Architecture of Ethereum, Hyperledger and Corda; three leading Blockchain technology platforms

Presented BY: Dr Abdurashid Turgunov

Course name: Blockchain Technology

Hyperledger

- Complex set of components
  - Provide lots of functions
    - Involves tuning
    - Require configuration expert services
    - Can be adapted for different usage
  - Smart contract
    - Use different languages
    - Ease the integration with the legacy IS
  - Identity management using PKI
  - Data stored in NoSQL DB
- Value
  - Configuration process for the provider
  - Fine-grained tuned solution for the client

Ethereum

- Can be deployed as a public or private blockchain
- Simple
  - Lower setup cost
  - Less tuned
- Offer PoW and PoA
  - Manage a smoothed transition
  - Less energy
- Does not integrate access control
- Smart contract feature
- Value:
  - Large community (for providers)
  - Easy configuration (for clients)

Quorum

- Provided by JP Morgan
  - Rather related to the FinTech
- Extend Ethereum
  - Interoperable with Ethereum
  - Provide few management tools
  - Provide access control features
- Value source
  - Related to the domain-dependent configuration (i.e. adapted for the Fin Tech)

Ripple

- Provided by an enterprise
- Specifically designed for payment management
  - Provide several components
  - Pre-configured for the payment business
  - Provide management tools
- Value
  - Trusted international payment function
  - More fluent transactions (scaling abilities)

Corda

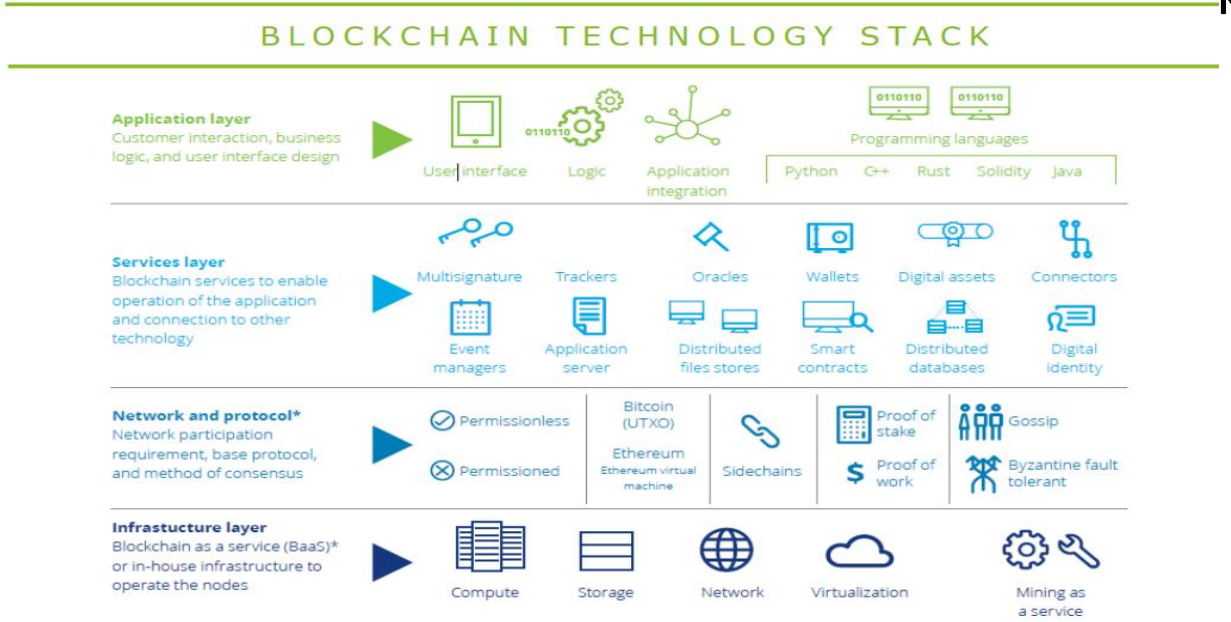
- Consortiyum-based blockchain
  - Banks
  - R3 consortium
- Notarization based concensus
  - Trusted actors
  - PoA
  - Efficient transaction validation
- Value
  - Shared business process defined by the R3 consortium

To conclude

- Different value sources depending on the blockchain usage
  - Generic purpose blockchain
    - Configuration cost vs blockchain adaptation to the need
    - Rather similar to other IT model
    - Comparing Hyperledger and Ethereum
      - Hyperledger has more configuration costs thanEthereum
      - Ethereum requires more developments to integrate the blockchain in the IS
  - FinTech blockchains
    - Most of the developments
    - Due to the initial crypto-currency model
    - More efficient and scaling architecture
    - Integrate shared processes as main value sources

Back to the blockchain technology stack

- Several components from infrastructure to application oriented components
  - Some are totally dependent of the core blockchain



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

Main actors

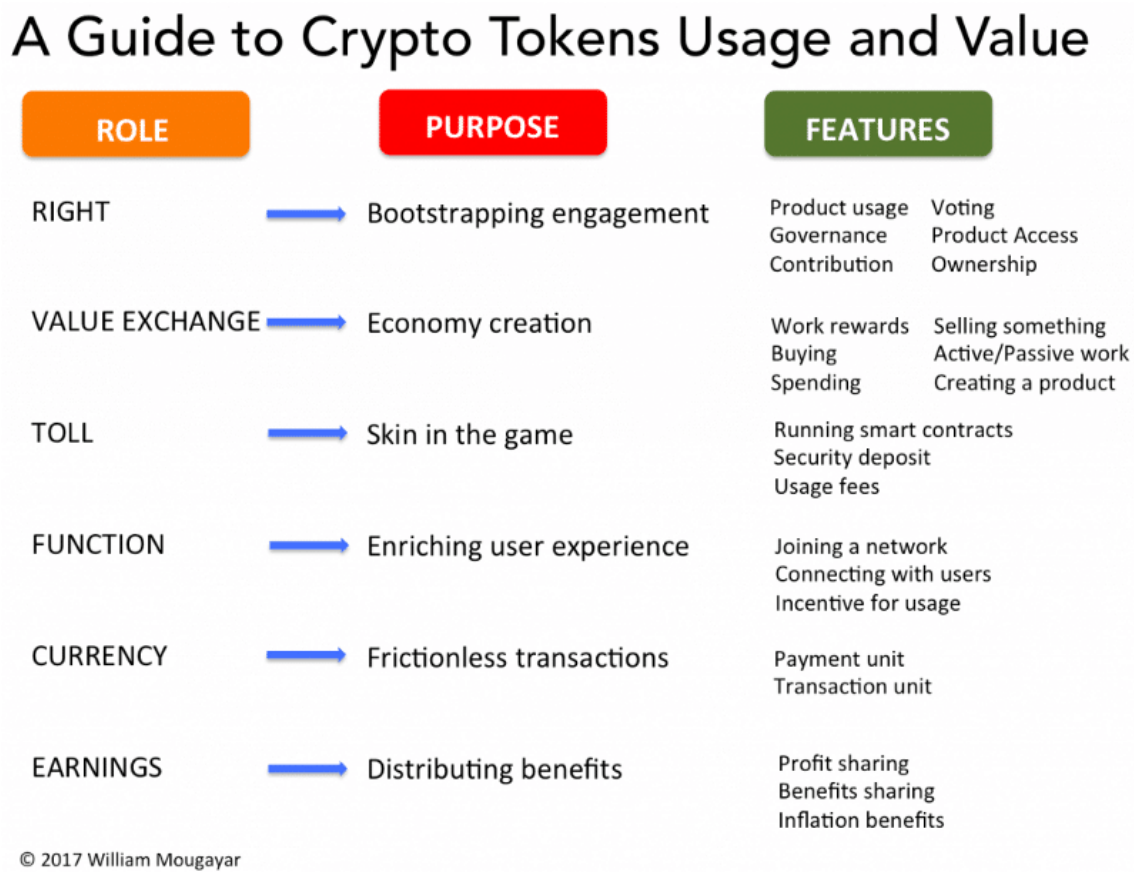
- A single community with different actors
  - Sharing a same “currency”
  - Each actor has its own value model and financial strategy
- Key competencies
  - Developers
    - Core components
    - Extra services necessary to promote the blockchain usage
  - Infrastructure providers
    - Data centers : hosting and management
    - Hardware development for wallets, CPU
  - Global resource optimization
- Investors

Token value

- Depend on the actor and on the project
  - Utility token
    - Allow using the network
    - Involved in the governance
  - Security token
    - Money investment
    - Bet on a project to get profit
  - Payment token
    - Pure crypto-currencies
    - Pay for products or fund transfer
- Different regulation rules apply for the Initial Funding process

How to qualify a token?

- Utility
  - Right
  - Function
- Security
  - Earnings
  - Value exchange?
- Payment
  - Toll
  - Currency
  - Value exchange?



Blockchain value

- Objectively
  - Add the value of each component
  - Add the value of the tokens
- Blockchain is a collaborative networked organization
  - Require a networked value analysis
  - Integrate interaction synergy
  - May evolve depending on the Hype Cycle
- Economic model evolution
  - Blue Ocean: new technology
  - Red Ocean: Blockchain practioners compete strongly to develop their own project – Stable core technology
  - Value is moving to the Usage and Application Service layer

According to you, Does digital transformation involves Blockchain?

- What are the main characteristics of the new collaborative economy?
- Is Blockchain as a Service similar to other Cloud services?
- Does blockchain require new legal studies?
- How is blockchain integrated to support collaborative business?

According to you, How can you describe the blockchain ecosystem?

- In this part you will
  - Identify business requirements to promote blockchain benefits
  - Learn why different regulations can be applied to smart contract
  - Compare Blockchain as a Service to other XaaS organisation
  - Learn how blockchain can be introduced to support collaborative business

Traditional transactions

- Basically P2P transaction
- Rely formally on accounting
  - Double spending problem
  - Seperate logs on both sides to prove its validity (Debit = Credit!)
- Parties authentication
  - Certified by a trusted authority
  - May require identity proof “deposit” linking physical and virtual worlds
- Transaction price allow paying the authority

Traditional Business relationships

- Use transactions between parties
- Involve trust
  - Face to face relationships : subjective
  - Reputation
    - Successful collaboration
    - Cooptation
  - Different trust levels are necessary depending on “what could be lost in case of unfair behavior”
  - May require time!
- Reduced set of potential partners

What does a blockchain provide

- A new service
  - To manage trust
  - To store P2P transaction, solving the double spending problem
- As a service Blockchain has cost
  - Fees
- Blockchain is a distributed organization
  - Owned by community members => each member has to invest
  - No central authority => transaction fees are associated to the validation service
- Blockchain uses its own currency
  - Tokens
  - Need to exchange them with real world currencies

So what is the blockchain status?

- Blockchain is an Internet-based distrusted trust system
- Development of Web-based technology
  - New supports for collaborative Business
  - BUT Internet stack does not provide transaction processing
- Blockchain is the Internet missing element to support distributed process
  - Manage transaction
  - Own economy based on tokens => autonomous international currency?
  - IS interconnection thanks to Smart Contract
  - Event based organization
    - More reactive
    - Data driven processing?

Blockchain as a Service?

- Different offers
  - Public/private
  - Extra developments to support application development
    - Use the event driven smart contract
- Blockchain is a distributed system
  - Can mix insourcing/outsourcing strategy

BaaS: a new Cloud organization? (1)

- Technology side: what is similar
  - Distributed organization similar to Cloud based organization
  - Require the integration of multiple IaaS, PaaS and SaaS to deploy a consistent Blockchain project
  - Require Scalable trusted resources
- Technology side: what is different from traditional SaaS and PaaS
  - The community also include IaaS
  - No interoperability / very poor interoperability: key differentiator for the business model (Black ocean strategy?)
  - Immutablity: code cannot be changed
  - No real access control

BaaS: a new Cloud organization? (2)

- Regarding the oranisation side
  - Consortium or public blockchain may be used
    - Depending on what is stored
    - Blockchain provide “self-trusted” system
  - P2P organization
    - May be different from the Cloud
    - Require identified parties
    - Similar to TP components
  - Trust management
    - Extend the potential partnership basin
    - May integrate “checkable” and objective reputation part

What about distributed processes?

- Shared processes must be defined
  - To be associated to the transaction
  - Activities can be loged
    - May improve the process maturity
  - Require some specific developments
- Extra processes to set
  - Blockchain community management is required

So why using Blockchain as a Service?

- Blockchain as a service means pay per transaction
  - Similar to the pay per use model
  - Reduces the necessary initial investment
- Blockchain throughput is reduced compared to other technologies
  - Initial scaling is important while choosing the technology
  - Important energy cost depending on the consensus strategy
- Benefits are related to the shared process organization
  - May increase the reactivity
  - Save time and money by avoiding useless tasks
- Benefits are related to the blockchain infrastructure
  - Requires only few development
  - The necessary infrastructure is outsourced using the Blockchain as a Service model

Using Blockchain in Collaborative economy?

- Different business areas
  - Agriculture
  - Manufacturing and Supply chain
  - E-governement
  - Fin Tech
- Different distributed systems
  - From Business transaction
  - To IoT device integration
- Common requirements
  - P2P exchanges
  - Safe transaction system
- Internet opened environment to support large scale collaboration

Automating collaborative economy?

- Smart contract
  - Automated execution for transactions
  - Trusted inputs
  - Published actions
    - At least interfaces
- Collaborative economy means reacting to events to be more agile
  - Smart contract change the software organization from a control driven vision to an event driven organization
  - More agility and complexity
- New challenges
  - Smart contracts rely on stateless services
  - How to link transactions to “backtrack” processes?

What does “collaborative” means?

- New collaborative and sharing economy paradigm?
- Sharing is not outsourcing?
  - Transaction must be defined and accepted
  - Partners and not suppliers
    - Co-operation while defining and running the process
  - But in fact it impacts what is shared and stored in the blockchain
    - Simple “ordering” transactions for outsourced process
  - Identify precisely what is public
    - Stored in the blockchain
  - Risk due to immutability

Legal environment

- Contracts are necessary
  - To identify parties
  - To identify the purpose
  - To have a common legal reference
- Contract can be stored in the blockchain
  - Automatized signature protocol
- Different blockchain depending on the collaboration time-frame
  - Public blockchain for short term : reduced investments
  - Consortium / private blockchain for long term collaboration
  - Keep in mind that different legal framework may apply

Main motivation to adopt blockchain

- Collaborative networked models
  - Multi-tier collaboration
  - Multi-tier process execution
  - Value co-creation
- Blockchain is only P2P
  - BUT most commercial transaction are P2P transactions
  - Shared process means several P2P transaction
  - Combining data and event to coordinate these transactions
- BUT
  - Lack of interoperability
  - Require new blockchain model to manage multi-tiers transactions

New Supply chain organization?

- Context
  - P2P transaction among the supply chain
  - Well identified process interactions
  - Industry 4.0
    - Integrate IoT
    - Increase the call for trackable information
- Blockchain model adoption
  - Because it is P2P
  - Because it can store immutable information related to a transaction
  - Because it can interact with IoT
  - Because Mining tools can be applied to the ledger content to rebuild a product “history”

From supply chain to consortium based organisation? (1)

- Consortium blockchain
  - Mid to long term collaboration
    - SCM stability
  - Identify clearly potential partners
    - ICO for initial partners
    - Coptation for others
  - Change the collaborative organization relationships
    - Equilibrate relationships
    - Impact the trust level
  - Use access control to the supply chain information
    - Require tokens!
  - Trusted environment for IoT
    - May provide a “mediation” storage of the IoT raw data

From supply chain to consortium based organisation? (2)

- Cons
  - Blockchain cost
  - Processes must be co-defined
  - Only P2P transactions (and not multi-tiers dependencies)
- Pros
  - Increased efficiency by sharing up to date information
  - Increased trust between partners by providing more transparency
  - Increased quality for the products by integrating IoT information

Reference and source

- 1. Bitcoin & Cryptocurrency Technologies: Bitcoin Mining, Blockchain Basics And Cryptocurrency Trading & Investing For Beginners | 7 Books In 1 by Boris Weiser (Author)
- 2. The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them (Cryptography, Crypto Trading, Derivatives, Digital Assets) – Illustrated, September 15, 2018 by Antony Lewis (Author)
- 3. Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies Is Changing the World – June 12, 2018 by Don Tapscott (Author), Alex Tapscott (Author)
- 4. Blockchain Technology for IoT Applications (Blockchain Technologies) 1st ed. 2021 Edition
- by Seok-Won Lee (Editor), Irish Singh (Editor), Masoud Mohammadian (Editor)
- 5. Blockchain Basics: A Non-Technical Introduction in 25 Steps by Daniel Drescher (Author) Format
- 6. Cryptoassets: The Innovative Investor's Guide to Bitcoin and Beyond – October 19, 2017 by Chris Burniske (Author), Jack Tatar (Author)