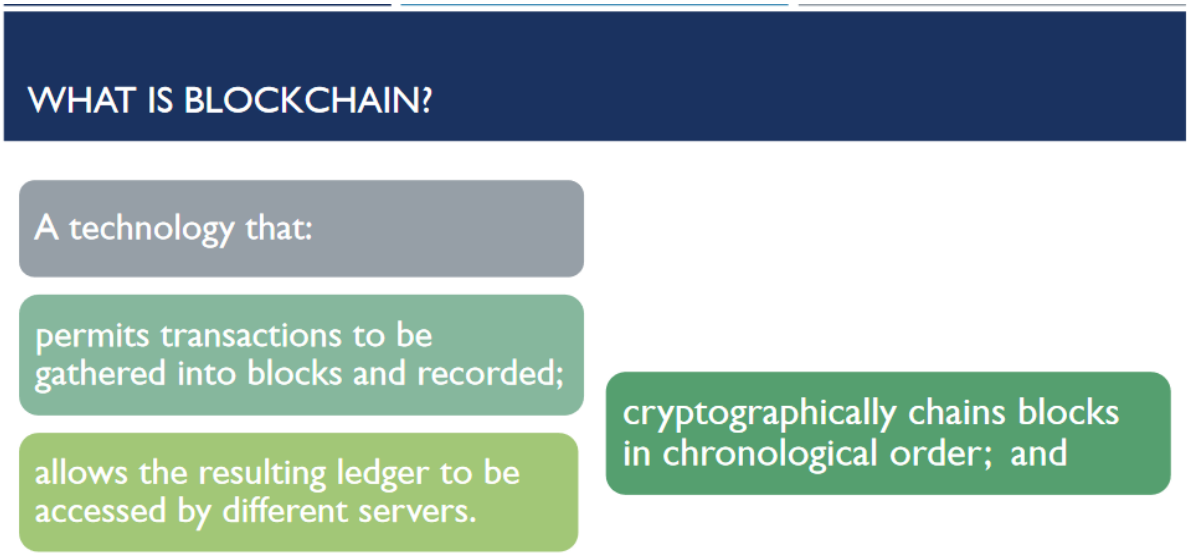
What is the Blockchain ?

- Blockchain technology is a structure that stores transactional records, also known as the block, of the public in several databases, known as the “chain,” in a network connected through peer-to-peer nodes. Typically, this storage is referred to as a ‘digital ledger.’
- Every transaction in this ledger is authorized by the digital signature of the owner, which authenticates the transaction and safeguards it from tampering. Hence, the information the digital ledger contains is highly secure.
- In simpler words, the digital ledger is like a Google spreadsheet shared among numerous computers in a network, in which, the transactional records are stored based on actual purchases. The fascinating angle is that anybody can see the data, but they can’t corrupt it.

History of Blockchain

- **2008**
- Satoshi Nakamoto, a pseudonym for a person or group, publishes “Bitcoin: A Peer to Peer Electronic Cash System."
- **2009**
- The first successful Bitcoin (BTC) transaction occurs between computer scientist Hal Finney and the mysterious Satoshi Nakamoto.
- **2011**
- 1 BTC = $1USD, giving the cryptocurrency parity with the US dollar.

- **2019**
- China's President Ji Xinping publicly embraces blockchain as China's central bank announces it is working on its own cryptocurrency
- Twitter & Square CEO Jack Dorsey announces that Square will be hiring blockchain engineers to work on the company's future crypto plans.The New York Stock Exchange (NYSE) announces the creation of Bakkt - a digital wallet company that includes crypto trading
- **2020**
- Bitcoin almost reaches $30,000 by the end of 2020.PayPal announces it will allow users to buy, sell and hold cryptocurrencies
- The Bahamas becomes the world's first country to launch its central bank digital currency, fittingly known as the "Sand Dollar"
- Blockchain becomes a key player in the fight against COVID-19, mainly for securely storing medical research data and patient information



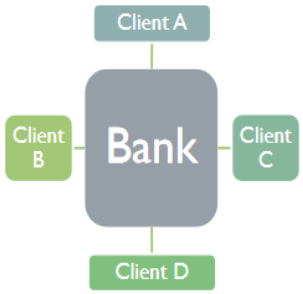
https://www.sec.gov/spotlight/investor-advisory-committee-2012/slides-nancy-liao-brief-intro-to-blockchain-iac-101217.pdf

What is the Blockchain?

Blockchain, sometimes referred to as Distributed Ledger Technology (DLT), makes the history of any digital asset unalterable and transparent through the use of decentralization and cryptographic hashing.

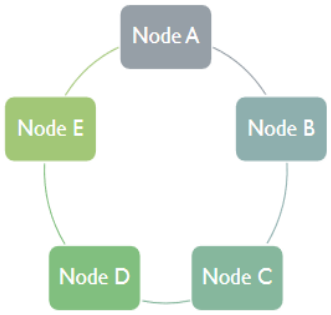
WHAT IS A DISTRIBUTED LEDGER?

Centralized Ledger



- There are multiple ledgers, but Bank holds the "golden record"
- Client B must reconcile its own ledger against that of Bank, and must convince Bank of the "true state" of the Bank ledger if discrepancies arise

Distributed Ledger



- There is one ledger. All Nodes have some level of access to that ledger.
- All Nodes agree to a protocol that determines the "true state" of the ledger at any point in time. The application of this protocol is sometimes called "achieving consensus."

https://www.sec.gov/spotlight/investor-advisory-committee-2012/slides-nancy-liao-brief-intro-to-blockchain-iac-101217.pdf

WHERE MIGHT BLOCKCHAIN USE CRYPTOGRAPHY?

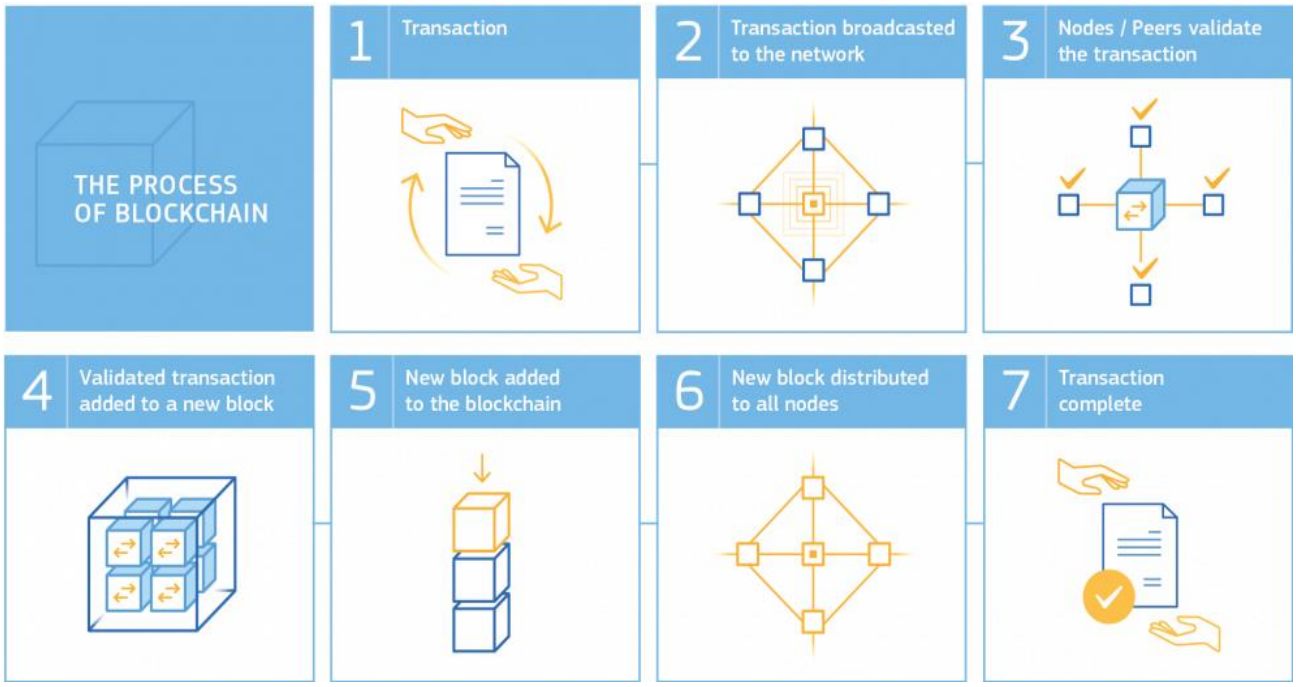
Initiation and Broadcasting of Transaction	• *Digital Signatures* • *Private/Public Keys*
Validation of Transaction	• *Proof of Work and certain alternatives*
Chaining Blocks	• *Hash Function*

https://www.sec.gov/spotlight/investor-advisory-committee-2012/slides-nancy-liao-brief-intro-to-blockchain-iac-101217.pdf

What is the Blockchain ?

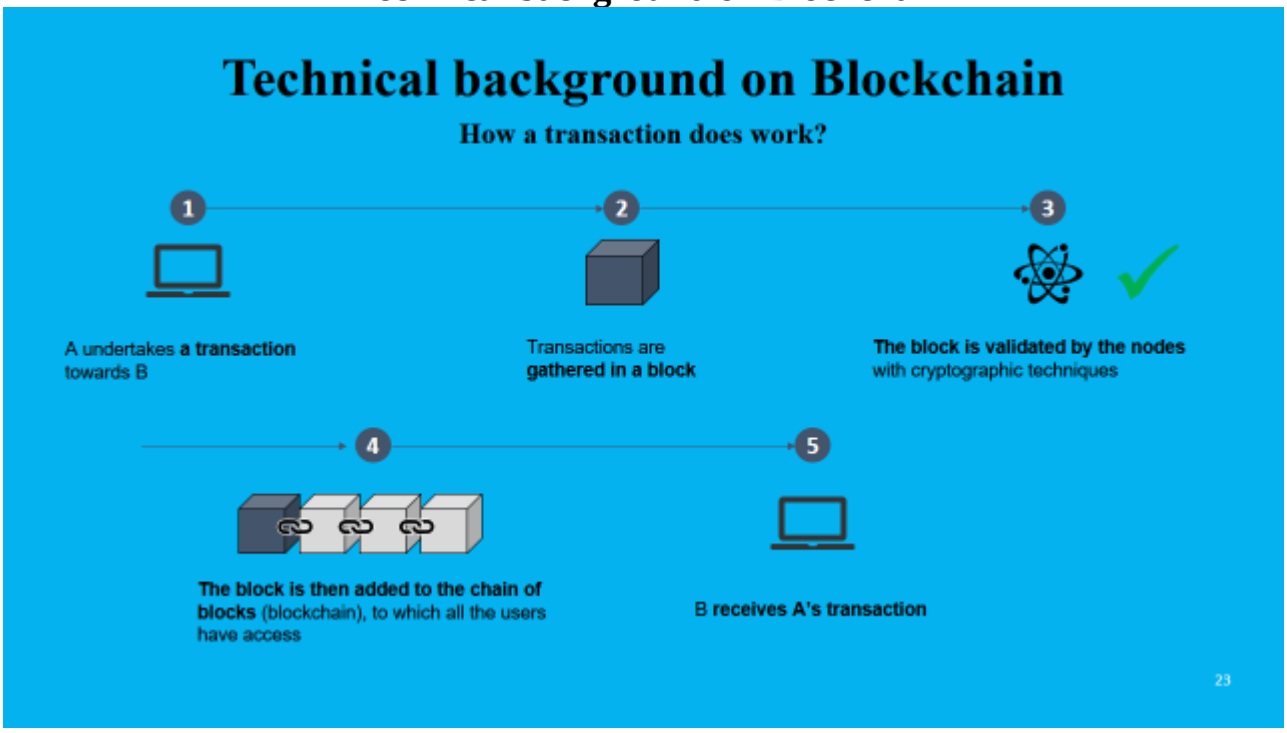
Blockchain is a series of immutable records of data, managed by groups of computers that don't belong to any entity, company, or government. Each of these data blocks is secure and linked to each other using a cryptographic chain. Hence the name "block + chain". The blockchain is, therefore, a fully automated and secure way of transmitting the information. A part of a transaction starts the process by creating a block. This block is verified by thousands, perhaps millions of computers distributed over the network. The verified block is added to a chain, stored on the network, creating an exclusive record with an also exclusive history. To falsify a single record, it would be necessary to falsify the entire chain in millions of instances. This is practically impossible. And all of this is completely free. Because the block is not regulated by anybody. This technology can replace all business processes and models that depend on charging one for any transaction between two parties.

How Blockchain Works ?

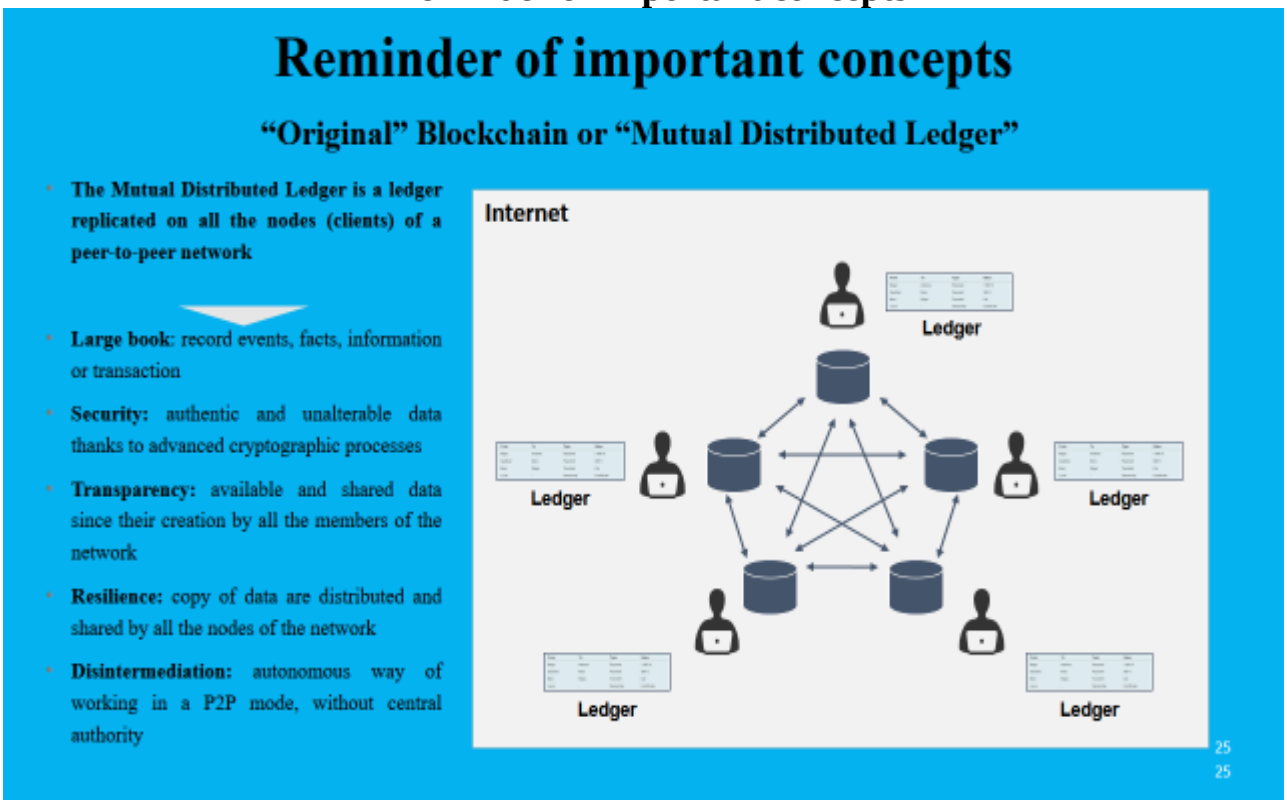


https://joint-research-centre.ec.europa.eu/crosscutting-activities/facts4eufuture-series-reports-future-europe/blockchain-now-and-tomorrow-assessing-multidimensional-impacts-distributed-ledger-technologies/blockchain-promising-technology-bottlenecks-and-complex-challenges-lie-ahead_en

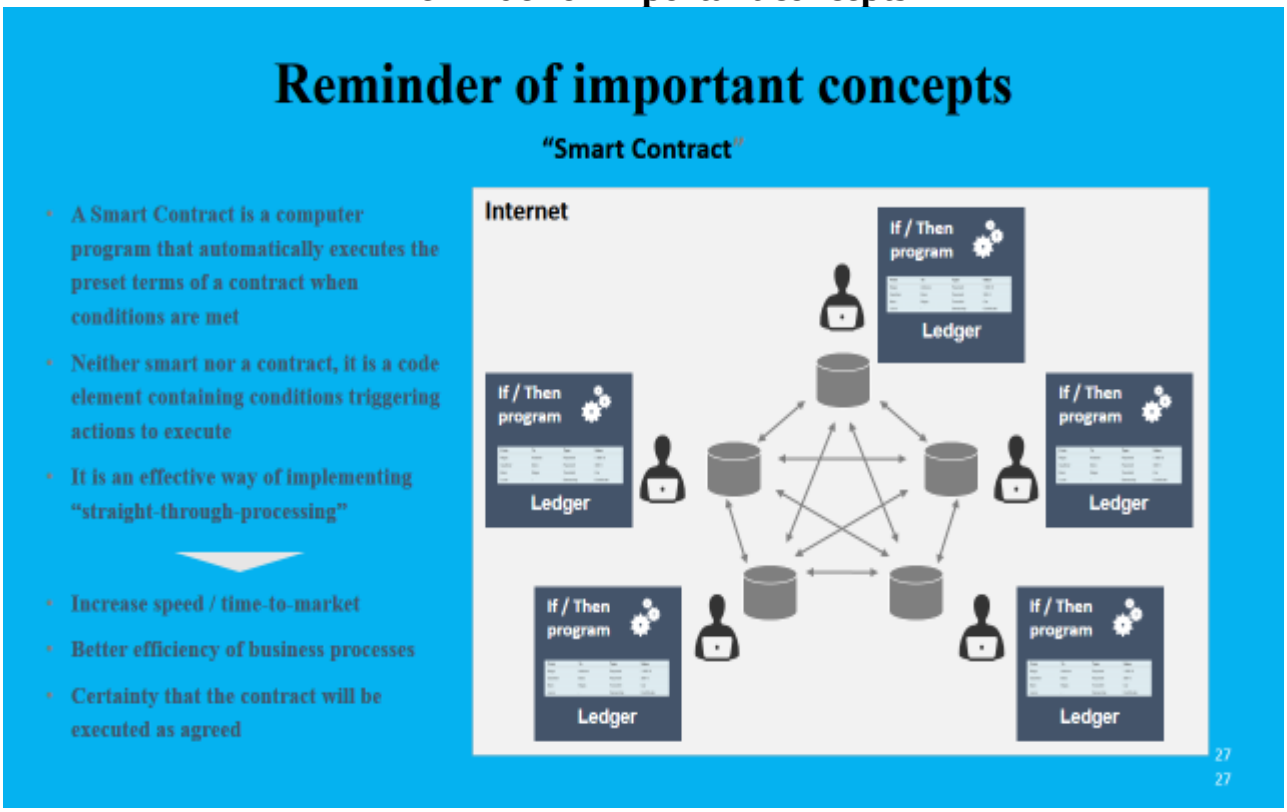
Technical background on Blockchain



Reminder of important concepts



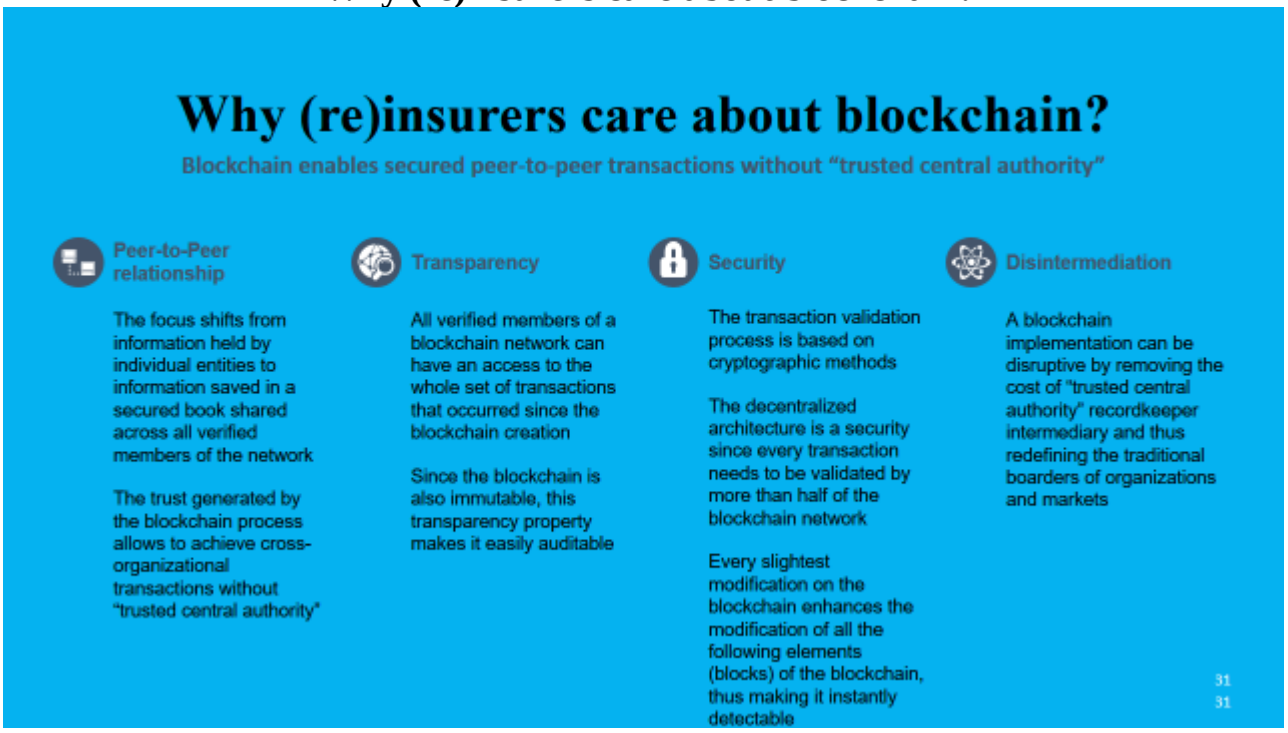
Reminder of important concepts



Blockchain is based on three pillars

- **Decentralization**: as mentioned above, the data is stored inside the blockchain and shared by all of the networks. Nobody owns the records.
- **Immutability**: all the data is non-tamperable, through cryptography, ensuring cybersecurity.
- **Transparency**: the identity is hidden via complex cryptography and represented by their public address. So, although the person's real identity is secure, all the transactions that were done by their public address can still be seen. This level of transparency has never existed before.

Why (re)insurers care about blockchain?



Advantages of Blockchain

- Security is probably the most significant advantage. It is almost impossible to corrupt a blockchain because the information is shared and continually reconciled by thousands, even millions, of computers. Blockchain also has no single point of failure.
- Transactions can be more efficient than in non-DLT-based transactional systems, though public blockchains can sometimes suffer from slow speed and inefficiency.
- It's resilient: There is no problem if one node goes down because all the other nodes have a copy of the ledger.
- It provides trust between participants on a network. Confirmed blocks are very difficult to reverse, which means data is difficult to remove or change.
- It can be cost effective because it often reduces the expense associated with transactions by eliminating middlemen and third parties.

Disadvantages of blockchain

- With public blockchains, there are questions about ownership and who is responsible when problems arise.
- There are also questions about whether organizations are capable of or willing to invest in the infrastructure needed to build, participate and maintain a blockchain-based network.
- Changing data in a blockchain typically takes a lot of work.
- Users have to keep track of their private keys to avoid losing their money.
- Storage can grow to be very large over time, which risks the loss of nodes if the ledger becomes too large for users to download.
- Blockchain is susceptible to 51% attacks, which is a specific attack designed to overwhelm other participants in the network and change blocks.

What is the Blockchain Business Model ?

Blockchain technology is transforming business

Although the blockchain technology landscape can be confusing and is constantly changing, it is a technology that is almost certain to impact the business of most IT leaders in the next five years. Whether due to the adoption of blockchain by a competitor or the necessity to participate in a blockchain network, you can’t afford to ignore this powerful technology.

Blockchain Model

- Blockchain has the potential to reshape industries by enabling trust, providing transparency and enabling value exchange across business ecosystems. There is a huge potential to lower costs, reduce transaction settlement times and improve cash flow. digital business models
- Moreover, in combination with IOT technologies, assets can be traced and tracked from their origin to the point of production or purchase. Often it is the combination of blockchain and other digital technologies that produces more radical digital business models.
- As a result, blockchain significantly improves supply logistics and reduces risks associated with counterfeit goods.
- Another area in which blockchain has potential is identity management. Smart

contracts can be programmed into the blockchain where events can trigger actions; for example, payment is released when goods are received.

What is a Blockchain Business Model ?

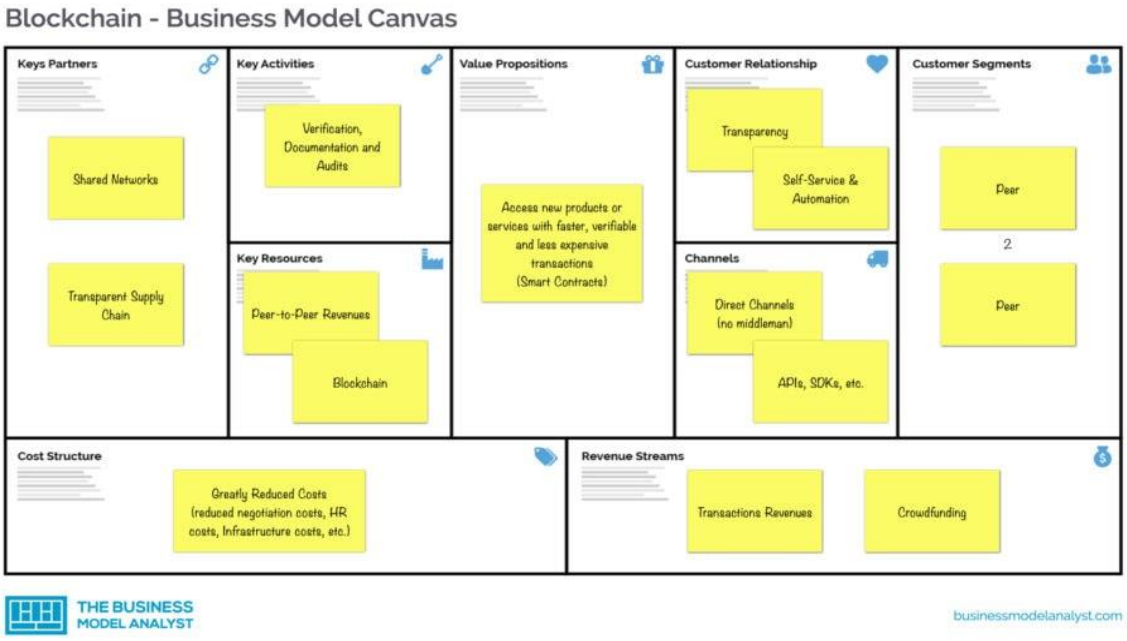
Well, in short, a business model describes a plan or strategy of a company to sell a product or service and earn profit from there. Each company will create their ways of handling business. However, there is a centralized model, composed of the owners or the shareholders, the organization, the customers, and the employees. A blockchain business model has all the three main characteristics of blockchain technology: it is decentralized, based on peer-to-peer transactions, within a trusted and reliable network.

The Value Proposition of the Blockchain models

- A key component of digital business models is the realization of value. Blockchain potentially drives value in a number of different ways:
- Blockchain removes business and technical friction by making the ledger independent of individual applications and participants and replicating the ledger across a distributed network to create an authoritative record of significant events. Everyone with permission access sees the same information, and integration is simplified by having a single shared blockchain model.
- Blockchain also enables a distributed trust architecture that allows parties that do not know or inherently trust one another to create and exchange value using a diverse range of assets.
- With the use of smart contracts as part of the blockchain, actions can be codified such that changes in the blockchain trigger other actions.

Blockchain on Development Platforms

As blockchain technology and ecosystem is still recent, for it to grow, more developers are needed to enter the environment. Therefore, a lot of startups are creating decentralized applications (Dapps) on development platforms. To understand the relationship between development and the value of the network, we can refer to Metcalfe’s Law. According to this theory, the effect of a network is proportional to the square of the number of users connected to the system. In simple words, the more people involved, the more valuable the network is.



Blockchain on Development Platforms

- **Network Fee:** In this case, there is a network fee associated with the blockchain itself. They charge a small amount for the user for different activities on the network. For example, the Ethereum network charges gas fees for the use of the platform., NEO charges GAS tokens, Golem asks for golem tokens, and so on.
- **Auditing:** This model works in two ways: either the developers hire an auditing company to look over the smart contract for them or put up a bounty on their contract and several independent auditors and developers look up the code and search for flaws. That works out because Dapps deal with a lot of money, so it is imperative for their code to work correctly. Any little bug can lead to a large catastrophe.
- **Other Services**: As a blockchain business requires a lot of work, such as website, content, and frameworks, the startups may save money and time by hiring freelancers of agencies to deal with these services. It is a nice blockchain business model for talented professionals who want to use their skills to do business.

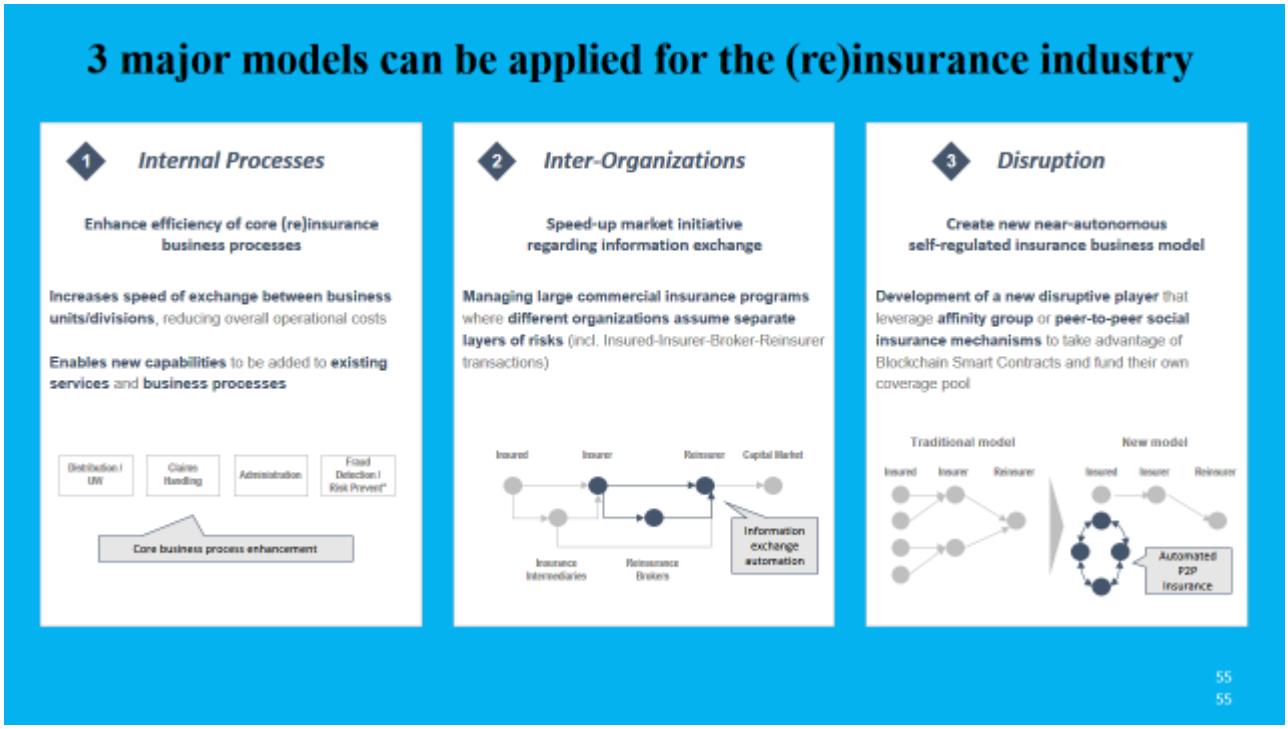
Tokens

- Ethereum programmers can create tokens to represent any kind of digital asset, track its ownership and execute its functionality according to a set of programming instructions.
- Tokens can be music files, contracts, concert tickets or even a patient's medical

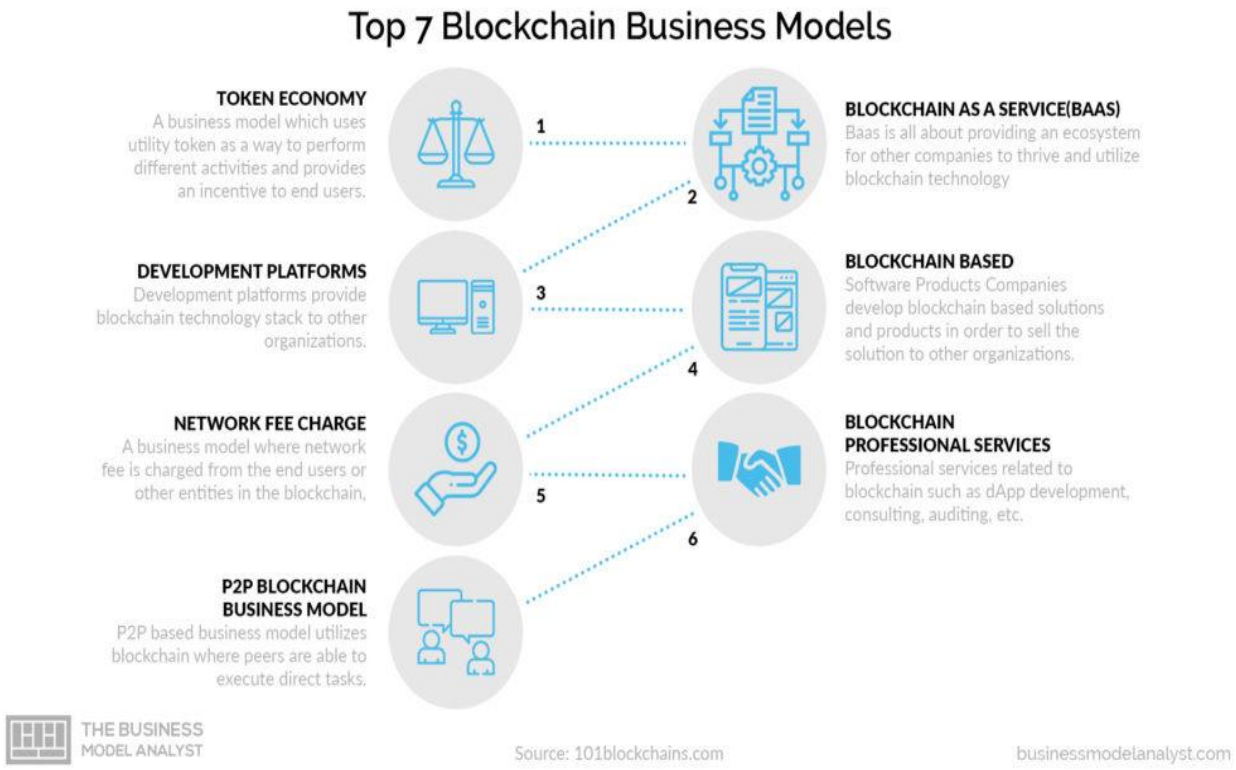
records. Most recently, Non-Fungible Tokens (NFTs) have become all the rage. NFTs are unique blockchain-based tokens that store digital media (like a video, music or art). Each NFT has the ability to verify authenticity, past history and sole ownership of the piece of digital media. NFTs have become wildly popular because they offer a new wave of digital creators the ability to buy and sell their creations, while getting proper credit and a fair share of profits.

- Newfound uses for blockchain have broadened the potential of the ledger technology to permeate other sectors like media, government and identity security. Thousands of companies are currently researching and developing products and ecosystems that run entirely on the burgeoning technology.
- Blockchain is challenging the current status quo of innovation by letting companies experiment with groundbreaking technology like peer-to-peer energy distribution or decentralized forms for news media. Much like the definition of blockchain, the uses for the ledger system will only evolve as technology evolves.

3 major models can be applied for the (re)insurance industry



The types of Blockchain Business Models



P2P Blockchain Business Model

As said before, blockchain technology has always been peer to peer, allowing end-users to interact with each other. The profit may be made here via tokens, BaaS (Blockchain as a Service), transaction fees, and others. Filecoin and IPFS are popular examples that use this business model, by providing a platform for data storage and sharing.

Blockchain as a Service Business Model (BaaS)

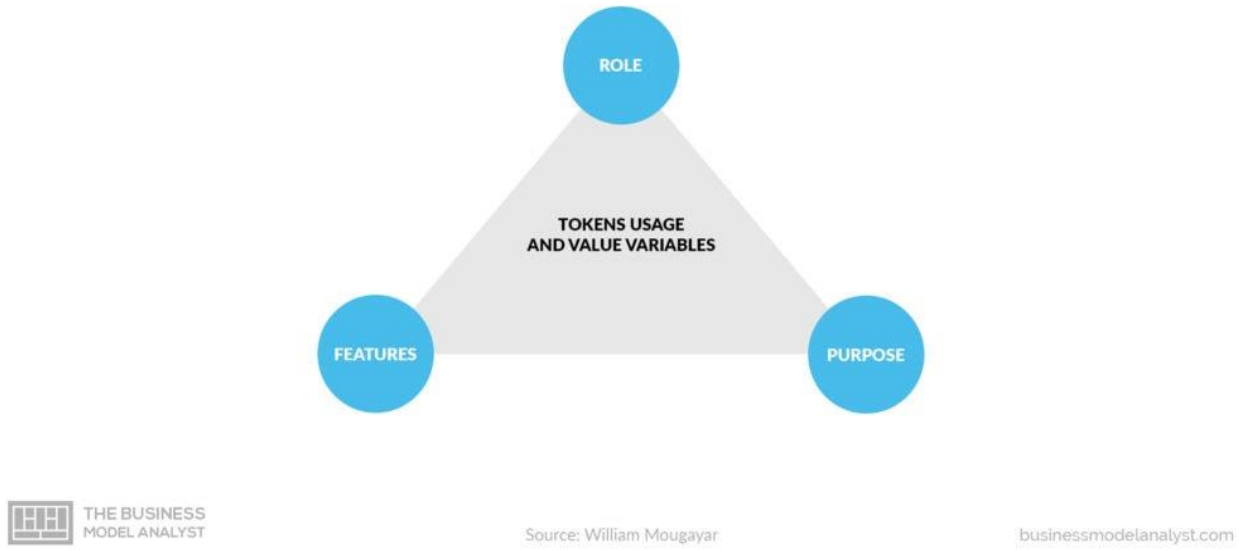
Blockchain technology and ecosystem can be pretty intimidating for people in general. Nevertheless, this Blockchain-as-a-Service (BaaS) business model permits the clients to outsource all the backend structure and focus only on the frontend. Blockchain Business Models - Front-End Back-End.

BaaS companies usually provide services such as user authentication, database management, remote updating, push notifications (for smartphone apps), cloud storage, and hosting. It is, therefore, one of the most popular blockchain business models, with famous operators such as Microsoft (Azure), Amazon (AWS), and IBM (BlueMix). The end-users, in this case, are not usually people, but other businesses and organizations. And they don’t have to worry about how blockchain works nor hardware infrastructure, thus allowing them to experiment, test, and conduct research.

Token Economy – Utility Token Business Model

The utility toke business model drives functionality into business via the use of tokens, which facilitate the network activities. Nowadays, there is plenty of startups, companies, and e-commerce websites that use the utility token business model. The token utility has three important properties: role, feature, and purpose. Utility Token Business Model Each role has its own set of features and purpose:

Token Economy – Utility Token Business Model



The rules of token business model

- Right: with a particular token, the holder gets a certain amount of rights within the ecosystem.
- Value Exchange: the tokens create an internal economic system that can help the buyers and sellers trade value within the ecosystem.
- Toll: it acts as a toll gateway to use specific functionalities of a particular system.
- Function: the token enables the holder to enrich the user experience inside a particular environment.
- Currency: it is a store of value that can be used to conduct transactions both

inside and outside the given ecosystem.

- Earnings: it allows an equitable distribution of profits and benefits among investors in a particular project.

Blockchain-Based Software Products

There are blockchain companies that create solutions to be sold to bigger companies and organizations, as well as support after implementation. That usually works out fine, because the big companies don't want to go through the process of selecting and hiring talent. It is much easier to buy a ready-made blockchain solution. Proving blockchain technology to organizations can be extremely profitable. The best example of this is the MediaChain blockchain being sold to Spotify.

Key characteristics of Blockchain

Blockchain characteristics

- Digital and distributed ledgers storing signed transactions
  - Transactions are stored in blocks and blocks are chained
  - Double-spending mechanism
  - Shared ledgers increase availability and reduce fraud risks
  - Digital signature provides integrity and imputability
  - Increased transparency (but no confidentiality)
- Extra services
  - Smart contract allowing event-based process organization
  - Digital identity providing certified authentication process
  - Multiple signature mechanisms

Benefits of use Blockchain

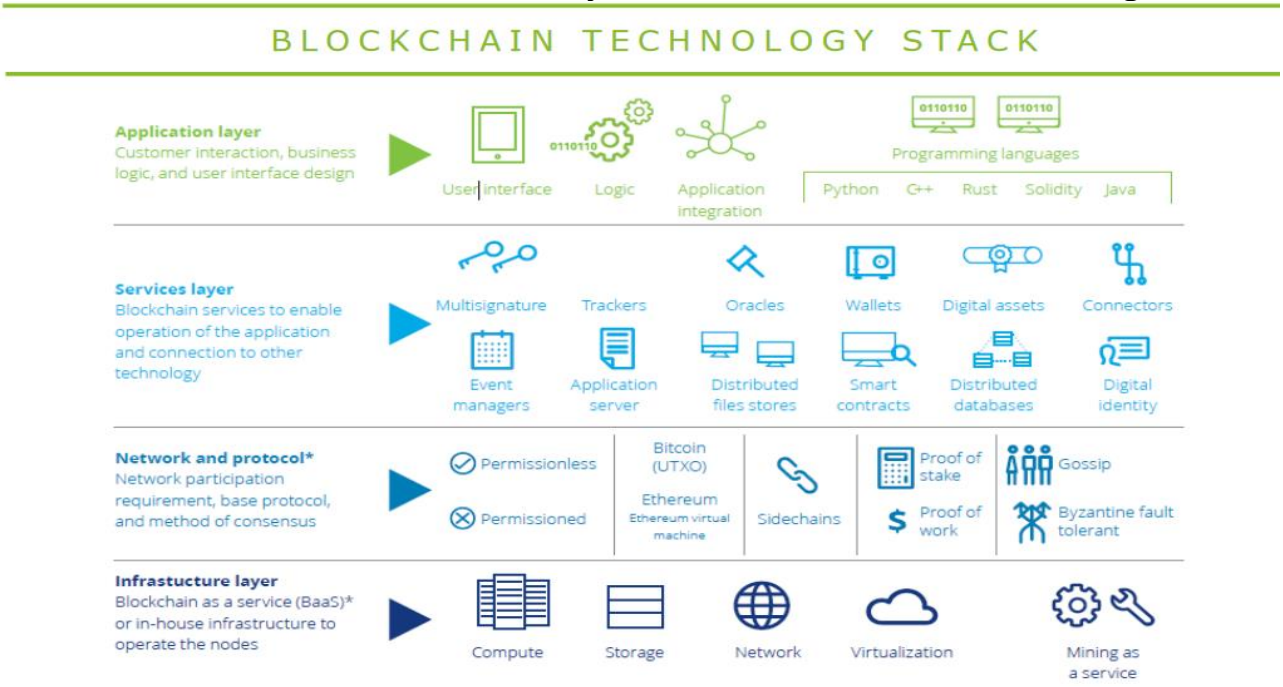
- Transparency
  - Recorded transactions
- Need to define precisely the transaction information
- Collaborative network management
- Identity certification
- Cooptation process registering
- Distributed BP
- Record processes interactions
- Identify "launching conditions" for each sub-process

Access control in Blockchain

- Permissionless blockchain
  - Opened and shared ledgers
  - Free access for validators
  - Users are identified by their avatar
  - Public blockchain
- Permissioned blockchain
  - Authorized validators
  - Restricted access to the ledgers
  - Users are associated to well known identities
  - Used for private blockchain / consortium blockchain

Architecture of Blockchain

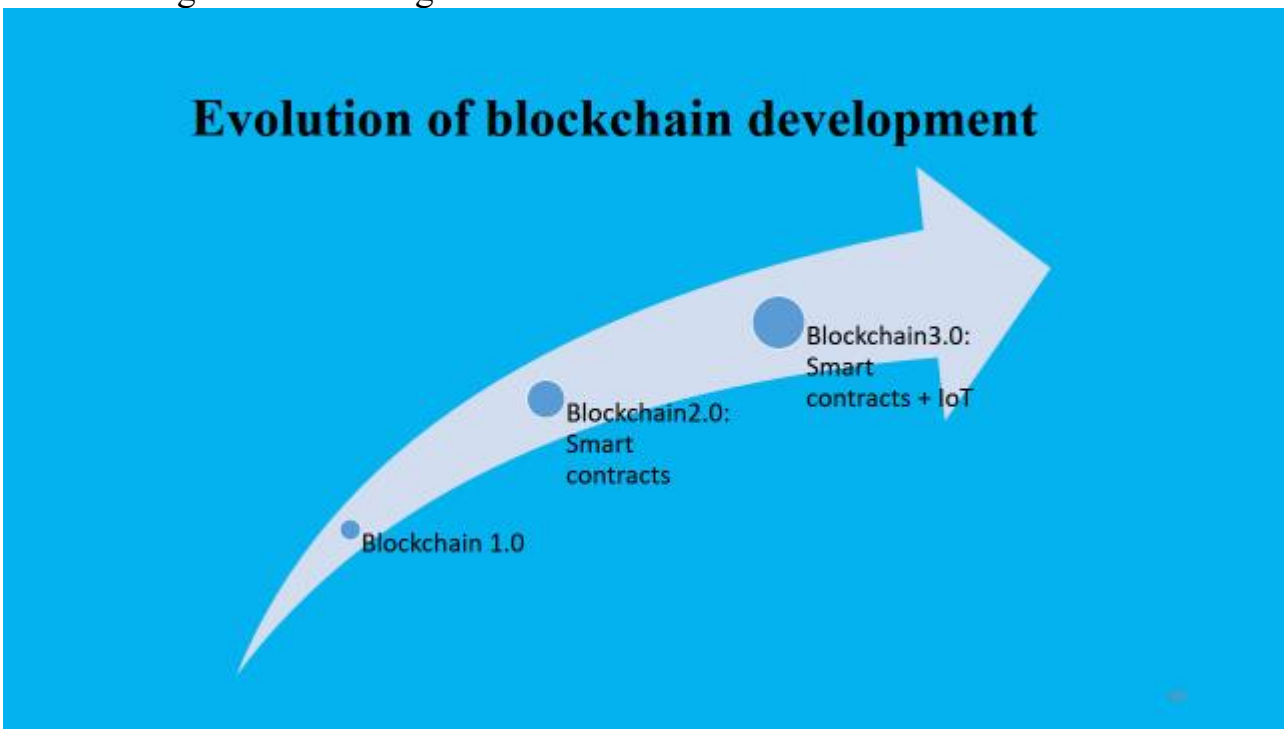
Similar to the Cloud stack model . May lead to Blockchain as a Service organisation



Source:https://www2.deloitte.com/content/dam/Deloitte/in/Documents/industries/in-convergence-blockchain-tech-stack-noexp.pdf

What is Architecture of Blockchain ?

- Infrastructure
  - Computing, communication and storage features
  - Mining process
    - Adapted hardware
    - Optimized cryptographic computation
- Organisation and protocols
  - Blockchain platform
  - Validation strategy
  - Consensus method
- Services
  - End user wallet system
  - Trusted services: identity management, distributed files/DB, event manager, digital asset management…



Blockchain 1.0

- Easy to pay without taking care of the currency type of the country
- trusted exchange
- « no charge »
- Heavy Carbon cost !
- Various real price depending on the cryptocurrency rate
- Require adding the cryptocurrency as a payment mean in the reseller information system

Key elements of Blockchain 1.0

- First introduced as Bitcoin
- Fiat currency
  - P2P currency transfer without intermediaries
    - But it requires miners!
  - No valuable good exchange to support the crypto-currency
- Transaction validation
  - Solve the double spending problem
  - Fees
    - Use the blockchain token
    - Miners choose “the best transactions” to integrate into blocks
    - Paid only if the block is validated

Key elements of Blockchain 1.0 limits

- Long delay (10 minutes for a bitcoin block validation)
- Scalability problem
- Identity management
- Identity related to a key
- No proven links between the real identity and the avatar
- Security risks
- Internal byzantine fault
- Lossing private key
- Crypto-currency
- No legal status for the tokens
- Crypto-currency isolation: no exchange mechanisms between different currencies

- Highly volatile value due to speculation of the main actors

Blockchain 2.0

- Define once the ordering conditions and do not take care after that
- Choose your own trusted sources to define the contract launching conditions
- The contract will be automatically launch depending on external context
- Only 1 shot contract
- Your reseller will have to establish the contract and its connection with its IS
- The smart contract has a registration cost and the carbon cost may be heavy
- P2P trusted organization which does not allow multi-tenant contract

Key elements of Blockchain 2.0

- First implementation in Ethereum
- Smart contracts
  - Distributed application
  - Contract based organization
  - Event driven
  - Integrates the transaction payment
- Distributed application
  - Open-source
  - Manage its own tokens
  - Automated transaction execution
  - Data and operations are stored in the blockchain

Key elements of Blockchain 2.0 limits

- Smart contract legal status
  - Computarized transaction and not a contract
  - How parties identity can be proven?
  - How to be sure of the capacity of the contracting parties?
  - Different regulations depending on the hosting countries
- Event driven organization
  - Allows reactivity
  - Different organization than the traditional control driven logic
- “Code is law”
  - Code cannot be adapted even in case of failure
  - Increased security risks
- Blockchain delay and scalability?

Blockchain 3.0

- Fully trusted and distributed process organization
- Totally new and distributed collaborative and trusted organization
- Block registration cost, carbon impact
- Change the application design model
- Limited to P2P organizations and requires to set the collaboration chain separately

Key elements of Blockchain 3.0

- Designed to overcome Blockchain 1.0 and 2.0 main limits
  - Lack of scalability
  - Lack of interoperability
  - Lack of sustainability
  - Off-line governance strategy lack of transparency
- Main characteristics
  - Blockchain middleware approach
  - New on line governance strategy
    - Scalable validation processes
  - Integration of private blockchain requirements and characteristics
  - Sustainable block management
  - IoT integration

Blockchain hype cycle: Reduced community

- Single use
  - Blockchain provides a less expensive solution
  - Focused solution
  - Used to certify and store transactions in a distributed ledger
  - Example: micro-payment
- Localisation
  - Reduced business community
  - High novelty
  - Mostly FinTech applications
  - Example: NASDAQ management

Blockchain hype cycle: large community

- Substitution
  - Blockchain technology replaces traditional ones
  - Use basic blockchain characteristics
    - Immutability
    - Availability
  - Most applications are related to
    - Certification (diploma, shipment documents…)
    - Exchange (gift cards…)
- Transformation
  - Rethink applications to fit the digital transformation
  - Heavy use of smart contracts
  - Example: collaborative and shared economy (energy P2P exchange…)

Blockchain key principles: Previous works

- Time-stamped information
  - Digital signature including a time-stamp (1991)
  - Use hashing techniques
- Merkle tree (1979)
  - Store hashed information
  - Binary tree organization
  - Merging blocks involves computing new hash associated to the "father node"
- Strong cryptographic foundation but
  - How can the Merkle tree be stored
  - How to protect it from attacks

Blockchain key principles: characteristics

- From transaction to blockchain
  - A block stores
    - transactions data
    - The previous block hash
  - A Merkle tree stores the blocks
    - Each block is signed with a hash
- Decentralized storage of the Merkle tree
  - Distributed ledgers
    - Safer storage
  - Common governance rule

- How to trust the block validation process

Blockchain key principles: governance rules

- Proof of Work (PoW)
  - Block's hash is computed according to a mathematical challenge
    - Finding the "nonce" in a bruteforce way
  - Requires important computing resources and energy
    - Trust depend on the hardware investment and on the "consumed" computing resources
- Proof of Stake
  - Validator is randomly chosen according to the invested currency
  - Avoid heavy computation
    - Involves less speculation
- Proof of Authority
  - List of potential certified validators
  - Reputation mark

Using blockchain in business

Using blockchain in business

- **How does blockchain work for business?**
- ***Replication:*** Once a block — the record of an event — is approved, it is automatically created across the ledgers for all participants in that channel. Every network partner sees and shares a single ***"trusted reality"*** of the transactions.
- ***Immutability*****:** More blocks can be added, but not removed, so there is a permanent record of every transaction, which increases trust among the stakeholders.
- ***Security*****:** Only authorized entities are allowed to create blocks and access them. Only trusted partners are given access permission.

Using blockchain in business

- **Applications of blockchain for business.** Across industries around the world,

blockchain is helping transform business. Greater trust leads to greater efficiency by eliminating duplication of effort. Blockchain is revolutionizing the supply chain, food distribution, financial services, government, retail, and more.

- **Blockchain ensures safer food.** We all eat - and we've all had second thoughts about food safety or freshness. What if we could replace those doubts with visibility into every step from farm to fork? Many companies are now doing just that, sharing and using data from IBM Food Trust™, built on the IBM Blockchain Platform.

Using blockchain in business

- **Applications of blockchain for business**. Blockchain tracks every step in shipping. Think of everything you've used today. How did it get here? Today's supply chain is a complex network of relationships, scheduling, systems and data. Even the smallest error can lead to delays that have tremendous ripple effects.
- **Blockchain spreads trust everywhere**. Whether it's between people or organizations, relationships flourish when there's more trust. From jewelry to insurance to food, IBM Blockchain can elevate that trust to an entirely new level by helping parties transacting together validate and share immutable transaction records on a private, distributed ledger.

https://www.ibm.com/topics/blockchain-for-business

Using blockchain in business

Examples of industries that benefit from using blockchain

- Blockchain's benefits span industry sectors, but some sectors and enterprises are better suited to this technology than others. Businesses that are decentralized by definition, have multiple parties that need access to the same data and need a better way to ensure that data has not been tampered with are piloting programs or brought test cases to full production. The following are a few examples of industries benefiting from blockchain.
- ***Financial institutions*** -- and their customers -- are seeing faster and less-costly clearing and settlement.
- ***Healthcare entities*** are finding that blockchain can ensure the security of patient records and to maintain patient privacy while also enabling the ability to share a patient's data only as the patient allows.

- ***Nonprofits and government agencies*** have adopted smart contracts and other blockchain-based applications to create immutable records that enforce stipulated terms.

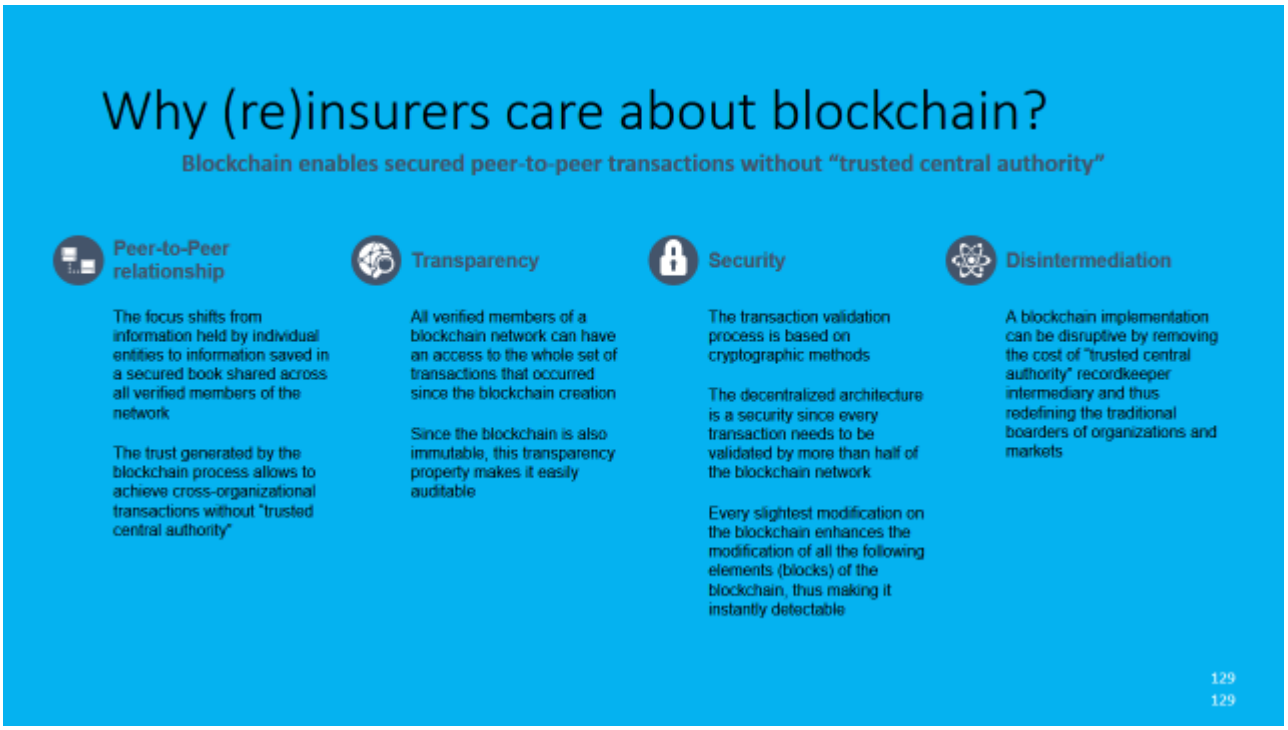
Using blockchain in business

International trade and blockchain system

- How does foreign trade benefit from blockchain?
- Blockchain optimizes processes, makes goods traceable, guarantees the security of payments and financing, facilitates the verification of digital quality and origin certifications, enables real-time sharing of information on the different stages of trade, and helps improve how related public and private services operate, among other benefits.
- Blockchain provides solutions for trade operations by simplifying cross-border trade, contributing to competitive improvements, and reducing transaction costs. Although blockchain has been used within foreign trade for several years, its significance has increased since the start of the COVID-19 health crisis and it is expected to play an even more prominent role in the post-pandemic world.

Is there money to be made with blockchain technology?

- Even though the initial hype surrounding blockchain applications, and the prolonged blockchain “winter” that followed, are beginning to settle, this is no time to rest on our laurels. IT leaders must prepare for the inevitable blockchain tech “spring” on the horizon, bringing with it core-enabling technologies and significant opportunities for digital business.
- By 2023, blockchain will support the global movement and tracking of $2 trillion of goods and services annually.



References

- Business analysis life cycle & IT- business analyst: Role in traditional, digital and agile world kindle edition by Subramanyam Gunda (Author) Format: Kindle Edition ASIN : B085X3CCSQ Publication date : March 13, 2020.
- Milani Fredrik. Digital Business Analysis. Springer, 2019. - 432 p. - ISBN 978-3-030-05719-0.
- Cadle James, Paul Debra, Turner Paul. Business Analysis Techniques: 99 essential tools for success . 2nd Edition BCS, The Chartered Institute for IT, 2014. - 356 p. - ISBN-10: 1780172737; ISBN-13: 978-1780172736.
- Wirtz, B. W. (2018a). Business model management: Design-Instrumente - Erfolgsfaktoren (4th ed.). Wiesbaden: Springer Gabler.
- Wirtz, B. W. (2018b). Electronic business (6th ed.). Wiesbaden: Springer Gabler.
- Zott, C., Amit, R., & Massa, L. (2011). The business model: Recent developments and future research. Journal of Management, 37(4), 1019–1042
- Bernd W. Wirtz. Digital Business Models.Concepts, Models, and the Alphabet Case Study. ISSN 2196-8705. Progress in IS. ISBN 978-3-030-13004-6.